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## VOLUME-II

# BRIDGE REFURBISHMENT & REPLACEMENT PROJECT

## SECTION – 1

### Background and General Requirement


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## 1.0 INTRODUCTION

Oil and Natural Gas Corporation Limited (ONGC), hereinafter called as ‘ONGC’, is engaged in exploration and exploitation of Western Offshore Field in the Arabian Sea on the continental shelf of Western India. The field well developed with an extensive infrastructure of wellhead platforms, process platforms and pipelines. Western offshore consists of three assets viz. Mumbai High Asset, Neelam & Heera (N&H) Asset and Bassein & Satellite (B&S) Asset. The present work package comprises of facilities in MH Asset.

ONGC intends to carry out the refurbishment / replacement of following existing bridges in offshore location at its MH asset:


S. N.	Asset	Complex	Platform Bridge	Nature of Work
Replacement Scope				
1	MH Asset	IC	ICP-ICG LD	Replacement
2		IC	ICG-ICW LD	Replacement
3		BHS	SLQ-BHS Cellar Deck	Replacement
Refurbishment Scope				
4	MH Asset	IC	ICG-ICW UD	Repair / Refurbishment
5		IC	ICP-ICG UD	Repair / Refurbishment
6		BHS	SLQ-WIS	Repair / Refurbishment
7		NQ	NQO-NQD	Repair / Refurbishment
8		WIN	WIN-NC	Repair / Refurbishment
9		SCA	SCA – SC1	Repair / Refurbishment
10		SCA	SCA Flare	Repair / Refurbishment

For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items. The replacement / refurbishment requirements for existing bridges are assessed. The details are provided elsewhere in the tender document.

The purpose of the present tender is to enable ONGC to award a LSTK contract for carrying out the refurbishment and replacement of bridges as per detailed basic bid scope of work and carrying out required modifications in existing platforms. The scope of work under this tender is indicated subsequently in the bid document.

The contract shall be awarded on an EPC basis with detail engineering, procurement, fabrication, transportation, installation and all associated pre-commissioning/commissioning checks as per the tender specifications along with provision of marine support.

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## 1.1 GENERAL

### 1.1.1 STRUCTURE OF BID DOCUMENTS.

The Bid document consists of five volumes as follows:

#### **VOL. I (Commercial part)**

Part – I: Instruction to Bidders including the price Proforma.

Part – II: General Conditions of Contract

Part – III: Project Instructions

Part - IV: Technical Part consists VOL. II, III, IV and V

The Technical Part of bid package broadly comprises of the following:

#### **Vol-II (Technical Part):**

Section – 1: Background and General

The Background and General section broadly covers the overview of the facilities being envisaged in this project.

Section – 2: Description of work (Basic Bid Work)

The Description of Work describes the various refurbishment & replacement work associated with bridges in MH Asset. Bridge reports are part of scope of work.

Section – 3: Design Criteria to be used by the Contractor in performing design & detailed engineering for the facilities. Execution methodology defines the general guidelines for the execution of the job.

The Design Criteria defines the design philosophy for the various systems envisaged under the project.

#### **VOL. III (Technical Part)**

This section consists of Functional & Job Specifications applicable for total Scope of Work of the project. Functional/Job Specifications for items pertaining to relevant disciplines required for this project are covered in this part. The Functional/Job Specifications describe the essential and minimum required functional considerations regarding selection, installation, calibration, testing and commissioning of individual equipment, items and systems.

#### **VOL. IV (Technical Part)**

It comprises of drawings, MTOs, Inspection requirement table. MTOs are indicative in nature and final MTO shall be prepared by contractor during detailed engineering.


## 1.2 DESIGN PHILOSOPHY

The Bid document provides the following:

Refurbishment and replacement requirements for the bridges, modification scope of work etc.

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Minimum indicative MTOs, drawings etc. for refurbishment & replacement of the bridges are provided. However, bidder to carry out the detailed engineering & design as per design requirements and functional specifications given in the Bid Documents and generates AFC drawings.

### **1.3 PRE-COMMISSIONING / COMMISSIONING OF PLATFORM & FACILITIES**

The existing SLQ-BHS cellar deck bridge is proposed to be dismantled. A new bridge is envisaged at an alternate location. The new bridge will be installed before demolition of the existing bridge. The existing bridge carry power & control cables and process lines. Contractor shall refer the bid document for the scope of work related to installation & commissioning of these power & control cables and process lines through the new bridge. It shall be Contractor's responsibility to carry out all pre-commissioning and commissioning activities applicable for each component of the facilities and hand over the facilities to the Company duly commissioned and complete in all respects. It shall be responsibility of Contractor to provide all men and materials for execution of the Work and hand over the facilities as per schedule indicated in the Bid Package.

### **1.4 SCOPE OF SUPPLY**

#### **1.4.1 Company's scope of supply**

Company shall make available wherever applicable, the as-built documents, drawings and other relevant information to the extent possible depending upon their availability.

The Company will be responsible for the following:

- Review and approval of Bidder documentation as per the Bidder's document approval matrix
- Provision of relevant Company personnel to attend major project review meetings conducted by the Bidder, including, but not limited to HAZID, QRA, engineering, design, fabrication, constructability, pre commissioning and Commissioning where ever applicable.


#### **1.4.2 Contractor's scope of supply**

The procurement and supply in sequence and at the appropriate time, of all materials and consumables required for the completion of work in accordance with the technical specifications/time schedule shall be entirely the responsibility of the Contractor and his quoted price shall include the provision of all such materials.

Transportation of materials to/from Contractor's/Vendor's stores/workshop worksite/field for fabrication/installation including handling loading/unloading etc. included in Contractor's scope.

### **1.5 QUALITY ASSURANCE**

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The Contractor and his sub-Contractor, shall operate a quality system satisfying the applicable provisions of BS 5750/ISO 9000 (Series) latest edition.

Contractor shall include in his bid the quality assurance plan containing overall quality management procedures which is required to be adhered to during execution of contract. After the award of the contract, detailed QA plans to be followed for execution of contract under various division of works will be mutually discussed and finalized.

The Contractor shall establish document and maintain an effective quality assurance system as outlined in recognized codes.

Quality assurance system plans/procedures of the Contractor shall be furnished in the form of a QA manual. This document should cover details of the personnel responsible for the quality assurance plans/procedures to be followed for quality control in respect of design engineering, procurement, fabrication, installation, hook-up and testing. The quality assurance system should indicate organizational approach for quality control and quality assurance of the constructional activities at all stages of work at site as well as workshop.

The Company or its representative shall reserve the right to witness/inspect review any or all stages of work at shop or site as deemed necessary for quality assurance.

The Contractor has to ensure the deployment of quality control and quality assurance Engineer depending upon the quantum of work. The QA/QC group shall be fully responsible to carry out the work as per contract. In case the Engineer in-charge feels that the Contractor's QA/QC Engineers are incompetent or insufficient, Contractor has to deploy other experienced Engineers as per site requirement and to the full satisfaction of Engineer in-charge.


## 1.6 HEALTH, SAFETY & ENVIRONMENT REQUIREMENTS

The Contractor shall be responsible to comply with code requirements of International Maritime Organization (IMO), International Convention of Safety of life on sea (SOLAS), Occupational Safety & Health Administration (OSHA), ISO – 14000 series, American Petroleum Institute (API) RP-14A, 14B, 14C, 14D, 14E, 14F, 14G, 14H, 14J and the international practices and the requirements as stipulated in Vol.-I of the bid document with regards to Health, Safety & Environment (Refer FS 5101). In addition, Contractor shall follow International Maritime Contractors Association (IMCA) Guidelines or International code of practice for offshore Diving work. Contractor shall indicate proposed code in bid offer.

During execution of the project, Contractor shall ensure compliance of various activities related to Safety, Health & Environment as per applicable codes and submit the compliance report to Company.

The Contractor shall carry out relevant safety studies as per Functional specification for safety studies No: 5101 and carry out necessary changes wherever required as per the findings of the safety studies without any time and cost impact to the Company. The contractor shall provide as a minimum relevant operation / safety equipment as per Functional safety specifications No. 5102 for the bridges. The contractor shall also take care of Health, Safety, and Environmental requirement for any other works specified elsewhere in the bid package.

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## 1.7 RESPONSIBILITIES OF THE CONTRACTOR

As described herein and in the instructions in Part-III of this bid document, it will be the Contractor's responsibility to carry out the following:

- All surveys such as pre-engineering, pre-construction, post-construction, as built etc. as described in the bid document.
- Design and detailed engineering of all facilities in accordance with design parameters and International Codes and Standards but incorporating changes/revisions which are not adequately covered and reflected, considering that bid document is solely based on functional specifications.
- Preparation of all fabrication drawings, specifications and procedures for fabrication, load out tie-down, transportation, offshore installation, hook-up, testing, pre-commissioning and commissioning (wherever applicable) including the existing facilities where modifications are to be carried out or where loose material are to be handed over.
- Procurement including expediting and inspection of all materials and equipment for construction and incorporation in the facilities. In addition to Company or Company appointed inspection agency, the Contractor has to carry out the inspection of material/equipment through third part inspection agency duly approved by the Company.
- All necessary documents including test certificates shall be furnished for Company's review and approval.
- Company reserves the right to participate in the selection of vendor for major equipment and items. Vendor, other than those indicated in the suggested vendor list, if proposed then contractor shall notify the company in writing of the name / details of the intended vendor and furnish company with two sets of the vendor's complete technical bid offer including past experience of supplying similar items and all technical correspondence / clarification furnished by the vendor to the contractor. Contractor shall ensure that the vendor's technical offer shall be duly vetted by their engineering sub-contractor incorporating observations / recommendations, before submission to the company.
- Company shall have right to hold detail technical discussion with the vendor and visit vendor's works to satisfy about the vendor's capability to execute the job. The contractor shall issue the purchase order only after written approval of the company regarding acceptance of the selected vendor. Approval of purchase specifications does not absolve the Contractor from supplying equipment of proven design as per company's specification, International codes etc. requirements.
- All matching flange, gaskets, bolts etc. wherever new piping/instruments are being hooked unto the existing piping.
- All types of welding consumables, electrodes, filler wires etc.
- All types of structural members as required for pipe supports, temporary

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supports, scaffolding materials etc.

- Primers and paints as specified in Spec.No.2005.
- Spool pipes, blinds, plugs, gaskets and other materials/arrangement required for testing of pipe work.
- Radiography/UT/MPI/DP machines and materials as required for NDT as per welding Functional Specifications.
- Any other material not-specifically mentioned above but required for completeness of the work as per specifications, drawings and instructions of Engineer-in-charge within, scheduled time shall be the Contractor's responsibility.
- Fabrication and assembly of all facilities including installation of piping, piping supports, cabling, tubing etc. into the facilities in accordance with approved drawings and specifications.
- Load out of all fabricated and bought out components for facilities onto transport barges, sea fastening and transportation to the offshore site.
- Offshore installation of all facilities hook-up, testing, pre-commissioning and commissioning. All such activities shall be witnessed by Company for their satisfactory completion.
- Manufacture, Procurement, Fabrication, load-out, tie-down & Supply of items.
- Packing, Forwarding and Transportation to yard as well as offshore site
- Custom clearance and Insurance, as required / applicable
- Receipt and storage of equipment /items/ instruments at yard and offshore site
- Calibration, Installation, hook-up, testing/Field Testing, pre-commissioning and Commissioning wherever applicable.
- Documentation and warranty
- As built documents
- Contractor is also required to meet any additional requirements spelt out in subsequent sections and drawings and specifications of this bid document.

## 1.8 AS-BUILT DATA

Contractor shall develop intelligent 3D models of all bridges under scope of present project in the latest version of Hexagon Intergraph's PDS/ SP3D or Aveva's PDMS/ E3D software. The intent of generation of an intelligent 3D Model is to consolidate complete project "As-Built" documentation in soft copy with a single source of data repository. The model shall facilitate instant access to all relevant information e.g. technical specifications, data sheets, design write-ups, installation manuals, fabrication drawings, vendor details, maintenance history, safety instruments etc. by a click of a button on any item of the 3D Model. Updation and maintenance of the Information stored in the 3D Model shall be simple and automatic.

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Complete project data, which includes reference data base, project directory, RIS dump files or equivalent files of project database, Design data base and reference database, customization done, and extraction of reports, orthographic, isometric etc. shall be made available along with the project.

### PROJECT DOCUMENTATION

It shall be the contractor's responsibility to prepare project documentation including as built drawings & documents, specifications, vendor data book etc. Soft copies of all as built drawings on Portable Hard disc using latest version of software shall be provided tabulated below.

During detailed engineering all drawings and documents shall be generated for submission to the company in electronic form and hard copy, wherever required.


Contractor shall upload detailed engineering documents as per approved project DCI-MCI in Company's on-line documentation portal Online Project Monitoring and Control (OPMAC) system. Review & approval process of engineering documents shall be through this portal. Necessary training shall be provided to Contractor's personnel in this regard.

Final Project documentation including As-Builts shall be submitted in hard copy (Except 3D models) as well as in soft also in following formats:

S No.	Description	Format
1	Project documents	Latest version of Microsoft Office
2	Drawings, specifications, data book etc.	Latest version of PDF
3	All drawings pertaining to modification job	Latest version of AUTOCAD and/ or MICROSTATION.
4	Engineering Analysis	Approved final calculations along with the corresponding native files (e.g. SACS files)
5.	3D Model	PDS/ SP3D/ PDMS/ E3D. A separate review file in 'Navisworks' (.nwd) format of each 3D model shall also be submitted.

All As-Built information required to build the model should be intelligent and shall be seamlessly integrated with the model enabling querying, data retrieval and automatic updation. The associated 2D drawings, GADs, isometrics etc. shall be generated from the 3D model using the automatic drawing extraction feature available in the PDS/ SP3D/ PDMS/ E3D software. Contractor shall follow general guidelines while modelling the project and independent online checking at various facets of the modelling shall be made available to the Company during model review workshop sessions if required to be carried out by the contractor in presence of company personnel. Contractor shall make suitable provision of PDS/ SP3D/ PDMS/ E3D terminal loaded with requisite software module/ review module with dedicated PDS/SP3D/ PDMS/ E3D designer for the Company. Contractor shall submit the details of the project setup

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of each module for Company's review. Contractor shall attend to queries and satisfy the queries, if any, while modelling the project.

Contractor shall follow the following methodology, as applicable while generating the intelligent 3D Model of the project-

- a. Before any deliverables are extracted, clash detection shall be performed.
- b. The above exercise will result in generation of PDS/ SP3D/ PDMS/ E3D 3D model of AFC engineering deliverables, which Contractor shall submit to the Company before the start of yard/ fabrication activities. Contractor shall also submit As-Built intelligent 3D Model along with deliverables after the installation and commissioning of the project.

Contractor is permitted to generate **3D Model with other software** (AUTO PLANT/ PLANT SPACE/ PLANT 4D) in place of PDS/ SP3D/ PDMS/ E3D provided **the following conditions are met:**


- In case the contractor uses a 3D Modelling software other than PDS/ SP3D/ PDMS/ E3D, complete **licensed** software package (latest version) along with all the modules shall be provided. Licenses for all the necessary modules shall be in the name of ONGC.
- 3D Modelling software shall have all the technical features as mentioned in this clause and shall have validity of 05 (five) years beyond the commissioning of the software.
- It is also required to provide:
  - i. Necessary hardware (workstation server grade machine with minimum specifications: DELL PowerEdge R430 Server with Intel Xeon E5-2630 v3 2.4Gz processor or equivalent) and external technical services for installation and configuration of the software at ONGC premises, and
  - ii. In depth training for various discipline engineers in respective/ identified modules. Also, it shall support unlimited number of models with which further editing, reviewing and updating should be possible as and when required.
- Further, Contractor must have executed 3D Modelling with all relevant data using the same software set-up in the last 5 years in minimum TWO projects, preferably in Oil /Gas industry.

In accomplishing the above tasks, the Contractor shall take total responsibility of executing the project in accordance with this bid document including supply of all materials and consumables, construction equipment etc. and will adhere to bid document instructions and requirements in respect of all matters relating to the project.

Contractor shall furnish all the information as sought by the company in defined formats for its data storage and retrieval system at no extra cost to company. Any formats left out shall be provided to the Contractor during detailed engineering.

## 1.9 SOME ABBREVIATIONS & ACRONYMS (For Reference only)

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### Abbreviations & Acronyms

AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BCM	Billions of Cubic Meters
BLPD	Barrels of Liquid Per Day
BOPD	Barrels of Oil Per Day
BS	British Standard
BS EN	British Standard European Norm
BS&W	Basic Sediment & Water
BWPD	Barrels of Water Per Day
CAA	Civil Aviation Authority
CENELEC	European Committee for Electro technical Standardization
CEN	European Committee for Standardization
CPT	Cone Penetration Test
DNV	Det Norske Veritas
EEMUA	Engineering Equipment & Materials User's Association
EIA	Electronic Industries Alliance
E & P	Exploration and Production
EPS	Early Production System
ESP	Electric Submersible Pump
FPSO	Floating Production, Storage and Offloading vessel
GOR	Gas Oil Ratio

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### Abbreviations & Acronyms

HAT	Highest Astronomical Tide
HCl	Hydrogen Chloride (Hydrochloric Acid)
IALA	International Association of Light House Authorities
IBP	Initial Boiling point
ICS	International Chamber of Shipping
IEC	International Electro technical Committee
IMO	International Maritime Organization
IP	Institute of Petroleum
IRI	Industrial Risk Insurers
IS	Indian Standards
ISA	Instrument Society of America
ISF	International Shipping Federation
ISO	International Standards Organization
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
IUGG	International Union of Geodesy & Geophysics
LAT	Lowest Astronomical Tide
MMSCMD	Millions of Standard Cubic Meters per Day
MMtPA	Millions of tons Per Annum
MSL	Mean Sea Level
MSS	Manufacturers Standardization Society
NACE	National Association of Corrosion Engineers
AIA	Aerospace Industries of America
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NORSOK	Norsk Søkkel Konkuranseposisjon
OCIMF	Oil Companies International Marine Forum
OGP	International Association of Oil and Gas Producers
ONGC	Oil and Natural Gas Corporation

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### Abbreviations & Acronyms

OSHA	Occupational Health and Safety Administration
PLEM	Pipeline End Manifold (subsea manifold)
ppm(v)	Parts per million (volume basis)
PVT	Pressure-Volume-Temperature
RTJ	Ring Type Joint
SBM	Single Buoy Mooring
RVP	Reid Vapour Pressure
SG	Specific Gravity
SIS	Swedish Standards Institution
SSIV	Subsea Isolation Valve
SSPC	Steel Structures Painting Council
TEMA	Tubular Exchanger Manufacturers Association
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TVP	True Vapour Pressure
UL	Underwriters Laboratory
UNS	Unified Numbering System
UTM	Universal Transverse Mercator
UU	Unconsolidated Undrained
WGS	World Geodetic System

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## VOLUME-II

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## SECTION - 2

## SCOPE OF WORK

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## SCOPE OF WORK & SUPPLY (STRUCTURAL)

**PROJECT :** ENGINEERING / TECHNICAL CONSULTANCY SERVICES FOR PREPERATION OF EXECUTION METHODOLOGY, SOW AND COST ESTIMATES FOR REPLACEMENT /REFURBISHMENT OF BRIDGES IN MH ASSET

**LOCATION:** MH ASSET (NORTH AND SOUTH FIELD)

**OWNER :** ONGC, MUMBAI

**JOB NO :** B774

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<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>

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## **Symbols and Abbreviations**

### **Organisations – India**

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### **Other abbreviations**

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge

## 1.0 INTRODUCTION

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges has deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset.

For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

The replacement / refurbishment requirements for existing bridges are assessed. The following document describes the scope of work for the EPC contractor to perform the replacement / refurbishment of bridges.

## 2.0 GENERAL

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc. The details of NDT and Laser scanning works are attached as reference for the contractor. However, Contractor shall perform all required data collection, NDT and laser scanning works to collect all necessary data.

i) Contractor shall carry out extensive site surveys and familiarize himself with the total work scope to be carried out on the existing platforms. Their scope of work shall include verification of data/ drawings of existing facilities (provided with bid) before proceeding with detailed engineering/ procurement based on bidding documents. It shall be Contractor's responsibility to assess the total quantum of work to be carried out on the existing platforms.

ii) To verify as-built documents (like elevations, sizes/ wall thickness of relevant structural as well as non-structural members, etc.) and fill the missing data.

iii) To collect data such as member size, corroded size & thickness (using ultrasound method) of plating's, equipment supports/ skids, primary/ secondary/tertiary structural members for replacement of corroded members/ strengthening of existing members/ providing additional members.

The scope of work and supply include supply and providing new bridges (including piping, cables, lighting, monorails, etc) and revamping, modifications and strengthening works of existing bridges, landing location, deck modification, jacket strengthening, etc. Piping, Electrical and Instrumentation scope of works are provided elsewhere in the document.

Following is the list of bridges envisaged in the scope of work.

### IC Complex:

1. ICP-ICG Lower Deck bridge (New)
2. ICW-ICG Lower Deck bridge (New)
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### BHS Complex:

5. BHS-SLQ Lower Deck bridge (Replacement)
6. SLQ-WIS Lower Deck bridge

**NQO Complex:**

7. NQO-NQD Lower Deck bridge

**WIN Complex:**

8. WIN-NC Lower Deck bridge

**SCA Complex:**

9. SCA-SC1 bridge
10. SCA-SCF bridge

Total of 10 bridges (2 nos. of new bridges, 1 no. of replacement of existing bridge & 7 bridges for strengthening) are included in the scope of work of LSTK contractor.

The scope of work is covered in two parts.

**Part A – Strengthening of existing bridges**

**Part B – New bridges / Replacement of existing bridges**

The LSTK contractor's scope of work includes the structural work related to the analysis, design, procurement, supply, fabrication, load-out, transportation to site, installation, hook-up and commissioning of modification works at associated well platforms described in more detail in cl. 3.0 & 4.0

### **3.0 STRUCTURAL SCOPE OF WORK FOR PART-A & B**

The EPC Contractor's structural scope of work shall include but not limited to the following:

- a) Pre-engineering survey of Jacket walkway, bridge landing, sub-cellar dec, cellar deck, middle deck and main deck for collection of all necessary information, as built information required for detailed engineering and preparation of the AFC drawings. The bid drawings are based on visual inspection, NDT works, Laser scanning works, preliminary analysis and design performed by company and the same are provided to bidder for the understanding of EPC Contractor's scope of work. All data, corroded/damaged members etc as shown in bid drawings shall be verified by the successful EPC Contractor during pre-engineering survey to collect the actual extent of damage/corrosion and other as-built data. It is mandatory that UT survey shall be carried out during pre-engineering survey for all structural members of the proposed modifications, revamp and strengthening and any new members as instructed by the Engineer-in-charge at site, to ascertain the extent of corrosion/ damage and its remedial measures. EPC Contractor shall also collect relevant data for preparation of installation scheme for various facilities. Refer cl. 5.0, 6.0 for detailed scope of work.
- b) Submission of pre-engineering survey report including marked-up sketches / drawing's installation schemes, fouling of structural members, damaged members etc to Company for review and approval.
- c) NDT works and laser scanning works performed by Company is attached with the tender as reference only (for bidding purpose).
- d) The strengthening drawings of existing bridges, drawings for new bridges attached elsewhere in the tender is for reference only. (For bidding purpose).

- e) Detail engineering (pre-service and in-service for new bridges) and preparation of Approved for Construction (AFC) drawings of all facilities (including dismantling of existing facilities) as per Bridge-wise detailed scope of work (refer Cl. No. 5.0, 6.0). All engineering & design shall be in accordance with relevant clauses of design criteria and specifications as provided in the bid document.
- f) Contractor shall obtain approval for all analysis, design, documents, drawings, surveys, works, execution from company / company representative.
- g) Submission of all analysis and engineering documents & drawings for Company's review.
- h) Incorporation of Company's comments on engineering documents & drawings and resubmission to Company for final approval.
- i) Preparation of fabrication drawings based on AFC drawings.
- j) Finalization of MTO's as per Fabrication drawings
- k) Procurement and supply of all structural steel, structural items and non-steel material based on AFC drawings and fabrication drawings.
- l) Fabrication, painting, load-out, sea fastening and transportation of all structural items from EPC Contractor's fabrication yard to offshore platforms.
- m) Preparation & submission of detailed installation methodology for the complete system including structural scope of work for Company's review & approval.
- n) Mobilization of adequate capacity marine spread for all installation works including structural installation and erection.
- o) Pre-construction survey for verification of the feasibility of the approved installation scheme for providing new facilities as per AFC drawings. EPC Contractor shall make necessary modifications in AFC drawings to facilitate the installation and matching with as-built site conditions after review and approval by Company.
- p) Dismantling of structural scrap items including damaged and corroded structural items needing repair & replacements as per the detailed platform wise scope of work (clause. 5.0, 6.0). Contractor's scope with respect to scrap material is demolition / removal, safe handling, loading on cargo barges / supply vessels, sea fastening, transportation from offshore sites to Nhava yard and handing over to ONGC at Nhava yard. Providing of cargo barges / supply boats is within the Contractor's scope of work. All marine spread for dismantling/ transportation of material shall be in EPC Contractor scope. All taxes and duties w.r.t. above scrap material while taking away to scrap shall be borne by the EPC Contractor.
- q) Modification / dismantling / cutting/ rerouting/ etc of any existing facilities, structures, piping, cabling, cable trays, instruments as necessary to overcome obstruction and to facilitate installation of new items and to make it good after installation, shall be carried out by the EPC Contractor.
- r) Installation and erection of all structural modifications, strengthening, deck extensions etc including Hook up and commissioning with existing platform facilities. Plates and tubular members used in the strengthening / replacement shall be as per FS 6001F.



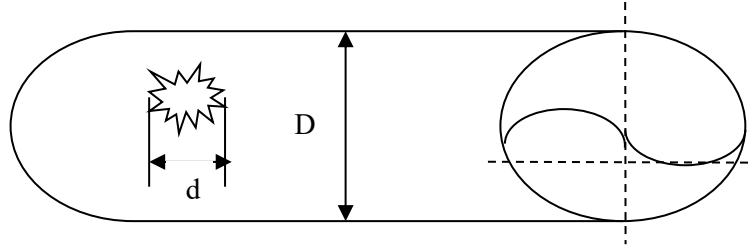
- s) EPC Contractor shall make necessary protective arrangement above/ below deck for safety of the neighboring structures, equipment etc.
- t) All grating, handrail, stairs, deck welding, etc shall be as per FS, standard drawings attached elsewhere in the tender.
- u) Specification for minor offshore structures are also attached
- v) All necessary approvals/ permit for commencement of the work shall be taken in advance from company and/ or appropriate authority for proper execution of the job. EPC Contractor and his representative, workmen shall follow ONGC safety norms and requirements as per the instruction of Engineer-in-charge to execute the job safely and without any operational hazards. The EPC Contractor shall provide personnel protection equipment's necessary for the safety of workmen and supervisory personnel necessary for the execution of work at platform.
- w) EPC Contractor will not be provided any space at platform for storage, fit-up, fabrication etc and all such activities shall be pre-planned by EPC Contractor at his own resources.
- x) EPC Contractor shall be fully responsible for any damage caused both direct and consequential to the existing facilities during installation, hook-up & commissioning and removal of existing items / components and shall repair/ replace at his own cost. All such works shall be carried out as per the instruction and within the schedule decided by Engineer-in-charge at platform.
- y) The complete bridge (Strengthened, New and replacement bridges), landing areas (All extensions and strengthened landings) including replaced plating, grating, handrail, monorails, Sheeting's, cladding shall be painted as per company painting specifications FS-2009. (Specifications for Protective Coating)
- z) Repair and Touch-up painting of all surfaces/ structural members etc affected during execution of work. All existing facilities shall be restored back to their original state & cleaning of work area from all debris, tools & tackles, temporary supports etc after completion of work.
- aa) Arrangement of the scaffolding shall be made for proper access during pre-engineering survey, Pre-construction, installation & inspection related works.
- bb) Post installation survey to verify the installation as per the AFC drawings.
- cc) Preparation and submission of as-built documentation.
- dd) Contractor shall perform the safety study for all the bridges and landings, supply and provide additional life bouys, other safety items, as required from the safety study.

For bridge wise detailed scope of work refer in Clause 5.0, 6.0. The drawings and scope of work mentioned in Clause 5.0, 6.0 are based on company's inspection and NDT, Laser scanning surveys for EPC Contractor's clear understanding regarding the scope of work. Contractor shall perform NDT and Laser scanning works for the platforms and bridges to collect all data required for performing the works. The EPC Contractor shall carryout necessary detailed engineering based on his detailed survey observations (collected during pre-engineering survey) duly approved by company considering scope of work mentioned in clause 5.0, 6.0 as basis for his pre-engineering survey.

#### **4.0 GUIDELINES TO LSTK CONTRACTOR FOR REPAIR OF MEMBERS**

This section lays down the guidelines that the EPC Contractor needs to follow while carrying out the scope of work pertaining to Bridge landing area members.

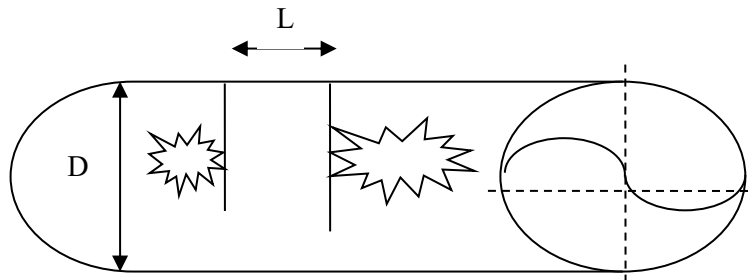
1)



If  $d > D/5$  then the complete segment of the member needs to be replaced. However, if  $d < D/5$ , then the member can be strengthened using doubler plates.

Where  $d$  is the largest dimension of a observed hole on the member

2)



If  $L < 914\text{mm}$  or  $D$  (whichever is less), the complete segment containing the two holes or more as a combination needs to be replaced. If however,  $L > 914\text{mm}$  or  $D$  (whichever is more), the member can be strengthened using separate doubler plates subject to meeting requirements of 1) above.

Where  $L$  is the Clear Spacing between two holes on a particular member

3) All strengthening work shall be in accordance with API RP 2A and API spec 2B. Final joint configuration and arrangement shall also meet requirements of API RP 2A (Section 4).

**NOTE:** For both clauses 1) and 2) above, the segment is defined as a length on either side of the hole until original thickness of member is achieved. The EPC Contractor shall carry out UT survey for checking the thicknesses of the members. In case the above necessitates complete dismantling and replacement of entire member, the same is also in scope of the LSTK Contractor.

1) The Contractor shall perform pre-engineering survey to verify the dimensions of the existing structural Members of beam components, tubular, cable or piping support of bridge & landing areas before carrying out detailed engineering of the proposed modification / strengthening / member replacements and examine if there are any obstructions in the way of installation of modification. Any problems envisaged in the offshore installation shall be brought to Company's notice in the pre-engineering survey report and feasible solution shall be put up for review, approval of Company.

2) Based on the contractor's pre-engineering survey, any required structural modifications, strengthening, or member replacements shall be determined by a Global In-place analysis of the bridge

and is included in scope of work. This analysis must incorporate all existing and new proposed loads and adhere to the structural design criteria and functional specifications.

3) Structural modifications, strengthening/ replacement of structural members (if required) to meet process/ piping/electrical & other operational requirement mentioned elsewhere in the bid document are included in scope of work and these modification works shall be based on Global In-place analysis of bridge to be carried out with new proposed loads along with existing loads and as per structural design criteria and functional specifications.

4) Payment shall be made for Structural Tonnage as specified in Appendix-A3 of Volume I of the Bid Document.

## **5.0 BRIDGE / PLATFORMWISE DETAILED SCOPE OF WORK FOR PART A (STRENGTHENING OF EXISTING BRIDGES)**

### **5.1 SUPPORTS FOR EQUIPMENT/ELECTRICAL/ INSTRUMENTATION/ PIPING (FOR ALL PLATFORMS)**

- a. Dismantling of existing and providing new Structural supports for new/ replacement of existing cable trays and repair/ strengthening of existing cable tray supports wherever required as per the piping, Electrical/ Instrumentation scope of work and bridge, platform layouts attached elsewhere in the bid package.
- b. Dismantling of existing and providing new structural supports and repair/strengthening of existing deck structural arrangement for new/ replaced equipment's, facilities etc. wherever required as per the relevant scope of work for equipment repair/ replacement/ removal/ new equipment's and platform equipment layouts attached elsewhere in the bid package.
- c. New service/ operating platforms supported at platform deck levels wherever required as per layout and operational requirements as defined in relevant scope of work.
- d. Rerouting of existing piping, E&I cable trays and other existing facilities found fouling with proposed facilities during pre-engineering survey and restoration of same after completion of work.
- e. Structural modifications/supports as required for modifications based on departmental inputs attached elsewhere in the bid package.

#### **General**

The Scope shall include the structural work for facility / requirements detailed elsewhere in the bidding documents but not limited to following:

- a. The Contractor shall perform pre-engineering survey to verify the dimensions of the existing Structural Members of beam components, tubular, cable or piping support of bridge & landing areas before carrying out detailed engineering of the proposed modification / strengthening / member replacements and examine if there are any obstructions in the way of installation of modification. Any problems envisaged in the offshore installation shall be brought to Company's notice in the pre-engineering survey report and feasible solution shall be put up for review, approval of Company. Pre-engineering survey shall also be carried out for Bridge Landing, and structural modifications required etc. to cater to process and other discipline scope of work

indicated elsewhere in the Bid Document.

- b. Based on the contractor's pre-engineering survey, any required structural modifications, strengthening, or member replacements shall be determined by a Global In-place analysis of the bridge and is included in scope of work. This analysis must incorporate all existing and new proposed loads and adhere to the structural design criteria and functional specifications.
- c. Structural modifications, strengthening/ replacement of structural members (if required) to meet process/ piping/electrical & other operational requirement mentioned elsewhere in the bid document are included in scope of work and these modification works shall be based on Global In-place analysis of bridge to be carried out with new proposed loads along with existing loads and as per structural design criteria and functional specifications.
- d. Verification of As-Built Elevations /Levels, As-built Structural member sizes with respect to available Structural Drawing, verification of member thickness (using ultrasound method) shall be carried out during Pre engineering survey for all proposed extension / Modification; Bridge Landing locations, Bridge Strengthening, and architectural modifications required for safe load transfer.
- e. Detailed Design & Engineering in compliance to Structural/ Architectural design criteria along with all related functional specifications.
- f. Procurement of various materials.
- g. Fabrication.
- h. Load-out.
- i. Transportation.
- j. Installation.
- k. Pre-Construction Surveys is to be taken up before installation. Data obtained from Pre-Construction Surveys is to be compared with data obtained during Pre-Engineering Survey and remedial action, if any, is to be taken up. Survey for anchor locations is to be taken up to ensure that the required area is free from obstruction and pipelines are at safe distance.
- l. Supply of loose items, if any.
- m. As built documentation of the project shall be submitted as defined in Bid document. As-Built documents shall include drawings (as-built drawings shall have marking showing changes with respect to AFC drawing), all In-service report. SACS model files (in SACS format along with Run files) of In-service shall also be submitted along with As-built documents.

- n. The work is to be executed in accordance with Structural design criteria and specifications as provided in the Bid documents.
- o. Payment shall be made for Structural Tonnage as specified in Appendix-A3 of Volume I of the Bid Document.

## **5.2 ICW-ICG Upper Deck Bridge (Strengthening)**

### **5.2.1 ICW-ICG Upper deck Bridge:**

- a. Analysis, design, modification of existing walkway bridge (as per company design basis, design criteria and FS attached elsewhere in the tender) including walkway, monorail at main deck level between platforms ICW and ICG (including fabrication, site works, transportation, modification with all marine spread and man machinery inclusive) with reference to tender drawing B774-001-83-43-0001 provided elsewhere in the tender. The tender drawings are provided for understanding of contractor. Final strengthening shall be as per actual site conditions during pre-engineering survey to be developed by contractor.
- b. Strengthening of bottom chord members and top chord members with half cut tubulars / channels, including strengthening of joints with stiffeners, etc.
- c. Strengthening of bracing members, providing additional bracing members, etc at ICW side and ICG side with half cut tubulars, / channels, etc including strengthening of joints with stiffeners, etc.
- d. Replacement of walkway support members with new members (after completion of other strengthening) sequentially after completing each of the member.
- e. Replacement of all walkway members, monorails, grating and handrail with new walkway members, grating and handrail.
- f. Replacement of existing cable tray support with new cable tray supports.
- g. Replacement of existing cladding, roofing (sheeting, j clamps, screw, etc, all inclusive), supporting members, with new members, roofing, cladding sheets.
- h. Strengthening of the fixed support (at support location) provided at ICG side. Refer tender drawing B774-001-83-43-0001 provided elsewhere in the tender.
- i. Strengthening of the sliding support (at support location) provided at ICW side. Refer tender drawing B774-001-83-43-0001 provided elsewhere in the tender.
- j. Supply, installation of walkway members, new grating, handrail, on the bridge as per standards and specifications attached. (B774-000-83-43-ST-01).

### **5.2.2 ICW side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-001-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-001-83-43-0002.

- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of ICW landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-001-83-43-0002.
- e. Preparation of surface for receiving the bridge sliding support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Dismantling of existing bridge supports (fallen) and making surface clean.
- i. Relocating the existing scramble net to nearby safe area including safety study for performing the same.
- j. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

### **5.2.3 ICG Side landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-001-83-43-0003.
- k. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-001-83-43-0003.
- l. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- m. Analysis, design, supply and strengthening of ICG landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-001-83-43-0003.
- n. Preparation of surface for receiving the bridge fixed support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- o. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.



- p. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- q. Dismantling of existing bridge supports (fallen) and making surface clean.
- r. Relocating the existing scramble net to nearby safe area including safety study for performing the same.
- b. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

### **5.3 ICP-ICG Upper Deck Bridge (Strengthening)**

#### **5.3.1 ICP-ICG Upper deck Bridge:**

- a. Analysis, design, modification of existing process bridge (as per company design basis, design criteria and FS attached elsewhere in the tender) including pipe supports, walkway, monorail at main deck level between platforms ICP and ICG (including fabrication, site works, transportation, modification with all marine spread and man machinery inclusive) with reference to tender drawing B774-002-83-43-0001 provided elsewhere in the tender. The tender drawings are provided for understanding of contractor. Final strengthening shall be as per actual site conditions during pre-engineering survey.
- b. Strengthening of bottom chord members and top chord members with half cut tubulars / channels, including strengthening of joints with stiffeners, etc.
- c. Strengthening / replacement of existing pipe supports, hanging supports, cable tray supports below bridge main truss.
- d. Strengthening of bracing members by providing additional bracing members, etc at ICP side and ICG side with half cut tubulars, / channels, etc including strengthening of joints with stiffeners, etc.
- e. Strengthening of bottom tier of bridge (cable tray supporting) by providing new members, half cut tubulars, etc.
- f. Replacement of all walkway members, monorails, grating and handrail with new walkway members, grating and handrail.
- g. Replacement of existing cable tray support with new cable tray supports.
- h. Replacement of existing cladding, roofing (sheeting, j clamps, screw, etc, all inclusive), supporting members, with new members, roofing, cladding sheets.
- i. Strengthening of the fixed support (at support location) provided at ICG side. Refer tender drawing B774-002-83-43-0001 provided elsewhere in the tender.
- j. Strengthening of the sliding support (at support location) provided at ICP side. Refer tender drawing B774-002-83-43-0001 provided elsewhere in the tender.
- k. Supply, installation of walkway members, new grating, handrail, on the bridge as per standards and specifications attached. (B774-000-83-43-ST-01).

### **5.3.2 ICP side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-002-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-002-83-43-0002.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of ICP landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-002-83-43-0002.
- e. Preparation of surface for receiving the bridge sliding support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Dismantling of existing bridge supports (fallen) and making surface clean.
- i. Relocating the existing scramble net to nearby safe area including safety study for performing the same.
- j. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

### **5.3.3 ICG Side landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-002-83-43-0003.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-002-83-43-0003.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of ICG landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-002-83-43-0003.
- e. Preparation of surface for receiving the bridge fixed support including construction



equipment's such as hydraulic jack-ups, strengthening of supports.

- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Dismantling of existing bridge supports (fallen) and making surface clean.
- i. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

## **5.4 SLQ-WIS Lower Deck Bridge (Strengthening)**

### **5.4.1 SLQ-WIS Lower deck Bridge:**

- a. Analysis, design, modification of existing process bridge (as per company design basis, design criteria and FS attached elsewhere in the tender) including pipe supports, walkway, monorail at cellar deck level between platforms SLQ and WIS (including fabrication, site works, transportation, modification with all marine spread and man machinery inclusive) with reference to tender drawing B774-003-83-43-0001 provided elsewhere in the tender. The tender drawings are provided for understanding of contractor. Final strengthening shall be as per actual site conditions during pre-engineering survey to be developed by contractor.
- b. Strengthening of bottom chord members and top chord members with half cut tubulars / channels, including strengthening of joints with stiffeners, etc.
- c. Strengthening / replacement of existing pipe supports, hanging supports, cable tray supports below bridge main truss.
- d. Strengthening of bracing members by providing additional bracing members, etc at SLQ side and WIS side with half cut tubulars, / channels, etc including strengthening of joints with stiffeners, etc.
- e. Strengthening of bottom tier of bridge (cable tray supporting) by providing new members, half cut tubulars, etc.
- f. Replacement of all walkway members, monorails, grating and handrail with new walkway members, grating and handrail.
- g. Replacement of existing cable tray support with new cable tray supports.
- h. Strengthening of the fixed support (at support location) provided at SLQ side. Refer tender drawing B774-003-83-43-0001 provided elsewhere in the tender.
- i. Strengthening of the sliding support (at support location) provided at WIS side. Refer tender drawing B774-003-83-43-0001 provided elsewhere in the tender.

- j. Supply, installation of walkway members, new grating, handrail, on the bridge as per standards and specifications attached. (B774-000-83-43-ST-01).

#### **5.4.2 SLQ side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-003-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-003-83-43-0002.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of SLQ landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-003-83-43-0002.
- e. Preparation of surface for receiving the bridge fixed support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Dismantling of existing bridge supports (fallen) and making surface clean.
- i. Relocating the existing scramble net to nearby safe area including safety study for performing the same.
- j. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

#### **5.4.3 WIS Side landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-003-83-43-0003.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-003-83-43-0003.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of WIS landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine

spread and man machinery inclusive) as per tender drawing B774-003-83-43-0003.

- e. Preparation of surface for receiving the bridge sliding support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

## **5.5 NQO-NQD Bridge (Strengthening)**

### **5.5.1 NQO-NQD Bridge:**

- a. Analysis, design, modification of existing process bridge (as per company design basis, design criteria and FS attached elsewhere in the tender) including pipe supports, walkway, monorail at main deck level between platforms NQO and NQD (including fabrication, site works, transportation, modification with all marine spread and man machinery inclusive) with reference to tender drawing B774-004-83-43-0001 provided elsewhere in the tender. The tender drawings are provided for understanding of contractor. Final strengthening shall be as per actual site conditions during pre-engineering survey.
- b. Strengthening of bottom chord members and top chord members with half cut tubulars / channels, including strengthening of joints with stiffeners, etc.
- c. Strengthening / replacement of existing pipe supports, hanging supports, cable tray supports below bridge main truss.
- d. Strengthening of bracing members by providing additional bracing members, etc at NQO side and NQD side with half cut tubulars, / channels, etc including strengthening of joints with stiffeners, etc.
- e. Strengthening of bottom tier of bridge (cable tray supporting) by providing new members, half cut tubulars, etc.
- f. Replacement of all walkway members, monorails, grating and handrail with new walkway members, grating and handrail.
- g. Replacement of existing cable tray support with new cable tray supports.
- h. Replacement of existing cladding, roofing (sheeting, j clamps, screw, etc, all inclusive), supporting members, with new members, roofing, cladding sheets.
- i. Strengthening of the fixed support (at support location) provided at NQO side. Refer tender drawing B774-004-83-43-0001 provided elsewhere in the tender.

- j. Strengthening of the sliding support (at support location) provided at NQD side. Refer tender drawing B774-004-83-43-0001 provided elsewhere in the tender.
- k. Supply, installation of walkway members, new grating, handrail, on the bridge as per standards and specifications attached. (B774-000-83-43-ST-01).

#### **5.5.2 NQO side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-004-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-004-83-43-0002.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of NQO landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-004-83-43-0002.
- e. Preparation of surface for receiving the bridge Fixed support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Relocating the existing scramble net to nearby safe area including safety study for performing the same.
- i. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

#### **5.5.3 NQD Side landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-004-83-43-0003.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-004-83-43-0003.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of NQD landing area near the bridge

- landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-004-83-43-0003.
- e. Preparation of surface for receiving the bridge sliding support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
  - f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
  - g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
  - h. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

## **5.6 WIN-NC Bridge (Strengthening)**

### **5.6.1 WIN-NC Bridge:**

- a. Analysis, design, modification of existing process bridge (as per company design basis, design criteria and FS attached elsewhere in the tender) including pipe supports, walkway, monorail at main deck level between platforms WIN and NC (including fabrication, site works, transportation, modification with all marine spread and man machinery inclusive) with reference to tender drawing B774-005-83-43-0001 provided elsewhere in the tender. The tender drawings are provided for understanding of contractor. Final strengthening shall be as per actual site conditions during pre-engineering survey.
- b. Strengthening of bottom chord members and top chord members with half cut tubulars / channels, including strengthening of joints with stiffeners, etc.
- c. Strengthening / replacement of existing pipe supports, hanging supports, cable tray supports below bridge main truss.
- d. Strengthening of bracing members by providing additional bracing members, etc at NC side and WIN side with half cut tubulars, / channels, etc including strengthening of joints with stiffeners, etc.
- e. Replacement of all walkway members, grating and handrail with new walkway members, grating and handrail.
- f. Replacement of existing cable tray support with new cable tray supports.
- g. Replacement of existing cladding, roofing (sheeting, j clamps, screw, etc, all inclusive), supporting members, with new members, roofing, cladding sheets.
- h. Strengthening of the fixed support (at support location) provided at WIN side. Refer tender drawing B774-005-83-43-0001 provided elsewhere in the tender.
- i. Strengthening of the sliding support (at support location) provided at NC side. Refer

tender drawing B774-005-83-43-0001 provided elsewhere in the tender.

- j. Supply, installation of walkway members, new grating, handrail, on the bridge as per standards and specifications attached. (B774-000-83-43-ST-01).

#### **5.6.2 WIN side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-005-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-005-83-43-0002.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of WIN landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-005-83-43-0002.
- e. Dismantling, removal of existing temporary supports performed by contractor including removal of scrap.
- f. Preparation of surface for receiving the bridge fixed support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- g. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- h. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- i. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

#### **5.6.3 NC Side landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-005-83-43-0003.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-005-83-43-0003.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of NC landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine



spread and man machinery inclusive) as per tender drawing B774-005-83-43-0003.

- e. Preparation of surface for receiving the bridge sliding support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

## **5.7 SC1-SCA Bridge (Strengthening)**

### **5.7.1 SC1-SCA Bridge:**

- a. Analysis, design, modification of existing process bridge (as per company design basis, design criteria and FS attached elsewhere in the tender) including pipe supports, walkway, monorail at main deck level between platforms SC1 and SCA (including fabrication, site works, transportation, modification with all marine spread and man machinery inclusive) with reference to tender drawing B774-007-83-43-0001 provided elsewhere in the tender. The tender drawings are provided for understanding of contractor. Final strengthening shall be as per actual site conditions during pre-engineering survey.
- b. Strengthening of bottom chord members and top chord members with half cut tubulars / channels, including strengthening of joints with stiffeners, etc.
- c. Strengthening / replacement of existing pipe supports, hanging supports, cable tray supports below bridge main truss.
- d. Strengthening of bracing members by providing additional bracing members, etc at SC1 side and SCA side with half cut tubulars, / channels, etc including strengthening of joints with stiffeners, etc.
- e. Strengthening of bottom tier of bridge (Piping, cable tray supporting) by providing new members, half cut tubulars, etc.
- f. Replacement of all walkway members, monorails, grating and handrail with new walkway members, grating and handrail.
- g. Replacement of existing cable tray support with new cable tray supports.
- h. Replacement of existing cladding, roofing (sheeting, j clamps, screw, etc, all inclusive), supporting members, with new members, roofing, cladding sheets.
- i. Strengthening of the fixed support (at support location) provided at SC1 side. Refer tender drawing B774-007-83-43-0001 provided elsewhere in the tender.

- j. Strengthening of the sliding support (at support location) provided at SCA side. Refer tender drawing B774-007-83-43-0001 provided elsewhere in the tender.
- k. Supply, installation of walkway members, new grating, handrail, on the bridge as per standards and specifications attached. (B774-000-83-43-ST-01).

#### **5.7.2 SC1 side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-006-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-006-83-43-0002.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of SC1 landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-007-83-43-0002.
- e. Preparation of surface for receiving the bridge Fixed support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Relocating the existing scramble net to nearby safe area including safety study for performing the same.
- i. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

#### **5.7.3 SCA Side landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-006-83-43-0003.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-006-83-43-0003.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of SCA landing area near the bridge



- landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-007-83-43-0003.
- e. Preparation of surface for receiving the bridge sliding support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
  - f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
  - g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
  - h. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

## **5.8 SCA-SCF Bridge (Strengthening)**

### **5.7.4 SCA-SCF Bridge:**

- a. Analysis, design, modification of existing flare bridge (as per company design basis, design criteria and FS attached elsewhere in the tender) including pipe supports, walkway main deck level between platforms SCA and SCF (including fabrication, site works, transportation, modification with all marine spread and man machinery inclusive) with reference to tender drawing B774-008-83-43-0001 provided elsewhere in the tender. The tender drawings are provided for understanding of contractor. Final strengthening shall be as per actual site conditions during pre-engineering survey.
- b. Strengthening of bottom chord members and top chord members with half cut tubulars / channels, including strengthening of joints with stiffeners, etc.
- c. Strengthening / replacement of existing pipe supports, hanging supports, cable tray supports.
- d. Strengthening of bracing members by providing additional bracing members, etc at SCA side and SCF side with half cut tubulars, / channels, etc including strengthening of joints with stiffeners, etc. Providing wrap plates, stiffeners for holes.
- e. Strengthening of bottom tier of bridge (Piping, cable tray supporting) by providing new members, half cut tubulars, etc.
- f. Replacement of all walkway members, grating and handrail with new walkway members, grating and handrail.
- g. Replacement of existing cable tray support with new cable tray supports.
- h. Strengthening of the fixed support (at support location) provided at SCF side. Refer tender drawing B774-008-83-43-0001 provided elsewhere in the tender.
- i. Strengthening of the sliding support (at support location) provided at SCA side. Refer tender drawing B774-008-83-43-0001 provided elsewhere in the tender.

- j. Supply, installation of walkway members, new grating, handrail, on the bridge as per standards and specifications attached. (B774-000-83-43-ST-01).

#### **5.7.5 SCA side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-008-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-008-83-43-0002.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of SCA landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-008-83-43-0002.
- e. Preparation of surface for receiving the bridge Fixed support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Relocating the existing scramble net to nearby safe area including safety study for performing the same.
- i. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

#### **5.7.6 SCF Side landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-008-83-43-0003.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-008-83-43-0003.
- c. UT survey of landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- d. Analysis, design, supply and strengthening of SCF landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-008-83-43-0003.

- e. Preparation of surface for receiving the bridge sliding support including construction equipment's such as hydraulic jack-ups, strengthening of supports.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses, deck legs by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position at contractor's cost and time.

## **6.0 BRIDGE / PLATFORMWISE DETAILED SCOPE OF WORK FOR PART B (NEW / REPLACEMENT OF BRIDGES)**

### **General**

The Scope shall include the structural work for facility / requirements detailed elsewhere in the bidding documents but not limited to following:

- a. The Contractor shall perform pre-engineering survey to verify the dimensions of existing structure for installation of the new Bridge structure & removal of obstructions, if any, before carrying out detailed engineering. Pre-engineering survey shall also be carried out for Bridge Landing, and structural modifications required etc. to cater to process/piping/electrical and other discipline scope of work indicated elsewhere in the Bid Document. Verification of As-Built Elevations /Levels, As-built Structural member sizes with respect to available Structural Drawing, verification of member thickness (using ultrasound method) shall be carried out during Pre engineering survey for all proposed extension / Modification; Bridge Landing locations and architectural modifications required for safe load transfer. Any problems envisaged in the offshore installation shall be brought to Company's notice in the pre-engineering survey report and feasible solution shall be put up for review, approval of Company.
- b. Detailed Design & Engineering in compliance to Structural/Architectural design criteria along with all related functional specifications. Global Inplace Analysis of the new bridge shall be carried out.
- c. Procurement of various materials.
- d. Fabrication.
- e. Load-out.
- f. Transportation.
- g. Installation.
- h. Pre-Construction Surveys is to be taken up before installation. Data obtained from Pre-Construction Surveys is to be compared with data obtained during Pre-Engineering Survey and remedial action, if any, is to be taken up.

- i. Supply of loose items, if any.
- j. As built documentation of the project shall be submitted as defined in Bid document. As-Built documents shall include drawings (as-built drawings shall have marking showing changes with respect to AFC drawing), all In-service & pre-service report. SACS model files (in SACS format along with Run files) of In-service, Lift Analysis and other Pre-service analysis shall also be submitted along with As-built documents.
- k. The work is to be executed in accordance with Structural design criteria and specifications as provided in the Bid documents.
- l. The Bridge shall cater for all piping, electrical and instrumentation cable/piping interconnection between existing platforms as indicated elsewhere in the bid.
- m. The exact length, width and height of bridge will be decided during detailed engineering.
- n. The bridge shall have rain protection. Roofing over bridge shall be provided as per FS. Bridge shall be coated as per FS-2005.
- o. Elevation of existing platforms shall be verified during pre-engineering survey and level differences if any shall be adjusted by Stepping, if required.
- p. Contractor is required to generate complete intelligent 3D model of the new platform and Bridges using software and procedures as given elsewhere in the tender. The associated 2D drawings, GADs & Piping Isometrics etc. shall be generated from the 3D model. Contractor shall follow the general guidelines described elsewhere in the Bid while modelling the project.

#### **DECK EXTENSION & STRENGTHENING OF EXISTING PLATFORMS**

- a. Indicative Deck extension on Cellar Deck & main deck (refer table below approx.) for ICW, ICG, ICP, BHS, SLQ Platforms is required for supporting new bridges ICW-ICG Lower Deck, ICP-ICG Lower Deck and replacement of BHS-SLQ bridge.

<b>Deck Extension / Bridge Landing Sizes for New / Replaced Bridges</b>				
<b>Sr. No</b>	<b>Bridge</b>	<b>Platform</b>	<b>Location</b>	<b>Extension envisaged (Approx.)</b>
1	ICW-ICG LD Bridge	ICW Platform	Near Existing Loading / Unloading area - Lower Deck	4.15 m X 3.75 m
2	ICW-ICG LD Bridge	ICG Platform	Near Existing Loading / Unloading area - Lower Deck	7.0 m X 8.5 m
3	ICP-ICG LD Bridge	ICP Platform	Along Grid 3, between Lifeboat & Loading / Unloading area	8.50 m X 3.75 m

4	ICP-ICG LD Bridge	ICG Platform	Near Existing scrabble net area	8.50 m X 3.0 m
5	BHS-SLQ Bridge	BHS Platform	Cellar Deck – For New Lifeboat & Bridge Landing	24.0 m X 5.5 m
6	BHS-SLQ Bridge	SLQ Platform	Cellar Deck – For New Bridge Landing	23.0 m X 4.0 m

- b. Deck extension location & exact details including deck extension sizes shall be firmed up during pre-engineering survey & detail engineering. The scope includes Local deck Inplace analysis and strengthening /addition/alterations of structural members at respective Platform for supporting the new Bridge, new life boat.
- c. To facilitate bridge connectivity at Cellar Deck of existing ICW, ICG, ICP, BHS and SLQ platform, modification to be carried out based on pre-engineering survey & landing details of new bridge. Wherever required, existing facilities to be relocated to facilitate bridge landing as part of the scope. Deck Structural Local Inplace Analysis & strengthening/addition/alterations shall be carried out for new location of facilities, if any.
- d. Peripheral walkway as per safety requirement shall be maintained after provision of bridge landing at ICW, ICG, ICP, BHS and SLQ Platform.
- e. Deck Structural Local inplace Analysis & strengthening shall be carried out as per Structural Design Criteria Part – I of Bid for the proposed extensions upto nearest Deck Leg for ICW, ICG, ICP, BHS and SLQ Platform with strengthening of existing structural members & Joints up to nearest Deck Legs. Strengthening of existing corroded structural members/replacement, provision of additional knee braces below cellar deck to support deck extensions as per Local inplace analysis during detail engineering is part of the scope.
- f. The replacement of Plating & Gratings at Piping/equipment/Process modification areas of ICW, ICG, ICP, BHS and SLQ Platform shall be carried out by the Contractor as defined elsewhere in the bid.
- g. The Strengthening scope of existing ICW, ICG, ICP, BHS and SLQ Deck Structure due to Local inplace analyses as per bid & meeting the requirements of structural design criteria, shall be carried out by the Contractor.
- h. The demolition & relocation of facilities wherever required shall be carried out as part of scope of work. Any structural Strengthening at ICW, ICG, ICP, BHS and SLQ platform due to facilities & modifications shall be carried out by the Contractor as part of the scope.

- i. Any problems envisaged for the modification works shall be brought to the Company's notice in the pre-engineering survey report and feasible solution shall also be proposed. If required, one more round of pre-engineering survey is to be carried out.

## **6.1 ICW-ICG Lower Deck Bridge (New Bridge)**

### **6.1.1 ICW-ICG Lower deck Bridge:**

- a. Analysis, design, supply and installation of new walkway bridge (as per design basis, design criteria and FS attached elsewhere in the tender) including walkway at cellar deck level between platforms ICW and ICG (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) at identified landing locations as per tender drawing B774-101-83-41-0001 provided elsewhere in the tender.
- b. The requirements of supply, erection of electrical items such as cables, cable tray, lighting, etc are provided elsewhere in the tender.
- c. Analysis and design of the fixed support of the new ICW-ICG walkway bridge (at identified support location) at ICG side. Refer tender drawing B774-101-83-41-0001 provided elsewhere in the tender.
- d. Analysis and design of the sliding support of the new ICW-ICG walkway bridge (at identified support location) at ICW side. Refer tender drawing B774-101-83-41-0001 provided elsewhere in the tender.
- e. Supply, installation of walkway members, new grating, handrail, on the bridge shall be as per standards and specifications attached. (B774-000-83-43-ST-01).

### **6.1.2 ICW side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-101-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-101-83-43-0002.
- c. Analysis, design, supply of loading / Unloading area (as per design basis, design criteria and FS attached elsewhere in the tender) near the existing loading / Unloading area (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-101-83-43-0003.
- d. UT survey of Existing loading / unloading area, Landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- e. Analysis, design, supply and strengthening of ICW landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-101-83-43-0002.



- f. Preparation of surface for receiving the bridge sliding support.
- g. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- h. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- i. Relocating the existing scramble net to nearby safe area including safety study for performing the same.
- j. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position.

### **6.1.3 ICG Side landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-101-83-43-0004.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-101-83-43-0004.
- c. Analysis, design, supply of deck extension for bridge supports area (as per design basis, design criteria and FS attached elsewhere in the tender) near the existing loading / Unloading area (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-101-83-43-0005.
- d. Preparation of surface for receiving the bridge fixed support.
- e. Analysis, design, supply and strengthening of ICW landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-101-83-43-0004.
- f. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- g. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- h. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position.

## **6.2 ICP-ICG Lower Deck Bridge (New Bridge)**

### **6.2.1 ICP-ICG Lower deck Bridge:**

- a. Analysis, design, supply and installation of new walkway bridge (as per design basis, design criteria and FS attached elsewhere in the tender) including walkway at cellar deck level between platforms ICP and ICG (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) at identified landing locations as per tender drawing B774-102-83-41-0001 provided elsewhere in the tender.
- b. The requirements of supply, erection of electrical items such as cables, cable tray, lighting, etc are provided elsewhere in the tender.
- c. Analysis and design of the fixed support of the new ICP-ICG walkway bridge (at identified support location) at ICG side. Refer tender drawing B774-102-83-41-0001 provided elsewhere in the tender.
- d. Analysis and design of the sliding support of the new ICP-ICG walkway bridge (at identified support location) at ICP side. Refer tender drawing B774-102-83-41-0001 provided elsewhere in the tender.
- e. Supply, installation of walkway members, new grating, handrail, on the bridge shall be as per standards and specifications attached. (B774-000-83-43-ST-01).

#### **6.2.2 ICP side Landin Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-102-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-102-83-43-0002.
- c. Analysis, design, supply and installation of extension for landing area (as per design basis, design criteria and FS attached elsewhere in the tender) near the existing loading / Unloading area (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-102-83-43-0003.
- d. UT survey of Existing loading / unloading area, Landing area from jacket walkway to main deck area including deck legs for performing the local strengthening of bridge landing area. NDT conducted by company is attached with the tender for understanding of the contractor.
- e. Analysis, design, supply and strengthening of ICP landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-102-83-43-0002.
- f. Preparation of surface for receiving the bridge sliding support.
- g. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.



- h. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- i. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position.

### **6.2.3 ICG Side Landing Area**

- i. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-102-83-43-0004.
- j. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-102-83-43-0004.
- k. Analysis, design, supply of deck extension for bridge supports area (as per design basis, design criteria and FS attached elsewhere in the tender) near the existing loading / Unloading area (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-102-83-43-0005.
- l. Preparation of surface for receiving the bridge fixed support.
- m. Analysis, design, supply and strengthening of ICG landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-102-83-43-0005.
- n. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- o. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- p. Relocation of the existing scramble net to the new location as per safety study.
- q. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position.

## **6.3 BHS-SLQ Lower Deck Bridge (New Bridge)**

### **6.3.1 BHS-SLQ Lower deck Bridge: (New Bridge)**

- a. Analysis, design, supply and installation of new walkway bridge (as per design basis, design criteria and FS attached elsewhere in the tender) including walkway at cellar deck level between platforms BHS and SLQ (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) at identified landing locations as per tender drawing B774-103-83-41-0001 provided elsewhere in the tender.
- b. The requirements of supply, erection of electrical items such as cables, cable tray, lighting, etc are provided elsewhere in the tender.

- c. Analysis and design of the fixed support of the new BHS-SLQ bridge (at identified support location) at SLQ side. Refer tender drawing B774-103-83-41-0001 provided elsewhere in the tender.
- d. Analysis and design of the sliding support of the new BHS-SLQ bridge (at identified support location) at BHS side. Refer tender drawing B774-103-83-41-0001 provided elsewhere in the tender.
- e. Analysis and design of cable tray supports, pipe supports, monorails, etc for re-routing of all new piping, cables, etc similar as existing BHS-SLQ bridge, Refer piping, electrical and instrumentation scope of work for further details.
- f. Analysis and design, supply, installation of cladding, roofing (including sheeting, J clamps, etc.) along with cladding, roofing supporting members.
- g. Supply, installation of walkway members, new grating, handrail, on the bridge shall be as per standards and specifications attached. (B774-000-83-43-ST-01).

#### **6.3.2 BHS side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-103-83-43-0002.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-103-83-43-0002.
- c. Analysis, design, supply and installation of extension for landing area (as per design basis, design criteria and FS attached elsewhere in the tender) near Row B along with extensions for new life boat, muster area, pipe way, cable tray (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-103-83-43-0003.
- d. Contractor shall perform safety study for performing the extension and supply, provide all necessary safety items, including marking of safety muster area, life jackets, other safety items, etc all inclusive shall be in scope of contractor.
- e. UT survey of Landing area from jacket walkway to main deck area including deck legs, module thickness for performing the local strengthening of bridge landing area along with lifeboat extension. NDT conducted by company is attached with the tender for understanding of the contractor only.
- f. Procurement, supply, transportation, erection and commissioning of new lifeboat.
- g. Analysis, design, supply and strengthening of BHS landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-102-83-43-0002.
- h. Preparation of surface for receiving the bridge sliding support.
- i. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses by providing strengthening/modification. Extent

of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.

- j. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- k. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position.

### **6.3.3 SLQ side Landing Area**

- a. Dismantling of existing corroded CS grating and providing new grating as per marked in drawing B774-103-83-43-0004.
- b. Dismantling of existing corroded handrail and providing new handrail as marked in drawing B774-103-83-43-0004.
- c. Analysis, design, supply and installation of extension for landing area (as per design basis, design criteria and FS attached elsewhere in the tender) near Row B along with extensions for new life boat, pipe way, cable tray (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-103-83-43-0005.
- d. UT survey of Landing area from jacket walkway to main deck area including deck legs, module thickness for performing the local strengthening of bridge landing area along with lifeboat extension. NDT conducted by company is attached with the tender for understanding of the contractor only.
- e. Analysis, design, supply and strengthening of SLQ landing area near the bridge landing (including fabrication at onshore, transportation, erection with all marine spread and man machinery inclusive) as per tender drawing B774-102-83-43-0002.
- f. Preparation of surface for receiving the bridge sliding support.
- g. Repair of existing corroded beams and corresponding joints consisting of stiffeners, flange extension plates, half cut tubulars, etc wherever corroded at cellar deck level and main deck level including trusses by providing strengthening/modification. Extent of corrosion / strengthening requirement are marked in NDT drawings for contractors understanding only.
- h. Repair of existing tubular joints, I section joints with stiffeners, plates, etc by strengthening / modification as per analysis requirements.
- i. Any other facility / structural members modified by contractor for execution of work shall be restored to its original position.

### **6.3.4 BHS-SLQ Lower deck bridge (Existing Bridge)**

- k. Analysis, design, strengthening, etc for demolition, dismantling of existing process bridge BHS-SLQ (as per company design basis, design criteria and FS attached elsewhere in the tender) including pipe supports, walkway, monorail between platforms BHS and SLQ (including site works, transportation, modification with all

marine spread and man machinery inclusive) with reference to tender drawing B774-005-83-43-0006 provided elsewhere in the tender. The tender drawings are provided for understanding of contractor. Final demolition / dismantling drawings shall be as per actual site conditions during pre-engineering survey. The removal of the bridge shall only commence after the new bridge is installed and all piping cables are commissioned in all respect with approval of Company and company representative)

- l. Demolition / Dismantling of existing pipe supports, hanging supports, cable tray supports below bridge main truss.
- m. Strengthening of bracing members by providing additional bracing members, etc at BHS and SLQ side with half cut tubulars, / channels, etc including strengthening of joints with stiffeners, etc to facilitate removal.
- n. Demolition / Dismantling of all walkway members, grating and handrail with new walkway members, grating and handrail.
- o. Demolition / Dismantling of existing cable tray support with new cable tray supports.
- p. Demolition / Dismantling of existing cladding, roofing (sheeting, j clamps, screw, etc, all inclusive), supporting members, with new members, roofing, cladding sheets.
- q. Demolition / Dismantling of the fixed support (at support location) provided at BHS side. Refer tender drawing B774-005-83-43-0001 provided elsewhere in the tender.
- r. Demolition / Dismantling of the sliding support (at support location) provided at SLQ side. Refer tender drawing B774-005-83-43-0001 provided elsewhere in the tender.

## **7.0 PRE ENGINEERING SURVEY REQUIREMENTS**

The survey requirement will include pre-engineering survey for platforms as mentioned in detailed scope of work to ascertain the quantity and location of work points. The EPC Contractor shall be fully responsible for carrying out the survey/ and other structural elements for replacements.

Survey requirement broadly includes:

- i) Collection of necessary as built information which are required for performing detailed engineering (extent of damage/corrosion, measurements, exact dimension, chequered plates, stair cases, replacement of plates, cladding, roofing, joints, members etc.).
- ii) EPC Contractor shall prepare drawings and sketches showing the existing and future structural components.
- iii) Check the feasibility of removal/ installation of all replaced items's, structural strengthening & modification at these locations.
- iv) Check the fouling of new facilities with the existing structural member, piping, & equipment.
- v) Availability of deck crane and its capacity including its lift radius & angle and approach to the installation location from loading & unloading area at the platform.
- vi) Visual Health check of all members and joints of for bridge including landing area from jacket walkway to main deck level, etc. UT survey of existing beams/members found damaged/corroded

in visual health check shall be carried out. UT survey shall also be carried out for members/beams in the area & member supporting the new/ replaced equipment, deck extensions and structural elements needing revamp/strengthening/replacement and as indicated by Engineer in charge at site.

vii) Carrying out the survey/ measurements for installation aspects.

viii) Any other detail/ aspect required for preparation of AFC drawings and smooth installation and execution of job.

The EPC Contractor shall submit detailed survey report clearly indicating the overall scope of structural work for each bridge individually giving details of survey observations in form of marked up sketches, drawings for site measurements, visual health check and UT survey results, extent and need for structural strengthening/replacement and all the constraints/obstacles, temporary arrangements if required to be erected, installation schemes and safety hazards for executing the work.

## **8.0 SCOPE OF SUPPLY**

### **8.1 LSTK Contractor scope of supply**

- a) All material, tools, tackles, equipment, manpower etc for the successful completion of the job.
- b) Adequate capacity marine spread for survey/ transportation/ installation etc of the entire scope of work.

### **8.2 Company scope of supply**

- a) Facility of deck crane at platform for material handling.

Facility of material handling by deck crane shall be made available to the LSTK Contractor with prior approval of company. However, company's operational requirements shall supersede LSTK Contractor's requirements with regards to availability of deck crane for material handling and LSTK Contractor shall make all necessary arrangements for material handling in absence of deck crane availability.

**ANNEXURE 1  
LIST OF TENDER DRAWINGS**

Sr. No	DRAWING NUMBER	DESCRIPTION	BRIDGE / PLATFORM	No. OF SHEETS
1	B774-000-83-43-0001	General Notes	Common	
2	B774-001-83-43-0001	ICW-ICG Upper Deck drawing – Strengthening and modifications.	ICW-ICG Upper Deck	
3	B774-001-83-43-0002	ICW Landing Area - Modification	ICW Platform	
4	B774-001-83-43-0003	ICG Landing Area - Modification	ICG Platform	
5	B774-002-83-43-0001	ICP-ICG Upper Deck drawing – Strengthening and modifications.	ICP-ICG Upper Deck	
6	B774-002-83-43-0002	ICP Landing Area - Modification	ICP Platform	
7	B774-002-83-43-0003	ICG Landing Area - Modification	ICG Platform	
8	B774-003-83-43-0001	WIS-SLQ Upper Deck drawing – Strengthening and modifications.	WIS-SLQ Lower deck Bridge	
9	B774-003-83-43-0002	WIS Landing Area - Modification	WIS Platform	
10	B774-003-83-43-0003	SLQ Landing Area - Modification	SLQ Platform	
11	B774-004-83-43-0001	NQO-NQD Upper Deck drawing – Strengthening and modifications.	NQO-NQD Bridge	
12	B774-004-83-43-0002	NQO Landing Area - Modification	NQO Platform	
13	B774-004-83-43-0003	NQD Landing Area - Modification	NQD Platform	
14	B774-005-83-43-0001	WIN-NC Bridge drawing – Strengthening and modifications.	WIN-NC Bridge	
15	B774-005-83-43-0002	WIN Landing Area - Modification	WIN Platform	
16	B774-005-83-43-0003	NC Landing Area - Modification	NC Platform	
17	B774-007-83-43-0001	SC1-SCA Bridge drawing – Strengthening and modifications.	SC1-SCA Bridge	



18	B774-007-83-43-0002	SC1 Landing Area - Modification	SC1 Platform	
19	B774-007-83-43-0003	SCA Landing Area - Modification	SCA Platform	
20	B774-008-83-43-0001	SCA-SCF Bridge drawing – Strengthening and modifications.	SC1-SCA Bridge	
21	B774-008-83-43-0002	SCA Landing Area - Modification	SCA Platform	
22	B774-008-83-43-0003	SCF Flare boom, Tripod Modification	SCF Platform	
23	B774-101-83-43-0001	ICW-ICG Lower Deck bridge drawings	ICW-ICG Lower Deck	
24	B774-101-83-43-0002	ICW Landing Area - Modification	ICW Platform	
25	B774-101-83-43-0003	ICW Landing Area -New Extensions	ICW Platform	
26	B774-101-83-43-0004	ICG Landing Area - Modification	ICG Platform	
27	B774-101-83-43-0005	ICG Landing Area -New Extensions	ICG Platform	
28	B774-102-83-43-0001	ICP-ICG Lower Deck bridge drawings	ICP-ICG Lower Deck	
29	B774-102-83-43-0002	ICP Landing Area - Modification	ICP Platform	
30	B774-102-83-43-0003	ICP Landing Area -New Extensions	ICP Platform	
31	B774-102-83-43-0004	ICG Landing Area - Modification	ICG Platform	
32	B774-102-83-43-0005	ICG Landing Area -New Extensions	ICG Platform	
33	B774-103-83-43-0001	BHS-SLQ Lower Deck bridge drawings	BHS-SLQ Lower Deck (New)	
34	B774-103-83-43-0002	BHS Landing Area - Modification	BHS Platform	
35	B774-103-83-43-0003	BHS Landing Area -New Extensions	BHS Platform	
36	B774-103-83-43-0004	SLQ Landing Area - Modification	SLQ Platform	



37	B774-103-83-43-0005	SLQ Landing Area -New Extensions	SLQ Platform	
38	B774-103-83-43-0006	BHS – SLQ Bridge Demolition Drawings	BHS-SLQ Lower Deck (Existing)	



## SCOPE OF SUPPLY & WORK (ELECTRICAL)

**PROJECT:** ENGINEERING / TECHNICAL CONSULTANCY  
SERVICES FOR PREPARATION OF  
EXECUTION METHODOLOGY, SOW AND  
COST ESTIMATES FOR REPLACEMENT /  
REFURBISHMENT OF BRIDGES IN MH ASSET

**OWNER :** M/S ONGC

**LOCATION :** MH ASSET (NORTH AND SOUTH FIELD)

**JOB NO :** B774

B	17.11.2025	REVISED & REISSUED WITH TENDER	PM	RKS	ANPS
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Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

## 1.1 INTRODUCTION

This document outlines the requirements for Electrical Facilities associated with the replacement and refurbishment of bridges as envisaged under the scope of this project. It includes all necessary hook-ups, tie-ins, and integration activities related to the electrical systems supporting the associated works.

The scope defines the minimum requirements for the following:

Design and Engineering of electrical systems in accordance with project specifications and applicable standards

Procurement and Supply of electrical equipment and materials taking into account of offshore environment.

Installation and Integration of electrical facilities with existing and new infrastructure.

Testing, Commissioning, and Handover of all electrical systems to ensure operational readiness

All activities shall be executed in compliance with the requirement of relevant standards and statutory regulations as defined in documents attached/ referred. Design, basic engineering, detailed engineering, preparation of drawings/ documents, manufacturing, supply of the electrical system shall be performed as per enclosed specifications, drawings enclosed and these documents shall be read in conjunction with project scope of work of other departments.

## 1.2 SCOPE OF WORK

Vendor's scope of work shall include the following:

1.2.1 Bidder scope includes pre-bid site survey, to ascertain the exact quantum of Electric work and the extent of modifications envisaged due to the replacement/refurbishment of the bridges.

### 1.2.2 Basic design and detailed Engineering

1.2.2.1 Collection of data from site as required for carrying out detailed engineering.

1.2.2.2 Preparation of area wise cable, lighting layouts.

1.2.2.3 Preparation of bill of materials for lighting, cabling, JBs, lighting poles, earthing and miscellaneous items.

1.2.2.4 Preparation of cable schedule.

1.2.2.5 Revalidation of voltage drop calculations due to modified cable lengths or routes.

1.2.2.6 Equipment specifications and data sheets.

1.2.2.7 Preparation of As-built drawings of all areas.

1.2.2.8 Any other work/ activity, which are not listed above, however are necessary for completeness of electrical system.

**1.2.3 Disconnection, dismantling, removal of electrical equipment affected due to replacement/refurbishment of bridges and replacement by new one**

- a. Disconnection, dismantling of existing lighting fixtures with associated control gear, junction box, cables.
- b. Disconnection, dismantling of Platform Lighting Pole complete with associated lighting fixtures and its junction box including disconnection of cables.
- c. Disconnection, dismantling of damaged lighting/JBs/Cable trays / supporting structures.
- d. Disconnection, dismantling of any other electrical items associated with bridge replacement/refurbishment.

1.2.4 Rerouting or extension of LV/MV power and control cables across the new bridge structure including supply, laying and termination of cables and accessories.

1.2.5 Supply and Installation of GI ladder type cable trays, supports.

1.2.6 Supply and Installation of bridge lighting (navigation, access, and emergency lighting) with IP65 (min) rated fixtures in GRP /COPPER FREE ALUMINIUM enclosure.

1.2.7 Supply and Installation of Lighting & Power Panel, sockets etc.

1.2.8 Integration of obstruction lights and aviation warning systems if applicable.

1.2.9 Provision of emergency lighting and exit signage powered via UPS or battery backup.

1.2.10 Supply and Installation of lighting poles and junction boxes suited for marine-grade environment.

1.2.11 Supply & installation of equipotential bonding across bridge structures.

1.2.12 Extension of earthing networks to maintain continuity and safety compliance.

1.2.13 Pre-commissioning and functional testing of all electrical systems.

1.2.14 Selection of all electrical items in line with existing electrical items and suitable for hazardous area classification specified in the job specification.

**1.3 Specific Requirements**

**1.3.1 ICP process Complex (ICP-ICG Top, ICP-ICG-Lower, ICG-ICW Top, ICG-ICW Lower)**

1.3.1.1 All power & control cables shall be XLPE insulated with FRLA sheathing.

1.3.1.2 The contractor shall ensure that the outgoing feeder of lighting/power panel is supplied with RCBO (Residual Current Breaker with Overcurrent protection) in place of conventional use of MCB (Miniature Circuit Breaker) and ELCB (Earth Leakage Circuit Breaker).

1.3.1.3 The contractor shall ensure that all cable gland shall be Flameproof type and suitable for use in Zone-1 hazardous area. Glands shall be of double compression type with rubber sealing elements specifically designed for durability and reliability in marine operations.

1.3.1.4 The contractor shall provide safety chains in conjunction with all hanging light fixtures. The intent is to ensure additional mechanical safety and protection against accidental dislodging or failure of primary supports.

### 1.3.2 New SLQ-BHS bridge

1.3.2.1 The contractor shall be responsible for the identification of both end terminations of all Power & control cables routed through SLQ-BHS Bridge.

1.3.2.2 The contractor shall be responsible for providing all temporary arrangements of electrical/instrument items as required during execution of the works. Such arrangements shall be designed and implemented to minimize or avoid shutdown of the platform.

Scope includes:

- Supply, installation, and maintenance of temporary electrical connections.
- Safe removal of temporary systems upon completion of permanent works.

All costs, manpower, materials, and associated activities for these temporary arrangements shall be considered within the contractor's scope of work.

1.3.2.3 The contractor shall be responsible for all activities associated with laying new cables across the bridge. Where such cable laying requires extra cable trays at the platform side, the contractor shall ensure provision and installation.

Scope shall include, but is not limited to, supply and installation of:

- Cables
- Cable trays
- Lighting fixtures and accessories
- Any other related electrical items necessary to complete the works.

### 1.4 List of attachments:

S.No.	Description	Document no.	Rev. No.
1	Job Specification Electrical	B774-000-16-50-SP-1001	A
2	Specification for flameproof lighting & power panel	6-51-0008	6
3	Specification for medium and high voltage cables and accessories.	6-51-0051	9
4	Specification for hazardous area light fixtures and junctions' boxes	6-51-0061	6
5	Typical earth plate and fixing details.	7-51-0103	7

6	Equipment earthing schedule	7-51-0116	9
7	Typical installation of lighting fixture on platform	7-51-0202	6
8	Details for hot dip galvanized ladder type cable trays	7-51-0333	4
9	Inspection and test plan for flameproof lighting and power panels	6-81-1008	4
10	Inspection and Test Plan for MV and HV cables and accessories	6-81-1051	4
11	Inspection and test plan for hazardous area lighting fixture and junction boxes	6-81-1061	4



## SCOPE OF WORKS & SUPPLY (PIPING)

**PROJECT :** ENGINEERING / TECHNICAL CONSULTANCY SERVICES FOR PREPERATION OF EXECUTION METHODOLOGY, SOW AND COST ESTIMATES FOR REPLACEMENT /REFURBISHMENT OF BRIDGES IN MH ASSET

**OWNER :** OIL AND NATURAL GAS CORPORATION LTD. (ONGC), MUMBAI

**LOCATION :** MH ASSET (NORTH AND SOUTH FIELD)

**CONSULTANT :** ENGINEERS INDIA LTD, DELHI

**EIL JOB NO. :** B774

A	14-11-2025	ISSUED FOR BIDS	AG	SKS	AKK
Rev. No	Date	Purpose	Prepared by	Checked by	Approved by

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## 1.0 **GENERAL**

The specifications given herein describes the minimum requirements and guidelines to EPC CONTRACTOR for the complete scope of work, supply and procurement of materials and consumables, fabrication, erection, testing, flushing, insulation, painting, liquidation of checklists and Box up including application of torqueing of the total piping system on the specified bridges of offshore platforms of M/s OIL AND NATURAL GAS CORPORATION Limited. EPC Contractor shall do close coordination with Client/Client representative and other contractors of the project. EPC Contractor shall comply Piping and Process specification/drawings/guidelines attached with the tender document elsewhere.

Following is the list of bridges envisaged in the scope of work.

### **IC Complex:**

1. ICP-ICG Lower Deck bridge (New)
2. ICW-ICG Lower Deck bridge (New)
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### **BHS Complex:**

5. BHS-SLQ Lower Deck bridge (Replacement)
6. SLQ-WIS Lower Deck bridge

### **NQO Complex:**

7. NQO-NQD Lower Deck bridge

### **WIN Complex:**

8. WIN-NC Lower Deck bridge

### **SCA Complex:**

9. SCA-SC1 bridge
10. SCA-SCF bridge

Total of 10 bridges (3 New bridges & 7 bridges for strengthening) are included in the scope of work of LSTK contractor.

## 2.0 **PIPING SCOPE OF WORK**

- 2.1 The piping scope of work and supply envisaged under this tender shall include complete design, detail engineering, preparation of drawings and documents, flexibility analysis and supporting, supply and procurement piping material and consumables as per specifications, fabrication, erection, Site survey to assess the extent of modification works, dismantling/removal of existing piping, support etc.. installation, commissioning, carrying out NDT, Positive material identification, boxing up including application of torqueing, supply of mandatory spares (if applicable), painting, insulation, testing, complete in all respects of all piping including hook-up with existing piping in accordance with the final process package, required for successful erection, commissioning, operation and maintenance of the offshore Platforms/Bridges.

## **2.2 REFURBISHMENT OF BRIDGES**

- 2.2.1 For Bridge Sl. No. 3, 4, 6, 7, 8, 9, and 10 no modification in pipe routing has been envisaged. EPC shall, in consultation with the Owner/Owner's Representative during the pre-engineering site survey, identify all worn-out or damaged pipe supports of the existing piping on these bridges. EPC shall replace the identified worn-out/damaged pipe supports during the course of bridge structural strengthening works with the identical supports like resting, non-resting, guide with gaps, cross guide with gaps etc...
- 2.2.2 In all cases where pipe supports are required to be replaced during operation, EPC shall provide adequate temporary supports to safely sustain the piping system, ensuring no disturbance to pipe alignment, slopes, stresses, or ongoing operations. Temporary supports shall be designed to withstand operating loads, including insulation and fluid contents.
- 2.2.3 EPC shall carry out replacement of damaged or worn-out pipe supports in a controlled manner, following the sequence of structural modification works to ensure safe and efficient execution. Permanent supports shall be reinstated in the same type and configuration as existing.
- 2.2.4 EPC shall ensure that support spacing, orientation, and load distribution remain unchanged. Any modification or deviation from the existing support arrangement shall be taken up only with prior approval of Owner/Owner's Representative.
- 2.2.5 Contractor shall obtain necessary permits for Hot work, Cold work and Confined Space from Owner in the prescribed format. All hot work and structural modifications in the vicinity of live piping shall be executed in strict compliance with project and Owner's safety procedures and Owner's work permit requirements.
- 2.2.6 EPC shall ensure adequate fire protection, spark containment, and monitoring to avoid any risk to ongoing operations. Work activities shall be planned in such a way so as to minimize the disruption of other activities being carried out in an operational area.
- 2.2.7 Any damage to piping, coating, insulation, or to other piping, equipment, or structural components during temporary support provision, support replacement, or reinstatement activities shall be rectified by EPC at no additional cost to the Owner/Owner's Representative.
- 2.2.8 For reference of the EPC, the Bridge GAD extracted from laser scanned 3D model has been provided in Annexure-I. The EPC shall utilize these GADs to ascertain the number of lines, tentative routing, and pipe supporting requirements.

## **2.3 NEW BRIDGE INSTALLATION**

- 2.3.1 **For Bridge Sl. No. 1 and 2, (ICP-ICG & ICW-ICG)** new bridges are being planned for installation at the identified locations. As of the date of this tender, no piping is planned to be routed along these bridges. In the event the Owner/Owner's Representative instructs EPC contractor to route any piping, the same shall be identified during the field survey and installed by EPC contractor in compliance with the specifications provided in this document.

- 2.3.2 The loading for such additional piping shall be calculated by EPC and duly incorporated in the bridge design, with approval from Owner/Owner's Representative.
- 2.3.3 For Bridge No. 5 (BHS-SLQ) replacement of the existing bridge at a newly identified location on the platform is proposed as per the details and specifications provided elsewhere in this tender. The existing piping on the existing bridge shall be replaced with new piping and shall be routed on the new bridge by the EPC contractor in accordance with the specifications / standards / guidelines / functional specifications provided in this tender.
- 2.3.4 EPC shall route the bridge piping on to the new bridge location, maintaining the same piping layout on the bridge as the existing, with new hook-ups to be taken from the existing lines on the platform.
- 2.3.5 All piping lines on the bridge connecting the two offshore platforms shall be classified as stress critical lines. The EPC Contractor shall carry out detailed flexibility analysis for these lines, considering bridge movements, thermal expansion, wind and wave induced loads, differential settlement, fatigue, and any other site-specific conditions. The analysis results shall be submitted to Owner/Owner's Representative for review and approval.
- 2.3.6 Pipe supporting on the bridge, including support locations, type of supports, guide gaps, cross-guides, and other restraint details, shall be designed and finalized based on the outcomes of the flexibility.
- 2.3.7 Sketches for tie-in points shall be developed based on the pre-engineering site survey and tender GAD (Annexure-1) which is extracted from laser scanned 3D model. The location of piping tie-in points shall be finalized by the Contractor in consultation with the Owner/Owner's Representative during the pre-engineering site survey.
- 2.3.8 Procedure for tie-in connections execution shall be decided and finalized by the EPC Contractor based on the site survey, with prior approval from the Owner/Owner's Representative, taking into account the shutdown schedules, considering partial shutdown and considering operational constraints communicated by the Owner.
- 2.3.9 EPC shall ensure proper isolation, control, and monitoring to avoid any risk to ongoing operations.
- 2.3.10 Contractor shall pre-fabricate to the maximum possible extent.
- 2.3.11 The field welds, adjustment welds shall be kept to a minimum.
- 2.3.12 Contractor shall mark all the hook-up points and paint the lines / part of these lines with the agreed colours that require dismantling.
- 2.4 Contractor to note that work has to be performed both in the running plant and during shutdown. The scheme of work execution shall be approved by OWNER/OWNER'S Representative prior to taking up these activities in the plant. Contractor has to take utmost care & safety precautions while working in the plant. Hot Work Permits / Safety Permits for working in the plant shall have to be taken from the Owner by the Contractor. Contractor under the supervision of Owner shall carry out draining and making the lines hydrocarbon free. Contractor shall carry out

work only after obtaining clearance from the Owner / Owner's Representative in the prescribed format.

- 2.5 The materials, design, and workmanship shall conform to relevant codes, Scope of Work & Supply (Piping), Standards & Specifications contained in the Tender Package. In the absence of any Standard/Specification/Codes covering any part of work covered in this Tender document, the instruction of OWNER/OWNER'S Representative shall be binding on the EPC contractor.
- 2.6 Drawings enclosed in the Tender Package shows minimum requirements and for guidance to the EPC Contractor. EPC Contractor shall develop Equipment Layouts (Part), Piping General Arrangement drawings, Isometrics and piping Support drawings, Nozzle orientations etc. in accordance and in compliance with the requirements of ONGC Piping Design criteria (Vol-II, Section-3.3), Functional Specifications For Piping Design - Spec. No. 2004 A, Functional Specifications For Piping Specialties - Spec. No. FS 2004 D, Specification For Inline Separator-2004-F, Job Specifications, Standard Specifications, codes & standards and Process Package etc. and submit the same to OWNER/OWNER'S REPRESENTATIVE for review/approval.
- 2.7 Supply, design, fabrication and installation of pipe support are in contractor's scope of work, supply and installation. Contractor shall develop Piping Support Standards and submit the same for OWNER/OWNER'S REPRESENTATIVE review/approval.
- 2.8 Piping Design, Engineering, Fabrication, Inspection & Testing shall be as per ASME B31.3, API RP 14E and other specifications and standards attached with this Tender.
- 2.9 Nace MR-0103 mentioned in specifications is not applicable for this project. All sour service piping materials shall conform to NACE Standard MR-01-75/ ISO 15156, as well as Functional Specification for Piping Design, Spec. No. 2004 A. and Specification for 'Material requirements for carbon steel components used in sour service for oil and gas production (Doc No. 6-79-0012).
- 2.10 All material shall be procured as per the specifications attached with the Tender Package. At any stage, if any specification is required to be revised or any new specification is required to be generated, the contractor shall prepare/ revise the specification and shall submit to the Company for approval.
- 2.11 Procurement of all piping material shall be done from Owner/Owner's Representative approved Vendors. The same shall be provided after award to successful bidder.
- 2.12 Procurement of support material for pipe supports, temporary supports & scaffolding materials, all types of welding materials, electrodes, filler wires, hot/cold insulation materials, primers & paints as required. Arrangement of Radiography /UT machine as required for NDT & all other facilities to complete the work in all respects shall be provided by the contractor.
- 2.13 Preparation of detailed survey report for complete scope of work including hook-up details and submission of the same to OWNER/OWNER'S REPRESENTATIVE for review.
- 2.14 Fabrication of pipe spools, piping supports etc. at contractor's works/yard & Non-Destructive Testing (UT/DP/MP/X-RAY/hydro-testing) as per technical

specifications, codes and standards. NDT shall be witnessed & certified by OWNER/OWNER'S REPRESENTATIVE.

- 2.15 Preparation of Welder Procedure Specification (WPS), Procedure Qualification Records (PQR), qualifying welders etc.
- 2.16 Torquing / Tensioning of bolts for all the flange joints is to be done as per the Specification. EPC Contractor shall develop a complete specification for bolt tensioning and bolt torque values line wise and size wise, stud/bolt tightening pattern, lubricants to be used and all other requirements. This shall be submitted to Owner for reference and records. However, any leakage observed during hydrotest / leak check / post commissioning is to be rectified by the contractor without and time and cost implications. Transportation of personnel, fabricated spool pieces & other erection materials to/from contractor's work site.
- 2.17 Contractor shall leave adequate margin in the prefabricated spools for any field adjustments. Non-Destructive Testing (NDT) of prefabricated spools shall be done by Contractor.
- 2.18 Painting on Piping including supports shall be carried out as per ONGC Specification for Protective Coating Spec. No. 2005. The work shall include surface preparation as required, selection, supply and application of required paint system on the insulated and un-insulated surface of pipe, valve assemblies, providing color coding and color bands on pipe etc. including repair of damaged painted surfaces
- 2.19 Contractor shall take necessary precautions for external corrosion, internal and external mechanical damages of each spool, including stiffener rings, bevel ends, finished face of flanges etc. of each pipe spool during storage as well as transportation.
- 2.20 All pre-fabricated piping spools shall be painted as per job specification.
- 2.21 All pre-fabricated spools shall be supplied with minimum field joints. EPC shall mark the field joints in the isometric/GAD. EPC shall ensure that marking/ tagging on piping spools shall be in a manner for proper traceability at site.
- 2.22 Any other work not specifically mentioned above but required for completeness of the project as per specifications/drawings & instructions of Owner / Owner's Representative.
- 2.23 Contractor is required to generate complete associated 2D drawings, GADs & Piping Isometrics including bill of material, test required, stress relieving and NDT requirement etc. for minimum requirement refer specification no. B774-6-44-0504.
- 2.24 All lines will be duly supported. Lines requiring formal stress analysis shall be stress analyzed using CAESAR II and stress reports shall be submitted to Owner / Owner's Representative.
- 2.25 Piping shall be located so as to eliminate any overhead or stumbling hazards. Minimum headroom clearance of 2.2 m shall be maintained. No line shall be run on floors, walkways, or skid grating, which would result in tripping hazard.
- 2.26 Piping shall run in an orderly manner and grouped in banks wherever possible. Piping arrangement shall be based on the requirements of economy and ease of maintenance/operation. The design shall also provide for economy in the location of

pipe supports with larger lines routed for flexibility and streamlined flow and smaller lines following the larger lines.

- 2.27 Piping in banks shall be assigned specific elevations for routing in the north-south and east-west directions. These elevations shall be used throughout except where pockets are to be avoided or where space limitations do not permit use of selected elevations.
- 2.28 Following minimum drawings and documents shall be prepared by the EPC CONTRACTOR for execution of piping works and submit for review/information to OWNER / OWNER's REPRESENTATIVE for review and approval.
  - 2.28.1 Equipment Layouts (Part) in plans, elevations, sections, with monorails, lift, and Vendor data incorporated. Approaches maintenance areas and drop out areas with all Vendor data, Escape Route.
  - 2.28.2 Safety and Escape Route Layout.
  - 2.28.3 Piping General Arrangement Drawings.
  - 2.28.4 Piping Support General Arrangement Drawings.
  - 2.28.5 Piping Isometrics for all lines including small bore lines. All isometrics to have Support Marking, Bill of Material and other contents as called for in this document.
  - 2.28.6 Flexibility Analysis reports (vis-à-vis static, dynamic, analog, slug flow, fatigue, wind & seismic analysis reports) / Flange leakage calculation reports, Engineering Data sheet for Spring Supports etc.
  - 2.28.7 Dynamic analysis reports.
  - 2.28.8 Engineering Data/sketches for Piping Specialties (refer ONGC Functional Specification for Piping Specialties, Spec. No. FS 2004 D other miscellaneous items.
  - 2.28.9 Special support drawings. Pipe support standards/drawings to cover entire piping. Separate pipe support standards for high-pressure piping and slope lines.
  - 2.28.10 Updated Piping Material Specification, for specifications EPC to refer Owner's Piping Material Specification, Spec. No. 2008. EPC shall update PMS & submit the same along with change list for Owner/ Owner's Representative approval. New piping class (if required) shall be designated based on consultation with Owner/ Owner's Representative. Any specific requirement not covered in PMS/NDT/Welding Specification documents attached with the tender but specified in elsewhere has to be updated by EPC Contractor in the relevant documents.



- 2.28.11 Valve Material Specification shall be prepared by EPC based on Owner's PMS (Spec. No. 2008) and any other requirement as specified in the Tender documents.

The following Fugitive emission requirement for valves shall be complied by EPC Contractor for all valves:

- i. All Gate valves as per API-600 and all Gate/ Globe valves as per API-602 shall comply to fugitive emission requirements of API 624.
- ii. Gate valves of Class rating 900 & above, Gate valves of size 26" & above and Globe valves of size 2" & above or valves where API-624 is not applicable due to non-graphite stem packing material, shall comply with Fugitive emission requirement of ISO-15848-1.
- iii. Quarter turn valves shall comply with Fugitive emission requirement of API 641. Quarter turn valves where API-641 is not applicable due to non-graphite stem packing material, shall comply with Fugitive emission requirement of ISO-15848-1.

- 2.28.12 Tie in schedule.

- 2.28.13 "AS BUILT" GADs, Isometrics, Nozzle Orientation (If applicable), Equipment Layout with different view elevations, Key-plan, etc..

- 2.28.14 Welding Specification charts for all Piping Classes.

- 2.28.15 Bolt Tensioning Specification, Bolt Torqueing Specification for all Piping Classes, along with list of changes from tender document.

- 2.28.16 Piping Bill of Materials / Material Summary including fabrication allowance, pre-commissioning, commissioning spares and mandatory spares.

- 2.28.17 Piping material summary including piping supports.

- 2.28.18 Preparation of Material Requisitions, Material Status Reports etc. Owner's Material Codes (if any) shall be indicated in MR / PR and Material status reports for all the Piping Items.

- 2.28.19 Placement of purchase orders for all piping items on vendors approved by OWNER / OWNER REPRESENTATIVE. Furnish Final vendor drawings piping items.

- 2.28.20 Engineering support services, including rectification, replacement, and troubleshooting in the event of any failure or malfunction during WHP/PROCESS PLATFORM operation due to issues arising from bridge modification, shall be provided until completion of the guarantee period after handing over of the bridges along with associated piping, cables, etc., of the WHP/PROCESS PLATFORM Platform.

- 2.28.21 All the comments from Owner/Owner Representative shall be incorporated by the EPC CONTRACTOR without any time and cost implication.

- 2.28.22 All documents/drawings submitted for OWNER/ OWNER's Representative review shall comply with the contract documents viz SOW, relevant Standards/Specifications, P&IDs etc., mentioned in the Tender Package. Contractor shall be fully responsible for more time taken during review by



OWNER/ OWNER's Representative because of poor quality of engineering performed.

- 2.28.23 Pipe flexibility calculations shall conform to ASME 31.3 and associated codes of practice. Analysis shall be done considering the various cases.
- 2.28.24 Develop Index of lines for Flexibility analysis as Tender requirements and this scope of supply/works documents no. B774-000-16-43-SOW-0001 to demonstrate the scope of stress analysis, this shall indicate line number, stress calculation number (stress identification number), type of analysis required, line size, material specification, design conditions etc.

## 2.29 **DISMANTLING WORKS**

Contractor shall carry out dismantling works in the existing Offshore Platform of the existing piping systems (bare/insulated/traced lines including supports, as applicable) and transport the same with proper tagging (line no. & piping class etc.) to Owner's storage point & stacking the materials as per requirement of Owners stores, in charge etc. as per the drawings/ P&ID's and instructions of the OWNER/ OWNER's Representative.

- a) Blinding of the retained piping shall also be carried out as per drawings and instructions of the OWNER/ OWNER's Representative.
- b) Some of the existing lines may have to be dismantled & re-routed to avoid fouling with the new lines and the same shall be done by Contractor as per Instructions of OWNER/ OWNER's Representative.
- c) All the lines requiring dismantling to facilitate revamp work shall be re-installed, tested and undergo NDT & PWHT as per piping material specification. List of all such lines shall be prepared & made available to the Owner/ OWNER's Representative.
- d) Contractor shall list out Pipe supports / structures required to be dismantled for facilitating the removal / dismantling of pipes. These dismantled structures / pipe supports shall be re-erected after the dismantling work is complete and made good in all respects by reinforcements / alternate structures. Contractor shall provide new reinforcement for supports below platform members wherein new loadings / openings / supports etc. are required as per the instruction of OWNER/ OWNER's Representative.
- e) Contractor shall provide suitable modification on account of fouling of new facilities with existing facilities like Pipes, cables, structures, platforms etc.
- f) Low support pedestals, sleepers required for modified existing piping shall be provided.
- g) All traced lines, which are being dismantled, shall be dismantled along with tracers from the steam supply station upto the condensate recovery station (if applicable).

- h) Before commencement of dismantling, contractor to identify the extent of dismantling based on the P&IDs / GAD / Isometrics / Hookup Drawings and as per instructions of Owner / Owner's Representative and prepare the isometrics for the piping for measurement purpose.
- i) Removal, segregation as CS/AS/SS material & transportation of dismantled pipes, fittings, flanges, valves, pipe supports etc., after flushing with air/water to Owner's storage area and reconciliation of all dismantled material. Contractor's scope includes disposal of debris such as insulation, etc. outside offshore platform at a location acceptable to civil authorities, including co-ordination with civil authorities. No separate payment shall be paid to the contractor for the disposal of the debris.
- j) Temporary supports required for the dismantling works shall be prefabricated to the extent possible.
- k) Contractor shall identify the redundant lines routed along the bridge during detailed engineering, in consultation with ONGC, and the removal of the same shall be included in the Contractor's scope.

The above list of activities is not exhaustive and therefore not limited to the above. The scope of work includes all such activities as required for successful commissioning of the plant as per the requirements of the P&IDs, line lists, Piping Design Criteria and Engineering specifications etc. enclosed in the EPC Package so as to result in a total trouble free operable and maintainable plant.

### **3.0 PIPING SCOPE OF SUPPLY**

- 3.1 The EPC CONTRACTOR's scope of supply includes procurement, supply & storage of all materials and consumables complete in all respects, of all piping in accordance with the final Process Package, required for successful erection, commissioning, operation and maintenance of the plant.
- 3.2 The EPC CONTRACTOR's scope also includes procurement, supply & storage of all materials and consumables complete in all respects for Piping Specialties.
- 3.3 Procurement, Supply & Storage of all piping materials including spring supports and bellows type expansion joints required within EPC CONTRACTOR's B/L along with all material test certificates in original.
- 3.4 EPC CONTRACTOR shall use piping material control system for the job and blank format of the various reports planned to be generated through the system shall be furnished.
- 3.5 Procure, supply insulation materials with all accessories and execute all insulation jobs including painting under insulation as per specifications for all sizes of piping.
- 3.6 Supply paint and execute painting of all equipment, piping (including small bore piping), pipe supports, structure's like platform, crossover etc. and other miscellaneous items as per specifications.
- 3.7 Supply of all Pipe Support materials, including material for secondary supports.

- 3.8 All piping materials required for testing, pre-commissioning and commissioning e.g. piping spools, flexible hoses, bolting and gaskets, flanges, blinds or any other piping materials for carrying out this activity is included in EPC CONTRACTOR's scope of supply.
- 3.9 Supply of any necessary blind or additional valving not identified in P&ID's to isolate lines to facilitate phased commissioning & start up.
- 3.10 All the Piping items/components of Carbon steel (for ratings & services required as per PMI specification), Alloy Steel, Stainless Steel, other higher grade materials etc. as per PMI specification enclosed with EPC Package procured under Bulk materials shall be positively identified and checked on three tier basis; first at supplier's shop, second at EPC CONTRACTOR's stores and third, after fabrication/erection. The properly identified material shall be given a distinctive color by supplier before dispatch to avoid mixing with any material and to be certified by the Third-Party Inspector.
- 3.11 EPC CONTRACTOR shall supply all testing apparatus, appurtenances and fittings and the like and specialist testing fluids where required.
- 3.12 EPC CONTRACTOR shall arrange suitable numbers of PMI equipment at fabrication yard and at offshore platform site to enable OWNER / OWNER REPRESENTATIVE to verify the bulk piping material supplied.
- 3.13 EPC Contractor shall provide mandatory spare items for piping if applicable as per Tender document.  
The above list of activities is not exhaustive and therefore not limited to the above. The scope of supply includes all such activities like supply of all materials and components as required, for successful commissioning of the offshore platform / Bridge as per the requirements of the Piping Design Criteria and Engineering specifications etc. enclosed in the EPC Package so as to result in a total trouble free operable and maintainable plant.

#### **4.0 PIPING SCOPE OF EXECUTION**

- 4.1 Provide WPS/PQR for OWNER / OWNER's REPRESENTATIVE review and maintain records for welder qualification and welder testing.
- 4.2 EPC CONTRACTOR shall execute all activities for receipt of materials at WORKSITE including offloading, checking, warehousing, proper storage and protection and material control facilities, including storage and retrieval of associated certification documentation. EPC CONTRACTOR shall also operate a separate quarantine stores/compound for storage of materials which arrive without suitable documentation. Security of the material and stores issue/report arrangement on round the clock basis is in the scope of EPC CONTRACTOR.
- 4.3 The EPC CONTRACTOR's scope of work shall include supporting, fabrication, laying, erection, painting, insulation, chemical cleaning, passivation of all grades of SS, testing, flushing and pre-commissioning including steam flushing, complete in all respects, of all piping in accordance with the final Process Package, required for successful erection, commissioning, operation and maintenance of the plant. Scope of EPC CONTRACTOR shall also include liquidation of following Punch list points, without any time and cost implications.
  - OWNER/OWNER REPRESENTATIVE Punch lists during Construction.
  - Third Party Safety Audit.
  - Pre-Commissioning Safety Audit.
  - Pre startup safety Review points.
  - Safety Audit
- 4.4 Execute piping fabrication including prefabrication, preheating, welding, NDT including radiography, site fabrication, Post weld heat treatment, lifting, laying and erection including

bolt tensioning, bolt torqueing, supporting, water/steam flushing, air drying, disposal of fluids, preservation of piping and miscellaneous items following hydrotest, nitrogen purging, testing, cleaning, painting, insulation, chemical cleaning, cardboard blasting etc. as per specifications.

- 4.5 Installation of all valves, Piping Specialties and other miscellaneous in line / on line items.
- 4.6 Fabrication and installation of pipe supports, guides, anchors, spring supports, expansion joints etc. as required.
- 4.7 Execute all mechanical jobs identified during OWNER/OWNER's REPRESENTATIVE check list, Technical audits, pre-commissioning and commissioning.
- 4.8 Use of commercially available Piping Construction management software to be ensured by EPC Contractor so that accurate tracking and control can be exercised for piping works.
- 4.9 Piping spool management software to be used by contractor for proper marking, segregation, storage and use of pre-fabricated piping spools during sequential execution of Project Piping. Contractor to arrange Spool tagging through Barcode, RFID, QR code or latest available coding & tagging system.
- 4.10 Document for bolt tightening and tensioning to be prepared with Bolt Torqueing details by EPC Contractor for Owner/Owner's Representative approval.
- 4.11 Set up field engineering Cell and execute field engineering, which becomes necessary to resolve problems arising during prefabrication, shop fabrication, field fabrication or erection at site & based on sub vendor data. Necessary field design change drawings shall be prepared by EPC CONTRACTOR and submitted for review/information and shall be reflected in the As Built Drawings/Documents/3D model. EPC CONTRACTOR shall arrange Checker for checking the P&ID, GAD and isometrics for correct transformation of data from one document to other document.
- 4.12 Obtain clearances and approvals from all applicable statutory/Government agencies .
- 4.13 Installation of any necessary blind or additional valving not identified on EPC CONTRACTOR P & ID's to isolate lines to facilitate phased commissioning and start-up.
- 4.14 EPC CONTRACTOR shall comply with the requirements of Mechanical Completion as described in relevant Section of the EPC Package.
- 4.15 Testing of welds/flanged joints not subjected to hydro testing.
- 4.16 EPC Contractor shall be responsible for complete execution of the project as per ONGC design criteria, functional specifications, Description of Work (Basic Bid Work), Piping Scope of work and supply, approved/reviewed DCI & MCI documents and approved P&IDs.

The above list of activities is not exhaustive and therefore activities are not limited to the above. The scope of construction includes all such activities as required for successful commissioning of the WHP/Process platform along with Bridges Piping as per the requirements of the P&IDs, line lists, Piping Design Criteria and Engineering specifications etc. enclosed in the EPC Package so as to result in a total trouble free operable and maintainable plant.

## 5.0 **BASIS OF WORK**

The following documents enclosed in the EPC Package form the basis of work for the EPC CONTRACTOR.

- a) Equipment layout drawings, prepared by EPC CONTRACTOR and approved by OWNER/ OWNER's Representative.
- b) Safety and Escape Route Layout.
- c) Piping Material Specifications (Existing ONGC specification No 2008).
- d) Specifications and engineering standards.
- e) Piping Design Criteria (Vol-II, Section-3.3), Functional Specification for Piping Design, Spec. No. 2004 A, Functional Specification for Piping Specialties, Spec. No. FS 2004 D, Functional Specification for Piping Specialties, Spec. No. FS 2004 D and Technical requirements given in this specification (B774-000-16-43-SOW-0001).
- f) Schedule of submission of drawings by EPC CONTRACTOR duly reviewed by OWNER / Owner's Representative and schedule of inputs from OWNER / Owner's Representative.
- g) Piping Site Survey.
- h) Existing Equipment layout and Piping GADs.

## 6.0 **DRAWING AND PROCEDURES**

PIPING GENERAL ARRANGEMENT DRAWINGS & view drawing from different directions. Supporting steel and operating platforms required shall be clearly marked in GADs. Also refer guidelines furnished in Specification No. B774-6-44-0504.

All Elevations shall be in line with Equipment layout. Dimensioning shall be done with equipment centerlines or main structural columns as reference grids. GADs shall be printed in 1:33 1/3 scale.

All piping drawings shall be prepared on OWNER/ OWNER's Representative approved formats. Contractor shall prepare drawing/documents format for OWNER/ OWNER's Representative approval.

All future lines shall be routed and shown as chain dotted on GADs with full details indicating dimensions line number etc.

Each line on the piping GADs and isometrics shall be clearly marked to denote the complete line designation as marked in P&ID's. Following symbols shall be used in Piping drawing:

- Bottom of the pipe level : BOP ▽  
(Above Grade/ Platform/ Floor etc. shall be 500mm min.for uninsulated lines and to be suitably raised for insulated lines to maintain clearance of min. 500mm from bottom of Insulation.)
- Center of the Pipe Level : C/L EL. ▼

▪	Top of Steel/Top of Rod	:	T.O.S./T.O.R.
▪	Platform/Grating Elevation	:	TOG EL/HPP EL
▪	Working Point Elevation for sloping lines	:	W.P. EL.

PIPING ISOMETRICS for All Lines to be submitted for record to Owner/ Owner's Representative including small bore lines.

Isometric shall be drawn on A3 size sheets. System Isometrics, if required by IBR authorities shall be prepared on A0/A1 size.

### DRAWING REVISIONS

Revisions in drawings/documents shall be clearly marked within clouds. Drawings/documents with revisions after Review Code-1 have to be re-submitted for OWNER/Owner's Representative review. No revision without clouding shall be recognized and the same shall not be considered reviewed and accepted.

### AS BUILT DRAWINGS

All as built drawings shall be submitted to OWNER/ OWNER's Representative.

- Hard copies (if required)
- Pen drive / Hardisk (Two set in Edible Format)

## 7.0 PIPING MATERIAL SPECIFICATION

Owner Piping Material Specification (PMS) Spec No. 2008, enclosed with bid shall be followed for this project. The wall thickness indicated in the enclosed PMS is the minimum thickness and EPC Contractor shall update the Piping Material Specification wherever required considering ONGC Functional Specification for Piping Design, Spec. No 2004 A and this clause and the maximum calculated thickness shall be considered and shall submit for OWNER/Owner's Representative for review. While updating/adding and piping class, practices followed in PMS and ONGC Functional Specification for Piping Design, Spec. No 2004 A attached with bid package shall be followed. The updated Piping Material Specification shall give all the necessary details as given in the enclosed Piping Material Specifications keeping the format same. These details shall be given for piping components like pipes, flanges, fittings, valves, studs/nuts, gaskets, strainers etc and shall include, **but not limited**, to the following:

- Size range, Temp./Pressure range
- Dimensional Standard, material description
- Schedules, ends, ratings, facing, finish
- Branch tables
- Standard and specific notes
- Service description in full in each piping class details
- NDT
- Stress Relieving

- 7.1 All calculations for pipe thickness are to be submitted along with the updated Piping Material Specification. Pipe wall thickness shall be calculated for all combinations of pressure-temperature and highest thickness shall be selected. For lines where thickness is to be calculated for actual line pressure-temperature conditions (design), thickness shall be selected at that combination of pressure-temperature, which results in maximum calculated



thickness. Maximum corrosion allowance as per PMS and ONGC Functional Specification for Piping Design, Spec. No 2004 A attached with bid package shall be selected and mill tolerance shall be considered while selecting nominal thickness. All pipes (seamless & welded) shall have uniform negative wall thickness tolerance of 12.5% for wall thickness calculations purpose. While submitting thickness calculations for review, Above aspects shall be considered by contractor.

- 7.2 Pipe thickness calculations shall be as per ASME B31.3 and API RP 14E and Contractor shall accordingly update PMS. Thicknesses given in the enclosed Piping Material Specifications are minimum & cannot be lowered. Any upward revision in the thickness as a result of pipe wall thickness calculation carried out by the contractor shall be accommodated by the EPC contractor at no extra cost or schedule impact. Updated PMS shall also reflect all the applicable Piping Classes.
- 7.3 Wherever required and asked for, piping schedule thickness shall be calculated on pressure temperature ratings including corrosion allowance (including mill tolerance) indicated in the respective piping classes up to & including ANSI 900#. For piping classes ANSI 1500# & above, thickness shall be calculated based on upto 4" Class condition and above 4" actual design conditions of the system.
- 7.4 For lines under vacuum service, contractor shall perform thickness calculation in accordance with ASME Sec. VIII Div.I and submit the same for review along with external stiffener required to OWNER/Owner's Representative.
- 7.5 Any changes to EPC contractor's proposal for updations during OWNER/Owner's Representative review shall not entitle Contractor to claim extra cost or schedule extension.
- 7.6 All material shall be per ASTM specifications and shall comply with the Piping Material Specification and Valve Material Specification. Material shall be new and unused, clean and free from rust, pits and obvious defects.
- 7.7 In piping system, when two dissimilar piping materials are in contact (for example Cu-Ni/DSS/SS/Copper with carbon steel) or when piping material having same chemical analysis but different surface conditions, and a conductive electrolyte medium is flowing, a sacrificial spool piece shall be provided between such piping joints to prevent electrogalvanic attack/galvanic corrosion. The Sacrificial spool piece shall be of anodic material with higher wall thickness and shall be 600 MM long or 3 times nominal pipe size whichever is greater. Where space does not permit the sacrificial spool piece installation, an electrical insulation joint shall be provided. For example, in a carbon steel to Cu-Ni joint, a sacrificial spool piece of Carbon steel with higher wall thickness/schedule or Ni-resistant steel (BS-3468 AUS 100) shall be used as a connection between Cu-Ni pipe and carbon steel pipe/equipment.
- 7.8 All supports welded directly to the piping shall be of the material as that of pipe.
- 7.9 In addition to the technical requirements for piping Components mentioned in Functional Specification for Piping Design, Spec. No. 2004 A the following technical notes shall also be followed by EPC Contractor:

**Pipes:**

- i. Test reports shall be supplied for all mandatory tests as per the applicable material specifications. Test reports shall also be furnished for any supplementary tests as specified in the MR
- ii. Material test certificates (physical property, chemical composition & heat treatment report including Chart) shall also be furnished for the pipes supplied.



- iii. Steel made by acid Bessemer process shall not be acceptable. All longitudinally welded pipes should employ only automatic welding.
- iv. Pipe with beveled ends shall be in accordance with ASME B16.25.
- v. For welded Carbon steel pipes wherever heat treatment is specified, hardness of weld and HAZ shall be 200 BHN (max.). For welded Alloy steel pipes, maximum hardness of weld and HAZ after heat treatment shall be as per relevant ASTM material specification unless otherwise specified. In addition, for 9Cr-1Mo-V(P91) pipes, a minimum hardness of 190BHN shall also be ensured.
- vi. All welded pipes indicated as 'CRYO' & 'LT' in MR shall be impact tested per requirement & acceptance criteria of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel and carbon steel respectively unless specifically mentioned otherwise in MR.
- vii. Specified heat treatment for carbon steel and alloy steel and solution annealing for stainless steel pipes shall be carried out after weld repairs. Number of weld repairs at the same spot shall be restricted to maximum two by approved repair procedure.
- viii. All 1Cr-1/2Mo and 1 1/4Cr-1/2Mo seamless pipes shall be normalised and tempered.
- ix. For all welded alloy steel pipes with mandatory requirement of heat treatment and radiography, radiography shall be performed after heat treatment.
- x. For dual grades of SS where specified, chemical composition and mechanical properties of both grades specified shall be ensured.
- xi. All pipes shall be hydrostatically tested.
- xii. Hydrostatic pressure testing shall be performed using iron free water, which is clean and free of silt. Test fluid temperature shall be min. 5 °C. Maximum chloride content in water for hydrostatic testing for SS piping shall be 50 ppm.

#### Flanges:

- i. Test reports shall be supplied for all mandatory tests as per the relevant material specifications/ MR. Test reports shall also be furnished for any supplementary tests as specified in the requisition.
- ii. Material test certificates (physical property, chemical composition & heat treatment report including Chart) shall also be furnished for the flanges supplied.
- iii. Ends of weld neck flanges shall be beveled to suit the schedule / thickness of matching pipe, as specified in the requisition.
- iv. Bevel end details for welding neck flanges shall be as per ASME B16.25.
- v. Bore of socket weld flanges & reducing blind flanges shall suit the outside diameter and schedule / thickness of matching pipe.
- vi. Flange face finish shall be normally specified in the requisition as serrated finish, 125 AARH etc. The interpretation for range of face finish shall be as follows: Serrated Finish/125 AARH Serrations with 125μ to 250μ in AARH: 63 AARH with 32 TO 63 μ in AARH.
- vii. For ring joint flanges, blinds and spacers the hardness shall be as follows:

Flange Material	Min. Hardness of Groove (BHN)
Carbon Steel	140
1% Cr to 5%, 9% Cr	150
9Cr-1Mo-V	190
Type 304, 316, 321, 347	160
Type 304L, 316L	150
Inconel UNS N06625	220
Incoloy UNS N08825	210
Duplex SS UNS S32205, S31803	250

- viii. For ring joint flanges, blinds and spacers, the hardness shall be recorded in the test report.
- ix. Dimensions for handle projection for Spacers & Blinds shall be as specified in d. 7-44- 0166.
- x. All 1Cr-1/2Mo and 1 1/4Cr-1/2Mo flanges shall be normalised and tempered.
- xi. The handle for spacers & blinds for classes 900# & above shall be designed by the vendor. The handle may be integral or attached to the line blank / spacer by welding. In case of attachment by welding heat treatment & welding shall be in accordance with B31.3.

#### Fittings:

- i. Test reports shall be supplied for all mandatory tests as per the relevant material specifications/ MR. Test reports shall also be furnished for any supplementary tests as specified in the MR. Material test certificates (physical properties, chemical composition & heat treatment report including chart) shall also be furnished for fittings supplied.
- ii. All fittings shall be seamless in construction unless otherwise specified.
- iii. For reducing butt weld fittings having different wall thicknesses at each end, the greater wall thickness of the fitting shall be employed and inside bore at each end shall be matched with the specified inside diameter.
- iv. Beveled ends for all fittings shall conform to ASME B16.25.
- v. All welded fittings shall be double welded. Inside weld projection shall not exceed 1.6 mm. Welds shall be ground smooth at least 25 mm from the ends. For fittings made out of welded pipe, the welded pipe shall be double welded type & shall be manufactured with the addition of filler metal.
- vi. Welded tees/Lateral Tees shall not be of fabricated (stub-in/stub-on) type unless otherwise specified in the MR.
- vii. All welded fittings shall be normalized & 100% radiographed by X-ray on all welds made by fitting manufacturers & also welds on the parent materials. Radiography by Gamma rays is also acceptable for thickness 8mm & above.
- viii. Welded pipes employed for manufacture of fittings shall be made by automatic welding only.
- ix. Specified heat treatment for carbon steel & alloy steel fittings shall be carried out again after weld repairs.
- x. Irrespective of the material code requirement, all welded fittings indicated in the MR as "Cryo"& "LT" shall meet impact test requirements of ASME B31.3. The impact test temperature shall be -196°C & -45°C for stainless steel & carbon steel respectively unless specifically mentioned otherwise in the MR.
- xi. For welded Carbon steel fittings wherever heat treatment is specified, hardness of weld and HAZ shall be 200 BHN (max.). For welded Alloy steel fittings, hardness after heat treatment shall be as per relevant ASTM material specification unless otherwise specified.
- xii. Thickness/schedule lower or higher than specified for the finished product shall not be accepted.
- xiii. For all welded alloy steel fittings with mandatory requirements of heat treatment and radiography, radiography shall be performed after heat treatment.
- xiv. All 1Cr-0.5Mo & 1.25Cr-0.5Mo fittings shall be normalized and tempered.

#### Gaskets:

- i. Test reports shall be supplied for all mandatory tests for gaskets as per the standards specified in the requisition.
- ii. Chemical composition and hardness of RTJ gaskets shall also be furnished in the form of test reports on samples.
- iii. For Spiral wound material following shall be furnished:
  - a. Manufacturer's test certificate for filler material and spiral material as per the relevant material specifications/ MR.

- b. Manufacturer's test certificate for raw materials and tests for compressibility/seal ability & recovery as per the relevant material specification.
- iv. Filler material for spiral wound gaskets shall not have any colour or dye
- v. All spiral wound gaskets shall be supplied with Outer ring. Material of the outer ring shall be CS unless otherwise specified in the MR.
- vi. Inner rings shall be provided for all Spiral Wound Gaskets. For spiral wound gaskets, material of Inner Compression ring shall be same as Spiral Strip material.
- vii. Hardness of metallic RTJ gaskets shall not exceed the values specified below unless otherwise specified in MR:

Ring Gasket Material	Maximum Hardness (BHN)
Soft Iron	90
Carbon steel	120
5 Cr. ½ Mo	130
Type 304, 316, 321, 347	140
Type 304L, 316L	135
Inconel UNS N06625	200
Incoloy UNS N08825	190
Duplex SS UNS S32205, S31803	230

- viii. Face finish of metallic RTJ gaskets shall be 32 to 63 AARH.
- ix. Spiral wound gasket as per ASME B16.20 shall match flanges to ASME B16.5 upto 24" and to ASME B16.47B above 24" unless specifically mentioned otherwise.

## 8.0 VALVE MATERIAL SPECIFICATION

VMS shall be prepared by Contractor based on the PMS and the detail VMS sheet shall be submitted for OWNER/ OWNER's Representative review/approval.

## 9.0 FLEXIBILITY ANALYSIS AND SUPPORTING

Piping systems shall be properly supported taking into account all type of loadings e.g. Sustained loads, thermal loads, wind, seismic loads etc. Piping systems shall be analyzed for expansion, contractions, terminal movements and other external forces/movements to keep the systems safe within allowable limits.

Following lines shall be considered critical & shall require formal analysis. Other lines may also need analysis, if required.

- a) Process pipe work 3" diameter and larger connected to centrifugal compressors or turbines.
- b) Pipe work connected to other strain sensitive equipment.
- c) All other lines as below:-
  - i. 2" to 3" analysis temp above 300° C
  - ii. 4" to 6" analysis temp above 200° C
  - iii. 8" to 14" analysis temp above 150° C
  - iv. 16" & above analysis temp above 80° C

- d) 6" diameter and larger at 65 Deg.C design temperature and above connected to equipment like air coolers, fin fan coolers, fired heaters / furnaces or any other sensitive equipment.
- e) All Lines subject to vibration, e.g. Reciprocating compressors and turbines.
- f) Pipe work larger than 3" diameter at -50 Deg. C design temperature and below.
- g) Large diameter piping between closely spaced equipment.
- h) All suction and discharge lines connected to pump.
- i) All lines connected to wellhead.
- j) All high pressure flange joints (i.e. 900# and above) shall be checked for leakage at flange joints due to combined effect of induced bending moments and internal pressure. This check shall also be performed for all lines  $\geq 24"$  NB irrespective of rating.
- k) All lines shall be analyzed at as a minimum for design / operating temperature range.
- l) All lines on the bridge between the two platforms.
- m) All other critical lines (connected to sensitive equipments).
- n) All lines requiring Seismic analysis, Wind analysis and Flange leakage analysis.

The list of lines (STRESS Index) shall be prepared as per the above basis. This Stress Index shall allocate a Stress System number to each system along with Design Temperature/Pressure, Insulation thickness, fluid state, fluid density etc.

**9.1 The following shall be taken care as a minimum while doing flexibility analysis:**

- I. The design of piping systems shall take into account the different conditions expected during operation, start-up, shut down, cold branch in case of stand by pump.
- II. Forces & moments due to weight, thermal loads on the equipment nozzles shall not exceed the allowable loads as specified in respective API/ASME codes & Equipment Vendor data.
- III. Apart from weight considerations, all piping connected particularly to rotating equipments shall be designed & adequately supported to avoid transmission of vibration between equipment and piping.

The stress analysis shall be checked for sustained & expansion stress, nozzle loadings, forces & moments at supports & deflections.

**9.2 Piping arrangement shall provide for flexibility of lines to take care of the thermal expansion and contraction. Large reactions or moments at equipment connections shall be avoided. Expansion computation and Stress Analysis shall cover (+ or -ve) design temperature(s) as shown in line schedule as well as start-up, shutdown and variable operating conditions. Analysis shall be done considering the actual fluid densities in the line.**

- 9.3 Flexibility analysis shall meet the requirements of Code API RP 14E and ASME B-31.3 (latest edition). Analysis shall consider stress intensification factors as per ASME B-31.3 or based on FEA (Finite Element Analysis).

The package used for analysis, shall be CAESAR II. All non-critical lines may be analysed using Stress Nomograph. Comprehensive computer analysis using CAESAR-II shall be carried out for piping connected to equipments like vessels, filters, compressors or other strain-sensitive equipments. The result of the analysis must satisfy the allowable loading on nozzles of such equipments.

- 9.4 Piping shall be adequately supported for weight of piping, hydrotest condition, attached unsupported components, wind, seismic, dynamic loads, insulation and any other applicable forces. Care should be taken that these supports are adequate to prevent excessive stress, loads or moments in either the piping or terminal nozzles of the equipment to which it is connected. Adequacy of supporting of lines having heavy valves shall be checked. Supports shall be located closest to heavy loads. The supports shall be indicated in the piping support GA Drawings. Adequacy check of the supports for imposed loads shall also be carried out. Adequacy of nozzles shall be checked to bear hydrotest loads, otherwise suitable precaution to be taken at nozzle points. For design of supports, due consideration shall be given for all load cases including hydrotest. Load generated due to wind and seismic effects shall be considered for design of supports. Pressure thrust shall be considered for all lines.

- 9.5 List of lines where seismic analysis is required shall be prepared. The reports shall include following:

- (a) Dynamic analysis boundary conditions,
- (b) Natural frequencies,
- (c) Mode shape plots and model displacements,
- (d) Mass participation factor,
- (e) SRSS load,
- (f) Stress considering earthquake load,
- (g) SRSS reactions.

- 9.6 List of lines where wind analysis is required shall be prepared. The reports shall necessarily include following load cases for support reactions, pipe member stresses and displacements:

- (i) Sustained + Wind
- (ii) Sustained + Thermal + Wind

- 9.7 Flange joints shall be checked for leakage for total equivalent pressure at flange joints due to combined effect of imposed forces and bending moments and internal pressure. This check is to be performed for all lines irrespective of rating when total equivalent pressure exceeds pressure as per pressure-temperature rating and for any other line as may be decided. Flange leakage analysis using CAESAR-II module shall be carried out.

- 9.8 The following factors/limits shall be considered in the stress analysis:

- Friction factor:
  - @ STEEL to STEEL = 0.3:
  - @ STEEL to PTFE = 0.1
  - @ STEEL to GRAPHITE = 0.15
- With and without Corrosion Allowance
- Initial thermal displacement of nozzles
- Transverse deflections due to sustained loading = 25mm (maximum)

- Vertical deflections in piping system between two adjacent supports due to sustained loading =15 mm (max) for all lines except flare lines. For flare lines the above deflection limit shall be such that slope is maintained in the flare line.
- Stress Analysis report shall contain corresponding nodes to demonstrate that the above limit of vertical deflection is not exceeded.
- Longitudinal expansion/contraction = 150mm (maximum)
- Special care to be taken to check for expansion loops and shoe support lengths shall be finalized accordingly.

9.9 The piping system analysis reports shall comprise of the following as a minimum, in addition to the requirements specified elsewhere:

- Basic input data and calculated conditions
- Nozzle initial thermal movement calculation details.
- Layout isometric with node numbering and supports configuration including gaps/limit stops
- Forces, moments and displacement reports
- Additional requirements (anti friction pads etc.)
- Flange leakage checks as applicable.
- Loads at interface B/L
- Basis of allowable forces and moments & wherever applicable, vendor furnished allowable loads/moments.
- Allowable Stress Range
- WRC 107/WRC 297 checks.
- Allowable equipment load check.
- Code compliance check report.
- Summary sheet indicating maximum stress/ force/ moment and conclusion
- Soft copy of all input data, units, spectrum files and configuration parameters.

#### 9.10 DYNAMIC ANALYSIS

Dynamic analysis shall be performed by the EPC CONTRACTOR for all two phase Slug or plug flow lines (under operating or start up or turn down conditions) in the plant in order to ensure that such lines are provided with proper supports and there shall be no vibrations in the line during normal operation as well as during start up or any upset conditions. The fundamental frequency of the piping system shall be well above the imposed frequencies, if any, to avoid resonance. The minimum acceptable frequency shall be for transfer lines 7 Hz and for remaining lines with slug flow, it shall be 6 Hz. A List of all such lines shall be prepared by the EPC CONTRACTOR and shall be submitted for review by OWNER / OWNER's REPRESENTATIVE. EPC CONTRACTOR shall decide the flow regime (slug or plug) based on Process Package.

Actual densities shall be considered while carrying out static analysis. Dynamic analysis shall be performed at operating temperature given in the line list. Line shall be safe in design condition with guides, etc. as provided in dynamic analysis. EPC CONTRACTOR shall submit mode shape plots up to 15 Hz. Modal displacement output shall be submitted. Boundary condition and other parameter used in dynamic analysis shall also be part of dynamic analysis report.

#### 9.11 SLUG FLOW ANALYSIS

EPC CONTRACTOR shall submit a list of lines for which Slug Flow analysis is also required in addition to dynamic analysis. EPC CONTRACTOR shall submit this list along with list of lines for stress analysis for review by PMC Process. EPC CONTRACTOR shall analyze the above lines for slug flow effect and modify the supporting accordingly.



#### 9.12 RELIEF VALVE ANALYSIS

Stress and Flange leak check analysis for relief valve piping discharging to atmosphere shall be performed using CAESAR-II module. Static analysis shall consider a Dynamic Load Factor of 2 for relief systems, unless a Dynamic Time History Analysis is carried out. A List of all such lines shall be prepared.

#### 9.13 ANALOG ANALYSIS

For pulsating lines connected to reciprocating compressors/pumps, list of lines and reports to be submitted. Reports shall include both acoustical and mechanical studies. The recommendation of the analog study (e.g., additional supports, springs etc.) shall be incorporated in the CAESAR-II files and overall system check shall be done to resolve conflicts of loadings, stress, deflections etc.

#### 9.14 EXPANSION BELLOWS

All the expansion bellows should be brought with the shipping rods in as shipped condition to avoid any damage in the bellow elements. The shipping rods should be removed after installation or prior to commissioning and bellows should be adjusted for cold or hot condition. Care should also be taken to avoid any restriction in the movement of the expansion bellow during operation. A list of all expansion bellows area wise should be handled over to the OWNER. Bellows shall be procured only from Licensor's recommended vendors.

#### 9.15 ALLOWABLE LOADS ON PRESSURE VESSELS NOZZLES

Localized stresses at nozzle to shell shall be calculated by WRC 107 and WRC 297, If required, else by FEM analysis and these computed stress values shall be limited in accordance with ASME section VIII, for all Pressure Vessels.

#### 9.16 FINAL DOCUMENTATION

Final flexibility analysis reports of piping along with input file, units file and configuration file shall be submitted to OWNER / Owner's Representative in soft copy and in two set of pen drive for records. Mismatch between drawings, supports and flexibility analysis shall not be permitted.



## **10.0 PIPING SUPPORTS**

Piping support shall be in accordance with Piping Design Criteria (Vol-II, Section-3.3), ONGC Functional Specification for Piping Design, Spec. No. 2004 A and as per Piping Scope of work and supply.

All piping shall be adequately supported, guided or anchored so as to prevent undue vibration, deflection/expansion or loads on connected equipment and piping and leakage at joints. Piping at valves and equipments such as heat exchangers and pumps, requiring periodic maintenance, shall be supported in such a way so that the valves and Equipments can be removed.

Long trunnion type supports are to be avoided. In case long trunnion type supports are unavoidable in straight length of pipe, it is to be provided with reinforcement pad on the pipe.

All the supports in a piping system shall be checked for their correctness & adequacy.

Spring support shall be avoided in piping systems. In case spring supports are unavoidable, special care shall be taken in design of spring support considering the offshore environment where atmosphere is salt laden and corrosive and metallurgy of spring supports shall be chosen accordingly. Spring supports should be unlocked and cold set prior to commissioning of the system as per the instructions of the spring manufacturer. A complete list of all spring supports in a unit is to be compiled along with relevant details (i.e. Make, spring rate, loads, travel & location).

Irrespective of line rating, 2 number stiffeners (made of 6mm thick flats of material equivalent to the pipe material) at 90° to each other shall be provided from the main pipe to impart adequate stiffness to the branch connection for all low point drains at pump discharge.

Supports used for Cu-Ni piping shall be lined with soft packing strip or pad free from ammonical components (EG: NEOPRENE) to prevent chafing and undue stressing and also to permit free expansion/contraction of Cu-Ni pipes between anchors. (Selection of Grade & type of Neoprene Rubber will be based on Design Temperature & as per ASTM D-2000).

## **11.0 FABRICATION, ERECTION, TESTING, FLUSHING & CHEMICAL CLEANING**

Fabrication, Testing, Flushing, Inspection and Erection of Piping shall be executed as per ONGC Functional Specification for Piping Fabrication and Installation Spec. No. FS 2004B.

Fabrication of all stub-in branch connections shall meet the requirement of the relevant codes. Reinforcement pad to be provided only after carrying out visual and additional checks specified for the branch weld. All the reinforcement pad tell tale holes should be taped properly & provided with grub screws. Gas-cut holes are not acceptable.

Welding Requirements shall be as per ONGC Functional Specification for Welding & NDT, Addendum to Functional Specification for Welding & NDT, Spec. No. 2009F.

## **12.0 WELDING AND NDT**

EPC CONTRACTOR shall prepare Welding Specification Charts based on requirements specified in ONGC Functional Specification for Welding & NDT, Addendum to Functional Specification for Welding & NDT, Spec. No. 2009F and in ASME B31.3 (latest edition). The most stringent requirements shall be followed and submit it for review by OWNER / Owner's Representative.

Welding, pre and post weld heat treatment for this project, shall be carried out as per ONGC Functional Specification for Welding & NDT, Addendum to Functional Specification for Welding & NDT, Spec. No. 2009F.

Welding procedure / welder qualification shall be approved by Owner/Owner's Representative.

Welding specification charts mention the services applicable as per PMS in addition to the piping class.

EPC CONTRACTOR shall update the Non-destructive testing specification of welds as per ONGC Functional Specification for Welding & NDT, Addendum to Functional Specification for Welding & NDT, Spec. No. 2009F, and ASME B-31.3. The most stringent requirements shall be followed.

Welding and NDT charts shall be updated by EPC CONTRACTOR covering all the classes of PMS in line with ONGC Functional Specification for Welding & NDT, Addendum to Functional Specification for Welding & NDT, Spec. No. 2009F and submit it for review by OWNER / Owner's Representative.

### 13.0 INSULATION

All the Piping, Piping Components and Piping Specialties shall be insulated in accordance with ONGC Functional Specification for Insulation of Piping & Equipments, Spec. No. 2006.

### 14.0 PAINTING

All the Piping, Piping Components and Piping Specialties shall be painted in accordance with ONGC Specification for Protective Coating, Spec. No. 2005.

All piping, piping equipment, machinery, vessels, exchangers etc. and others not insulated but painted shall have color coding and other requirements of markings regarding hazard marking, camouflaging etc. as per the ONGC Specification for Protective Coating, Spec. No. 2005.

### 15.0 LIST OF ATTACHEMENTS

Piping Specifications / Standards / Drawing / Enclosures:

Sl. No.	Description	Doc. No.	Rev. No.
<b>JOB SPECIFICATIONS</b>			
1.	Piping Design Criteria	Vol-II, Section-3.3	4
2.	Functional Specification for Piping Design	Spec. No. 2004 A	9
3.	Functional Specification for Piping Specialties	Spec. No. FS 2004 D	8
4.	Functional Specification for Piping Fabrication and Installation	Spec. No. FS 2004B	4
5.	Functional Specification for Insulation of Piping & Equipments	Spec. No. 2006	3

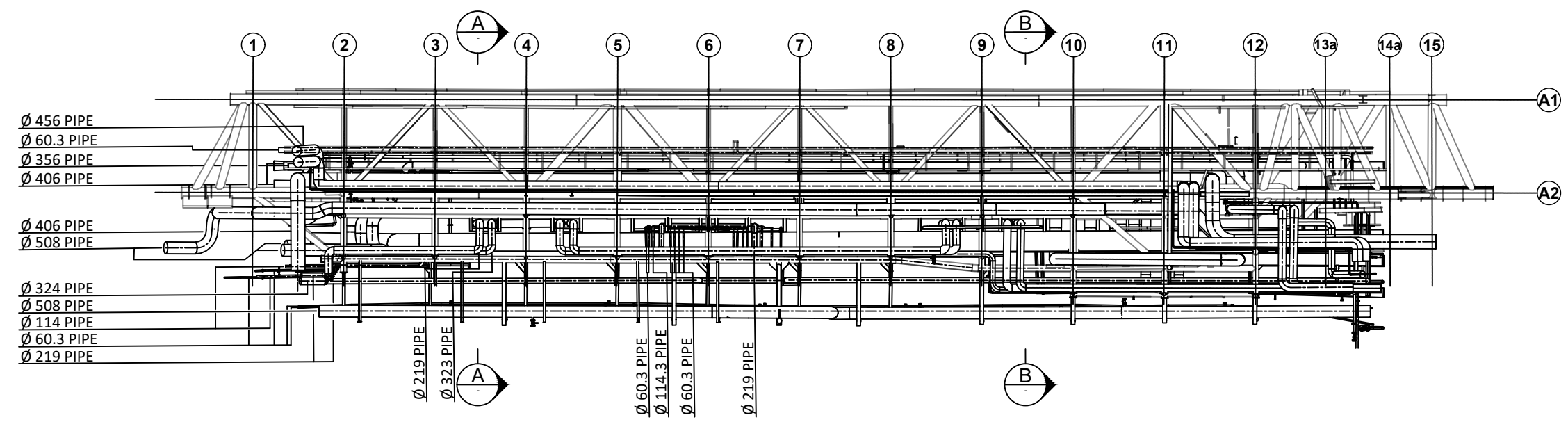
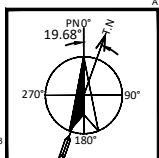
Sl. No.	Description	Doc. No.	Rev. No.
6.	Specification for Protective Coating	Spec. No. 2005	9
7.	Functional Specification for Welding & NDT	Spec. No. 2009F	7
8.	Addendum to Functional Specification for Welding & NDT	Spec. No. 2009F	8
9.	Specification for Inline separator	2004-F	0
10.	Job Standard Specification for Piping Drawings for Offshore Application	B774-6-44-0504	0
<b>STANDARD SPECIFICATION</b>			
11.	Material requirements for carbon steel components used in sour service for oil and gas production	6-79-0012	2
12.	Standard specification of Positive Material Identification (PMI) at vendor's work.	6-81-0001	3
13.	Standard Specification for Piping Stress Analysis	6-44-0091	3
14.	Technical notes for hoses & hose couplings	6-44-0064	3
<b>STANDARDS</b>			
15.	Vent & drains (on lines 1 1/2" and below).	7-44-0350	6
16.	Vents and drains (on lines 2" and above).	7-44-0351	6
17.	Orientation of orifice taps	7-44-0352	6
18.	Wells installation 1 1/2" dia taps	7-44-0353	6
19.	Pressure tappings (PA, PG, PC, PT, PIC etc).	7-44-0354	6
20.	Welding of pipe with different thickness	7-44-0476	6
21.	Butt welding end preparation	7-44-0477	6
22.	Fillet weld details	7-44-0478	6
23.	Welding details for branch connections (not breaking into)	7-44-0479	5
24.	Butt weld details (dimensions)	7-44-0480	6
25.	Butt weld details (sequence of welds)	7-44-0481	6
26.	Welding detail for branch connections (stub in)	7-44-0482	6
27.	Branch connection (breaking into).	7-44-0483	5
28.	Branch connection (not breaking into)	7-44-0484	5
29.	Tolerances for fabrication.	7-44-0486	6
30.	Clearance requirements for orifice flange instrument piping	7-44-0504	4

Sl. No.	Description	Doc. No.	Rev. No.
31.	Table of Basic Span	7-44-0506	4
32.	Maximum Spacing of Guides for Vertical and Horizontal Pipes	7-44-0507	4
33.	Bridge GAD extracted from Laser scanned 3D model.	Annexure-I	-

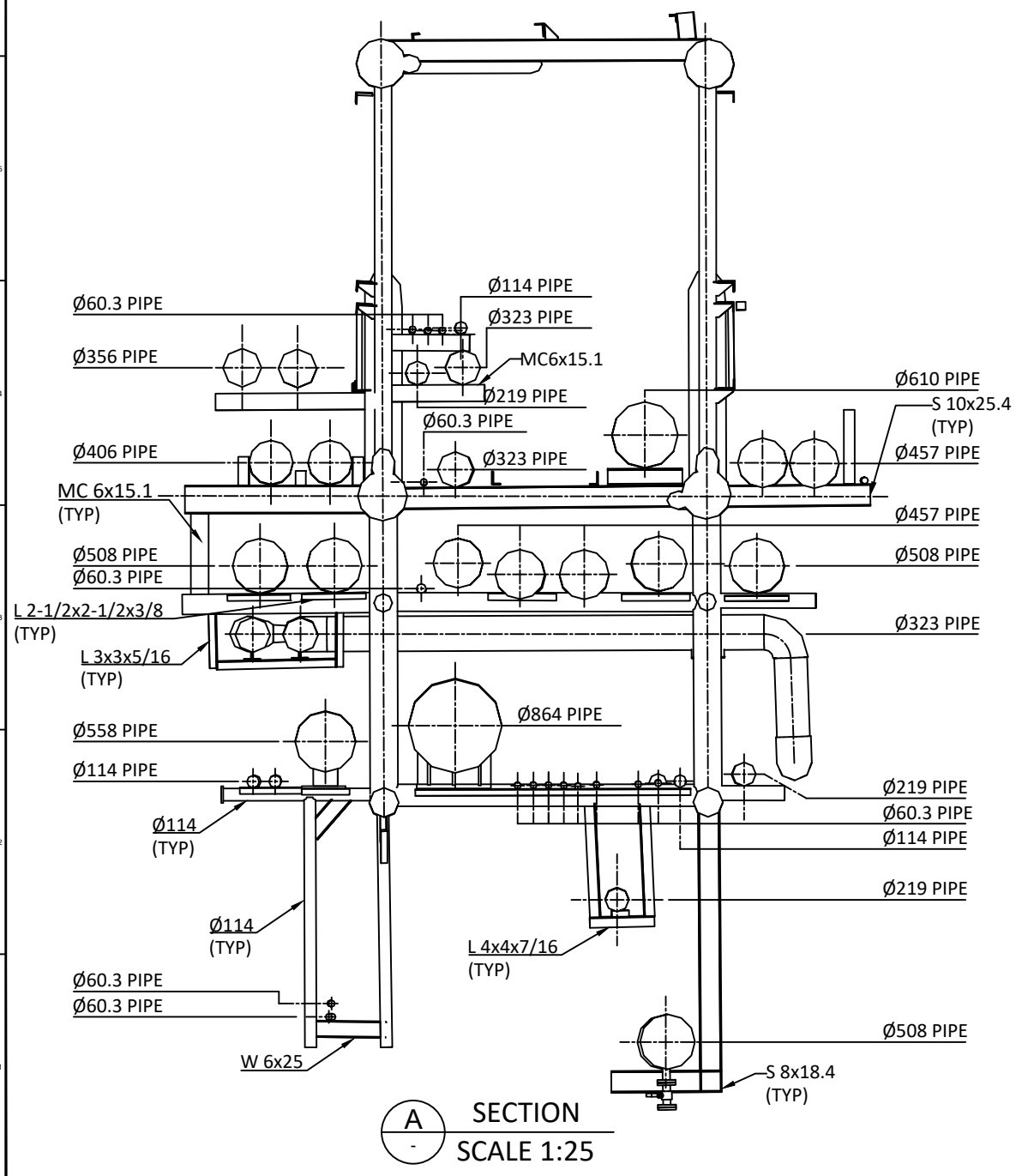
NOTE-1: All the attached standards are for reference and shall be updated based on the JOB specifications and Process Package without any time and cost implication to Owner / Owner's representative.

#### 16.0 Annexure-I

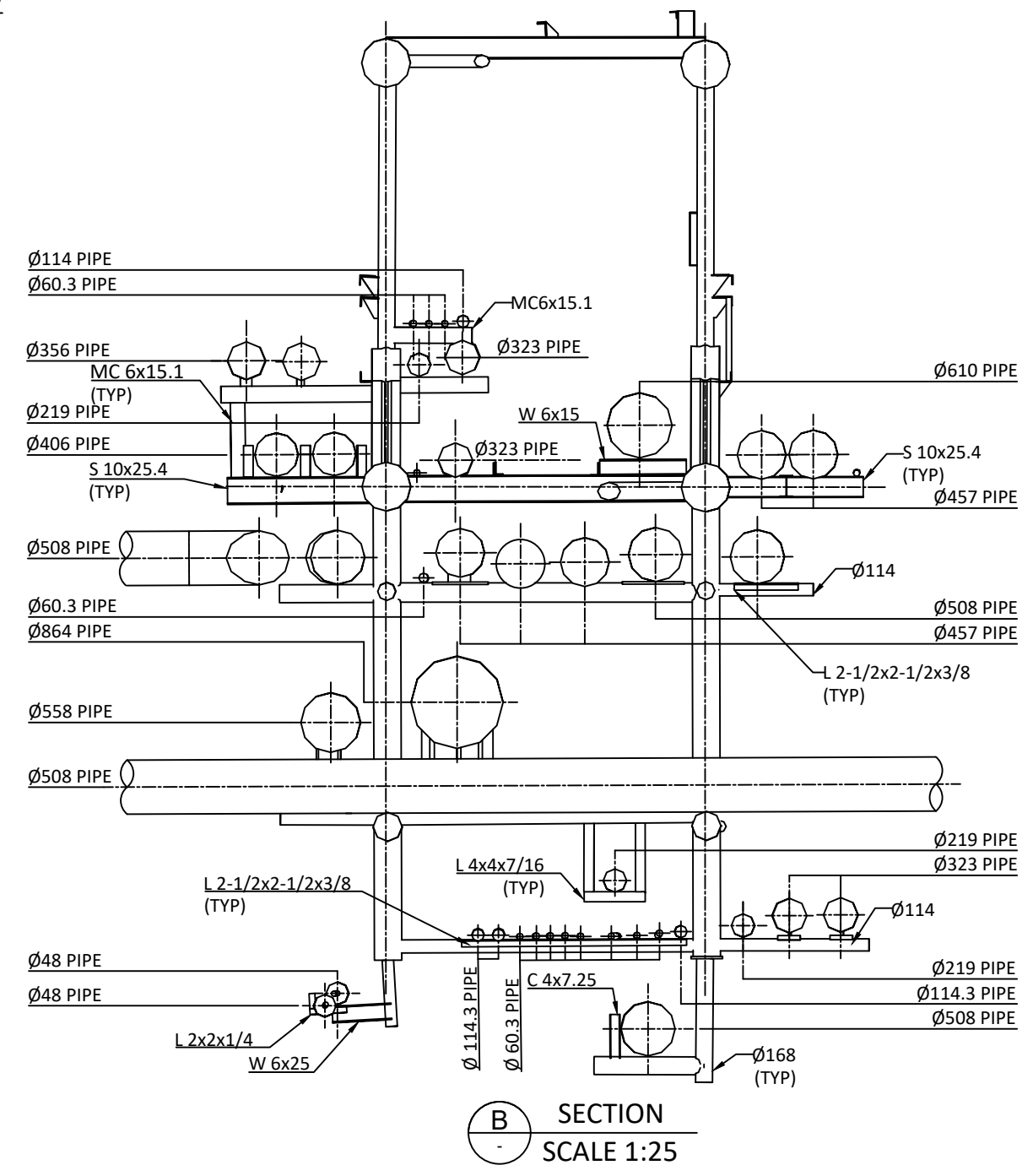
Reference Piping GAD of the Bridges extracted from laser scanned 3D model.



PIPING ELEVATION LAYOUT AT GRID-A  
SCALE 1:75



A SECTION  
SCALE 1:25



B SECTION  
SCALE 1:25

**GENERAL NOTES**

- ALL DIMENSIONS ARE IN MM & ELEVATIONS ARE IN METERS UNLESS OTHERWISE STATED.
- THIS DRAWING IS EXTRACTED USING LASER SCAN MODEL.

Rev.	Source Drawing No.	Reference Drawing Title
00	SAPL0034-STRL-L-071	KEY PLAN
00	SAPL0034-STRL-L-072	FRAMING PLAN
00	SAPL0034-STRL-L-073	FRAMING ELEVATION
00	SAPL0034-STRL-L-074	GRATING AND HANDRAIL
00	SAPL0034-STRL-L-075	SLIDING & ROOFING DETAILS
00	SAPL0034-PL-L-076	PIPING PLAN AND ELEVATION
00	SAPL0034-E&I-L-078	CABLETRAY PLAN, ELEVATION
		SECTION & DETAILS

Rev.	Date	Issued For Review	By	Check	Drawn	Scale	Project
00	13.03.24	ISSUED FOR REVIEW	PS	SK	SK	1:50	ICG

Client: OIL AND NATURAL GAS CORPORATION LIMITED  
MH ASSET - MUMBAI

Engineering: ICG  
3D SCAN Contractor: ICG

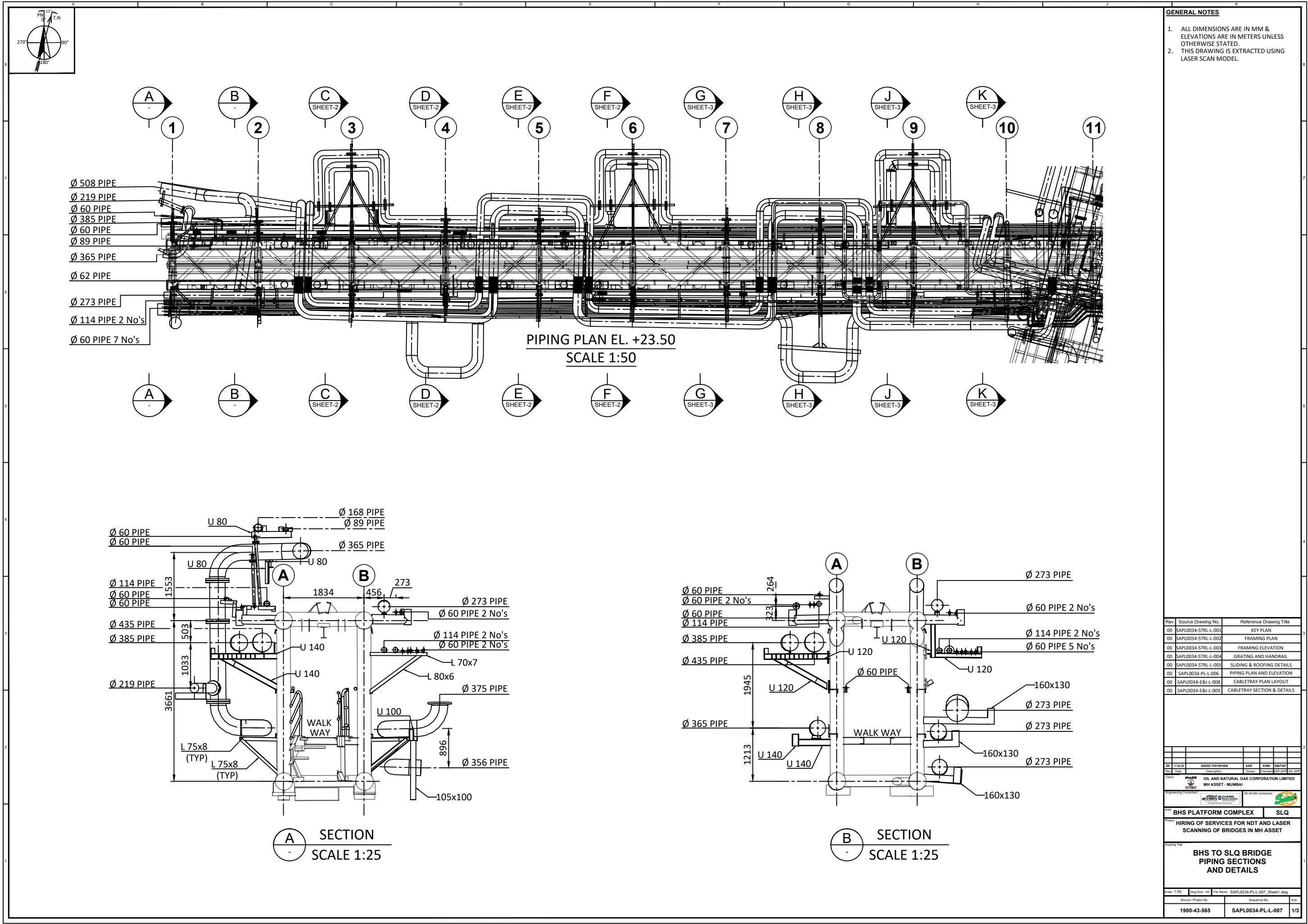
Project: ICP PLATFORM COMPLEX  
HIRING OF SERVICES FOR NDT AND LASER SCANNING OF BRIDGES IN MH ASSET

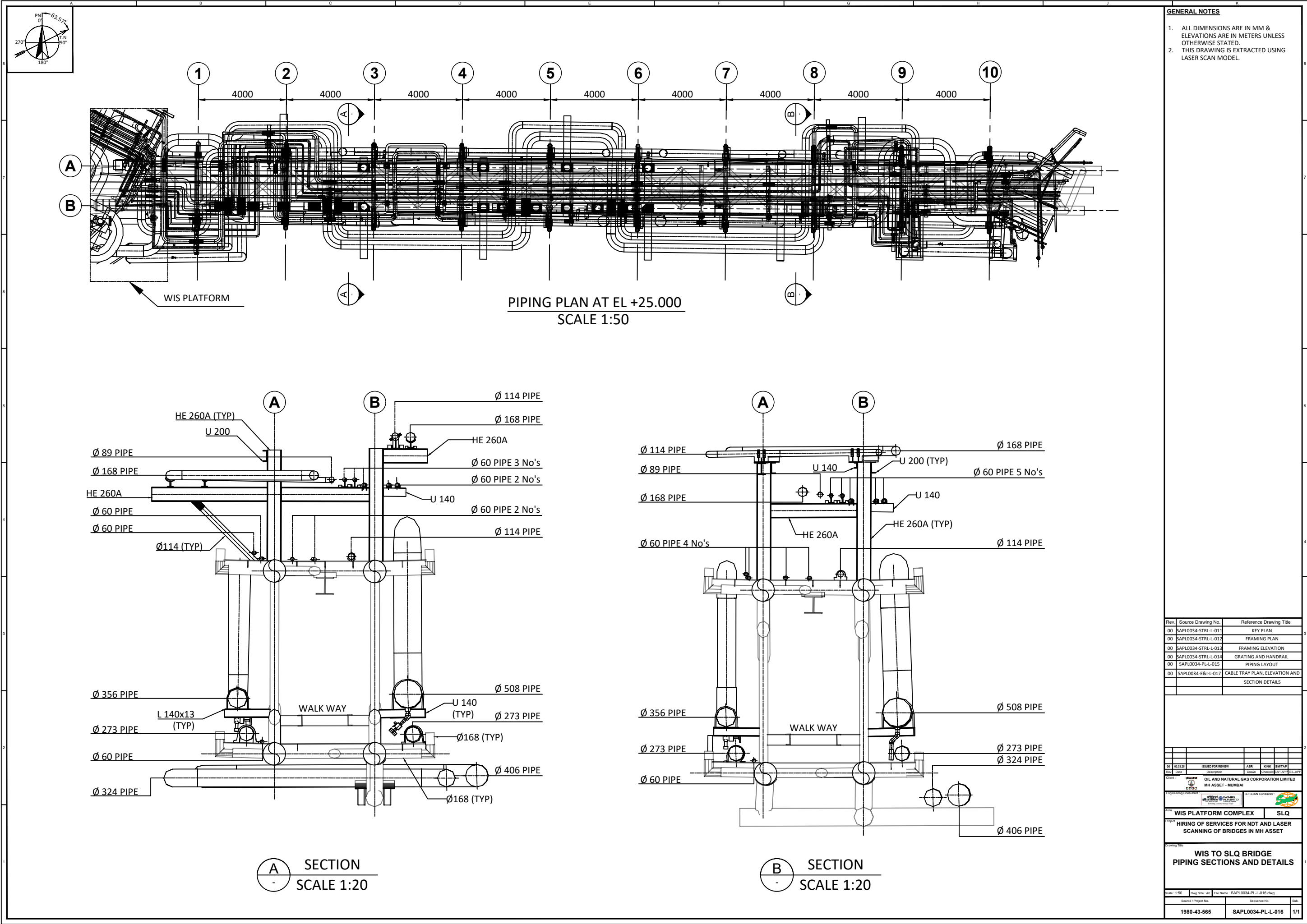
Drawing Title: ICP TO ICG BRIDGE PIPING SECTIONS AND DETAILS

Scale: 1:50  
Drawing Size: A0  
File Name: SAPL0034-PL-L-077.dwg  
Source / Project No.:  
Reference No.:  
Sub: SAPL0034-PL-L-077 1/1

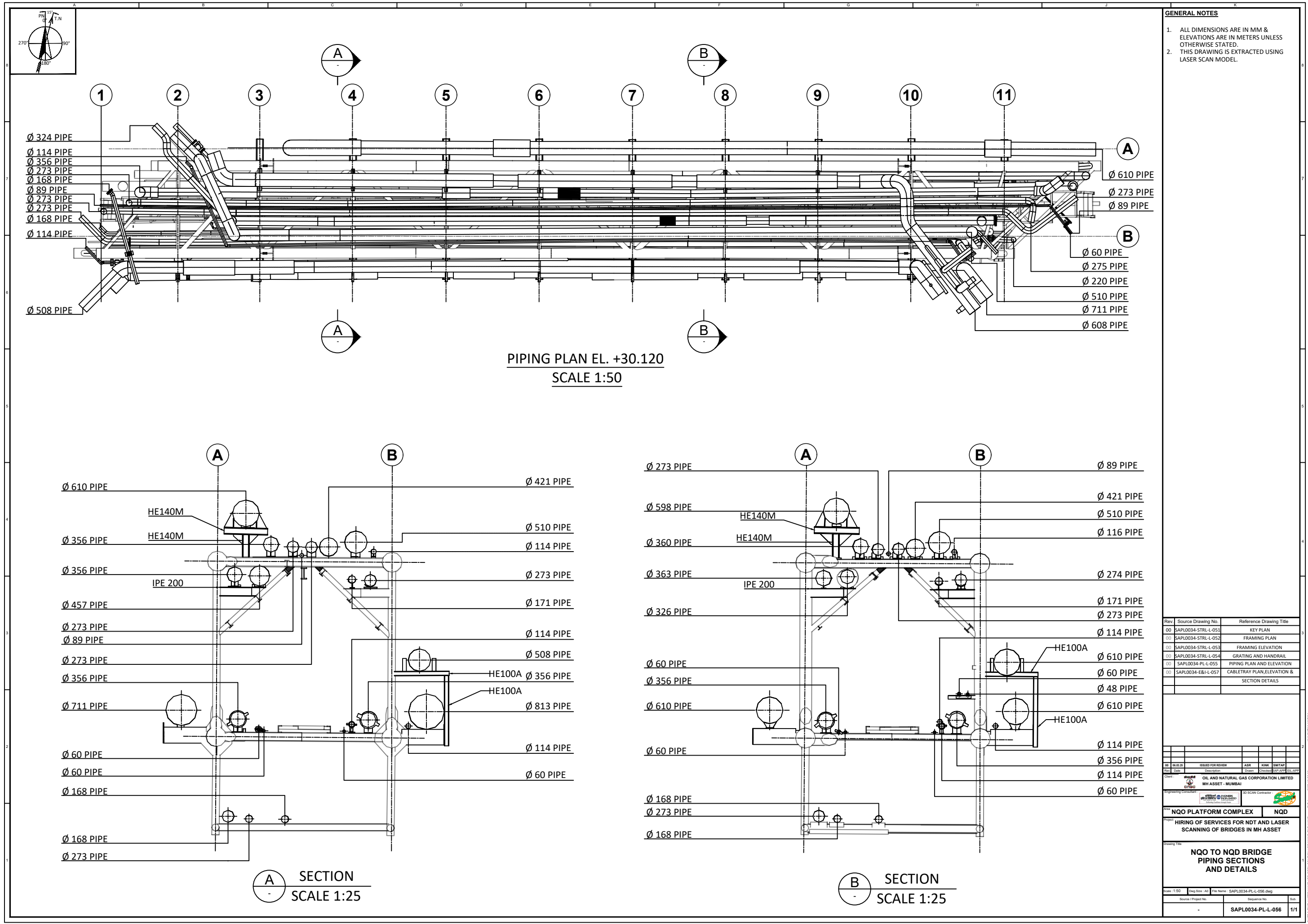
DATE & TIME / USER NAME / FOLDER LOCATION / DRAWING FILE NAME  
08 March 2024 11:02:12  
K.V. SATYA VARMA

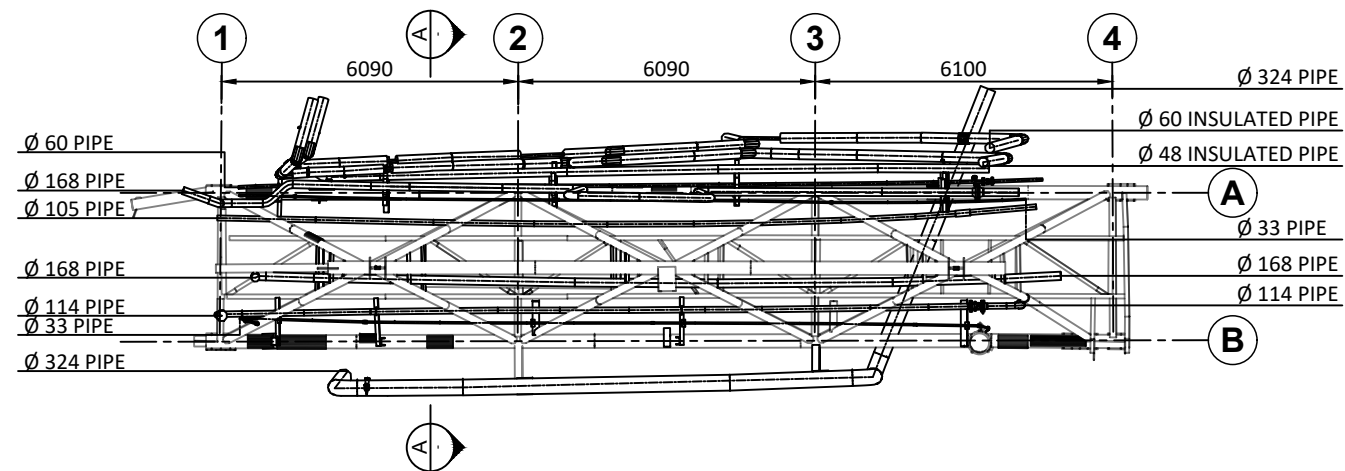












Technical drawing of a roof structure showing the layout of various pipes. The drawing is divided into four sections by vertical dashed lines labeled 1, 2, 3, and 4. Pipes are shown in cross-section with labels indicating their diameters: Ø 168 PIPE, Ø 33 PIPE, Ø 114 PIPE, Ø 324 PIPE, Ø 48 INSULATED PIPE, Ø 60 INSULATED PIPE, Ø 172 PIPE, and Ø 324 PIPE. The pipes are arranged in a complex network, with some running horizontally and others vertically or diagonally. The drawing is a black and white line drawing.

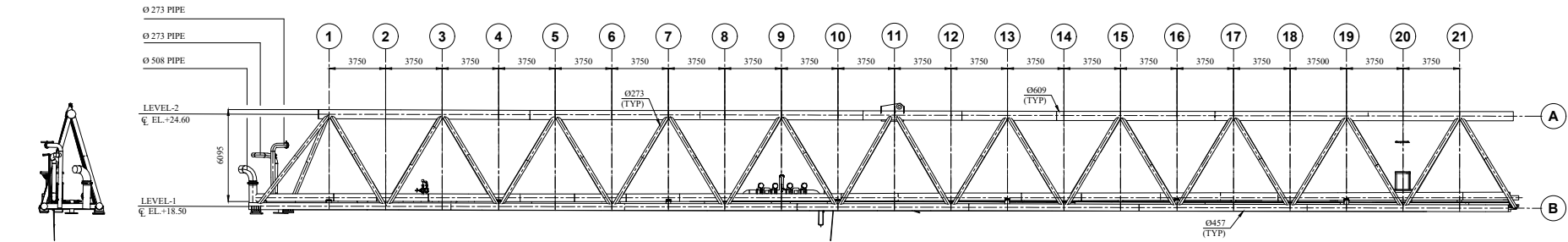
Technical drawing of a crane structure, showing dimensions and pipe specifications. The drawing includes a side view of the crane's boom and base, and a top view of the base. Key dimensions and specifications are labeled:

- Dimensions:**
  - 3055 (Length of the base structure)
- Pipe Specifications:**
  - Ø 105 PIPE
  - Ø 33 PIPE
  - Ø 168 PIPE
  - Ø 168 PIPE
  - Ø 48 PIPE
  - Ø 60 PIPE
  - Ø 170 PIPE
  - Ø 144 PIPE
  - Ø 33 PIPE
  - Ø 324 PIPE
  - Ø 60 PIPE

GENERAL NOTES						
1. ALL DIMENSIONS ARE IN MM & ELEVATIONS ARE IN METERS UNLESS OTHERWISE STATED.						
2. THIS DRAWING IS EXTRACTED USING LASER SCAN MODEL.						
Rev.	Source Drawing No.	Reference Drawing Title				
01	SAPL0038-STRL-L-311	KEY PLAN				
01	SAPL0038-STRL-L-312	FRAMING PLAN				
01	SAPL0038-STRL-L-313	GRATING AND HANDRAIL				
01	SAPL0038-E&I-L-411	CABLE-TRAY PLAN & ELEVATION				
01	SAPL0038-MP-L-211	PIPE LAYOUT PLAN & ELEVATION				
01	SAPL0038-MP-L-213	PIPE LAYOUT PLAN & ELEVATION				
01	SAPL0038-MP-L-214	PIPE LAYOUT PLAN & ELEVATION				
D1	14.08.25	ISSUED FOR APPROVAL		ANK	KNP	BMTAP
D2	16.07.25	ISSUED FOR REVIEW		GKM	KNP	BMTAP
Rev	Date	Description	Drawn	Checked	SAP APP	EIL
Client:  OIL AND NATURAL GAS CORPORATION LIMITED MH ASSET - MUMBAI						
Engineering Consultant:  SPPCL			3D SCAN Contractor:  Sona			
Area: <b>SC1-SCA BRIDGE</b>		<b>SCA-SC1</b>				
Project: <b>HIRING OF SERVICES FOR NDT AND LASER SCANNING OF BRIDGES IN MH ASSET</b>						
Drawing Title: <b>SC1-SCA BRIDGE PIPING SECTIONS AND DETAILS</b>						
Scale: 1/33      Drawn: AD      File Name: SAPL0038-MP-L-212.dwg						
Source / Project No.			Sequence No.			
-			SAPL0038-MP-L-212			

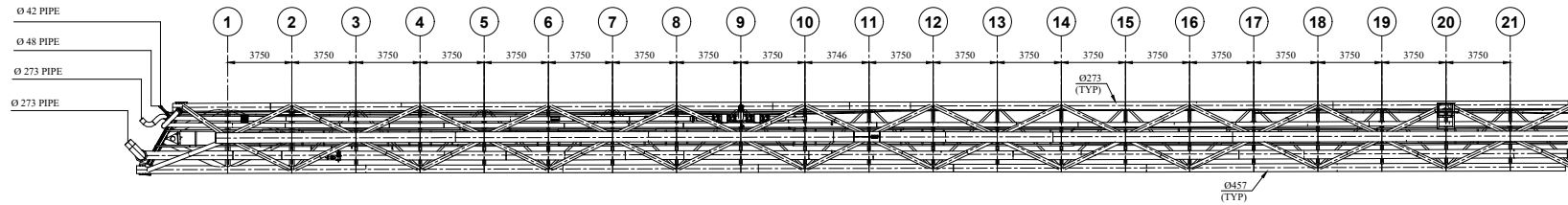


- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MM & ELEVATIONS ARE IN METERS UNLESS OTHERWISE STATED.
  2. THIS DRAWING IS EXTRACTED USING LASER SCAN MODEL.
  3. ALL STRUCTURAL STEEL PROFILE SIZES ARE INDICATED AS FLANGE WIDTH x WEB HEIGHT UNLESS OTHERWISE SPECIFIED.



**SIDE VIEW  
TOWARD EAST  
SCALE 1:100**

**ELEVATION VIEW LOOKING NORTH  
SCALE 1:100**



**PIPING PLAN VIEW  
SCALE 1:100**

Rev.	Source Drawing No.	Reference Drawing Title
01	SAPL0038-STRL-L-221	KEY PLAN
02	SAPL0038-STRL-L-222	FRAMING PLAN
03	SAPL0038-STRL-L-223	GRATING AND HANDRAIL
04	SAPL0038-STRL-L-224	CABLE-TRAY PLAN & ELE.

01	14.08.22	ISSUED FOR APPROVAL	ANK	KMP	DR/TAP
02	14.08.22	ISSUED FOR APPROVAL	ANK	KMP	DR/TAP
03	14.08.22	ISSUED FOR APPROVAL	ANK	KMP	DR/TAP

Client: OIL AND NATURAL GAS CORPORATION LIMITED  
MH ASSET - MUMBAI

SCA-SCF BRIDGE

HIRING OF SERVICES FOR NDT AND LASER  
SCANNING OF BRIDGES IN MH ASSET

SCA-SCF BRIDGE  
PIPING LAYOUT  
PLAN & ELEVATION

Scale: 1:100  
Drawing No: SAPL0038-MP-L-221-0001

Sheet No: 1/1



## **BRIDGE REPORT FOR BRIDGES IN MH ASSET (BHS-SLQ LOWER DECK BRIDGE)**

**PROJECT :** ENGINEERING / TECHNICAL CONSULTANCY  
SERVICES FOR PREPERATION OF EXECUTION  
METHODOLOGY, SOW AND COST ESTIMATES  
FOR REPLACEMENT /REFURBISHMENT OF  
BRIDGES IN MH ASSET

**LOCATION:** MH ASSET (NORTH AND SOUTH FIELD)

**OWNER :** ONGC, MUMBAI

**JOB NO :** B774

0	23.09.25	ISSUED AS STUDY	AA	DP	CS
Rev. No	Date	Purpose	Prepared by	Reviewed by	Approved by

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*No table of figures entries found.*

Annexures 1

## **Symbols and Abbreviations**

### **Organisations – India**

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### **Other abbreviations**

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge



## 1.0 INTRODUCTION

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges has deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## 2.0 GENERAL

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### IC Complex:

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### BHS Complex:

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### NQO Complex:

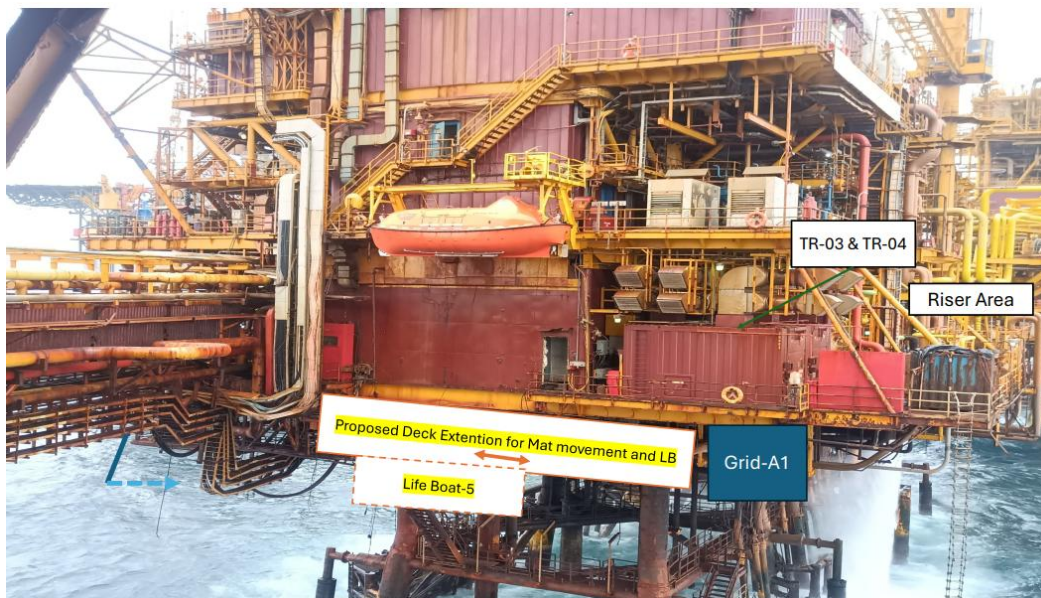
7. NQO-NQD Deck bridge

### WIN Complex:

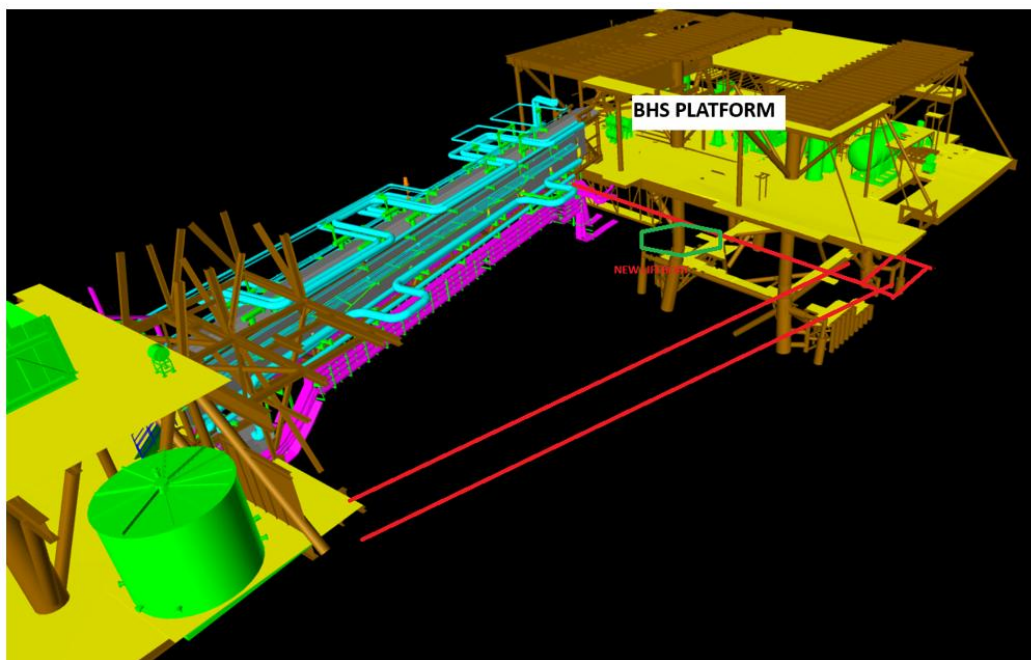
8. WIN-NC Lower Deck bridge

### 3.0 BHS-SLQ LOWER DECK BRIDGE DESCRIPTION

The existing bridge is highly corroded and its strengthening is not feasible. Hence New bridge (Walkway, power cables, piping etc.) is envisaged between BHS & SLQ platforms. The landing point at the SLQ platform is identified near grid B2 (southside). The landing point at the BHS platform is identified near grid A1 (southside).

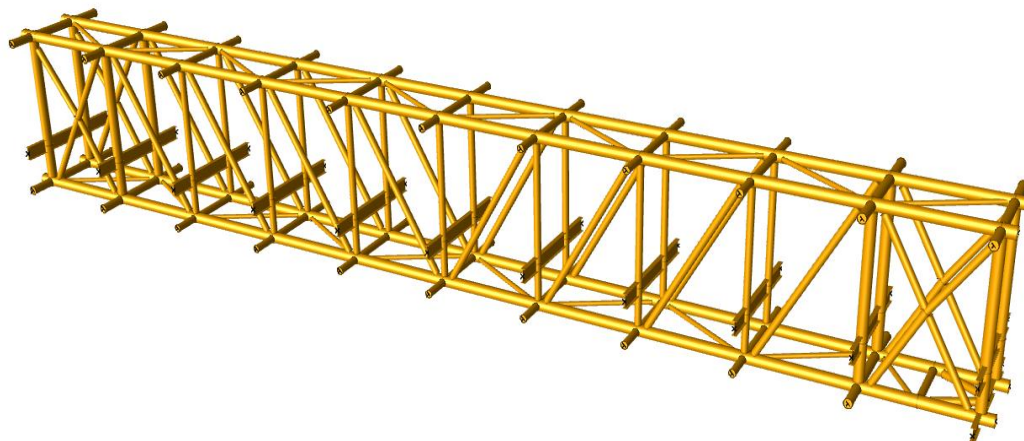


**Figure 1: BRIDGE (existing and proposed location-BHS SIDE)**



**Figure 2: BRIDGE (existing and proposed locations)**

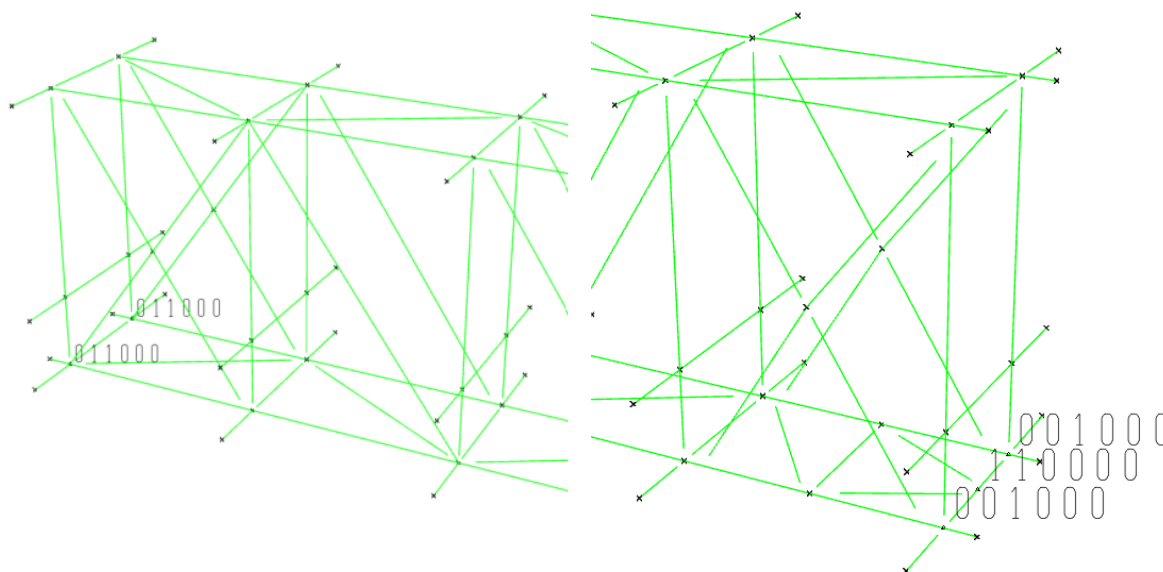
Approximate length of bridge is measured from 3D model as 40m. Hence, 42m length of bridge is modelled in SACS conservatively.



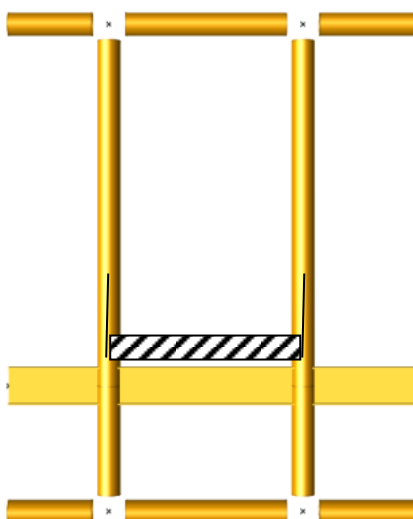
**Figure 3: 3D SACS MODEL**

Length of Bridge	42 m
Support Condition	Fixed: 001000, 111000, 001000 (SLQ Side) Sliding: 011000, 011000 (BHS Side)
No. of directions for environmental loads	8
Wind Speed (3 Sec Gust)	65.45 m/s for extreme and 39.99 m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	50ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

ISOMETRIC VIEW OF **BHS-SLQ Lower Deck Bridge** is shown in Figure1-3.



**Figure 4: SUPPORT CONDITIONS**



**Figure 5: BRIDGE CROSS SECTION**

## 4.0 LOADING

### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (kN)
DL	Self-weight, (Contingency - 13%), Walkway Member Wt	789.79
NGDL	Bracket load	266.47
	Extension	
	Grating Load	
	Grating support load	
	Handrail Load	
	Handrail support load	
	Light support	
	Monorail support	
	Roof Clad	
	Sheeting support	
	Tray support	
LL	Blanket live load on Walkway	268.42
MRL	Monorail Live Load	20.00
CL	Cable Loading	77.66
PLEM	Piping Load Empty (60% of PLOP)	864.00
PLOP	Piping Load Empty + Operating Contents (By Piping)	1440
PLTLX	Piping Load Empty + Operating Contents (30% of	432.16
PLTLY	Piping Load Empty + Operating Contents (30% of	432.16
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure
FLX	Bridge Friction Load X (30 % of SW+NGDL+LL+CL+PLOP)	926
FLY	Bridge Friction Load Y (30 % of SW+NGDL+LL+CL+PLOP)	926

### SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

### NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the Cable tray, cable tray support, grating and handrail loadings.

### LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 2.324 m width of walkway is considered.

### CABLE TRAY AND CABLE LOAD



Refer annexure for details of cable and cable tray loading.

### PIPING LOAD

Refer annexure for details of Piping loads.

### WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

#### 4.1 Load Combinations

##### Load Combinations

BASIC LOAD COMBINATIONS										
LComb	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
1000	DL	1.00	NDGL	1.13	CL	1.00	PLEM	1.00		
1001	DL	1.00	NDGL	1.13	CL	1.00	PLOP	1.00		
1002	1001	1.00	LL	1.00	MRLl	1.00	PLTX	1.00		
1003	1001	1.00	LL	1.00	MRLl	1.00	PLTX	-1.00		
1004	1001	1.00	LL	1.00	MRLl	1.00	PLTY	1.00		
1005	1001	1.00	LL	1.00	MRLl	1.00	PLTY	-1.00		
BASIC LOAD COMBINATIONS WITH BRIDGE FRICTION										
1011	1001	1.00	FLX	1.00						
1012	1001	1.00	FLX	-1.00						
1013	1001	1.00	FLY	1.00						
1014	1001	1.00	FLY	-1.00						
1021	1002	1.00	FLX	1.00						
1022	1002	1.00	FLX	-1.00						
1023	1002	1.00	FLY	1.00						
1024	1002	1.00	FLY	-1.00						
1031	1003	1.00	FLX	1.00						
1032	1003	1.00	FLX	-1.00						
1033	1003	1.00	FLY	1.00						
1034	1003	1.00	FLY	-1.00						
1041	1004	1.00	FLX	1.00						
1042	1004	1.00	FLX	-1.00						
1043	1004	1.00	FLY	1.00						
1044	1004	1.00	FLY	-1.00						

1051	1005	1.00	FLX	1.00						
1052	1005	1.00	FLX	-1.00						
1053	1005	1.00	FLY	1.00						
1054	1005	1.00	FLY	-1.00						
<b>LOAD COMBINATION FOR ENVIRONMENTAL LOAD</b>										
2001	TO	2038	Extreme environment loads							
4001	TO	4338	Operating environment loads							

NOTE: For a conservative approach, operating loads used for pipe are calculated using weight of water. Hence no separate case for hydrotest loads is used for design.

## 5.0 RESULTS & SUMMARY

### BASIC LOAD CASE SUMMARY SACS OUTPUT

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

DATE 23-SEP-2025 TIME 23:09:30 SEA PAGE 61

#### \*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

MARINE METHOD

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ	DEAD LOAD	BUOYANCY
CASE LABEL		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)	(KN)	(KN)
1 CL		0.00	0.00	-77.66	-152.3	2931.7	0.0	0.00	0.00
2 DL		-0.00	0.00	-826.71	-1593.6	31312.5	0.0	826.71	0.00
3 LL		0.00	0.00	-268.42	-513.2	10132.9	0.0	0.00	0.00
4 201		287.45	-0.13	-0.01	12.3	27579.3	-574.6	0.00	0.00
5 202		203.16	1139.49	-0.01	-109951.7	19492.8	42622.8	0.00	0.00
6 203		-0.13	1611.61	0.00	-155507.5	-12.3	60852.4	0.00	0.00
7 204		-203.35	1139.67	0.01	-109969.1	-19510.2	43435.4	0.00	0.00
8 205		-287.45	0.13	0.01	-12.3	-27579.3	574.6	0.00	0.00
9 206		-203.16	-1139.49	0.01	109951.7	-19492.8	-42622.8	0.00	0.00
10 207		0.13	-1611.61	-0.00	155507.5	12.3	-60852.4	0.00	0.00
11 208		203.35	-1139.67	-0.01	109969.1	19510.2	-43435.4	0.00	0.00
12 301		102.03	-0.05	-0.00	4.4	9788.7	-203.9	0.00	0.00
13 302		72.11	403.36	-0.00	-38918.8	6918.6	15087.4	0.00	0.00
14 303		-0.05	570.48	0.00	-55043.9	-4.4	21540.7	0.00	0.00
15 304		-72.18	403.43	0.00	-38925.0	-6924.8	15375.8	0.00	0.00
16 305		-102.03	0.05	0.00	-4.4	-9788.7	203.9	0.00	0.00
17 306		-72.11	-403.36	0.00	38918.8	-6918.6	-15087.4	0.00	0.00
18 307		0.05	-570.48	-0.00	55043.9	4.4	-21540.7	0.00	0.00



BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(BHS-SLQ LOWER DECK BRIDGE)

19	308	72.18	-403.43	-0.00	38925.0	6924.8	-15375.8	0.00	0.00
20	FLX	926.40	0.00	0.00	0.0	86437.8	-1771.3	0.00	0.00
21	FLY	0.00	-926.40	0.00	86437.8	0.0	-34971.6	0.00	0.00
22	MRL	0.00	0.00	-20.00	-39.1	755.0	0.0	0.00	0.00
23	NGDL	0.00	0.00	-266.47	-508.4	10059.4	-62.5	0.00	0.00
24	PLOP	0.00	0.00	-1440.00	-2656.0	52620.1	0.0	0.00	0.00
25	PLTX	-432.16	0.00	0.00	0.0	-41645.5	797.1	0.00	0.00
26	PLTY	0.00	-432.11	0.00	41640.8	0.0	-15790.1	0.00	0.00

COMBINED LOAD CASE SUMMARY SACS OUTPUT

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\* DATE 23-SEP-2025 TIME 23:09:30 SEA PAGE 74

\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
27	PLEM	0.00	0.00	-864.00	-1593.6	31572.1	0.0
28	1000	-0.00	0.00	-2069.49	-3914.0	77183.4	-70.6
29	1001	-0.00	0.00	-2645.49	-4976.3	98231.4	-70.6
30	1002	-432.16	0.00	-2933.91	-5528.6	67473.8	726.5
31	1003	432.16	0.00	-2933.91	-5528.6	150764.9	-867.7
32	1004	-0.00	-432.11	-2933.91	36112.2	109119.3	-15860.7
33	1005	-0.00	432.11	-2933.91	-47169.4	109119.3	15719.5
34	1011	926.40	0.00	-2645.49	-4976.3	184669.2	-1841.9
35	1012	-926.40	0.00	-2645.49	-4976.3	11793.6	1700.7
36	1013	-0.00	-926.40	-2645.49	81461.4	98231.4	-35042.2
37	1014	-0.00	926.40	-2645.49	-91414.1	98231.4	34901.0
38	1021	494.24	0.00	-2933.91	-5528.6	153911.6	-1044.8
39	1022	-1358.56	0.00	-2933.91	-5528.6	-18963.9	2497.8
40	1023	-432.16	-926.40	-2933.91	80909.1	67473.8	-34245.1
41	1024	-432.16	926.40	-2933.91	-91966.4	67473.8	35698.1
42	1031	1358.56	0.00	-2933.91	-5528.6	237202.6	-2639.0
43	1032	-494.24	0.00	-2933.91	-5528.6	64327.1	903.6
44	1033	432.16	-926.40	-2933.91	80909.1	150764.9	-35839.3
45	1034	432.16	926.40	-2933.91	-91966.4	150764.9	34103.9
46	1041	926.40	-432.11	-2933.91	36112.2	195557.1	-17632.0
47	1042	-926.40	-432.11	-2933.91	36112.2	22681.6	-14089.5
48	1043	-0.00	-1358.51	-2933.91	122549.9	109119.3	-50832.3
49	1044	-0.00	494.29	-2933.91	-50325.6	109119.3	19110.9
50	1051	926.40	432.11	-2933.91	-47169.4	195557.1	13948.3
51	1052	-926.40	432.11	-2933.91	-47169.4	22681.6	17490.8
52	1053	-0.00	-494.29	-2933.91	39268.3	109119.3	-19252.1

**BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(BHS-SLQ LOWER DECK BRIDGE)**

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53	1054	-0.00	1358.51	-2933.91	-133607.2	109119.3	50691.1
54	2001	1213.85	-0.13	-2645.49	-4964.0	212248.4	-2416.5
55	2002	-638.95	-0.13	-2645.49	-4964.0	39372.9	1126.1
56	2003	287.45	-926.53	-2645.49	81473.7	125810.7	-35616.8
57	2004	287.45	926.27	-2645.49	-91401.8	125810.7	34326.4
58	2005	1129.56	1139.49	-2645.49	-114928.0	204161.9	40780.9
59	2006	-723.24	1139.49	-2645.49	-114928.0	31286.4	44323.5
60	2007	203.16	213.09	-2645.49	-28490.3	117724.2	7580.6
61	2008	203.16	2065.89	-2645.49	-201365.8	117724.2	77523.8
62	2011	926.27	1611.61	-2645.49	-160483.8	184656.8	59010.5
63	2012	-926.53	1611.61	-2645.49	-160483.8	11781.3	62553.0
64	2013	-0.13	685.21	-2645.49	-74046.1	98219.1	25810.2
65	2014	-0.13	2538.01	-2645.49	-246921.6	98219.1	95753.4
66	2015	723.05	1139.67	-2645.48	-114945.4	165158.9	41593.6
67	2016	-1129.75	1139.67	-2645.48	-114945.4	-7716.6	45136.1
68	2017	-203.35	213.27	-2645.48	-28507.7	78721.2	8393.2
69	2018	-203.35	2066.07	-2645.48	-201383.2	78721.2	78336.4
70	2021	638.95	0.13	-2645.48	-4988.7	157089.9	-1267.3
71	2022	-1213.85	0.13	-2645.48	-4988.7	-15785.6	2275.3

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL						
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
72	2023	-287.45	-926.27	-2645.48	81449.1	70652.1	-34467.6
73	2024	-287.45	926.53	-2645.48	-91426.4	70652.1	35475.6
74	2025	723.24	-1139.49	-2645.48	104975.3	165176.4	-44464.7
75	2026	-1129.56	-1139.49	-2645.48	104975.3	-7699.1	-40922.1
76	2027	-203.16	-2065.89	-2645.48	191413.1	78738.6	-77665.0
77	2028	-203.16	-213.09	-2645.48	18537.6	78738.6	-7721.8
78	2031	926.53	-1611.61	-2645.49	150531.1	184681.5	-62694.3
79	2032	-926.27	-1611.61	-2645.49	150531.1	11806.0	-59151.7
80	2033	0.13	-2538.01	-2645.49	236968.9	98243.7	-95894.6
81	2034	0.13	-685.21	-2645.49	64093.4	98243.7	-25951.4
82	2035	1129.75	-1139.67	-2645.49	104992.8	204179.4	-45277.3
83	2036	-723.05	-1139.67	-2645.49	104992.8	31303.9	-41734.8
84	2037	203.35	-2066.07	-2645.49	191430.5	117741.6	-78477.7
85	2038	203.35	-213.27	-2645.49	18555.0	117741.6	-8534.4
86	4001	596.27	-0.05	-2933.91	-5524.2	163700.3	-1248.7
87	4002	-1256.53	-0.05	-2933.91	-5524.2	-9175.2	2293.9
88	4003	-330.13	-926.45	-2933.91	80913.5	77262.6	-34449.0
89	4004	-330.13	926.35	-2933.91	-91962.0	77262.6	35494.2
90	4005	566.36	403.36	-2933.91	-44447.4	160830.1	14042.6
91	4006	-1286.44	403.36	-2933.91	-44447.4	-12045.4	17585.2
92	4007	-360.04	-523.04	-2933.91	41990.3	74392.4	-19157.7
93	4008	-360.04	1329.76	-2933.91	-130885.2	74392.4	50785.5
94	4011	494.19	570.48	-2933.91	-60572.5	153907.2	20496.0
95	4012	-1358.61	570.48	-2933.91	-60572.5	-18968.3	24038.5
96	4013	-432.21	-355.92	-2933.91	25865.3	67469.4	-12704.4
97	4014	-432.21	1496.88	-2933.91	-147010.3	67469.4	57238.8
98	4015	422.06	403.43	-2933.91	-44453.6	146986.8	14331.0
99	4016	-1430.74	403.43	-2933.91	-44453.6	-25888.8	17873.6
100	4017	-504.34	-522.97	-2933.91	41984.1	60549.0	-18869.3
101	4018	-504.34	1329.83	-2933.91	-130891.4	60549.0	51073.9
102	4021	392.21	0.05	-2933.90	-5533.0	144122.8	-840.8
103	4022	-1460.59	0.05	-2933.90	-5533.0	-28752.7	2701.7
104	4023	-534.19	-926.35	-2933.90	80904.7	57685.1	-34041.2
105	4024	-534.19	926.45	-2933.90	-91970.8	57685.1	35902.1
106	4025	422.13	-403.36	-2933.91	33390.1	146993.0	-16132.1
107	4026	-1430.67	-403.36	-2933.91	33390.1	-25882.5	-12589.6
108	4027	-504.27	-1329.76	-2933.91	119827.9	60555.2	-49332.5

**BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(BHS-SLQ LOWER DECK BRIDGE)**

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109 4028	-504.27	523.04	-2933.91	-53047.6	60555.2	20610.7
110 4031	494.29	-570.48	-2933.91	49515.2	153916.0	-22585.5
111 4032	-1358.51	-570.48	-2933.91	49515.2	-18959.5	-19042.9
112 4033	-432.11	-1496.88	-2933.91	135953.0	67478.2	-55785.8
113 4034	-432.11	355.92	-2933.91	-36922.5	67478.2	14157.4
114 4035	566.42	-403.43	-2933.91	33396.4	160836.4	-16420.6
115 4036	-1286.38	-403.43	-2933.91	33396.4	-12039.1	-12878.0
116 4037	-359.98	-1329.83	-2933.91	119834.1	74398.6	-49620.9

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL						
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
117	4038	-359.98	522.97	-2933.91	-53041.4	74398.6	20322.3
118	4101	1460.59	-0.05	-2933.91	-5524.2	246991.4	-2842.9
119	4102	-392.21	-0.05	-2933.91	-5524.2	74115.8	699.6
120	4103	534.19	-926.45	-2933.91	80913.5	160553.6	-36043.3
121	4104	534.19	926.35	-2933.91	-91962.0	160553.6	33900.0
122	4105	1430.67	403.36	-2933.91	-44447.4	244121.2	12448.4
123	4106	-422.13	403.36	-2933.91	-44447.4	71245.7	15990.9
124	4107	504.27	-523.04	-2933.91	41990.3	157683.4	-20751.9
125	4108	504.27	1329.76	-2933.91	-130885.2	157683.4	49191.3
126	4111	1358.51	570.48	-2933.91	-60572.5	237198.2	18901.7
127	4112	-494.29	570.48	-2933.91	-60572.5	64322.7	22444.3
128	4113	432.11	-355.92	-2933.91	25865.3	150760.5	-14298.6
129	4114	432.11	1496.88	-2933.91	-147010.3	150760.5	55644.6
130	4115	1286.38	403.43	-2933.91	-44453.6	230277.8	12736.8
131	4116	-566.42	403.43	-2933.91	-44453.6	57402.3	16279.4
132	4117	359.98	-522.97	-2933.91	41984.1	143840.1	-20463.5
133	4118	359.98	1329.83	-2933.91	-130891.4	143840.1	49479.7
134	4121	1256.53	0.05	-2933.90	-5533.0	227413.9	-2435.1
135	4122	-596.27	0.05	-2933.90	-5533.0	54538.4	1107.5
136	4123	330.13	-926.35	-2933.90	80904.7	140976.1	-35635.4
137	4124	330.13	926.45	-2933.90	-91970.8	140976.1	34307.8
138	4125	1286.44	-403.36	-2933.91	33390.1	230284.1	-17726.4
139	4126	-566.36	-403.36	-2933.91	33390.1	57408.5	-14183.8
140	4127	360.04	-1329.76	-2933.91	119827.9	143846.3	-50926.7
141	4128	360.04	523.04	-2933.91	-53047.6	143846.3	19016.5
142	4131	1358.61	-570.48	-2933.91	49515.2	237207.0	-24179.7
143	4132	-494.19	-570.48	-2933.91	49515.2	64331.5	-20637.2
144	4133	432.21	-1496.88	-2933.91	135953.0	150769.3	-57380.0
145	4134	432.21	355.92	-2933.91	-36922.5	150769.3	12563.2
146	4135	1430.74	-403.43	-2933.91	33396.4	244127.4	-18014.8
147	4136	-422.06	-403.43	-2933.91	33396.4	71251.9	-14472.2
148	4137	504.34	-1329.83	-2933.91	119834.1	157689.7	-51215.1
149	4138	504.34	522.97	-2933.91	-53041.4	157689.7	18728.1
150	4201	1028.43	-432.16	-2933.91	36116.6	205345.8	-17836.0
151	4202	-824.37	-432.16	-2933.91	36116.6	32470.3	-14293.4
152	4203	102.03	-1358.56	-2933.91	122554.3	118908.1	-51036.3
153	4204	102.03	494.24	-2933.91	-50321.2	118908.1	18906.9

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154	4205	998.51	-28.75	-2933.91	-2806.6	202475.7	-2544.6
155	4206	-854.29	-28.75	-2933.91	-2806.6	29600.2	997.9
156	4207	72.11	-955.15	-2933.91	83631.1	116037.9	-35745.0
157	4208	72.11	897.65	-2933.91	-89244.4	116037.9	34198.2
158	4211	926.35	138.37	-2933.91	-18931.7	195552.7	3908.7
159	4212	-926.45	138.37	-2933.91	-18931.7	22677.2	7451.3
160	4213	-0.05	-788.03	-2933.91	67506.0	109114.9	-29291.6
161	4214	-0.05	1064.77	-2933.91	-105369.5	109114.9	40651.6

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
162	4215	854.22	-28.68	-2933.91	-2812.8	188632.3	-2256.2
163	4216	-998.58	-28.68	-2933.91	-2812.8	15756.8	1286.3
164	4217	-72.18	-955.08	-2933.91	83624.9	102194.5	-35456.6
165	4218	-72.18	897.72	-2933.91	-89250.6	102194.5	34486.7
166	4221	824.37	-432.06	-2933.90	36107.8	185768.3	-17428.1
167	4222	-1028.43	-432.06	-2933.90	36107.8	12892.8	-13885.5
168	4223	-102.03	-1358.46	-2933.90	122545.5	99330.6	-50628.4
169	4224	-102.03	494.34	-2933.90	-50330.0	99330.6	19314.8
170	4225	854.29	-835.47	-2933.91	75030.9	188638.5	-32719.4
171	4226	-998.51	-835.47	-2933.91	75030.9	15763.0	-29176.8
172	4227	-72.11	-1761.87	-2933.91	161468.7	102200.8	-65919.7
173	4228	-72.11	90.93	-2933.91	-11406.8	102200.8	4023.5
174	4231	926.45	-1002.59	-2933.91	91156.0	195561.5	-39172.7
175	4232	-926.35	-1002.59	-2933.91	91156.0	22686.0	-35630.2
176	4233	0.05	-1928.99	-2933.91	177593.8	109123.7	-72373.1
177	4234	0.05	-76.19	-2933.91	4718.3	109123.7	-2429.9
178	4235	998.58	-835.53	-2933.91	75037.2	202481.9	-33007.8
179	4236	-854.22	-835.53	-2933.91	75037.2	29606.4	-29465.3
180	4237	72.18	-1761.93	-2933.91	161474.9	116044.1	-66208.1
181	4238	72.18	90.87	-2933.91	-11400.6	116044.1	3735.1
182	4301	1028.43	432.06	-2933.91	-47165.0	205345.8	13744.3
183	4302	-824.37	432.06	-2933.91	-47165.0	32470.3	17286.9
184	4303	102.03	-494.34	-2933.91	39272.7	118908.1	-19456.0
185	4304	102.03	1358.46	-2933.91	-133602.8	118908.1	50487.2
186	4305	998.51	835.47	-2933.91	-86088.2	202475.7	29035.6
187	4306	-854.29	835.47	-2933.91	-86088.2	29600.2	32578.2
188	4307	72.11	-90.93	-2933.91	349.6	116037.9	-4164.7
189	4308	72.11	1761.87	-2933.91	-172526.0	116037.9	65778.5
190	4311	926.35	1002.59	-2933.91	-102213.3	195552.7	35489.0
191	4312	-926.45	1002.59	-2933.91	-102213.3	22677.2	39031.5
192	4313	-0.05	76.19	-2933.91	-15775.5	109114.9	2288.6
193	4314	-0.05	1928.99	-2933.91	-188651.0	109114.9	72231.9
194	4315	854.22	835.53	-2933.91	-86094.4	188632.3	29324.1
195	4316	-998.58	835.53	-2933.91	-86094.4	15756.8	32866.6
196	4317	-72.18	-90.87	-2933.91	343.3	102194.5	-3876.3
197	4318	-72.18	1761.93	-2933.91	-172532.2	102194.5	66066.9
198	4321	824.37	432.16	-2933.90	-47173.8	185768.3	14152.2



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199	4322	-1028.43	432.16	-2933.90	-47173.8	12892.8	17694.7
200	4323	-102.03	-494.24	-2933.90	39263.9	99330.6	-19048.1
201	4324	-102.03	1358.56	-2933.90	-133611.6	99330.6	50895.1
202	4325	854.29	28.75	-2933.91	-8250.6	188638.5	-1139.1
203	4326	-998.51	28.75	-2933.91	-8250.6	15763.0	2403.4
204	4327	-72.11	-897.65	-2933.91	78187.1	102200.8	-34339.5
205	4328	-72.11	955.15	-2933.91	-94688.4	102200.8	35603.8
206	4331	926.45	-138.37	-2933.91	7874.5	195561.5	-7592.5

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

		RELATIVE TO MUDLINE ELEVATION					
LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL						
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
207	4332	-926.35	-138.37	-2933.91	7874.5	22686.0	-4049.9
208	4333	0.05	-1064.77	-2933.91	94312.2	109123.7	-40792.8
209	4334	0.05	788.03	-2933.91	-78563.3	109123.7	29150.4
210	4335	998.58	28.68	-2933.91	-8244.4	202481.9	-1427.5
211	4336	-854.22	28.68	-2933.91	-8244.4	29606.4	2115.0
212	4337	72.18	-897.72	-2933.91	78193.4	116044.1	-34627.9
213	4338	72.18	955.08	-2933.91	-94682.2	116044.1	35315.3

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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**BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(BHS-SLQ LOWER DECK BRIDGE)**

\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
1	CL	0.00			0.00				-77.66	37.75	1.96	19.73	
2	DL	-0.00			0.00				-826.71	37.88	1.93	21.33	
3	LL	0.00			0.00				-268.42	37.75	1.91	20.00	
4	201	287.45	38.53	1.97	20.65	-0.13	66.41	-0.69	18.50	COUPLE			
5	202	203.16	38.52	1.97	20.65	1139.49	37.76	0.92	21.69	COUPLE			
6	203	-0.13	66.41	-0.69	18.50	1611.61	37.76	0.92	21.69	0.00			
7	204	-203.35	38.54	1.97	20.65	1139.67	37.76	0.92	21.69	COUPLE			
8	205	-287.45	38.53	1.97	20.65	0.13	66.42	-0.69	18.50	COUPLE			
9	206	-203.16	38.52	1.97	20.65	-1139.49	37.76	2.90	21.69	COUPLE			
10	207	0.13	66.41	-0.69	18.50	-1611.61	37.76	2.90	21.69	-0.00			
11	208	203.35	38.54	1.97	20.65	-1139.67	37.76	2.90	21.69	COUPLE			
12	301	102.03	38.54	1.97	20.64	-0.05	65.25	-0.69	18.50	COUPLE			
13	302	72.11	38.52	1.97	20.64	403.36	37.76	0.92	21.68	COUPLE			
14	303	-0.05	65.25	-0.69	18.50	570.48	37.76	0.92	21.68	0.00			
15	304	-72.18	38.55	1.97	20.64	403.43	37.76	0.92	21.68	COUPLE			
16	305	-102.03	38.54	1.97	20.64	0.05	65.26	-0.69	18.50	COUPLE			
17	306	-72.11	38.52	1.97	20.64	-403.36	37.76	2.90	21.68	COUPLE			
18	307	0.05	65.25	-0.69	18.50	-570.48	37.76	2.90	21.68	-0.00			
19	308	72.18	38.55	1.97	20.64	-403.43	37.76	2.90	21.68	COUPLE			
20	FLX	926.40	37.75	1.91	18.50	0.00			0.00				
21	FLY	0.00			-926.40	37.75	1.91	18.50	0.00				
22	MRLL	0.00			0.00			-20.00	37.75	1.95	24.32		
23	NGDL	0.00			0.00			-266.47	37.75	1.91	21.69		
24	PLOP	0.00			0.00			-1440.00	36.54	1.84	21.56		
25	PLTX	-432.16	36.54	1.84	21.56	0.00			0.00				
26	PLTY	0.00			-432.11	36.54	1.84	21.56	0.00				
27	PLEM	0.00			0.00			-864.00	36.54	1.84	21.56		
28	1000	-0.00			0.00			-2069.49	37.30	1.89	21.42		
29	1001	-0.00			0.00			-2645.49	37.13	1.88	21.45		
30	1002	-432.16	36.54	1.84	21.56	0.00			-2933.91	37.19	1.88	21.34	
31	1003	432.16	36.54	1.84	21.56	0.00			-2933.91	37.19	1.88	21.34	
32	1004	-0.00			-432.11	36.54	1.84	21.56	-2933.91	37.19	1.88	21.34	
33	1005	-0.00			432.11	36.54	1.84	21.56	-2933.91	37.19	1.88	21.34	
34	1011	926.40	37.75	1.91	18.50	0.00			-2645.49	37.13	1.88	21.45	
35	1012	-926.40	37.75	1.91	18.50	0.00			-2645.49	37.13	1.88	21.45	
36	1013	-0.00			-926.40	37.75	1.91	18.50	-2645.49	37.13	1.88	21.45	
37	1014	-0.00			926.40	37.75	1.91	18.50	-2645.49	37.13	1.88	21.45	
38	1021	494.24	38.81	1.97	15.82	0.00			-2933.91	37.19	1.88	21.34	
39	1022	-1358.56	37.37	1.89	19.47	0.00			-2933.91	37.19	1.88	21.34	
40	1023	-432.16	36.54	1.84	21.56	-926.40	37.75	1.91	18.50	-2933.91	37.19	1.88	21.34
41	1024	-432.16	36.54	1.84	21.56	926.40	37.75	1.91	18.50	-2933.91	37.19	1.88	21.34
42	1031	1358.56	37.37	1.89	19.47	0.00			-2933.91	37.19	1.88	21.34	

43	1032	-494.24	38.81	1.97	15.82	0.00		-2933.91	37.19	1.88	21.34		
44	1033	432.16	36.54	1.84	21.56	-926.40	37.75	1.91	18.50	-2933.91	37.19	1.88	21.34
45	1034	432.16	36.54	1.84	21.56	926.40	37.75	1.91	18.50	-2933.91	37.19	1.88	21.34

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Company: Engineers India Limited

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
46	1041	926.40	37.75	1.91	18.50	-432.11	36.54	1.84	21.56	-2933.91	37.19	1.88	21.34
47	1042	-926.40	37.75	1.91	18.50	-432.11	36.54	1.84	21.56	-2933.91	37.19	1.88	21.34
48	1043	-0.00			-1358.51	37.37	1.89	19.47	-2933.91	37.19	1.88	21.34	
49	1044	-0.00			494.29	38.81	1.97	15.82	-2933.91	37.19	1.88	21.34	
50	1051	926.40	37.75	1.91	18.50	432.11	36.54	1.84	21.56	-2933.91	37.19	1.88	21.34
51	1052	-926.40	37.75	1.91	18.50	432.11	36.54	1.84	21.56	-2933.91	37.19	1.88	21.34
52	1053	-0.00			-494.29	38.81	1.97	15.82	-2933.91	37.19	1.88	21.34	
53	1054	-0.00			1358.51	37.37	1.89	19.47	-2933.91	37.19	1.88	21.34	
54	2001	1213.85	37.93	1.93	19.01	-0.13	66.41	-0.69	18.50	-2645.49	37.19	1.88	21.45
55	2002	-638.95	37.40	1.89	17.53	-0.13	66.41	-0.69	18.50	-2645.49	37.19	1.88	21.45
56	2003	287.45	38.53	1.97	20.65	-926.53	37.75	1.91	18.50	-2645.49	37.19	1.88	21.45
57	2004	287.45	38.53	1.97	20.65	926.27	37.75	1.91	18.50	-2645.49	37.19	1.88	21.45
58	2005	1129.56	37.89	1.92	18.89	1139.49	37.76	0.92	21.69	-2645.49	37.17	1.88	21.45
59	2006	-723.24	37.53	1.90	17.90	1139.49	37.76	0.92	21.69	-2645.49	37.17	1.88	21.45
60	2007	203.16	38.52	1.97	20.65	213.09	37.78	-3.37	35.55	-2645.49	37.17	1.88	21.45
61	2008	203.16	38.52	1.97	20.65	2065.89	37.75	1.37	20.26	-2645.49	37.17	1.88	21.45
62	2011	926.27	37.75	1.91	18.50	1611.61	37.76	0.92	21.69	-2645.49	37.13	1.88	21.45
63	2012	-926.53	37.75	1.91	18.50	1611.61	37.76	0.92	21.69	-2645.49	37.13	1.88	21.45
64	2013	-0.13	66.41	-0.69	18.50	685.21	37.77	-0.41	26.00	-2645.49	37.13	1.88	21.45
65	2014	-0.13	66.41	-0.69	18.50	2538.01	37.76	1.28	20.52	-2645.49	37.13	1.88	21.45
66	2015	723.05	37.53	1.90	17.90	1139.67	37.76	0.92	21.69	-2645.48	37.09	1.88	21.45
67	2016	-1129.75	37.89	1.92	18.89	1139.67	37.76	0.92	21.69	-2645.48	37.09	1.88	21.45
68	2017	-203.35	38.54	1.97	20.65	213.27	37.81	-3.37	35.53	-2645.48	37.09	1.88	21.45
69	2018	-203.35	38.54	1.97	20.65	2066.07	37.76	1.37	20.26	-2645.48	37.09	1.88	21.45
70	2021	638.95	37.40	1.89	17.53	0.13	66.42	-0.69	18.50	-2645.48	37.08	1.88	21.45
71	2022	-1213.85	37.93	1.93	19.01	0.13	66.42	-0.69	18.50	-2645.48	37.08	1.88	21.45
72	2023	-287.45	38.53	1.97	20.65	-926.27	37.75	1.91	18.50	-2645.48	37.08	1.88	21.45
73	2024	-287.45	38.53	1.97	20.65	926.53	37.75	1.91	18.50	-2645.48	37.08	1.88	21.45
74	2025	723.24	37.53	1.90	17.90	-1139.49	37.76	2.90	21.69	-2645.48	37.09	1.88	21.45
75	2026	-1129.56	37.89	1.92	18.89	-1139.49	37.76	2.90	21.69	-2645.48	37.09	1.88	21.45
76	2027	-203.16	38.52	1.97	20.65	-2065.89	37.75	2.46	20.26	-2645.48	37.09	1.88	21.45
77	2028	-203.16	38.52	1.97	20.65	-213.09	37.78	7.18	35.55	-2645.48	37.09	1.88	21.45
78	2031	926.53	37.75	1.91	18.50	-1611.61	37.76	2.90	21.69	-2645.49	37.13	1.88	21.45
79	2032	-926.27	37.75	1.91	18.50	-1611.61	37.76	2.90	21.69	-2645.49	37.13	1.88	21.45
80	2033	0.13	66.41	-0.69	18.50	-2538.01	37.76	2.54	20.52	-2645.49	37.13	1.88	21.45
81	2034	0.13	66.41	-0.69	18.50	-685.21	37.77	4.23	26.00	-2645.49	37.13	1.88	21.45
82	2035	1129.75	37.89	1.92	18.89	-1139.67	37.76	2.90	21.69	-2645.49	37.17	1.88	21.45

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83	2036	-723.05	37.53	1.90	17.90	-1139.67	37.76	2.90	21.69	-2645.49	37.17	1.88	21.45
84	2037	203.35	38.54	1.97	20.65	-2066.07	37.76	2.45	20.26	-2645.49	37.17	1.88	21.45
85	2038	203.35	38.54	1.97	20.65	-213.27	37.81	7.17	35.53	-2645.49	37.17	1.88	21.45
86	4001	596.27	38.76	1.97	16.65	-0.05	65.25	-0.69	18.50	-2933.91	37.21	1.88	21.34
87	4002	-1256.53	37.27	1.88	19.38	-0.05	65.25	-0.69	18.50	-2933.91	37.21	1.88	21.34
88	4003	-330.13	35.92	1.81	21.84	-926.45	37.75	1.91	18.50	-2933.91	37.21	1.88	21.34
89	4004	-330.13	35.92	1.81	21.84	926.35	37.75	1.91	18.50	-2933.91	37.21	1.88	21.34
90	4005	566.36	38.77	1.97	16.44	403.36	37.76	0.92	21.68	-2933.91	37.20	1.88	21.34



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Company: Engineers India Limited

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD	LOAD	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
91	4006	-1286.44	37.30	1.89	19.41	403.36	37.76	0.92	21.68	-2933.91	37.20	1.88	21.34
92	4007	-360.04	36.14	1.82	21.74	-523.04	37.74	2.67	16.05	-2933.91	37.20	1.88	21.34
93	4008	-360.04	36.14	1.82	21.74	1329.76	37.75	1.61	19.47	-2933.91	37.20	1.88	21.34
94	4011	494.19	38.81	1.97	15.82	570.48	37.76	0.92	21.68	-2933.91	37.19	1.88	21.34
95	4012	-1358.61	37.37	1.89	19.47	570.48	37.76	0.92	21.68	-2933.91	37.19	1.88	21.34
96	4013	-432.21	36.54	1.84	21.56	-355.92	37.74	3.50	13.40	-2933.91	37.19	1.88	21.34
97	4014	-432.21	36.54	1.84	21.56	1496.88	37.75	1.54	19.71	-2933.91	37.19	1.88	21.34
98	4015	422.06	38.85	1.97	15.00	403.43	37.76	0.92	21.68	-2933.91	37.18	1.88	21.34
99	4016	-1430.74	37.42	1.89	19.53	403.43	37.76	0.92	21.68	-2933.91	37.18	1.88	21.34
100	4017	-504.34	36.83	1.86	21.43	-522.97	37.74	2.67	16.05	-2933.91	37.18	1.88	21.34
101	4018	-504.34	36.83	1.86	21.43	1329.83	37.75	1.61	19.47	-2933.91	37.18	1.88	21.34
102	4021	392.21	38.88	1.97	14.57	0.05	65.26	-0.69	18.50	-2933.90	37.18	1.88	21.34
103	4022	-1460.59	37.45	1.90	19.56	0.05	65.26	-0.69	18.50	-2933.90	37.18	1.88	21.34
104	4023	-534.19	36.92	1.87	21.39	-926.35	37.75	1.91	18.50	-2933.90	37.18	1.88	21.34
105	4024	-534.19	36.92	1.87	21.39	926.45	37.75	1.91	18.50	-2933.90	37.18	1.88	21.34
106	4025	422.13	38.86	1.97	15.00	-403.36	37.76	2.90	21.68	-2933.91	37.18	1.88	21.34
107	4026	-1430.67	37.42	1.89	19.53	-403.36	37.76	2.90	21.68	-2933.91	37.18	1.88	21.34
108	4027	-504.27	36.82	1.86	21.43	-1329.76	37.75	2.21	19.47	-2933.91	37.18	1.88	21.34
109	4028	-504.27	36.82	1.86	21.43	523.04	37.74	1.15	16.05	-2933.91	37.18	1.88	21.34
110	4031	494.29	38.81	1.97	15.82	-570.48	37.76	2.90	21.68	-2933.91	37.19	1.88	21.34
111	4032	-1358.51	37.36	1.89	19.47	-570.48	37.76	2.90	21.68	-2933.91	37.19	1.88	21.34
112	4033	-432.11	36.54	1.84	21.56	-1496.88	37.75	2.29	19.71	-2933.91	37.19	1.88	21.34
113	4034	-432.11	36.54	1.84	21.56	355.92	37.74	0.33	13.40	-2933.91	37.19	1.88	21.34
114	4035	566.42	38.77	1.97	16.44	-403.43	37.76	2.90	21.68	-2933.91	37.20	1.88	21.34
115	4036	-1286.38	37.30	1.89	19.41	-403.43	37.76	2.90	21.68	-2933.91	37.20	1.88	21.34
116	4037	-359.98	36.14	1.82	21.75	-1329.83	37.75	2.21	19.47	-2933.91	37.20	1.88	21.34
117	4038	-359.98	36.14	1.82	21.75	522.97	37.74	1.15	16.05	-2933.91	37.20	1.88	21.34
118	4101	1460.59	37.45	1.90	19.56	-0.05	65.25	-0.69	18.50	-2933.91	37.21	1.88	21.34
119	4102	-392.21	38.88	1.97	14.57	-0.05	65.25	-0.69	18.50	-2933.91	37.21	1.88	21.34
120	4103	534.19	36.92	1.87	21.39	-926.45	37.75	1.91	18.50	-2933.91	37.21	1.88	21.34
121	4104	534.19	36.92	1.87	21.39	926.35	37.75	1.91	18.50	-2933.91	37.21	1.88	21.34
122	4105	1430.67	37.42	1.89	19.53	403.36	37.76	0.92	21.68	-2933.91	37.20	1.88	21.34
123	4106	-422.13	38.86	1.97	15.00	403.36	37.76	0.92	21.68	-2933.91	37.20	1.88	21.34
124	4107	504.27	36.82	1.86	21.43	-523.04	37.74	2.67	16.05	-2933.91	37.20	1.88	21.34
125	4108	504.27	36.82	1.86	21.43	1329.76	37.75	1.61	19.47	-2933.91	37.20	1.88	21.34
126	4111	1358.51	37.36	1.89	19.47	570.48	37.76	0.92	21.68	-2933.91	37.19	1.88	21.34
127	4112	-494.29	38.81	1.97	15.82	570.48	37.76	0.92	21.68	-2933.91	37.19	1.88	21.34

**BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(BHS-SLQ LOWER DECK BRIDGE)**

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128	4113	432.11	36.54	1.84	21.56	-355.92	37.74	3.50	13.40	-2933.91	37.19	1.88	21.34
129	4114	432.11	36.54	1.84	21.56	1496.88	37.75	1.54	19.71	-2933.91	37.19	1.88	21.34
130	4115	1286.38	37.30	1.89	19.41	403.43	37.76	0.92	21.68	-2933.91	37.18	1.88	21.34
131	4116	-566.42	38.77	1.97	16.44	403.43	37.76	0.92	21.68	-2933.91	37.18	1.88	21.34
132	4117	359.98	36.14	1.82	21.75	-522.97	37.74	2.67	16.05	-2933.91	37.18	1.88	21.34
133	4118	359.98	36.14	1.82	21.75	1329.83	37.75	1.61	19.47	-2933.91	37.18	1.88	21.34
134	4121	1256.53	37.27	1.88	19.38	0.05	65.26	-0.69	18.50	-2933.90	37.18	1.88	21.34
135	4122	-596.27	38.76	1.97	16.65	0.05	65.26	-0.69	18.50	-2933.90	37.18	1.88	21.34

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Company: Engineers India Limited

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
136	4123	330.13	35.92	1.81	21.84	-926.35	37.75	1.91	18.50	-2933.90	37.18	1.88	21.34
137	4124	330.13	35.92	1.81	21.84	926.45	37.75	1.91	18.50	-2933.90	37.18	1.88	21.34
138	4125	1286.44	37.30	1.89	19.41	-403.36	37.76	2.90	21.68	-2933.91	37.18	1.88	21.34
139	4126	-566.36	38.77	1.97	16.44	-403.36	37.76	2.90	21.68	-2933.91	37.18	1.88	21.34
140	4127	360.04	36.14	1.82	21.74	-1329.76	37.75	2.21	19.47	-2933.91	37.18	1.88	21.34
141	4128	360.04	36.14	1.82	21.74	523.04	37.74	1.15	16.05	-2933.91	37.18	1.88	21.34
142	4131	1358.61	37.37	1.89	19.47	-570.48	37.76	2.90	21.68	-2933.91	37.19	1.88	21.34
143	4132	-494.19	38.81	1.97	15.82	-570.48	37.76	2.90	21.68	-2933.91	37.19	1.88	21.34
144	4133	432.21	36.54	1.84	21.56	-1496.88	37.75	2.29	19.71	-2933.91	37.19	1.88	21.34
145	4134	432.21	36.54	1.84	21.56	355.92	37.74	0.33	13.40	-2933.91	37.19	1.88	21.34
146	4135	1430.74	37.42	1.89	19.53	-403.43	37.76	2.90	21.68	-2933.91	37.20	1.88	21.34
147	4136	-422.06	38.85	1.97	15.00	-403.43	37.76	2.90	21.68	-2933.91	37.20	1.88	21.34
148	4137	504.34	36.83	1.86	21.43	-1329.83	37.75	2.21	19.47	-2933.91	37.20	1.88	21.34
149	4138	504.34	36.83	1.86	21.43	522.97	37.74	1.15	16.05	-2933.91	37.20	1.88	21.34
150	4201	1028.43	37.83	1.92	18.71	-432.16	36.55	1.84	21.56	-2933.91	37.21	1.88	21.34
151	4202	-824.37	37.65	1.91	18.23	-432.16	36.55	1.84	21.56	-2933.91	37.21	1.88	21.34
152	4203	102.03	38.54	1.97	20.64	-1358.56	37.37	1.89	19.47	-2933.91	37.21	1.88	21.34
153	4204	102.03	38.54	1.97	20.64	494.24	38.80	1.97	15.82	-2933.91	37.21	1.88	21.34
154	4205	998.51	37.81	1.92	18.65	-28.75	19.50	14.75	19.86	-2933.91	37.20	1.88	21.34
155	4206	-854.29	37.68	1.91	18.32	-28.75	19.50	14.75	19.86	-2933.91	37.20	1.88	21.34
156	4207	72.11	38.52	1.97	20.64	-955.15	37.20	2.30	18.54	-2933.91	37.20	1.88	21.34
157	4208	72.11	38.52	1.97	20.64	897.65	38.33	1.50	18.46	-2933.91	37.20	1.88	21.34
158	4211	926.35	37.75	1.91	18.50	138.37	41.56	-1.95	22.06	-2933.91	37.19	1.88	21.34
159	4212	-926.45	37.75	1.91	18.50	138.37	41.56	-1.95	22.06	-2933.91	37.19	1.88	21.34
160	4213	-0.05	65.25	-0.69	18.50	-788.03	37.08	2.59	17.88	-2933.91	37.19	1.88	21.34
161	4214	-0.05	65.25	-0.69	18.50	1064.77	38.24	1.41	18.96	-2933.91	37.19	1.88	21.34
162	4215	854.22	37.68	1.91	18.32	-28.68	19.40	14.79	19.87	-2933.91	37.18	1.88	21.34
163	4216	-998.58	37.81	1.92	18.65	-28.68	19.40	14.79	19.87	-2933.91	37.18	1.88	21.34
164	4217	-72.18	38.55	1.97	20.64	-955.08	37.20	2.30	18.54	-2933.91	37.18	1.88	21.34
165	4218	-72.18	38.55	1.97	20.64	897.72	38.34	1.50	18.46	-2933.91	37.18	1.88	21.34
166	4221	824.37	37.65	1.91	18.23	-432.06	36.54	1.85	21.56	-2933.90	37.18	1.88	21.34
167	4222	-1028.43	37.83	1.92	18.71	-432.06	36.54	1.85	21.56	-2933.90	37.18	1.88	21.34
168	4223	-102.03	38.54	1.97	20.64	-1358.46	37.36	1.89	19.47	-2933.90	37.18	1.88	21.34
169	4224	-102.03	38.54	1.97	20.64	494.34	38.81	1.97	15.82	-2933.90	37.18	1.88	21.34
170	4225	854.29	37.68	1.91	18.32	-835.47	37.13	2.35	21.62	-2933.91	37.18	1.88	21.34
171	4226	-998.51	37.81	1.92	18.65	-835.47	37.13	2.35	21.62	-2933.91	37.18	1.88	21.34
172	4227	-72.11	38.52	1.97	20.64	-1761.87	37.46	2.12	19.98	-2933.91	37.18	1.88	21.34

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173	4228	-72.11	38.52	1.97	20.64	90.93	43.46	-2.14	-10.16	-2933.91	37.18	1.88	21.34
174	4231	926.45	37.75	1.91	18.50	-1002.59	37.23	2.44	21.63	-2933.91	37.19	1.88	21.34
175	4232	-926.35	37.75	1.91	18.50	-1002.59	37.23	2.44	21.63	-2933.91	37.19	1.88	21.34
176	4233	0.05	65.25	-0.69	18.50	-1928.99	37.48	2.19	20.13	-2933.91	37.19	1.88	21.34
177	4234	0.05	65.25	-0.69	18.50	-76.19	30.96	8.90	59.69	-2933.91	37.19	1.88	21.34
178	4235	998.58	37.81	1.92	18.65	-835.53	37.13	2.35	21.62	-2933.91	37.20	1.88	21.34
179	4236	-854.22	37.68	1.91	18.32	-835.53	37.13	2.35	21.62	-2933.91	37.20	1.88	21.34
180	4237	72.18	38.55	1.97	20.64	-1761.93	37.46	2.12	19.98	-2933.91	37.20	1.88	21.34

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z	
	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	
181 4238	72.18	38.55	1.97	20.64	90.87	43.45	-2.14	-10.18	-2933.91	37.20	1.88	21.34	
182 4301	1028.43	37.83	1.92	18.71	432.06	36.54	1.85	21.56	-2933.91	37.21	1.88	21.34	
183 4302	-824.37	37.65	1.91	18.23	432.06	36.54	1.85	21.56	-2933.91	37.21	1.88	21.34	
184 4303	102.03	38.54	1.97	20.64	-494.34	38.81	1.97	15.82	-2933.91	37.21	1.88	21.34	
185 4304	102.03	38.54	1.97	20.64	1358.46	37.36	1.89	19.47	-2933.91	37.21	1.88	21.34	
186 4305	998.51	37.81	1.92	18.65	835.47	37.13	1.40	21.62	-2933.91	37.20	1.88	21.34	
187 4306	-854.29	37.68	1.91	18.32	835.47	37.13	1.40	21.62	-2933.91	37.20	1.88	21.34	
188 4307	72.11	38.52	1.97	20.64	-90.93	43.46	6.61	-10.16	-2933.91	37.20	1.88	21.34	
189 4308	72.11	38.52	1.97	20.64	1761.87	37.46	1.67	19.98	-2933.91	37.20	1.88	21.34	
190 4311	926.35	37.75	1.91	18.50	1002.59	37.23	1.32	21.63	-2933.91	37.19	1.88	21.34	
191 4312	-926.45	37.75	1.91	18.50	1002.59	37.23	1.32	21.63	-2933.91	37.19	1.88	21.34	
192 4313	-0.05	65.25	-0.69	18.50	76.19	30.96	-5.86	59.69	-2933.91	37.19	1.88	21.34	
193 4314	-0.05	65.25	-0.69	18.50	1928.99	37.48	1.60	20.13	-2933.91	37.19	1.88	21.34	
194 4315	854.22	37.68	1.91	18.32	835.53	37.13	1.40	21.62	-2933.91	37.18	1.88	21.34	
195 4316	-998.58	37.81	1.92	18.65	835.53	37.13	1.40	21.62	-2933.91	37.18	1.88	21.34	
196 4317	-72.18	38.55	1.97	20.64	-90.87	43.45	6.62	-10.18	-2933.91	37.18	1.88	21.34	
197 4318	-72.18	38.55	1.97	20.64	1761.93	37.46	1.67	19.98	-2933.91	37.18	1.88	21.34	
198 4321	824.37	37.65	1.91	18.23	432.16	36.55	1.84	21.56	-2933.90	37.18	1.88	21.34	
199 4322	-1028.43	37.83	1.92	18.71	432.16	36.55	1.84	21.56	-2933.90	37.18	1.88	21.34	
200 4323	-102.03	38.54	1.97	20.64	-494.24	38.80	1.97	15.82	-2933.90	37.18	1.88	21.34	
201 4324	-102.03	38.54	1.97	20.64	1358.56	37.37	1.89	19.47	-2933.90	37.18	1.88	21.34	
202 4325	854.29	37.68	1.91	18.32	28.75	19.50	-12.91	19.86	-2933.91	37.18	1.88	21.34	
203 4326	-998.51	37.81	1.92	18.65	28.75	19.50	-12.91	19.86	-2933.91	37.18	1.88	21.34	
204 4327	-72.11	38.52	1.97	20.64	-897.65	38.33	2.39	18.46	-2933.91	37.18	1.88	21.34	
205 4328	-72.11	38.52	1.97	20.64	955.15	37.20	1.47	18.54	-2933.91	37.18	1.88	21.34	
206 4331	926.45	37.75	1.91	18.50	-138.37	41.56	6.18	22.06	-2933.91	37.19	1.88	21.34	
207 4332	-926.35	37.75	1.91	18.50	-138.37	41.56	6.18	22.06	-2933.91	37.19	1.88	21.34	
208 4333	0.05	65.25	-0.69	18.50	-1064.77	38.24	2.47	18.96	-2933.91	37.19	1.88	21.34	
209 4334	0.05	65.25	-0.69	18.50	788.03	37.08	1.16	17.88	-2933.91	37.19	1.88	21.34	
210 4335	998.58	37.81	1.92	18.65	28.68	19.40	-12.94	19.87	-2933.91	37.20	1.88	21.34	
211 4336	-854.22	37.68	1.91	18.32	28.68	19.40	-12.94	19.87	-2933.91	37.20	1.88	21.34	
212 4337	72.18	38.55	1.97	20.64	-897.72	38.34	2.39	18.46	-2933.91	37.20	1.88	21.34	
213 4338	72.18	38.55	1.97	20.64	955.08	37.20	1.47	18.54	-2933.91	37.20	1.88	21.34	

#### 4.2 Member Unity Check Result

Member having Unity check ratio above 0.800 for the bridge members are summarized below.

##### Member Unity Check Result

S. No.	Member	Group ID	Load Case	UC	Remarks
1	B001-A001	PB3	2032	0.916	
2	F109-F009	BM1	4101	0.900	
3	B011-A011	PB3	2034	0.882	

#### 4.3 Joint Punching Shear Unity Check Result

Joints having Load UC ratio above 0.80 for the Bridge framing member are summarized below.

##### Maximum Joint UC Ratio

Joint	Diameter (mm)	Thickness (mm)	Strength UC	Remarks
C001	406	19.0	0.859	UC < 1.0.
D001	406	19.0	0.858	
0013	273	12.7	0.838	

#### 4.4 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below

##### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum vertical Deflection (cm)	Remarks
1.	D006	3.1	Allowable Deflection = (4200 / 400) = 10.5 cm
2.	C006	3.2	

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below.

##### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	D006	7.6	Allowable Deflection = (4200 / 500) = 8.4 cm
2.	C006	7.6	

Vertical and Horizontal Deflection of bridge are under control. 32 mm of vertical deflection is observed in the dead load combination. Hence a camber of 1 in 200 shall be provided.

#### 4.5 Reaction Summary

Following is the reaction summary of the bridge supports.

**Summary of Bridge Horizontal Deflections**

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	D001	0	-800.746	1818.545
2.	C001	0	499.328	1757.379
3.	D011	0	0	1750.960
4.	C011	0	0	1741.701
5.	0000	1460.594	1271.014	0

#### 5.0 CONCLUSION

From the above it is concluded that all members and joints are safe for operating and extreme conditions. Also, functionally the deflection is under the limits. The adequacy of the bridge support locations, adequacy of deck members, jacket are performed separately.



# ANNEXURE-1

## LOAD CALCULATIONS

**WIND LOAD:**

DESIGN WIND SPEED CALCULATIONS													
S.No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulence Intensity at height "z"	t <sub>o</sub>	t	Design Wind Speed at Height "z"	
			U <sub>o</sub>			z		U(z)				u(z,t)	
			kmph	ft/sec		m	ft	ft/sec	Iu(z)	sec	sec	ft/sec	m/sec
1	Extreme	0	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	3	214.68	65.45
2	Extreme	45	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	3	214.68	65.45
3	Extreme	90	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	3	214.68	65.45
4	Extreme	135	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	3	214.68	65.45
5	Extreme	180	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	3	214.68	65.45
6	Extreme	225	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	3	214.68	65.45
7	Extreme	270	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	3	214.68	65.45
8	Extreme	315	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	3	214.68	65.45
1	Operating	All	99.22	90.40	0.130	21.00	68.88	99.11	0.111	3600	3	131.18	39.99
LEGENDS :													
t	Design Averaging Time Period in sec. (for t < t <sub>o</sub> )										<div>INPUT FIELD</div>		
t <sub>o</sub>	1 Hour Averaging Time Period												
U <sub>o</sub>	1 hour Mean Wind Speed at 10m above Reference Level (Chart Datum) in kmph.												
z	Design Height above above Reference Level (Chart Datum) in m												
u(z,t)	Design Wind Speed at height "z" above Reference Level (Chart Datum) (for "t" averaging time period)												

1	DL	DEAD LOAD											
		MODELLED LOAD											
		CONTINGENCY			1.13								
2	NGDL	NON GENERATED DEAD LOAD											
		WALKWAY		SPAN/LENGTH									
		GRATING		4.2	X	0.5	KN/SQM	1	2.10	KN/M			
		HANDRAIL		4.2	X	0.5	KN/M	1	2.10	KN			
		MONORAIL	MB250	4.2	X	0.373	KN/M	1	1.57	KN			
		MONORAIL	MC250	4.2	X	0.304	KN/M	1	1.28	KN			
		LIGHTING	50506	0.6	X	0.045	KN/M	1	0.03	KN		2	
		TOP SHEET SUP	MC250	4.2	X	0.304	KN/M	2	2.55	KN			
		TOP SHEET SUP	75756	4.2	X	0.068	KN/M	1	0.29	KN		2	
		SIDE SHEET SUP	MC200	4.2	X	0.221	KN/M	1	0.93	KN		3X2	
		GRT SUPP	75756	4.2	X	0.068	KN/M	1	0.29	KN		2	
		HNDRL SUPP	MC150	4.2	X	0.164	KN/M	1	0.69	KN		2	
									0.00				
		BRACKET	75756	2.9	X	0.068	KN/M	1	0.20	KN		2	
		EXT	75756	1	X	0.068	KN/M	1	0.07	KN		2X2	
		TRAY SUPP	50506	8	X	0.045	KN/M	1	0.36	KN		2	
		CLADDING	SHEET	4.2	X	0.15	KN/SQM	1	0.21	KN/M		X2	
		ROOF CLADD	SHEET	4.2	X	0.15	KN/SQM	1	0.19	KN/M		4	
3		LIVE LOAD											
		BLANKET LIVE LOAD		4.2	X	2.5	KN/SQM	1	10.50	KN/M			
4		MONORAIL LL											
									20.00	KN			

4 nos. 750MM tray below the walkway	8 run 3.5CX95 SQ. MM Cu conductor armoured cables	FOR 750 mm CABLE TRAY LOAD = 35.9 KG/3 MTR LONG	4.2	0.119667	KN/M	4	2.01	KN
2 nos 600mm tray at right side								
1 no 450mm tray at right side	4 run 3C X2.5 SQ. MM armoured cu. conductor cable	FOR 600 mm CABLE TRAY LOAD = 22.89 KG/3 MTR LONG	4.2	0.0763	KN/M	8	2.56	KN
2 nos. 300mm tray at right side		FOR 450 mm CABLE TRAY LOAD = 21.85 KG/3 MTR LONG	4.2	0.072833	KN/M	3	0.92	KN
1 no 150mm tray at right side	4 run 3.5CX95 SQ. MM Cu conductor armoured cables	FOR 150 mm CABLE TRAY LOAD = 5 KG/3 MTR LONG	4.2	0.016667	KN/M	1	0.07	KN
5 nos 600mm tray at left side							0.00	KN
2 nos 450 mm tray at left side		FOR 300 mm CABLE TRAY LOAD = 7.7 KG/3 MTR LONG	4.2	0.025667	KN/M	2	0.22	KN
1 no 60mm slotted tray inside the bridge		FOR CABLE LOAD	4.2					
		for 3.5CX95 SQ. MM Cu conductor armoured cables = 3686 kg/km	4.2	0.03686	KN/M	8	1.24	KN
		for 3C X2.5 SQ. MM armoured cu. conductor cable = 162 kg/km	4.2	0.00162	KN/M	4	0.03	KN
		for DCS cables = 120 kg/km	4.2	0.0012	KN/M	4	0.02	KN

**BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(BHS-SLQ LOWER DECK BRIDGE)**

6	PLEM														
		0.6 PLOP													
7	PLOP				1	2	3	4	5	6	7	8	9	10	11
	INPUT1	PIPD1	GRIDA				6.5	6.00	5		5	5	5	7.5	7.5
		PIPD2	GRIDB TOP			6	6	6	6	6	6	6	6	6	2
		PIPD3	GRIDB MID VERT BR	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	10
		PIPD4	GRIDB MIDVERT BR		52.5	45	75.00	45	27.5	45	30	85			
		PIPD5	GRIDB BOTT		9	9	9.00	9	9	9	9	9	9	12	
		PIPD6	GRIDB BOTT	17.5	12.5	16	16.00	16	16	16	16	16	16	18.5	
		PIPD7	TOP A	8	16	20	16.00	16	20	16	16	26.25	11.25		
8	INPUT2														
		PIPD1A	GRIDA TOP			67.5	35.00	35	35	35	52.5				
		PIPD2A	GRIDB TOP			4	4.00	4	4	4	4.5				
	INPUT3														
		PIPD1C	GRIDA BOTT	15	12.5		12.50	12.5			12.5	12.5		12.5	11
	INPUT4														
		PIPD1D	GRIDA TOP	5	5	5	5.00	5	5	5	5	5	5	5	5
	PLTLX	0.3PLOP													
9	PLTLY	0.3PLOP													

\*ALLOADS IN KN-M



## **BRIDGE REPORT FOR BRIDGES IN MH ASSET (ICG-ICW LOWER DECK BRIDGE)**

**PROJECT : ENGINEERING / TECHNICAL CONSULTANCY  
SERVICES FOR PREPERATION OF EXECUTION  
METHODOLOGY, SOW AND COST ESTIMATES  
FOR REPLACEMENT /REFURBISHMENT OF  
BRIDGES IN MH ASSET**

**LOCATION: MH ASSET (NORTH AND SOUTH FIELD)**

**OWNER : ONGC, MUMBAI**

**JOB NO : B774**

0	23.09.25	ISSUED AS STUDY	AA	DP	CS
Rev. No	Date	Purpose	Prepared by	Reviewed by	Approved by

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Annexures 1



## Symbols and Abbreviations

### Organisations – India

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### Other abbreviations

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge

## 1.0 INTRODUCTION

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges has deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## 2.0 GENERAL

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### IC Complex:

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### BHS Complex:

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### NQO Complex:

7. NQO-NQD bridge

### WIN Complex:

8. WIN-NC Lower Deck bridge

### 3.0 ICW-ICG LOWER DECK BRIDGE DESCRIPTION

The existing bridge has fallen during the cyclone. Hence New bridge (Walkway) is envisaged between ICG & ICW platforms.

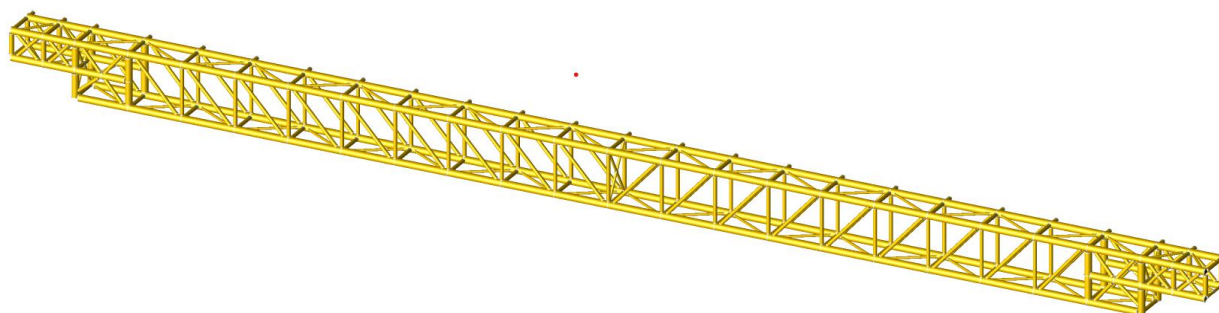
The landing point at the ICW platform is identified near grid 4 (northside near loading unloading area). The landing point at the ICG platform is identified near grid 3 (southside).

Approximate length of bridge is measured from 3D model as 54.5m. Hence, 56m length of bridge is modelled in SACS conservatively.

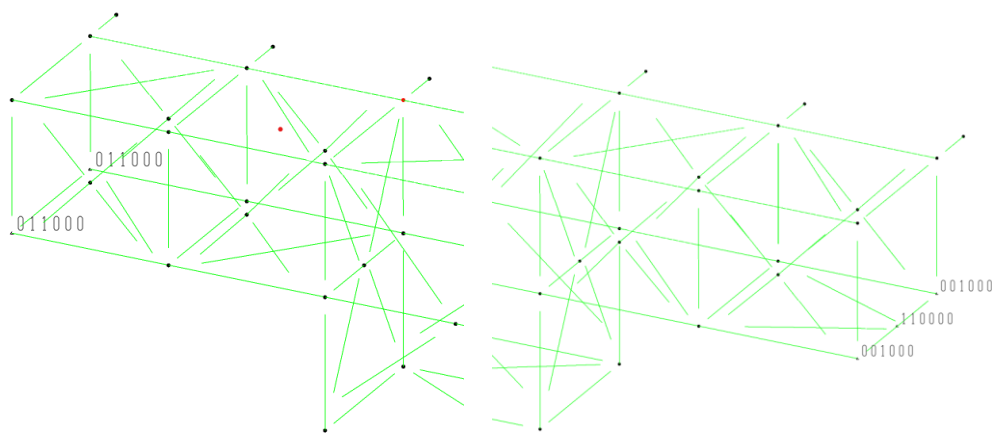
No piping is envisaged in the existing bridge. Only cable loading is considered for Lighting purpose.

Length of Bridge	56 m
Support Condition	Fixed: 001000, 111000, 001000 (ICG Side)) Sliding: 011000, 011000 (ICW Side)
No. of directions for environmental loads	8
Wind Speed (15 Sec Gust)	61.11 m/s for extreme and 37.7 m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	50ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

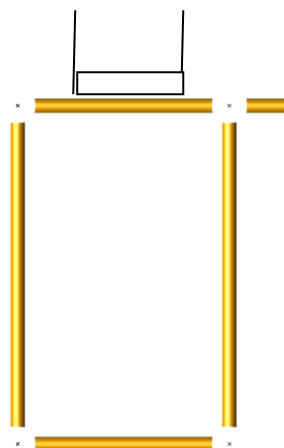
ISOMETRIC VIEW OF ICG-ICW Lower Deck Bridge is shown in Figure1.



**Figure 1: 3D SACS MODEL**



**Figure 2: SUPPORT CONDITIONS**



**Figure 3: BRIDGE CROSS SECTION**

## 4.0 LOADING

### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (kN)
DL	Self-weight, (Contingency - 13%), Walkway Member Wt	418.03
NGDL	Cable tray	155.75
	Cable tray Support	
	Grating Load	
	Handrail Load	

LL	Blanket live load on Walkway	156.25
CL	Cable Loading	0.750
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure
FLX	Bridge Friction Load X (30 % of SW+NGDL+LL)	216
FLY	Bridge Friction Load Y (30 % of SW+NGDL+LL)	216

## SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

## NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the Cable tray, cable tray support, grating and handrail loadings. .

## LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1.2 m width of walkway is considered.

## CABLE TRAY AND CABLE LOAD

For 450mm cable tray, 21.85kg/3m load is considered. Cable trays consist of 4 cables (2no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km, 2no.s 4C x 16 m<sup>2</sup> with load 350kg/km)

## WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

### 4.1 Load Combinations

#### Load Combinations

BASIC LOAD COMBINATIONS										
LComb	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
1000	DL	1.00	NDGL	1.13	CL	1.00				
1001	DL	1.00	NDGL	1.13	CL	1.00				
1002	DL	1.00	NDGL	1.13	CL	1.00				
1003	DL	1.00	NDGL	1.13	CL	1.00				
1004	DL	1.00	NDGL	1.13	CL	1.00	LL	1.00		
1005	DL	1.00	NDGL	1.13	CL	1.00	LL	1.00		

BASIC LOAD COMBINATIONS WITH BRIDGE FRICTION										
1011	1001	1.00	FLX	1.00						
1012	1001	1.00	FLX	-1.00						
1013	1001	1.00	FLY	1.00						
1014	1001	1.00	FLY	-1.00						
1021	1002	1.00	FLX	1.00						
1022	1002	1.00	FLX	-1.00						
1023	1002	1.00	FLY	1.00						
1024	1002	1.00	FLY	-1.00						
1031	1003	1.00	FLX	1.00						
1032	1003	1.00	FLX	-1.00						
1033	1003	1.00	FLY	1.00						
1034	1003	1.00	FLY	-1.00						
1041	1004	1.00	FLX	1.00						
1042	1004	1.00	FLX	-1.00						
1043	1004	1.00	FLY	1.00						
1044	1004	1.00	FLY	-1.00						
1051	1005	1.00	FLX	1.00						
1052	1005	1.00	FLX	-1.00						
1053	1005	1.00	FLY	1.00						
1054	1005	1.00	FLY	-1.00						
LOAD COMBINATIONS FOR EXTREME STORM ENVIRONMENT										
2001 to 3038	1021 to 1034	1.00	201 to 208	1.00						
LOAD COMBINATIONS FOR OPERATING STORM ENVIRONMENT										
2003	1041 to 1044	1.00	301 to 308	1.00						

## 5.0 RESULTS & SUMMARY

### BASIC LOAD CASE SUMMARY SACS OUTPUT

SACS (2025)

Company: Engineers India Limited

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ	DEAD LOAD	BUOYANCY
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)	(KN)	(KN)
1	CL	0.00	0.00	-0.75	-2.1	21.0	0.0	0.00	0.00
2	DL	0.00	-0.00	-418.03	-630.8	11700.0	-0.0	418.03	0.00
3	LL	0.00	0.00	-144.69	-235.1	4051.3	0.0	0.00	0.00
4	201	69.73	0.13	-0.16	-12.3	6745.2	-100.1	0.00	0.00
5	202	49.40	151.38	-0.12	-14365.4	4778.3	4169.8	0.00	0.00
6	203	0.13	213.96	-0.01	-20303.5	12.3	5997.1	0.00	0.00
7	204	-49.21	151.20	0.11	-14348.0	-4760.9	4311.3	0.00	0.00
8	205	-69.73	-0.13	0.16	12.3	-6745.2	100.1	0.00	0.00
9	206	-49.40	-151.38	0.12	14365.4	-4778.3	-4169.8	0.00	0.00
10	207	-0.13	-213.96	0.01	20303.5	-12.3	-5997.1	0.00	0.00
11	208	49.21	-151.20	-0.11	14348.0	4760.9	-4311.3	0.00	0.00
12	301	25.44	0.05	-0.06	-4.5	2460.7	-36.5	0.00	0.00
13	302	18.02	55.20	-0.04	-5237.6	1743.1	1520.3	0.00	0.00
14	303	0.05	78.01	-0.00	-7402.6	4.5	2186.6	0.00	0.00
15	304	-17.95	55.13	0.04	-5231.3	-1736.8	1572.0	0.00	0.00
16	305	-25.44	-0.05	0.06	4.5	-2460.7	36.5	0.00	0.00
17	306	-18.02	-55.20	0.04	5237.6	-1743.1	-1520.3	0.00	0.00
18	307	-0.05	-78.01	0.00	7402.6	-4.5	-2186.6	0.00	0.00
19	308	17.95	-55.13	-0.04	5231.3	1736.8	-1572.0	0.00	0.00
20	FLX	216.00	0.00	0.00	0.0	20423.9	-324.0	0.00	0.00
21	FLY	0.00	216.00	0.00	-20423.9	0.0	6048.0	0.00	0.00
22	NGDL	0.00	0.00	-155.75	-280.1	4361.0	0.0	0.00	0.00

**COMBINED LOAD CASE SUMMARY SACS OUTPUT**

SACS (2025)

Company: Engineers India Limited

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
23	1000	0.00	-0.00	-594.78	-949.3	16649.0	-0.0
24	1001	0.00	-0.00	-594.78	-949.3	16649.0	-0.0
25	1002	0.00	-0.00	-594.78	-949.3	16649.0	-0.0
26	1003	0.00	-0.00	-594.78	-949.3	16649.0	-0.0

**BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(ICG-ICW LOWER DECK BRIDGE)**

27	1004	0.00	-0.00	-739.47	-1184.5	20700.2	-0.0
28	1005	0.00	-0.00	-739.47	-1184.5	20700.2	-0.0
29	1011	216.00	-0.00	-594.78	-949.3	37072.8	-324.0
30	1012	-216.00	-0.00	-594.78	-949.3	-3774.9	324.0
31	1013	0.00	216.00	-594.78	-21373.2	16649.0	6048.0
32	1014	0.00	-216.00	-594.78	19474.5	16649.0	-6048.0
33	1021	216.00	-0.00	-594.78	-949.3	37072.8	-324.0
34	1022	-216.00	-0.00	-594.78	-949.3	-3774.9	324.0
35	1023	0.00	216.00	-594.78	-21373.2	16649.0	6048.0
36	1024	0.00	-216.00	-594.78	19474.5	16649.0	-6048.0
37	1031	216.00	-0.00	-594.78	-949.3	37072.8	-324.0
38	1032	-216.00	-0.00	-594.78	-949.3	-3774.9	324.0
39	1033	0.00	216.00	-594.78	-21373.2	16649.0	6048.0
40	1034	0.00	-216.00	-594.78	19474.5	16649.0	-6048.0
41	1041	216.00	-0.00	-739.47	-1184.5	41124.1	-324.0
42	1042	-216.00	-0.00	-739.47	-1184.5	276.3	324.0
43	1043	0.00	216.00	-739.47	-21608.3	20700.2	6048.0
44	1044	0.00	-216.00	-739.47	19239.4	20700.2	-6048.0
45	1051	216.00	-0.00	-739.47	-1184.5	41124.1	-324.0
46	1052	-216.00	-0.00	-739.47	-1184.5	276.3	324.0
47	1053	0.00	216.00	-739.47	-21608.3	20700.2	6048.0
48	1054	0.00	-216.00	-739.47	19239.4	20700.2	-6048.0
49	2001	285.73	0.13	-594.94	-961.7	43818.1	-424.1
50	2002	-146.27	0.13	-594.94	-961.7	2970.3	223.9
51	2003	69.73	216.13	-594.94	-21385.5	23394.2	5947.9
52	2004	69.73	-215.87	-594.94	19462.2	23394.2	-6148.1
53	2005	265.40	151.38	-594.90	-15314.8	41851.2	3845.8
54	2006	-166.60	151.38	-594.90	-15314.8	1003.4	4493.8
55	2007	49.40	367.38	-594.90	-35738.7	21427.3	10217.8
56	2008	49.40	-64.62	-594.90	5109.1	21427.3	-1878.2
57	2011	216.13	213.96	-594.79	-21252.9	37085.2	5673.1
58	2012	-215.87	213.96	-594.79	-21252.9	-3762.6	6321.1
59	2013	0.13	429.96	-594.79	-41676.7	16661.3	12045.1
60	2014	0.13	-2.04	-594.79	-829.0	16661.3	-50.9
61	2015	166.79	151.20	-594.67	-15297.3	32311.9	3987.3
62	2016	-265.21	151.20	-594.67	-15297.3	-8535.8	4635.3
63	2017	-49.21	367.20	-594.67	-35721.2	11888.1	10359.3
64	2018	-49.21	-64.80	-594.67	5126.5	11888.1	-1736.7
65	2021	146.27	-0.13	-594.62	-937.0	30327.6	-223.9
66	2022	-285.73	-0.13	-594.62	-937.0	-10520.2	424.1
67	2023	-69.73	215.87	-594.62	-21360.9	9903.7	6148.1



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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL						
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
68	2024	-69.73	-216.13	-594.62	19486.9	9903.7	-5947.9
69	2025	166.60	-151.38	-594.66	13416.1	32294.5	-4493.8
70	2026	-265.40	-151.38	-594.66	13416.1	-8553.3	-3845.8
71	2027	-49.40	64.62	-594.66	-7007.8	11870.6	1878.2
72	2028	-49.40	-367.38	-594.66	33840.0	11870.6	-10217.8
73	2031	215.87	-213.96	-594.77	19354.2	37060.5	-6321.1
74	2032	-216.13	-213.96	-594.77	19354.2	-3787.3	-5673.1
75	2033	-0.13	2.04	-594.77	-1069.7	16636.6	50.9
76	2034	-0.13	-429.96	-594.77	39778.1	16636.6	-12045.1
77	2035	265.21	-151.20	-594.89	13398.7	41833.7	-4635.3
78	2036	-166.79	-151.20	-594.89	13398.7	986.0	-3987.3
79	2037	49.21	64.80	-594.89	-7025.2	21409.9	1736.7
80	2038	49.21	-367.20	-594.89	33822.6	21409.9	-10359.3
81	3001	285.73	0.13	-594.94	-961.7	43818.1	-424.1
82	3002	-146.27	0.13	-594.94	-961.7	2970.3	223.9
83	3003	69.73	216.13	-594.94	-21385.5	23394.2	5947.9
84	3004	69.73	-215.87	-594.94	19462.2	23394.2	-6148.1
85	3005	265.40	151.38	-594.90	-15314.8	41851.2	3845.8
86	3006	-166.60	151.38	-594.90	-15314.8	1003.4	4493.8
87	3007	49.40	367.38	-594.90	-35738.7	21427.3	10217.8
88	3008	49.40	-64.62	-594.90	5109.1	21427.3	-1878.2
89	3011	216.13	213.96	-594.79	-21252.9	37085.2	5673.1
90	3012	-215.87	213.96	-594.79	-21252.9	-3762.6	6321.1
91	3013	0.13	429.96	-594.79	-41676.7	16661.3	12045.1
92	3014	0.13	-2.04	-594.79	-829.0	16661.3	-50.9
93	3015	166.79	151.20	-594.67	-15297.3	32311.9	3987.3
94	3016	-265.21	151.20	-594.67	-15297.3	-8535.8	4635.3
95	3017	-49.21	367.20	-594.67	-35721.2	11888.1	10359.3
96	3018	-49.21	-64.80	-594.67	5126.5	11888.1	-1736.7
97	3021	146.27	-0.13	-594.62	-937.0	30327.6	-223.9
98	3022	-285.73	-0.13	-594.62	-937.0	-10520.2	424.1
99	3023	-69.73	215.87	-594.62	-21360.9	9903.7	6148.1
100	3024	-69.73	-216.13	-594.62	19486.9	9903.7	-5947.9
101	3025	166.60	-151.38	-594.66	13416.1	32294.5	-4493.8
102	3026	-265.40	-151.38	-594.66	13416.1	-8553.3	-3845.8
103	3027	-49.40	64.62	-594.66	-7007.8	11870.6	1878.2

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104	3028	-49.40	-367.38	-594.66	33840.0	11870.6	-10217.8
105	3031	215.87	-213.96	-594.77	19354.2	37060.5	-6321.1
106	3032	-216.13	-213.96	-594.77	19354.2	-3787.3	-5673.1
107	3033	-0.13	2.04	-594.77	-1069.7	16636.6	50.9
108	3034	-0.13	-429.96	-594.77	39778.1	16636.6	-12045.1
109	3035	265.21	-151.20	-594.89	13398.7	41833.7	-4635.3
110	3036	-166.79	-151.20	-594.89	13398.7	986.0	-3987.3
111	3037	49.21	64.80	-594.89	-7025.2	21409.9	1736.7
112	3038	49.21	-367.20	-594.89	33822.6	21409.9	-10359.3

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL						
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
113	4001	241.44	0.05	-739.53	-1188.9	43584.8	-360.5
114	4002	-190.56	0.05	-739.53	-1188.9	2737.0	287.5
115	4003	25.44	216.05	-739.53	-21612.8	23160.9	6011.5
116	4004	25.44	-215.95	-739.53	19234.9	23160.9	-6084.5
117	4005	234.02	55.20	-739.51	-6422.1	42867.2	1196.3
118	4006	-197.98	55.20	-739.51	-6422.1	2019.5	1844.3
119	4007	18.02	271.20	-739.51	-26846.0	22443.3	7568.3
120	4008	18.02	-160.80	-739.51	14001.8	22443.3	-4527.7
121	4011	216.05	78.01	-739.47	-8587.1	41128.6	1862.6
122	4012	-215.95	78.01	-739.47	-8587.1	280.8	2510.6
123	4013	0.05	294.01	-739.47	-29010.9	20704.7	8234.6
124	4014	0.05	-137.99	-739.47	11836.8	20704.7	-3861.4
125	4015	198.05	55.13	-739.43	-6415.7	39387.3	1248.0
126	4016	-233.95	55.13	-739.43	-6415.7	-1460.4	1896.0
127	4017	-17.95	271.13	-739.43	-26839.6	18963.4	7620.0
128	4018	-17.95	-160.87	-739.43	14008.2	18963.4	-4476.0
129	4021	190.56	-0.05	-739.41	-1180.0	38663.4	-287.5
130	4022	-241.44	-0.05	-739.41	-1180.0	-2184.3	360.5
131	4023	-25.44	215.95	-739.41	-21603.8	18239.5	6084.5
132	4024	-25.44	-216.05	-739.41	19243.9	18239.5	-6011.5
133	4025	197.98	-55.20	-739.43	4053.2	39380.9	-1844.3
134	4026	-234.02	-55.20	-739.43	4053.2	-1466.8	-1196.3
135	4027	-18.02	160.80	-739.43	-16370.7	18957.1	4527.7
136	4028	-18.02	-271.20	-739.43	24477.1	18957.1	-7568.3
137	4031	215.95	-78.01	-739.47	6218.2	41119.6	-2510.6
138	4032	-216.05	-78.01	-739.47	6218.2	271.8	-1862.6
139	4033	-0.05	137.99	-739.47	-14205.7	20695.7	3861.4
140	4034	-0.05	-294.01	-739.47	26642.0	20695.7	-8234.6
141	4035	233.95	-55.13	-739.51	4046.8	42860.9	-1896.0
142	4036	-198.05	-55.13	-739.51	4046.8	2013.1	-1248.0
143	4037	17.95	160.87	-739.51	-16377.1	22437.0	4476.0
144	4038	17.95	-271.13	-739.51	24470.7	22437.0	-7620.0
145	5001	241.44	0.05	-739.53	-1188.9	43584.8	-360.5
146	5002	-190.56	0.05	-739.53	-1188.9	2737.0	287.5
147	5003	25.44	216.05	-739.53	-21612.8	23160.9	6011.5
148	5004	25.44	-215.95	-739.53	19234.9	23160.9	-6084.5

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149 5005	234.02	55.20	-739.51	-6422.1	42867.2	1196.3
150 5006	-197.98	55.20	-739.51	-6422.1	2019.5	1844.3
151 5007	18.02	271.20	-739.51	-26846.0	22443.3	7568.3
152 5008	18.02	-160.80	-739.51	14001.8	22443.3	-4527.7
153 5011	216.05	78.01	-739.47	-8587.1	41128.6	1862.6
154 5012	-215.95	78.01	-739.47	-8587.1	280.8	2510.6
155 5013	0.05	294.01	-739.47	-29010.9	20704.7	8234.6
156 5014	0.05	-137.99	-739.47	11836.8	20704.7	-3861.4
157 5015	198.05	55.13	-739.43	-6415.7	39387.3	1248.0

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
158	5016	-233.95	55.13	-739.43	-6415.7	-1460.4	1896.0
159	5017	-17.95	271.13	-739.43	-26839.6	18963.4	7620.0
160	5018	-17.95	-160.87	-739.43	14008.2	18963.4	-4476.0
161	5021	190.56	-0.05	-739.41	-1180.0	38663.4	-287.5
162	5022	-241.44	-0.05	-739.41	-1180.0	-2184.3	360.5
163	5023	-25.44	215.95	-739.41	-21603.8	18239.5	6084.5
164	5024	-25.44	-216.05	-739.41	19243.9	18239.5	-6011.5
165	5025	197.98	-55.20	-739.43	4053.2	39380.9	-1844.3
166	5026	-234.02	-55.20	-739.43	4053.2	-1466.8	-1196.3
167	5027	-18.02	160.80	-739.43	-16370.7	18957.1	4527.7
168	5028	-18.02	-271.20	-739.43	24477.1	18957.1	-7568.3
169	5031	215.95	-78.01	-739.47	6218.2	41119.6	-2510.6
170	5032	-216.05	-78.01	-739.47	6218.2	271.8	-1862.6
171	5033	-0.05	137.99	-739.47	-14205.7	20695.7	3861.4
172	5034	-0.05	-294.01	-739.47	26642.0	20695.7	-8234.6
173	5035	233.95	-55.13	-739.51	4046.8	42860.9	-1896.0
174	5036	-198.05	-55.13	-739.51	4046.8	2013.1	-1248.0
175	5037	17.95	160.87	-739.51	-16377.1	22437.0	4476.0
176	5038	17.95	-271.13	-739.51	24470.7	22437.0	-7620.0

\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
1	CL	0.00			0.00				-0.75	28.00	2.75	21.00	
2	DL	0.00			-0.00				-418.03	27.99	1.51	19.83	
3	LL	0.00			0.00				-144.69	28.00	1.63	21.00	
4	201	69.73	27.90	1.53	19.87	0.13	52.62	1.89	19.75	-0.16	892.33	1.50	20.37
5	202	49.40	27.94	1.53	19.87	151.38	28.04	1.39	20.09	-0.12	845.84	1.70	20.34
6	203	0.13	52.62	1.89	19.75	213.96	28.03	1.39	20.09	-0.01	28.00	5.19	19.75
7	204	-49.21	27.85	1.53	19.87	151.20	28.02	1.39	20.09	0.11	944.45	1.28	20.41
8	205	-69.73	27.90	1.53	19.87	-0.13	52.62	1.89	19.75	0.16	892.33	1.50	20.37
9	206	-49.40	27.94	1.53	19.87	-151.38	28.04	1.61	20.09	0.12	845.84	1.70	20.34
10	207	-0.13	52.62	1.89	19.75	-213.96	28.03	1.61	20.09	0.01	28.00	5.19	19.75
11	208	49.21	27.85	1.53	19.87	-151.20	28.02	1.61	20.09	-0.11	944.44	1.28	20.41
12	301	25.44	27.90	1.53	19.87	0.05	52.39	1.89	19.75	-0.06	893.72	1.50	20.37
13	302	18.02	27.94	1.53	19.87	55.20	28.04	1.39	20.08	-0.04	847.07	1.70	20.34
14	303	0.05	52.39	1.89	19.75	78.01	28.03	1.39	20.08	-0.00	28.00	5.12	19.75
15	304	-17.95	27.85	1.53	19.87	55.13	28.02	1.39	20.08	0.04	946.00	1.28	20.41
16	305	-25.44	27.90	1.53	19.87	-0.05	52.38	1.89	19.75	0.06	893.72	1.50	20.37
17	306	-18.02	27.94	1.53	19.87	-55.20	28.04	1.61	20.08	0.04	847.07	1.70	20.34
18	307	-0.05	52.39	1.89	19.75	-78.01	28.03	1.61	20.08	0.00	28.00	5.12	19.75
19	308	17.95	27.85	1.53	19.87	-55.13	28.02	1.61	20.08	-0.04	946.00	1.28	20.41
20	FLX	216.00	28.00	1.50	19.75	0.00			0.00				
21	FLY	0.00			216.00	28.00	1.50	19.75	0.00				
22	NGDL	0.00			0.00				-155.75	28.00	1.80	21.00	
23	1000	0.00			-0.00				-594.78	27.99	1.60	20.18	
24	1001	0.00			-0.00				-594.78	27.99	1.60	20.18	
25	1002	0.00			-0.00				-594.78	27.99	1.60	20.18	
26	1003	0.00			-0.00				-594.78	27.99	1.60	20.18	
27	1004	0.00			-0.00				-739.47	27.99	1.60	20.34	
28	1005	0.00			-0.00				-739.47	27.99	1.60	20.34	
29	1011	216.00	28.00	1.50	19.75	-0.00			-594.78	27.99	1.60	20.18	
30	1012	-216.00	28.00	1.50	19.75	-0.00			-594.78	27.99	1.60	20.18	
31	1013	0.00			216.00	28.00	1.50	19.75	-594.78	27.99	1.60	20.18	
32	1014	0.00			-216.00	28.00	1.50	19.75	-594.78	27.99	1.60	20.18	
33	1021	216.00	28.00	1.50	19.75	-0.00			-594.78	27.99	1.60	20.18	
34	1022	-216.00	28.00	1.50	19.75	-0.00			-594.78	27.99	1.60	20.18	

**BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(ICG-ICW LOWER DECK BRIDGE)**

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35	1023	0.00		216.00	28.00	1.50	19.75	-594.78	27.99	1.60	20.18
36	1024	0.00		-216.00	28.00	1.50	19.75	-594.78	27.99	1.60	20.18
37	1031	216.00	28.00	1.50	19.75	-0.00		-594.78	27.99	1.60	20.18
38	1032	-216.00	28.00	1.50	19.75	-0.00		-594.78	27.99	1.60	20.18
39	1033	0.00		216.00	28.00	1.50	19.75	-594.78	27.99	1.60	20.18
40	1034	0.00		-216.00	28.00	1.50	19.75	-594.78	27.99	1.60	20.18
41	1041	216.00	28.00	1.50	19.75	-0.00		-739.47	27.99	1.60	20.34
42	1042	-216.00	28.00	1.50	19.75	-0.00		-739.47	27.99	1.60	20.34
43	1043	0.00		216.00	28.00	1.50	19.75	-739.47	27.99	1.60	20.34
44	1044	0.00		-216.00	28.00	1.50	19.75	-739.47	27.99	1.60	20.34
45	1051	216.00	28.00	1.50	19.75	-0.00		-739.47	27.99	1.60	20.34

SACS (2025)

Company: Engineers India Limited

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
46	1052	-216.00	28.00	1.50	19.75	-0.00				-739.47	27.99	1.60	20.34
47	1053	0.00			216.00	28.00	1.50	19.75	-739.47	27.99	1.60	20.34	
48	1054	0.00			-216.00	28.00	1.50	19.75	-739.47	27.99	1.60	20.34	
49	2001	285.73	27.97	1.51	19.78	0.13	52.62	1.89	19.75	-594.94	28.23	1.60	20.18
50	2002	-146.27	28.05	1.48	19.69	0.13	52.62	1.89	19.75	-594.94	28.23	1.60	20.18
51	2003	69.73	27.90	1.53	19.87	216.13	28.01	1.50	19.75	-594.94	28.23	1.60	20.18
52	2004	69.73	27.90	1.53	19.87	-215.87	27.99	1.50	19.75	-594.94	28.23	1.60	20.18
53	2005	265.40	27.99	1.51	19.77	151.38	28.04	1.39	20.09	-594.90	28.16	1.60	20.18
54	2006	-166.60	28.02	1.49	19.71	151.38	28.04	1.39	20.09	-594.90	28.16	1.60	20.18
55	2007	49.40	27.94	1.53	19.87	367.38	28.02	1.45	19.89	-594.90	28.16	1.60	20.18
56	2008	49.40	27.94	1.53	19.87	-64.62	27.90	1.77	18.96	-594.90	28.16	1.60	20.18
57	2011	216.13	28.01	1.50	19.75	213.96	28.03	1.39	20.09	-594.79	27.99	1.60	20.18
58	2012	-215.87	27.99	1.50	19.75	213.96	28.03	1.39	20.09	-594.79	27.99	1.60	20.18
59	2013	0.13	52.62	1.89	19.75	429.96	28.01	1.44	19.92	-594.79	27.99	1.60	20.18
60	2014	0.13	52.62	1.89	19.75	-2.04	24.88	13.46	-15.72	-594.79	27.99	1.60	20.18
61	2015	166.79	28.04	1.49	19.71	151.20	28.02	1.39	20.09	-594.67	27.83	1.60	20.18
62	2016	-265.21	27.97	1.51	19.77	151.20	28.02	1.39	20.09	-594.67	27.83	1.60	20.18
63	2017	-49.21	27.85	1.53	19.87	367.20	28.01	1.45	19.89	-594.67	27.83	1.60	20.18
64	2018	-49.21	27.85	1.53	19.87	-64.80	27.96	1.77	18.96	-594.67	27.83	1.60	20.18
65	2021	146.27	28.05	1.48	19.69	-0.13	52.62	1.89	19.75	-594.62	27.76	1.60	20.18
66	2022	-285.73	27.97	1.51	19.78	-0.13	52.62	1.89	19.75	-594.62	27.76	1.60	20.18
67	2023	-69.73	27.90	1.53	19.87	215.87	27.99	1.50	19.75	-594.62	27.76	1.60	20.18
68	2024	-69.73	27.90	1.53	19.87	-216.13	28.01	1.50	19.75	-594.62	27.76	1.60	20.18
69	2025	166.60	28.02	1.49	19.71	-151.38	28.04	1.61	20.09	-594.66	27.83	1.60	20.18
70	2026	-265.40	27.99	1.51	19.77	-151.38	28.04	1.61	20.09	-594.66	27.83	1.60	20.18
71	2027	-49.40	27.94	1.53	19.87	64.62	27.90	1.23	18.96	-594.66	27.83	1.60	20.18
72	2028	-49.40	27.94	1.53	19.87	-367.38	28.02	1.55	19.89	-594.66	27.83	1.60	20.18
73	2031	215.87	27.99	1.50	19.75	-213.96	28.03	1.61	20.09	-594.77	27.99	1.60	20.18
74	2032	-216.13	28.01	1.50	19.75	-213.96	28.03	1.61	20.09	-594.77	27.99	1.60	20.18
75	2033	-0.13	52.62	1.89	19.75	COUPLE				-594.77	27.99	1.60	20.18
76	2034	-0.13	52.62	1.89	19.75	-429.96	28.01	1.56	19.92	-594.77	27.99	1.60	20.18
77	2035	265.21	27.97	1.51	19.77	-151.20	28.02	1.61	20.09	-594.89	28.16	1.60	20.18
78	2036	-166.79	28.04	1.49	19.71	-151.20	28.02	1.61	20.09	-594.89	28.16	1.60	20.18
79	2037	49.21	27.85	1.53	19.87	64.80	27.96	1.23	18.96	-594.89	28.16	1.60	20.18
80	2038	49.21	27.85	1.53	19.87	-367.20	28.01	1.55	19.89	-594.89	28.16	1.60	20.18
81	3001	285.73	27.97	1.51	19.78	0.13	52.62	1.89	19.75	-594.94	28.23	1.60	20.18



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82	3002	-146.27	28.05	1.48	19.69	0.13	52.62	1.89	19.75	-594.94	28.23	1.60	20.18
83	3003	69.73	27.90	1.53	19.87	216.13	28.01	1.50	19.75	-594.94	28.23	1.60	20.18
84	3004	69.73	27.90	1.53	19.87	-215.87	27.99	1.50	19.75	-594.94	28.23	1.60	20.18
85	3005	265.40	27.99	1.51	19.77	151.38	28.04	1.39	20.09	-594.90	28.16	1.60	20.18
86	3006	-166.60	28.02	1.49	19.71	151.38	28.04	1.39	20.09	-594.90	28.16	1.60	20.18
87	3007	49.40	27.94	1.53	19.87	367.38	28.02	1.45	19.89	-594.90	28.16	1.60	20.18
88	3008	49.40	27.94	1.53	19.87	-64.62	27.90	1.77	18.96	-594.90	28.16	1.60	20.18
89	3011	216.13	28.01	1.50	19.75	213.96	28.03	1.39	20.09	-594.79	27.99	1.60	20.18
90	3012	-215.87	27.99	1.50	19.75	213.96	28.03	1.39	20.09	-594.79	27.99	1.60	20.18

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z	
	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	
91 3013	0.13	52.62	1.89	19.75	429.96	28.01	1.44	19.92	-594.79	27.99	1.60	20.18	
92 3014	0.13	52.62	1.89	19.75	-2.04	24.88	13.46	-15.72	-594.79	27.99	1.60	20.18	
93 3015	166.79	28.04	1.49	19.71	151.20	28.02	1.39	20.09	-594.67	27.83	1.60	20.18	
94 3016	-265.21	27.97	1.51	19.77	151.20	28.02	1.39	20.09	-594.67	27.83	1.60	20.18	
95 3017	-49.21	27.85	1.53	19.87	367.20	28.01	1.45	19.89	-594.67	27.83	1.60	20.18	
96 3018	-49.21	27.85	1.53	19.87	-64.80	27.96	1.77	18.96	-594.67	27.83	1.60	20.18	
97 3021	146.27	28.05	1.48	19.69	-0.13	52.62	1.89	19.75	-594.62	27.76	1.60	20.18	
98 3022	-285.73	27.97	1.51	19.78	-0.13	52.62	1.89	19.75	-594.62	27.76	1.60	20.18	
99 3023	-69.73	27.90	1.53	19.87	215.87	27.99	1.50	19.75	-594.62	27.76	1.60	20.18	
100 3024	-69.73	27.90	1.53	19.87	-216.13	28.01	1.50	19.75	-594.62	27.76	1.60	20.18	
101 3025	166.60	28.02	1.49	19.71	-151.38	28.04	1.61	20.09	-594.66	27.83	1.60	20.18	
102 3026	-265.40	27.99	1.51	19.77	-151.38	28.04	1.61	20.09	-594.66	27.83	1.60	20.18	
103 3027	-49.40	27.94	1.53	19.87	64.62	27.90	1.23	18.96	-594.66	27.83	1.60	20.18	
104 3028	-49.40	27.94	1.53	19.87	-367.38	28.02	1.55	19.89	-594.66	27.83	1.60	20.18	
105 3031	215.87	27.99	1.50	19.75	-213.96	28.03	1.61	20.09	-594.77	27.99	1.60	20.18	
106 3032	-216.13	28.01	1.50	19.75	-213.96	28.03	1.61	20.09	-594.77	27.99	1.60	20.18	
107 3033	-0.13	52.62	1.89	19.75	COUPLE				-594.77	27.99	1.60	20.18	
108 3034	-0.13	52.62	1.89	19.75	-429.96	28.01	1.56	19.92	-594.77	27.99	1.60	20.18	
109 3035	265.21	27.97	1.51	19.77	-151.20	28.02	1.61	20.09	-594.89	28.16	1.60	20.18	
110 3036	-166.79	28.04	1.49	19.71	-151.20	28.02	1.61	20.09	-594.89	28.16	1.60	20.18	
111 3037	49.21	27.85	1.53	19.87	64.80	27.96	1.23	18.96	-594.89	28.16	1.60	20.18	
112 3038	49.21	27.85	1.53	19.87	-367.20	28.01	1.55	19.89	-594.89	28.16	1.60	20.18	
113 4001	241.44	27.99	1.50	19.76	0.05	52.39	1.89	19.75	-739.53	28.06	1.60	20.34	
114 4002	-190.56	28.01	1.50	19.73	0.05	52.39	1.89	19.75	-739.53	28.06	1.60	20.34	
115 4003	25.44	27.90	1.53	19.87	216.05	28.01	1.50	19.75	-739.53	28.06	1.60	20.34	
116 4004	25.44	27.90	1.53	19.87	-215.95	27.99	1.50	19.75	-739.53	28.06	1.60	20.34	
117 4005	234.02	28.00	1.50	19.76	55.20	28.04	1.39	20.08	-739.51	28.04	1.60	20.34	
118 4006	-197.98	28.01	1.50	19.74	55.20	28.04	1.39	20.08	-739.51	28.04	1.60	20.34	
119 4007	18.02	27.94	1.53	19.87	271.20	28.01	1.48	19.82	-739.51	28.04	1.60	20.34	
120 4008	18.02	27.94	1.53	19.87	-160.80	27.98	1.54	19.64	-739.51	28.04	1.60	20.34	
121 4011	216.05	28.01	1.50	19.75	78.01	28.03	1.39	20.08	-739.47	27.99	1.60	20.34	
122 4012	-215.95	27.99	1.50	19.75	78.01	28.03	1.39	20.08	-739.47	27.99	1.60	20.34	
123 4013	0.05	52.39	1.89	19.75	294.01	28.01	1.47	19.84	-739.47	27.99	1.60	20.34	
124 4014	0.05	52.39	1.89	19.75	-137.99	27.98	1.56	19.56	-739.47	27.99	1.60	20.34	
125 4015	198.05	28.01	1.50	19.74	55.13	28.02	1.39	20.08	-739.43	27.94	1.60	20.34	
126 4016	-233.95	27.99	1.50	19.76	55.13	28.02	1.39	20.08	-739.43	27.94	1.60	20.34	

---

127	4017	-17.95	27.85	1.53	19.87	271.13	28.00	1.48	19.82	-739.43	27.94	1.60	20.34
128	4018	-17.95	27.85	1.53	19.87	-160.87	27.99	1.54	19.64	-739.43	27.94	1.60	20.34
129	4021	190.56	28.01	1.50	19.73	-0.05	52.38	1.89	19.75	-739.41	27.92	1.60	20.34
130	4022	-241.44	27.99	1.50	19.76	-0.05	52.38	1.89	19.75	-739.41	27.92	1.60	20.34
131	4023	-25.44	27.90	1.53	19.87	215.95	27.99	1.50	19.75	-739.41	27.92	1.60	20.34
132	4024	-25.44	27.90	1.53	19.87	-216.05	28.01	1.50	19.75	-739.41	27.92	1.60	20.34
133	4025	197.98	28.01	1.50	19.74	-55.20	28.04	1.61	20.08	-739.43	27.94	1.60	20.34
134	4026	-234.02	28.00	1.50	19.76	-55.20	28.04	1.61	20.08	-739.43	27.94	1.60	20.34
135	4027	-18.02	27.94	1.53	19.87	160.80	27.98	1.46	19.64	-739.43	27.94	1.60	20.34

**BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(ICG-ICW LOWER DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

DATE 23-SEP-2025 TIME 15:13:45 SEA PAGE 77

\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
136	4028	-18.02	27.94	1.53	19.87	-271.20	28.01	1.52	19.82	-739.43	27.94	1.60	20.34
137	4031	215.95	27.99	1.50	19.75	-78.01	28.03	1.61	20.08	-739.47	27.99	1.60	20.34
138	4032	-216.05	28.01	1.50	19.75	-78.01	28.03	1.61	20.08	-739.47	27.99	1.60	20.34
139	4033	-0.05	52.39	1.89	19.75	137.99	27.98	1.44	19.56	-739.47	27.99	1.60	20.34
140	4034	-0.05	52.39	1.89	19.75	-294.01	28.01	1.53	19.84	-739.47	27.99	1.60	20.34
141	4035	233.95	27.99	1.50	19.76	-55.13	28.02	1.61	20.08	-739.51	28.04	1.60	20.34
142	4036	-198.05	28.01	1.50	19.74	-55.13	28.02	1.61	20.08	-739.51	28.04	1.60	20.34
143	4037	17.95	27.85	1.53	19.87	160.87	27.99	1.46	19.64	-739.51	28.04	1.60	20.34
144	4038	17.95	27.85	1.53	19.87	-271.13	28.00	1.52	19.82	-739.51	28.04	1.60	20.34
145	5001	241.44	27.99	1.50	19.76	0.05	52.39	1.89	19.75	-739.53	28.06	1.60	20.34
146	5002	-190.56	28.01	1.50	19.73	0.05	52.39	1.89	19.75	-739.53	28.06	1.60	20.34
147	5003	25.44	27.90	1.53	19.87	216.05	28.01	1.50	19.75	-739.53	28.06	1.60	20.34
148	5004	25.44	27.90	1.53	19.87	-215.95	27.99	1.50	19.75	-739.53	28.06	1.60	20.34
149	5005	234.02	28.00	1.50	19.76	55.20	28.04	1.39	20.08	-739.51	28.04	1.60	20.34
150	5006	-197.98	28.01	1.50	19.74	55.20	28.04	1.39	20.08	-739.51	28.04	1.60	20.34
151	5007	18.02	27.94	1.53	19.87	271.20	28.01	1.48	19.82	-739.51	28.04	1.60	20.34
152	5008	18.02	27.94	1.53	19.87	-160.80	27.98	1.54	19.64	-739.51	28.04	1.60	20.34
153	5011	216.05	28.01	1.50	19.75	78.01	28.03	1.39	20.08	-739.47	27.99	1.60	20.34
154	5012	-215.95	27.99	1.50	19.75	78.01	28.03	1.39	20.08	-739.47	27.99	1.60	20.34
155	5013	0.05	52.39	1.89	19.75	294.01	28.01	1.47	19.84	-739.47	27.99	1.60	20.34
156	5014	0.05	52.39	1.89	19.75	-137.99	27.98	1.56	19.56	-739.47	27.99	1.60	20.34
157	5015	198.05	28.01	1.50	19.74	55.13	28.02	1.39	20.08	-739.43	27.94	1.60	20.34
158	5016	-233.95	27.99	1.50	19.76	55.13	28.02	1.39	20.08	-739.43	27.94	1.60	20.34
159	5017	-17.95	27.85	1.53	19.87	271.13	28.00	1.48	19.82	-739.43	27.94	1.60	20.34
160	5018	-17.95	27.85	1.53	19.87	-160.87	27.99	1.54	19.64	-739.43	27.94	1.60	20.34
161	5021	190.56	28.01	1.50	19.73	-0.05	52.38	1.89	19.75	-739.41	27.92	1.60	20.34
162	5022	-241.44	27.99	1.50	19.76	-0.05	52.38	1.89	19.75	-739.41	27.92	1.60	20.34
163	5023	-25.44	27.90	1.53	19.87	215.95	27.99	1.50	19.75	-739.41	27.92	1.60	20.34
164	5024	-25.44	27.90	1.53	19.87	-216.05	28.01	1.50	19.75	-739.41	27.92	1.60	20.34
165	5025	197.98	28.01	1.50	19.74	-55.20	28.04	1.61	20.08	-739.43	27.94	1.60	20.34
166	5026	-234.02	28.00	1.50	19.76	-55.20	28.04	1.61	20.08	-739.43	27.94	1.60	20.34
167	5027	-18.02	27.94	1.53	19.87	160.80	27.98	1.46	19.64	-739.43	27.94	1.60	20.34
168	5028	-18.02	27.94	1.53	19.87	-271.20	28.01	1.52	19.82	-739.43	27.94	1.60	20.34
169	5031	215.95	27.99	1.50	19.75	-78.01	28.03	1.61	20.08	-739.47	27.99	1.60	20.34
170	5032	-216.05	28.01	1.50	19.75	-78.01	28.03	1.61	20.08	-739.47	27.99	1.60	20.34
171	5033	-0.05	52.39	1.89	19.75	137.99	27.98	1.44	19.56	-739.47	27.99	1.60	20.34

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172	5034	-0.05	52.39	1.89	19.75	-294.01	28.01	1.53	19.84	-739.47	27.99	1.60	20.34
173	5035	233.95	27.99	1.50	19.76	-55.13	28.02	1.61	20.08	-739.51	28.04	1.60	20.34
174	5036	-198.05	28.01	1.50	19.74	-55.13	28.02	1.61	20.08	-739.51	28.04	1.60	20.34
175	5037	17.95	27.85	1.53	19.87	160.87	27.99	1.46	19.64	-739.51	28.04	1.60	20.34
176	5038	17.95	27.85	1.53	19.87	-271.13	28.00	1.52	19.82	-739.51	28.04	1.60	20.34

#### 4.2 Member Unity Check Result

Member having Unity check ratio above 0.555 for the bridge members are summarized below.

##### Member Unity Check Result

S. No.	Member	Group ID	Load Case	UC	Remarks
1	D013-D014	C01	4032	0.557	Bridge Chord members UC <1.0.
2	D014-D015	C01	4032	0.557	
3	D124-D125	C01	4012	0.555	
4	D125-D126	C01	4012	0.555	

#### 4.3 Joint Punching Shear Unity Check Result

Joints having Load UC ratio above 0.5 for the jacket framing member are summarized below.

##### Maximum Joint UC Ratio

Joint	Diameter (mm)	Thickness (mm)	Load UC	Remarks
0001	168	9.5	0.509	UC <1.0.

#### 4.4 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below

##### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum vertical Deflection (cm)	Remarks
1.	D014	10.4	Allowable Deflection = (5600 / 400) = 14 cm
2.	D125	10.5	

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below

##### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	D014	8.700	Allowable Deflection = (5600 / 500) = 11.2 cm
2.	D125	8.700	

Vertical and Horizontal Deflection of bridge are under control. 85 mm of vertical deflection is observed in the dead load combination. Hence a camber of 1 in 200 shall be provided.

#### 4.5 Reaction Summary

Following is the reaction summary of the bridge supports.

**Summary of Bridge reactions**

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	D001	0	-82.005	168.334
2.	D113	0	142.360	219.537
3.	D008	285.728	-215.093	0
4.	D028	0	0	168.891
5.	D137	0	0	218.029

## 5.0 CONCLUSION

From the above it is concluded that all members and joints are safe for operating and extreme conditions. Also, functionally the deflection is under the limits. The adequacy of the bridge support locations, adequacy of deck members, jacket are performed separately and shall be covered in a separate report.

# ANNEXURE-1

## LOAD CALCULATIONS



### WIND LOAD:

S.No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulence Intensity at height "z"	t <sub>0</sub>	t	Design Wind Speed at Height "z"	
			U <sub>0</sub>			z		U(z)	Iu(z)			u(z,t)	
			kmph	ft/sec		m	ft	ft/sec				sec	sec
1	Extreme	0	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	15	200.44	61.11
2	Extreme	45	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	15	200.44	61.11
3	Extreme	90	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	15	200.44	61.11
4	Extreme	135	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	15	200.44	61.11
5	Extreme	180	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	15	200.44	61.11
6	Extreme	225	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	15	200.44	61.11
7	Extreme	270	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	15	200.44	61.11
8	Extreme	315	149.67	136.37	0.154	21.00	68.88	151.96	0.142	3600	15	200.44	61.11
1	Operating	All	99.22	90.40	0.130	21.00	68.88	99.11	0.111	3600	15	123.90	37.77

### CABLE LOAD:

2 Run 3C X2.5 @162 Kg /  
km= 3.24  
N/m

2 Run 4C X16 @162 Kg /  
km= 7 N/m

10.24 N/  
m  
Total for cable =  
i.e. 10.24\*2/1000  
0.02048 Kn

### CABLE TRAY LOAD:

CABTRAY load = 21.85 Kg/ 3 m  
i.e Point load = 21.85 /3 \*2 /100 = 0.0728 Kn

### DEAD LOAD

Self-weight is considered with contingency 13%. The member load for walkway is considered as MC250 (30.4 Kg /m)

Point Load = 30.4 \*2.5 /100 = 0.76 Kn.

### GRATING LOAD

Grating load of 50 kg/m<sup>2</sup> is considered

### HANDRAIL LOAD

Handrail Load of 50Kg/m is considered.



## BRIDGE REPORT FOR REFURBISHMENT / REPLACEMENT OF BRIDGES IN MH ASSET (ICW-ICG BRIDGE)

**PROJECT :** ENGINEERING / TECHNICAL CONSULTANCY  
SERVICES FOR PREPERATION OF EXECUTION  
METHODOLOGY, SOW AND COST ESTIMATES  
FOR REPLACEMENT /REFURBISHMENT OF  
BRIDGES IN MH ASSET

**LOCATION:** MH ASSET (NORTH AND SOUTH FIELD)

**OWNER :** ONGC, MUMBAI

**JOB NO :** B774

0	25.09.2025	ISSUED AS STUDY	AP	DP	CS
Rev. No	Date	Purpose	Prepared by	Reviewed by	Approved by

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Annexures : 1

## **Symbols and Abbreviations**

### **Organisations – India**

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### **Other abbreviations**

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge

## 1.0 INTRODUCTION

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges have deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## 2.0 GENERAL

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non-Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### IC Complex:

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### BHS Complex:

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### NQO Complex:

7. NQO-NQD Bridge

### WIN Complex:

8. WIN-NC Bridge

### Additional bridges

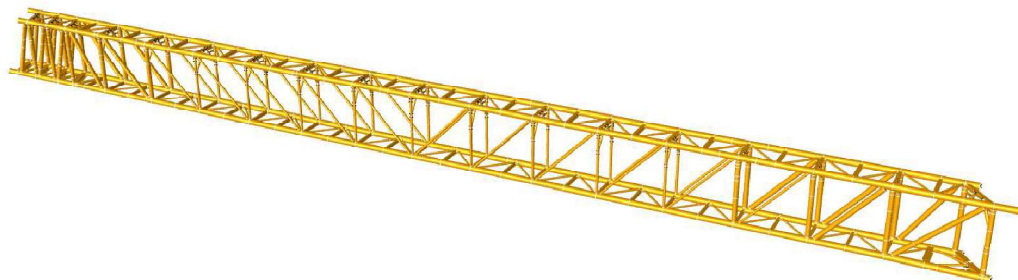
9. ICP-ICD Bridge
10. SC1-SCA Bridge
11. SCA-SCF Bridge

### 3.0 ICW- ICG BRIDGE DESCRIPTION

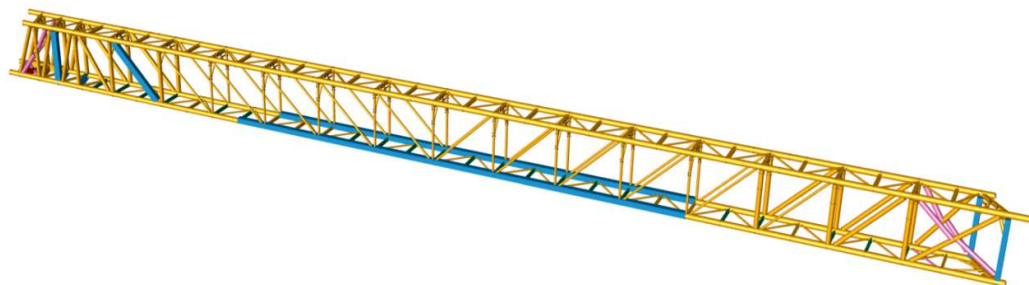
Approximate length of bridge is measured from 3D model as 48.401m. Hence, 48.401m length of bridge is modelled in SACS conservatively.

Length of Bridge	48.401m
Support Condition	Fixed: 001000, 110000, 001000 (ICG Side) Sliding: 011000, 011000 (ICW Side)
No. of directions for environmental loads	8
Wind Speed (3 Sec Gust)	61.78 m/s for extreme and 38.06 m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	36 ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

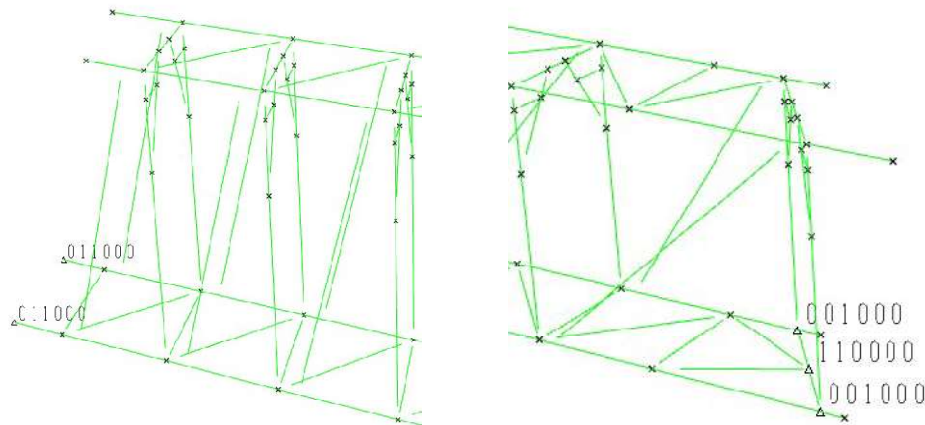
ISOMETRIC VIEW OF **ICW-ICG Bridge** is shown in Figure1.



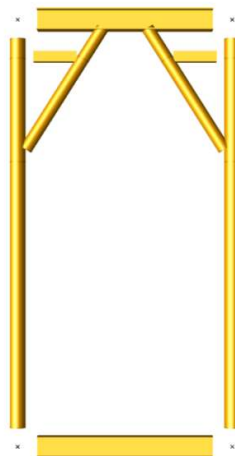
**Figure 1: 3D SACS Model (Original)**



**Figure 2: 3D SACS Model (Strengthened)**



**Figure 2: SUPPORT CONDITIONS**



**Figure 3: BRIDGE CROSS SECTION**

#### 4.0 PROPOSED STRENGTHENING CONFIGURATION

##### 1. Bottom Chord-

###### a) Main Chord:

273dia.+MC250 on bottom side.

###### b) Horizontal Framing members: Replacement of 21 members of H100 x 148 x 9 x 6.

Replacement of H250250 with H300300+ with 16 thk box plates and 16 thk flange plate at top and bottom (1 member).

Replacement of H250250 + 10 thk flange plate at top and bottom (1 member).

###### c) Diagonal Framing members:

134dia. + 101.6 dia. Half cut on both sides.

Addition of a 141.8dia member

Addition of a 88.9dia member

**2. Framing Elevation Row-A:**

a) Vertical member:

- 219dia. + 168dia, Half cut tubular on both sides.

b) Diagonal member:

- New member of 219dia. 2no.s.
- 219dia. + 168dia, Half cut tubular on both sides.

**3. Framing Elevation Row-B:**

a) Vertical member:

- 219dia. + 168dia, Half cut tubular on both sides.

b) Diagonal member:

- New member of 219dia.

The proposed strengthening and replacement works shall also comprise the following:

- Replacement of walkway members, gratings, and handrails.
- Replacement of stairs on both sides.
- Replacement of roof sheeting and cladding along with supporting members, clamps, and bolts.
- Replacement of monorail member.
- Strengthening of supports at fixed and sliding ends.

## 5.0 LOADING

### Basic Load Cases

LOADCN	DESCRIPTION	LOAD(kN)
DL	Self-weight,(Contingency-13%)	238.098
NGDL	Cable tray	175.87
	Cable tray Support	
	Grating Load	
	Handrail Load	
	Sheeting Cladding	
LL	Blanket live load on Walkway (Grating) Area-250Kg/m <sup>2</sup>	131.733
MRLL	Monorail Live Load	20
CL	Cable Loading	31.786
PLEM	Piping Load Empty (60% of PLOP)	DUMMY
PLOP	Piping Load Empty + Operating Contents (By Piping)	DUMMY
PLTLX	Piping Load Empty + Operating Contents (15% of PLOP) X	DUMMY
PLTLY	Piping Load Empty + Operating Contents (15% of PLOP) Y	DUMMY
201to208	Extreme Wind load	See Annexure
301to308	Operating Wind Load	See Annexure



FLX	Bridge Friction Load X (30% of SW+NGDL+LL+CL+PLOP)	184.12
FLY	Bridge Friction Load Y (30% of SW+NGDL+LL+CL+PLOP)	184.12

### SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

### NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the Cable tray, cable tray support, grating and handrail loadings.

### LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1 m width of walkway is considered.

### CABLE TRAY AND CABLE LOAD

- For 150mm cable tray, 5kg/3m load is considered. Each cable trays consist of 6 cables (2no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km, 2no.s 3C x 4 m<sup>2</sup> with load 530kg/km, and 2no.s 24P x 1 m<sup>2</sup> with load 162kg/km).

### WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

### Load Combinations

#### Load Combinations

BASIC LOAD COMBINATIONS								
LCOMB	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
PLEM	PLOP	0.60						
1000	DL	1.00	NDGL	1.13	CL	1.00	PLEM	1.00
1001	DL	1.00	NDGL	1.13	CL	1.00	PLOP	1.00
1002	1001	1.00	LL	1.00	MRLL	1.00	PLTX	1.00
1003	1001	1.00	LL	1.00	MRLL	1.00	PLTX	-1.00
1004	1001	1.00	LL	1.00	MRLL	1.00	PLTY	1.00

1005	1001	1.00	LL	1.00	MRL	1.00	PLTY	-1.00
1011	1001	1.00	FLX	1.00				
1012	1001	1.00	FLX	-1.00				
1013	1001	1.00	FLY	1.00				
1014	1001	1.00	FLY	-1.00				
1021	1002	1.00	FLX	1.00				
1022	1002	1.00	FLX	-1.00				
1023	1002	1.00	FLY	1.00				
1024	1002	1.00	FLY	-1.00				
1031	1003	1.00	FLX	1.00				
1032	1003	1.00	FLX	-1.00				
1033	1003	1.00	FLY	1.00				
1034	1003	1.00	FLY	-1.00				
1041	1004	1.00	FLX	1.00				
1042	1004	1.00	FLX	-1.00				
1043	1004	1.00	FLY	1.00				
1044	1004	1.00	FLY	-1.00				
1051	1005	1.00	FLX	1.00				
1052	1005	1.00	FLX	-1.00				
1053	1005	1.00	FLY	1.00				
1054	1005	1.00	FLY	-1.00				
<b>EXTREME WIND CONDITION</b>								
2001 to 2004	1011 to 1014	1.00	201	1.00				
2005 to 2008	1011 to 1014	1.00	202	1.00				
2011 to 2014	1011 to 1014	1.00	203	1.00				
2015 to 2018	1011 to 1014	1.00	204	1.00				
2021 to 2024	1011 to 1014	1.00	205	1.00				
2025 to 2028	1011 to 1014	1.00	206	1.00				
2031 to 2034	1011 to 1014	1.00	207	1.00				
2035 to 2038	1011 to 1014	1.00	208	1.00				
<b>OPERATING WIND CONDITION</b>								
4001 to 4004	1021 to 1024	1.00	301	1.00				
4005 to 4008	1021 to 1024	1.00	302	1.00				
4011 to 4014	1021 to 1024	1.00	303	1.00				
4015 to 4018	1021 to 1024	1.00	304	1.00				
4021 to 4024	1021 to 1024	1.00	305	1.00				
4025 to 4028	1021 to 1024	1.00	306	1.00				

4031 to 4034	1021 to 1024	1.00	307	1.00				
4035 to 4038	1021 to 1024	1.00	308	1.00				
4101 to 4104	1031 to 1034	1.00	301	1.00				
4105 to 4108	1031 to 1034	1.00	302	1.00				
4111 to 4114	1031 to 1034	1.00	303	1.00				
4115 to 4118	1031 to 1034	1.00	304	1.00				
4121 to 4124	1031 to 1034	1.00	305	1.00				
4125 to 4128	1031 to 1034	1.00	306	1.00				
4131 to 4134	1031 to 1034	1.00	307	1.00				
4135 to 4138	1031 to 1034	1.00	308	1.00				
4201 to 4204	1041 to 1044	1.00	301	1.00				
4205 to 4208	1041 to 1044	1.00	302	1.00				
4211 to 4214	1041 to 1044	1.00	303	1.00				
4215 to 4218	1041 to 1044	1.00	304	1.00				
4221 to 4224	1041 to 1044	1.00	305	1.00				
4225 to 4228	1041 to 1044	1.00	306	1.00				
4231 to 4234	1041 to 1044	1.00	307	1.00				
4235 to 4238	1041 to 1044	1.00	308	1.00				
4301 to 4304	1051 to 1054	1.00	301	1.00				
4305 to 4308	1051 to 1054	1.00	302	1.00				
4311 to 4314	1051 to 1054	1.00	303	1.00				
4315 to 4318	1051 to 1054	1.00	304	1.00				
4321 to 4324	1051 to 1054	1.00	305	1.00				
4325 to 4328	1051 to 1054	1.00	306	1.00				
4331 to 4334	1051 to 1054	1.00	307	1.00				
4335 to 4338	1051 to 1054	1.00	308	1.00				

## 6.0 RESULTS & SUMMARY

### A. BASIC LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

SACS (2025) \*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\* Company: Company  
DATE 06-OCT-2025 TIME 14:04:37 SEA PAGE 79

\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	CL	USER GENERATED LOADS
2	DL	DEAD
3	LL	USER GENERATED LOADS
4	201	WIND
5	202	WIND
6	203	WIND
7	204	WIND

8	205	WIND
9	206	WIND
10	207	WIND
11	208	WIND
12	301	WIND
13	302	WIND
14	303	WIND
15	304	WIND
16	305	WIND
17	306	WIND
18	307	WIND
19	308	WIND
20	FLX	USER GENERATED LOADS
21	FLY	USER GENERATED LOADS
22	MRLL	USER GENERATED LOADS
23	NGDL	USER GENERATED LOADS
24	PLEM	USER GENERATED LOADS
25	PLOP	USER GENERATED LOADS
26	PLTL	USER GENERATED LOADS

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	CL	0.00	0.00	-31.79	-19.5	739.6	0.0	0.00	0.00
2	DL	-0.00	0.00	-238.10	-185.5	5758.2	-0.0	238.10	0.00
3	LL	0.00	0.00	-131.73	-98.8	3052.8	0.0	0.00	0.00
4	201	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
5	202	0.00	432.89	0.00	-41227.1	0.0	10838.0	0.00	0.00
6	203	0.00	606.10	0.00	-57723.6	0.0	15174.9	0.00	0.00
7	204	0.00	428.58	0.00	-40816.8	0.0	10730.3	0.00	0.00
8	205	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
9	206	0.00	-421.91	0.00	40181.6	0.0	-10170.8	0.00	0.00
10	207	0.00	-596.67	0.00	56825.4	0.0	-14383.7	0.00	0.00
11	208	0.00	-419.53	0.00	39954.5	0.0	-10113.4	0.00	0.00
12	301	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
13	302	0.00	156.70	0.00	-14923.9	0.0	3923.1	0.00	0.00
14	303	0.00	221.61	0.00	-21105.5	0.0	5548.2	0.00	0.00
15	304	0.00	156.70	0.00	-14923.9	0.0	3923.1	0.00	0.00
16	305	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
17	306	0.00	-154.59	0.00	14722.8	0.0	-3726.5	0.00	0.00
18	307	0.00	-218.63	0.00	20821.2	0.0	-5270.1	0.00	0.00
19	308	0.00	-154.59	0.00	14722.8	0.0	-3726.5	0.00	0.00
20	FLX	184.12	0.00	0.00	0.0	17261.4	-138.1	0.00	0.00
21	FLY	0.00	184.12	0.00	-17261.4	0.0	-166.4	0.00	0.00
22	MRLL	0.00	0.00	-20.00	-15.0	426.8	0.0	0.00	0.00
23	NGDL	0.00	0.00	-175.87	-131.6	4198.4	0.0	0.00	0.00
24	PLEM	0.00	0.00	-0.00	-0.0	0.0	0.0	0.00	0.00
25	PLOP	0.00	0.00	-0.00	-0.0	0.0	0.0	0.00	0.00
26	PLTL	0.00	0.00	0.00	0.0	0.1	-0.0	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
27	1000	-0.00	0.00	-468.62	-353.7	11242.0	-0.0
28	1001	-0.00	0.00	-468.62	-353.7	11242.0	-0.0
29	1002	0.00	0.00	-468.62	-353.7	11242.0	-0.0
30	1003	-0.00	0.00	-468.62	-353.7	11241.9	0.0
31	1004	0.00	0.00	-620.35	-467.5	14721.7	-0.0
32	1005	-0.00	0.00	-620.35	-467.5	14721.5	0.0
33	1011	184.12	0.00	-468.62	-353.7	28503.4	-138.1
34	1012	-184.12	0.00	-468.62	-353.7	-6019.9	138.1
35	1013	-0.00	184.12	-468.62	-17615.1	11242.0	-166.4
36	1014	-0.00	-184.12	-468.62	16907.8	11242.0	166.4
37	1021	184.12	0.00	-468.62	-353.7	28503.5	-138.1
38	1022	-184.12	0.00	-468.62	-353.7	-6019.4	138.1
39	1023	0.00	184.12	-468.62	-17615.1	11242.0	-166.4
40	1024	0.00	-184.12	-468.62	16907.8	11242.0	166.4
41	1031	184.12	0.00	-468.62	-353.7	28503.3	-138.1
42	1032	-184.12	0.00	-468.62	-353.7	-6019.6	138.1
43	1033	-0.00	184.12	-468.62	-17615.1	11241.9	-166.4
44	1034	-0.00	-184.12	-468.62	16907.8	11241.9	166.4
45	1041	184.12	0.00	-620.35	-467.5	31983.1	-138.1
46	1042	-184.12	0.00	-620.35	-467.5	-2539.8	138.1
47	1043	0.00	184.12	-620.35	-17728.9	14721.7	-166.4
48	1044	0.00	-184.12	-620.35	16794.0	14721.7	166.4
49	1051	184.12	0.00	-620.35	-467.5	31982.9	-138.1
50	1052	-184.12	0.00	-620.35	-467.5	-2540.0	138.1
51	1053	-0.00	184.12	-620.35	-17728.9	14721.5	-166.4
52	1054	-0.00	-184.12	-620.35	16794.0	14721.5	166.4
53	2001	184.12	0.00	-468.62	-353.7	28503.5	-138.1
54	2002	-184.12	0.00	-468.62	-353.7	-6019.4	138.1
55	2003	0.00	184.12	-468.62	-17615.1	11242.0	-166.4
56	2004	0.00	-184.12	-468.62	16907.8	11242.0	166.4
57	2005	184.12	432.89	-468.62	-41580.7	28503.5	10699.9
58	2006	-184.12	432.89	-468.62	-41580.7	-6019.4	10976.1
59	2007	0.00	617.01	-468.62	-58842.2	11242.0	10671.6
60	2008	0.00	248.77	-468.62	-24319.3	11242.0	11004.5
61	2011	184.12	606.10	-468.62	-58077.3	28503.5	15036.8
62	2012	-184.12	606.10	-468.62	-58077.3	-6019.4	15313.0
63	2013	0.00	790.22	-468.62	-75338.7	11242.0	15008.4
64	2014	0.00	421.98	-468.62	-40815.8	11242.0	15341.3
65	2015	184.12	428.58	-468.62	-41170.4	28503.5	10592.2
66	2016	-184.12	428.58	-468.62	-41170.4	-6019.4	10868.3
67	2017	0.00	612.70	-468.62	-58431.9	11242.0	10563.8
68	2018	0.00	244.46	-468.62	-23909.0	11242.0	10896.7
69	2021	184.12	0.00	-468.62	-353.7	28503.5	-138.1
70	2022	-184.12	0.00	-468.62	-353.7	-6019.4	138.1
71	2023	0.00	184.12	-468.62	-17615.1	11242.0	-166.4

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	Fx (KN)	Fy (KN)	Fz (KN)	Mx (KN-M)	My (KN-M)	Mz (KN-M)
72	2024	0.00	-184.12	-468.62	16907.8	11242.0	166.4
73	2025	184.12	-421.91	-468.62	39827.9	28503.5	-10308.9
74	2026	-184.12	-421.91	-468.62	39827.9	-6019.4	-10032.8
75	2027	0.00	-237.79	-468.62	22566.5	11242.0	-10337.3
76	2028	0.00	-606.03	-468.62	57089.4	11242.0	-10004.4
77	2031	184.12	-596.67	-468.62	56471.7	28503.5	-14521.8
78	2032	-184.12	-596.67	-468.62	56471.7	-6019.4	-14245.7
79	2033	0.00	-412.55	-468.62	39210.3	11242.0	-14550.2
80	2034	0.00	-780.79	-468.62	73733.1	11242.0	-14217.3
81	2035	184.12	-419.53	-468.62	39600.9	28503.5	-10251.5
82	2036	-184.12	-419.53	-468.62	39600.9	-6019.4	-9975.3
83	2037	0.00	-235.41	-468.62	22339.4	11242.0	-10279.9
84	2038	0.00	-603.65	-468.62	56862.3	11242.0	-9947.0
85	3001	184.12	0.00	-468.62	-353.7	28503.3	-138.1
86	3002	-184.12	0.00	-468.62	-353.7	-6019.6	138.1
87	3003	-0.00	184.12	-468.62	-17615.1	11241.9	-166.4
88	3004	-0.00	-184.12	-468.62	16907.8	11241.9	166.4
89	3005	184.12	432.89	-468.62	-41580.7	28503.3	10699.9
90	3006	-184.12	432.89	-468.62	-41580.7	-6019.6	10976.1
91	3007	-0.00	617.01	-468.62	-58842.2	11241.9	10671.6
92	3008	-0.00	248.77	-468.62	-24319.3	11241.9	11004.5
93	3011	184.12	606.10	-468.62	-58077.3	28503.3	15036.8
94	3012	-184.12	606.10	-468.62	-58077.3	-6019.6	15313.0
95	3013	-0.00	790.22	-468.62	-75338.7	11241.9	15008.4
96	3014	-0.00	421.98	-468.62	-40815.8	11241.9	15341.3
97	3015	184.12	428.58	-468.62	-41170.4	28503.3	10592.2
98	3016	-184.12	428.58	-468.62	-41170.4	-6019.6	10868.3
99	3017	-0.00	612.70	-468.62	-58431.9	11241.9	10563.8
100	3018	-0.00	244.46	-468.62	-23909.0	11241.9	10896.7
101	3021	184.12	0.00	-468.62	-353.7	28503.3	-138.1
102	3022	-184.12	0.00	-468.62	-353.7	-6019.6	138.1
103	3023	-0.00	184.12	-468.62	-17615.1	11241.9	-166.4
104	3024	-0.00	-184.12	-468.62	16907.8	11241.9	166.4
105	3025	184.12	-421.91	-468.62	39827.9	28503.3	-10308.9
106	3026	-184.12	-421.91	-468.62	39827.9	-6019.6	-10032.7
107	3027	-0.00	-237.79	-468.62	22566.5	11241.9	-10337.3
108	3028	-0.00	-606.03	-468.62	57089.4	11241.9	-10004.4
109	3031	184.12	-596.67	-468.62	56471.7	28503.3	-14521.8
110	3032	-184.12	-596.67	-468.62	56471.7	-6019.6	-14245.6
111	3033	-0.00	-412.55	-468.62	39210.3	11241.9	-14550.2
112	3034	-0.00	-780.79	-468.62	73733.1	11241.9	-14217.3
113	3035	184.12	-419.53	-468.62	39600.9	28503.3	-10251.5
114	3036	-184.12	-419.53	-468.62	39600.9	-6019.6	-9975.3
115	3037	-0.00	-235.41	-468.62	22339.4	11241.9	-10279.9
116	3038	-0.00	-603.65	-468.62	56862.3	11241.9	-9947.0

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	Fx (KN)	Fy (KN)	Fz (KN)	Mx (KN-M)	My (KN-M)	Mz (KN-M)
117	4001	184.12	0.00	-620.35	-467.5	31983.1	-138.1
118	4002	-184.12	0.00	-620.35	-467.5	-2539.8	138.1
119	4003	0.00	184.12	-620.35	-17728.9	14721.7	-166.4
120	4004	0.00	-184.12	-620.35	16794.0	14721.7	166.4
121	4005	184.12	156.70	-620.35	-15391.3	31983.1	3785.1
122	4006	-184.12	156.70	-620.35	-15391.3	-2539.8	4061.2
123	4007	0.00	340.82	-620.35	-32652.7	14721.7	3756.7
124	4008	0.00	-27.42	-620.35	1870.1	14721.7	4089.6
125	4011	184.12	221.61	-620.35	-21573.0	31983.1	5410.1
126	4012	-184.12	221.61	-620.35	-21573.0	-2539.8	5686.2
127	4013	0.00	405.73	-620.35	-38834.4	14721.7	5381.7
128	4014	0.00	37.49	-620.35	-4311.5	14721.7	5714.6
129	4015	184.12	156.70	-620.35	-15391.3	31983.1	3785.1
130	4016	-184.12	156.70	-620.35	-15391.3	-2539.8	4061.2
131	4017	0.00	340.82	-620.35	-32652.7	14721.7	3756.7
132	4018	0.00	-27.42	-620.35	1870.1	14721.7	4089.6
133	4021	184.12	0.00	-620.35	-467.5	31983.1	-138.1
134	4022	-184.12	0.00	-620.35	-467.5	-2539.8	138.1
135	4023	0.00	184.12	-620.35	-17728.9	14721.7	-166.4
136	4024	0.00	-184.12	-620.35	16794.0	14721.7	166.4
137	4025	184.12	-154.59	-620.35	14255.4	31983.1	-3864.6
138	4026	-184.12	-154.59	-620.35	14255.4	-2539.8	-3588.4
139	4027	0.00	29.53	-620.35	-3006.1	14721.7	-3892.9
140	4028	0.00	-338.71	-620.35	31516.8	14721.7	-3560.1
141	4031	184.12	-218.63	-620.35	20353.7	31983.1	-5408.2
142	4032	-184.12	-218.63	-620.35	20353.7	-2539.8	-5132.0
143	4033	0.00	-34.51	-620.35	3092.3	14721.7	-5436.5
144	4034	0.00	-402.75	-620.35	37615.2	14721.7	-5103.6
145	4035	184.12	-154.59	-620.35	14255.4	31983.1	-3864.6
146	4036	-184.12	-154.59	-620.35	14255.4	-2539.8	-3588.4
147	4037	0.00	29.53	-620.35	-3006.1	14721.7	-3892.9
148	4038	0.00	-338.71	-620.35	31516.8	14721.7	-3560.1
149	5001	184.12	0.00	-620.35	-467.5	31983.1	-138.1
150	5002	-184.12	0.00	-620.35	-467.5	-2539.8	138.1
151	5003	0.00	184.12	-620.35	-17728.9	14721.7	-166.4
152	5004	0.00	-184.12	-620.35	16794.0	14721.7	166.4
153	5005	184.12	156.70	-620.35	-15391.3	31983.1	3785.1
154	5006	-184.12	156.70	-620.35	-15391.3	-2539.8	4061.2
155	5007	0.00	340.82	-620.35	-32652.7	14721.7	3756.7
156	5008	0.00	-27.42	-620.35	1870.1	14721.7	4089.6
157	5011	184.12	221.61	-620.35	-21573.0	31983.1	5410.1
158	5012	-184.12	221.61	-620.35	-21573.0	-2539.8	5686.2
159	5013	0.00	405.73	-620.35	-38834.4	14721.7	5381.7
160	5014	0.00	37.49	-620.35	-4311.5	14721.7	5714.6
161	5015	184.12	156.70	-620.35	-15391.3	31983.1	3785.1

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
162	5016	-184.12	156.70	-620.35	-15391.3	-2539.8	4061.2
163	5017	0.00	340.82	-620.35	-32652.7	14721.7	3756.7
164	5018	0.00	-27.42	-620.35	1870.1	14721.7	4089.6
165	5021	184.12	0.00	-620.35	-467.5	31983.1	-138.1
166	5022	-184.12	0.00	-620.35	-467.5	-2539.8	138.1
167	5023	0.00	184.12	-620.35	-17728.9	14721.7	-166.4
168	5024	0.00	-184.12	-620.35	16794.0	14721.7	166.4
169	5025	184.12	-154.59	-620.35	14255.4	31983.1	-3864.6
170	5026	-184.12	-154.59	-620.35	14255.4	-2539.8	-3588.4
171	5027	0.00	29.53	-620.35	-3006.1	14721.7	-3892.9
172	5028	0.00	-338.71	-620.35	31516.8	14721.7	-3560.1
173	5031	184.12	-218.63	-620.35	20353.7	31983.1	-5408.2
174	5032	-184.12	-218.63	-620.35	20353.7	-2539.8	-5132.0
175	5033	0.00	-34.51	-620.35	3092.3	14721.7	-5436.5
176	5034	0.00	-402.75	-620.35	37615.2	14721.7	-5103.6
177	5035	184.12	-154.59	-620.35	14255.4	31983.1	-3864.6
178	5036	-184.12	-154.59	-620.35	14255.4	-2539.8	-3588.4
179	5037	0.00	29.53	-620.35	-3006.1	14721.7	-3892.9
180	5038	0.00	-338.71	-620.35	31516.8	14721.7	-3560.1



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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
1	CL	0.00				0.00				-31.79	23.27	0.61	19.12
2	DL	-0.00				0.00				-238.10	24.18	0.78	19.65
3	LL	0.00				0.00				-131.73	23.17	0.75	18.00
4	201	0.00				0.00				0.00			
5	202	0.00				432.89	25.04	0.00	19.49	0.00			
6	203	0.00				606.10	25.04	0.00	19.49	0.00			
7	204	0.00				428.58	25.04	0.00	19.49	0.00			
8	205	0.00				0.00				0.00			
9	206	0.00				-421.91	24.11	1.50	19.49	0.00			
10	207	0.00				-596.67	24.11	1.50	19.49	0.00			
11	208	0.00				-419.53	24.11	1.50	19.49	0.00			
12	301	0.00				0.00				0.00			
13	302	0.00				156.70	25.04	0.00	19.49	0.00			
14	303	0.00				221.61	25.04	0.00	19.49	0.00			
15	304	0.00				156.70	25.04	0.00	19.49	0.00			
16	305	0.00				0.00				0.00			
17	306	0.00				-154.59	24.11	1.50	19.49	0.00			
18	307	0.00				-218.63	24.11	1.50	19.49	0.00			
19	308	0.00				-154.59	24.11	1.50	19.49	0.00			
20	FLX	184.12	-0.90	0.75	18.00	0.00				0.00			
21	FLY	0.00				184.12	-0.90	0.75	18.00	0.00			
22	MRLL	0.00				0.00				-20.00	21.34	0.75	21.00
23	NGDL	0.00				0.00				-175.87	23.87	0.75	19.43
24	PLEM	0.00				0.00				-0.00	28.97	0.75	18.00
25	PLOP	0.00				0.00				-0.00	25.92	0.75	18.00
26	PLTL	0.00	25.92	0.75	18.00	0.00				0.00			
27	1000	-0.00				0.00				-468.62	23.99	0.75	19.52
28	1001	-0.00				0.00				-468.62	23.99	0.75	19.52
29	1002	0.00	25.92	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
30	1003	-0.00	25.92	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
31	1004	0.00	25.92	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
32	1005	-0.00	25.92	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
33	1011	184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
34	1012	-184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
35	1013	-0.00				184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
36	1014	-0.00				-184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
37	1021	184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
38	1022	-184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
39	1023	0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
40	1024	0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
41	1031	184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
42	1032	-184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
43	1033	-0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
44	1034	-0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
45	1041	184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1042	-184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
47	1043	0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
48	1044	0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
49	1051	184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
50	1052	-184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
51	1053	-0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
52	1054	-0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
53	2001	184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
54	2002	-184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
55	2003	0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
56	2004	0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
57	2005	184.12	-0.90	0.75	18.00	432.89	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
58	2006	-184.12	-0.90	0.75	18.00	432.89	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
59	2007	0.00	25.92	0.75	18.00	617.01	17.30	0.22	19.04	-468.62	23.99	0.75	19.52
60	2008	0.00	25.92	0.75	18.00	248.77	44.24	-0.56	20.59	-468.62	23.99	0.75	19.52
61	2011	184.12	-0.90	0.75	18.00	606.10	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
62	2012	-184.12	-0.90	0.75	18.00	606.10	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
63	2013	0.00	25.92	0.75	18.00	790.22	18.99	0.17	19.14	-468.62	23.99	0.75	19.52
64	2014	0.00	25.92	0.75	18.00	421.98	36.36	-0.33	20.13	-468.62	23.99	0.75	19.52
65	2015	184.12	-0.90	0.75	18.00	428.58	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
66	2016	-184.12	-0.90	0.75	18.00	428.58	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
67	2017	0.00	25.92	0.75	18.00	612.70	17.24	0.23	19.04	-468.62	23.99	0.75	19.52
68	2018	0.00	25.92	0.75	18.00	244.46	44.57	-0.56	20.61	-468.62	23.99	0.75	19.52
69	2021	184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
70	2022	-184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
71	2023	0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
72	2024	0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
73	2025	184.12	-0.90	0.75	18.00	-421.91	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
74	2026	-184.12	-0.90	0.75	18.00	-421.91	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
75	2027	0.00	25.92	0.75	18.00	-237.79	43.47	2.08	20.64	-468.62	23.99	0.75	19.52
76	2028	0.00	25.92	0.75	18.00	-606.03	16.51	1.27	19.03	-468.62	23.99	0.75	19.52
77	2031	184.12	-0.90	0.75	18.00	-596.67	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
78	2032	-184.12	-0.90	0.75	18.00	-596.67	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
79	2033	0.00	25.92	0.75	18.00	-412.55	35.27	1.83	20.15	-468.62	23.99	0.75	19.52
80	2034	0.00	25.92	0.75	18.00	-780.79	18.21	1.32	19.14	-468.62	23.99	0.75	19.52
81	2035	184.12	-0.90	0.75	18.00	-419.53	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
82	2036	-184.12	-0.90	0.75	18.00	-419.53	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
83	2037	0.00	25.92	0.75	18.00	-235.41	43.67	2.09	20.65	-468.62	23.99	0.75	19.52
84	2038	0.00	25.92	0.75	18.00	-603.65	16.48	1.27	19.03	-468.62	23.99	0.75	19.52
85	3001	184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
86	3002	-184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
87	3003	-0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
88	3004	-0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
89	3005	184.12	-0.90	0.75	18.00	432.89	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
90	3006	-184.12	-0.90	0.75	18.00	432.89	25.04	0.00	19.49	-468.62	23.99	0.75	19.52

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	3007	-0.00	25.92	0.75	18.00	617.01	17.30	0.22	19.04	-468.62	23.99	0.75	19.52
92	3008	-0.00	25.92	0.75	18.00	248.77	44.24	-0.56	20.59	-468.62	23.99	0.75	19.52
93	3011	184.12	-0.90	0.75	18.00	606.10	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
94	3012	-184.12	-0.90	0.75	18.00	606.10	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
95	3013	-0.00	25.92	0.75	18.00	790.22	18.99	0.17	19.14	-468.62	23.99	0.75	19.52
96	3014	-0.00	25.92	0.75	18.00	421.98	36.36	-0.33	20.13	-468.62	23.99	0.75	19.52
97	3015	184.12	-0.90	0.75	18.00	428.58	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
98	3016	-184.12	-0.90	0.75	18.00	428.58	25.04	0.00	19.49	-468.62	23.99	0.75	19.52
99	3017	-0.00	25.92	0.75	18.00	612.70	17.24	0.23	19.04	-468.62	23.99	0.75	19.52
100	3018	-0.00	25.92	0.75	18.00	244.46	44.57	-0.56	20.61	-468.62	23.99	0.75	19.52
101	3021	184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
102	3022	-184.12	-0.90	0.75	18.00	0.00				-468.62	23.99	0.75	19.52
103	3023	-0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
104	3024	-0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-468.62	23.99	0.75	19.52
105	3025	184.12	-0.90	0.75	18.00	-421.91	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
106	3026	-184.12	-0.90	0.75	18.00	-421.91	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
107	3027	-0.00	25.92	0.75	18.00	-237.79	43.47	2.08	20.64	-468.62	23.99	0.75	19.52
108	3028	-0.00	25.92	0.75	18.00	-606.03	16.51	1.27	19.03	-468.62	23.99	0.75	19.52
109	3031	184.12	-0.90	0.75	18.00	-596.67	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
110	3032	-184.12	-0.90	0.75	18.00	-596.67	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
111	3033	-0.00	25.92	0.75	18.00	-412.55	35.27	1.83	20.15	-468.62	23.99	0.75	19.52
112	3034	-0.00	25.92	0.75	18.00	-780.79	18.21	1.32	19.14	-468.62	23.99	0.75	19.52
113	3035	184.12	-0.90	0.75	18.00	-419.53	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
114	3036	-184.12	-0.90	0.75	18.00	-419.53	24.11	1.50	19.49	-468.62	23.99	0.75	19.52
115	3037	-0.00	25.92	0.75	18.00	-235.41	43.67	2.09	20.65	-468.62	23.99	0.75	19.52
116	3038	-0.00	25.92	0.75	18.00	-603.65	16.48	1.27	19.03	-468.62	23.99	0.75	19.52
117	4001	184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
118	4002	-184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
119	4003	0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
120	4004	0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
121	4005	184.12	-0.90	0.75	18.00	156.70	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
122	4006	-184.12	-0.90	0.75	18.00	156.70	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
123	4007	0.00	25.92	0.75	18.00	340.82	11.02	0.41	18.68	-620.35	23.73	0.75	19.24
124	4008	0.00	25.92	0.75	18.00	-27.42	-149.16	5.04	9.51	-620.35	23.73	0.75	19.24
125	4011	184.12	-0.90	0.75	18.00	221.61	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
126	4012	-184.12	-0.90	0.75	18.00	221.61	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
127	4013	0.00	25.92	0.75	18.00	405.73	13.26	0.34	18.81	-620.35	23.73	0.75	19.24
128	4014	0.00	25.92	0.75	18.00	37.49	152.43	-3.68	26.78	-620.35	23.73	0.75	19.24
129	4015	184.12	-0.90	0.75	18.00	156.70	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
130	4016	-184.12	-0.90	0.75	18.00	156.70	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
131	4017	0.00	25.92	0.75	18.00	340.82	11.02	0.41	18.68	-620.35	23.73	0.75	19.24
132	4018	0.00	25.92	0.75	18.00	-27.42	-149.16	5.04	9.51	-620.35	23.73	0.75	19.24
133	4021	184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
134	4022	-184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
135	4023	0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4024	0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
137	4025	184.12	-0.90	0.75	18.00	-154.59	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
138	4026	-184.12	-0.90	0.75	18.00	-154.59	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
139	4027	0.00	25.92	0.75	18.00	29.53	-131.84	-3.18	10.22	-620.35	23.73	0.75	19.24
140	4028	0.00	25.92	0.75	18.00	-338.71	10.51	1.09	18.68	-620.35	23.73	0.75	19.24
141	4031	184.12	-0.90	0.75	18.00	-218.63	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
142	4032	-184.12	-0.90	0.75	18.00	-218.63	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
143	4033	0.00	25.92	0.75	18.00	-34.51	157.56	5.50	27.41	-620.35	23.73	0.75	19.24
144	4034	0.00	25.92	0.75	18.00	-402.75	12.67	1.16	18.81	-620.35	23.73	0.75	19.24
145	4035	184.12	-0.90	0.75	18.00	-154.59	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
146	4036	-184.12	-0.90	0.75	18.00	-154.59	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
147	4037	0.00	25.92	0.75	18.00	29.53	-131.84	-3.18	10.22	-620.35	23.73	0.75	19.24
148	4038	0.00	25.92	0.75	18.00	-338.71	10.51	1.09	18.68	-620.35	23.73	0.75	19.24
149	5001	184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
150	5002	-184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
151	5003	0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
152	5004	0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
153	5005	184.12	-0.90	0.75	18.00	156.70	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
154	5006	-184.12	-0.90	0.75	18.00	156.70	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
155	5007	0.00	25.92	0.75	18.00	340.82	11.02	0.41	18.68	-620.35	23.73	0.75	19.24
156	5008	0.00	25.92	0.75	18.00	-27.42	-149.16	5.04	9.51	-620.35	23.73	0.75	19.24
157	5011	184.12	-0.90	0.75	18.00	221.61	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
158	5012	-184.12	-0.90	0.75	18.00	221.61	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
159	5013	0.00	25.92	0.75	18.00	405.73	13.26	0.34	18.81	-620.35	23.73	0.75	19.24
160	5014	0.00	25.92	0.75	18.00	37.49	152.43	-3.68	26.78	-620.35	23.73	0.75	19.24
161	5015	184.12	-0.90	0.75	18.00	156.70	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
162	5016	-184.12	-0.90	0.75	18.00	156.70	25.04	0.00	19.49	-620.35	23.73	0.75	19.24
163	5017	0.00	25.92	0.75	18.00	340.82	11.02	0.41	18.68	-620.35	23.73	0.75	19.24
164	5018	0.00	25.92	0.75	18.00	-27.42	-149.16	5.04	9.51	-620.35	23.73	0.75	19.24
165	5021	184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
166	5022	-184.12	-0.90	0.75	18.00	0.00				-620.35	23.73	0.75	19.24
167	5023	0.00	25.92	0.75	18.00	184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
168	5024	0.00	25.92	0.75	18.00	-184.12	-0.90	0.75	18.00	-620.35	23.73	0.75	19.24
169	5025	184.12	-0.90	0.75	18.00	-154.59	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
170	5026	-184.12	-0.90	0.75	18.00	-154.59	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
171	5027	0.00	25.92	0.75	18.00	29.53	-131.84	-3.18	10.22	-620.35	23.73	0.75	19.24
172	5028	0.00	25.92	0.75	18.00	-338.71	10.51	1.09	18.68	-620.35	23.73	0.75	19.24
173	5031	184.12	-0.90	0.75	18.00	-218.63	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
174	5032	-184.12	-0.90	0.75	18.00	-218.63	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
175	5033	0.00	25.92	0.75	18.00	-34.51	157.56	5.50	27.41	-620.35	23.73	0.75	19.24
176	5034	0.00	25.92	0.75	18.00	-402.75	12.67	1.16	18.81	-620.35	23.73	0.75	19.24
177	5035	184.12	-0.90	0.75	18.00	-154.59	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
178	5036	-184.12	-0.90	0.75	18.00	-154.59	24.11	1.50	19.49	-620.35	23.73	0.75	19.24
179	5037	0.00	25.92	0.75	18.00	29.53	-131.84	-3.18	10.22	-620.35	23.73	0.75	19.24
180	5038	0.00	25.92	0.75	18.00	-338.71	10.51	1.09	18.68	-620.35	23.73	0.75	19.24

## B. BASIC LOAD CASE SUMMARY SACS OUTPUT AFTER STRENGTHENING

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### \*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\* RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	CL	0.00	0.00	-31.79	-19.5	739.6	0.0	0.00	0.00
2	DL	-0.00	0.00	-277.23	-208.5	6502.0	-0.0	277.23	0.00
3	LL	0.00	0.00	-131.73	-98.8	3052.8	0.0	0.00	0.00
4	201	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
5	202	0.00	432.89	0.00	-41227.1	0.0	10838.0	0.00	0.00
6	203	0.00	606.10	0.00	-57723.6	0.0	15174.9	0.00	0.00
7	204	0.00	428.58	0.00	-40816.8	0.0	10730.3	0.00	0.00
8	205	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
9	206	0.00	-421.91	0.00	40181.6	0.0	-10170.8	0.00	0.00
10	207	0.00	-596.67	0.00	56825.4	0.0	-14383.7	0.00	0.00
11	208	0.00	-419.53	0.00	39954.5	0.0	-10113.4	0.00	0.00
12	301	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
13	302	0.00	156.70	0.00	-14923.9	0.0	3923.1	0.00	0.00
14	303	0.00	221.61	0.00	-21105.5	0.0	5548.2	0.00	0.00
15	304	0.00	156.70	0.00	-14923.9	0.0	3923.1	0.00	0.00
16	305	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
17	306	0.00	-154.59	0.00	14722.8	0.0	-3726.5	0.00	0.00
18	307	0.00	-218.63	0.00	20821.2	0.0	-5270.1	0.00	0.00
19	308	0.00	-154.59	0.00	14722.8	0.0	-3726.5	0.00	0.00
20	FLX	184.12	0.00	0.00	0.0	17261.4	-138.1	0.00	0.00
21	FLY	0.00	184.12	0.00	-17261.4	0.0	-56.9	0.00	0.00
22	MRLL	0.00	0.00	-20.00	-12.6	487.8	0.0	0.00	0.00
23	NGDL	0.00	0.00	-175.87	-131.6	4198.4	0.0	0.00	0.00
24	PLEM	0.00	0.00	-0.00	-0.0	0.0	0.0	0.00	0.00
25	PLOP	0.00	0.00	-0.00	-0.0	0.0	0.0	0.00	0.00
26	PLTL	0.00	0.00	0.00	0.0	0.1	-0.0	0.00	0.00

**COMBINED LOAD CASE SUMMARY SACS OUTPUT AS IN CASE**

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
27	1000	-0.00	0.00	-507.75	-376.7	11985.8	-0.0
28	1001	-0.00	0.00	-507.75	-376.7	11985.8	-0.0
29	1002	0.00	0.00	-507.75	-376.7	11985.9	-0.0
30	1003	-0.00	0.00	-507.75	-376.7	11985.7	0.0
31	1004	0.00	0.00	-659.48	-488.1	15526.5	-0.0
32	1005	-0.00	0.00	-659.48	-488.1	15526.3	0.0
33	1011	184.12	0.00	-507.75	-376.7	29247.3	-138.1
34	1012	-184.12	0.00	-507.75	-376.7	-5275.6	138.1
35	1013	-0.00	184.12	-507.75	-17638.1	11985.8	-56.9
36	1014	-0.00	-184.12	-507.75	16884.8	11985.8	56.9
37	1021	184.12	0.00	-507.75	-376.7	29247.3	-138.1
38	1022	-184.12	0.00	-507.75	-376.7	-5275.5	138.1
39	1023	0.00	184.12	-507.75	-17638.1	11985.9	-56.9
40	1024	0.00	-184.12	-507.75	16884.8	11985.9	56.9
41	1031	184.12	0.00	-507.75	-376.7	29247.2	-138.1
42	1032	-184.12	0.00	-507.75	-376.7	-5275.7	138.1
43	1033	-0.00	184.12	-507.75	-17638.1	11985.7	-56.9
44	1034	-0.00	-184.12	-507.75	16884.8	11985.7	56.9
45	1041	184.12	0.00	-659.48	-488.1	32788.0	-138.1
46	1042	-184.12	0.00	-659.48	-488.1	-1734.9	138.1
47	1043	0.00	184.12	-659.48	-17749.5	15526.5	-56.9
48	1044	0.00	-184.12	-659.48	16773.4	15526.5	56.9
49	1051	184.12	0.00	-659.48	-488.1	32787.8	-138.1
50	1052	-184.12	0.00	-659.48	-488.1	-1735.1	138.1
51	1053	-0.00	184.12	-659.48	-17749.5	15526.3	-56.9
52	1054	-0.00	-184.12	-659.48	16773.4	15526.3	56.9
53	2001	184.12	0.00	-507.75	-376.7	29247.3	-138.1
54	2002	-184.12	0.00	-507.75	-376.7	-5275.5	138.1
55	2003	0.00	184.12	-507.75	-17638.1	11985.9	-56.9
56	2004	0.00	-184.12	-507.75	16884.8	11985.9	56.9
57	2005	184.12	432.89	-507.75	-41603.7	29247.3	10699.9
58	2006	-184.12	432.89	-507.75	-41603.7	-5275.5	10976.1
59	2007	0.00	617.01	-507.75	-58865.2	11985.9	10781.1
60	2008	0.00	248.77	-507.75	-24342.3	11985.9	10894.9
61	2011	184.12	606.10	-507.75	-58100.3	29247.3	15036.8
62	2012	-184.12	606.10	-507.75	-58100.3	-5275.5	15313.0
63	2013	0.00	790.22	-507.75	-75361.7	11985.9	15118.0
64	2014	0.00	421.98	-507.75	-40838.8	11985.9	15231.8
65	2015	184.12	428.58	-507.75	-41193.4	29247.3	10592.2
66	2016	-184.12	428.58	-507.75	-41193.4	-5275.5	10868.3
67	2017	0.00	612.70	-507.75	-58454.9	11985.9	10673.4
68	2018	0.00	244.46	-507.75	-23932.0	11985.9	10787.1
69	2021	184.12	0.00	-507.75	-376.7	29247.3	-138.1
70	2022	-184.12	0.00	-507.75	-376.7	-5275.5	138.1
71	2023	0.00	184.12	-507.75	-17638.1	11985.9	-56.9

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	Fx (KN)	Fy (KN)	Fz (KN)	Mx (KN-M)	My (KN-M)	Mz (KN-M)
72	2024	0.00	-184.12	-507.75	16884.8	11985.9	56.9
73	2025	184.12	-421.91	-507.75	39804.9	29247.3	-10308.9
74	2026	-184.12	-421.91	-507.75	39804.9	-5275.5	-10032.8
75	2027	0.00	-237.79	-507.75	22543.5	11985.9	-10227.7
76	2028	0.00	-606.03	-507.75	57066.4	11985.9	-10113.9
77	2031	184.12	-596.67	-507.75	56448.7	29247.3	-14521.8
78	2032	-184.12	-596.67	-507.75	56448.7	-5275.5	-14245.7
79	2033	0.00	-412.55	-507.75	39187.3	11985.9	-14440.6
80	2034	0.00	-780.79	-507.75	73710.1	11985.9	-14326.8
81	2035	184.12	-419.53	-507.75	39577.9	29247.3	-10251.5
82	2036	-184.12	-419.53	-507.75	39577.9	-5275.5	-9975.3
83	2037	0.00	-235.41	-507.75	22316.4	11985.9	-10170.3
84	2038	0.00	-603.65	-507.75	56839.3	11985.9	-10056.5
85	3001	184.12	0.00	-507.75	-376.7	29247.2	-138.1
86	3002	-184.12	0.00	-507.75	-376.7	-5275.7	138.1
87	3003	-0.00	184.12	-507.75	-17638.1	11985.7	-56.9
88	3004	-0.00	-184.12	-507.75	16884.8	11985.7	56.9
89	3005	184.12	432.89	-507.75	-41603.7	29247.2	10699.9
90	3006	-184.12	432.89	-507.75	-41603.7	-5275.7	10976.1
91	3007	-0.00	617.01	-507.75	-58865.2	11985.7	10781.1
92	3008	-0.00	248.77	-507.75	-24342.3	11985.7	10894.9
93	3011	184.12	606.10	-507.75	-58100.3	29247.2	15036.8
94	3012	-184.12	606.10	-507.75	-58100.3	-5275.7	15313.0
95	3013	-0.00	790.22	-507.75	-75361.7	11985.7	15118.0
96	3014	-0.00	421.98	-507.75	-40838.8	11985.7	15231.8
97	3015	184.12	428.58	-507.75	-41193.4	29247.2	10592.2
98	3016	-184.12	428.58	-507.75	-41193.4	-5275.7	10868.3
99	3017	-0.00	612.70	-507.75	-58454.9	11985.7	10673.4
100	3018	-0.00	244.46	-507.75	-23932.0	11985.7	10787.1
101	3021	184.12	0.00	-507.75	-376.7	29247.2	-138.1
102	3022	-184.12	0.00	-507.75	-376.7	-5275.7	138.1
103	3023	-0.00	184.12	-507.75	-17638.1	11985.7	-56.9
104	3024	-0.00	-184.12	-507.75	16884.8	11985.7	56.9
105	3025	184.12	-421.91	-507.75	39804.9	29247.2	-10308.9
106	3026	-184.12	-421.91	-507.75	39804.9	-5275.7	-10032.7
107	3027	-0.00	-237.79	-507.75	22543.5	11985.7	-10227.7
108	3028	-0.00	-606.03	-507.75	57066.4	11985.7	-10113.9
109	3031	184.12	-596.67	-507.75	56448.7	29247.2	-14521.8
110	3032	-184.12	-596.67	-507.75	56448.7	-5275.7	-14245.6
111	3033	-0.00	-412.55	-507.75	39187.3	11985.7	-14440.6
112	3034	-0.00	-780.79	-507.75	73710.1	11985.7	-14326.8
113	3035	184.12	-419.53	-507.75	39577.9	29247.2	-10251.5
114	3036	-184.12	-419.53	-507.75	39577.9	-5275.7	-9975.3
115	3037	-0.00	-235.41	-507.75	22316.4	11985.7	-10170.3
116	3038	-0.00	-603.65	-507.75	56839.3	11985.7	-10056.5

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	Fx (KN)	Fy (KN)	Fz (KN)	Mx (KN-M)	My (KN-M)	Mz (KN-M)
117	4001	184.12	0.00	-659.48	-488.1	32788.0	-138.1
118	4002	-184.12	0.00	-659.48	-488.1	-1734.9	138.1
119	4003	0.00	184.12	-659.48	-17749.5	15526.5	-56.9
120	4004	0.00	-184.12	-659.48	16773.4	15526.5	56.9
121	4005	184.12	156.70	-659.48	-15411.9	32788.0	3785.1
122	4006	-184.12	156.70	-659.48	-15411.9	-1734.9	4061.2
123	4007	0.00	340.82	-659.48	-32673.3	15526.5	3866.2
124	4008	0.00	-27.42	-659.48	1849.5	15526.5	3980.0
125	4011	184.12	221.61	-659.48	-21593.6	32788.0	5410.1
126	4012	-184.12	221.61	-659.48	-21593.6	-1734.9	5686.2
127	4013	0.00	405.73	-659.48	-38855.0	15526.5	5491.3
128	4014	0.00	37.49	-659.48	-4332.1	15526.5	5605.1
129	4015	184.12	156.70	-659.48	-15411.9	32788.0	3785.1
130	4016	-184.12	156.70	-659.48	-15411.9	-1734.9	4061.2
131	4017	0.00	340.82	-659.48	-32673.3	15526.5	3866.2
132	4018	0.00	-27.42	-659.48	1849.5	15526.5	3980.0
133	4021	184.12	0.00	-659.48	-488.1	32788.0	-138.1
134	4022	-184.12	0.00	-659.48	-488.1	-1734.9	138.1
135	4023	0.00	184.12	-659.48	-17749.5	15526.5	-56.9
136	4024	0.00	-184.12	-659.48	16773.4	15526.5	56.9
137	4025	184.12	-154.59	-659.48	14234.7	32788.0	-3864.6
138	4026	-184.12	-154.59	-659.48	14234.7	-1734.9	-3588.4
139	4027	0.00	29.53	-659.48	-3026.7	15526.5	-3783.4
140	4028	0.00	-338.71	-659.48	31496.2	15526.5	-3669.6
141	4031	184.12	-218.63	-659.48	20333.1	32788.0	-5408.2
142	4032	-184.12	-218.63	-659.48	20333.1	-1734.9	-5132.0
143	4033	0.00	-34.51	-659.48	3071.7	15526.5	-5327.0
144	4034	0.00	-402.75	-659.48	37594.6	15526.5	-5213.2
145	4035	184.12	-154.59	-659.48	14234.8	32788.0	-3864.6
146	4036	-184.12	-154.59	-659.48	14234.8	-1734.9	-3588.4
147	4037	0.00	29.53	-659.48	-3026.7	15526.5	-3783.4
148	4038	0.00	-338.71	-659.48	31496.2	15526.5	-3669.6
149	5001	184.12	0.00	-659.48	-488.1	32788.0	-138.1
150	5002	-184.12	0.00	-659.48	-488.1	-1734.9	138.1
151	5003	0.00	184.12	-659.48	-17749.5	15526.5	-56.9
152	5004	0.00	-184.12	-659.48	16773.4	15526.5	56.9
153	5005	184.12	156.70	-659.48	-15411.9	32788.0	3785.1
154	5006	-184.12	156.70	-659.48	-15411.9	-1734.9	4061.2
155	5007	0.00	340.82	-659.48	-32673.3	15526.5	3866.2
156	5008	0.00	-27.42	-659.48	1849.5	15526.5	3980.0
157	5011	184.12	221.61	-659.48	-21593.6	32788.0	5410.1
158	5012	-184.12	221.61	-659.48	-21593.6	-1734.9	5686.2
159	5013	0.00	405.73	-659.48	-38855.0	15526.5	5491.3
160	5014	0.00	37.49	-659.48	-4332.1	15526.5	5605.1
161	5015	184.12	156.70	-659.48	-15411.9	32788.0	3785.1



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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
162	5016	-184.12	156.70	-659.48	-15411.9	-1734.9	4061.2
163	5017	0.00	340.82	-659.48	-32673.3	15526.5	3866.2
164	5018	0.00	-27.42	-659.48	1849.5	15526.5	3980.0
165	5021	184.12	0.00	-659.48	-488.1	32788.0	-138.1
166	5022	-184.12	0.00	-659.48	-488.1	-1734.9	138.1
167	5023	0.00	184.12	-659.48	-17749.5	15526.5	-56.9
168	5024	0.00	-184.12	-659.48	16773.4	15526.5	56.9
169	5025	184.12	-154.59	-659.48	14234.7	32788.0	-3864.6
170	5026	-184.12	-154.59	-659.48	14234.7	-1734.9	-3588.4
171	5027	0.00	29.53	-659.48	-3026.7	15526.5	-3783.4
172	5028	0.00	-338.71	-659.48	31496.2	15526.5	-3669.6
173	5031	184.12	-218.63	-659.48	20333.1	32788.0	-5408.2
174	5032	-184.12	-218.63	-659.48	20333.1	-1734.9	-5132.0
175	5033	0.00	-34.51	-659.48	3071.7	15526.5	-5327.0
176	5034	0.00	-402.75	-659.48	37594.6	15526.5	-5213.2
177	5035	184.12	-154.59	-659.48	14234.8	32788.0	-3864.6
178	5036	-184.12	-154.59	-659.48	14234.8	-1734.9	-3588.4
179	5037	0.00	29.53	-659.48	-3026.7	15526.5	-3783.4
180	5038	0.00	-338.71	-659.48	31496.2	15526.5	-3669.6

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Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD	LOAD	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
1	CL	0.00				0.00				-31.79	23.27	0.61	19.12
2	DL	-0.00				0.00				-277.23	23.45	0.75	19.52
3	LL	0.00				0.00				-131.73	23.17	0.75	18.00
4	201	0.00				0.00				0.00			
5	202	0.00				432.89	25.04	0.00	19.49	0.00			
6	203	0.00				606.10	25.04	0.00	19.49	0.00			
7	204	0.00				428.58	25.04	0.00	19.49	0.00			
8	205	0.00				0.00				0.00			
9	206	0.00				-421.91	24.11	1.50	19.49	0.00			
10	207	0.00				-596.67	24.11	1.50	19.49	0.00			
11	208	0.00				-419.53	24.11	1.50	19.49	0.00			
12	301	0.00				0.00				0.00			
13	302	0.00				156.70	25.04	0.00	19.49	0.00			
14	303	0.00				221.61	25.04	0.00	19.49	0.00			
15	304	0.00				156.70	25.04	0.00	19.49	0.00			
16	305	0.00				0.00				0.00			
17	306	0.00				-154.59	24.11	1.50	19.49	0.00			
18	307	0.00				-218.63	24.11	1.50	19.49	0.00			
19	308	0.00				-154.59	24.11	1.50	19.49	0.00			
20	FLX	184.12	-0.31	0.75	18.00	0.00				0.00			
21	FLY	0.00				184.12	-0.31	0.75	18.00	0.00			
22	MRLL	0.00				0.00				-20.00	24.39	0.63	21.00
23	NGDL	0.00				0.00				-175.87	23.87	0.75	19.43
24	PLEM	0.00				0.00				-0.00	28.97	0.75	18.00
25	PLOP	0.00				0.00				-0.00	25.92	0.75	18.00
26	PLTL	0.00	25.92	0.75	18.00	0.00				0.00			
27	1000	-0.00				0.00				-507.75	23.61	0.74	19.46
28	1001	-0.00				0.00				-507.75	23.61	0.74	19.46
29	1002	0.00	25.92	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
30	1003	-0.00	25.91	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
31	1004	0.00	25.92	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
32	1005	-0.00	25.91	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
33	1011	184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
34	1012	-184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
35	1013	-0.00				184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
36	1014	-0.00				-184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
37	1021	184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
38	1022	-184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
39	1023	0.00	25.92	0.75	18.00	184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
40	1024	0.00	25.92	0.75	18.00	-184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
41	1031	184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
42	1032	-184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
43	1033	-0.00	25.91	0.75	18.00	184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
44	1034	-0.00	25.91	0.75	18.00	-184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
45	1041	184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21

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Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** FORCE (KN)	X - DIRECTION X (M)	Y (M)	Z (M)	***** FORCE (KN)	Y - DIRECTION X (M)	Y (M)	Z (M)	***** FORCE (KN)	Z - DIRECTION X (M)	Y (M)	Z (M)
46	1042	-184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
47	1043	0.00	25.92	0.75	18.00	184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
48	1044	0.00	25.92	0.75	18.00	-184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
49	1051	184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
50	1052	-184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
51	1053	-0.00	25.91	0.75	18.00	184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
52	1054	-0.00	25.91	0.75	18.00	-184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
53	2001	184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
54	2002	-184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
55	2003	0.00	25.92	0.75	18.00	184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
56	2004	0.00	25.92	0.75	18.00	-184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
57	2005	184.12	-0.31	0.75	18.00	432.89	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
58	2006	-184.12	-0.31	0.75	18.00	432.89	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
59	2007	0.00	25.92	0.75	18.00	617.01	17.47	0.22	19.04	-507.75	23.61	0.74	19.46
60	2008	0.00	25.92	0.75	18.00	248.77	43.80	-0.56	20.59	-507.75	23.61	0.74	19.46
61	2011	184.12	-0.31	0.75	18.00	606.10	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
62	2012	-184.12	-0.31	0.75	18.00	606.10	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
63	2013	0.00	25.92	0.75	18.00	790.22	19.13	0.17	19.14	-507.75	23.61	0.74	19.46
64	2014	0.00	25.92	0.75	18.00	421.98	36.10	-0.33	20.13	-507.75	23.61	0.74	19.46
65	2015	184.12	-0.31	0.75	18.00	428.58	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
66	2016	-184.12	-0.31	0.75	18.00	428.58	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
67	2017	0.00	25.92	0.75	18.00	612.70	17.42	0.23	19.04	-507.75	23.61	0.74	19.46
68	2018	0.00	25.92	0.75	18.00	244.46	44.13	-0.56	20.61	-507.75	23.61	0.74	19.46
69	2021	184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
70	2022	-184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
71	2023	0.00	25.92	0.75	18.00	184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
72	2024	0.00	25.92	0.75	18.00	-184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
73	2025	184.12	-0.31	0.75	18.00	-421.91	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
74	2026	-184.12	-0.31	0.75	18.00	-421.91	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
75	2027	0.00	25.92	0.75	18.00	-237.79	43.01	2.08	20.64	-507.75	23.61	0.74	19.46
76	2028	0.00	25.92	0.75	18.00	-606.03	16.69	1.27	19.03	-507.75	23.61	0.74	19.46
77	2031	184.12	-0.31	0.75	18.00	-596.67	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
78	2032	-184.12	-0.31	0.75	18.00	-596.67	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
79	2033	0.00	25.92	0.75	18.00	-412.55	35.00	1.83	20.15	-507.75	23.61	0.74	19.46
80	2034	0.00	25.92	0.75	18.00	-780.79	18.35	1.32	19.14	-507.75	23.61	0.74	19.46
81	2035	184.12	-0.31	0.75	18.00	-419.53	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
82	2036	-184.12	-0.31	0.75	18.00	-419.53	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
83	2037	0.00	25.92	0.75	18.00	-235.41	43.20	2.09	20.65	-507.75	23.61	0.74	19.46
84	2038	0.00	25.92	0.75	18.00	-603.65	16.66	1.27	19.03	-507.75	23.61	0.74	19.46
85	3001	184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
86	3002	-184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
87	3003	-0.00	25.91	0.75	18.00	184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
88	3004	-0.00	25.91	0.75	18.00	-184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
89	3005	184.12	-0.31	0.75	18.00	432.89	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
90	3006	-184.12	-0.31	0.75	18.00	432.89	25.04	0.00	19.49	-507.75	23.61	0.74	19.46

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	3007	-0.00	25.91	0.75	18.00	617.01	17.47	0.22	19.04	-507.75	23.61	0.74	19.46
92	3008	-0.00	25.91	0.75	18.00	248.77	43.80	-0.56	20.59	-507.75	23.61	0.74	19.46
93	3011	184.12	-0.31	0.75	18.00	606.10	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
94	3012	-184.12	-0.31	0.75	18.00	606.10	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
95	3013	-0.00	25.91	0.75	18.00	790.22	19.13	0.17	19.14	-507.75	23.61	0.74	19.46
96	3014	-0.00	25.91	0.75	18.00	421.98	36.10	-0.33	20.13	-507.75	23.61	0.74	19.46
97	3015	184.12	-0.31	0.75	18.00	428.58	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
98	3016	-184.12	-0.31	0.75	18.00	428.58	25.04	0.00	19.49	-507.75	23.61	0.74	19.46
99	3017	-0.00	25.91	0.75	18.00	612.70	17.42	0.23	19.04	-507.75	23.61	0.74	19.46
100	3018	-0.00	25.91	0.75	18.00	244.46	44.13	-0.56	20.61	-507.75	23.61	0.74	19.46
101	3021	184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
102	3022	-184.12	-0.31	0.75	18.00	0.00				-507.75	23.61	0.74	19.46
103	3023	-0.00	25.91	0.75	18.00	184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
104	3024	-0.00	25.91	0.75	18.00	-184.12	-0.31	0.75	18.00	-507.75	23.61	0.74	19.46
105	3025	184.12	-0.31	0.75	18.00	-421.91	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
106	3026	-184.12	-0.31	0.75	18.00	-421.91	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
107	3027	-0.00	25.91	0.75	18.00	-237.79	43.01	2.08	20.64	-507.75	23.61	0.74	19.46
108	3028	-0.00	25.91	0.75	18.00	-606.03	16.69	1.27	19.03	-507.75	23.61	0.74	19.46
109	3031	184.12	-0.31	0.75	18.00	-596.67	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
110	3032	-184.12	-0.31	0.75	18.00	-596.67	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
111	3033	-0.00	25.91	0.75	18.00	-412.55	35.00	1.83	20.15	-507.75	23.61	0.74	19.46
112	3034	-0.00	25.91	0.75	18.00	-780.79	18.35	1.32	19.14	-507.75	23.61	0.74	19.46
113	3035	184.12	-0.31	0.75	18.00	-419.53	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
114	3036	-184.12	-0.31	0.75	18.00	-419.53	24.11	1.50	19.49	-507.75	23.61	0.74	19.46
115	3037	-0.00	25.91	0.75	18.00	-235.41	43.20	2.09	20.65	-507.75	23.61	0.74	19.46
116	3038	-0.00	25.91	0.75	18.00	-603.65	16.66	1.27	19.03	-507.75	23.61	0.74	19.46
117	4001	184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
118	4002	-184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
119	4003	0.00	25.92	0.75	18.00	184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
120	4004	0.00	25.92	0.75	18.00	-184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
121	4005	184.12	-0.31	0.75	18.00	156.70	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
122	4006	-184.12	-0.31	0.75	18.00	156.70	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
123	4007	0.00	25.92	0.75	18.00	340.82	11.34	0.41	18.68	-659.48	23.54	0.74	19.21
124	4008	0.00	25.92	0.75	18.00	-27.42	-145.16	5.04	9.51	-659.48	23.54	0.74	19.21
125	4011	184.12	-0.31	0.75	18.00	221.61	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
126	4012	-184.12	-0.31	0.75	18.00	221.61	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
127	4013	0.00	25.92	0.75	18.00	405.73	13.53	0.34	18.81	-659.48	23.54	0.74	19.21
128	4014	0.00	25.92	0.75	18.00	37.49	149.51	-3.68	26.78	-659.48	23.54	0.74	19.21
129	4015	184.12	-0.31	0.75	18.00	156.70	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
130	4016	-184.12	-0.31	0.75	18.00	156.70	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
131	4017	0.00	25.92	0.75	18.00	340.82	11.34	0.41	18.68	-659.48	23.54	0.74	19.21
132	4018	0.00	25.92	0.75	18.00	-27.42	-145.16	5.04	9.51	-659.48	23.54	0.74	19.21
133	4021	184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
134	4022	-184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
135	4023	0.00	25.92	0.75	18.00	184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 06-OCT-2025 TIME 15:41:20 SEA PAGE 98

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****			***** Y - DIRECTION *****			***** Z - DIRECTION *****			***** Z - DIRECTION *****		
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4024	0.00	25.92	0.75	18.00	-184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
137	4025	184.12	-0.31	0.75	18.00	-154.59	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
138	4026	-184.12	-0.31	0.75	18.00	-154.59	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
139	4027	0.00	25.92	0.75	18.00	29.53	-128.13	-3.18	10.22	-659.48	23.54	0.74	19.21
140	4028	0.00	25.92	0.75	18.00	-338.71	10.83	1.09	18.68	-659.48	23.54	0.74	19.21
141	4031	184.12	-0.31	0.75	18.00	-218.63	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
142	4032	-184.12	-0.31	0.75	18.00	-218.63	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
143	4033	0.00	25.92	0.75	18.00	-34.51	154.38	5.50	27.41	-659.48	23.54	0.74	19.21
144	4034	0.00	25.92	0.75	18.00	-402.75	12.94	1.16	18.81	-659.48	23.54	0.74	19.21
145	4035	184.12	-0.31	0.75	18.00	-154.59	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
146	4036	-184.12	-0.31	0.75	18.00	-154.59	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
147	4037	0.00	25.92	0.75	18.00	29.53	-128.13	-3.18	10.22	-659.48	23.54	0.74	19.21
148	4038	0.00	25.92	0.75	18.00	-338.71	10.83	1.09	18.68	-659.48	23.54	0.74	19.21
149	5001	184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
150	5002	-184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
151	5003	0.00	25.92	0.75	18.00	184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
152	5004	0.00	25.92	0.75	18.00	-184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
153	5005	184.12	-0.31	0.75	18.00	156.70	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
154	5006	-184.12	-0.31	0.75	18.00	156.70	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
155	5007	0.00	25.92	0.75	18.00	340.82	11.34	0.41	18.68	-659.48	23.54	0.74	19.21
156	5008	0.00	25.92	0.75	18.00	-27.42	-145.16	5.04	9.51	-659.48	23.54	0.74	19.21
157	5011	184.12	-0.31	0.75	18.00	221.61	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
158	5012	-184.12	-0.31	0.75	18.00	221.61	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
159	5013	0.00	25.92	0.75	18.00	405.73	13.53	0.34	18.81	-659.48	23.54	0.74	19.21
160	5014	0.00	25.92	0.75	18.00	37.49	149.51	-3.68	26.78	-659.48	23.54	0.74	19.21
161	5015	184.12	-0.31	0.75	18.00	156.70	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
162	5016	-184.12	-0.31	0.75	18.00	156.70	25.04	0.00	19.49	-659.48	23.54	0.74	19.21
163	5017	0.00	25.92	0.75	18.00	340.82	11.34	0.41	18.68	-659.48	23.54	0.74	19.21
164	5018	0.00	25.92	0.75	18.00	-27.42	-145.16	5.04	9.51	-659.48	23.54	0.74	19.21
165	5021	184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
166	5022	-184.12	-0.31	0.75	18.00	0.00				-659.48	23.54	0.74	19.21
167	5023	0.00	25.92	0.75	18.00	184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
168	5024	0.00	25.92	0.75	18.00	-184.12	-0.31	0.75	18.00	-659.48	23.54	0.74	19.21
169	5025	184.12	-0.31	0.75	18.00	-154.59	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
170	5026	-184.12	-0.31	0.75	18.00	-154.59	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
171	5027	0.00	25.92	0.75	18.00	29.53	-128.13	-3.18	10.22	-659.48	23.54	0.74	19.21
172	5028	0.00	25.92	0.75	18.00	-338.71	10.83	1.09	18.68	-659.48	23.54	0.74	19.21
173	5031	184.12	-0.31	0.75	18.00	-218.63	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
174	5032	-184.12	-0.31	0.75	18.00	-218.63	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
175	5033	0.00	25.92	0.75	18.00	-34.51	154.38	5.50	27.41	-659.48	23.54	0.74	19.21
176	5034	0.00	25.92	0.75	18.00	-402.75	12.94	1.16	18.81	-659.48	23.54	0.74	19.21
177	5035	184.12	-0.31	0.75	18.00	-154.59	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
178	5036	-184.12	-0.31	0.75	18.00	-154.59	24.11	1.50	19.49	-659.48	23.54	0.74	19.21
179	5037	0.00	25.92	0.75	18.00	29.53	-128.13	-3.18	10.22	-659.48	23.54	0.74	19.21
180	5038	0.00	25.92	0.75	18.00	-338.71	10.83	1.09	18.68	-659.48	23.54	0.74	19.21

## 6.1 Member Unity Check Result

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

### 6.1a AS-IS CONDITION

#### Member Unity Check Result

Member	Group ID	Load Case	UC
0001-0011	B1A	2031	2.391
0069-0070	B2F	2011	1.096
0071-0076	B2H	2011	1.092
0001-0080	D1A	4032	2.07
0083-0017	D1D	4012	1.142
0012-0087	D4A	2011	1.934
0012-0001	H2A	3032	5.839
0011-0002	H2B	2011	1.301
0071-0070	H3G	2011	1.053
0072-0076	H3H	3012	1.163
0087-0203	K1A	2032	1.029
0200-0080	K1A	2032	1.656
0200-0203	K1A	2032	1.265
0359-0097	K1R	3012	1.281
0359-0358	K1R	2012	1.499
0206-0200	K2A	2032	1.04
0345-0360	K2R	2031	1.231
0203-0207	K3A	2032	1.116
0359-0361	K3R	2012	1.295
0194-0206	KB1	4032	1.341
0207-0195	KB1	2032	1.181
0349-0360	KB1	2031	1.931
0361-0348	KB1	2012	1.314
0108-0110	L1F	2011	1.019
0112-0114	L1H	2011	1.019
0114-0116	L1I	2011	1.02
0118-0120	L1K	2011	1.007
0120-0122	L1K	2011	1.01
0113-0115	L2H	2032	1.031

Member	Group ID	Load Case	UC
0115-0117	L2I	2032	1.11
0125-0123	L2L	2032	1.025
0125-0127	L2M	2032	1.011
0127-0129	L2N	2032	1.014
0131-0133	L2P	3032	6.309
0133-0135	L2Q	2032	1.084
0135-0137	L2R	3032	1.084
0139-0141	L2T	2032	1.007
0000-0001	L3A	2032	2.086
0001-0002	L3B	2032	1.86
0017-0019	L3E	2032	1.093
0021-0023	L3F	2032	1.135
0023-0025	L3G	2032	1.091
0025-0027	L3H	2032	1.222
0027-0029	L3I	2032	1.277
0029-0031	L3I	2032	1.485
0033-0035	L3J	2032	1.032
0035-0037	L3K	2032	1.414
0037-0039	L3K	2032	1.498
0039-0041	L3L	2032	1.551
0041-0043	L3M	3032	1.507
0043-0045	L3M	2032	1.507
0045-0047	L3N	3032	1.496
0047-0049	L3O	3032	1.462
0049-0051	L3O	3032	1.337
0051-0053	L3O	3032	1.344
0053-0055	L3O	3032	1.164
0055-0057	L3O	3032	1.171
0057-0059	L3P	3032	1.03
0059-0061	L3P	3032	1.041
0013-0012	L4A	2011	6.247
0012-0011	L4B	2012	1.691
0020-0022	L4F	2012	1.072

Member	Group ID	Load Case	UC
0022-0024	L4F	2012	1.283
0024-0026	L4G	2012	1.266
0026-0028	L4H	2012	1.057
0028-0030	L4I	2012	1.308
0038-0040	L4L	2012	1.13
0040-0042	L4L	2012	1.094
0044-0046	L4N	3012	1.015
0046-0048	L4O	3012	1.1
0048-0050	L4O	3012	1.038
0002-0188	V1A	4012	1.342
0188-0194	V1A	4032	1.232
0194-0080	V1A	4032	1.38
0003-0190	V1B	4012	1.017
0017-0216	V1D	4011	1.1
0226-0092	V1D	4011	1.002
0021-0256	V1E	4012	1.051
0025-0270	V1F	4012	1.059
0073-0345	V1R	2031	2.031
0011-0189	V4A	2011	1.271
0195-0087	V4A	2011	1.036
0072-0344	V4R	2012	1.204

#### 6.1b AFTER STRENGTHENING

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

##### Member Unity Check Result

Member	Group ID	Load Case	UC	Remarks
0078-0088	DX1	2011	1.053	Member UC has increased marginally.
0005-0017	L3E	2012	1.028	
0359-0358	K1R	2012	1.013	

#### 6.2 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below



#### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum Vertical Deflection (cm)	Remarks
1.	0124	7.4	Allowable Deflection = (4840.1 / 400) = 12.1 cm
2.	0310	7.3	

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	0132	5	Allowable Deflection = (4840.1 / 500) = 9.68 cm
2.	0134	4.9	

Vertical and Horizontal Deflection of bridge are under control.

### 6.3 Reaction Summary

Following is the reaction summary of the bridge supports.

#### Summary of Bridge Reaction

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	0072	0	0	438.074
2.	0073	0	0	359.191
3.	0076	184.121	257.844	0
4.	0001	0	4705.201	494.953
5.	0012	0	4349.398	420.035

## 7.0 CONCLUSION

The analysis of bridge has been carried out considering the piping, electrical & instrumentation cable tray and wind loads. Based on the results, the necessary strengthening requirements, as outlined in Clause 4.0, have been recommended. With the implementation of these strengthening measures of the top chord, bottom chord, and associated framing members, the bridge is found to be structurally adequate and safe under all load combinations.

Also, functionally the deflection is under the limits. The adequacy of the bridge landing locations, adequacy of deck members are performed separately.

It is also recommended that no additional structural loading/modifications shall be carried out on ICW-ICG bridge without adequate structural analysis.

**ANNEXURE-1  
LOAD CALCULATIONS**

**WIND LOAD:**

S.No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulence Intensity at height "z"	t <sub>o</sub>	t	Design Wind Speed at Height "z"	
			U <sub>o</sub>			z		U(z)	Iu(z)			u(z,t)	
			kmph	ft/sec		m	ft	ft/sec		sec	sec	ft/sec	m/sec
1	Extreme	0	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
2	Extreme	45	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	187.59	61.78
3	Extreme	90	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	187.59	61.78
4	Extreme	135	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	187.59	61.78
5	Extreme	180	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	187.59	61.78
6	Extreme	225	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	187.59	61.78
7	Extreme	270	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	187.59	61.78
8	Extreme	315	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	187.59	61.78
1	Operating	All	99.22	90.40	0.130	10.00	32.80	90.40	0.131	3600	3	124.84	38.06

**CABLE LOAD&CABLE TRAY LOAD:**

<b>3 CABLE TRAY AND CABLE LOADING</b>			
Cable Tray	5	kg/3m	
E&I TRAY 150mm			
Length	48.401	m	
Load	80.66833	kg	
	<b>0.791356</b>	<b>kN</b>	(Top and middle, ie; load x2)
<b>Top</b>			
<b>Cable</b>			<b>Load</b>
3C x 2.5m <sup>2</sup>	162	kg/km	15.68192 kg
3Cx4m <sup>2</sup>	530	kg/km	51.30506 kg
24Px1m <sup>2</sup>	2545	kg/km	246.3611 kg
<b>Total</b>			313.3481 kg
<b>Total load</b>			<b>3.073945 kN</b>
<b>Middle</b>			
<b>Cable</b>			<b>Load</b>
3C x 2.5m <sup>2</sup>	162	kg/km	15.68192 kg
3Cx4m <sup>2</sup>	530	kg/km	51.30506 kg
24Px1m <sup>2</sup>	2545	kg/km	246.3611 kg
<b>Total</b>			313.3481 kg
<b>Total load</b>			<b>3.073945 kN</b>
<b>Bottom</b>			
Cable Tray 1			
E&I TRAY 150mm			
Length	9.1375	m	
Load	15.22917	kg	
	<b>0.149398</b>	<b>kN</b>	
<b>Cable</b>			<b>Load</b>
3C x 2.5m <sup>2</sup>	162	kg/km	2.96055 kg
3Cx4m <sup>2</sup>	530	kg/km	9.68575 kg
24Px1m <sup>2</sup>	2545	kg/km	46.50988 kg
<b>Total</b>			59.15618 kg
<b>Total load</b>			<b>0.580322 kN</b>
Cable Tray 2			
E&I TRAY 150mm			
Length	48.401	m	
Load	80.66833	kg	
	<b>0.791356</b>	<b>kN</b>	

<b>Cable x 3</b>			<b>Load</b>	
3C x 2.5m <sup>2</sup>	162	kg/km	15.68192	kg
3Cx4m <sup>2</sup>	530	kg/km	51.30506	kg
24Px1m <sup>2</sup>	2545	kg/km	246.3611	kg
<b>Total</b>			940.0442	kg
<b>Total load</b>			<b>9.221834</b>	<b>kN</b>
<b>Total Load</b>		<b>18.4735</b>	<b>kN</b>	

#### GRATING LOAD

Grating load of 50 kg/m<sup>2</sup> is considered

#### HANDRAIL LOAD

Handrail Load of 0.45kN/m is considered.



## BRIDGE PRELIMINARY REPORT FOR BRIDGES IN NH ASSET (ICG-ICP LOWER DECK BRIDGE)

**PROJECT :** ENGINEERING / TECHNICAL CONSULTANCY  
 SERVICES FOR PREPERATION OF EXECUTION  
 METHODOLOGY, SOW AND COST ESTIMATES  
 FOR REPLACEMENT /REFURBISHMENT OF  
 BRIDGES IN MH ASSET

**LOCATION:** MH ASSET (NORTH AND SOUTH FIELD)

**OWNER :** ONGC, MUMBAI

**JOB NO :** B774

0	26.09.25	Re-ISSUED AS STUDY	NS	DP	CS
A	20.06.25	ISSUED AS STUDY	NS	DP	CS
<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>

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Annexures 1

## **Symbols and Abbreviations**

### **Organisations – India**

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### **Other abbreviations**

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge



## 1.0 INTRODUCTION

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges has deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## 2.0 GENERAL

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### IC Complex:

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### BHS Complex:

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### NQO Complex:

7. NQO-NQD Lower Deck bridge

### WIN Complex:

8. WIN-NC Lower Deck bridge

### ADDITIONAL Bridges:

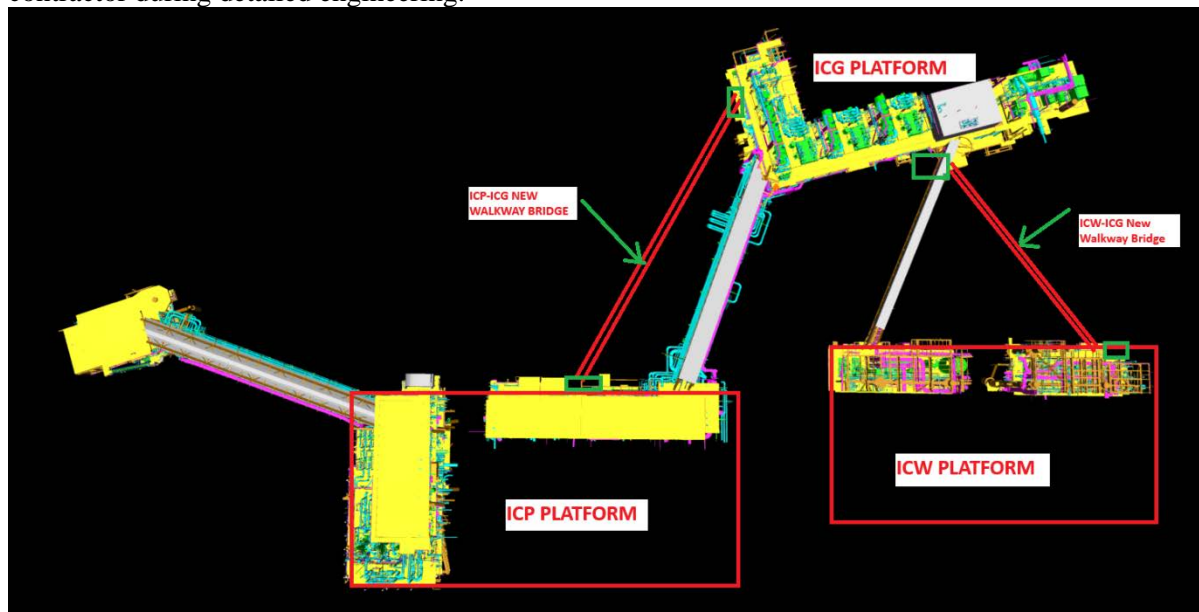
9. SC1-SCA Bridge
10. SCA-SCF Bridge
11. ICP-ICD Bridge

### 3.0 ICP-ICG LOWER DECK BRIDGE DESCRIPTION

The existing bridge has fallen during the cyclone. Hence New bridge (Walkway) is envisaged between ICG & ICP platforms.

The landing point at the ICP platform is identified near grid 3 (northside between loading area and Survival craft). The landing point at the ICG platform is identified near the Scramble Net area (Between staircase and landing Area).

Approximate length of bridge is measured from 3D model as 80.5m. Hence, 84m length of bridge is modelled in SACS conservatively. The exact length of the bridge shall be measured by contractor during detailed engineering.



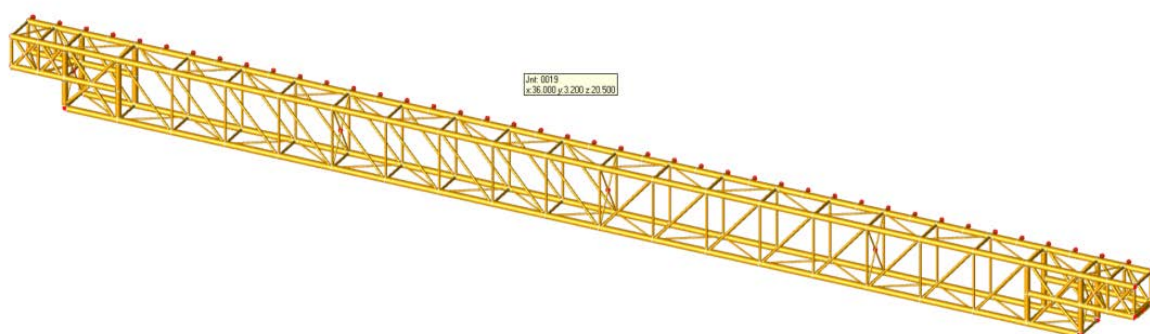
It was suggested from ICP platform site that the ICP new landing location shall be considered at the present lifeboat location. (Shifting the life boat westwards). This shall reduce the gap between the existing ICP-ICG Upper deck bridge and new Bridge. (Approximate gap of 3 m is only available presently). The same is huge risk during installation of new bridge (considering projection of existing live piping from the ICP-CIG UD bridge). Hence identified landing location (identified during the combined site visit) is retained.

No piping is envisaged in the existing bridge. Only cable loading is considered for Lighting purpose.

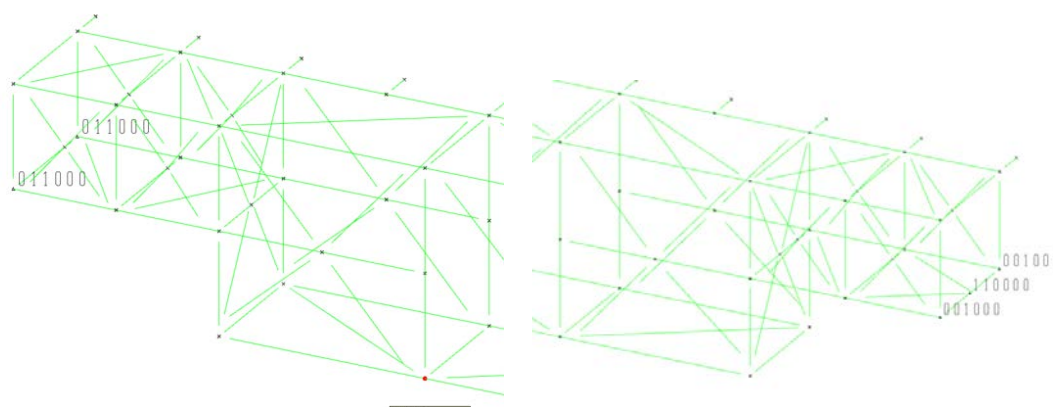
Length of Bridge	84 m
Support Condition	Fixed: 001000, 111000, 001000 (ICG Side) Sliding: 011000, 011000 (ICP Side)
No. of directions for environmental loads	8
Wind Speed (15 Sec Gust)	57.19 m/s for extreme and 35.68 m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>

Yield strength of steel	50ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

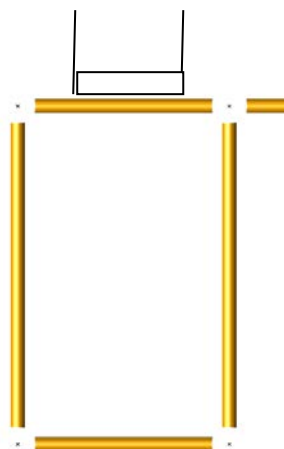
ISOMETRIC VIEW OF ICG-ICP Lower Deck Bridge is shown in Figure1.



**Figure 1: 3D SACS MODEL**



**Figure 2: SUPPORT CONDITIONS**



**Figure 3: BRIDGE CROSS SECTION**

## 4.0 LOADING

### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (kN)
DL	Self-weight, (Contingency - 13%), Walkway Member Wt	895.54 +71.1
NGDL	Cable tray Support	3.13
	Grating Load	57.6
	Handrail Load	96.0
LL	Blanket live load on Walkway	288
MRLL	Monorail Live Load	Nil
CL	Cable Loading	0.882
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure
FLX	Bridge Friction Load X (30 % of SW+NGDL+LL+CL+PLOP)	342
FLY	Bridge Friction Load Y (30 % of SW+NGDL+LL+CL+PLOP)	342

### SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

### NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the Cable tray, cable tray support, grating and handrail loadings. .

### LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1.2 m width of walkway is considered.

#### CABLE TRAY AND CABLE LOAD

For 450mm cable tray, 21.85kg/3m load is considered. Cable trays consist of 4 cables (2no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km, 2no.s 4C x 16 m<sup>2</sup> with load 350kg/km)

#### WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

#### 4.1 Load Combinations

##### Load Combinations

BASIC LOAD COMBINATIONS										
LComb	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
1000	DL	1.00	NDGL	1.13	CL	1.00				
BASIC LOAD COMBINATIONS WITH BRIDGE FRICTION										
1011	1000	1.00	FLX	1.00						
1012	1000	1.00	FLX	-1.00						
1013	1000	1.00	FLY	1.00						
1014	1000	1.00	FLY	-1.00						
LOAD COMBINATIONS FOR EXTREME STORM ENVIRONMENT										
2001 to 2038	1011 to 1014	1.00	201 to 208	1.00						
LOAD COMBINATIONS FOR OPERATING STORM ENVIRONMENT										
3001 to 3038	1011 to 1014	1.00	301 to 308	1.00						

## 5.0 RESULTS & SUMMARY

### BASIC LOAD CASE SUMMARY SACS OUTPUT

\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

MARINE METHOD

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ	DEAD LOAD	BUOYANCY
CASE LABEL		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)	(KN)	(KN)

1	CL	0.00	0.00	-0.88	-2.6	37.0	0.0	0.00	0.00
2	DL	0.00	0.00	-967.45	-1220.7	40712.1	0.0	895.83	0.00
3	LL	0.00	0.00	-288.00	-346.5	12096.0	0.0	0.00	0.00
4	201	125.14	0.84	0.89	-77.1	12003.3	-101.1	0.00	0.00
5	202	89.08	266.37	0.61	-24994.4	8543.8	11107.6	0.00	0.00
6	203	0.84	375.87	-0.03	-35270.3	79.4	15809.6	0.00	0.00
7	204	-87.90	265.19	-0.65	-24885.3	-8431.4	11250.5	0.00	0.00
8	205	-125.14	-0.84	-0.89	77.1	-12003.3	101.1	0.00	0.00
9	206	-89.08	-266.37	-0.61	24994.4	-8543.8	-11107.6	0.00	0.00
10	207	-0.84	-375.87	0.03	35270.3	-79.4	-15809.6	0.00	0.00
11	208	87.90	-265.19	0.65	24885.3	8431.4	-11250.5	0.00	0.00
12	301	45.75	0.31	0.33	-28.2	4388.0	-37.0	0.00	0.00
13	302	32.57	97.32	0.22	-9130.5	3123.4	4058.0	0.00	0.00
14	303	0.31	137.32	-0.01	-12884.2	29.1	5775.8	0.00	0.00
15	304	-32.13	96.88	-0.24	-9090.6	-3082.3	4110.3	0.00	0.00
16	305	-45.75	-0.31	-0.33	28.2	-4388.0	37.0	0.00	0.00
17	306	-32.57	-97.32	-0.22	9130.5	-3123.4	-4058.0	0.00	0.00
18	307	-0.31	-137.32	0.01	12884.2	-29.1	-5775.8	0.00	0.00
19	308	32.13	-96.88	0.24	9090.6	3082.3	-4110.3	0.00	0.00
20	FLX	342.00	0.00	0.00	0.0	31910.3	-427.5	0.00	0.00
21	FLY	0.00	342.00	0.00	-31910.3	0.0	14364.0	0.00	0.00
22	MRLL	-0.00	0.00	-0.00	-0.0	-0.1	0.0	0.00	0.00
23	NGDL	0.00	0.00	-156.74	-194.1	6582.7	0.0	0.00	0.00
24	PLEM	0.00	0.00	-0.00	-0.0	0.0	0.0	0.00	0.00
25	PLOP	0.00	0.00	-0.00	-0.0	0.0	0.0	0.00	0.00
26	PLTL	0.00	0.00	-0.00	-0.0	0.0	0.0	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT

\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
27	1000	0.00	0.00	-1145.45	-1442.6	48187.6	0.0
28	1011	342.00	0.00	-1145.45	-1442.6	80097.9	-427.5
29	1012	-342.00	0.00	-1145.45	-1442.6	16277.3	427.5
30	1013	0.00	342.00	-1145.45	-33352.9	48187.6	14364.0
31	1014	0.00	-342.00	-1145.45	30467.7	48187.6	-14364.0
32	2001	467.14	0.84	-1144.55	-1519.8	92101.1	-528.6
33	2002	-216.86	0.84	-1144.55	-1519.8	28280.5	326.4
34	2003	125.14	342.84	-1144.55	-33430.1	60190.8	14262.9
35	2004	125.14	-341.16	-1144.55	30390.6	60190.8	-14465.1
36	2005	431.08	266.37	-1144.83	-26437.0	88641.6	10680.1
37	2006	-252.92	266.37	-1144.83	-26437.0	24821.0	11535.1
38	2007	89.08	608.37	-1144.83	-58347.3	56731.3	25471.6
39	2008	89.08	-75.63	-1144.83	5473.3	56731.3	-3256.4

40	2011	342.84	375.87	-1145.47	-36712.9	80177.3	15382.1
41	2012	-341.16	375.87	-1145.47	-36712.9	16356.7	16237.1
42	2013	0.84	717.87	-1145.47	-68623.2	48267.0	30173.6
43	2014	0.84	33.87	-1145.47	-4802.6	48267.0	1445.6
44	2015	254.10	265.19	-1146.09	-26327.9	71666.5	10823.0
45	2016	-429.90	265.19	-1146.09	-26327.9	7845.8	11678.0
46	2017	-87.90	607.19	-1146.09	-58238.2	39756.2	25614.5
47	2018	-87.90	-76.81	-1146.09	5582.4	39756.2	-3113.5
48	2021	216.86	-0.84	-1146.34	-1365.5	68094.6	-326.4
49	2022	-467.14	-0.84	-1146.34	-1365.5	4274.0	528.6
50	2023	-125.14	341.16	-1146.34	-33275.8	36184.3	14465.1
51	2024	-125.14	-342.84	-1146.34	30544.8	36184.3	-14262.9
52	2025	252.92	-266.37	-1146.06	23551.8	71554.1	-11535.1
53	2026	-431.08	-266.37	-1146.06	23551.8	7733.5	-10680.1
54	2027	-89.08	75.63	-1146.06	-8358.6	39643.8	3256.4
55	2028	-89.08	-608.37	-1146.06	55462.1	39643.8	-25471.6
56	2031	341.16	-375.87	-1145.42	33827.7	80018.4	-16237.1
57	2032	-342.84	-375.87	-1145.42	33827.7	16197.8	-15382.1
58	2033	-0.84	-33.87	-1145.42	1917.4	48108.1	-1445.6
59	2034	-0.84	-717.87	-1145.42	65738.0	48108.1	-30173.6
60	2035	429.90	-265.19	-1144.80	23442.7	88529.3	-11678.0
61	2036	-254.10	-265.19	-1144.80	23442.7	24708.7	-10823.0
62	2037	87.90	76.81	-1144.80	-8467.6	56619.0	3113.5
63	2038	87.90	-607.19	-1144.80	55353.0	56619.0	-25614.5
64	3001	387.75	0.31	-1145.12	-1470.8	84485.9	-464.5
65	3002	-296.25	0.31	-1145.12	-1470.8	20665.3	390.5
66	3003	45.75	342.31	-1145.12	-33381.1	52575.6	14327.0
67	3004	45.75	-341.69	-1145.12	30439.5	52575.6	-14401.0
68	3005	374.57	97.32	-1145.22	-10573.1	83221.2	3630.5
69	3006	-309.43	97.32	-1145.22	-10573.1	19400.6	4485.5
70	3007	32.57	439.32	-1145.22	-42483.4	51310.9	18422.0
71	3008	32.57	-244.68	-1145.22	21337.2	51310.9	-10306.0

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
72	3011	342.31	137.32	-1145.45	-14326.8	80126.9	5348.3
73	3012	-341.69	137.32	-1145.45	-14326.8	16306.3	6203.3
74	3013	0.31	479.32	-1145.45	-46237.2	48216.6	20139.8
75	3014	0.31	-204.68	-1145.45	17583.5	48216.6	-8588.2
76	3015	309.87	96.88	-1145.68	-10533.2	77015.6	3682.8
77	3016	-374.13	96.88	-1145.68	-10533.2	13195.0	4537.8
78	3017	-32.13	438.88	-1145.68	-42443.5	45105.3	18474.3
79	3018	-32.13	-245.12	-1145.68	21377.1	45105.3	-10253.7
80	3021	296.25	-0.31	-1145.77	-1414.4	75709.9	-390.5
81	3022	-387.75	-0.31	-1145.77	-1414.4	11889.2	464.5
82	3023	-45.75	341.69	-1145.77	-33324.7	43799.5	14401.0
83	3024	-45.75	-342.31	-1145.77	30495.9	43799.5	-14327.0
84	3025	309.43	-97.32	-1145.67	7687.9	76974.5	-4485.5
85	3026	-374.57	-97.32	-1145.67	7687.9	13153.9	-3630.5
86	3027	-32.57	244.68	-1145.67	-24222.5	45064.2	10306.0
87	3028	-32.57	-439.32	-1145.67	39598.2	45064.2	-18422.0
88	3031	341.69	-137.32	-1145.44	11441.6	80068.8	-6203.3
89	3032	-342.31	-137.32	-1145.44	11441.6	16248.2	-5348.3
90	3033	-0.31	204.68	-1145.44	-20468.7	48158.5	8588.2
91	3034	-0.31	-479.32	-1145.44	43351.9	48158.5	-20139.8
92	3035	374.13	-96.88	-1145.21	7648.0	83180.1	-4537.8
93	3036	-309.87	-96.88	-1145.21	7648.0	19359.5	-3682.8
94	3037	32.13	245.12	-1145.21	-24262.3	51269.8	10253.7
95	3038	32.13	-438.88	-1145.21	39558.3	51269.8	-18474.3



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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD	LOAD	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
1	CL	0.00			0.00					-0.88	42.00	2.95	20.50
2	DL	0.00	21.30	1.25	18.89	0.00				-967.45	42.08	1.26	18.77
3	LL	0.00			0.00					-288.00	42.00	1.20	20.50
4	201	125.14	42.67	1.32	18.75	0.84	76.56	1.51	18.55	0.89	-331.79	1.25	18.23
5	202	89.08	42.90	1.32	18.74	266.37	42.14	1.15	19.03	0.61	-343.55	1.14	18.22
6	203	0.84	76.56	1.51	18.55	375.87	42.06	1.15	19.03	-0.03	44.00	4.90	18.50
7	204	-87.90	42.44	1.32	18.75	265.19	41.99	1.15	19.03	-0.65	-320.73	1.36	18.24
8	205	-125.14	42.67	1.32	18.75	-0.84	76.56	1.51	18.55	-0.89	-331.79	1.25	18.23
9	206	-89.08	42.90	1.32	18.74	-266.37	42.14	1.35	19.03	-0.61	-343.55	1.14	18.22
10	207	-0.84	76.56	1.51	18.55	-375.87	42.06	1.35	19.03	0.03	44.00	4.90	18.50
11	208	87.90	42.44	1.32	18.75	-265.19	41.99	1.35	19.03	0.65	-320.73	1.36	18.24
12	301	45.75	42.67	1.32	18.74	0.31	76.39	1.51	18.55	0.33	-331.40	1.25	18.23
13	302	32.57	42.90	1.32	18.74	97.32	42.14	1.15	19.02	0.22	-343.12	1.14	18.22
14	303	0.31	76.39	1.51	18.55	137.32	42.06	1.15	19.02	-0.01	44.00	4.68	18.50
15	304	-32.13	42.45	1.32	18.74	96.88	41.99	1.15	19.02	-0.24	-320.36	1.35	18.23
16	305	-45.75	42.67	1.32	18.74	-0.31	76.39	1.51	18.55	-0.33	-331.40	1.25	18.23
17	306	-32.57	42.90	1.32	18.74	-97.32	42.14	1.35	19.02	-0.22	-343.12	1.14	18.22
18	307	-0.31	76.39	1.51	18.55	-137.32	42.06	1.35	19.02	0.01	44.00	4.68	18.50
19	308	32.13	42.45	1.32	18.74	-96.88	41.99	1.35	19.02	0.24	-320.36	1.35	18.23
20	FLX	342.00	42.00	1.25	18.50	0.00				0.00			
21	FLY	0.00			342.00	42.00	1.25	18.50	0.00				
22	MRL	-0.00	2.00	2.50	20.50	0.00				-0.00	0.00	2.50	20.50
23	NGDL	0.00			0.00					-156.74	42.00	1.24	20.50
24	PLEM	0.00			0.00					-0.00	0.00	2.50	20.50
25	PLOP	0.00			0.00					-0.00	0.00	2.50	20.50
26	PLTL	0.00			0.00					-0.00	0.00	2.50	20.50
27	1000	0.00	21.30	1.25	18.89	0.00				-1145.45	42.07	1.26	19.04
28	1011	342.00	42.00	1.25	18.50	0.00				-1145.45	42.07	1.26	19.04
29	1012	-342.00	42.00	1.25	18.50	0.00				-1145.45	42.07	1.26	19.04
30	1013	0.00	21.30	1.25	18.89	342.00	42.00	1.25	18.50	-1145.45	42.07	1.26	19.04
31	1014	0.00	21.30	1.25	18.89	-342.00	42.00	1.25	18.50	-1145.45	42.07	1.26	19.04
32	2001	467.14	42.18	1.27	18.57	0.84	76.56	1.51	18.55	-1144.55	42.36	1.26	19.04
33	2002	-216.86	41.61	1.21	18.36	0.84	76.56	1.51	18.55	-1144.55	42.36	1.26	19.04
34	2003	125.14	42.67	1.32	18.75	342.84	42.08	1.25	18.50	-1144.55	42.36	1.26	19.04
35	2004	125.14	42.67	1.32	18.75	-341.16	41.92	1.25	18.50	-1144.55	42.36	1.26	19.04
36	2005	431.08	42.19	1.26	18.55	266.37	42.14	1.15	19.03	-1144.83	42.27	1.26	19.04

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37	2006	-252.92	41.68	1.22	18.41	266.37	42.14	1.15	19.03	-1144.83	42.27	1.26	19.04
38	2007	89.08	42.90	1.32	18.74	608.37	42.06	1.21	18.73	-1144.83	42.27	1.26	19.04
39	2008	89.08	42.90	1.32	18.74	-75.63	41.50	1.59	16.63	-1144.83	42.27	1.26	19.04
40	2011	342.84	42.08	1.25	18.50	375.87	42.06	1.15	19.03	-1145.47	42.07	1.26	19.04
41	2012	-341.16	41.92	1.25	18.50	375.87	42.06	1.15	19.03	-1145.47	42.07	1.26	19.04
42	2013	0.84	76.56	1.51	18.55	717.87	42.03	1.20	18.78	-1145.47	42.07	1.26	19.04
43	2014	0.84	76.56	1.51	18.55	33.87	42.71	0.16	24.39	-1145.47	42.07	1.26	19.04
44	2015	254.10	41.85	1.23	18.41	265.19	41.99	1.15	19.03	-1146.09	41.86	1.26	19.04
45	2016	-429.90	42.09	1.26	18.55	265.19	41.99	1.15	19.03	-1146.09	41.86	1.26	19.04

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD LOAD		***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z	
	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	
46 2017	-87.90	42.44	1.32	18.75	607.19	41.99	1.21	18.73	-1146.09	41.86	1.26	19.04	
47 2018	-87.90	42.44	1.32	18.75	-76.81	42.04	1.59	16.66	-1146.09	41.86	1.26	19.04	
48 2021	216.86	41.61	1.21	18.36	-0.84	76.56	1.51	18.55	-1146.34	41.78	1.26	19.04	
49 2022	-467.14	42.18	1.27	18.57	-0.84	76.56	1.51	18.55	-1146.34	41.78	1.26	19.04	
50 2023	-125.14	42.67	1.32	18.75	341.16	41.92	1.25	18.50	-1146.34	41.78	1.26	19.04	
51 2024	-125.14	42.67	1.32	18.75	-342.84	42.08	1.25	18.50	-1146.34	41.78	1.26	19.04	
52 2025	252.92	41.68	1.22	18.41	-266.37	42.14	1.35	19.03	-1146.06	41.86	1.26	19.04	
53 2026	-431.08	42.19	1.26	18.55	-266.37	42.14	1.35	19.03	-1146.06	41.86	1.26	19.04	
54 2027	-89.08	42.90	1.32	18.74	75.63	41.50	0.90	16.63	-1146.06	41.86	1.26	19.04	
55 2028	-89.08	42.90	1.32	18.74	-608.37	42.06	1.29	18.73	-1146.06	41.86	1.26	19.04	
56 2031	341.16	41.92	1.25	18.50	-375.87	42.06	1.35	19.03	-1145.42	42.07	1.26	19.04	
57 2032	-342.84	42.08	1.25	18.50	-375.87	42.06	1.35	19.03	-1145.42	42.07	1.26	19.04	
58 2033	-0.84	76.56	1.51	18.55	-33.87	42.71	2.34	24.39	-1145.42	42.07	1.26	19.04	
59 2034	-0.84	76.56	1.51	18.55	-717.87	42.03	1.30	18.78	-1145.42	42.07	1.26	19.04	
60 2035	429.90	42.09	1.26	18.55	-265.19	41.99	1.35	19.03	-1144.80	42.27	1.26	19.04	
61 2036	-254.10	41.85	1.23	18.41	-265.19	41.99	1.35	19.03	-1144.80	42.27	1.26	19.04	
62 2037	87.90	42.44	1.32	18.75	76.81	42.04	0.91	16.66	-1144.80	42.27	1.26	19.04	
63 2038	87.90	42.44	1.32	18.75	-607.19	41.99	1.29	18.73	-1144.80	42.27	1.26	19.04	
64 3001	387.75	42.08	1.26	18.53	0.31	76.39	1.51	18.55	-1145.12	42.18	1.26	19.04	
65 3002	-296.25	41.90	1.24	18.46	0.31	76.39	1.51	18.55	-1145.12	42.18	1.26	19.04	
66 3003	45.75	42.67	1.32	18.74	342.31	42.03	1.25	18.50	-1145.12	42.18	1.26	19.04	
67 3004	45.75	42.67	1.32	18.74	-341.69	41.97	1.25	18.50	-1145.12	42.18	1.26	19.04	
68 3005	374.57	42.08	1.26	18.52	97.32	42.14	1.15	19.02	-1145.22	42.14	1.26	19.04	
69 3006	-309.43	41.91	1.24	18.47	97.32	42.14	1.15	19.02	-1145.22	42.14	1.26	19.04	
70 3007	32.57	42.90	1.32	18.74	439.32	42.03	1.23	18.62	-1145.22	42.14	1.26	19.04	
71 3008	32.57	42.90	1.32	18.74	-244.68	41.94	1.29	18.29	-1145.22	42.14	1.26	19.04	
72 3011	342.31	42.03	1.25	18.50	137.32	42.06	1.15	19.02	-1145.45	42.07	1.26	19.04	
73 3012	-341.69	41.97	1.25	18.50	137.32	42.06	1.15	19.02	-1145.45	42.07	1.26	19.04	
74 3013	0.31	76.39	1.51	18.55	479.32	42.02	1.22	18.65	-1145.45	42.07	1.26	19.04	
75 3014	0.31	76.39	1.51	18.55	-204.68	41.96	1.32	18.15	-1145.45	42.07	1.26	19.04	
76 3015	309.87	41.95	1.24	18.47	96.88	41.99	1.15	19.02	-1145.68	41.99	1.26	19.04	
77 3016	-374.13	42.04	1.26	18.52	96.88	41.99	1.15	19.02	-1145.68	41.99	1.26	19.04	
78 3017	-32.13	42.45	1.32	18.74	438.88	42.00	1.23	18.62	-1145.68	41.99	1.26	19.04	
79 3018	-32.13	42.45	1.32	18.74	-245.12	42.00	1.29	18.29	-1145.68	41.99	1.26	19.04	
80 3021	296.25	41.90	1.24	18.46	-0.31	76.39	1.51	18.55	-1145.77	41.96	1.26	19.04	
81 3022	-387.75	42.08	1.26	18.53	-0.31	76.39	1.51	18.55	-1145.77	41.96	1.26	19.04	

---

82	3023	-45.75	42.67	1.32	18.74	341.69	41.97	1.25	18.50	-1145.77	41.96	1.26	19.04
83	3024	-45.75	42.67	1.32	18.74	-342.31	42.03	1.25	18.50	-1145.77	41.96	1.26	19.04
84	3025	309.43	41.91	1.24	18.47	-97.32	42.14	1.35	19.02	-1145.67	41.99	1.26	19.04
85	3026	-374.57	42.08	1.26	18.52	-97.32	42.14	1.35	19.02	-1145.67	41.99	1.26	19.04
86	3027	-32.57	42.90	1.32	18.74	244.68	41.94	1.21	18.29	-1145.67	41.99	1.26	19.04
87	3028	-32.57	42.90	1.32	18.74	-439.32	42.03	1.27	18.62	-1145.67	41.99	1.26	19.04
88	3031	341.69	41.97	1.25	18.50	-137.32	42.06	1.35	19.02	-1145.44	42.07	1.26	19.04
89	3032	-342.31	42.03	1.25	18.50	-137.32	42.06	1.35	19.02	-1145.44	42.07	1.26	19.04
90	3033	-0.31	76.39	1.51	18.55	204.68	41.96	1.18	18.15	-1145.44	42.07	1.26	19.04

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD	LOAD	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
CASE	LABEL	FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
91	3034	-0.31	76.39	1.51	18.55	-479.32	42.02	1.28	18.65	-1145.44	42.07	1.26	19.04
92	3035	374.13	42.04	1.26	18.52	-96.88	41.99	1.35	19.02	-1145.21	42.14	1.26	19.04
93	3036	-309.87	41.95	1.24	18.47	-96.88	41.99	1.35	19.02	-1145.21	42.14	1.26	19.04
94	3037	32.13	42.45	1.32	18.74	245.12	42.00	1.21	18.29	-1145.21	42.14	1.26	19.04
95	3038	32.13	42.45	1.32	18.74	-438.88	42.00	1.27	18.62	-1145.21	42.14	1.26	19.04

## 4.2 Member Unity Check Result

Member having Unity check ratio above 0.6 for the bridge members are summarized below.

### Member Unity Check Result

S. No.	Member	Group ID	Load Case	UC	Remarks
1	A012-A013	C01	4011	0.608	Bridge Chord members UC <1.0.
2	A011-A012	C01	4011	0.610	
3	A013-A014	C01	4011	0.607	

## 4.3 Joint Punching Shear Unity Check Result

Joints having Load UC ratio above 0.6 for the jacket framing member are summarized below.

### Maximum Joint UC Ratio

Joint	Diameter (mm)	Thickness (mm)	Strength UC	Remarks
D028	406	12.7	0.625	UC <1.0.
D137	406	12.7	0.606	
D113	406	12.7	0.566	
D115	406	12.7	0.528	

## 4.4 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	D013	17.700	Allowable Deflection = (8400 / 400) = 21 cm
2.	D014	17.700	

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	D013	12.200	Allowable Deflection = (8400 / 500) = 16.8 cm
2.	D014	12.300	

Vertical and Horizontal Deflection of bridge are under control. However, 143 mm of vertical deflection is observed in the dead load combination. Hence a camber of 1 in 200 shall be provided.

#### 4.5 Reaction Summary

Following is the reaction summary of the bridge supports.

#### Summary of Bridge Horizontal Deflections

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	D001	0	-106.156	370.342
2.	D113	0	257.582	375.132
3.	D008	467.145	-359.221	0
4.	D028	0	0	369.604
5.	D137	0	0	376.519

#### 5.0 VIV – Air:

The safety of all type members in VIV is checked for as per provisions of DNGVL-RP-C205 and following is obtained

#### Summary of Bridge Horizontal Deflections

S. No.	Member	Length (m)	Remarks
1.	406 X 15.9	4	Safe in VIV
2.	406 X 12.7	4	Safe in VIV
3.	168 X 9.5	4.98	Safe in VIV
4.	114 X7.9	4.71	Safe in VIV

---

## **6.0 CONCLUSION**

From the above it is concluded that all members and joints are safe for operating and extreme conditions. Also, functionally the deflection is under the limits. The adequacy of the bridge support locations, adequacy of deck members, jacket are performed separately.

**ANNEXURE-1  
LOAD CALCULATIONS**



### WIND LOAD:

S.No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulence Intensity at height "z"	t <sub>o</sub>	t	Design Wind Speed at Height "z"	
			U <sub>o</sub>			z		U(z)	I <sub>u</sub> (z)			u(z,t)	
			kmph	ft/sec		m	ft	ft/sec				sec	sec
1	Extreme	0	149.67	136.37	0.154	22.00	72.16	152.93	0.141	3600	15	201.24	61.35
2	Extreme	45	149.67	136.37	0.154	22.00	72.16	152.93	0.141	3600	15	201.24	61.35
3	Extreme	90	149.67	136.37	0.154	22.00	72.16	152.93	0.141	3600	15	201.24	61.35
4	Extreme	135	149.67	136.37	0.154	22.00	72.16	152.93	0.141	3600	15	201.24	61.35
5	Extreme	180	149.67	136.37	0.154	22.00	72.16	152.93	0.141	3600	15	201.24	61.35
6	Extreme	225	149.67	136.37	0.154	22.00	72.16	152.93	0.141	3600	15	201.24	61.35
7	Extreme	270	149.67	136.37	0.154	22.00	72.16	152.93	0.141	3600	15	201.24	61.35
8	Extreme	315	149.67	136.37	0.154	22.00	72.16	152.93	0.141	3600	15	201.24	61.35
1	Operating	All	99.22	90.40	0.130	22.00	72.16	99.65	0.110	3600	15	124.32	37.90

### CABLE LOAD:

2 Run 3C X2.5 @162 Kg / 3.24  
 km= N/m  
  
 2 Run 4C X16 @162 Kg /  
 km= 7 N/m  
  
 Total for cable = 10.24 N/  
 m  
 i.e. 10.24\*2/1000  
 0.02048 Kn

### CABLE TRAY LOAD:

CABTRAY load = 21.85 Kg/ 3 m  
 i.e Point load = 21.85 /3 \*2 /100 = 0.0728 Kn

### DEAD LOAD

Self-weight is considered with contingency 13%. The member load for walkway is considered as MC250 (37.3 Kg /m)

Point Load = 37.3 \*4 /100 = 1.492 Kn.

### GRATING LOAD

Grating load of 50 kg/m<sup>2</sup> is considered

### HANDRAIL LOAD

Handrail Load of 50Kg/m is considered.



## **BRIDGE REPORT FOR REFURBISHMENT / REPLACEMENT OF BRIDGES IN MH ASSET (ICP-ICG) TOP DECK BRIDGE**

**PROJECT : ENGINEERING / TECHNICAL CONSULTANCY  
SERVICES FOR PREPERATION OF EXECUTION  
METHODOLOGY, SOW AND COST ESTIMATES FOR  
REPLACEMENT /REFURBISHMENT OF BRIDGES IN  
MH ASSET**

**LOCATION: MH ASSET (NORTH AND SOUTH FIELD)**

**OWNER : ONGC, MUMBAI**

**JOB NO : B774**

0	22.09.2025	RE-ISSUED AS STUDY	NS	DP	CS
A	07.08.2025	ISSUED AS STUDY	NS	DP	CS
<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>

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## **Symbols and Abbreviations**

### **Organisations – India**

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### **Other abbreviations**

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
L	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
LAT	Lowest Astronomical Tide
SS	Storm Surge

## **1.0 INTRODUCTION**

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges have deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## **2.0 GENERAL**

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### **IC Complex:**

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### **BHS Complex:**

5. BHS-SLQ Lower Deck bridge

6. SLQ-WIS Lower Deck bridge

**NQO Complex:**

7. NQO-NQD Bridge

**WIN Complex:**

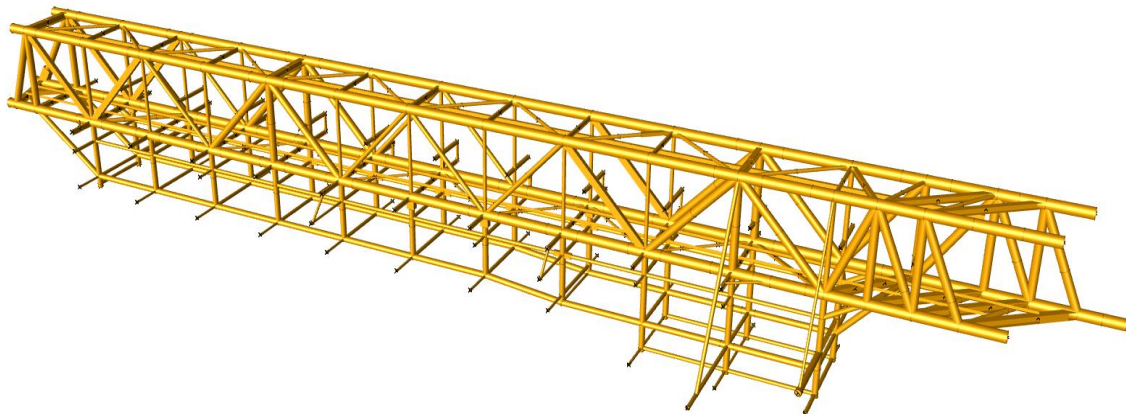
8. WIN-NC Bridge

### 3.0 IGP-ICG BRIDGE DESCRIPTION

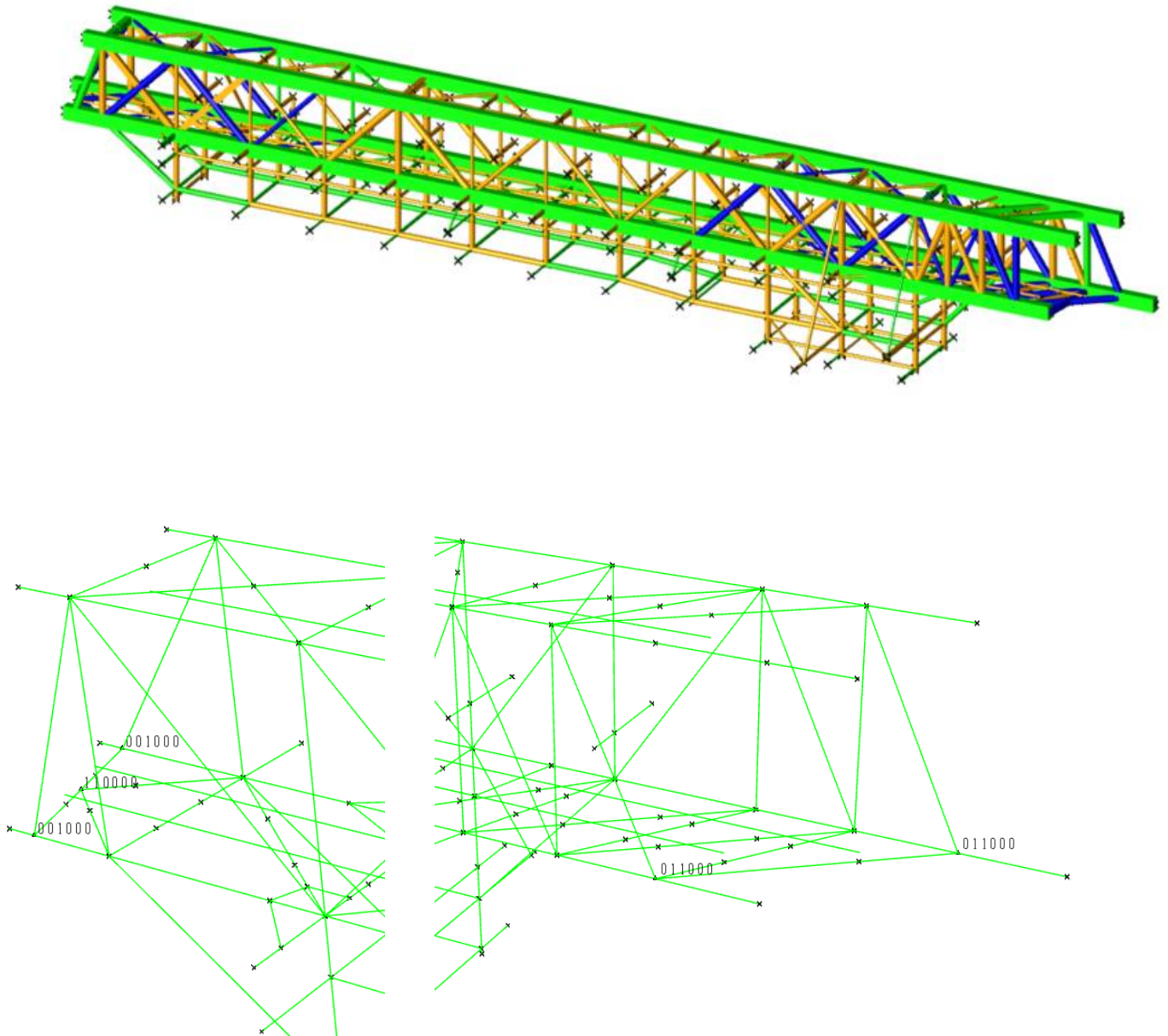
Approximate length of bridge is measured from 3D model as 53m. Hence, 53m length of bridge is modelled in SACS conservatively.

Length of Bridge	53 m
Support Condition	Fixed: 001000, 110000, 001000 (ICP Side) Sliding: 011000, 011000 (ICG Side)
No. of directions for environmental loads	8
Wind Speed (3 Sec Gust)	57.19 m/s for extreme and 35.68 m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	35/50 ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

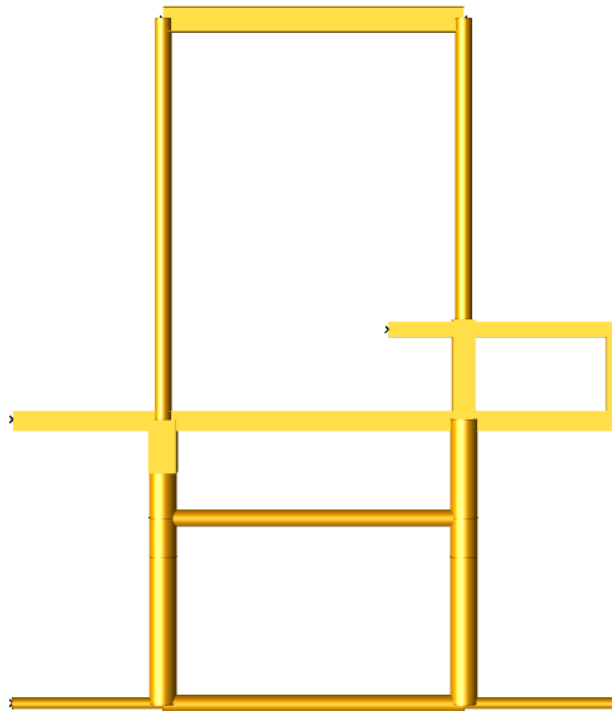
ISOMETRIC VIEW OF **ICP-ICG Top Deck Bridge** is shown in Figure1 ( AS-IS condition) and Figure 2 ( After strengthening)



**Figure 1: 3D SACS MODEL**



**Figure 2: SUPPORT CONDITIONS**

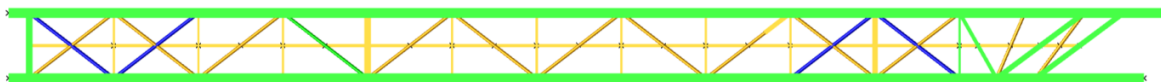


**Figure 3: BRIDGE CROSS SECTION**

#### 4.0 PROPOSED STRENGTHENING CONFIGURATION

##### 1. Top Chord-

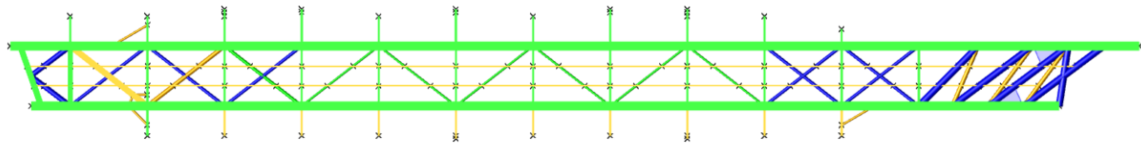
- Main Chord:  $\Phi 457\text{mm}$  dia + 12thk wrap plate + 2 no's Half cut tubular (356dia. x 15.9mm)
- Horizontal Framing members: Flange strengthening & Boxing with 10thk / 20 thk plate ( Green color)
- Diagonal Framing members: New members modelled ( Blue Color)



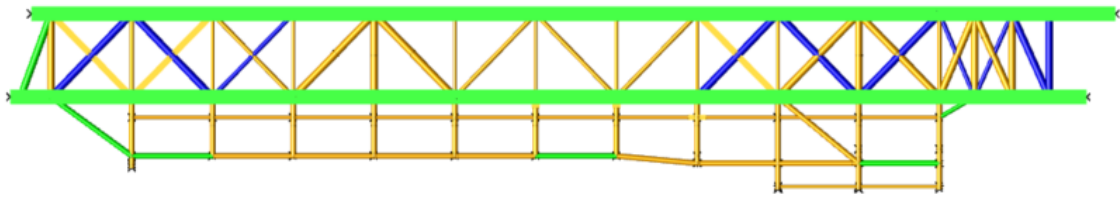
##### 2. Bottom Chord-

- Main Chord: 457 mm dia. +12thk wrap plate + 2 no's Half cut tubular (356dia. x 15.9mm)
- Horizontal Framing members: Flange strengthening & Boxing with 10thk /20 thk plate
- Diagonal Framing members: New members modelled
- 8mm/10 mm Wrap plate provided around 219dia. / 114 dia. member
- Framing members at sliding end: New members modelled
- Framing members at Pinned end: New members modelled

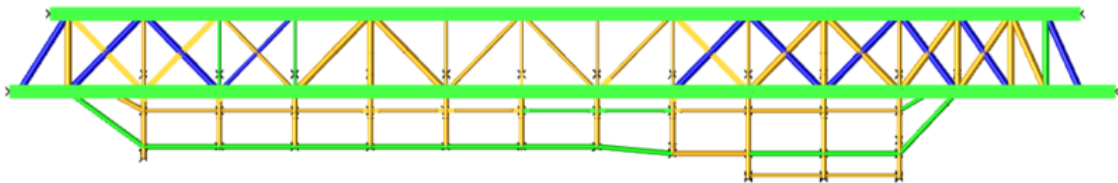




### 3. Framing Elevation Row-B:



### 4. Framing Elevation Row-A:



The proposed strengthening and replacement works shall also comprise the following:

- Replacement of walkway members, gratings, and handrails.
- Replacement of stairs on both sides.
- Replacement of roof sheeting along with supporting members, clamps, and bolts.
- Replacement of monorail member.
- Strengthening of supports at fixed and sliding ends.

## 5.0 LOADING

### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (kN)
DL	Self-weight, (Contingency - 13%)	922.03
NGDL	Cable tray Support	173.77
	Grating Load	
	Handrail Load	

	Sheeting Cladding	
	Handrail Socket	
LL	Blanket live load on walkway (Grating) Area -250 Kg/m <sup>2</sup>	128.31
MRL	Monorail Live Load	20.00
CL	Cable Loading + Cable tray load	145.85
PLEM	Piping Load Empty (60% of PLOP)	2690.052
PLOP	Piping Load Empty + Operating Contents (By Piping)	4483.42
PLTLX	Piping Load Empty + Operating Contents (15% of PLOP) X	672.51
PLTLY	Piping Load Empty + Operating Contents (15% of PLOP) Y	672.51
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure
FLX	Bridge Friction Load X (10 % of SW+NGDL+LL+CL+PLOP)	587.1
FLY	Bridge Friction Load Y (10 % of SW+NGDL+LL+CL+PLOP)	587.1

## SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

## NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the cable tray supports, cladding, grating and handrail loadings.

## LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1.0 m width of walkway is considered.

## CABLE TRAY AND CABLE LOAD

- For 750mm cable tray, 35.9kg/3m load is considered. 8 nos. Cable trays consist of 16 cables (4nos. 3.5C x 120 m<sup>2</sup> with load 4617kg/km)
- For 450mm cable tray, 21.85kg/3m load is considered. Cable trays consist of 2 cables (2nos. 3.5C x 95 m<sup>2</sup> with load 3686kg/km)

3. For 150mm cable tray, 5kg/3m load is considered. Cable trays consist of 2 cables (2no.s 3.0C x 2.5 m2 with load 162kg/km.

## WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

## 6.0 Load Combinations

### Load Combinations

BASIC LOAD COMBINATIONS								
LComb	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
PLEM	PLOP	0.60						
1000	DL	1.00	NDGL	1.13	CL	1.00	PLEM	1.00
1001	DL	1.00	NDGL	1.13	CL	1.00	PLOP	0.80
1002	1001	1.00	LL	1.00	MRLl	1.00	PLTX	1.00
1003	1001	1.00	LL	1.00	MRLl	1.00	PLTX	-1.00
1004	1001	1.00	LL	1.00	MRLl	1.00	PLTY	1.00
1005	1001	1.00	LL	1.00	MRLl	1.00	PLTY	-1.00
1011	1001	1.00	FLX	1.00				
1012	1001	1.00	FLX	-1.00				
1013	1001	1.00	FLY	1.00				
1014	1001	1.00	FLY	-1.00				
1021	1002	1.00	FLX	1.00				
1022	1002	1.00	FLX	-1.00				
1023	1002	1.00	FLY	1.00				
1024	1002	1.00	FLY	-1.00				
1031	1003	1.00	FLX	1.00				
1032	1003	1.00	FLX	-1.00				
1033	1003	1.00	FLY	1.00				
1034	1003	1.00	FLY	-1.00				
1041	1004	1.00	FLX	1.00				
1042	1004	1.00	FLX	-1.00				
1043	1004	1.00	FLY	1.00				
1044	1004	1.00	FLY	-1.00				
1051	1005	1.00	FLX	1.00				

1052	1005	1.00	FLX	-1.00				
1053	1005	1.00	FLY	1.00				
1054	1005	1.00	FLY	-1.00				
<b>EXTREME WIND CONDITION</b>								
2001 to 2004	1011 to 1014	1.00	201	1.00				
2005 to 2008	1011 to 1014	1.00	202	1.00				
2011 to 2014	1011 to 1014	1.00	203	1.00				
2015 to 2018	1011 to 1014	1.00	204	1.00				
2021 to 2024	1011 to 1014	1.00	205	1.00				
2025 to 2028	1011 to 1014	1.00	206	1.00				
2031 to 2034	1011 to 1014	1.00	207	1.00				
2035 to 2038	1011 to 1014	1.00	208	1.00				
<b>OPERATING WIND CONDITION</b>								
4001 to 4004	1021 to 1024	1.00	301	1.00				
4005 to 4008	1021 to 1024	1.00	302	1.00				
4011 to 4014	1021 to 1024	1.00	303	1.00				
4015 to 4018	1021 to 1024	1.00	304	1.00				
4021 to 4024	1021 to 1024	1.00	305	1.00				
4025 to 4028	1021 to 1024	1.00	306	1.00				
4031 to 4034	1021 to 1024	1.00	307	1.00				
4035 to 4038	1021 to 1024	1.00	308	1.00				
4101 to 4104	1031 to 1034	1.00	301	1.00				
4105 to 4108	1031 to 1034	1.00	302	1.00				
4111 to 4114	1031 to 1034	1.00	303	1.00				
4115 to 4118	1031 to 1034	1.00	304	1.00				
4121 to 4124	1031 to 1034	1.00	305	1.00				
4125 to 4128	1031 to 1034	1.00	306	1.00				
4131 to 4134	1031 to 1034	1.00	307	1.00				
4135 to 4138	1031 to 1034	1.00	308	1.00				
4201 to 4204	1041 to 1044	1.00	301	1.00				
4205 to 4208	1041 to 1044	1.00	302	1.00				
4211 to 4214	1041 to 1044	1.00	303	1.00				
4215 to 4218	1041 to 1044	1.00	304	1.00				
4221 to 4224	1041 to 1044	1.00	305	1.00				
4225 to 4228	1041 to 1044	1.00	306	1.00				
4231 to 4234	1041 to 1044	1.00	307	1.00				
4235 to 4238	1041 to 1044	1.00	308	1.00				
4301 to 4304	1051 to 1054	1.00	301	1.00				

4305 to 4308	1051 to 1054	1.00	302	1.00				
4311 to 4314	1051 to 1054	1.00	303	1.00				
4315 to 4318	1051 to 1054	1.00	304	1.00				
4321 to 4324	1051 to 1054	1.00	305	1.00				
4325 to 4328	1051 to 1054	1.00	306	1.00				
4331 to 4334	1051 to 1054	1.00	307	1.00				
4335 to 4338	1051 to 1054	1.00	308	1.00				

## 7.0 RESULTS & SUMMARY

### A. BASIC LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

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\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	DL	DEAD
2	201	WIND
3	202	WIND
4	203	WIND
5	204	WIND
6	205	WIND
7	206	WIND
8	207	WIND
9	208	WIND
10	301	WIND
11	302	WIND
12	303	WIND
13	304	WIND
14	305	WIND
15	306	WIND
16	307	WIND
17	308	WIND
18	CL	USER GENERATED LOADS
19	PLOP	USER GENERATED LOADS
20	NGDL	USER GENERATED LOADS
21	PLTX	USER GENERATED LOADS
22	PLTY	USER GENERATED LOADS
23	LL	USER GENERATED LOADS
24	MRL	USER GENERATED LOADS
25	FLX	USER GENERATED LOADS
26	FLY	USER GENERATED LOADS

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	DL	0.00	-0.00	-922.03	-72.7	23756.0	-0.0	922.04	0.00
2	201	316.16	-14.87	3.80	415.1	8642.8	-901.1	0.00	0.00
3	202	213.04	1203.27	2.60	-33591.6	5839.5	28496.6	0.00	0.00
4	203	-14.87	1716.55	-0.13	-47920.9	-384.5	41201.4	0.00	0.00
5	204	-234.07	1224.30	-2.78	-34178.7	-6383.3	29771.0	0.00	0.00
6	205	-316.16	14.87	-3.80	-415.1	-8642.8	901.1	0.00	0.00
7	206	-213.04	-1203.23	-2.60	33584.9	-5839.5	-28765.8	0.00	0.00
8	207	14.87	-1716.50	0.13	47911.4	384.5	-41582.1	0.00	0.00
9	208	234.07	-1224.26	2.78	34172.0	6383.3	-30040.2	0.00	0.00
10	301	116.19	-5.46	1.40	152.4	3175.6	-331.0	0.00	0.00
11	302	78.30	442.01	0.96	-12337.0	2145.7	10468.3	0.00	0.00
12	303	-5.46	630.56	-0.05	-17599.6	-141.1	15135.4	0.00	0.00
13	304	-86.02	449.73	-1.02	-12552.5	-2345.3	10936.4	0.00	0.00
14	305	-116.19	5.46	-1.40	-152.4	-3175.6	331.0	0.00	0.00
15	306	-78.30	-442.00	-0.96	12334.7	-2145.7	-10566.8	0.00	0.00
16	307	5.46	-630.54	0.05	17596.3	141.1	-15274.7	0.00	0.00
17	308	86.02	-449.72	1.02	12550.2	2345.3	-11034.9	0.00	0.00
18	CL	0.00	0.00	-145.85	133.1	3530.0	0.0	0.00	0.00
19	PLOP	0.00	0.00	-4483.42	-787.4	108770.5	0.0	0.00	0.00
20	NGDL	0.00	0.00	-173.77	-36.3	4369.0	0.0	0.00	0.00
21	PLTX	-672.51	0.00	0.00	0.0	-17074.2	118.1	0.00	0.00
22	PLTY	0.00	-672.51	0.00	17074.2	0.0	-16315.6	0.00	0.00
23	LL	0.00	0.00	-128.31	-0.7	3036.3	0.0	0.00	0.00
24	MRLL	0.00	0.00	-20.00	0.0	468.0	0.0	0.00	0.00
25	FLX	587.00	0.00	0.00	0.0	15763.3	0.0	0.00	0.00
26	FLY	0.00	587.00	0.00	-15763.3	0.0	14153.9	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
27	PLEM	0.00	0.00	-2690.05	-472.4	65262.3	0.0
28	1000	0.00	-0.00	-3954.29	-453.1	97485.2	-0.0
29	1001	0.00	-0.00	-4850.98	-610.6	119239.3	-0.0
30	1002	-672.51	-0.00	-4999.29	-611.2	105669.4	118.1
31	1003	672.51	-0.00	-4999.29	-611.2	139817.9	-118.1
32	1004	0.00	-672.51	-4999.29	16463.0	122743.7	-16315.6
33	1005	0.00	672.51	-4999.29	-17685.5	122743.7	16315.6
34	1011	587.00	-0.00	-4850.98	-610.6	135002.6	-0.0
35	1012	-587.00	-0.00	-4850.98	-610.6	103476.0	-0.0
36	1013	0.00	587.00	-4850.98	-16373.9	119239.3	14153.9
37	1014	0.00	-587.00	-4850.98	15152.7	119239.3	-14153.9
38	1021	-85.51	-0.00	-4999.29	-611.2	121432.7	118.1
39	1022	-1259.51	-0.00	-4999.29	-611.2	89906.1	118.1
40	1023	-672.51	587.00	-4999.29	-16374.5	105669.4	14272.0
41	1024	-672.51	-587.00	-4999.29	15152.1	105669.4	-14035.8
42	1031	1259.51	-0.00	-4999.29	-611.2	155581.2	-118.1
43	1032	85.51	-0.00	-4999.29	-611.2	124054.6	-118.1
44	1033	672.51	587.00	-4999.29	-16374.5	139817.9	14035.8
45	1034	672.51	-587.00	-4999.29	15152.1	139817.9	-14272.0
46	1041	587.00	-672.51	-4999.29	16463.0	138507.0	-16315.6
47	1042	-587.00	-672.51	-4999.29	16463.0	106980.4	-16315.6
48	1043	0.00	-85.51	-4999.29	699.7	122743.7	-2161.7
49	1044	0.00	-1259.51	-4999.29	32226.3	122743.7	-30469.5
50	1051	587.00	672.51	-4999.29	-17685.5	138507.0	16315.6
51	1052	-587.00	672.51	-4999.29	-17685.5	106980.4	16315.6
52	1053	0.00	1259.51	-4999.29	-33448.8	122743.7	30469.5
53	1054	0.00	85.51	-4999.29	-1922.2	122743.7	2161.7
54	2001	903.16	-14.87	-4847.17	-195.4	143645.5	-901.1
55	2002	-270.84	-14.87	-4847.17	-195.4	112118.9	-901.1
56	2003	316.16	572.13	-4847.17	-15958.7	127882.2	13252.8
57	2004	316.16	-601.87	-4847.17	15567.9	127882.2	-15055.0
58	2005	800.04	1203.27	-4848.38	-34202.2	140842.1	28496.6
59	2006	-373.96	1203.27	-4848.38	-34202.2	109315.5	28496.6
60	2007	213.04	1790.27	-4848.38	-49965.5	125078.8	42650.5
61	2008	213.04	616.27	-4848.38	-18438.9	125078.8	14342.7
62	2011	572.13	1716.55	-4851.10	-48531.4	134618.1	41201.4
63	2012	-601.87	1716.55	-4851.10	-48531.4	103091.5	41201.4
64	2013	-14.87	2303.55	-4851.10	-64294.7	118854.8	55355.3
65	2014	-14.87	1129.55	-4851.10	-32768.1	118854.8	27047.5
66	2015	352.93	1224.30	-4853.76	-34789.3	128619.3	29771.0
67	2016	-821.07	1224.30	-4853.76	-34789.3	97092.7	29771.0
68	2017	-234.07	1811.30	-4853.76	-50552.6	112856.0	43924.9
69	2018	-234.07	637.30	-4853.76	-19026.0	112856.0	15617.1
70	2021	270.84	14.87	-4854.78	-1025.7	126359.8	901.1
71	2022	-903.16	14.87	-4854.78	-1025.7	94833.2	901.1

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
72	2023	-316.16	601.87	-4854.78	-16789.0	110596.5	15055.0
73	2024	-316.16	-572.13	-4854.78	14737.6	110596.5	-13252.8
74	2025	373.96	-1203.23	-4853.58	32974.4	129163.1	-28765.8
75	2026	-800.04	-1203.23	-4853.58	32974.4	97636.5	-28765.8
76	2027	-213.04	-616.23	-4853.58	17211.1	113399.8	-14611.9
77	2028	-213.04	-1790.23	-4853.58	48737.7	113399.8	-42919.7
78	2031	601.87	-1716.50	-4850.85	47300.9	135387.2	-41582.1
79	2032	-572.13	-1716.50	-4850.85	47300.9	103860.6	-41582.1
80	2033	14.87	-1129.50	-4850.85	31537.6	119623.9	-27428.2
81	2034	14.87	-2303.50	-4850.85	63064.2	119623.9	-55736.0
82	2035	821.07	-1224.26	-4848.20	33561.5	141385.9	-30040.2
83	2036	-352.93	-1224.26	-4848.20	33561.5	109859.3	-30040.2
84	2037	234.07	-637.26	-4848.20	17798.2	125622.6	-15886.3
85	2038	234.07	-1811.26	-4848.20	49324.8	125622.6	-44194.1
86	4001	30.68	-5.46	-4997.89	-458.9	124608.3	-212.9
87	4002	-1143.32	-5.46	-4997.89	-458.9	93081.7	-212.9
88	4003	-556.32	581.54	-4997.89	-16222.2	108845.0	13941.0
89	4004	-556.32	-592.46	-4997.89	15304.4	108845.0	-14366.8
90	4005	-7.21	442.01	-4998.33	-12948.3	123578.4	10586.4
91	4006	-1181.21	442.01	-4998.33	-12948.3	92051.8	10586.4
92	4007	-594.21	1029.01	-4998.33	-28711.6	107815.1	24740.3
93	4008	-594.21	-144.99	-4998.33	2815.0	107815.1	-3567.5
94	4011	-90.97	630.56	-4999.33	-18210.8	121291.6	15253.5
95	4012	-1264.97	630.56	-4999.33	-18210.8	89765.0	15253.5
96	4013	-677.97	1217.56	-4999.33	-33974.1	105528.3	29407.4
97	4014	-677.97	43.56	-4999.33	-2447.5	105528.3	1099.6
98	4015	-171.53	449.73	-5000.31	-13163.8	119087.4	11054.5
99	4016	-1345.53	449.73	-5000.31	-13163.8	87560.9	11054.5
100	4017	-758.53	1036.73	-5000.31	-28927.1	103324.2	25208.4
101	4018	-758.53	-137.27	-5000.31	2599.5	103324.2	-3099.4
102	4021	-201.70	5.46	-5000.69	-763.6	118257.1	449.1
103	4022	-1375.70	5.46	-5000.69	-763.6	86730.6	449.1
104	4023	-788.70	592.46	-5000.69	-16526.9	102493.8	14603.0
105	4024	-788.70	-581.54	-5000.69	14999.7	102493.8	-13704.8
106	4025	-163.81	-442.00	-5000.24	11723.5	119287.1	-10448.7
107	4026	-1337.81	-442.00	-5000.24	11723.5	87760.5	-10448.7
108	4027	-750.81	145.00	-5000.24	-4039.8	103523.8	3705.2
109	4028	-750.81	-1029.00	-5000.24	27486.8	103523.8	-24602.6
110	4031	-80.05	-630.54	-4999.24	16985.0	121573.9	-15156.6
111	4032	-1254.05	-630.54	-4999.24	16985.0	90047.3	-15156.6
112	4033	-667.05	-43.54	-4999.24	1221.7	105810.6	-1002.7
113	4034	-667.05	-1217.54	-4999.24	32748.3	105810.6	-29310.5
114	4035	0.51	-449.72	-4998.27	11938.9	123778.0	-10916.8
115	4036	-1173.49	-449.72	-4998.27	11938.9	92251.4	-10916.8
116	4037	-586.49	137.28	-4998.27	-3824.4	108014.7	3237.1



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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
117	4038	-586.49	-1036.72	-4998.27	27702.2	108014.7	-25070.7
118	4101	1375.70	-5.46	-4997.89	-458.9	158756.8	-449.1
119	4102	201.70	-5.46	-4997.89	-458.9	127230.2	-449.1
120	4103	788.70	581.54	-4997.89	-16222.2	142993.5	13704.8
121	4104	788.70	-592.46	-4997.89	15304.4	142993.5	-14603.0
122	4105	1337.81	442.01	-4998.33	-12948.3	157726.9	10350.2
123	4106	163.81	442.01	-4998.33	-12948.3	126200.3	10350.2
124	4107	750.81	1029.01	-4998.33	-28711.6	141963.6	24504.1
125	4108	750.81	-144.99	-4998.33	2815.0	141963.6	-3803.7
126	4111	1254.05	630.56	-4999.33	-18210.8	155440.0	15017.3
127	4112	80.05	630.56	-4999.33	-18210.8	123913.5	15017.3
128	4113	667.05	1217.56	-4999.33	-33974.1	139676.7	29171.2
129	4114	667.05	43.56	-4999.33	-2447.5	139676.7	863.4
130	4115	1173.49	449.73	-5000.31	-13163.8	153235.9	10818.3
131	4116	-0.51	449.73	-5000.31	-13163.8	121709.3	10818.3
132	4117	586.49	1036.73	-5000.31	-28927.1	137472.6	24972.2
133	4118	586.49	-137.27	-5000.31	2599.5	137472.6	-3335.6
134	4121	1143.32	5.46	-5000.69	-763.6	152405.6	212.9
135	4122	-30.68	5.46	-5000.69	-763.6	120879.0	212.9
136	4123	556.32	592.46	-5000.69	-16526.9	136642.3	14366.8
137	4124	556.32	-581.54	-5000.69	14999.7	136642.3	-13941.0
138	4125	1181.21	-442.00	-5000.24	11723.5	153435.5	-10684.9
139	4126	7.21	-442.00	-5000.24	11723.5	121908.9	-10684.9
140	4127	594.21	145.00	-5000.24	-4039.8	137672.2	3469.0
141	4128	594.21	-1029.00	-5000.24	27486.8	137672.2	-24838.8
142	4131	1264.97	-630.54	-4999.24	16985.0	155722.3	-15392.8
143	4132	90.97	-630.54	-4999.24	16985.0	124195.7	-15392.8
144	4133	677.97	-43.54	-4999.24	1221.7	139959.0	-1239.0
145	4134	677.97	-1217.54	-4999.24	32748.3	139959.0	-29546.7
146	4135	1345.53	-449.72	-4998.27	11938.9	157926.5	-11153.0
147	4136	171.53	-449.72	-4998.27	11938.9	126399.9	-11153.0
148	4137	758.53	137.28	-4998.27	-3824.4	142163.2	3000.8
149	4138	758.53	-1036.72	-4998.27	27702.2	142163.2	-25306.9
150	4201	703.19	-677.97	-4997.89	16615.4	141682.5	-16646.6
151	4202	-470.81	-677.97	-4997.89	16615.4	110155.9	-16646.6
152	4203	116.19	-90.97	-4997.89	852.1	125919.2	-2492.7
153	4204	116.19	-1264.97	-4997.89	32378.7	125919.2	-30800.5
154	4205	665.30	-230.50	-4998.33	4126.0	140652.6	-5847.3
155	4206	-508.70	-230.50	-4998.33	4126.0	109126.0	-5847.3
156	4207	78.30	356.50	-4998.33	-11637.3	124889.3	8306.6
157	4208	78.30	-817.50	-4998.33	19889.3	124889.3	-20001.2
158	4211	581.54	-41.96	-4999.33	-1136.6	138365.8	-1180.2
159	4212	-592.46	-41.96	-4999.33	-1136.6	106839.2	-1180.2
160	4213	-5.46	545.04	-4999.33	-16899.9	122602.5	12973.7
161	4214	-5.46	-628.96	-4999.33	14626.7	122602.5	-15334.1

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
162	4215	500.98	-222.78	-5000.31	3910.5	136161.7	-5379.2
163	4216	-673.02	-222.78	-5000.31	3910.5	104635.1	-5379.2
164	4217	-86.02	364.22	-5000.31	-11852.8	120398.4	8774.7
165	4218	-86.02	-809.78	-5000.31	19673.8	120398.4	-19533.1
166	4221	470.81	-667.05	-5000.69	16310.6	135331.4	-15984.6
167	4222	-703.19	-667.05	-5000.69	16310.6	103804.8	-15984.6
168	4223	-116.19	-80.05	-5000.69	547.3	119568.1	-1830.7
169	4224	-116.19	-1254.05	-5000.69	32073.9	119568.1	-30138.5
170	4225	508.70	-1114.51	-5000.24	28797.7	136361.3	-26882.4
171	4226	-665.30	-1114.51	-5000.24	28797.7	104834.7	-26882.4
172	4227	-78.30	-527.51	-5000.24	13034.4	120598.0	-12728.5
173	4228	-78.30	-1701.51	-5000.24	44561.0	120598.0	-41036.3
174	4231	592.46	-1303.05	-4999.24	34059.3	138648.1	-31590.3
175	4232	-581.54	-1303.05	-4999.24	34059.3	107121.5	-31590.3
176	4233	5.46	-716.05	-4999.24	18296.0	122884.8	-17436.4
177	4234	5.46	-1890.05	-4999.24	49822.6	122884.8	-45744.2
178	4235	673.02	-1122.23	-4998.27	29013.2	140852.2	-27350.5
179	4236	-500.98	-1122.23	-4998.27	29013.2	109325.6	-27350.5
180	4237	86.02	-535.23	-4998.27	13249.9	125088.9	-13196.6
181	4238	86.02	-1709.23	-4998.27	44776.5	125088.9	-41504.4
182	4301	703.19	667.05	-4997.89	-17533.1	141682.5	15984.6
183	4302	-470.81	667.05	-4997.89	-17533.1	110155.9	15984.6
184	4303	116.19	1254.05	-4997.89	-33296.4	125919.2	30138.5
185	4304	116.19	80.05	-4997.89	-1769.8	125919.2	1830.7
186	4305	665.30	1114.52	-4998.33	-30022.5	140652.6	26783.9
187	4306	-508.70	1114.52	-4998.33	-30022.5	109126.0	26783.9
188	4307	78.30	1701.52	-4998.33	-45785.8	124889.3	40937.7
189	4308	78.30	527.52	-4998.33	-14259.2	124889.3	12630.0
190	4311	581.54	1303.07	-4999.33	-35285.0	138365.8	31451.0
191	4312	-592.46	1303.07	-4999.33	-35285.0	106839.2	31451.0
192	4313	-5.46	1890.07	-4999.33	-51048.3	122602.5	45604.9
193	4314	-5.46	716.07	-4999.33	-19521.7	122602.5	17297.1
194	4315	500.98	1122.24	-5000.31	-30238.0	136161.7	27252.0
195	4316	-673.02	1122.24	-5000.31	-30238.0	104635.1	27252.0
196	4317	-86.02	1709.24	-5000.31	-46001.3	120398.4	41405.9
197	4318	-86.02	535.24	-5000.31	-14474.7	120398.4	13098.1
198	4321	470.81	677.97	-5000.69	-17837.8	135331.4	16646.6
199	4322	-703.19	677.97	-5000.69	-17837.8	103804.8	16646.6
200	4323	-116.19	1264.97	-5000.69	-33601.1	119568.1	30800.5
201	4324	-116.19	90.97	-5000.69	-2074.5	119568.1	2492.7
202	4325	508.70	230.51	-5000.24	-5350.8	136361.3	5748.8
203	4326	-665.30	230.51	-5000.24	-5350.8	104834.7	5748.8
204	4327	-78.30	817.51	-5000.24	-21114.1	120598.0	19902.7
205	4328	-78.30	-356.49	-5000.24	10412.5	120598.0	-8405.1
206	4331	592.46	41.97	-4999.24	-89.2	138648.1	1040.8

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
207	4332	-581.54	41.97	-4999.24	-89.2	107121.5	1040.8
208	4333	5.46	628.97	-4999.24	-15852.5	122884.8	15194.7
209	4334	5.46	-545.03	-4999.24	15674.1	122884.8	-13113.1
210	4335	673.02	222.79	-4998.27	-5135.3	140852.2	5280.6
211	4336	-500.98	222.79	-4998.27	-5135.3	109325.6	5280.6
212	4337	86.02	809.79	-4998.27	-20898.6	125088.9	19434.5
213	4338	86.02	-364.21	-4998.27	10628.0	125088.9	-8873.2

BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(IGP-ICG) TOP DECK BRIDGE

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
1	DL	0.00	450.03	4.80	11.03	-0.00				-922.03	25.76	0.08	28.05
2	201	316.16	24.66	0.19	27.69	-14.87	56.66	0.15	28.24	3.80	29.45	-1.25	28.20
3	202	213.04	23.09	0.19	27.66	1203.27	23.72	-1.02	27.92	2.60	20.85	1.31	28.08
4	203	-14.87	56.66	0.15	28.24	1716.55	24.00	-1.01	27.92	-0.13	279.79	-75.69	31.86
5	204	-234.07	26.10	0.18	27.72	1224.30	24.28	-1.00	27.93	-2.78	37.50	-3.65	28.32
6	205	-316.16	24.66	0.19	27.69	14.87	56.66	0.15	28.24	-3.80	29.45	-1.25	28.20
7	206	-213.04	23.09	0.19	27.66	-1203.23	23.94	1.05	27.92	-2.60	20.85	1.31	28.08
8	207	14.87	56.66	0.15	28.24	-1716.50	24.22	1.04	27.92	0.13	279.79	-75.69	31.86
9	208	234.07	26.10	0.18	27.72	-1224.26	24.50	1.04	27.92	2.78	37.50	-3.65	28.32
10	301	116.19	24.66	0.19	27.68	-5.46	56.68	0.15	28.24	1.40	29.37	-1.25	28.20
11	302	78.30	23.09	0.19	27.66	442.01	23.72	-1.02	27.91	0.96	20.76	1.31	28.07
12	303	-5.46	56.68	0.15	28.24	630.56	24.00	-1.01	27.92	-0.05	281.63	-76.42	31.90
13	304	-86.02	26.10	0.18	27.71	449.73	24.28	-1.00	27.92	-1.02	37.43	-3.65	28.31
14	305	-116.19	24.66	0.19	27.68	5.46	56.68	0.15	28.24	-1.40	29.37	-1.25	28.20
15	306	-78.30	23.09	0.19	27.66	-442.00	23.94	1.05	27.91	-0.96	20.76	1.31	28.07
16	307	5.46	56.68	0.15	28.24	-630.54	24.22	1.04	27.91	0.05	281.63	-76.42	31.90
17	308	86.02	26.10	0.18	27.71	-449.72	24.50	1.04	27.92	1.02	37.43	-3.65	28.31
18	CL	0.00				0.00				-145.85	24.20	-0.57	29.36
19	PLOP	0.00				0.00				-4483.42	24.26	0.18	25.39
20	NGDL	0.00				0.00				-173.77	25.14	0.21	29.13
21	PLTX	-672.51	24.26	0.18	25.39	0.00				0.00			
22	PLTY	0.00				-672.51	24.26	0.18	25.39	0.00			
23	LL	0.00				0.00				-128.31	23.66	0.01	27.02
24	MRLL	0.00				0.00				-20.00	23.40	0.00	30.85
25	FLX	587.00	24.11	0.00	26.85	0.00				0.00			
26	FLY	0.00				587.00	24.11	0.00	26.85	0.00			
27	FLEM	0.00				0.00				-2690.05	24.26	0.18	25.39
28	1000	0.00	450.03	4.80	11.03	-0.00				-3954.29	24.65	0.13	26.34
29	1001	0.00	450.03	4.80	11.03	-0.00				-4850.98	24.58	0.14	26.17
30	1002	-672.51	24.26	0.18	25.39	-0.00				-4999.29	24.55	0.13	26.21
31	1003	672.51	24.26	0.18	25.39	-0.00				-4999.29	24.55	0.13	26.21
32	1004	0.00	450.03	4.80	11.03	-672.51	24.26	0.18	25.39	-4999.29	24.55	0.13	26.21
33	1005	0.00	450.03	4.80	11.03	672.51	24.26	0.18	25.39	-4999.29	24.55	0.13	26.21
34	1011	587.00	24.11	0.00	26.85	-0.00				-4850.98	24.58	0.14	26.17
35	1012	-587.00	24.11	-0.00	26.85	-0.00				-4850.98	24.58	0.14	26.17
36	1013	0.00	450.03	4.80	11.03	587.00	24.11	-0.00	26.85	-4850.98	24.58	0.14	26.17
37	1014	0.00	450.03	4.80	11.03	-587.00	24.11	0.00	26.85	-4850.98	24.58	0.14	26.17
38	1021	-85.51	25.28	1.38	15.33	-0.00				-4999.29	24.55	0.13	26.21
39	1022	-1259.51	24.19	0.09	26.07	-0.00				-4999.29	24.55	0.13	26.21
40	1023	-672.51	24.26	0.18	25.39	587.00	24.11	-0.00	26.85	-4999.29	24.55	0.13	26.21
41	1024	-672.51	24.26	0.18	25.39	-587.00	24.11	0.00	26.85	-4999.29	24.55	0.13	26.21
42	1031	1259.51	24.19	0.09	26.07	-0.00				-4999.29	24.55	0.13	26.21
43	1032	85.51	25.28	1.38	15.33	-0.00				-4999.29	24.55	0.13	26.21
44	1033	672.51	24.26	0.18	25.39	587.00	24.11	-0.00	26.85	-4999.29	24.55	0.13	26.21
45	1034	672.51	24.26	0.18	25.39	-587.00	24.11	0.00	26.85	-4999.29	24.55	0.13	26.21

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1041	587.00	24.11	0.00	26.85	-672.51	24.26	0.18	25.39	-4999.29	24.55	0.13	26.21
47	1042	-587.00	24.11	-0.00	26.85	-672.51	24.26	0.18	25.39	-4999.29	24.55	0.13	26.21
48	1043	0.00	450.03	4.80	11.03	-85.51	25.28	1.38	15.33	-4999.29	24.55	0.13	26.21
49	1044	0.00	450.03	4.80	11.03	-1259.51	24.19	0.09	26.07	-4999.29	24.55	0.13	26.21
50	1051	587.00	24.11	0.00	26.85	672.51	24.26	0.18	25.39	-4999.29	24.55	0.13	26.21
51	1052	-587.00	24.11	-0.00	26.85	672.51	24.26	0.18	25.39	-4999.29	24.55	0.13	26.21
52	1053	0.00	450.03	4.80	11.03	1259.51	24.19	0.09	26.07	-4999.29	24.55	0.13	26.21
53	1054	0.00	450.03	4.80	11.03	85.51	25.28	1.38	15.33	-4999.29	24.55	0.13	26.21
54	2001	903.16	24.31	0.07	27.15	-14.87	56.66	0.15	28.24	-4847.17	24.58	0.14	26.16
55	2002	-270.84	23.47	-0.22	25.88	-14.87	56.66	0.15	28.24	-4847.17	24.58	0.14	26.16
56	2003	316.16	24.66	0.19	27.69	572.13	23.27	-0.00	26.82	-4847.17	24.58	0.14	26.16
57	2004	316.16	24.66	0.19	27.69	-601.87	24.92	0.00	26.89	-4847.17	24.58	0.14	26.16
58	2005	800.04	23.84	0.05	27.07	1203.27	23.72	-1.02	27.92	-4848.38	24.58	0.14	26.16
59	2006	-373.96	24.70	-0.11	26.39	1203.27	23.72	-1.02	27.92	-4848.38	24.58	0.14	26.16
60	2007	213.04	23.09	0.19	27.66	1790.27	23.85	-0.68	27.57	-4848.38	24.58	0.14	26.16
61	2008	213.04	23.09	0.19	27.66	616.27	23.34	-1.98	28.93	-4848.38	24.58	0.14	26.16
62	2011	572.13	23.27	-0.00	26.82	1716.55	24.00	-1.01	27.92	-4851.10	24.59	0.13	26.17
63	2012	-601.87	24.92	0.00	26.89	1716.55	24.00	-1.01	27.92	-4851.10	24.59	0.13	26.17
64	2013	-14.87	56.66	0.15	28.24	2303.55	24.03	-0.75	27.65	-4851.10	24.59	0.13	26.17
65	2014	-14.87	56.66	0.15	28.24	1129.55	23.94	-1.53	28.48	-4851.10	24.59	0.13	26.17
66	2015	352.93	22.79	-0.12	26.28	1224.30	24.28	-1.00	27.93	-4853.76	24.59	0.13	26.17
67	2016	-821.07	24.68	0.05	27.10	1224.30	24.28	-1.00	27.93	-4853.76	24.59	0.13	26.17
68	2017	-234.07	26.10	0.18	27.72	1811.30	24.23	-0.67	27.58	-4853.76	24.59	0.13	26.17
69	2018	-234.07	26.10	0.18	27.72	637.30	24.44	-1.91	28.91	-4853.76	24.59	0.13	26.17
70	2021	270.84	23.47	-0.22	25.88	14.87	56.66	0.15	28.24	-4854.78	24.58	0.14	26.17
71	2022	-903.16	24.31	0.07	27.15	14.87	56.66	0.15	28.24	-4854.78	24.58	0.14	26.17
72	2023	-316.16	24.66	0.19	27.69	601.87	24.92	0.00	26.89	-4854.78	24.58	0.14	26.17
73	2024	-316.16	24.66	0.19	27.69	-572.13	23.27	-0.00	26.82	-4854.78	24.58	0.14	26.17
74	2025	373.96	24.70	-0.11	26.39	-1203.23	23.94	1.05	27.92	-4853.58	24.58	0.14	26.17
75	2026	-800.04	23.84	0.05	27.07	-1203.23	23.94	1.05	27.92	-4853.58	24.58	0.14	26.17
76	2027	-213.04	23.09	0.19	27.66	-616.23	23.78	2.05	28.93	-4853.58	24.58	0.14	26.17
77	2028	-213.04	23.09	0.19	27.66	-1790.23	24.00	0.71	27.57	-4853.58	24.58	0.14	26.17
78	2031	601.87	24.92	0.00	26.89	-1716.50	24.22	1.04	27.92	-4850.85	24.57	0.14	26.17
79	2032	-572.13	23.27	-0.00	26.82	-1716.50	24.22	1.04	27.92	-4850.85	24.57	0.14	26.17
80	2033	14.87	56.66	0.15	28.24	-1129.50	24.28	1.59	28.47	-4850.85	24.57	0.14	26.17
81	2034	14.87	56.66	0.15	28.24	-2303.50	24.20	0.78	27.65	-4850.85	24.57	0.14	26.17
82	2035	821.07	24.68	0.05	27.10	-1224.26	24.50	1.04	27.92	-4848.20	24.57	0.14	26.16
83	2036	-352.93	22.79	-0.12	26.28	-1224.26	24.50	1.04	27.92	-4848.20	24.57	0.14	26.16
84	2037	234.07	26.10	0.18	27.72	-637.26	24.86	1.99	28.90	-4848.20	24.57	0.14	26.16
85	2038	234.07	26.10	0.18	27.72	-1811.26	24.38	0.70	27.58	-4848.20	24.57	0.14	26.16
86	4001	30.68	22.95	-3.15	62.12	-5.46	56.68	0.15	28.24	-4997.89	24.55	0.13	26.21
87	4002	-1143.32	24.14	0.08	25.91	-5.46	56.68	0.15	28.24	-4997.89	24.55	0.13	26.21
88	4003	-556.32	24.18	0.17	24.91	581.54	23.81	-0.00	26.84	-4997.89	24.55	0.13	26.21
89	4004	-556.32	24.18	0.17	24.91	-592.46	24.41	0.00	26.87	-4997.89	24.55	0.13	26.21
90	4005	-7.21	49.09	14.34	-118.48	442.01	23.72	-1.02	27.91	-4998.33	24.55	0.13	26.21

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	4006	-1181.21	24.26	0.09	25.97	442.01	23.72	-1.02	27.91	-4998.33	24.55	0.13	26.21
92	4007	-594.21	24.42	0.17	25.09	1029.01	23.94	-0.44	27.31	-4998.33	24.55	0.13	26.21
93	4008	-594.21	24.42	0.17	25.09	-144.99	25.32	3.10	23.62	-4998.33	24.55	0.13	26.21
94	4011	-90.97	27.16	1.31	16.10	630.56	24.00	-1.01	27.92	-4999.33	24.55	0.13	26.21
95	4012	-1264.97	24.33	0.09	26.08	630.56	24.00	-1.01	27.92	-4999.33	24.55	0.13	26.21
96	4013	-677.97	24.52	0.18	25.41	1217.56	24.06	-0.52	27.40	-4999.33	24.55	0.13	26.21
97	4014	-677.97	24.52	0.18	25.41	43.56	22.51	-14.55	42.24	-4999.33	24.55	0.13	26.21
98	4015	-171.53	25.69	0.78	21.54	449.73	24.28	-1.00	27.92	-5000.31	24.55	0.13	26.21
99	4016	-1345.53	24.31	0.10	26.18	449.73	24.28	-1.00	27.92	-5000.31	24.55	0.13	26.21
100	4017	-758.53	24.47	0.18	25.65	1036.73	24.19	-0.43	27.32	-5000.31	24.55	0.13	26.21
101	4018	-758.53	24.47	0.18	25.65	-137.27	23.55	3.26	23.36	-5000.31	24.55	0.13	26.21
102	4021	-201.70	24.92	0.69	22.45	5.46	56.68	0.15	28.24	-5000.69	24.55	0.13	26.21
103	4022	-1375.70	24.23	0.10	26.21	5.46	56.68	0.15	28.24	-5000.69	24.55	0.13	26.21
104	4023	-788.70	24.32	0.18	25.73	592.46	24.41	0.00	26.87	-5000.69	24.55	0.13	26.21
105	4024	-788.70	24.32	0.18	25.73	-581.54	23.81	-0.00	26.84	-5000.69	24.55	0.13	26.21
106	4025	-163.81	24.23	0.81	21.22	-442.00	23.94	1.05	27.91	-5000.24	24.55	0.13	26.21
107	4026	-1337.81	24.13	0.10	26.16	-442.00	23.94	1.05	27.91	-5000.24	24.55	0.13	26.21
108	4027	-750.81	24.14	0.18	25.63	145.00	24.64	-3.21	23.64	-5000.24	24.55	0.13	26.21
109	4028	-750.81	24.14	0.18	25.63	-1029.00	24.04	0.45	27.31	-5000.24	24.55	0.13	26.21
110	4031	-80.05	23.14	1.47	14.45	-630.54	24.22	1.04	27.91	-4999.24	24.55	0.13	26.21
111	4032	-1254.05	24.05	0.09	26.06	-630.54	24.22	1.04	27.91	-4999.24	24.55	0.13	26.21
112	4033	-667.05	24.00	0.18	25.37	-43.54	25.72	15.11	42.18	-4999.24	24.55	0.13	26.21
113	4034	-667.05	24.00	0.18	25.37	-1217.54	24.17	0.54	27.40	-4999.24	24.55	0.13	26.21
114	4035	COUPLE				-449.72	24.50	1.04	27.92	-4998.27	24.55	0.13	26.21
115	4036	-1173.49	24.05	0.09	25.95	-449.72	24.50	1.04	27.92	-4998.27	24.55	0.13	26.21
116	4037	-586.49	23.99	0.17	25.05	137.28	22.83	-3.39	23.38	-4998.27	24.55	0.13	26.21
117	4038	-586.49	23.99	0.17	25.05	-1036.72	24.28	0.45	27.31	-4998.27	24.55	0.13	26.21
118	4101	1375.70	24.23	0.10	26.21	-5.46	56.68	0.15	28.24	-4997.89	24.55	0.13	26.21
119	4102	201.70	24.92	0.69	22.45	-5.46	56.68	0.15	28.24	-4997.89	24.55	0.13	26.21
120	4103	788.70	24.32	0.18	25.73	581.54	23.81	-0.00	26.84	-4997.89	24.55	0.13	26.21
121	4104	788.70	24.32	0.18	25.73	-592.46	24.41	0.00	26.87	-4997.89	24.55	0.13	26.21
122	4105	1337.81	24.13	0.10	26.16	442.01	23.72	-1.02	27.91	-4998.33	24.55	0.13	26.21
123	4106	163.81	24.23	0.81	21.22	442.01	23.72	-1.02	27.91	-4998.33	24.55	0.13	26.21
124	4107	750.81	24.14	0.18	25.63	1029.01	23.94	-0.44	27.31	-4998.33	24.55	0.13	26.21
125	4108	750.81	24.14	0.18	25.63	-144.99	25.32	3.10	23.62	-4998.33	24.55	0.13	26.21
126	4111	1254.05	24.05	0.09	26.06	630.56	24.00	-1.01	27.92	-4999.33	24.55	0.13	26.21
127	4112	80.05	23.14	1.47	14.45	630.56	24.00	-1.01	27.92	-4999.33	24.55	0.13	26.21
128	4113	667.05	24.00	0.18	25.37	1217.56	24.06	-0.52	27.40	-4999.33	24.55	0.13	26.21
129	4114	667.05	24.00	0.18	25.37	43.56	22.51	-14.55	42.24	-4999.33	24.55	0.13	26.21
130	4115	1173.49	24.05	0.09	25.95	449.73	24.28	-1.00	27.92	-5000.31	24.55	0.13	26.21
131	4116	COUPLE				449.73	24.28	-1.00	27.92	-5000.31	24.55	0.13	26.21
132	4117	586.49	23.99	0.17	25.05	1036.73	24.19	-0.43	27.32	-5000.31	24.55	0.13	26.21
133	4118	586.49	23.99	0.17	25.05	-137.27	23.55	3.26	23.36	-5000.31	24.55	0.13	26.21
134	4121	1143.32	24.14	0.08	25.91	5.46	56.68	0.15	28.24	-5000.69	24.55	0.13	26.21
135	4122	-30.68	22.95	-3.15	62.12	5.46	56.68	0.15	28.24	-5000.69	24.55	0.13	26.21

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4123	556.32	24.18	0.17	24.91	592.46	24.41	0.00	26.87	-5000.69	24.55	0.13	26.21
137	4124	556.32	24.18	0.17	24.91	-581.54	23.81	-0.00	26.84	-5000.69	24.55	0.13	26.21
138	4125	1181.21	24.26	0.09	25.97	-442.00	23.94	1.05	27.91	-5000.24	24.55	0.13	26.21
139	4126	7.21	49.09	14.34	-118.48	-442.00	23.94	1.05	27.91	-5000.24	24.55	0.13	26.21
140	4127	594.21	24.42	0.17	25.09	145.00	24.64	-3.21	23.64	-5000.24	24.55	0.13	26.21
141	4128	594.21	24.42	0.17	25.09	-1029.00	24.04	0.45	27.31	-5000.24	24.55	0.13	26.21
142	4131	1264.97	24.33	0.09	26.08	-630.54	24.22	1.04	27.91	-4999.24	24.55	0.13	26.21
143	4132	90.97	27.16	1.31	16.10	-630.54	24.22	1.04	27.91	-4999.24	24.55	0.13	26.21
144	4133	677.97	24.52	0.18	25.41	-43.54	25.72	15.11	42.18	-4999.24	24.55	0.13	26.21
145	4134	677.97	24.52	0.18	25.41	-1217.54	24.17	0.54	27.40	-4999.24	24.55	0.13	26.21
146	4135	1345.53	24.31	0.10	26.18	-449.72	24.50	1.04	27.92	-4998.27	24.55	0.13	26.21
147	4136	171.53	25.69	0.78	21.54	-449.72	24.50	1.04	27.92	-4998.27	24.55	0.13	26.21
148	4137	758.53	24.47	0.18	25.65	137.28	22.83	-3.39	23.38	-4998.27	24.55	0.13	26.21
149	4138	758.53	24.47	0.18	25.65	-1036.72	24.28	0.45	27.31	-4998.27	24.55	0.13	26.21
150	4201	703.19	24.20	0.03	26.99	-677.97	24.52	0.18	25.41	-4997.89	24.55	0.13	26.21
151	4202	-470.81	23.98	-0.05	26.65	-677.97	24.52	0.18	25.41	-4997.89	24.55	0.13	26.21
152	4203	116.19	24.66	0.19	27.68	-90.97	27.16	1.31	16.10	-4997.89	24.55	0.13	26.21
153	4204	116.19	24.66	0.19	27.68	-1264.97	24.33	0.09	26.08	-4997.89	24.55	0.13	26.21
154	4205	665.30	23.99	0.02	26.95	-230.50	25.30	2.46	20.55	-4998.33	24.55	0.13	26.21
155	4206	-508.70	24.27	-0.03	26.73	-230.50	25.30	2.46	20.55	-4998.33	24.55	0.13	26.21
156	4207	78.30	23.09	0.19	27.66	356.50	23.34	-1.59	30.93	-4998.33	24.55	0.13	26.21
157	4208	78.30	23.09	0.19	27.66	-817.50	24.45	0.69	25.08	-4998.33	24.55	0.13	26.21
158	4211	581.54	23.81	-0.00	26.84	-41.96	28.15	17.92	-12.61	-4999.33	24.55	0.13	26.21
159	4212	-592.46	24.41	0.00	26.87	-41.96	28.15	17.92	-12.61	-4999.33	24.55	0.13	26.21
160	4213	-5.46	56.68	0.15	28.24	545.04	23.80	-1.38	29.89	-4999.33	24.55	0.13	26.21
161	4214	-5.46	56.68	0.15	28.24	-628.96	24.38	1.20	24.22	-4999.33	24.55	0.13	26.21
162	4215	500.98	23.77	-0.03	26.71	-222.78	24.22	2.54	20.28	-5000.31	24.55	0.13	26.21
163	4216	-673.02	24.37	0.02	26.96	-222.78	24.22	2.54	20.28	-5000.31	24.55	0.13	26.21
164	4217	-86.02	26.10	0.18	27.71	364.22	24.05	-1.55	30.88	-5000.31	24.55	0.13	26.21
165	4218	-86.02	26.10	0.18	27.71	-809.78	24.14	0.70	25.05	-5000.31	24.55	0.13	26.21
166	4221	470.81	23.98	-0.05	26.65	-667.05	24.00	0.18	25.37	-5000.69	24.55	0.13	26.21
167	4222	-703.19	24.20	0.03	26.99	-667.05	24.00	0.18	25.37	-5000.69	24.55	0.13	26.21
168	4223	-116.19	24.66	0.19	27.68	-80.05	23.14	1.47	14.45	-5000.69	24.55	0.13	26.21
169	4224	-116.19	24.66	0.19	27.68	-1254.05	24.05	0.09	26.06	-5000.69	24.55	0.13	26.21
170	4225	508.70	24.27	-0.03	26.73	-1114.51	24.13	0.52	26.39	-5000.24	24.55	0.13	26.21
171	4226	-665.30	23.99	0.02	26.95	-1114.51	24.13	0.52	26.39	-5000.24	24.55	0.13	26.21
172	4227	-78.30	23.09	0.19	27.66	-527.51	24.16	1.10	25.87	-5000.24	24.55	0.13	26.21
173	4228	-78.30	23.09	0.19	27.66	-1701.51	24.13	0.34	26.55	-5000.24	24.55	0.13	26.21
174	4231	592.46	24.41	0.00	26.87	-1303.05	24.24	0.60	26.61	-4999.24	24.55	0.13	26.21
175	4232	-581.54	23.81	-0.00	26.84	-1303.05	24.24	0.60	26.61	-4999.24	24.55	0.13	26.21
176	4233	5.46	56.68	0.15	28.24	-716.05	24.35	1.08	26.41	-4999.24	24.55	0.13	26.21
177	4234	5.46	56.68	0.15	28.24	-1890.05	24.20	0.41	26.69	-4999.24	24.55	0.13	26.21
178	4235	673.02	24.37	0.02	26.96	-1122.23	24.36	0.52	26.40	-4998.27	24.55	0.13	26.21
179	4236	-500.98	23.77	-0.03	26.71	-1122.23	24.36	0.52	26.40	-4998.27	24.55	0.13	26.21
180	4237	86.02	26.10	0.18	27.71	-535.23	24.63	1.09	25.90	-4998.27	24.55	0.13	26.21

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
181	4238	86.02	26.10	0.18	27.71	-1709.23	24.27	0.34	26.56	-4998.27	24.55	0.13	26.21
182	4301	703.19	24.20	0.03	26.99	667.05	24.00	0.18	25.37	-4997.89	24.55	0.13	26.21
183	4302	-470.81	23.98	-0.05	26.65	667.05	24.00	0.18	25.37	-4997.89	24.55	0.13	26.21
184	4303	116.19	24.66	0.19	27.68	1254.05	24.05	0.09	26.06	-4997.89	24.55	0.13	26.21
185	4304	116.19	24.66	0.19	27.68	80.05	23.14	1.47	14.45	-4997.89	24.55	0.13	26.21
186	4305	665.30	23.99	0.02	26.95	1114.52	24.04	-0.30	26.39	-4998.33	24.55	0.13	26.21
187	4306	-508.70	24.27	-0.03	26.73	1114.52	24.04	-0.30	26.39	-4998.33	24.55	0.13	26.21
188	4307	78.30	23.09	0.19	27.66	1701.52	24.07	-0.19	26.55	-4998.33	24.55	0.13	26.21
189	4308	78.30	23.09	0.19	27.66	527.52	23.97	-0.63	25.87	-4998.33	24.55	0.13	26.21
190	4311	581.54	23.81	-0.00	26.84	1303.07	24.14	-0.40	26.61	-4999.33	24.55	0.13	26.21
191	4312	-592.46	24.41	0.00	26.87	1303.07	24.14	-0.40	26.61	-4999.33	24.55	0.13	26.21
192	4313	-5.46	56.68	0.15	28.24	1890.07	24.13	-0.27	26.69	-4999.33	24.55	0.13	26.21
193	4314	-5.46	56.68	0.15	28.24	716.07	24.15	-0.72	26.41	-4999.33	24.55	0.13	26.21
194	4315	500.98	23.77	-0.03	26.71	1122.24	24.27	-0.29	26.40	-5000.31	24.55	0.13	26.21
195	4316	-673.02	24.37	0.02	26.96	1122.24	24.27	-0.29	26.40	-5000.31	24.55	0.13	26.21
196	4317	-86.02	26.10	0.18	27.71	1709.24	24.22	-0.19	26.56	-5000.31	24.55	0.13	26.21
197	4318	-86.02	26.10	0.18	27.71	535.24	24.44	-0.62	25.91	-5000.31	24.55	0.13	26.21
198	4321	470.81	23.98	-0.05	26.65	677.97	24.52	0.18	25.41	-5000.69	24.55	0.13	26.21
199	4322	-703.19	24.20	0.03	26.99	677.97	24.52	0.18	25.41	-5000.69	24.55	0.13	26.21
200	4323	-116.19	24.66	0.19	27.68	1264.97	24.33	0.09	26.08	-5000.69	24.55	0.13	26.21
201	4324	-116.19	24.66	0.19	27.68	90.97	27.16	1.31	16.10	-5000.69	24.55	0.13	26.21
202	4325	508.70	24.27	-0.03	26.73	230.51	24.88	-1.50	20.56	-5000.24	24.55	0.13	26.21
203	4326	-665.30	23.99	0.02	26.95	230.51	24.88	-1.50	20.56	-5000.24	24.55	0.13	26.21
204	4327	-78.30	23.09	0.19	27.66	817.51	24.33	-0.42	25.08	-5000.24	24.55	0.13	26.21
205	4328	-78.30	23.09	0.19	27.66	-356.49	23.62	0.97	30.93	-5000.24	24.55	0.13	26.21
206	4331	592.46	24.41	0.00	26.87	41.97	24.82	-12.86	-12.52	-4999.24	24.55	0.13	26.21
207	4332	-581.54	23.81	-0.00	26.84	41.97	24.82	-12.86	-12.52	-4999.24	24.55	0.13	26.21
208	4333	5.46	56.68	0.15	28.24	628.97	24.16	-0.86	24.23	-4999.24	24.55	0.13	26.21
209	4334	5.46	56.68	0.15	28.24	-545.03	24.06	0.99	29.89	-4999.24	24.55	0.13	26.21
210	4335	673.02	24.37	0.02	26.96	222.79	23.77	-1.56	20.29	-4998.27	24.55	0.13	26.21
211	4336	-500.98	23.77	-0.03	26.71	222.79	23.77	-1.56	20.29	-4998.27	24.55	0.13	26.21
212	4337	86.02	26.10	0.18	27.71	809.79	24.02	-0.43	25.05	-4998.27	24.55	0.13	26.21
213	4338	86.02	26.10	0.18	27.71	-364.21	24.32	0.95	30.87	-4998.27	24.55	0.13	26.21

## B. BASIC LOAD CASE SUMMARY SACS OUTPUT AFTER STRENGTHENING

SACS (2025) \*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\* Company: Engineers India Limited  
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\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	DL	DEAD
2	201	WIND
3	202	WIND
4	203	WIND
5	204	WIND
6	205	WIND
7	206	WIND
8	207	WIND
9	208	WIND
10	301	WIND
11	302	WIND
12	303	WIND
13	304	WIND
14	305	WIND
15	306	WIND
16	307	WIND
17	308	WIND
18	CL	USER GENERATED LOADS
19	PLOP	USER GENERATED LOADS
20	NGDL	USER GENERATED LOADS
21	PLTX	USER GENERATED LOADS
22	PLTY	USER GENERATED LOADS
23	LL	USER GENERATED LOADS
24	MRLL	USER GENERATED LOADS
25	FLX	USER GENERATED LOADS
26	FLY	USER GENERATED LOADS

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	DL	-0.00	-0.00	-1611.31	-121.6	41497.2	-0.0	1611.31	0.00
2	201	344.91	-8.54	2.95	252.6	9444.8	-582.3	0.00	0.00
3	202	237.85	1596.12	2.00	-44925.9	6523.6	38477.7	0.00	0.00
4	203	-8.54	2265.79	-0.13	-63787.5	-219.1	54998.0	0.00	0.00
5	204	-249.92	1608.19	-2.18	-45283.1	-6833.4	39301.2	0.00	0.00
6	205	-344.91	8.54	-2.95	-252.5	-9444.8	582.3	0.00	0.00
7	206	-237.85	-1596.08	-2.00	44919.2	-6523.6	-38746.8	0.00	0.00
8	207	8.54	-2265.74	0.13	63778.0	219.1	-55378.6	0.00	0.00
9	208	249.92	-1608.15	2.18	45276.4	6833.4	-39570.4	0.00	0.00
10	301	126.74	-3.13	1.09	92.5	3469.5	-213.6	0.00	0.00
11	302	87.41	586.09	0.74	-16493.1	2396.6	14128.8	0.00	0.00
12	303	-3.13	831.98	-0.05	-23417.2	-80.2	20194.8	0.00	0.00
13	304	-91.83	590.51	-0.80	-16623.8	-2510.0	14430.9	0.00	0.00
14	305	-126.74	3.13	-1.09	-92.5	-3469.5	213.6	0.00	0.00
15	306	-87.41	-586.08	-0.74	16490.7	-2396.6	-14227.4	0.00	0.00
16	307	3.13	-831.97	0.05	23413.9	80.2	-20334.1	0.00	0.00
17	308	91.83	-590.50	0.80	16621.5	2510.0	-14529.4	0.00	0.00
18	CL	0.00	0.00	-145.85	133.1	3530.0	0.0	0.00	0.00
19	PLOP	0.00	0.00	-3989.93	-786.2	99814.6	0.0	0.00	0.00
20	NGDL	0.00	0.00	-173.77	-36.3	4369.0	0.0	0.00	0.00
21	PLTX	-644.24	0.00	0.00	0.0	-16391.5	107.1	0.00	0.00
22	PLTY	0.00	-660.51	0.00	16786.0	0.0	-16268.8	0.00	0.00
23	LL	0.00	0.00	-128.31	-0.7	3036.3	0.0	0.00	0.00
24	MRLL	0.00	0.00	-20.00	0.0	468.0	0.0	0.00	0.00
25	FLX	587.00	0.00	0.00	0.0	15763.3	0.0	0.00	0.00
26	FLY	0.00	587.00	0.00	-15763.3	0.0	14153.9	0.00	0.00



## COMBINED LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
27	PLEM	0.00	0.00	-2393.96	-471.7	59888.8	0.0
28	1000	-0.00	-0.00	-4347.47	-501.3	109852.8	-0.0
29	1001	-0.00	-0.00	-5145.46	-658.6	129815.7	-0.0
30	1002	-644.24	-0.00	-5293.77	-659.3	116928.6	107.1
31	1003	644.24	-0.00	-5293.77	-659.3	149711.6	-107.1
32	1004	-0.00	-660.51	-5293.77	16126.7	133320.1	-16268.8
33	1005	-0.00	660.51	-5293.77	-17445.3	133320.1	16268.8
34	1011	587.00	-0.00	-5145.46	-658.6	145579.0	-0.0
35	1012	-587.00	-0.00	-5145.46	-658.6	114052.5	-0.0
36	1013	-0.00	587.00	-5145.46	-16421.9	129815.8	14153.9
37	1014	-0.00	-587.00	-5145.46	15104.7	129815.8	-14153.9
38	1021	-57.24	-0.00	-5293.77	-659.3	132691.9	107.1
39	1022	-1231.24	-0.00	-5293.77	-659.3	101165.3	107.1
40	1023	-644.24	587.00	-5293.77	-16422.6	116928.6	14261.0
41	1024	-644.24	-587.00	-5293.77	15104.0	116928.6	-14046.8
42	1031	1231.24	-0.00	-5293.77	-659.3	165474.9	-107.1
43	1032	57.24	-0.00	-5293.77	-659.3	133948.3	-107.1
44	1033	644.24	587.00	-5293.77	-16422.6	149711.6	14046.8
45	1034	644.24	-587.00	-5293.77	15104.0	149711.6	-14261.0
46	1041	587.00	-660.51	-5293.77	16126.7	149083.4	-16268.8
47	1042	-587.00	-660.51	-5293.77	16126.7	117556.8	-16268.8
48	1043	-0.00	-73.51	-5293.77	363.4	133320.1	-2114.9
49	1044	-0.00	-1247.51	-5293.77	31890.0	133320.1	-30422.7
50	1051	587.00	660.51	-5293.77	-17445.3	149083.4	16268.8
51	1052	-587.00	660.51	-5293.77	-17445.3	117556.8	16268.8
52	1053	-0.00	1247.51	-5293.77	-33208.6	133320.1	30422.7
53	1054	-0.00	73.51	-5293.77	-1682.0	133320.1	2114.9
54	2001	931.91	-8.54	-5142.51	-406.0	155023.9	-582.3
55	2002	-242.09	-8.54	-5142.51	-406.0	123497.3	-582.3
56	2003	344.91	578.46	-5142.51	-16169.3	139260.6	13571.5
57	2004	344.91	-595.54	-5142.51	15357.3	139260.6	-14736.2
58	2005	824.85	1596.12	-5143.46	-45584.5	152102.6	38477.7
59	2006	-349.15	1596.12	-5143.46	-45584.5	120576.0	38477.7
60	2007	237.85	2183.12	-5143.46	-61347.8	136339.3	52631.6
61	2008	237.85	1009.12	-5143.46	-29821.2	136339.3	24323.8
62	2011	578.46	2265.79	-5145.59	-64446.0	145360.0	54998.0
63	2012	-595.54	2265.79	-5145.59	-64446.0	113833.4	54998.0
64	2013	-8.54	2852.79	-5145.59	-80209.3	129596.7	69151.9
65	2014	-8.54	1678.79	-5145.59	-48682.7	129596.7	40844.1
66	2015	337.08	1608.19	-5147.64	-45941.7	138745.6	39301.2
67	2016	-836.92	1608.19	-5147.64	-45941.7	107219.0	39301.2
68	2017	-249.92	2195.19	-5147.64	-61705.0	122982.3	53455.1
69	2018	-249.92	1021.19	-5147.64	-30178.4	122982.3	25147.3
70	2021	242.09	8.54	-5148.41	-911.1	136134.2	582.3
71	2022	-931.91	8.54	-5148.41	-911.1	104607.6	582.3

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
72	2023	-344.91	595.54	-5148.41	-16674.4	120370.9	14736.2
73	2024	-344.91	-578.46	-5148.41	14852.2	120370.9	-13571.6
74	2025	349.15	-1596.08	-5147.46	44260.7	139055.5	-38746.8
75	2026	-824.85	-1596.08	-5147.46	44260.7	107528.9	-38746.8
76	2027	-237.85	-1009.08	-5147.46	28497.4	123292.2	-24592.9
77	2028	-237.85	-2183.08	-5147.46	60024.0	123292.2	-52900.7
78	2031	595.54	-2265.74	-5145.33	63119.4	145798.1	-55378.6
79	2032	-578.46	-2265.74	-5145.33	63119.4	114271.5	-55378.6
80	2033	8.54	-1678.74	-5145.33	47356.1	130034.8	-41224.7
81	2034	8.54	-2852.74	-5145.33	78882.7	130034.8	-69532.5
82	2035	836.92	-1608.15	-5143.28	44617.8	152412.5	-39570.4
83	2036	-337.08	-1608.15	-5143.28	44617.8	120885.9	-39570.4
84	2037	249.92	-1021.15	-5143.28	28854.5	136649.2	-25416.5
85	2038	249.92	-2195.15	-5143.28	60381.1	136649.2	-53724.3
86	4001	69.50	-3.13	-5292.69	-566.8	136161.4	-106.5
87	4002	-1104.50	-3.13	-5292.69	-566.8	104634.8	-106.5
88	4003	-517.50	583.87	-5292.69	-16330.1	120398.1	14047.4
89	4004	-517.50	-590.13	-5292.69	15196.5	120398.1	-14260.4
90	4005	30.17	586.09	-5293.04	-17152.3	135088.5	14235.9
91	4006	-1143.83	586.09	-5293.04	-17152.3	103561.9	14235.9
92	4007	-556.83	1173.09	-5293.04	-32915.6	119325.2	28389.8
93	4008	-556.83	-0.91	-5293.04	-1389.0	119325.2	82.0
94	4011	-60.36	831.98	-5293.82	-24076.4	132611.7	20301.8
95	4012	-1234.37	831.98	-5293.82	-24076.4	101085.1	20301.8
96	4013	-647.37	1418.98	-5293.82	-39839.7	116848.4	34455.7
97	4014	-647.37	244.98	-5293.82	-8313.1	116848.4	6147.9
98	4015	-149.06	590.51	-5294.57	-17283.1	130181.9	14537.9
99	4016	-1323.07	590.51	-5294.57	-17283.1	98655.3	14537.9
100	4017	-736.07	1177.51	-5294.57	-33046.4	114418.6	28691.8
101	4018	-736.07	3.51	-5294.57	-1519.8	114418.6	384.0
102	4021	-183.97	3.13	-5294.86	-751.7	129222.4	320.6
103	4022	-1357.97	3.13	-5294.86	-751.7	97695.8	320.6
104	4023	-770.97	590.13	-5294.86	-16515.0	113459.1	14474.5
105	4024	-770.97	-583.87	-5294.86	15011.6	113459.1	-13833.3
106	4025	-144.64	-586.08	-5294.51	15831.4	130295.3	-14120.3
107	4026	-1318.64	-586.08	-5294.51	15831.4	98768.7	-14120.3
108	4027	-731.64	0.92	-5294.51	68.1	114532.0	33.6
109	4028	-731.64	-1173.08	-5294.51	31594.7	114532.0	-28274.2
110	4031	-54.11	-831.97	-5293.73	22754.6	132772.1	-20227.1
111	4032	-1228.11	-831.97	-5293.73	22754.6	101245.5	-20227.1
112	4033	-641.11	-244.97	-5293.73	6991.3	117008.8	-6073.2
113	4034	-641.11	-1418.97	-5293.73	38517.9	117008.8	-34381.0
114	4035	34.59	-590.50	-5292.97	15962.2	135201.9	-14422.4
115	4036	-1139.41	-590.50	-5292.97	15962.2	103675.3	-14422.4
116	4037	-552.41	-3.50	-5292.97	198.9	119438.6	-268.5

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX  (KN)	FY  (KN)	FZ  (KN)	MX  (KN-M)	MY  (KN-M)	MZ  (KN-M)
117	4038	-552.41	-1177.50	-5292.97	31725.5	119438.6	-28576.3
118	4101	1357.97	-3.13	-5292.69	-566.8	168944.4	-320.6
119	4102	183.97	-3.13	-5292.69	-566.8	137417.8	-320.6
120	4103	770.97	583.87	-5292.69	-16330.1	153181.1	13833.3
121	4104	770.97	-590.13	-5292.69	15196.5	153181.1	-14474.5
122	4105	1318.64	586.09	-5293.04	-17152.3	167871.5	14021.8
123	4106	144.64	586.09	-5293.04	-17152.3	136344.9	14021.8
124	4107	731.64	1173.09	-5293.04	-32915.6	152108.2	28175.7
125	4108	731.64	-0.91	-5293.04	-1389.0	152108.2	-132.1
126	4111	1228.11	831.98	-5293.82	-24076.4	165394.7	20087.7
127	4112	54.11	831.98	-5293.82	-24076.4	133868.1	20087.7
128	4113	641.11	1418.98	-5293.82	-39839.7	149631.4	34241.6
129	4114	641.11	244.98	-5293.82	-8313.1	149631.4	5933.8
130	4115	1139.41	590.51	-5294.57	-17283.1	162964.8	14323.8
131	4116	-34.59	590.51	-5294.57	-17283.1	131438.3	14323.8
132	4117	552.41	1177.51	-5294.57	-33046.4	147201.6	28477.7
133	4118	552.41	3.51	-5294.57	-1519.8	147201.6	169.9
134	4121	1104.50	3.13	-5294.86	-751.7	162005.3	106.5
135	4122	-69.50	3.13	-5294.86	-751.7	130478.7	106.5
136	4123	517.50	590.13	-5294.86	-16515.0	146242.0	14260.4
137	4124	517.50	-583.87	-5294.86	15011.6	146242.0	-14047.4
138	4125	1143.83	-586.08	-5294.51	15831.4	163078.2	-14334.4
139	4126	-30.17	-586.08	-5294.51	15831.4	131551.6	-14334.4
140	4127	556.83	0.92	-5294.51	68.1	147314.9	-180.6
141	4128	556.83	-1173.08	-5294.51	31594.7	147314.9	-28488.3
142	4131	1234.37	-831.97	-5293.73	22754.6	165555.1	-20441.2
143	4132	60.36	-831.97	-5293.73	22754.6	134028.5	-20441.2
144	4133	647.37	-244.97	-5293.73	6991.3	149791.8	-6287.3
145	4134	647.37	-1418.97	-5293.73	38517.9	149791.8	-34595.1
146	4135	1323.07	-590.50	-5292.97	15962.2	167984.9	-14636.5
147	4136	149.06	-590.50	-5292.97	15962.2	136458.3	-14636.5
148	4137	736.07	-3.50	-5292.97	198.9	152221.6	-482.6
149	4138	736.07	-1177.50	-5292.97	31725.5	152221.6	-28790.4
150	4201	713.74	-663.64	-5292.69	16219.2	152552.9	-16482.3
151	4202	-460.26	-663.64	-5292.69	16219.2	121026.3	-16482.3
152	4203	126.74	-76.64	-5292.69	455.9	136789.6	-2328.5
153	4204	126.74	-1250.64	-5292.69	31982.5	136789.6	-30636.2
154	4205	674.41	-74.42	-5293.04	-366.3	151480.0	-2139.9
155	4206	-499.59	-74.42	-5293.04	-366.3	119953.4	-2139.9
156	4207	87.41	512.58	-5293.04	-16129.6	135716.7	12014.0
157	4208	87.41	-661.42	-5293.04	15397.0	135716.7	-16293.8
158	4211	583.87	171.47	-5293.82	-7290.4	149003.2	3926.0
159	4212	-590.13	171.47	-5293.82	-7290.4	117476.6	3926.0
160	4213	-3.13	758.47	-5293.82	-23053.7	133239.9	18079.9
161	4214	-3.13	-415.53	-5293.82	8472.9	133239.9	-10227.9

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX  (KN)	FY  (KN)	FZ  (KN)	MX  (KN-M)	MY  (KN-M)	MZ  (KN-M)
162	4215	495.17	-70.00	-5294.57	-497.1	146573.3	-1837.9
163	4216	-678.83	-70.00	-5294.57	-497.1	115046.8	-1837.9
164	4217	-91.83	517.00	-5294.57	-16260.4	130810.1	12316.0
165	4218	-91.83	-657.00	-5294.57	15266.2	130810.1	-15991.8
166	4221	460.26	-657.39	-5294.86	16034.3	145613.8	-16055.2
167	4222	-713.74	-657.39	-5294.86	16034.3	114087.2	-16055.2
168	4223	-126.74	-70.39	-5294.86	271.0	129850.5	-1901.3
169	4224	-126.74	-1244.39	-5294.86	31797.6	129850.5	-30209.1
170	4225	499.59	-1246.59	-5294.51	32617.4	146686.7	-30496.2
171	4226	-674.41	-1246.59	-5294.51	32617.4	115160.1	-30496.2
172	4227	-87.41	-659.59	-5294.51	16854.1	130923.4	-16342.3
173	4228	-87.41	-1833.59	-5294.51	48380.7	130923.4	-44650.1
174	4231	590.13	-1492.48	-5293.73	39540.6	149163.6	-36602.9
175	4232	-583.87	-1492.48	-5293.73	39540.6	117637.0	-36602.9
176	4233	3.13	-905.48	-5293.73	23777.3	133400.3	-22449.0
177	4234	3.13	-2079.48	-5293.73	55303.9	133400.3	-50756.8
178	4235	678.83	-1251.01	-5292.97	32748.2	151593.4	-30798.2
179	4236	-495.17	-1251.01	-5292.97	32748.2	120066.8	-30798.2
180	4237	91.83	-664.01	-5292.97	16984.9	135830.1	-16644.3
181	4238	91.83	-1838.01	-5292.97	48511.5	135830.1	-44952.1
182	4301	713.74	657.39	-5292.69	-17352.8	152552.9	16055.2
183	4302	-460.26	657.39	-5292.69	-17352.8	121026.3	16055.2
184	4303	126.74	1244.39	-5292.69	-33116.1	136789.6	30209.1
185	4304	126.74	70.39	-5292.69	-1589.5	136789.6	1901.3
186	4305	674.41	1246.60	-5293.04	-33938.3	151480.0	30397.6
187	4306	-499.59	1246.60	-5293.04	-33938.3	119953.4	30397.6
188	4307	87.41	1833.60	-5293.04	-49701.6	135716.7	44551.5
189	4308	87.41	659.60	-5293.04	-18175.0	135716.7	16243.7
190	4311	583.87	1492.50	-5293.82	-40862.4	149003.2	36463.6
191	4312	-590.13	1492.50	-5293.82	-40862.4	117476.6	36463.6
192	4313	-3.13	2079.50	-5293.82	-56625.7	133239.9	50617.5
193	4314	-3.13	905.50	-5293.82	-25099.1	133239.9	22309.7
194	4315	495.17	1251.03	-5294.57	-34069.1	146573.3	30699.7
195	4316	-678.83	1251.03	-5294.57	-34069.1	115046.8	30699.7
196	4317	-91.83	1838.03	-5294.57	-49832.4	130810.1	44853.5
197	4318	-91.83	664.02	-5294.57	-18305.8	130810.1	16545.8
198	4321	460.26	663.64	-5294.86	-17537.7	145613.8	16482.3
199	4322	-713.74	663.64	-5294.86	-17537.7	114087.2	16482.3
200	4323	-126.74	1250.64	-5294.86	-33301.0	129850.5	30636.2
201	4324	-126.74	76.64	-5294.86	-1774.4	129850.5	2328.5
202	4325	499.59	74.43	-5294.51	-954.6	146686.7	2041.4
203	4326	-674.41	74.43	-5294.51	-954.6	115160.1	2041.4
204	4327	-87.41	661.43	-5294.51	-16717.9	130923.4	16195.3
205	4328	-87.41	-512.57	-5294.51	14808.7	130923.4	-12112.5
206	4331	590.13	-171.45	-5293.73	5968.6	149163.6	-4065.4

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX  (KN)	FY  (KN)	FZ  (KN)	MX  (KN-M)	MY  (KN-M)	MZ  (KN-M)
207	4332	-583.87	-171.45	-5293.73	5968.6	117637.0	-4065.4
208	4333	3.13	415.55	-5293.73	-9794.7	133400.3	10088.5
209	4334	3.13	-758.45	-5293.73	21731.9	133400.3	-18219.2
210	4335	678.83	70.01	-5292.97	-823.8	151593.4	1739.4
211	4336	-495.17	70.01	-5292.97	-823.8	120066.8	1739.4
212	4337	91.83	657.01	-5292.97	-16587.1	135830.1	15893.3
213	4338	91.83	-516.99	-5292.97	14939.5	135830.1	-12414.5

BRIDGE REPORT FOR REFURBISHMENT /  
REPLACEMENT OF BRIDGES IN MH ASSET  
(IGP-ICG) TOP DECK BRIDGE

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
1	DL	-0.00	-14.75	1.04	31.47	-0.00				-1611.31	25.75	0.08	28.21
2	201	344.91	24.78	0.15	27.79	-8.54	62.28	0.44	29.81	2.95	47.54	-0.65	26.65
3	202	237.85	23.83	0.14	27.74	1596.12	24.13	-0.76	28.15	2.00	37.14	2.71	26.42
4	203	-8.54	62.28	0.44	29.81	2265.79	24.27	-0.75	28.16	-0.13	279.79	-75.69	31.86
5	204	-249.92	25.68	0.15	27.84	1608.19	24.41	-0.75	28.16	-2.18	57.07	-3.73	26.87
6	205	-344.91	24.78	0.15	27.79	8.54	62.28	0.44	29.81	-2.95	47.54	-0.65	26.65
7	206	-237.85	23.83	0.14	27.74	-1596.08	24.30	0.80	28.15	-2.00	37.14	2.71	26.42
8	207	8.54	62.28	0.44	29.81	-2265.74	24.44	0.80	28.15	0.13	279.79	-75.69	31.86
9	208	249.92	25.68	0.15	27.84	-1608.15	24.58	0.80	28.16	2.18	57.07	-3.73	26.87
10	301	126.74	24.78	0.15	27.78	-3.13	62.36	0.45	29.81	1.09	47.38	-0.65	26.64
11	302	87.41	23.83	0.14	27.73	586.09	24.13	-0.76	28.14	0.74	37.00	2.71	26.41
12	303	-3.13	62.36	0.45	29.81	831.98	24.27	-0.75	28.15	-0.05	281.63	-76.42	31.90
13	304	-91.83	25.68	0.15	27.83	590.51	24.41	-0.75	28.16	-0.80	56.91	-3.73	26.86
14	305	-126.74	24.78	0.15	27.78	3.13	62.36	0.45	29.81	-1.09	47.38	-0.65	26.64
15	306	-87.41	23.83	0.14	27.73	-586.08	24.30	0.80	28.14	-0.74	37.00	2.71	26.41
16	307	3.13	62.36	0.45	29.81	-831.97	24.44	0.80	28.15	0.05	281.63	-76.42	31.90
17	308	91.83	25.68	0.15	27.83	-590.50	24.58	0.80	28.15	0.80	56.91	-3.73	26.86
18	CL	0.00				0.00				-145.85	24.20	-0.57	29.36
19	PLOP	0.00				0.00				-3989.93	25.02	0.20	25.53
20	NGDL	0.00				0.00				-173.77	25.14	0.21	29.13
21	PLTX	-644.24	24.22	0.17	25.44	0.00				0.00			
22	PLTY	0.00				-660.51	24.63	0.17	25.41	0.00			
23	LL	0.00				0.00				-128.31	23.66	0.01	27.02
24	MRLL	0.00				0.00				-20.00	23.40	0.00	30.85
25	FLX	587.00	24.11	0.00	26.85	0.00				0.00			
26	FLY	0.00				587.00	24.11	0.00	26.85	0.00			
27	PLEM	0.00				0.00				-2393.96	25.02	0.20	25.53
28	1000	-0.00	-14.75	1.04	31.47	-0.00				-4347.47	25.27	0.13	26.81
29	1001	-0.00	-14.75	1.04	31.47	-0.00				-5145.46	25.23	0.14	26.61
30	1002	-644.24	24.22	0.17	25.44	-0.00				-5293.77	25.18	0.13	26.64
31	1003	644.24	24.22	0.17	25.44	-0.00				-5293.77	25.18	0.13	26.64
32	1004	-0.00	-14.75	1.04	31.47	-660.51	24.63	0.17	25.41	-5293.77	25.18	0.13	26.64
33	1005	-0.00	-14.75	1.04	31.47	660.51	24.63	0.17	25.41	-5293.77	25.18	0.13	26.64
34	1011	587.00	24.11	-0.00	26.85	-0.00				-5145.46	25.23	0.14	26.61
35	1012	-587.00	24.11	0.00	26.85	-0.00				-5145.46	25.23	0.14	26.61
36	1013	-0.00	-14.75	1.04	31.47	587.00	24.11	-0.00	26.85	-5145.46	25.23	0.14	26.61
37	1014	-0.00	-14.75	1.04	31.47	-587.00	24.11	0.00	26.85	-5145.46	25.23	0.14	26.61
38	1021	-57.24	25.33	1.87	10.98	-0.00				-5293.77	25.18	0.13	26.64
39	1022	-1231.24	24.17	0.09	26.12	-0.00				-5293.77	25.18	0.13	26.64
40	1023	-644.24	24.22	0.17	25.44	587.00	24.11	-0.00	26.85	-5293.77	25.18	0.13	26.64
41	1024	-644.24	24.22	0.17	25.44	-587.00	24.11	0.00	26.85	-5293.77	25.18	0.13	26.64
42	1031	1231.24	24.17	0.09	26.12	-0.00				-5293.77	25.18	0.13	26.64
43	1032	57.24	25.33	1.87	10.98	-0.00				-5293.77	25.18	0.13	26.64
44	1033	644.24	24.22	0.17	25.44	587.00	24.11	-0.00	26.85	-5293.77	25.18	0.13	26.64
45	1034	644.24	24.22	0.17	25.44	-587.00	24.11	0.00	26.85	-5293.77	25.18	0.13	26.64

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1041	587.00	24.11	-0.00	26.85	-660.51	24.63	0.17	25.41	-5293.77	25.18	0.13	26.64
47	1042	-587.00	24.11	0.00	26.85	-660.51	24.63	0.17	25.41	-5293.77	25.18	0.13	26.64
48	1043	-0.00	-14.75	1.04	31.47	-73.51	28.77	1.48	13.91	-5293.77	25.18	0.13	26.64
49	1044	-0.00	-14.75	1.04	31.47	-1247.51	24.39	0.09	26.09	-5293.77	25.18	0.13	26.64
50	1051	587.00	24.11	-0.00	26.85	660.51	24.63	0.17	25.41	-5293.77	25.18	0.13	26.64
51	1052	-587.00	24.11	0.00	26.85	660.51	24.63	0.17	25.41	-5293.77	25.18	0.13	26.64
52	1053	-0.00	-14.75	1.04	31.47	1247.51	24.39	0.09	26.09	-5293.77	25.18	0.13	26.64
53	1054	-0.00	-14.75	1.04	31.47	73.51	28.77	1.48	13.91	-5293.77	25.18	0.13	26.64
54	2001	931.91	24.36	0.05	27.20	-8.54	62.28	0.44	29.81	-5142.51	25.22	0.14	26.61
55	2002	-242.09	23.16	-0.21	25.52	-8.54	62.28	0.44	29.81	-5142.51	25.22	0.14	26.61
56	2003	344.91	24.78	0.15	27.79	578.46	23.55	-0.01	26.81	-5142.51	25.22	0.14	26.61
57	2004	344.91	24.78	0.15	27.79	-595.54	24.66	0.01	26.90	-5142.51	25.22	0.14	26.61
58	2005	824.85	24.03	0.04	27.11	1596.12	24.13	-0.76	28.15	-5143.46	25.22	0.14	26.61
59	2006	-349.15	24.31	-0.10	26.25	1596.12	24.13	-0.76	28.15	-5143.46	25.22	0.14	26.61
60	2007	237.85	23.83	0.14	27.74	2183.12	24.12	-0.55	27.80	-5143.46	25.22	0.14	26.61
61	2008	237.85	23.83	0.14	27.74	1009.12	24.14	-1.20	28.90	-5143.46	25.22	0.14	26.61
62	2011	578.46	23.55	-0.01	26.81	2265.79	24.27	-0.75	28.16	-5145.59	25.24	0.14	26.61
63	2012	-595.54	24.66	0.01	26.90	2265.79	24.27	-0.75	28.16	-5145.59	25.24	0.14	26.61
64	2013	-8.54	62.28	0.44	29.81	2852.79	24.24	-0.60	27.89	-5145.59	25.24	0.14	26.61
65	2014	-8.54	62.28	0.44	29.81	1678.79	24.33	-1.02	28.61	-5145.59	25.24	0.14	26.61
66	2015	337.08	22.95	-0.11	26.12	1608.19	24.41	-0.75	28.16	-5147.64	25.24	0.14	26.61
67	2016	-836.92	24.58	0.05	27.15	1608.19	24.41	-0.75	28.16	-5147.64	25.24	0.14	26.61
68	2017	-249.92	25.68	0.15	27.84	2195.19	24.33	-0.55	27.81	-5147.64	25.24	0.14	26.61
69	2018	-249.92	25.68	0.15	27.84	1021.19	24.59	-1.18	28.92	-5147.64	25.24	0.14	26.61
70	2021	242.09	23.16	-0.21	25.52	8.54	62.28	0.44	29.81	-5148.41	25.24	0.14	26.61
71	2022	-931.91	24.36	0.05	27.20	8.54	62.28	0.44	29.81	-5148.41	25.24	0.14	26.61
72	2023	-344.91	24.78	0.15	27.79	595.54	24.66	0.01	26.90	-5148.41	25.24	0.14	26.61
73	2024	-344.91	24.78	0.15	27.79	-578.46	23.55	-0.01	26.81	-5148.41	25.24	0.14	26.61
74	2025	349.15	24.31	-0.10	26.25	-1596.08	24.30	0.80	28.15	-5147.46	25.23	0.14	26.61
75	2026	-824.85	24.03	0.04	27.11	-1596.08	24.30	0.80	28.15	-5147.46	25.23	0.14	26.61
76	2027	-237.85	23.83	0.14	27.74	-1009.08	24.40	1.26	28.90	-5147.46	25.23	0.14	26.61
77	2028	-237.85	23.83	0.14	27.74	-2183.08	24.25	0.58	27.80	-5147.46	25.23	0.14	26.61
78	2031	595.54	24.66	0.01	26.90	-2265.74	24.44	0.80	28.15	-5145.33	25.22	0.14	26.61
79	2032	-578.46	23.55	-0.01	26.81	-2265.74	24.44	0.80	28.15	-5145.33	25.22	0.14	26.61
80	2033	8.54	62.28	0.44	29.81	-1678.74	24.55	1.08	28.61	-5145.33	25.22	0.14	26.61
81	2034	8.54	62.28	0.44	29.81	-2852.74	24.37	0.63	27.89	-5145.33	25.22	0.14	26.61
82	2035	836.92	24.58	0.05	27.15	-1608.15	24.58	0.80	28.16	-5143.28	25.22	0.14	26.61
83	2036	-337.08	22.95	-0.11	26.12	-1608.15	24.58	0.80	28.16	-5143.28	25.22	0.14	26.61
84	2037	249.92	25.68	0.15	27.84	-1021.15	24.85	1.26	28.91	-5143.28	25.22	0.14	26.61
85	2038	249.92	25.68	0.15	27.84	-2195.15	24.46	0.58	27.81	-5143.28	25.22	0.14	26.61
86	4001	69.50	24.32	-1.27	41.63	-3.13	62.36	0.45	29.81	-5292.69	25.18	0.13	26.64
87	4002	-1104.50	24.10	0.08	25.92	-3.13	62.36	0.45	29.81	-5292.69	25.18	0.13	26.64
88	4003	-517.50	24.08	0.17	24.87	583.87	23.91	-0.00	26.84	-5292.69	25.18	0.13	26.64
89	4004	-517.50	24.08	0.17	24.87	-590.13	24.31	0.00	26.87	-5292.69	25.18	0.13	26.64
90	4005	30.17	20.97	-3.15	59.53	586.09	24.13	-0.76	28.14	-5293.04	25.18	0.13	26.64

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	4006	-1143.83	24.20	0.08	25.99	586.09	24.13	-0.76	28.14	-5293.04	25.18	0.13	26.64
92	4007	-556.83	24.28	0.17	25.08	1173.09	24.12	-0.38	27.50	-5293.04	25.18	0.13	26.64
93	4008	-556.83	24.28	0.17	25.08	-0.91	14.16	489.53	-805.68	-5293.04	25.18	0.13	26.64
94	4011	-60.36	27.25	1.80	11.95	831.98	24.27	-0.75	28.15	-5293.82	25.19	0.13	26.64
95	4012	-1234.37	24.27	0.09	26.13	831.98	24.27	-0.75	28.15	-5293.82	25.19	0.13	26.64
96	4013	-647.37	24.40	0.17	25.46	1418.98	24.21	-0.44	27.61	-5293.82	25.19	0.13	26.64
97	4014	-647.37	24.40	0.17	25.46	244.98	24.65	-2.56	31.26	-5293.82	25.19	0.13	26.64
98	4015	-149.06	25.55	0.81	21.36	590.51	24.41	-0.75	28.16	-5294.57	25.19	0.13	26.64
99	4016	-1323.07	24.27	0.09	26.23	590.51	24.41	-0.75	28.16	-5294.57	25.19	0.13	26.64
100	4017	-736.07	24.40	0.16	25.74	1177.51	24.26	-0.38	27.51	-5294.57	25.19	0.13	26.64
101	4018	-736.07	24.40	0.16	25.74	3.51	74.83	-126.04	245.88	-5294.57	25.19	0.13	26.64
102	4021	-183.97	24.95	0.68	22.55	3.13	62.36	0.45	29.81	-5294.86	25.19	0.13	26.64
103	4022	-1357.97	24.23	0.09	26.27	3.13	62.36	0.45	29.81	-5294.86	25.19	0.13	26.64
104	4023	-770.97	24.31	0.16	25.83	590.13	24.31	0.00	26.87	-5294.86	25.19	0.13	26.64
105	4024	-770.97	24.31	0.16	25.83	-583.87	23.91	-0.00	26.84	-5294.86	25.19	0.13	26.64
106	4025	-144.64	24.42	0.82	21.10	-586.08	24.30	0.80	28.14	-5294.51	25.19	0.13	26.64
107	4026	-1318.64	24.15	0.09	26.22	-586.08	24.30	0.80	28.14	-5294.51	25.19	0.13	26.64
108	4027	-731.64	24.17	0.16	25.72	COUPLE				-5294.51	25.19	0.13	26.64
109	4028	-731.64	24.17	0.16	25.72	-1173.08	24.20	0.40	27.50	-5294.51	25.19	0.13	26.64
110	4031	-54.11	23.20	1.95	9.89	-831.97	24.44	0.80	28.15	-5293.73	25.18	0.13	26.64
111	4032	-1228.11	24.07	0.09	26.11	-831.97	24.44	0.80	28.15	-5293.73	25.18	0.13	26.64
112	4033	-641.11	24.03	0.16	25.42	-244.97	25.22	2.71	31.25	-5293.73	25.18	0.13	26.64
113	4034	-641.11	24.03	0.16	25.42	-1418.97	24.30	0.47	27.61	-5293.73	25.18	0.13	26.64
114	4035	34.59	26.26	-2.69	55.73	-590.50	24.58	0.80	28.15	-5292.97	25.18	0.13	26.64
115	4036	-1139.41	24.05	0.08	25.98	-590.50	24.58	0.80	28.15	-5292.97	25.18	0.13	26.64
116	4037	-552.41	23.98	0.17	25.05	COUPLE				-5292.97	25.18	0.13	26.64
117	4038	-552.41	23.98	0.17	25.05	-1177.50	24.35	0.40	27.51	-5292.97	25.18	0.13	26.64
118	4101	1357.97	24.23	0.09	26.27	-3.13	62.36	0.45	29.81	-5292.69	25.18	0.13	26.64
119	4102	183.97	24.95	0.68	22.55	-3.13	62.36	0.45	29.81	-5292.69	25.18	0.13	26.64
120	4103	770.97	24.31	0.16	25.83	583.87	23.91	-0.00	26.84	-5292.69	25.18	0.13	26.64
121	4104	770.97	24.31	0.16	25.83	-590.13	24.31	0.00	26.87	-5292.69	25.18	0.13	26.64
122	4105	1318.64	24.15	0.09	26.22	586.09	24.13	-0.76	28.14	-5293.04	25.18	0.13	26.64
123	4106	144.64	24.42	0.82	21.10	586.09	24.13	-0.76	28.14	-5293.04	25.18	0.13	26.64
124	4107	731.64	24.17	0.16	25.72	1173.09	24.12	-0.38	27.50	-5293.04	25.18	0.13	26.64
125	4108	731.64	24.17	0.16	25.72	-0.91	14.16	489.53	-805.68	-5293.04	25.18	0.13	26.64
126	4111	1228.11	24.07	0.09	26.11	831.98	24.27	-0.75	28.15	-5293.82	25.19	0.13	26.64
127	4112	54.11	23.20	1.95	9.89	831.98	24.27	-0.75	28.15	-5293.82	25.19	0.13	26.64
128	4113	641.11	24.03	0.16	25.42	1418.98	24.21	-0.44	27.61	-5293.82	25.19	0.13	26.64
129	4114	641.11	24.03	0.16	25.42	244.98	24.65	-2.56	31.26	-5293.82	25.19	0.13	26.64
130	4115	1139.41	24.05	0.08	25.98	590.51	24.41	-0.75	28.16	-5294.57	25.19	0.13	26.64
131	4116	-34.59	26.26	-2.69	55.73	590.51	24.41	-0.75	28.16	-5294.57	25.19	0.13	26.64
132	4117	552.41	23.98	0.17	25.05	1177.51	24.26	-0.38	27.51	-5294.57	25.19	0.13	26.64
133	4118	552.41	23.98	0.17	25.05	3.51	74.83	-126.04	245.88	-5294.57	25.19	0.13	26.64
134	4121	1104.50	24.10	0.08	25.92	3.13	62.36	0.45	29.81	-5294.86	25.19	0.13	26.64
135	4122	-69.50	24.32	-1.27	41.63	3.13	62.36	0.45	29.81	-5294.86	25.19	0.13	26.64

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4123	517.50	24.08	0.17	24.87	590.13	24.31	0.00	26.87	-5294.86	25.19	0.13	26.64
137	4124	517.50	24.08	0.17	24.87	-583.87	23.91	-0.00	26.84	-5294.86	25.19	0.13	26.64
138	4125	1143.83	24.20	0.08	25.99	-586.08	24.30	0.80	28.14	-5294.51	25.19	0.13	26.64
139	4126	-30.17	20.97	-3.15	59.53	-586.08	24.30	0.80	28.14	-5294.51	25.19	0.13	26.64
140	4127	556.83	24.28	0.17	25.08	COUPLE				-5294.51	25.19	0.13	26.64
141	4128	556.83	24.28	0.17	25.08	-1173.08	24.20	0.40	27.50	-5294.51	25.19	0.13	26.64
142	4131	1234.37	24.27	0.09	26.13	-831.97	24.44	0.80	28.15	-5293.73	25.18	0.13	26.64
143	4132	60.36	27.25	1.80	11.95	-831.97	24.44	0.80	28.15	-5293.73	25.18	0.13	26.64
144	4133	647.37	24.40	0.17	25.46	-244.97	25.22	2.71	31.25	-5293.73	25.18	0.13	26.64
145	4134	647.37	24.40	0.17	25.46	-1418.97	24.30	0.47	27.61	-5293.73	25.18	0.13	26.64
146	4135	1323.07	24.27	0.09	26.23	-590.50	24.58	0.80	28.15	-5292.97	25.18	0.13	26.64
147	4136	149.06	25.55	0.81	21.36	-590.50	24.58	0.80	28.15	-5292.97	25.18	0.13	26.64
148	4137	736.07	24.40	0.16	25.74	COUPLE				-5292.97	25.18	0.13	26.64
149	4138	736.07	24.40	0.16	25.74	-1177.50	24.35	0.40	27.51	-5292.97	25.18	0.13	26.64
150	4201	713.74	24.23	0.03	27.02	-663.64	24.81	0.17	25.43	-5292.69	25.18	0.13	26.64
151	4202	-460.26	23.93	-0.04	26.60	-663.64	24.81	0.17	25.43	-5292.69	25.18	0.13	26.64
152	4203	126.74	24.78	0.15	27.78	-76.64	30.14	1.44	14.56	-5292.69	25.18	0.13	26.64
153	4204	126.74	24.78	0.15	27.78	-1250.64	24.48	0.09	26.10	-5292.69	25.18	0.13	26.64
154	4205	674.41	24.08	0.02	26.97	-74.42	28.59	7.44	3.91	-5293.04	25.18	0.13	26.64
155	4206	-499.59	24.16	-0.02	26.70	-74.42	28.59	7.44	3.91	-5293.04	25.18	0.13	26.64
156	4207	87.41	23.83	0.14	27.73	512.58	23.46	-1.08	30.19	-5293.04	25.18	0.13	26.64
157	4208	87.41	23.83	0.14	27.73	-661.42	24.62	0.84	24.27	-5293.04	25.18	0.13	26.64
158	4211	583.87	23.91	-0.00	26.84	171.47	22.89	-4.30	38.69	-5293.82	25.19	0.13	26.64
159	4212	-590.13	24.31	0.00	26.87	171.47	22.89	-4.30	38.69	-5293.82	25.19	0.13	26.64
160	4213	-3.13	62.36	0.45	29.81	758.47	23.84	-0.97	29.53	-5293.82	25.19	0.13	26.64
161	4214	-3.13	62.36	0.45	29.81	-415.53	24.62	1.77	21.97	-5293.82	25.19	0.13	26.64
162	4215	495.17	23.82	-0.03	26.67	-70.00	26.46	7.88	2.27	-5294.57	25.19	0.13	26.64
163	4216	-678.83	24.32	0.02	26.99	-70.00	26.46	7.88	2.27	-5294.57	25.19	0.13	26.64
164	4217	-91.83	25.68	0.15	27.83	517.00	23.79	-1.07	30.18	-5294.57	25.19	0.13	26.64
165	4218	-91.83	25.68	0.15	27.83	-657.00	24.36	0.84	24.24	-5294.57	25.19	0.13	26.64
166	4221	460.26	23.93	-0.04	26.60	-657.39	24.45	0.16	25.39	-5294.86	25.19	0.13	26.64
167	4222	-713.74	24.23	0.03	27.02	-657.39	24.45	0.16	25.39	-5294.86	25.19	0.13	26.64
168	4223	-126.74	24.78	0.15	27.78	-70.39	27.28	1.53	13.21	-5294.86	25.19	0.13	26.64
169	4224	-126.74	24.78	0.15	27.78	-1244.39	24.29	0.09	26.08	-5294.86	25.19	0.13	26.64
170	4225	499.59	24.16	-0.02	26.70	-1246.59	24.47	0.46	26.70	-5294.51	25.19	0.13	26.64
171	4226	-674.41	24.08	0.02	26.97	-1246.59	24.47	0.46	26.70	-5294.51	25.19	0.13	26.64
172	4227	-87.41	23.83	0.14	27.73	-659.59	24.79	0.88	26.55	-5294.51	25.19	0.13	26.64
173	4228	-87.41	23.83	0.14	27.73	-1833.59	24.36	0.32	26.75	-5294.51	25.19	0.13	26.64
174	4231	590.13	24.31	0.00	26.87	-1492.48	24.52	0.52	26.94	-5293.73	25.18	0.13	26.64
175	4232	-583.87	23.91	-0.00	26.84	-1492.48	24.52	0.52	26.94	-5293.73	25.18	0.13	26.64
176	4233	3.13	62.36	0.45	29.81	-905.48	24.79	0.85	26.99	-5293.73	25.18	0.13	26.64
177	4234	3.13	62.36	0.45	29.81	-2079.48	24.41	0.37	26.91	-5293.73	25.18	0.13	26.64
178	4235	678.83	24.32	0.02	26.99	-1251.01	24.61	0.46	26.71	-5292.97	25.18	0.13	26.64
179	4236	-495.17	23.82	-0.03	26.67	-1251.01	24.61	0.46	26.71	-5292.97	25.18	0.13	26.64
180	4237	91.83	25.68	0.15	27.83	-664.01	25.04	0.87	26.58	-5292.97	25.18	0.13	26.64



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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
181	4238	91.83	25.68	0.15	27.83	-1838.01	24.45	0.32	26.75	-5292.97	25.18	0.13	26.64
182	4301	713.74	24.23	0.03	27.02	657.39	24.45	0.16	25.39	-5292.69	25.18	0.13	26.64
183	4302	-460.26	23.93	-0.04	26.60	657.39	24.45	0.16	25.39	-5292.69	25.18	0.13	26.64
184	4303	126.74	24.78	0.15	27.78	1244.39	24.29	0.09	26.08	-5292.69	25.18	0.13	26.64
185	4304	126.74	24.78	0.15	27.78	70.39	27.28	1.53	13.21	-5292.69	25.18	0.13	26.64
186	4305	674.41	24.08	0.02	26.97	1246.60	24.39	-0.27	26.70	-5293.04	25.18	0.13	26.64
187	4306	-499.59	24.16	-0.02	26.70	1246.60	24.39	-0.27	26.70	-5293.04	25.18	0.13	26.64
188	4307	87.41	23.83	0.14	27.73	1833.60	24.30	-0.18	26.75	-5293.04	25.18	0.13	26.64
189	4308	87.41	23.83	0.14	27.73	659.60	24.64	-0.51	26.56	-5293.04	25.18	0.13	26.64
190	4311	583.87	23.91	-0.00	26.84	1492.50	24.43	-0.35	26.94	-5293.82	25.19	0.13	26.64
191	4312	-590.13	24.31	0.00	26.87	1492.50	24.43	-0.35	26.94	-5293.82	25.19	0.13	26.64
192	4313	-3.13	62.36	0.45	29.81	2079.50	24.34	-0.25	26.92	-5293.82	25.19	0.13	26.64
193	4314	-3.13	62.36	0.45	29.81	905.50	24.64	-0.57	26.99	-5293.82	25.19	0.13	26.64
194	4315	495.17	23.82	-0.03	26.67	1251.03	24.53	-0.27	26.71	-5294.57	25.19	0.13	26.64
195	4316	-678.83	24.32	0.02	26.99	1251.03	24.53	-0.27	26.71	-5294.57	25.19	0.13	26.64
196	4317	-91.83	25.68	0.15	27.83	1838.03	24.40	-0.18	26.75	-5294.57	25.19	0.13	26.64
197	4318	-91.83	25.68	0.15	27.83	664.02	24.90	-0.50	26.58	-5294.57	25.19	0.13	26.64
198	4321	460.26	23.93	-0.04	26.60	663.64	24.81	0.17	25.43	-5294.86	25.19	0.13	26.64
199	4322	-713.74	24.23	0.03	27.02	663.64	24.81	0.17	25.43	-5294.86	25.19	0.13	26.64
200	4323	-126.74	24.78	0.15	27.78	1250.64	24.48	0.09	26.10	-5294.86	25.19	0.13	26.64
201	4324	-126.74	24.78	0.15	27.78	76.64	30.14	1.44	14.56	-5294.86	25.19	0.13	26.64
202	4325	499.59	24.16	-0.02	26.70	74.43	27.26	-4.83	3.94	-5294.51	25.19	0.13	26.64
203	4326	-674.41	24.08	0.02	26.97	74.43	27.26	-4.83	3.94	-5294.51	25.19	0.13	26.64
204	4327	-87.41	23.83	0.14	27.73	661.43	24.47	-0.54	24.28	-5294.51	25.19	0.13	26.64
205	4328	-87.41	23.83	0.14	27.73	-512.57	23.65	0.70	30.18	-5294.51	25.19	0.13	26.64
206	4331	590.13	24.31	0.00	26.87	-171.45	23.70	3.24	38.68	-5293.73	25.18	0.13	26.64
207	4332	-583.87	23.91	-0.00	26.84	-171.45	23.70	3.24	38.68	-5293.73	25.18	0.13	26.64
208	4333	3.13	62.36	0.45	29.81	415.55	24.28	-1.34	21.98	-5293.73	25.18	0.13	26.64
209	4334	3.13	62.36	0.45	29.81	-758.45	24.02	0.73	29.53	-5293.73	25.18	0.13	26.64
210	4335	678.83	24.32	0.02	26.99	70.01	25.05	-5.17	2.31	-5292.97	25.18	0.13	26.64
211	4336	-495.17	23.82	-0.03	26.67	70.01	25.05	-5.17	2.31	-5292.97	25.18	0.13	26.64
212	4337	91.83	25.68	0.15	27.83	657.01	24.21	-0.55	24.24	-5292.97	25.18	0.13	26.64
213	4338	91.83	25.68	0.15	27.83	-516.99	23.99	0.70	30.18	-5292.97	25.18	0.13	26.64

## 6.1 Member Unity Check Result

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

### 6.1a AS-IS CONDITION

#### Member Unity Check Result

Member	Group ID	Load Case	UC
B001-B002	BCE	4101	2.98
M007-M005	BLA	4331	2.351
M016-M015	MCV	4021	1.564
M015-M013	BLC	4312	2.236
M024-M023	MCV	4101	1.059
M023-M021	BLE	4312	2.003
M032-M031	MCV	4021	1.325
M031-M029	BLG	4231	2.525
M040-M039	MCV	4021	1.564
M039-M037	BLI	4312	2.626
M043-M041	BLJ	4311	1.113
B017-B018	YAE	4101	1.017
B025-B026	YAI	4101	1.255
M005-B005	WTC	4311	1.033
L008-L007	MCV	4021	1.385
L007-L005	BL1	4211	4.351
M009-B009	WTH	4311	1.048
L013-L014	MCV	4021	1.163
L015-L013	BL3	4232	1.841
L023-L021	BL5	4231	1.528
L021-L022	MCV	4021	1.068
L031-L029	BL7	4231	2.02
L029-L030	MCV	4021	1.068
L031-M031	EVD	4231	1.29
M031-B031	EVC	4231	1.03
M035-B035	EVG	4231	1.156
L039-L037	BL9	4231	2.038
L037-L038	MCV	4101	1.056
L039-M039	EVM	4231	1.186
M039-B039	EVL	4231	1.446
L043-L041	B1L	4231	1.837
L043-M043	EVS	4231	1.508

Member	Group ID	Load Case	UC
M043-B043	EVR	4231	1.03
M041-B041	WVP	4311	1.109
L047-L045	B2L	4231	3.273
M047-B047	EVX	4231	1.159
B021-B025	BMG	4311	1.215
B029-B025	BMH	4311	1.269
B029-B033	BMI	4311	1.27
B023-B027	BNG	4231	1.187
B027-B031	BNH	4231	1.36
B031-B035	BNI	4231	1.211
B033-B037	BMJ	4311	1.105
B035-B039	BNJ	4231	1.392
T005-T007	TCO	4232	1.264
T007-T009	TCP	4232	1.202
T009-T011	TCQ	4232	1.159
T011-T013	TAA	4232	1.135
T013-T015	TAB	4232	1.248
T015-T017	TAC	4232	1.186
T017-T019	TAD	4232	1.012
T006-T008	TCD	4312	1.083
T008-T010	TCE	4312	1.044
T010-T012	TCF	4312	1.058
T012-T014	TCG	4312	1.06
T014-T016	TDA	4312	1.129
T016-T018	TDB	4312	1.187
B003-L007	ETA	4231	1.045
B001-L005	WTA	4311	1.688
L027-L031	EVB	4231	1.02
L035-L039	EVK	4231	1.023
L039-L043	EVP	4231	1.032
L043-L047	EVV	4231	1.547
M023-M027	ETY	4231	1.192
M027-M031	EVA	4231	1.358
M031-M035	EVE	4231	1.666
M035-M039	EVJ	4231	1.76
M039-M043	EVO	4231	1.759
M043-M047	EVU	4231	1.88

Member	Group ID	Load Case	UC
B050-T001	WAA	4211	1.323
L005-L009	WTG	4111	1.268
L009-L013	WTK	4111	1.277
L013-L017	WTO	4111	1.21
L021-L025	WTW	4111	1.216
L025-L029	WVA	4311	1.006
L029-L033	WVE	4311	1.165
L033-L037	WVJ	4311	1.066
L037-L041	WVO	4311	1.159
L041-L045	WVS	4311	1.51
M009-M013	WTJ	4311	1.167
M013-M017	WTN	4311	1.323
M017-M021	WTR	4311	1.251
M021-M025	WTV	4311	1.143
M025-M029	WTZ	4311	1.774
M029-M033	WVD	4311	1.334
M033-M037	WVI	4311	1.295
M037-M041	WVN	4311	1.051
T002-B007	EAC	4312	1.111
B007-T006	EAE	4312	1.515
B047-T022	EAW	4312	1.101
T001-B005	WAC	4232	1.071
B005-T005	WAE	4232	1.344
B067-B056	EBB	4312	1.127
T029-B062	WBC	4212	1.078
T028-B062	WBB	4212	1.115
T029-B063	WBD	4212	1.214
B067-B057	EBC	4231	1.313
L045-B060	WVX	4011	1.701
B066-B056	EBA	4332	1.483
B005-0000	BCF	4132	1.147
B070-B007	BCG	4106	1.213
M009-0007	MCT	4311	1.057
M021-0013	MCT	4106	1.16
M029-0015	MCZ	4022	1.67
M033-0017	MCT	4015	1.327
0020-0021	BL8	4231	1.146

Member	Group ID	Load Case	UC
B073-B076	B3A	4231	1.197
B074-B077	B3B	4231	1.391
0028-L043	MBC	4101	1.223
L047-0033	EVY	4231	1.438
0033-M047	EVY	4231	1.544
0033-0034	MBK	4231	1.813
B075-B078	B3C	4231	1.589
B055-M047	EZZ	4231	2.44
B007-0031	BHB	2031	1.468
B041-B042	YAQ	4021	3.025
0044-B043	YAR	4105	1.017
B043-0047	BLN	4231	1.065
0047-B047	BNL	4231	1.595
B003-0045	BHA	4012	1.184
0046-B001	BHA	4211	1.171
0049-B009	BHC	4232	1.285
B015-0050	BHD	4312	1.17
0051-B013	BHD	4232	1.488
B019-0052	BHE	4312	1.818
0053-B017	BHE	4232	1.735
B023-0054	BHF	4312	1.692
0055-B021	BHF	4232	1.701
B027-0056	BHG	4312	1.621
0057-B025	BHG	4232	1.456
B031-0058	BHH	4311	1.495
0058-0059	BHH	4231	1.028
0059-B029	BHH	4231	1.673
B035-0060	BHI	4311	1.321
0061-B033	BHI	4231	1.489
B039-0062	BHJ	4311	2.702
0062-0063	BHJ	4231	1.564
0063-B037	BHJ	4231	2.224
B043-0064	BHK	4311	1.836
0064-0065	BHK	4311	1.559
0065-B041	BHK	4231	1.827
B050-0066	BAA	4212	1.221
0067-B045	BHL	4231	1.555

Member	Group ID	Load Case	UC
0071-B051	BAA	4012	1.482
B047-0072	BHL	4311	2.353
0072-0067	BHL	4231	1.292
0069-0074	BAP	4231	1.121
B054-0076	BAB	4105	1.013
0078-B009	BAE	4232	1.671
B009-0079	BAF	4234	1.599
0080-B017	BAG	4232	1.485
B017-0081	BAH	4231	1.29
0084-B033	BAK	4231	1.175
B033-0085	BAL	4311	1.694
0086-B041	BAM	4231	2.107
B041-0087	BAN	4232	1.807
0088-B060	BHM	4231	1.458
0089-B061	B12	4231	2.067
0090-B062	B22	4231	2.508
B057-0091	BHP	2031	3.229
0091-B063	BHP	4231	4.299
0031-0092	BHB	4212	1.365
0092-0093	BHB	4232	1.003
0093-B005	BHB	4212	2.179
0077-0094	BAD	4232	1.028
0094-0032	BAD	4232	1.079
B007-0095	BAE	4232	1.401
0095-0078	BAE	4232	1.348
0079-0099	BAF	4231	1.461
0099-B015	BAF	4231	1.39
B015-0100	BAG	4232	1.294
0100-0080	BAG	4232	1.273
0081-0097	BAH	4231	1.077
0097-B023	BAH	4231	1.029
0085-0103	BAL	4311	1.831
0103-B039	BAL	4311	1.971
B039-0104	BAM	4312	2.242
0104-0086	BAM	4312	2.079
0087-0105	BAN	4311	1.703
0105-B047	BAN	4311	2.318

Member	Group ID	Load Case	UC
B047-0106	BHM	4311	1.926
B055-0107	B11	4232	2.033
0107-0089	BHN	4231	1.442
B056-0108	B21	4231	2.314
0108-0090	BHO	4231	1.417
0109-T001	TBA	4212	1.784
0110-T003	TBB	2012	1.262
T004-0111	TBC	4032	1.312
0111-T003	TBC	2012	1.149
T003-0112	TBD	4212	1.388
0112-T006	TBD	4212	1.171
0113-T005	TBE	4212	1.095
T007-0116	TBH	4212	1.157
T018-0126	TRB	2012	1.017
0126-T019	TBR	2012	1.129
T019-0128	TBT	2032	1.05
0128-T022	TBT	2032	1.236
0130-T023	TBV	2012	1.049
T024-0131	TBW	2032	1.613
T023-0132	TBX	2012	1.23
0132-B066	TBX	2032	2.335
0133-T027	TBY	4312	1.098
B066-0134	TBZ	2034	1.568
0134-T028	TBZ	2012	1.457
T028-0135	TCX	2012	1.462
0135-B067	TCX	2031	1.743
B067-0136	TCW	2031	1.932
0136-T029	TCW	2012	1.562
B009-0138	WFA	4026	1.025
0138-T005	WAF	4232	1.703
B029-0014	YAK	4101	1.749
B021-0012	YAG	4021	1.336
B013-0009	YAC	4021	1.143
B009-0160	YAA	4015	1.355
B033-0161	YAM	4101	1.55

## 6.1b AFTER STRENGTHENING

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

### Member Unity Check Result

Member	Group ID	Load Case	UC	Remarks
M015-M013	BLC	4312	1.056	Member UC has increased marginally during extreme condition.
M031-M029	BLG	4231	1.079	
M039-M037	BLI	4311	1.185	
L015-L013	BL3	4231	1.008	
L047-L045	B2L	4231	1.148	
B047-0072	BHL	2032	1.017	

## 6.2 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below

### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum Vertical Deflection (cm)	Remarks
1.	B029	7.30	Allowable Deflection = $(5300 / 400) = 13.25$ cm
2.	B025	7.30	

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below

### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	T025	1.30	Allowable Deflection = $(5300 / 500) = 10.60$ cm
2.	0111	1.20	

Vertical and Horizontal Deflection of bridge are under control.

## 6.3 Reaction Summary

Following is the reaction summary of the bridge supports.

### Summary of Bridge Reaction

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	B050	0	0	1883
2.	B051	0	0	1285



S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
3.	B054	1357.975	930.228	0
4.	B057	0	1869	1819
5.	B063	0	1013	1661

## 8.0 CONCLUSION

The analysis of bridge has been carried out considering the piping, electrical & instrumentation cable tray and wind loads. Based on the results, the necessary strengthening requirements, as outlined in Clause 4.0, have been recommended. With the implementation of these strengthening measures of the top chord, bottom chord, and associated framing members, the bridge is found to be structurally adequate and safe under all load combinations.

Also, functionally the deflection is under the limits. The adequacy of the bridge landing locations, adequacy of deck members are performed separately.

It is also recommended that no additional structural loading/modifications shall be carried out on ICP-ICG bridge without adequate structural analysis.

**ANNEXURE-1  
LOAD CALCULATIONS**

## WIND LOAD:

S.No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulance Intensity at height "z"	t <sub>o</sub>	t	Design Wind Speed at Height "z"	
			U <sub>o</sub>			z		U(z)	Iu(z)			u(z,t)	
			kmph	ft/sec		m	ft	ft/sec				sec	sec
1	Extreme	0	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
2	Extreme	45	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
3	Extreme	90	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
4	Extreme	135	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
5	Extreme	180	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
6	Extreme	225	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
7	Extreme	270	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
8	Extreme	315	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
1	Operating	All	99.22	90.40	0.130	10.00	32.80	90.40	0.131	3600	15	117.02	35.68

## CABLE LOAD & CABLE TRAY LOAD:

SR NO	NAME OF COMPLEX	NAME OF BRIDGES	PURPOSE FOR ELECTRICAL POINT OF VIEW	NO OF TRAYS TO BE CONSIDERED/EXISTING	CABLES TO BE CONSIDERED	WEIGHT FOR TRAY & CABLES
1	IC COMPLEX	ICP-ICG UPPER DECK BRIDGE (EXISTING)	Both HT & LT Power cable, DCS cable, lighting cables are passing	8 nos 750mm tray (inside of bridge)	16 run 3.5CX120 SQ. MM Cu conductor armoured cables	FOR 750 mm CABLE TRAY LOAD= 35.9 KG/3 MTR LONG
				1 no 150 mm tray (inside of bridge)		FOR 450 mm CABLE TRAY LOAD = 21.85KG/3 MTR LONG
				3 nos 750mm tray (outside the bridge)	8 run 3.5CX95 SQ. MM Cu conductor armoured cables	
				1 no 450mm tray (outside the bridge)		FOR 150 mm CABLE TRAY LOAD = 5KG/3 MTR LONG
					4 run 3.5CX185 SQ. MM Cu conductor armoured cables (HT)	
						FOR CABLE LOAD
						for 3.5CX120 SQ. MM Cu conductor armoured cables= 4617 kg/km
						for 3.5CX95 SQ. MM Cu conductor armoured cables= 3686 kg/km
					2 run 3C X2.5 SQ. MM armoured cu. conductor cable	for 3.5CX185 SQ. MM Cu conductor armoured cables
						=7430 kg/km
						for 3C X2.5 SQ. MM armoured cu. conductor cable= 162 kg/km
						for DCS cables-120kg/km

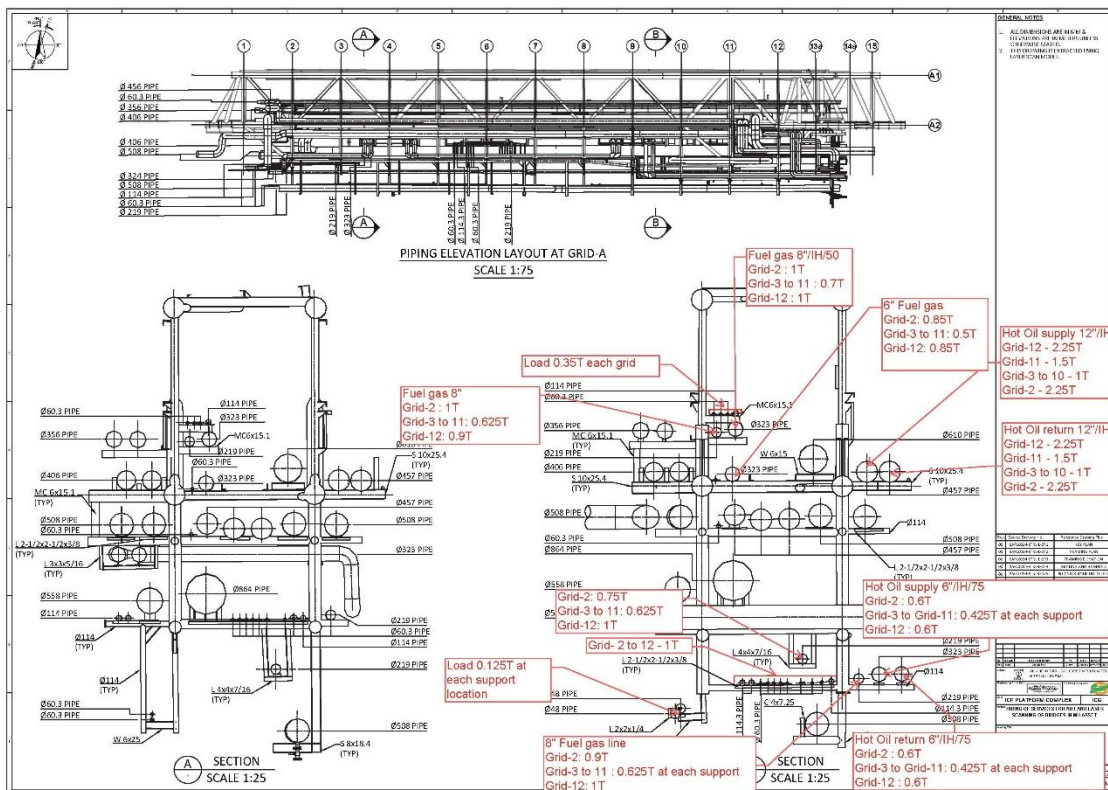
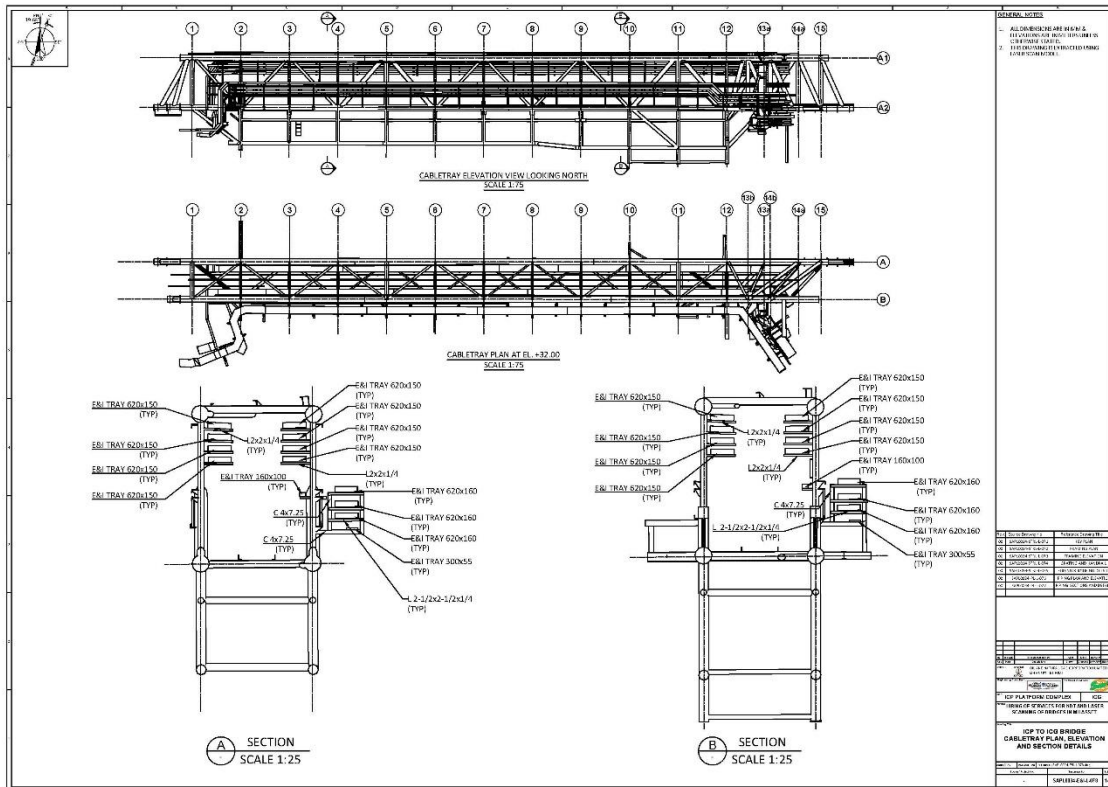
## GRATING LOAD

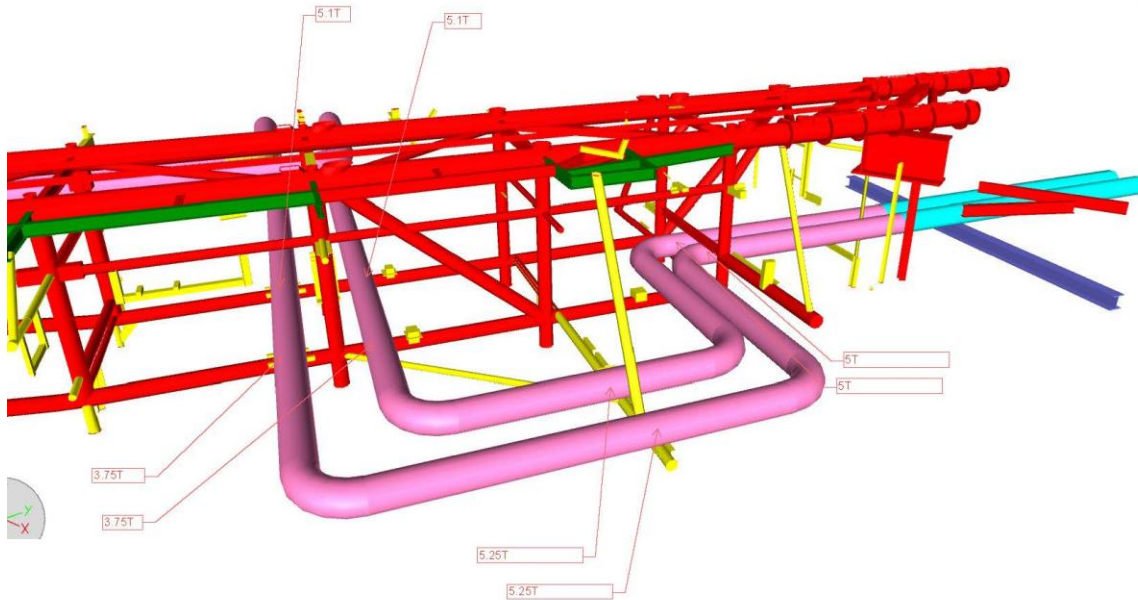
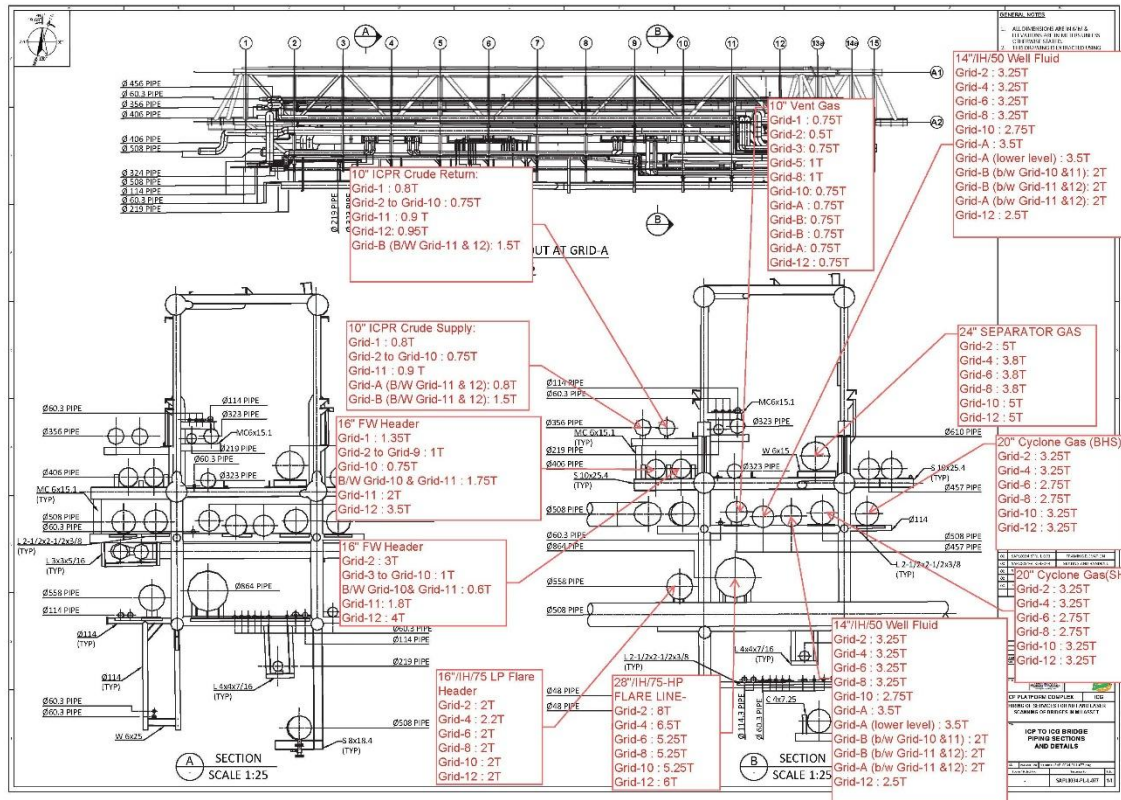
Grating load of 50 kg/m<sup>2</sup> is considered

## HANDRAIL LOAD

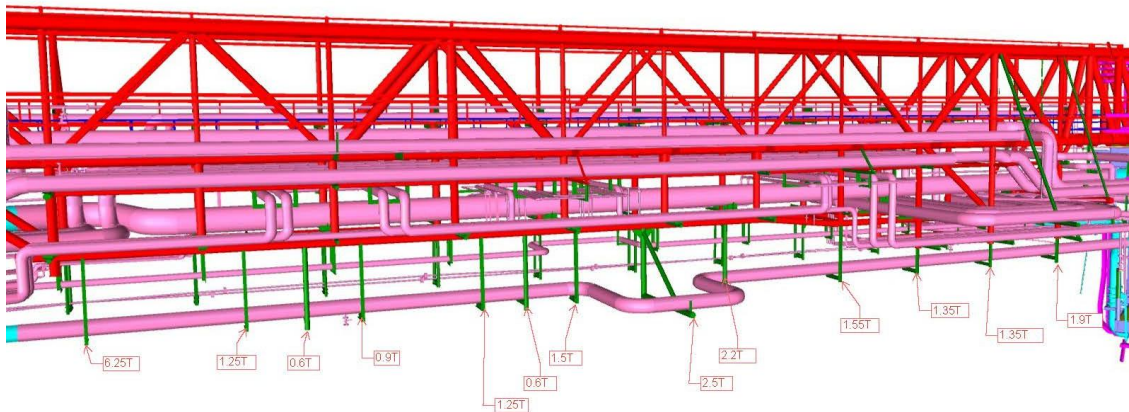
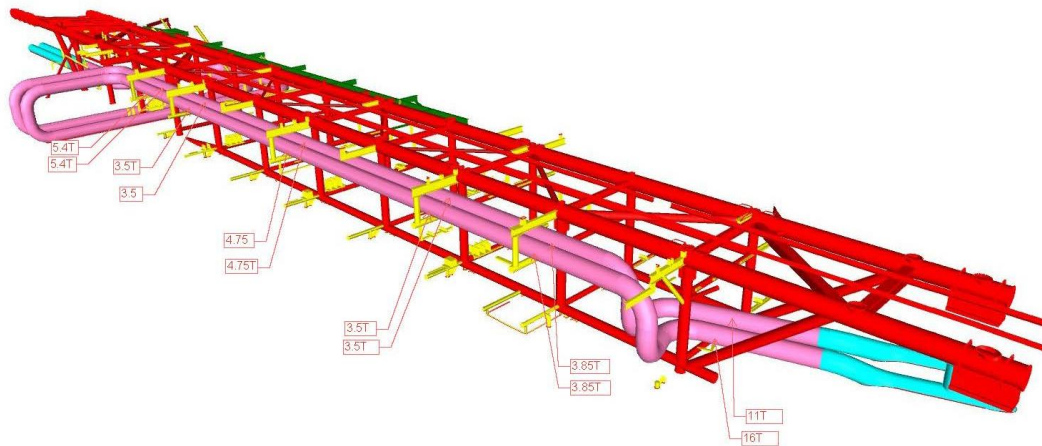
Handrail Load of 50Kg/m is considered.

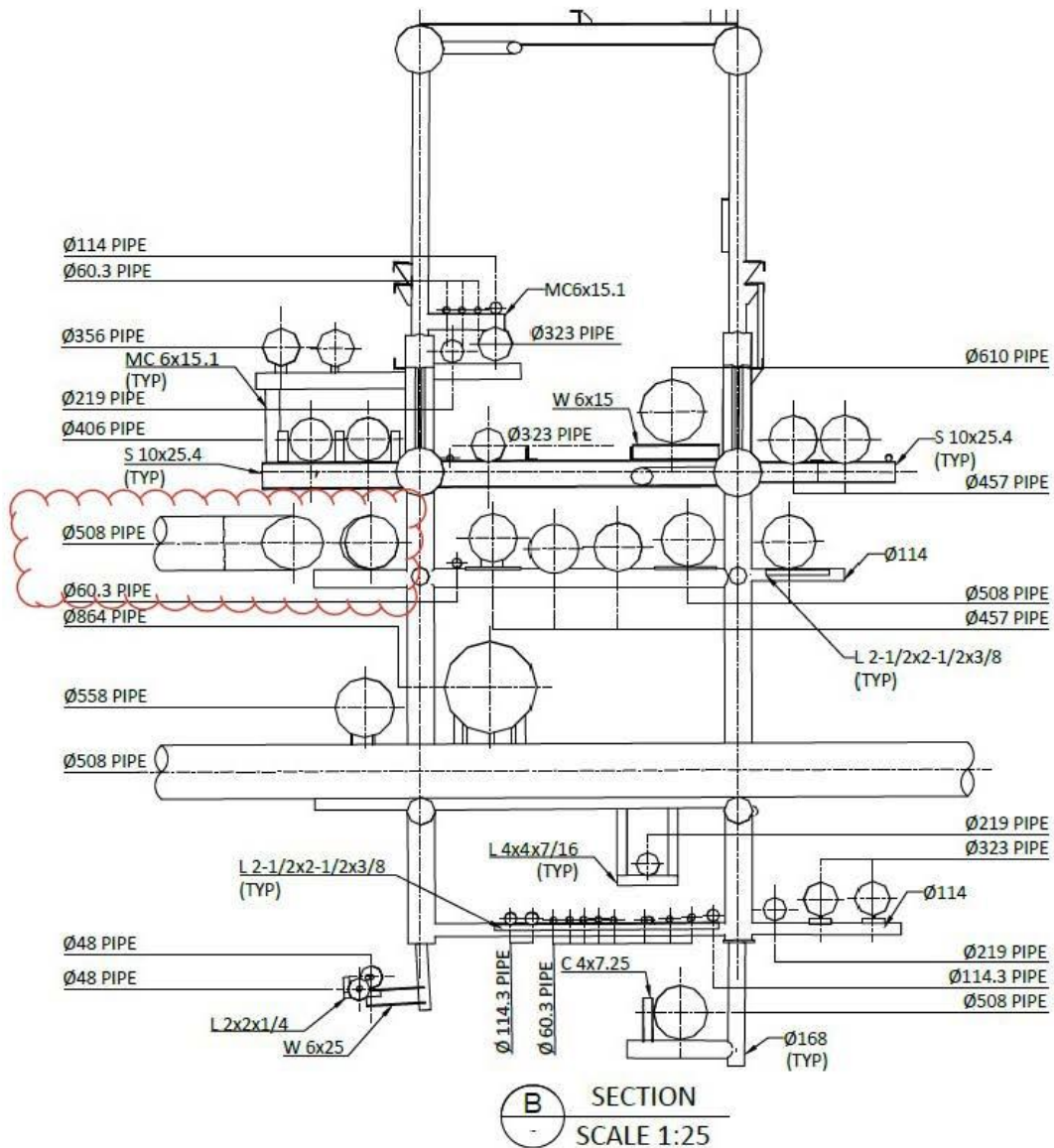
## PIPING LOAD













## **BRIDGE REPORT FOR REFURBISHMENT / REPLACEMENT OF BRIDGES IN MH ASSET (NQO-NQD BRIDGE)**

**PROJECT :** ENGINEERING / TECHNICAL CONSULTANCY  
 SERVICES FOR PREPERATION OF EXECUTION  
 METHODOLOGY, SOW AND COST ESTIMATES  
 FOR REPLACEMENT /REFURBISHMENT OF  
 BRIDGES IN MH ASSET

**LOCATION:** MH ASSET (NORTH AND SOUTH FIELD)

**OWNER :** ONGC, MUMBAI

**JOB NO :** B774

0	22.09.2025	RE-ISSUED AS STUDY	RS	DP	CS
A	07.08.2025	ISSUED AS STUDY	RS	DP	CS
<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>



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## Symbols and Abbreviations

### Organisations – India

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### Other abbreviations

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge

## **1.0 INTRODUCTION**

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges have deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## **2.0 GENERAL**

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### **IC Complex:**

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### **BHS Complex:**

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### **NQO Complex:**

7. NQO-NQD Bridge

### **WIN Complex:**

8. WIN-NC Bridge

### 3.0 NQO-NQD BRIDGE DESCRIPTION

Approximate length of bridge is measured from 3D model as 40m. Hence, 40m length of bridge is modelled in SACS conservatively.

Length of Bridge	40 m
Support Condition	Fixed: 001000, 110000, 001000 (NQD Side) Sliding: 011000, 011000 (NQO Side)
No. of directions for environmental loads	8
Wind Speed (3 Sec Gust)	67.78 m/s for extreme and 38.06 m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	50/36 ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

ISOMETRIC VIEW OF NQO-NQD Bridge is shown in Figure1.

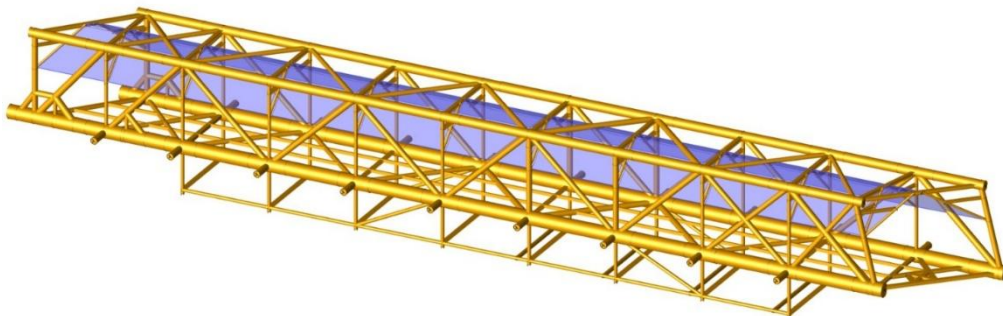


Figure 1: 3D SACS Model (Original)

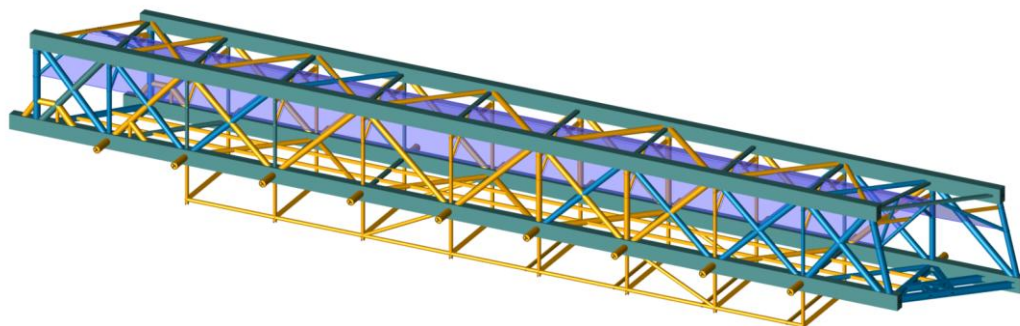
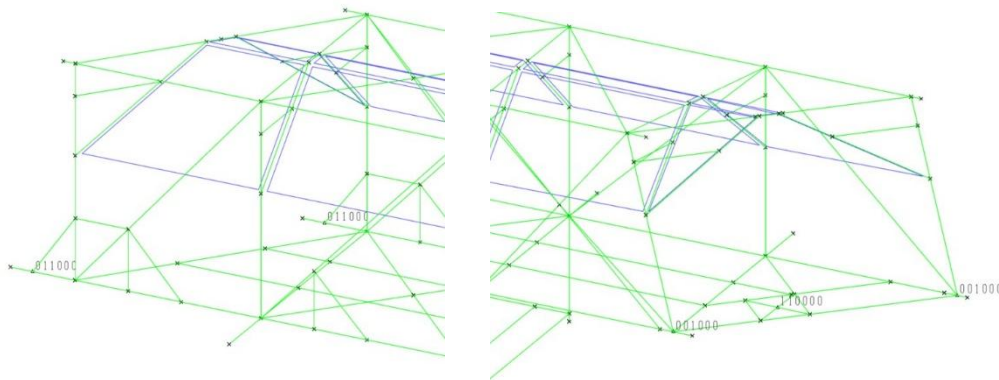
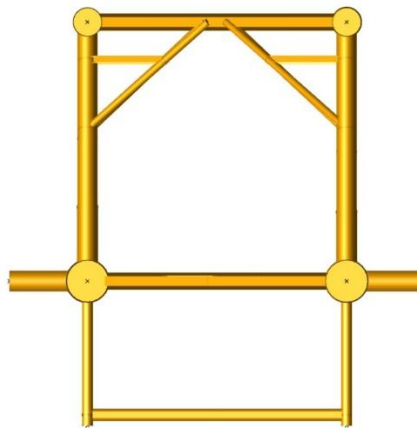


Figure 2: 3D SACS Model (Strengthened)



**Figure 2: SUPPORT CONDITIONS**



**Figure 3: BRIDGE CROSS SECTION**

#### 4.0 PROPOSED STRENGTHENING CONFIGURATION

##### 1. Top Chord-

- Main Chord:  $\Phi 457$ dia. x 8.2 mm + 12thk wrap plate + 2 no's Half cut tubular (356dia. x 16mm)
- Horizontal Framing members: Flange strengthening & Boxing with 10thk plate
- Diagonal Framing members: 2 no's new members modelled (219dia. x 12.7mm)

##### 2. Bottom Chord-

- Main Chord:  
457dia. x 6.3 mm + 12thk wrap plate + 2 no's Half cut tubular (356dia. x 16mm)  
457dia. x 11.4 mm + 12thk wrap plate + 2 no's Half cut tubular (356dia. x 16mm)
- Horizontal Framing members: Flange strengthening & Boxing with 10thk plate
- Diagonal Framing members:  
3 no's new members modelled (219dia. x 12.7mm)  
8mm Wrap plate provided around 219dia. member (3 no's)
- Framing members at sliding end: 2 no's new members modelled (W8X58)
- Framing members at Pinned end: 3 no's new members modelled (W10X112)

### 3. Framing Elevation Row-B:

#### a) Vertical member:

- 1 no. new member modelled (324dia. x 1.91mm)
- 1 no. new member modelled (324dia. x 2.22mm)
- 1 no. new member modelled (168dia. x 1.59mm)
- 1 no. new member modelled (219dia. x 1.59mm)
- 8mm wrap plate provided around 168dia. member (2no's)

#### b) Diagonal member:

- 1 no. new member modelled (324dia. x 1.0mm)
- 6 no's new member modelled (273dia. x 1.27mm)
- 2 no's new member modelled (324dia. x 1.27mm)
- 10mm wrap plate provided around 324dia. member (1 no.)

### 4. Framing Elevation Row-A:

#### a) Vertical member:

- 1 no. new member modelled (324dia. x 1.91mm)
- 1 no. new member modelled (273dia. x 1.91mm)
- 1 no. new member modelled (273dia. x 1.59mm)
- 8mm wrap plate provided around 168dia. member (3no's)

#### b) Diagonal member:

- 3 no's new member modelled (324dia. x 1.59mm)
- 4 no's new member modelled (273dia. x 1.27mm)

The proposed strengthening and replacement works shall also comprise the following:

- Replacement of walkway members, gratings, and handrails.
- Replacement of stairs on both sides.
- Replacement of roof sheeting along with supporting members, clamps, and bolts.
- Replacement of monorail member.
- Strengthening of supports at fixed and sliding ends.

## 5.0 LOADING

### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (kN)
DL	Self-weight, (Contingency - 13%)	483.32
NGDL	Cable tray	317.90
	Cable tray Support	
	Grating Load	
	Handrail Load	
	Monorail, Sheeting Cladding – Nil	
LL	Blanket live load on Walkway	142.86
MRL	Monorail Live Load	20.00
CL	Cable Loading	15.95

PLEM	Piping Load Empty (60% of PLOP)	1624.65
PLOP	Piping Load Empty + Operating Contents (By Piping)	2707.75
PLTLX	Piping Load Empty + Operating Contents (30% of PLOP) X	812.32
PLTLY	Piping Load Empty + Operating Contents (30% of PLOP) Y	812.32
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure
FLX	Bridge Friction Load X (30 % of SW+NGDL+LL+CL+PLOP)	1121.40
FLY	Bridge Friction Load Y (30 % of SW+NGDL+LL+CL+PLOP)	1121.40

### SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

### NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the Cable tray, cable tray support, grating and handrail loadings.

### LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1.2 m width of walkway is considered.

### CABLE TRAY AND CABLE LOAD

1. For 750mm cable tray, 35.9kg/3m load is considered. Cable trays consist of 4 cables (4no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km)
2. For 600mm cable tray, 22.89kg/3m load is considered. Cable trays consist of 2 cables (2no.s 3.5C x 35 m<sup>2</sup> with load 1311kg/km)
3. For 300mm cable tray, 7.7kg/3m load is considered. Cable trays consist of 14 cables (4no.s 2P x 1.5 m<sup>2</sup> with load 585kg/km, 10no.s 2C x 4 m<sup>2</sup> with load 403kg/km)

### WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

## Load Combinations

### Load Combinations

BASIC LOAD COMBINATIONS								
LComb	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
PLEM	PLOP	0.60						
1000	DL	1.00	NDGL	1.13	CL	1.00	PLEM	1.00
1001	DL	1.00	NDGL	1.13	CL	1.00	PLOP	1.00
1002	1001	1.00	LL	1.00	MRLl	1.00	PLTX	1.00
1003	1001	1.00	LL	1.00	MRLl	1.00	PLTX	-1.00
1004	1001	1.00	LL	1.00	MRLl	1.00	PLTY	1.00
1005	1001	1.00	LL	1.00	MRLl	1.00	PLTY	-1.00
1011	1001	1.00	FLX	1.00				
1012	1001	1.00	FLX	-1.00				
1013	1001	1.00	FLY	1.00				
1014	1001	1.00	FLY	-1.00				
1021	1002	1.00	FLX	1.00				
1022	1002	1.00	FLX	-1.00				
1023	1002	1.00	FLY	1.00				
1024	1002	1.00	FLY	-1.00				
1031	1003	1.00	FLX	1.00				
1032	1003	1.00	FLX	-1.00				
1033	1003	1.00	FLY	1.00				
1034	1003	1.00	FLY	-1.00				
1041	1004	1.00	FLX	1.00				
1042	1004	1.00	FLX	-1.00				
1043	1004	1.00	FLY	1.00				
1044	1004	1.00	FLY	-1.00				
1051	1005	1.00	FLX	1.00				
1052	1005	1.00	FLX	-1.00				
1053	1005	1.00	FLY	1.00				
1054	1005	1.00	FLY	-1.00				
EXTREME WIND CONDITION								
2001 to 2004	1011 to 1014	1.00	201	1.00				
2005 to 2008	1011 to 1014	1.00	202	1.00				
2011 to 2014	1011 to 1014	1.00	203	1.00				
2015 to 2018	1011 to 1014	1.00	204	1.00				



2021 to 2024	1011 to 1014	1.00	205	1.00				
2025 to 2028	1011 to 1014	1.00	206	1.00				
2031 to 2034	1011 to 1014	1.00	207	1.00				
2035 to 2038	1011 to 1014	1.00	208	1.00				
<b>OPERATING WIND CONDITION</b>								
4001 to 4004	1021 to 1024	1.00	301	1.00				
4005 to 4008	1021 to 1024	1.00	302	1.00				
4011 to 4014	1021 to 1024	1.00	303	1.00				
4015 to 4018	1021 to 1024	1.00	304	1.00				
4021 to 4024	1021 to 1024	1.00	305	1.00				
4025 to 4028	1021 to 1024	1.00	306	1.00				
4031 to 4034	1021 to 1024	1.00	307	1.00				
4035 to 4038	1021 to 1024	1.00	308	1.00				
4101 to 4104	1031 to 1034	1.00	301	1.00				
4105 to 4108	1031 to 1034	1.00	302	1.00				
4111 to 4114	1031 to 1034	1.00	303	1.00				
4115 to 4118	1031 to 1034	1.00	304	1.00				
4121 to 4124	1031 to 1034	1.00	305	1.00				
4125 to 4128	1031 to 1034	1.00	306	1.00				
4131 to 4134	1031 to 1034	1.00	307	1.00				
4135 to 4138	1031 to 1034	1.00	308	1.00				
4201 to 4204	1041 to 1044	1.00	301	1.00				
4205 to 4208	1041 to 1044	1.00	302	1.00				
4211 to 4214	1041 to 1044	1.00	303	1.00				
4215 to 4218	1041 to 1044	1.00	304	1.00				
4221 to 4224	1041 to 1044	1.00	305	1.00				
4225 to 4228	1041 to 1044	1.00	306	1.00				
4231 to 4234	1041 to 1044	1.00	307	1.00				
4235 to 4238	1041 to 1044	1.00	308	1.00				
4301 to 4304	1051 to 1054	1.00	301	1.00				
4305 to 4308	1051 to 1054	1.00	302	1.00				
4311 to 4314	1051 to 1054	1.00	303	1.00				
4315 to 4318	1051 to 1054	1.00	304	1.00				
4321 to 4324	1051 to 1054	1.00	305	1.00				
4325 to 4328	1051 to 1054	1.00	306	1.00				
4331 to 4334	1051 to 1054	1.00	307	1.00				
4335 to 4338	1051 to 1054	1.00	308	1.00				

## 6.0 RESULTS & SUMMARY

### A. BASIC LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	CL	USER GENERATED LOADS
2	DL	DEAD
3	LL	USER GENERATED LOADS
4	201	WIND
5	202	WIND
6	203	WIND
7	204	WIND
8	205	WIND
9	206	WIND
10	207	WIND
11	208	WIND
12	301	WIND
13	302	WIND
14	303	WIND
15	304	WIND
16	305	WIND
17	306	WIND
18	307	WIND
19	308	WIND
20	FLX	USER GENERATED LOADS
21	FLY	USER GENERATED LOADS
22	MRL	USER GENERATED LOADS
23	NGDL	USER GENERATED LOADS
24	PLOP	USER GENERATED LOADS
25	PLTX	USER GENERATED LOADS
26	PLTY	USER GENERATED LOADS

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
 RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ	DEAD LOAD	MARINE METHOD BUOYANCY
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)	(KN)	(KN)
1	CL	0.00	0.00	-15.95	-5.2	321.5	0.0	0.00	0.00
2	DL	0.00	-0.00	-483.37	-816.1	10459.2	-0.0	483.37	0.00
3	LL	0.00	0.00	-142.87	-285.7	2828.5	0.0	0.00	0.00
4	201	185.84	-10.16	0.50	857.4	15297.1	-592.8	0.00	0.00
5	202	124.23	825.22	0.33	-68387.8	10215.3	17019.7	0.00	0.00
6	203	-10.16	1177.20	-0.03	-97572.3	-850.4	24662.2	0.00	0.00
7	204	-138.59	839.59	-0.38	-69600.3	-11418.0	17857.9	0.00	0.00
8	205	-185.84	10.16	-0.50	-857.4	-15297.1	592.8	0.00	0.00
9	206	-124.23	-825.22	-0.33	68387.8	-10215.3	-17019.7	0.00	0.00
10	207	10.16	-1177.20	0.03	97572.3	850.4	-24662.2	0.00	0.00
11	208	138.59	-839.59	0.38	69600.4	11418.0	-17857.9	0.00	0.00
12	301	67.26	-3.67	0.18	309.5	5535.3	-214.3	0.00	0.00
13	302	44.97	298.52	0.12	-24736.2	3697.0	6157.5	0.00	0.00
14	303	-3.67	425.83	-0.01	-35291.8	-306.9	8922.3	0.00	0.00
15	304	-50.15	303.70	-0.14	-25173.9	-4131.1	6460.6	0.00	0.00
16	305	-67.26	3.67	-0.18	-309.5	-5535.3	214.3	0.00	0.00
17	306	-44.97	-298.52	-0.12	24736.2	-3697.0	-6157.5	0.00	0.00
18	307	3.67	-425.83	0.01	35291.8	306.9	-8922.3	0.00	0.00
19	308	50.15	-303.70	0.14	25173.9	4131.1	-6460.6	0.00	0.00
20	FLX	1121.40	0.00	0.00	0.0	91035.3	-2242.8	0.00	0.00
21	FLY	0.00	1121.40	0.00	-91035.3	0.0	24826.1	0.00	0.00
22	MRLL	0.00	0.00	-20.00	-40.0	485.0	0.0	0.00	0.00
23	NGDL	0.00	0.00	-317.90	-629.6	7069.9	0.0	0.00	0.00
24	PLOP	0.00	0.00	-2707.75	-4319.2	58539.7	0.0	0.00	0.00
25	PLTX	-2707.75	0.00	0.00	50.7	-223345.7	4369.9	0.00	0.00
26	PLTY	0.00	-2707.75	0.00	223396.3	0.0	-58539.7	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\* DATE 18-SEP-2025 TIME 14:53:24 SEA PAGE 90

\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
27	PLEM	0.00	0.00	-1624.65	-2591.5	35123.8	0.0
28	1000	0.00	-0.00	-2483.21	-4124.2	53893.5	-0.0
29	1001	0.00	-0.00	-3566.31	-5851.9	77309.4	-0.0
30	1002	-406.16	-0.00	-3729.18	-6170.0	47121.1	655.5
31	1003	406.16	-0.00	-3729.18	-6185.2	114124.8	-655.5
32	1004	0.00	-406.16	-3729.18	27331.9	80622.9	-8780.9
33	1005	0.00	406.16	-3729.18	-39687.0	80622.9	8780.9
34	1011	1121.40	-0.00	-3566.31	-5851.9	168344.6	-2242.8
35	1012	-1121.40	-0.00	-3566.31	-5851.9	-13725.9	2242.8
36	1013	0.00	1121.40	-3566.31	-96887.2	77309.4	24826.1
37	1014	0.00	-1121.40	-3566.31	85183.4	77309.4	-24826.1
38	1021	715.24	-0.00	-3729.18	-6170.0	138156.3	-1587.3
39	1022	-1527.56	-0.00	-3729.18	-6170.0	-43914.2	2898.3
40	1023	-406.16	1121.40	-3729.18	-97205.2	47121.1	25481.6
41	1024	-406.16	-1121.40	-3729.18	84865.3	47121.1	-24170.6
42	1031	1527.56	-0.00	-3729.18	-6185.2	205160.1	-2898.3
43	1032	-715.24	-0.00	-3729.18	-6185.2	23089.5	1587.3
44	1033	406.16	1121.40	-3729.18	-97220.4	114124.8	24170.6
45	1034	406.16	-1121.40	-3729.18	84850.1	114124.8	-25481.6
46	1041	1121.40	-406.16	-3729.18	27331.9	171658.2	-11023.7
47	1042	-1121.40	-406.16	-3729.18	27331.9	-10412.3	-6538.1
48	1043	0.00	715.24	-3729.18	-63703.4	80622.9	16045.2
49	1044	0.00	-1527.56	-3729.18	118367.1	80622.9	-33607.1
50	1051	1121.40	406.16	-3729.18	-39687.0	171658.2	6538.1
51	1052	-1121.40	406.16	-3729.18	-39687.0	-10412.3	11023.7
52	1053	0.00	1527.56	-3729.18	-130722.3	80622.9	33607.1
53	1054	0.00	-715.24	-3729.18	51348.2	80622.9	-16045.2
54	2001	1307.24	-10.16	-3565.81	-4994.5	183641.7	-2835.6
55	2002	-935.56	-10.16	-3565.81	-4994.5	1571.2	1650.0
56	2003	185.84	1111.24	-3565.81	-96029.8	92606.5	24233.4
57	2004	185.84	-1131.56	-3565.81	86040.8	92606.5	-25418.9
58	2005	1245.63	825.22	-3565.98	-74239.7	178560.0	14776.9
59	2006	-997.17	825.22	-3565.98	-74239.7	-3510.5	19262.5
60	2007	124.23	1946.62	-3565.98	-165275.0	87524.7	41845.8
61	2008	124.23	-296.18	-3565.98	16795.6	87524.7	-7806.5
62	2011	1111.24	1177.20	-3566.34	-103424.3	167494.3	22419.4
63	2012	-1131.56	1177.20	-3566.34	-103424.3	-14576.3	26905.0
64	2013	-10.16	2298.60	-3566.34	-194459.5	76459.0	49488.3
65	2014	-10.16	55.80	-3566.34	-12389.0	76459.0	-163.9
66	2015	982.81	839.59	-3566.69	-75452.2	156926.7	15615.1
67	2016	-1259.99	839.59	-3566.69	-75452.2	-25143.9	20100.7
68	2017	-138.59	1960.99	-3566.69	-166487.5	65891.4	42684.1
69	2018	-138.59	-281.81	-3566.69	15583.0	65891.4	-6968.2
70	2021	935.56	10.16	-3566.81	-6709.3	153047.6	-1650.0
71	2022	-1307.24	10.16	-3566.81	-6709.3	-29023.0	2835.6

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
72	2023	-185.84	1131.56	-3566.81	-97744.6	62012.3	25418.9
73	2024	-185.84	-1111.24	-3566.81	84326.0	62012.3	-24233.4
74	2025	997.17	-825.22	-3566.64	62535.9	158129.3	-19262.5
75	2026	-1245.63	-825.22	-3566.64	62535.9	-23941.2	-14776.9
76	2027	-124.23	296.18	-3566.64	-28499.4	67094.0	7806.5
77	2028	-124.23	-1946.62	-3566.64	153571.1	67094.0	-41845.8
78	2031	1131.56	-1177.20	-3566.28	91720.4	169195.1	-26905.0
79	2032	-1111.24	-1177.20	-3566.28	91720.4	-12875.5	-22419.4
80	2033	10.16	-55.80	-3566.28	685.2	78159.8	163.9
81	2034	10.16	-2298.60	-3566.28	182755.7	78159.8	-49488.3
82	2035	1259.99	-839.59	-3565.93	63748.4	179762.6	-20100.7
83	2036	-982.81	-839.59	-3565.93	63748.4	-2307.9	-15615.1
84	2037	138.59	281.81	-3565.93	-27286.8	88727.4	6968.2
85	2038	138.59	-1960.99	-3565.93	154783.7	88727.4	-42684.1
86	4001	782.49	-3.67	-3729.00	-5860.5	143691.6	-1801.6
87	4002	-1460.30	-3.67	-3729.00	-5860.5	-38378.9	2684.0
88	4003	-338.91	1117.73	-3729.00	-96895.8	52656.4	25267.3
89	4004	-338.91	-1125.07	-3729.00	85174.8	52656.4	-24384.9
90	4005	760.20	298.52	-3729.06	-30906.2	141853.4	4570.2
91	4006	-1482.60	298.52	-3729.06	-30906.2	-40217.2	9055.8
92	4007	-361.20	1419.92	-3729.06	-121941.5	50818.1	31639.1
93	4008	-361.20	-822.88	-3729.06	60129.1	50818.1	-18013.1
94	4011	711.57	425.83	-3729.19	-41461.8	137849.4	7335.0
95	4012	-1531.23	425.83	-3729.19	-41461.8	-44221.1	11820.6
96	4013	-409.83	1547.23	-3729.19	-132497.0	46814.1	34403.9
97	4014	-409.83	-695.57	-3729.19	49573.5	46814.1	-15248.3
98	4015	665.09	303.70	-3729.31	-31343.9	134025.3	4873.2
99	4016	-1577.71	303.70	-3729.31	-31343.9	-48045.3	9358.8
100	4017	-456.31	1425.10	-3729.31	-122379.1	42990.0	31942.1
101	4018	-456.31	-817.70	-3729.31	59691.4	42990.0	-17710.1
102	4021	647.98	3.67	-3729.36	-6479.4	132621.0	-1373.0
103	4022	-1594.82	3.67	-3729.36	-6479.4	-49449.5	3112.6
104	4023	-473.42	1125.07	-3729.36	-97514.7	41585.8	25695.9
105	4024	-473.42	-1117.73	-3729.36	84555.8	41585.8	-23956.4
106	4025	670.27	-298.52	-3729.30	18566.3	134459.3	-7744.8
107	4026	-1572.53	-298.52	-3729.30	18566.3	-47611.2	-3259.2
108	4027	-451.13	822.88	-3729.30	-72469.0	43424.1	19324.1
109	4028	-451.13	-1419.92	-3729.30	109601.5	43424.1	-30328.1
110	4031	718.90	-425.83	-3729.17	29121.8	138463.3	-10509.6
111	4032	-1523.90	-425.83	-3729.17	29121.8	-43607.3	-6024.0
112	4033	-402.50	695.57	-3729.17	-61913.4	47428.0	16559.3
113	4034	-402.50	-1547.23	-3729.17	120157.1	47428.0	-33093.0
114	4035	765.39	-303.70	-3729.04	19003.9	142287.4	-8047.9
115	4036	-1477.41	-303.70	-3729.04	19003.9	-39783.1	-3562.3
116	4037	-356.01	817.70	-3729.04	-72031.3	51252.2	19021.0

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
117	4038	-356.01	-1425.10	-3729.04	110039.2	51252.2	-30631.2
118	4101	1594.82	-3.67	-3729.00	-5875.7	210695.4	-3112.6
119	4102	-647.98	-3.67	-3729.00	-5875.7	28624.8	1373.0
120	4103	473.42	1117.73	-3729.00	-96911.0	119660.1	23956.4
121	4104	473.42	-1125.07	-3729.00	85159.6	119660.1	-25695.9
122	4105	1572.53	298.52	-3729.06	-30921.4	208857.1	3259.2
123	4106	-670.27	298.52	-3729.06	-30921.4	26786.5	7744.8
124	4107	451.13	1419.92	-3729.06	-121956.7	117821.8	30328.1
125	4108	451.13	-822.88	-3729.06	60113.8	117821.8	-19324.1
126	4111	1523.90	425.83	-3729.19	-41477.0	204853.1	6024.0
127	4112	-718.90	425.83	-3729.19	-41477.0	22782.6	10509.6
128	4113	402.50	1547.23	-3729.19	-132512.2	113817.9	33093.0
129	4114	402.50	-695.57	-3729.19	49558.3	113817.9	-16559.3
130	4115	1477.41	303.70	-3729.31	-31359.1	201029.0	3562.3
131	4116	-765.39	303.70	-3729.31	-31359.1	18958.4	8047.9
132	4117	356.01	1425.10	-3729.31	-122394.3	109993.7	30631.2
133	4118	356.01	-817.70	-3729.31	59676.2	109993.7	-19021.0
134	4121	1460.30	3.67	-3729.36	-6494.6	199624.8	-2684.0
135	4122	-782.49	3.67	-3729.36	-6494.6	17554.2	1801.6
136	4123	338.91	1125.07	-3729.36	-97529.9	108589.5	24384.9
137	4124	338.91	-1117.73	-3729.36	84540.6	108589.5	-25267.3
138	4125	1482.60	-298.52	-3729.30	18551.1	201463.0	-9055.8
139	4126	-760.20	-298.52	-3729.30	18551.1	19392.5	-4570.2
140	4127	361.20	822.88	-3729.30	-72484.2	110427.8	18013.1
141	4128	361.20	-1419.92	-3729.30	109586.3	110427.8	-31639.1
142	4131	1531.23	-425.83	-3729.17	29106.6	205467.0	-11820.6
143	4132	-711.57	-425.83	-3729.17	29106.6	23396.5	-7335.0
144	4133	409.83	695.57	-3729.17	-61928.6	114431.7	15248.3
145	4134	409.83	-1547.23	-3729.17	120141.9	114431.7	-34403.9
146	4135	1577.71	-303.70	-3729.04	18988.7	209291.1	-9358.8
147	4136	-665.09	-303.70	-3729.04	18988.7	27220.6	-4873.2
148	4137	456.31	817.70	-3729.04	-72046.5	118255.9	17710.1
149	4138	456.31	-1425.10	-3729.04	110024.0	118255.9	-31942.1
150	4201	1188.66	-409.83	-3729.00	27641.3	177193.5	-11238.0
151	4202	-1054.14	-409.83	-3729.00	27641.3	-4877.0	-6752.4
152	4203	67.26	711.57	-3729.00	-63393.9	86158.2	15830.9
153	4204	67.26	-1531.23	-3729.00	118676.6	86158.2	-33821.3
154	4205	1166.37	-107.65	-3729.06	2595.6	175355.2	-4866.2
155	4206	-1076.43	-107.65	-3729.06	2595.6	-6715.3	-380.6
156	4207	44.97	1013.75	-3729.06	-88439.6	84319.9	22202.7
157	4208	44.97	-1229.05	-3729.06	93630.9	84319.9	-27449.5
158	4211	1117.73	19.67	-3729.19	-7959.9	171351.3	-2101.4
159	4212	-1125.07	19.67	-3729.19	-7959.9	-10719.3	2384.2
160	4213	-3.67	1141.07	-3729.19	-98995.2	80316.0	24967.5
161	4214	-3.67	-1101.73	-3729.19	83075.4	80316.0	-24684.7

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
162	4215	1071.25	-102.46	-3729.31	2158.0	167527.1	-4563.2
163	4216	-1171.55	-102.46	-3729.31	2158.0	-14543.4	-77.6
164	4217	-50.15	1018.94	-3729.31	-88877.3	76491.8	22505.7
165	4218	-50.15	-1223.86	-3729.31	93193.3	76491.8	-27146.5
166	4221	1054.14	-402.50	-3729.36	27022.4	166122.9	-10809.5
167	4222	-1188.66	-402.50	-3729.36	27022.4	-15947.6	-6323.9
168	4223	-67.26	718.90	-3729.36	-64012.8	75087.6	16259.4
169	4224	-67.26	-1523.90	-3729.36	118057.7	75087.6	-33392.8
170	4225	1076.43	-704.68	-3729.30	52068.1	167961.2	-17181.3
171	4226	-1166.37	-704.68	-3729.30	52068.1	-14109.4	-12695.7
172	4227	-44.97	416.72	-3729.30	-38967.1	76925.9	9887.6
173	4228	-44.97	-1826.08	-3729.30	143103.4	76925.9	-39764.6
174	4231	1125.07	-832.00	-3729.17	62623.7	171965.1	-19946.1
175	4232	-1117.73	-832.00	-3729.17	62623.7	-10105.4	-15460.5
176	4233	3.67	289.40	-3729.17	-28411.6	80929.9	7122.8
177	4234	3.67	-1953.40	-3729.17	153658.9	80929.9	-42529.4
178	4235	1171.55	-709.87	-3729.04	52505.8	175789.3	-17484.3
179	4236	-1071.25	-709.87	-3729.04	52505.8	-6281.3	-12998.7
180	4237	50.15	411.53	-3729.04	-38529.5	84754.0	9584.6
181	4238	50.15	-1831.27	-3729.04	143541.0	84754.0	-40067.6
182	4301	1188.66	402.50	-3729.00	-39377.6	177193.5	6323.9
183	4302	-1054.14	402.50	-3729.00	-39377.6	-4877.0	10809.5
184	4303	67.26	1523.90	-3729.00	-130412.8	86158.2	33392.8
185	4304	67.26	-718.90	-3729.00	51657.7	86158.2	-16259.4
186	4305	1166.37	704.68	-3729.06	-64423.3	175355.2	12695.7
187	4306	-1076.43	704.68	-3729.06	-64423.3	-6715.3	17181.3
188	4307	44.97	1826.08	-3729.06	-155458.5	84319.9	39764.6
189	4308	44.97	-416.72	-3729.06	26612.0	84319.9	-9887.6
190	4311	1117.73	832.00	-3729.19	-74978.8	171351.3	15460.5
191	4312	-1125.07	832.00	-3729.19	-74978.8	-10719.3	19946.1
192	4313	-3.67	1953.40	-3729.19	-166014.1	80316.0	42529.4
193	4314	-3.67	-289.40	-3729.19	16056.5	80316.0	-7122.8
194	4315	1071.25	709.87	-3729.31	-64860.9	167527.1	12998.7
195	4316	-1171.55	709.87	-3729.31	-64860.9	-14543.4	17484.3
196	4317	-50.15	1831.27	-3729.31	-155896.2	76491.8	40067.6
197	4318	-50.15	-411.53	-3729.31	26174.4	76491.8	-9584.6
198	4321	1054.14	409.83	-3729.36	-39996.5	166122.9	6752.4
199	4322	-1188.66	409.83	-3729.36	-39996.5	-15947.6	11238.0
200	4323	-67.26	1531.23	-3729.36	-131031.7	75087.6	33821.3
201	4324	-67.26	-711.57	-3729.36	51038.8	75087.6	-15830.9
202	4325	1076.43	107.65	-3729.30	-14950.8	167961.2	380.6
203	4326	-1166.37	107.65	-3729.30	-14950.8	-14109.4	4866.2
204	4327	-44.97	1229.05	-3729.30	-105986.0	76925.9	27449.5
205	4328	-44.97	-1013.75	-3729.30	76084.5	76925.9	-22202.7
206	4331	1125.07	-19.67	-3729.17	-4395.2	171965.1	-2384.2

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
207	4332	-1117.73	-19.67	-3729.17	-4395.2	-10105.4	2101.4
208	4333	3.67	1101.73	-3729.17	-95430.5	80929.9	24684.7
209	4334	3.67	-1141.07	-3729.17	86640.0	80929.9	-24967.5
210	4335	1171.55	102.46	-3729.04	-14513.1	175789.3	77.6
211	4336	-1071.25	102.46	-3729.04	-14513.1	-6281.3	4563.2
212	4337	50.15	1223.86	-3729.04	-105548.4	84754.0	27146.5
213	4338	50.15	-1018.94	-3729.04	76522.1	84754.0	-22505.7

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
1	CL	0.00				0.00				-15.95	20.16	0.00	18.80
2	DL	0.00				-0.00				-483.37	21.64	1.69	20.46
3	LL	0.00				0.00				-142.87	19.80	2.00	18.80
4	201	185.84	22.21	1.99	20.37	-10.16	22.00	2.02	21.35	0.50	161.81	13.77	19.78
5	202	124.23	22.22	1.99	20.31	825.22	20.92	0.50	20.50	0.33	172.36	25.40	19.63
6	203	-10.16	22.00	2.02	21.35	1177.20	20.93	0.51	20.51	-0.03	2.79	-161.69	22.07
7	204	-138.59	22.20	1.99	20.42	839.59	20.94	0.53	20.52	-0.38	152.50	3.50	19.91
8	205	-185.84	22.21	1.99	20.37	10.16	22.00	2.02	21.35	-0.50	161.81	13.77	19.78
9	206	-124.23	22.22	1.99	20.31	-825.22	20.92	0.50	20.50	-0.33	172.36	25.40	19.63
10	207	10.16	22.00	2.02	21.35	-1177.20	20.93	0.51	20.51	0.03	2.79	-161.69	22.07
11	208	138.59	22.20	1.99	20.42	-839.59	20.94	0.53	20.52	0.38	152.50	3.50	19.91
12	301	67.26	22.21	1.99	20.36	-3.67	21.99	2.02	21.35	0.18	161.71	13.73	19.78
13	302	44.97	22.22	1.99	20.30	298.52	20.93	0.50	20.49	0.12	172.18	25.29	19.63
14	303	-3.67	21.99	2.02	21.35	425.83	20.94	0.51	20.50	-0.01	2.76	-161.82	22.07
15	304	-50.15	22.20	1.99	20.41	303.70	20.94	0.53	20.51	-0.14	152.46	3.51	19.91
16	305	-67.26	22.21	1.99	20.36	3.67	21.99	2.02	21.35	-0.18	161.71	13.73	19.78
17	306	-44.97	22.22	1.99	20.30	-298.52	20.93	0.50	20.49	-0.12	172.18	25.29	19.63
18	307	3.67	21.99	2.02	21.35	-425.83	20.94	0.51	20.50	0.01	2.76	-161.82	22.07
19	308	50.15	22.20	1.99	20.41	-303.70	20.94	0.53	20.51	0.14	152.46	3.51	19.91
20	FLX	1121.40	22.14	2.00	18.80	0.00				0.00			
21	FLY	0.00				1121.40	22.14	2.00	18.80	0.00			
22	MRLL	0.00				0.00				-20.00	24.25	2.00	22.80
23	NGDL	0.00				0.00				-317.90	22.24	1.98	21.06
24	PLOP	0.00				0.00				-2707.75	21.62	1.61	20.10
25	PLTX	-2707.75	21.62	1.61	20.10	0.00				0.00			
26	PLTY	0.00				-2707.75	21.62	1.61	20.10	0.00			
27	PLEM	0.00				0.00				-1624.65	21.62	1.61	20.10
28	1000	0.00				-0.00				-2483.21	21.70	1.67	20.30
29	1001	0.00				-0.00				-3566.31	21.68	1.65	20.24
30	1002	-406.16	21.62	1.61	20.10	-0.00				-3729.18	21.62	1.67	20.20
31	1003	406.16	21.62	1.61	20.10	-0.00				-3729.18	21.62	1.67	20.20
32	1004	0.00				-406.16	21.62	1.61	20.10	-3729.18	21.62	1.67	20.20
33	1005	0.00				406.16	21.62	1.61	20.10	-3729.18	21.62	1.67	20.20
34	1011	1121.40	22.14	2.00	18.80	-0.00				-3566.31	21.68	1.65	20.24
35	1012	-1121.40	22.14	2.00	18.80	-0.00				-3566.31	21.68	1.65	20.24
36	1013	0.00				1121.40	22.14	2.00	18.80	-3566.31	21.68	1.65	20.24
37	1014	0.00				-1121.40	22.14	2.00	18.80	-3566.31	21.68	1.65	20.24
38	1021	715.24	22.43	2.22	18.06	-0.00				-3729.18	21.62	1.67	20.20
39	1022	-1527.56	22.00	1.90	19.15	-0.00				-3729.18	21.62	1.67	20.20
40	1023	-406.16	21.62	1.61	20.10	1121.40	22.14	2.00	18.80	-3729.18	21.62	1.67	20.20
41	1024	-406.16	21.62	1.61	20.10	-1121.40	22.14	2.00	18.80	-3729.18	21.62	1.67	20.20
42	1031	1527.56	22.00	1.90	19.15	-0.00				-3729.18	21.62	1.67	20.20
43	1032	-715.24	22.43	2.22	18.06	-0.00				-3729.18	21.62	1.67	20.20
44	1033	406.16	21.62	1.61	20.10	1121.40	22.14	2.00	18.80	-3729.18	21.62	1.67	20.20
45	1034	406.16	21.62	1.61	20.10	-1121.40	22.14	2.00	18.80	-3729.18	21.62	1.67	20.20



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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1041	1121.40	22.14	2.00	18.80	-406.16	21.62	1.61	20.10	-3729.18	21.62	1.67	20.20
47	1042	-1121.40	22.14	2.00	18.80	-406.16	21.62	1.61	20.10	-3729.18	21.62	1.67	20.20
48	1043	0.00				715.24	22.43	2.22	18.06	-3729.18	21.62	1.67	20.20
49	1044	0.00				-1527.56	22.00	1.90	19.15	-3729.18	21.62	1.67	20.20
50	1051	1121.40	22.14	2.00	18.80	406.16	21.62	1.61	20.10	-3729.18	21.62	1.67	20.20
51	1052	-1121.40	22.14	2.00	18.80	406.16	21.62	1.61	20.10	-3729.18	21.62	1.67	20.20
52	1053	0.00				1527.56	22.00	1.90	19.15	-3729.18	21.62	1.67	20.20
53	1054	0.00				-715.24	22.43	2.22	18.06	-3729.18	21.62	1.67	20.20
54	2001	1307.24	22.15	2.00	19.02	-10.16	22.00	2.02	21.35	-3565.81	21.66	1.65	20.24
55	2002	-935.56	22.12	2.00	18.49	-10.16	22.00	2.02	21.35	-3565.81	21.66	1.65	20.24
56	2003	185.84	22.21	1.99	20.37	1111.24	22.14	2.00	18.78	-3565.81	21.66	1.65	20.24
57	2004	185.84	22.21	1.99	20.37	-1131.56	22.14	2.00	18.82	-3565.81	21.66	1.65	20.24
58	2005	1245.63	22.15	2.00	18.95	825.22	20.92	0.50	20.50	-3565.98	21.66	1.65	20.24
59	2006	-997.17	22.13	2.00	18.61	825.22	20.92	0.50	20.50	-3565.98	21.66	1.65	20.24
60	2007	124.23	22.22	1.99	20.31	1946.62	21.62	1.36	19.52	-3565.98	21.66	1.65	20.24
61	2008	124.23	22.22	1.99	20.31	-296.18	25.52	6.18	14.06	-3565.98	21.66	1.65	20.24
62	2011	1111.24	22.14	2.00	18.78	1177.20	20.93	0.51	20.51	-3566.34	21.68	1.65	20.24
63	2012	-1131.56	22.14	2.00	18.82	1177.20	20.93	0.51	20.51	-3566.34	21.68	1.65	20.24
64	2013	-10.16	22.00	2.02	21.35	2298.60	21.52	1.24	19.68	-3566.34	21.68	1.65	20.24
65	2014	-10.16	22.00	2.02	21.35	55.80	-3.31	-29.37	54.87	-3566.34	21.68	1.65	20.24
66	2015	982.81	22.13	2.00	18.57	839.59	20.94	0.53	20.52	-3566.69	21.69	1.65	20.24
67	2016	-1259.99	22.15	2.00	18.98	839.59	20.94	0.53	20.52	-3566.69	21.69	1.65	20.24
68	2017	-138.59	22.20	1.99	20.42	1960.99	21.63	1.37	19.54	-3566.69	21.69	1.65	20.24
69	2018	-138.59	22.20	1.99	20.42	-281.81	25.70	6.39	13.68	-3566.69	21.69	1.65	20.24
70	2021	935.56	22.12	2.00	18.49	10.16	22.00	2.02	21.35	-3566.81	21.70	1.65	20.24
71	2022	-1307.24	22.15	2.00	19.02	10.16	22.00	2.02	21.35	-3566.81	21.70	1.65	20.24
72	2023	-185.84	22.21	1.99	20.37	1131.56	22.14	2.00	18.82	-3566.81	21.70	1.65	20.24
73	2024	-185.84	22.21	1.99	20.37	-1111.24	22.14	2.00	18.78	-3566.81	21.70	1.65	20.24
74	2025	997.17	22.13	2.00	18.61	-825.22	20.92	0.50	20.50	-3566.64	21.69	1.66	20.24
75	2026	-1245.63	22.15	2.00	18.95	-825.22	20.92	0.50	20.50	-3566.64	21.69	1.66	20.24
76	2027	-124.23	22.22	1.99	20.31	296.18	25.52	6.18	14.06	-3566.64	21.69	1.66	20.24
77	2028	-124.23	22.22	1.99	20.31	-1946.62	21.62	1.36	19.52	-3566.64	21.69	1.66	20.24
78	2031	1131.56	22.14	2.00	18.82	-1177.20	20.93	0.51	20.51	-3566.28	21.68	1.65	20.24
79	2032	-1111.24	22.14	2.00	18.78	-1177.20	20.93	0.51	20.51	-3566.28	21.68	1.65	20.24
80	2033	10.16	22.00	2.02	21.35	-55.80	-3.31	-29.37	54.87	-3566.28	21.68	1.65	20.24
81	2034	10.16	22.00	2.02	21.35	-2298.60	21.52	1.24	19.68	-3566.28	21.68	1.65	20.24
82	2035	1259.99	22.15	2.00	18.98	-839.59	20.94	0.53	20.52	-3565.93	21.66	1.65	20.24
83	2036	-982.81	22.13	2.00	18.57	-839.59	20.94	0.53	20.52	-3565.93	21.66	1.65	20.24
84	2037	138.59	22.20	1.99	20.42	281.81	25.70	6.39	13.68	-3565.93	21.66	1.65	20.24
85	2038	138.59	22.20	1.99	20.42	-1960.99	21.63	1.37	19.54	-3565.93	21.66	1.65	20.24
86	4001	782.49	22.41	2.20	18.26	-3.67	21.99	2.02	21.35	-3729.00	21.61	1.67	20.20
87	4002	-1460.30	21.99	1.89	19.09	-3.67	21.99	2.02	21.35	-3729.00	21.61	1.67	20.20
88	4003	-338.91	21.50	1.54	20.05	1117.73	22.14	2.00	18.79	-3729.00	21.61	1.67	20.20
89	4004	-338.91	21.50	1.54	20.05	-1125.07	22.14	2.00	18.81	-3729.00	21.61	1.67	20.20
90	4005	760.20	22.42	2.21	18.19	298.52	20.93	0.50	20.49	-3729.06	21.61	1.67	20.20

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	4006	-1482.60	21.99	1.89	19.11	298.52	20.93	0.50	20.49	-3729.06	21.61	1.67	20.20
92	4007	-361.20	21.54	1.57	20.08	1419.92	21.88	1.68	19.16	-3729.06	21.61	1.67	20.20
93	4008	-361.20	21.54	1.57	20.08	-822.88	22.58	2.54	18.19	-3729.06	21.61	1.67	20.20
94	4011	711.57	22.44	2.22	18.04	425.83	20.94	0.51	20.50	-3729.19	21.62	1.67	20.20
95	4012	-1531.23	22.00	1.90	19.15	425.83	20.94	0.51	20.50	-3729.19	21.62	1.67	20.20
96	4013	-409.83	21.62	1.62	20.11	1547.23	21.81	1.59	19.27	-3729.19	21.62	1.67	20.20
97	4014	-409.83	21.62	1.62	20.11	-695.57	22.88	2.91	17.76	-3729.19	21.62	1.67	20.20
98	4015	665.09	22.45	2.24	17.88	303.70	20.94	0.53	20.51	-3729.31	21.62	1.67	20.20
99	4016	-1577.71	22.01	1.90	19.19	303.70	20.94	0.53	20.51	-3729.31	21.62	1.67	20.20
100	4017	-456.31	21.68	1.66	20.14	1425.10	21.88	1.69	19.16	-3729.31	21.62	1.67	20.20
101	4018	-456.31	21.68	1.66	20.14	-817.70	22.58	2.55	18.17	-3729.31	21.62	1.67	20.20
102	4021	647.98	22.46	2.24	17.82	3.67	21.99	2.02	21.35	-3729.36	21.63	1.67	20.20
103	4022	-1594.82	22.01	1.90	19.20	3.67	21.99	2.02	21.35	-3729.36	21.63	1.67	20.20
104	4023	-473.42	21.70	1.67	20.14	1125.07	22.14	2.00	18.81	-3729.36	21.63	1.67	20.20
105	4024	-473.42	21.70	1.67	20.14	-1117.73	22.14	2.00	18.79	-3729.36	21.63	1.67	20.20
106	4025	670.27	22.45	2.23	17.91	-298.52	20.93	0.50	20.49	-3729.30	21.62	1.67	20.20
107	4026	-1572.53	22.01	1.90	19.18	-298.52	20.93	0.50	20.49	-3729.30	21.62	1.67	20.20
108	4027	-451.13	21.68	1.65	20.12	822.88	22.58	2.54	18.19	-3729.30	21.62	1.67	20.20
109	4028	-451.13	21.68	1.65	20.12	-1419.92	21.88	1.68	19.16	-3729.30	21.62	1.67	20.20
110	4031	718.90	22.43	2.22	18.08	-425.83	20.94	0.51	20.50	-3729.17	21.62	1.67	20.20
111	4032	-1523.90	22.00	1.90	19.14	-425.83	20.94	0.51	20.50	-3729.17	21.62	1.67	20.20
112	4033	-402.50	21.62	1.61	20.09	695.57	22.88	2.91	17.76	-3729.17	21.62	1.67	20.20
113	4034	-402.50	21.62	1.61	20.09	-1547.23	21.81	1.59	19.27	-3729.17	21.62	1.67	20.20
114	4035	765.39	22.42	2.20	18.21	-303.70	20.94	0.53	20.51	-3729.04	21.61	1.67	20.20
115	4036	-1477.41	21.99	1.89	19.10	-303.70	20.94	0.53	20.51	-3729.04	21.61	1.67	20.20
116	4037	-356.01	21.54	1.56	20.06	817.70	22.58	2.55	18.17	-3729.04	21.61	1.67	20.20
117	4038	-356.01	21.54	1.56	20.06	-1425.10	21.88	1.69	19.16	-3729.04	21.61	1.67	20.20
118	4101	1594.82	22.01	1.90	19.20	-3.67	21.99	2.02	21.35	-3729.00	21.61	1.67	20.20
119	4102	-647.98	22.46	2.24	17.82	-3.67	21.99	2.02	21.35	-3729.00	21.61	1.67	20.20
120	4103	473.42	21.70	1.67	20.14	1117.73	22.14	2.00	18.79	-3729.00	21.61	1.67	20.20
121	4104	473.42	21.70	1.67	20.14	-1125.07	22.14	2.00	18.81	-3729.00	21.61	1.67	20.20
122	4105	1572.53	22.01	1.90	19.18	298.52	20.93	0.50	20.49	-3729.06	21.61	1.67	20.20
123	4106	-670.27	22.45	2.23	17.91	298.52	20.93	0.50	20.49	-3729.06	21.61	1.67	20.20
124	4107	451.13	21.68	1.65	20.12	1419.92	21.88	1.68	19.16	-3729.06	21.61	1.67	20.20
125	4108	451.13	21.68	1.65	20.12	-822.88	22.58	2.54	18.19	-3729.06	21.61	1.67	20.20
126	4111	1523.90	22.00	1.90	19.14	425.83	20.94	0.51	20.50	-3729.19	21.62	1.67	20.20
127	4112	-718.90	22.43	2.22	18.08	425.83	20.94	0.51	20.50	-3729.19	21.62	1.67	20.20
128	4113	402.50	21.62	1.61	20.09	1547.23	21.81	1.59	19.27	-3729.19	21.62	1.67	20.20
129	4114	402.50	21.62	1.61	20.09	-695.57	22.88	2.91	17.76	-3729.19	21.62	1.67	20.20
130	4115	1477.41	21.99	1.89	19.10	303.70	20.94	0.53	20.51	-3729.31	21.62	1.67	20.20
131	4116	-765.39	22.42	2.20	18.21	303.70	20.94	0.53	20.51	-3729.31	21.62	1.67	20.20
132	4117	356.01	21.54	1.56	20.06	1425.10	21.88	1.69	19.16	-3729.31	21.62	1.67	20.20
133	4118	356.01	21.54	1.56	20.06	-817.70	22.58	2.55	18.17	-3729.31	21.62	1.67	20.20
134	4121	1460.30	21.99	1.89	19.09	3.67	21.99	2.02	21.35	-3729.36	21.63	1.67	20.20
135	4122	-782.49	22.41	2.20	18.26	3.67	21.99	2.02	21.35	-3729.36	21.63	1.67	20.20

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4123	338.91	21.50	1.54	20.05	1125.07	22.14	2.00	18.81	-3729.36	21.63	1.67	20.20
137	4124	338.91	21.50	1.54	20.05	-1117.73	22.14	2.00	18.79	-3729.36	21.63	1.67	20.20
138	4125	1482.60	21.99	1.89	19.11	-298.52	20.93	0.50	20.49	-3729.30	21.62	1.67	20.20
139	4126	-760.20	22.42	2.21	18.19	-298.52	20.93	0.50	20.49	-3729.30	21.62	1.67	20.20
140	4127	361.20	21.54	1.57	20.08	822.88	22.58	2.54	18.19	-3729.30	21.62	1.67	20.20
141	4128	361.20	21.54	1.57	20.08	-1419.92	21.88	1.68	19.16	-3729.30	21.62	1.67	20.20
142	4131	1531.23	22.00	1.90	19.15	-425.83	20.94	0.51	20.50	-3729.17	21.62	1.67	20.20
143	4132	-711.57	22.44	2.22	18.04	-425.83	20.94	0.51	20.50	-3729.17	21.62	1.67	20.20
144	4133	409.83	21.62	1.62	20.11	695.57	22.88	2.91	17.76	-3729.17	21.62	1.67	20.20
145	4134	409.83	21.62	1.62	20.11	-1547.23	21.81	1.59	19.27	-3729.17	21.62	1.67	20.20
146	4135	1577.71	22.01	1.90	19.19	-303.70	20.94	0.53	20.51	-3729.04	21.61	1.67	20.20
147	4136	-665.09	22.45	2.24	17.88	-303.70	20.94	0.53	20.51	-3729.04	21.61	1.67	20.20
148	4137	456.31	21.68	1.66	20.14	817.70	22.58	2.55	18.17	-3729.04	21.61	1.67	20.20
149	4138	456.31	21.68	1.66	20.14	-1425.10	21.88	1.69	19.16	-3729.04	21.61	1.67	20.20
150	4201	1188.66	22.14	2.00	18.89	-409.83	21.62	1.62	20.11	-3729.00	21.61	1.67	20.20
151	4202	-1054.14	22.13	2.00	18.70	-409.83	21.62	1.62	20.11	-3729.00	21.61	1.67	20.20
152	4203	67.26	22.21	1.99	20.36	711.57	22.44	2.22	18.04	-3729.00	21.61	1.67	20.20
153	4204	67.26	22.21	1.99	20.36	-1531.23	22.00	1.90	19.15	-3729.00	21.61	1.67	20.20
154	4205	1166.37	22.14	2.00	18.86	-107.65	23.54	4.70	19.02	-3729.06	21.61	1.67	20.20
155	4206	-1076.43	22.13	2.00	18.74	-107.65	23.54	4.70	19.02	-3729.06	21.61	1.67	20.20
156	4207	44.97	22.22	1.99	20.30	1013.75	21.99	1.71	18.78	-3729.06	21.61	1.67	20.20
157	4208	44.97	22.22	1.99	20.30	-1229.05	22.26	2.24	18.82	-3729.06	21.61	1.67	20.20
158	4211	1117.73	22.14	2.00	18.79	19.67	6.81	-22.20	28.71	-3729.19	21.62	1.67	20.20
159	4212	-1125.07	22.14	2.00	18.81	19.67	6.81	-22.20	28.71	-3729.19	21.62	1.67	20.20
160	4213	-3.67	21.99	2.02	21.35	1141.07	21.87	1.58	18.97	-3729.19	21.62	1.67	20.20
161	4214	-3.67	21.99	2.02	21.35	-1101.73	22.41	2.43	18.62	-3729.19	21.62	1.67	20.20
162	4215	1071.25	22.14	2.00	18.72	-102.46	23.62	4.84	18.90	-3729.31	21.62	1.67	20.20
163	4216	-1171.55	22.14	2.00	18.87	-102.46	23.62	4.84	18.90	-3729.31	21.62	1.67	20.20
164	4217	-50.15	22.20	1.99	20.41	1018.94	21.99	1.71	18.79	-3729.31	21.62	1.67	20.20
165	4218	-50.15	22.20	1.99	20.41	-1223.86	22.26	2.24	18.81	-3729.31	21.62	1.67	20.20
166	4221	1054.14	22.13	2.00	18.70	-402.50	21.62	1.61	20.09	-3729.36	21.63	1.67	20.20
167	4222	-1188.66	22.14	2.00	18.89	-402.50	21.62	1.61	20.09	-3729.36	21.63	1.67	20.20
168	4223	-67.26	22.21	1.99	20.36	718.90	22.43	2.22	18.08	-3729.36	21.63	1.67	20.20
169	4224	-67.26	22.21	1.99	20.36	-1523.90	22.00	1.90	19.14	-3729.36	21.63	1.67	20.20
170	4225	1076.43	22.13	2.00	18.74	-704.68	21.33	1.14	20.27	-3729.30	21.62	1.67	20.20
171	4226	-1166.37	22.14	2.00	18.86	-704.68	21.33	1.14	20.27	-3729.30	21.62	1.67	20.20
172	4227	-44.97	22.22	1.99	20.30	416.72	23.51	3.45	16.32	-3729.30	21.62	1.67	20.20
173	4228	-44.97	22.22	1.99	20.30	-1826.08	21.82	1.67	19.37	-3729.30	21.62	1.67	20.20
174	4231	1125.07	22.14	2.00	18.81	-832.00	21.27	1.05	20.31	-3729.17	21.62	1.67	20.20
175	4232	-1117.73	22.14	2.00	18.79	-832.00	21.27	1.05	20.31	-3729.17	21.62	1.67	20.20
176	4233	3.67	21.99	2.02	21.35	289.40	24.64	4.73	14.47	-3729.17	21.62	1.67	20.20
177	4234	3.67	21.99	2.02	21.35	-1953.40	21.77	1.60	19.44	-3729.17	21.62	1.67	20.20
178	4235	1171.55	22.14	2.00	18.87	-709.87	21.33	1.15	20.28	-3729.04	21.61	1.67	20.20
179	4236	-1071.25	22.14	2.00	18.72	-709.87	21.33	1.15	20.28	-3729.04	21.61	1.67	20.20
180	4237	50.15	22.20	1.99	20.41	411.53	23.53	3.47	16.25	-3729.04	21.61	1.67	20.20

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
181	4238	50.15	22.20	1.99	20.41	-1831.27	21.83	1.67	19.37	-3729.04	21.61	1.67	20.20
182	4301	1188.66	22.14	2.00	18.89	402.50	21.62	1.61	20.09	-3729.00	21.61	1.67	20.20
183	4302	-1054.14	22.13	2.00	18.70	402.50	21.62	1.61	20.09	-3729.00	21.61	1.67	20.20
184	4303	67.26	22.21	1.99	20.36	1523.90	22.00	1.90	19.14	-3729.00	21.61	1.67	20.20
185	4304	67.26	22.21	1.99	20.36	-718.90	22.43	2.22	18.08	-3729.00	21.61	1.67	20.20
186	4305	1166.37	22.14	2.00	18.86	704.68	21.33	1.14	20.27	-3729.06	21.61	1.67	20.20
187	4306	-1076.43	22.13	2.00	18.74	704.68	21.33	1.14	20.27	-3729.06	21.61	1.67	20.20
188	4307	44.97	22.22	1.99	20.30	1826.08	21.82	1.67	19.37	-3729.06	21.61	1.67	20.20
189	4308	44.97	22.22	1.99	20.30	-416.72	23.51	3.45	16.32	-3729.06	21.61	1.67	20.20
190	4311	1117.73	22.14	2.00	18.79	832.00	21.27	1.05	20.31	-3729.19	21.62	1.67	20.20
191	4312	-1125.07	22.14	2.00	18.81	832.00	21.27	1.05	20.31	-3729.19	21.62	1.67	20.20
192	4313	-3.67	21.99	2.02	21.35	1953.40	21.77	1.60	19.44	-3729.19	21.62	1.67	20.20
193	4314	-3.67	21.99	2.02	21.35	-289.40	24.64	4.73	14.47	-3729.19	21.62	1.67	20.20
194	4315	1071.25	22.14	2.00	18.72	709.87	21.33	1.15	20.28	-3729.31	21.62	1.67	20.20
195	4316	-1171.55	22.14	2.00	18.87	709.87	21.33	1.15	20.28	-3729.31	21.62	1.67	20.20
196	4317	-50.15	22.20	1.99	20.41	1831.27	21.83	1.67	19.37	-3729.31	21.62	1.67	20.20
197	4318	-50.15	22.20	1.99	20.41	-411.53	23.53	3.47	16.25	-3729.31	21.62	1.67	20.20
198	4321	1054.14	22.13	2.00	18.70	409.83	21.62	1.62	20.11	-3729.36	21.63	1.67	20.20
199	4322	-1188.66	22.14	2.00	18.89	409.83	21.62	1.62	20.11	-3729.36	21.63	1.67	20.20
200	4323	-67.26	22.21	1.99	20.36	1531.23	22.00	1.90	19.15	-3729.36	21.63	1.67	20.20
201	4324	-67.26	22.21	1.99	20.36	-711.57	22.44	2.22	18.04	-3729.36	21.63	1.67	20.20
202	4325	1076.43	22.13	2.00	18.74	107.65	23.54	4.70	19.02	-3729.30	21.62	1.67	20.20
203	4326	-1166.37	22.14	2.00	18.86	107.65	23.54	4.70	19.02	-3729.30	21.62	1.67	20.20
204	4327	-44.97	22.22	1.99	20.30	1229.05	22.26	2.24	18.82	-3729.30	21.62	1.67	20.20
205	4328	-44.97	22.22	1.99	20.30	-1013.75	21.99	1.71	18.78	-3729.30	21.62	1.67	20.20
206	4331	1125.07	22.14	2.00	18.81	-19.67	6.81	-22.20	28.71	-3729.17	21.62	1.67	20.20
207	4332	-1117.73	22.14	2.00	18.79	-19.67	6.81	-22.20	28.71	-3729.17	21.62	1.67	20.20
208	4333	3.67	21.99	2.02	21.35	1101.73	22.41	2.43	18.62	-3729.17	21.62	1.67	20.20
209	4334	3.67	21.99	2.02	21.35	-1141.07	21.87	1.58	18.97	-3729.17	21.62	1.67	20.20
210	4335	1171.55	22.14	2.00	18.87	102.46	23.62	4.84	18.90	-3729.04	21.61	1.67	20.20
211	4336	-1071.25	22.14	2.00	18.72	102.46	23.62	4.84	18.90	-3729.04	21.61	1.67	20.20
212	4337	50.15	22.20	1.99	20.41	1223.86	22.26	2.24	18.81	-3729.04	21.61	1.67	20.20
213	4338	50.15	22.20	1.99	20.41	-1018.94	21.99	1.71	18.79	-3729.04	21.61	1.67	20.20

## B. BASIC LOAD CASE SUMMARY SACS OUTPUT AFTER STRENGTHENING

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	CL	USER GENERATED LOADS
2	DL	DEAD
3	LL	USER GENERATED LOADS
4	201	WIND
5	202	WIND
6	203	WIND
7	204	WIND
8	205	WIND
9	206	WIND
10	207	WIND
11	208	WIND
12	301	WIND
13	302	WIND
14	303	WIND
15	304	WIND
16	305	WIND
17	306	WIND
18	307	WIND
19	308	WIND
20	FLX	USER GENERATED LOADS
21	FLY	USER GENERATED LOADS
22	MRL	USER GENERATED LOADS
23	NGDL	USER GENERATED LOADS
24	PLOP	USER GENERATED LOADS
25	PLTX	USER GENERATED LOADS
26	PLTY	USER GENERATED LOADS

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	CL	0.00	0.00	-15.95	-5.2	321.5	0.0	0.00	0.00
2	DL	0.00	-0.00	-1003.62	-2003.5	22587.2	-0.0	1003.62	0.00
3	LL	0.00	0.00	-142.87	-285.7	2828.5	0.0	0.00	0.00
4	201	215.01	-13.02	1.80	1096.9	17681.3	-751.8	0.00	0.00
5	202	142.83	1146.51	1.25	-95102.8	11733.3	24083.0	0.00	0.00
6	203	-13.02	1634.44	-0.03	-135592.6	-1088.0	34810.4	0.00	0.00
7	204	-161.25	1164.93	-1.29	-96654.0	-13271.9	25146.3	0.00	0.00
8	205	-215.01	13.02	-1.80	-1096.9	-17681.3	751.8	0.00	0.00
9	206	-142.83	-1146.51	-1.25	95102.8	-11733.3	-24083.0	0.00	0.00
10	207	13.02	-1634.44	0.03	135592.6	1088.0	-34810.4	0.00	0.00
11	208	161.25	-1164.93	1.29	96654.1	13271.9	-25146.3	0.00	0.00
12	301	77.83	-4.70	0.65	396.1	6399.5	-271.9	0.00	0.00
13	302	51.71	414.66	0.45	-34392.6	4247.3	8711.0	0.00	0.00
14	303	-4.70	591.13	-0.01	-49034.7	-392.9	12591.1	0.00	0.00
15	304	-58.36	421.32	-0.47	-34952.8	-4802.9	9095.6	0.00	0.00
16	305	-77.83	4.70	-0.65	-396.1	-6399.5	271.9	0.00	0.00
17	306	-51.71	-414.66	-0.45	34392.6	-4247.3	-8711.0	0.00	0.00
18	307	4.70	-591.13	0.01	49034.7	392.9	-12591.1	0.00	0.00
19	308	58.36	-421.32	0.47	34952.8	4802.9	-9095.6	0.00	0.00
20	FLX	1121.40	0.00	0.00	0.0	91035.3	-2242.8	0.00	0.00
21	FLY	0.00	1121.40	0.00	-91035.3	0.0	24826.1	0.00	0.00
22	MRLL	0.00	0.00	-20.00	-40.0	485.0	0.0	0.00	0.00
23	NGDL	0.00	0.00	-317.90	-629.6	7069.9	0.0	0.00	0.00
24	PLDP	0.00	0.00	-2707.75	-4319.2	58539.7	0.0	0.00	0.00
25	PLTX	-2707.75	0.00	0.00	50.7	-223345.7	4369.9	0.00	0.00
26	PLTY	0.00	-2707.75	0.00	223396.3	0.0	-58539.7	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
27	PLEM	0.00	0.00	-1624.65	-2591.5	35123.8	0.0
28	1000	0.00	-0.00	-3003.45	-5311.6	66021.5	-0.0
29	1001	0.00	-0.00	-4086.55	-7039.3	89437.4	-0.0
30	1002	-406.16	-0.00	-4249.42	-7357.4	59249.1	655.5
31	1003	406.16	-0.00	-4249.42	-7372.6	126252.8	-655.5
32	1004	0.00	-406.16	-4249.42	26144.5	92750.9	-8780.9
33	1005	0.00	406.16	-4249.42	-40874.4	92750.9	8780.9
34	1011	1121.40	-0.00	-4086.55	-7039.3	180472.6	-2242.8
35	1012	-1121.40	-0.00	-4086.55	-7039.3	-1597.9	2242.8
36	1013	0.00	1121.40	-4086.55	-98074.6	89437.4	24826.1
37	1014	0.00	-1121.40	-4086.55	83996.0	89437.4	-24826.1
38	1021	715.24	-0.00	-4249.42	-7357.4	150284.3	-1587.3
39	1022	-1527.56	-0.00	-4249.42	-7357.4	-31786.2	2898.3
40	1023	-406.16	1121.40	-4249.42	-98392.6	59249.1	25481.6
41	1024	406.16	-1121.40	-4249.42	83677.9	59249.1	-24170.6
42	1031	1527.56	-0.00	-4249.42	-7372.6	217288.0	-2898.3
43	1032	-715.24	-0.00	-4249.42	-7372.6	35217.5	1587.3
44	1033	406.16	1121.40	-4249.42	-98407.8	126252.8	24170.6
45	1034	406.16	-1121.40	-4249.42	83662.7	126252.8	-25481.6
46	1041	1121.40	-406.16	-4249.42	26144.5	183786.2	-11023.7
47	1042	-1121.40	-406.16	-4249.42	26144.5	1715.7	-6538.1
48	1043	0.00	715.24	-4249.42	-64890.8	92750.9	16045.2
49	1044	0.00	-1527.56	-4249.42	117179.8	92750.9	-33607.1
50	1051	1121.40	406.16	-4249.42	-40874.4	183786.2	6538.1
51	1052	-1121.40	406.16	-4249.42	-40874.4	1715.7	11023.7
52	1053	0.00	1527.56	-4249.42	-131909.7	92750.9	33607.1
53	1054	0.00	-715.24	-4249.42	50160.8	92750.9	-16045.2
54	2001	1336.41	-13.02	-4084.75	-5942.4	198154.0	-2994.6
55	2002	-906.39	-13.02	-4084.75	-5942.4	16083.4	1491.0
56	2003	215.01	1108.38	-4084.75	-96977.7	107118.7	24074.3
57	2004	215.01	-1134.42	-4084.75	85092.8	107118.7	-25577.9
58	2005	1264.23	1146.51	-4085.30	-102142.1	192205.9	21840.2
59	2006	-978.57	1146.51	-4085.30	-102142.1	10135.4	26325.8
60	2007	142.83	2267.91	-4085.30	-193177.4	101170.6	48909.2
61	2008	142.83	25.11	-4085.30	-11106.9	101170.6	-743.1
62	2011	1108.38	1634.44	-4086.58	-142631.9	179384.7	32567.6
63	2012	-1134.42	1634.44	-4086.58	-142631.9	-2685.8	37053.2
64	2013	-13.02	2755.84	-4086.58	-233667.1	88349.4	59636.5
65	2014	-13.02	513.04	-4086.58	-51596.6	88349.4	9984.3
66	2015	960.15	1164.93	-4087.84	-103693.3	167200.8	22903.5
67	2016	-1282.65	1164.93	-4087.84	-103693.3	-14869.8	27389.1
68	2017	-161.25	2286.33	-4087.84	-194728.6	76165.5	49972.4
69	2018	-161.25	43.53	-4087.84	-12658.1	76165.5	320.2
70	2021	906.39	13.02	-4088.35	-8136.2	162791.3	-1491.0
71	2022	-1336.41	13.02	-4088.35	-8136.2	-19279.2	2994.6

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
72	2023	-215.01	1134.42	-4088.35	-99171.4	71756.1	25577.9
73	2024	-215.01	-1108.38	-4088.35	82899.1	71756.1	-24074.3
74	2025	978.57	-1146.51	-4087.80	88063.5	168739.4	-26325.8
75	2026	-1264.23	-1146.51	-4087.80	88063.5	-13331.2	-21840.2
76	2027	-142.83	-25.11	-4087.80	-2971.8	77704.1	743.1
77	2028	-142.83	-2267.91	-4087.80	179098.8	77704.1	-48909.2
78	2031	1134.42	-1634.44	-4086.52	128553.3	181560.6	-37053.2
79	2032	-1108.38	-1634.44	-4086.52	128553.3	-509.9	-32567.6
80	2033	13.02	-513.04	-4086.52	37518.0	90525.3	-9984.3
81	2034	13.02	-2755.84	-4086.52	219588.5	90525.3	-59636.5
82	2035	1282.65	-1164.93	-4085.26	89614.8	193744.5	-27389.1
83	2036	-960.15	-1164.93	-4085.26	89614.8	11674.0	-22903.5
84	2037	161.25	-43.53	-4085.26	-1420.5	102709.3	-320.2
85	2038	161.25	-2286.33	-4085.26	180650.0	102709.3	-49972.4
86	4001	793.07	-4.70	-4248.77	-6961.3	156683.8	-1859.2
87	4002	-1449.73	-4.70	-4248.77	-6961.3	-25386.7	2626.4
88	4003	-328.33	1116.70	-4248.77	-97996.5	65648.5	25209.7
89	4004	-328.33	-1126.10	-4248.77	84074.0	65648.5	-24442.5
90	4005	766.95	414.66	-4248.97	-41750.0	154531.6	7123.7
91	4006	-1475.85	414.66	-4248.97	-41750.0	-27538.9	11609.3
92	4007	-354.45	1536.06	-4248.97	-132785.3	63496.4	34192.6
93	4008	-354.45	-706.74	-4248.97	49285.3	63496.4	-15459.6
94	4011	710.53	591.13	-4249.43	-56392.0	149891.5	11003.8
95	4012	-1532.27	591.13	-4249.43	-56392.0	-32179.1	15489.4
96	4013	-410.87	1712.53	-4249.43	-147427.3	58856.2	38072.7
97	4014	-410.87	-530.27	-4249.43	34643.2	58856.2	-11579.5
98	4015	656.88	421.32	-4249.89	-42310.1	145481.4	7508.2
99	4016	-1585.92	421.32	-4249.89	-42310.1	-36589.1	11993.8
100	4017	-464.52	1542.72	-4249.89	-133345.4	54446.2	34577.2
101	4018	-464.52	-700.08	-4249.89	48725.1	54446.2	-15075.1
102	4021	637.41	4.70	-4250.07	-7753.4	143884.9	-1315.4
103	4022	-1605.39	4.70	-4250.07	-7753.4	-38185.7	3170.2
104	4023	-483.99	1126.10	-4250.07	-98788.7	52849.6	25753.5
105	4024	-483.99	-1116.70	-4250.07	83281.8	52849.6	-23898.7
106	4025	663.53	-414.66	-4249.87	27035.3	146037.0	-10298.3
107	4026	-1579.27	-414.66	-4249.87	27035.3	-36033.5	-5812.7
108	4027	-457.87	706.74	-4249.87	-64000.0	55001.8	16770.6
109	4028	-457.87	-1536.06	-4249.87	118070.6	55001.8	-32881.6
110	4031	719.94	-591.13	-4249.41	41677.3	150677.2	-14178.5
111	4032	-1522.86	-591.13	-4249.41	41677.3	-31393.3	-9692.9
112	4033	-401.46	530.27	-4249.41	-49358.0	59641.9	12890.4
113	4034	-401.46	-1712.53	-4249.41	132712.6	59641.9	-36761.8
114	4035	773.60	-421.32	-4248.95	27595.4	155087.2	-10682.9
115	4036	-1469.20	-421.32	-4248.95	27595.4	-26983.3	-6197.3
116	4037	-347.80	700.08	-4248.95	-63439.8	64052.0	16386.0



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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
117	4038	-347.80	-1542.72	-4248.95	118630.7	64052.0	-33266.2
118	4101	1605.39	-4.70	-4248.77	-6976.5	223687.5	-3170.2
119	4102	-637.41	-4.70	-4248.77	-6976.5	41617.0	1315.4
120	4103	483.99	1116.70	-4248.77	-98011.8	132652.2	23898.7
121	4104	483.99	-1126.10	-4248.77	84058.8	132652.2	-25753.5
122	4105	1579.27	414.66	-4248.97	-41765.2	221535.4	5812.7
123	4106	-663.53	414.66	-4248.97	-41765.2	39464.8	10298.3
124	4107	457.87	1536.06	-4248.97	-132800.5	130500.1	32881.6
125	4108	457.87	-706.74	-4248.97	49270.1	130500.1	-16770.6
126	4111	1522.86	591.13	-4249.43	-56407.2	216895.2	9692.9
127	4112	-719.94	591.13	-4249.43	-56407.2	34824.7	14178.5
128	4113	401.46	1712.53	-4249.43	-147442.5	125859.9	36761.8
129	4114	401.46	-530.27	-4249.43	34628.0	125859.9	-12890.4
130	4115	1469.20	421.32	-4249.89	-42325.4	212485.2	6197.3
131	4116	-773.60	421.32	-4249.89	-42325.4	30414.6	10682.9
132	4117	347.80	1542.72	-4249.89	-133360.6	121449.9	33266.2
133	4118	347.80	-700.08	-4249.89	48709.9	121449.9	-16386.0
134	4121	1449.73	4.70	-4250.07	-7768.6	210888.6	-2626.4
135	4122	-793.07	4.70	-4250.07	-7768.6	28818.1	1859.2
136	4123	328.33	1126.10	-4250.07	-98803.9	119853.3	24442.5
137	4124	328.33	-1116.70	-4250.07	83266.6	119853.3	-25209.7
138	4125	1475.85	-414.66	-4249.87	27020.1	213040.7	-11609.3
139	4126	-766.95	-414.66	-4249.87	27020.1	30970.2	-7123.7
140	4127	354.45	706.74	-4249.87	-64015.2	122005.5	15459.6
141	4128	354.45	-1536.06	-4249.87	118055.3	122005.5	-34192.6
142	4131	1532.27	-591.13	-4249.41	41662.1	217680.9	-15489.4
143	4132	-710.53	-591.13	-4249.41	41662.1	35610.4	-11003.8
144	4133	410.87	530.27	-4249.41	-49373.2	126645.6	11579.5
145	4134	410.87	-1712.53	-4249.41	132697.4	126645.6	-38072.7
146	4135	1585.92	-421.32	-4248.95	27580.2	222090.9	-11993.8
147	4136	-656.88	-421.32	-4248.95	27580.2	40020.4	-7508.2
148	4137	464.52	700.08	-4248.95	-63455.0	131055.7	15075.1
149	4138	464.52	-1542.72	-4248.95	118615.5	131055.7	-34577.2
150	4201	1199.23	-410.87	-4248.77	26540.6	190185.6	-11295.7
151	4202	-1043.57	-410.87	-4248.77	26540.6	8115.1	-6810.1
152	4203	77.83	710.53	-4248.77	-64494.7	99150.4	15773.3
153	4204	77.83	-1532.27	-4248.77	117575.8	99150.4	-33879.0
154	4205	1173.11	8.50	-4248.97	-8248.2	188033.5	-2312.7
155	4206	-1069.69	8.50	-4248.97	-8248.2	5963.0	2172.9
156	4207	51.71	1129.90	-4248.97	-99283.4	96998.2	24756.2
157	4208	51.71	-1112.90	-4248.97	82787.1	96998.2	-24896.0
158	4211	1116.70	184.97	-4249.43	-22890.2	183393.3	1567.4
159	4212	-1126.10	184.97	-4249.43	-22890.2	1322.8	6053.0
160	4213	-4.70	1306.37	-4249.43	-113925.4	92358.1	28636.3
161	4214	-4.70	-936.43	-4249.43	68145.1	92358.1	-21015.9

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX  (KN)	FY  (KN)	FZ  (KN)	MX  (KN-M)	MY  (KN-M)	MZ  (KN-M)
162	4215	1063.04	15.15	-4249.89	-8808.3	178983.3	-1928.2
163	4216	-1179.76	15.15	-4249.89	-8808.3	-3087.2	2557.4
164	4217	-58.36	1136.55	-4249.89	-99843.6	87948.0	25140.7
165	4218	-58.36	-1106.25	-4249.89	82227.0	87948.0	-24511.5
166	4221	1043.57	-401.46	-4250.07	25748.4	177386.7	-10751.8
167	4222	-1199.23	-401.46	-4250.07	25748.4	-4683.8	-6266.2
168	4223	-77.83	719.94	-4250.07	-65286.9	86351.5	16317.1
169	4224	-77.83	-1522.86	-4250.07	116783.7	86351.5	-33335.2
170	4225	1069.69	-820.83	-4249.87	60537.1	179538.9	-19734.8
171	4226	-1173.11	-820.83	-4249.87	60537.1	-2531.7	-15249.2
172	4227	-51.71	300.57	-4249.87	-30498.1	88503.6	7334.1
173	4228	-51.71	-1942.23	-4249.87	151572.4	88503.6	-42318.1
174	4231	1126.10	-997.29	-4249.41	75179.2	184179.0	-23614.9
175	4232	-1116.70	-997.29	-4249.41	75179.2	2108.5	-19129.3
176	4233	4.70	124.11	-4249.41	-15856.1	93143.8	3454.0
177	4234	4.70	-2118.69	-4249.41	166214.4	93143.8	-46198.2
178	4235	1179.76	-827.48	-4248.95	61097.3	188589.1	-20119.3
179	4236	-1063.04	-827.48	-4248.95	61097.3	6518.5	-15633.7
180	4237	58.36	293.92	-4248.95	-29938.0	97553.8	6949.6
181	4238	58.36	-1948.88	-4248.95	152132.5	97553.8	-42702.6
182	4301	1199.23	401.46	-4248.77	-40478.3	190185.6	6266.2
183	4302	-1043.57	401.46	-4248.77	-40478.3	8115.1	10751.8
184	4303	77.83	1522.86	-4248.77	-131513.6	99150.4	33335.2
185	4304	77.83	-719.94	-4248.77	50556.9	99150.4	-16317.1
186	4305	1173.11	820.83	-4248.97	-75267.1	188033.5	15249.2
187	4306	-1069.69	820.83	-4248.97	-75267.1	5963.0	19734.8
188	4307	51.71	1942.23	-4248.97	-166302.3	96998.2	42318.1
189	4308	51.71	-300.57	-4248.97	15768.2	96998.2	-7334.1
190	4311	1116.70	997.29	-4249.43	-89909.1	183393.3	19129.3
191	4312	-1126.10	997.29	-4249.43	-89909.1	1322.8	23614.9
192	4313	-4.70	2118.69	-4249.43	-180944.4	92358.1	46198.2
193	4314	-4.70	-124.11	-4249.43	1126.2	92358.1	-3454.0
194	4315	1063.04	827.48	-4249.89	-75827.2	178983.3	15633.7
195	4316	-1179.76	827.48	-4249.89	-75827.2	-3087.2	20119.3
196	4317	-58.36	1948.88	-4249.89	-166862.5	87948.0	42702.6
197	4318	-58.36	-293.92	-4249.89	15208.1	87948.0	-6949.6
198	4321	1043.57	410.87	-4250.07	-41270.5	177386.7	6810.1
199	4322	-1199.23	410.87	-4250.07	-41270.5	-4683.8	11295.7
200	4323	-77.83	1532.27	-4250.07	-132305.8	86351.5	33879.0
201	4324	-77.83	-710.53	-4250.07	49764.8	86351.5	-15773.3
202	4325	1069.69	-8.50	-4249.87	-6481.8	179538.9	-2172.9
203	4326	-1173.11	-8.50	-4249.87	-6481.8	-2531.7	2312.7
204	4327	-51.71	1112.90	-4249.87	-97517.0	88503.6	24896.0
205	4328	-51.71	-1129.90	-4249.87	84553.5	88503.6	-24756.2
206	4331	1126.10	-184.97	-4249.41	8160.3	184179.0	-6053.0

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
207	4332	-1116.70	-184.97	-4249.41	8160.3	2108.5	-1567.4
208	4333	4.70	936.43	-4249.41	-82875.0	93143.8	21015.9
209	4334	4.70	-1306.37	-4249.41	99195.5	93143.8	-28636.3
210	4335	1179.76	-15.15	-4248.95	-5921.6	188589.1	-2557.4
211	4336	-1063.04	-15.15	-4248.95	-5921.6	6518.5	1928.2
212	4337	58.36	1106.25	-4248.95	-96956.9	97553.8	24511.5
213	4338	58.36	-1136.55	-4248.95	85113.6	97553.8	-25140.7

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
1	CL	0.00				0.00				-15.95	20.16	0.00	18.80
2	DL	0.00	8.37	4.95	21.69	-0.00				-1003.62	22.51	2.00	20.45
3	LL	0.00				0.00				-142.87	19.80	2.00	18.80
4	201	215.01	22.61	1.98	20.28	-13.02	25.02	2.02	21.17	1.80	50.39	4.88	20.53
5	202	142.83	22.46	1.98	20.22	1146.51	21.25	0.92	20.58	1.25	51.17	8.41	20.50
6	203	-13.02	25.02	2.02	21.17	1634.44	21.28	0.93	20.58	-0.03	4.48	-201.62	22.17
7	204	-161.25	22.75	1.98	20.33	1164.93	21.31	0.94	20.59	-1.29	49.63	1.47	20.56
8	205	-215.01	22.61	1.98	20.28	13.02	25.02	2.02	21.17	-1.80	50.39	4.88	20.53
9	206	-142.83	22.46	1.98	20.22	-1146.51	21.25	0.92	20.58	-1.25	51.17	8.41	20.50
10	207	13.02	25.02	2.02	21.17	-1634.44	21.28	0.93	20.58	0.03	4.48	-201.62	22.17
11	208	161.25	22.75	1.98	20.33	-1164.93	21.31	0.94	20.59	1.29	49.63	1.47	20.56
12	301	77.83	22.62	1.98	20.27	-4.70	25.03	2.02	21.16	0.65	50.47	4.88	20.52
13	302	51.71	22.46	1.98	20.21	414.66	21.25	0.92	20.57	0.45	51.25	8.39	20.50
14	303	-4.70	25.03	2.02	21.16	591.13	21.28	0.93	20.57	-0.01	4.44	-201.84	22.17
15	304	-58.36	22.76	1.98	20.32	421.32	21.31	0.94	20.58	-0.47	49.71	1.48	20.55
16	305	-77.83	22.62	1.98	20.27	4.70	25.03	2.02	21.16	-0.65	50.47	4.88	20.52
17	306	-51.71	22.46	1.98	20.21	-414.66	21.25	0.92	20.57	-0.45	51.25	8.39	20.50
18	307	4.70	25.03	2.02	21.16	-591.13	21.28	0.93	20.57	0.01	4.44	-201.84	22.17
19	308	58.36	22.76	1.98	20.32	-421.32	21.31	0.94	20.58	0.47	49.71	1.48	20.55
20	FLX	1121.40	22.14	2.00	18.80	0.00				0.00			
21	FLY	0.00				1121.40	22.14	2.00	18.80	0.00			
22	MRLL	0.00				0.00				-20.00	24.25	2.00	22.80
23	NGDL	0.00				0.00				-317.90	22.24	1.98	21.06
24	PLOP	0.00				0.00				-2707.75	21.62	1.61	20.10
25	PLTX	-2707.75	21.62	1.61	20.10	0.00				0.00			
26	PLTY	0.00				-2707.75	21.62	1.61	20.10	0.00			
27	PLEM	0.00				0.00				-1624.65	21.62	1.61	20.10
28	1000	0.00	8.37	4.95	21.69	-0.00				-3003.45	21.98	1.78	20.33
29	1001	0.00	8.37	4.95	21.69	-0.00				-4086.55	21.89	1.73	20.27
30	1002	-406.16	21.62	1.61	20.10	-0.00				-4249.42	21.83	1.74	20.23
31	1003	406.16	21.62	1.61	20.10	-0.00				-4249.42	21.83	1.74	20.23
32	1004	0.00	8.37	4.95	21.69	-406.16	21.62	1.61	20.10	-4249.42	21.83	1.74	20.23
33	1005	0.00	8.37	4.95	21.69	406.16	21.62	1.61	20.10	-4249.42	21.83	1.74	20.23
34	1011	1121.40	22.14	2.00	18.80	-0.00				-4086.55	21.89	1.73	20.27
35	1012	-1121.40	22.14	2.00	18.80	-0.00				-4086.55	21.89	1.73	20.27
36	1013	0.00	8.37	4.95	21.69	1121.40	22.14	2.00	18.80	-4086.55	21.89	1.73	20.27
37	1014	0.00	8.37	4.95	21.69	-1121.40	22.14	2.00	18.80	-4086.55	21.89	1.73	20.27
38	1021	715.24	22.43	2.22	18.06	-0.00				-4249.42	21.83	1.74	20.23
39	1022	-1527.56	22.00	1.90	19.15	-0.00				-4249.42	21.83	1.74	20.23
40	1023	-406.16	21.62	1.61	20.10	1121.40	22.14	2.00	18.80	-4249.42	21.83	1.74	20.23
41	1024	-406.16	21.62	1.61	20.10	-1121.40	22.14	2.00	18.80	-4249.42	21.83	1.74	20.23
42	1031	1527.56	22.00	1.90	19.15	-0.00				-4249.42	21.83	1.74	20.23
43	1032	-715.24	22.43	2.22	18.06	-0.00				-4249.42	21.83	1.74	20.23
44	1033	406.16	21.62	1.61	20.10	1121.40	22.14	2.00	18.80	-4249.42	21.83	1.74	20.23
45	1034	406.16	21.62	1.61	20.10	-1121.40	22.14	2.00	18.80	-4249.42	21.83	1.74	20.23

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1041	1121.40	22.14	2.00	18.80	-406.16	21.62	1.61	20.10	-4249.42	21.83	1.74	20.23
47	1042	-1121.40	22.14	2.00	18.80	-406.16	21.62	1.61	20.10	-4249.42	21.83	1.74	20.23
48	1043	0.00	8.37	4.95	21.69	715.24	22.43	2.22	18.06	-4249.42	21.83	1.74	20.23
49	1044	0.00	8.37	4.95	21.69	-1527.56	22.00	1.90	19.15	-4249.42	21.83	1.74	20.23
50	1051	1121.40	22.14	2.00	18.80	406.16	21.62	1.61	20.10	-4249.42	21.83	1.74	20.23
51	1052	-1121.40	22.14	2.00	18.80	406.16	21.62	1.61	20.10	-4249.42	21.83	1.74	20.23
52	1053	0.00	8.37	4.95	21.69	1527.56	22.00	1.90	19.15	-4249.42	21.83	1.74	20.23
53	1054	0.00	8.37	4.95	21.69	-715.24	22.43	2.22	18.06	-4249.42	21.83	1.74	20.23
54	2001	1336.41	22.21	2.00	19.04	-13.02	25.02	2.02	21.17	-4084.75	21.87	1.73	20.27
55	2002	-906.39	22.03	2.00	18.45	-13.02	25.02	2.02	21.17	-4084.75	21.87	1.73	20.27
56	2003	215.01	22.61	1.98	20.28	1108.38	22.10	2.00	18.77	-4084.75	21.87	1.73	20.27
57	2004	215.01	22.61	1.98	20.28	-1134.42	22.17	2.00	18.83	-4084.75	21.87	1.73	20.27
58	2005	1264.23	22.17	2.00	18.96	1146.51	21.25	0.92	20.58	-4085.30	21.88	1.73	20.27
59	2006	-978.57	22.09	2.00	18.59	1146.51	21.25	0.92	20.58	-4085.30	21.88	1.73	20.27
60	2007	142.83	22.46	1.98	20.22	2267.91	21.69	1.45	19.70	-4085.30	21.88	1.73	20.27
61	2008	142.83	22.46	1.98	20.22	25.11	-18.34	-47.22	100.01	-4085.30	21.88	1.73	20.27
62	2011	1108.38	22.10	2.00	18.77	1634.44	21.28	0.93	20.58	-4086.58	21.89	1.73	20.27
63	2012	-1134.42	22.17	2.00	18.83	1634.44	21.28	0.93	20.58	-4086.58	21.89	1.73	20.27
64	2013	-13.02	25.02	2.02	21.17	2755.84	21.63	1.37	19.86	-4086.58	21.89	1.73	20.27
65	2014	-13.02	25.02	2.02	21.17	513.04	19.41	-1.41	24.48	-4086.58	21.89	1.73	20.27
66	2015	960.15	22.04	2.00	18.54	1164.93	21.31	0.94	20.59	-4087.84	21.89	1.73	20.27
67	2016	-1282.65	22.22	2.00	18.99	1164.93	21.31	0.94	20.59	-4087.84	21.89	1.73	20.27
68	2017	-161.25	22.75	1.98	20.33	2286.33	21.72	1.46	19.71	-4087.84	21.89	1.73	20.27
69	2018	-161.25	22.75	1.98	20.33	43.53	0.01	-26.39	66.66	-4087.84	21.89	1.73	20.27
70	2021	906.39	22.03	2.00	18.45	13.02	25.02	2.02	21.17	-4088.35	21.90	1.73	20.27
71	2022	-1336.41	22.21	2.00	19.04	13.02	25.02	2.02	21.17	-4088.35	21.90	1.73	20.27
72	2023	-215.01	22.61	1.98	20.28	1134.42	22.17	2.00	18.83	-4088.35	21.90	1.73	20.27
73	2024	-215.01	22.61	1.98	20.28	-1108.38	22.10	2.00	18.77	-4088.35	21.90	1.73	20.27
74	2025	978.57	22.09	2.00	18.59	-1146.51	21.25	0.92	20.58	-4087.80	21.89	1.74	20.27
75	2026	-1264.23	22.17	2.00	18.96	-1146.51	21.25	0.92	20.58	-4087.80	21.89	1.74	20.27
76	2027	-142.83	22.46	1.98	20.22	-25.11	-18.34	-47.22	100.01	-4087.80	21.89	1.74	20.27
77	2028	-142.83	22.46	1.98	20.22	-2267.91	21.69	1.45	19.70	-4087.80	21.89	1.74	20.27
78	2031	1134.42	22.17	2.00	18.83	-1634.44	21.28	0.93	20.58	-4086.52	21.89	1.73	20.27
79	2032	-1108.38	22.10	2.00	18.77	-1634.44	21.28	0.93	20.58	-4086.52	21.89	1.73	20.27
80	2033	13.02	25.02	2.02	21.17	-513.04	19.41	-1.41	24.48	-4086.52	21.89	1.73	20.27
81	2034	13.02	25.02	2.02	21.17	-2755.84	21.63	1.37	19.86	-4086.52	21.89	1.73	20.27
82	2035	1282.65	22.22	2.00	18.99	-1164.93	21.31	0.94	20.59	-4085.26	21.88	1.73	20.27
83	2036	-960.15	22.04	2.00	18.54	-1164.93	21.31	0.94	20.59	-4085.26	21.88	1.73	20.27
84	2037	161.25	22.75	1.98	20.33	-43.53	0.01	-26.39	66.66	-4085.26	21.88	1.73	20.27
85	2038	161.25	22.75	1.98	20.33	-2286.33	21.72	1.46	19.71	-4085.26	21.88	1.73	20.27
86	4001	793.07	22.45	2.20	18.28	-4.70	25.03	2.02	21.16	-4248.77	21.82	1.74	20.23
87	4002	-1449.73	21.97	1.89	19.09	-4.70	25.03	2.02	21.16	-4248.77	21.82	1.74	20.23
88	4003	-328.33	21.38	1.53	20.07	1116.70	22.13	2.00	18.79	-4248.77	21.82	1.74	20.23
89	4004	-328.33	21.38	1.53	20.07	-1126.10	22.15	2.00	18.81	-4248.77	21.82	1.74	20.23
90	4005	766.95	22.44	2.20	18.20	414.66	21.25	0.92	20.57	-4248.97	21.82	1.74	20.23

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	4006	-1475.85	21.98	1.89	19.11	414.66	21.25	0.92	20.57	-4248.97	21.82	1.74	20.23
92	4007	-354.45	21.50	1.56	20.09	1536.06	21.90	1.71	19.28	-4248.97	21.82	1.74	20.23
93	4008	-354.45	21.50	1.56	20.09	-706.74	22.66	2.63	17.76	-4248.97	21.82	1.74	20.23
94	4011	710.53	22.42	2.22	18.04	591.13	21.28	0.93	20.57	-4249.43	21.83	1.74	20.23
95	4012	-1532.27	22.01	1.90	19.15	591.13	21.28	0.93	20.57	-4249.43	21.83	1.74	20.23
96	4013	-410.87	21.66	1.62	20.12	1712.53	21.84	1.63	19.41	-4249.43	21.83	1.74	20.23
97	4014	-410.87	21.66	1.62	20.12	-530.27	23.09	3.19	16.82	-4249.43	21.83	1.74	20.23
98	4015	656.88	22.40	2.24	17.86	421.32	21.31	0.94	20.58	-4249.89	21.83	1.74	20.23
99	4016	-1585.92	22.03	1.90	19.19	421.32	21.31	0.94	20.58	-4249.89	21.83	1.74	20.23
100	4017	-464.52	21.76	1.66	20.13	1542.72	21.91	1.71	19.29	-4249.89	21.83	1.74	20.23
101	4018	-464.52	21.76	1.66	20.13	-700.08	22.63	2.64	17.73	-4249.89	21.83	1.74	20.23
102	4021	637.41	22.41	2.25	17.79	4.70	25.03	2.02	21.16	-4250.07	21.83	1.74	20.23
103	4022	-1605.39	22.03	1.90	19.20	4.70	25.03	2.02	21.16	-4250.07	21.83	1.74	20.23
104	4023	-483.99	21.78	1.67	20.13	1126.10	22.15	2.00	18.81	-4250.07	21.83	1.74	20.23
105	4024	-483.99	21.78	1.67	20.13	-1126.70	22.13	2.00	18.79	-4250.07	21.83	1.74	20.23
106	4025	663.53	22.43	2.24	17.89	-414.66	21.25	0.92	20.57	-4249.87	21.83	1.74	20.23
107	4026	-1579.27	22.02	1.90	19.18	-414.66	21.25	0.92	20.57	-4249.87	21.83	1.74	20.23
108	4027	-457.87	21.71	1.66	20.12	706.74	22.66	2.63	17.76	-4249.87	21.83	1.74	20.23
109	4028	-457.87	21.71	1.66	20.12	-1536.06	21.90	1.71	19.28	-4249.87	21.83	1.74	20.23
110	4031	719.94	22.45	2.22	18.08	-591.13	21.28	0.93	20.57	-4249.41	21.83	1.74	20.23
111	4032	-1522.86	21.99	1.90	19.14	-591.13	21.28	0.93	20.57	-4249.41	21.83	1.74	20.23
112	4033	-401.46	21.58	1.61	20.09	530.27	23.09	3.19	16.82	-4249.41	21.83	1.74	20.23
113	4034	-401.46	21.58	1.61	20.09	-1712.53	21.84	1.63	19.41	-4249.41	21.83	1.74	20.23
114	4035	773.60	22.46	2.20	18.23	-421.32	21.31	0.94	20.58	-4248.95	21.82	1.74	20.23
115	4036	-1469.20	21.97	1.89	19.10	-421.32	21.31	0.94	20.58	-4248.95	21.82	1.74	20.23
116	4037	-347.80	21.43	1.55	20.07	700.08	22.63	2.64	17.73	-4248.95	21.82	1.74	20.23
117	4038	-347.80	21.43	1.55	20.07	-1542.72	21.91	1.71	19.29	-4248.95	21.82	1.74	20.23
118	4101	1605.39	22.03	1.90	19.20	-4.70	25.03	2.02	21.16	-4248.77	21.82	1.74	20.23
119	4102	-637.41	22.41	2.25	17.79	-4.70	25.03	2.02	21.16	-4248.77	21.82	1.74	20.23
120	4103	483.99	21.78	1.67	20.13	1116.70	22.13	2.00	18.79	-4248.77	21.82	1.74	20.23
121	4104	483.99	21.78	1.67	20.13	-1126.10	22.15	2.00	18.81	-4248.77	21.82	1.74	20.23
122	4105	1579.27	22.02	1.90	19.18	414.66	21.25	0.92	20.57	-4248.97	21.82	1.74	20.23
123	4106	-663.53	22.43	2.24	17.89	414.66	21.25	0.92	20.57	-4248.97	21.82	1.74	20.23
124	4107	457.87	21.71	1.66	20.12	1536.06	21.90	1.71	19.28	-4248.97	21.82	1.74	20.23
125	4108	457.87	21.71	1.66	20.12	-706.74	22.66	2.63	17.76	-4248.97	21.82	1.74	20.23
126	4111	1522.86	21.99	1.90	19.14	591.13	21.28	0.93	20.57	-4249.43	21.83	1.74	20.23
127	4112	-719.94	22.45	2.22	18.08	591.13	21.28	0.93	20.57	-4249.43	21.83	1.74	20.23
128	4113	401.46	21.58	1.61	20.09	1712.53	21.84	1.63	19.41	-4249.43	21.83	1.74	20.23
129	4114	401.46	21.58	1.61	20.09	-530.27	23.09	3.19	16.82	-4249.43	21.83	1.74	20.23
130	4115	1469.20	21.97	1.89	19.10	421.32	21.31	0.94	20.58	-4249.89	21.83	1.74	20.23
131	4116	-773.60	22.46	2.20	18.23	421.32	21.31	0.94	20.58	-4249.89	21.83	1.74	20.23
132	4117	347.80	21.43	1.55	20.07	1542.72	21.91	1.71	19.29	-4249.89	21.83	1.74	20.23
133	4118	347.80	21.43	1.55	20.07	-700.08	22.63	2.64	17.73	-4249.89	21.83	1.74	20.23
134	4121	1449.73	21.97	1.89	19.09	4.70	25.03	2.02	21.16	-4250.07	21.83	1.74	20.23
135	4122	-793.07	22.45	2.20	18.28	4.70	25.03	2.02	21.16	-4250.07	21.83	1.74	20.23

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4123	328.33	21.38	1.53	20.07	1126.10	22.15	2.00	18.81	-4250.07	21.83	1.74	20.23
137	4124	328.33	21.38	1.53	20.07	-1116.70	22.13	2.00	18.79	-4250.07	21.83	1.74	20.23
138	4125	1475.85	21.98	1.89	19.11	-414.66	21.25	0.92	20.57	-4249.87	21.83	1.74	20.23
139	4126	-766.95	22.44	2.20	18.20	-414.66	21.25	0.92	20.57	-4249.87	21.83	1.74	20.23
140	4127	354.45	21.50	1.56	20.09	706.74	22.66	2.63	17.76	-4249.87	21.83	1.74	20.23
141	4128	354.45	21.50	1.56	20.09	-1536.06	21.90	1.71	19.28	-4249.87	21.83	1.74	20.23
142	4131	1532.27	22.01	1.90	19.15	-591.13	21.28	0.93	20.57	-4249.41	21.83	1.74	20.23
143	4132	-710.53	22.42	2.22	18.04	-591.13	21.28	0.93	20.57	-4249.41	21.83	1.74	20.23
144	4133	410.87	21.66	1.62	20.12	530.27	23.09	3.19	16.82	-4249.41	21.83	1.74	20.23
145	4134	410.87	21.66	1.62	20.12	-1712.53	21.84	1.63	19.41	-4249.41	21.83	1.74	20.23
146	4135	1585.92	22.03	1.90	19.19	-421.32	21.31	0.94	20.58	-4248.95	21.82	1.74	20.23
147	4136	-656.88	22.40	2.24	17.86	-421.32	21.31	0.94	20.58	-4248.95	21.82	1.74	20.23
148	4137	464.52	21.76	1.66	20.13	700.08	22.63	2.64	17.73	-4248.95	21.82	1.74	20.23
149	4138	464.52	21.76	1.66	20.13	-1542.72	21.91	1.71	19.29	-4248.95	21.82	1.74	20.23
150	4201	1199.23	22.17	2.00	18.90	-410.87	21.66	1.62	20.12	-4248.77	21.82	1.74	20.23
151	4202	-1043.57	22.10	2.00	18.69	-410.87	21.66	1.62	20.12	-4248.77	21.82	1.74	20.23
152	4203	77.83	22.62	1.98	20.27	710.53	22.42	2.22	18.04	-4248.77	21.82	1.74	20.23
153	4204	77.83	22.62	1.98	20.27	-1532.27	22.01	1.90	19.15	-4248.77	21.82	1.74	20.23
154	4205	1173.11	22.15	2.00	18.86	8.50	3.81	-32.13	42.84	-4248.97	21.82	1.74	20.23
155	4206	-1069.69	22.12	2.00	18.73	8.50	3.81	-32.13	42.84	-4248.97	21.82	1.74	20.23
156	4207	51.71	22.46	1.98	20.21	1129.90	22.00	1.74	18.98	-4248.97	21.82	1.74	20.23
157	4208	51.71	22.46	1.98	20.21	-1112.90	22.28	2.26	18.62	-4248.97	21.82	1.74	20.23
158	4211	1116.10	22.13	2.00	18.79	184.97	20.55	-0.57	21.61	-4249.43	21.83	1.74	20.23
159	4212	-1126.10	22.15	2.00	18.81	184.97	20.55	-0.57	21.61	-4249.43	21.83	1.74	20.23
160	4213	-4.70	25.03	2.02	21.16	1306.37	21.91	1.64	19.20	-4249.43	21.83	1.74	20.23
161	4214	-4.70	25.03	2.02	21.16	-936.43	22.45	2.51	18.25	-4249.43	21.83	1.74	20.23
162	4215	1063.04	22.10	2.00	18.72	15.15	13.12	-17.14	33.33	-4249.89	21.83	1.74	20.23
163	4216	-1179.76	22.17	2.00	18.88	15.15	13.12	-17.14	33.33	-4249.89	21.83	1.74	20.23
164	4217	-58.36	22.76	1.98	20.32	1136.55	22.02	1.74	18.99	-4249.89	21.83	1.74	20.23
165	4218	-58.36	22.76	1.98	20.32	-1106.25	22.26	2.26	18.60	-4249.89	21.83	1.74	20.23
166	4221	1043.57	22.10	2.00	18.69	-401.46	21.58	1.61	20.09	-4250.07	21.83	1.74	20.23
167	4222	-1199.23	22.17	2.00	18.90	-401.46	21.58	1.61	20.09	-4250.07	21.83	1.74	20.23
168	4223	-77.83	22.62	1.98	20.27	719.94	22.45	2.22	18.08	-4250.07	21.83	1.74	20.23
169	4224	-77.83	22.62	1.98	20.27	-1522.86	21.99	1.90	19.14	-4250.07	21.83	1.74	20.23
170	4225	1069.69	22.12	2.00	18.73	-820.83	21.43	1.26	20.34	-4249.87	21.83	1.74	20.23
171	4226	-1173.11	22.15	2.00	18.86	-820.83	21.43	1.26	20.34	-4249.87	21.83	1.74	20.23
172	4227	-51.71	22.46	1.98	20.21	300.57	24.06	4.01	14.60	-4249.87	21.83	1.74	20.23
173	4228	-51.71	22.46	1.98	20.21	-1942.23	21.84	1.69	19.45	-4249.87	21.83	1.74	20.23
174	4231	1126.10	22.15	2.00	18.81	-997.29	21.42	1.21	20.38	-4249.41	21.83	1.74	20.23
175	4232	-1116.70	22.13	2.00	18.79	-997.29	21.42	1.21	20.38	-4249.41	21.83	1.74	20.23
176	4233	4.70	25.03	2.02	21.16	124.11	27.91	8.36	6.08	-4249.41	21.83	1.74	20.23
177	4234	4.70	25.03	2.02	21.16	-2118.69	21.80	1.63	19.55	-4249.41	21.83	1.74	20.23
178	4235	1179.76	22.17	2.00	18.88	-827.48	21.46	1.27	20.35	-4248.95	21.82	1.74	20.23
179	4236	-1063.04	22.10	2.00	18.72	-827.48	21.46	1.27	20.35	-4248.95	21.82	1.74	20.23
180	4237	58.36	22.76	1.98	20.32	293.92	24.04	4.05	14.45	-4248.95	21.82	1.74	20.23

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
181	4238	58.36	22.76	1.98	20.32	-1948.88	21.85	1.69	19.46	-4248.95	21.82	1.74	20.23
182	4301	1199.23	22.17	2.00	18.90	401.46	21.58	1.61	20.09	-4248.77	21.82	1.74	20.23
183	4302	-1043.57	22.10	2.00	18.69	401.46	21.58	1.61	20.09	-4248.77	21.82	1.74	20.23
184	4303	77.83	22.62	1.98	20.27	1522.86	21.99	1.90	19.14	-4248.77	21.82	1.74	20.23
185	4304	77.83	22.62	1.98	20.27	-719.94	22.45	2.22	18.08	-4248.77	21.82	1.74	20.23
186	4305	1173.11	22.15	2.00	18.86	820.83	21.43	1.26	20.34	-4248.97	21.82	1.74	20.23
187	4306	-1069.69	22.12	2.00	18.73	820.83	21.43	1.26	20.34	-4248.97	21.82	1.74	20.23
188	4307	51.71	22.46	1.98	20.21	1942.23	21.84	1.69	19.45	-4248.97	21.82	1.74	20.23
189	4308	51.71	22.46	1.98	20.21	-300.57	24.06	4.01	14.60	-4248.97	21.82	1.74	20.23
190	4311	1116.70	22.13	2.00	18.79	997.29	21.42	1.21	20.38	-4249.43	21.83	1.74	20.23
191	4312	-1126.10	22.15	2.00	18.81	997.29	21.42	1.21	20.38	-4249.43	21.83	1.74	20.23
192	4313	-4.70	25.03	2.02	21.16	2118.69	21.80	1.63	19.55	-4249.43	21.83	1.74	20.23
193	4314	-4.70	25.03	2.02	21.16	-124.11	27.91	8.36	6.08	-4249.43	21.83	1.74	20.23
194	4315	1063.04	22.10	2.00	18.72	827.48	21.46	1.27	20.35	-4249.89	21.83	1.74	20.23
195	4316	-1179.76	22.17	2.00	18.88	827.48	21.46	1.27	20.35	-4249.89	21.83	1.74	20.23
196	4317	-58.36	22.76	1.98	20.32	1948.88	21.85	1.69	19.46	-4249.89	21.83	1.74	20.23
197	4318	-58.36	22.76	1.98	20.32	-293.92	24.04	4.05	14.45	-4249.89	21.83	1.74	20.23
198	4321	1043.57	22.10	2.00	18.69	410.87	21.66	1.62	20.12	-4250.07	21.83	1.74	20.23
199	4322	-1199.23	22.17	2.00	18.90	410.87	21.66	1.62	20.12	-4250.07	21.83	1.74	20.23
200	4323	-77.83	22.62	1.98	20.27	1532.27	22.01	1.90	19.15	-4250.07	21.83	1.74	20.23
201	4324	-77.83	22.62	1.98	20.27	-710.53	22.42	2.22	18.04	-4250.07	21.83	1.74	20.23
202	4325	1069.69	22.12	2.00	18.73	-8.50	3.81	-32.13	42.84	-4249.87	21.83	1.74	20.23
203	4326	-1173.11	22.15	2.00	18.86	-8.50	3.81	-32.13	42.84	-4249.87	21.83	1.74	20.23
204	4327	-51.71	22.46	1.98	20.21	1112.90	22.28	2.26	18.62	-4249.87	21.83	1.74	20.23
205	4328	-51.71	22.46	1.98	20.21	-1129.90	22.00	1.74	18.98	-4249.87	21.83	1.74	20.23
206	4331	1126.10	22.15	2.00	18.81	-184.97	20.55	-0.57	21.61	-4249.41	21.83	1.74	20.23
207	4332	-1116.70	22.13	2.00	18.79	-184.97	20.55	-0.57	21.61	-4249.41	21.83	1.74	20.23
208	4333	4.70	25.03	2.02	21.16	936.43	22.45	2.51	18.25	-4249.41	21.83	1.74	20.23
209	4334	4.70	25.03	2.02	21.16	-1306.37	21.91	1.64	19.20	-4249.41	21.83	1.74	20.23
210	4335	1179.76	22.17	2.00	18.88	-15.15	13.12	-17.14	33.33	-4248.95	21.82	1.74	20.23
211	4336	-1063.04	22.10	2.00	18.72	-15.15	13.12	-17.14	33.33	-4248.95	21.82	1.74	20.23
212	4337	58.36	22.76	1.98	20.32	1106.25	22.26	2.26	18.60	-4248.95	21.82	1.74	20.23
213	4338	58.36	22.76	1.98	20.32	-1136.55	22.02	1.74	18.99	-4248.95	21.82	1.74	20.23



## 6.1 Member Unity Check Result

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

### 6.1a AS-IS CONDITION

#### Member Unity Check Result

Member	Group ID	Load Case	UC
B187-B190	B1B	4312	1.417
B042-B047	B1D	4232	1.646
B144-B150	B2A	4312	1.08
B190-B201	B2B	4312	1.945
B047-B051	B2D	4232	1.317
B150-B151	B3A	4312	1.046
B201-B203	B3B	4012	1.054
B051-B061	B3D	4232	1.488
B203-B206	B4B	4311	1.034
B061-B063	B4D	4232	1.391
B158-B164	B5A	4312	1.058
B063-B069	B5D	4032	1.367
B164-B168	B6A	4312	2.006
B069-B078	B6D	4032	1.343
B168-B176	B7A	4312	1.82
B176-B182	B8A	4312	1.316
B029-B035	B8C	4232	1.086
B182-B187	B9A	4312	1.08
B042-B035	B9C	4232	2.206
B156-B161	CHC	4233	1.888
B161-B170	CHD	4233	1.93
B170-B174	CHE	4233	1.903
B174-B180	CHF	4233	1.498
B180-B186	CHG	4233	1.109
B186-B195	CHH	4233	1.151
B195-B197	CHI	4233	5.42
B197-B205	CHJ	4313	1.13
B020-B028	CHO	4232	1.457
B028-B036	CHP	4311	2.051
B036-B043	CHQ	4311	2.024
B043-B049	CHR	4314	2.298
B049-B053	CHS	4314	2.385
B060-B065	CHU	4314	3.003
B065-B070	CHV	4314	3.798
B070-B074	CHW	4314	1.276
B053-B061	D11	4308	102.82
0000-B063	D13	4232	1.424

Member	Group ID	Load Case	UC
B070-0000	D13	4232	1.73
0000-B069	D14	4231	5.524
B065-0000	D14	4134	5.827
0001-B069	D15	4312	1.995
B074-0001	D15	4232	2.389
0001-B078	D16	4232	6.082
B070-0001	D16	4231	3.971
B147-B144	D17	4312	1.489
B152-B147	D18	4314	1.232
0002-B156	D20	4312	2.158
B150-B152	D20	4314	1.365
B152-0002	D20	4312	3.602
0002-B158	D21	4312	1.278
B146-0002	D21	4312	1.329
B156-B164	D22	4312	1.684
B164-B170	D23	4027	1.534
B195-B201	D28	4233	1.995
B201-B205	D29	4231	1.656
B212-B205	D30	4233	1.713
B161-B043	D34	4312	3.632
B197-B074	D40	4232	1.275
B011-B014	DB1	4231	1.165
B016-B014	DB2	4231	1.653
B013-B016	DB4	4231	1.723
B016-B020	DB4	4231	4.024
B022-B024	DB5	4231	1.058
B024-B028	DB5	4311	1.597
B028-B035	DB7	4311	1.105
B070-B102	H10	4137	6.65
B102-B130	H10	4013	4.024
B130-B197	H10	4311	2.861
B074-B103	H11	4234	1.027
B103-B121	H11	4133	1.085
B121-B205	H11	4313	1.194
0023-B207	H12	4233	1.372
0024-B104	H12	4233	1.076
B074-0024	H12	4232	1.031
B104-B120	H12	4232	1.699
B120-0023	H12	4233	1.399
0015-0016	HB1	4314	1.262
B015-0015	HB1	4314	1.142
B094-B122	HB2	4312	1.152

Member	Group ID	Load Case	UC
B122-B146	HB2	4312	1.112
B096-B124	HB4	4332	1.295
B043-B097	HB5	4108	1.419
B097-B125	HB5	4031	1.309
B125-B170	HB5	4031	1.226
B049-B098	HB6	4106	1.531
B098-B126	HB6	4032	2.051
B126-B174	HB6	4233	1.129
B053-B099	HB7	4027	1.589
B099-B127	HB7	4032	1.475
B127-B180	HB7	4032	1.26
B060-B100	HB8	4026	1.675
B100-B128	HB8	4232	1.153
B128-B186	HB8	4232	1.105
B065-B101	HB9	4232	1.549
B101-B129	HB9	4232	2.14
B129-B195	HB9	4232	1.597
B013-B247	HBA	4232	3.398
B246-B150	HBA	4232	3.077
B247-B246	HBA	4312	1.647
B022-B225	HBB	4312	2.207
B224-B150	HBB	4312	2.604
B225-B224	HBB	4312	1.302
B029-B234	HBC	4312	1.473
B226-B158	HBC	4312	3.028
B234-B226	HBC	4312	1.073
B035-B235	HBD	4026	2.796
B227-B164	HBD	4312	3.915
B235-B227	HBD	4012	1.593
B042-B236	HBE	4026	1.525
B228-B168	HBE	4012	2.492
B047-B237	HBF	4016	1.829
B229-B176	HBF	4012	2.436
B237-B229	HBF	4012	1.005
B051-B238	HBG	4135	1.54
B230-B182	HBG	4016	1.633
B061-B239	HBH	4031	2.701
B231-B187	HBH	4311	1.379
B063-B240	HBI	4111	208.919
B232-B190	HBI	4135	162.509
B240-B232	HBI	4105	95.886
B069-B241	HBJ	4131	4.447

Member	Group ID	Load Case	UC
B233-B201	HBJ	4105	2.633
B241-B233	HBJ	4131	1.835
B079-B093	HBK	4234	4.082
B093-B242	HBK	4131	2.259
B242-B203	HBK	4312	2.436
B150-B109	HBL	2014	1.41
B022-B109	HBM	2012	1.332
B158-B109	HBM	4312	1.187
B029-B164	HBN	4232	1.226
B063-B201	HBT	4313	1.707
B201-B079	HBU	2034	2.108
0012-B131	HBV	4101	3.268
0013-0014	HBV	4105	3.608
0014-0012	HBV	4101	3.186
0014-B131	HBV	4135	4.116
B106-0013	HBV	4313	3.027
B106-0014	HBV	4016	3.246
B131-B203	HBV	4131	3.483
B093-B106	HBW	4313	8.24
B106-B249	HBW	4012	3.634
B131-B206	HBW	4313	2.144
B249-B131	HBW	4234	1.841
0012-0013	HBX	4135	2.08
0013-B079	HBX	4032	3.978
B212-0012	HBX	4234	1.378
B083-B096	MEC	4231	1.165
B085-B098	MEE	4232	1.993
B086-B099	MEF	4231	1.174
B073-B089	MEI	4234	1.061
B089-B102	MEI	4333	1.179
B076-B090	MEJ	4232	1.989
B090-B103	MEJ	4232	1.371
B076-B091	MEK	4232	1.865
0011-0021	MEL	4231	2.847
0021-0015	MEL	4231	1.878
B134-B122	MWA	4312	1.381
B149-B134	MWA	4312	2.268
B154-B135	MWB	4314	1.097
B165-B136	MWC	4312	1.007
B141-B129	MWH	4131	1.052
B132-B120	MWK	4232	1.194
B210-B132	MWK	2011	1.169

Member	Group ID	Load Case	UC
0017-0022	MWL	4312	1.073
0022-B149	MWL	4312	2.084
B032-B083	PED	4312	1.53
B044-B085	PEF	4114	1.59
B090-B075	PEK	4232	1.09
B075-B091	PEL	4232	1.75
B134-B148	PWB	4031	2.24
B137-B166	PWE	4016	51.819
B138-B173	PWF	4105	3.261
B139-B183	PWG	4026	5.886
B140-B189	PWH	4026	7.627
B141-B192	PWI	4032	3.736
B142-B198	PWJ	4234	4.416
B204-B133	PWK	4231	6.087
B057-B060	V10	4032	1.082
B059-B057	V10	4134	1.174
B061-B059	V10	4134	1.318
B063-B064	V11	4234	2.901
B064-B067	V11	4234	2.2
B067-B065	V11	4134	1.459
B068-B070	V12	4314	1.813
B069-B073	V12	4234	3.966
B073-B068	V12	4234	2.869
B075-B074	V13	4232	3.119
B076-B075	V13	4232	5.388
B079-B076	V13	4232	6.655
B147-B149	V14	4312	5.09
B148-B146	V14	4312	2.075
B149-B148	V14	4312	4.351
B150-B147	V14	4312	1.375
B154-B159	V16	4314	1.633
B158-B154	V16	4312	1.981
B164-B165	V17	4312	1.512
B165-B160	V17	4312	1.182
B166-B170	V18	4031	1.003
B168-B171	V18	4231	1.424
B171-B166	V18	4231	1.378
B176-B172	V19	4212	1.172
B190-B194	V22	4232	1.47
B192-B195	V22	4232	1.364
B194-B192	V22	4232	1.09
B196-B198	V23	4234	1.654

Member	Group ID	Load Case	UC
B198-B197	V23	4234	1.165
B201-B196	V23	4231	1.991
B202-B204	V24	4231	2.052
B203-B202	V24	4231	2.716
B204-B205	V24	4234	2.228
B210-B208	V25	2011	1.752
B212-B210	V25	2011	1.95
0011-0020	VB1	2031	2.371
B013-B014	VB1	4231	1.188
B014-0011	VB1	4231	3.974
B019-B020	VB3	4314	2.718
B021-B019	VB3	4314	2.775
B022-B021	VB3	4314	3.163
B027-B030	VB5	4312	1.62
B029-B027	VB5	4314	2.111
B030-B028	VB5	4312	1.604
B032-B036	VB6	4312	1.212
B035-B037	VB6	4312	1.458
B037-B032	VB6	2012	1.004
B039-B043	VB7	4012	1.34
B042-B040	VB7	4013	1.246
B155-B158	YAA	4312	1.889
B163-B164	YAB	4312	1.884
B167-B168	YAC	4312	1.225
0010-B178	YAF	4312	1.631
B155-B163	YAF	4312	1.37
B167-B177	YAF	4312	1.45
B177-0010	YAF	4312	1.58
0004-B199	YAG	4312	1.344
0006-B191	YAG	4312	1.562
0008-B188	YAG	4312	1.571
B178-0008	YAG	4312	1.327
B188-0006	YAG	4312	1.244
B187-B191	YAJ	4012	1.097
B191-B190	YAK	4312	1.225
B199-B201	YAL	4312	1.82
B031-B029	ZAA	4232	2.107
B031-B033	ZAB	4232	1.276
B033-B041	ZAB	4232	1.009
B041-B048	ZAB	4232	1.493
B033-B035	ZAC	4232	1.627
B041-B042	ZAD	4232	1.113

Member	Group ID	Load Case	UC
0003-B072	ZAG	4232	1.041
0005-B066	ZAG	4232	1.684
0007-B056	ZAG	4232	1.774
0009-B050	ZAG	4032	1.491
B048-0009	ZAG	4232	1.545
B050-0007	ZAG	4232	1.699
B056-0005	ZAG	4232	1.523
B061-B066	ZAJ	4232	1.886
B066-B063	ZAK	4232	1.441
B072-B069	ZAL	4232	1.674

### 6.1b AFTER STRENGTHENING

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

#### Member Unity Check Result

Member	Group ID	Load Case	UC	Remarks
B144-B150	BZZ	2012	1.058	Member UC has increased marginally during extreme condition.
B016-0019	DB4	4231	1.02	
0010-B178	YAF	4012	1.018	
0006-B191	YAG	4012	1.001	

### 6.2 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum Vertical Deflection (cm)	Remarks
1.	B047	4.70	Allowable Deflection = $(4000 / 400) = 10.00$ cm
2.	B176	4.30	

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	B051	1.40	Allowable Deflection = $(4000 / 500) = 8.00$ cm
2.	B182	1.40	

Vertical and Horizontal Deflection of bridge are under control.

### 6.3 Reaction Summary

Following is the reaction summary of the bridge supports.

**Summary of Bridge Reaction**

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	B079	0	0	1847.925
2.	B212	0	0	931.385
3.	0014	1605.394	1338.627	0
4.	B011	0	333.094	1232.402
5.	B144	0	1101.226	1580.770

## 7.0 CONCLUSION

The analysis of bridge has been carried out considering the piping, electrical & instrumentation cable tray and wind loads. Based on the results, the necessary strengthening requirements, as outlined in Clause 4.0, have been recommended. With the implementation of these strengthening measures of the top chord, bottom chord, and associated framing members, the bridge is found to be structurally adequate and safe under all load combinations.

Also, functionally the deflection is under the limits. The adequacy of the bridge landing locations, adequacy of deck members are performed separately.

It is also recommended that no additional structural loading/modifications shall be carried out on NQO-NQD bridge without adequate structural analysis.



**ANNEXURE-1  
LOAD CALCULATIONS**

## WIND LOAD:

S.No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulence Intensity at height "z"	t <sub>o</sub>	t	Design Wind Speed at Height "z"	
			U <sub>o</sub>			z		U(z)	Iu(z)			u(z,t)	
			kmph	ft/sec		m	ft	ft/sec		sec	sec	ft/sec	m/sec
1	Extreme	0	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
2	Extreme	45	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
3	Extreme	90	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
4	Extreme	135	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
5	Extreme	180	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
6	Extreme	225	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
7	Extreme	270	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
8	Extreme	315	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
1	Operating	All	99.22	90.40	0.130	10.00	32.80	90.40	0.131	3600	3	124.84	38.06

## CABLE LOAD & CABLE TRAY LOAD:

Spacing	No of Trays	Cables to be considered	Weight of Cable Tray	Weight of Cable Tray (kN/m)	Tray Load (kN)	WEIGHT FOR CABLES	kN/m	Cable Load (kN/m)	Cable Load (kN)	Total Load (kN)	Moment (kN/m)
4.2	1 no. 750MM tray at East Side	4 run 3C X2.5 SQ. MM armoured cu. conductor cable	FOR 750 mm CABLE TRAY LOAD= 3 5.9 KG/3 MTR LONG	0.12	0.50	for 3C X2.5 SQ. MM armoured cu. conductor cable= 162 kg/km	0.002	0.006	0.027	0.53	0.20
4.2	1 no. 600mm tray at East Side	2 run 3.5CX35 SQ. MM Cu conductor armoured cables	FOR 600 mm CABLE TRAY LOAD= 2 2.89 KG/3 MTR LONG	0.08	0.32	for 3.5CX35 SQ. MM Cu conductor armoured cables=1311kg/km	0.013	0.026	0.110	0.43	0.13
4.2	1 no. 300mm tray at East Side	4 run 2Px1.5 SQ. MM CABLE	FOR 300 mm CABLE TRAY LOAD =7. 7KG/3 MTR LONG	0.03	0.11	for 2PX1.5 SQ MM=585kg/km	0.006	0.023	0.098	0.21	0.06
4.2	1 no. 300mm tray at East Side	10 run 2C X4 SQMM CU CABLE	FOR 300 mm CABLE TRAY LOAD =7. 7KG/3 MTR LONG	0.03	0.11	for 2C X4 SQ MM=403 kg/Km	0.004	0.040	0.169	0.28	0.08

## GRATING LOAD

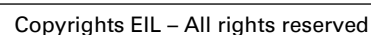
Grating load of 50 kg/m<sup>2</sup> is considered

## HANDRAIL LOAD

Handrail Load of 50Kg/m is considered.

## PIPING LOAD

Load ID	Location	Grid										
		1	2	3	4	5	6	7	8	9	10	11
PIPDLA	Top Chord Grid A To B	-	2.5	1.75	1.75	1.75	1.75	1.75	1.75	3.2	-	-
PIPDLB		3	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	-
PIPDLC		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1.25
PIPDLD		-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PIPDLE		-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1.25
PIPDFL		-	-	1.5	0.85	0.85	0.85	0.85	0.85	0.85	0.85	1.5
PIPDLG		-	2.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	3.5	-
PIPDLH		0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
PIPDLI	Below Top Chord Near Grid A	-	2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	2
PIPD LJ		-	2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	2
PIPD LK	Below Top Chord Near Grid B	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
PIPD LL		1.25	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1.5
PIPD LM	Cantilever From Grid B	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
PIPD LN		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
PIPD LO	Cant. To Left of Grid A	-	-	-	12.5	4.5	4.5	4.5	4.5	4.5	4.5	7
PIPD LP	Bottom Chord Grid A To B	-	1.3	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.3	
PIPD LQ		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
PIPD LR		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
PIPD LS		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
PIPD LT		0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175	0.175
PIPD LU		-	1.3	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.3	-
PIPD LV	Cant. To Left of Grid B	0.25	0.175	0.175	0.175	0.175	0.175	0.175	0.175		0.25	-
PIPD LW		-	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	6	-
PIPD LX	Below Bottom Chord	-	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
PIPD LY		-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
PIPD LZ		-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
PIPD L1	Outside Of Grid B	-	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	4.5	-





## **BRIDGE REPORT FOR REFURBISHMENT / REPLACEMENT OF BRIDGES IN MH ASSET (SCA-SCF BRIDGE)**

**PROJECT : ENGINEERING / TECHNICAL CONSULTANCY  
SERVICES FOR PREPERATION OF EXECUTION  
METHODOLOGY, SOW AND COST ESTIMATES  
FOR REPLACEMENT /REFURBISHMENT OF  
BRIDGES IN MH ASSET**

**LOCATION: MH ASSET (NORTH AND SOUTH FIELD)**

**OWNER : ONGC, MUMBAI**

**JOB NO : B774**

0	25-09-2025	ISSUED AS STUDY	RS	DP	CS
<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>

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## Symbols and Abbreviations

### Organisations – India

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### Other abbreviations

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge

## 1.0 INTRODUCTION

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges have deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## 2.0 GENERAL

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### IC Complex:

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### BHS Complex:

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### NQO Complex:

7. NQO-NQD Bridge

### WIN Complex:

8. WIN-NC Bridge

### ADDITIONAL BRIDGES:

9. SC1-SCA
10. SCA-SCF
11. ICP-ICD



### 3.0 SCA-SCF BRIDGE DESCRIPTION

120 M

Approximate length of bridge is measured from 3D model as 40m. Hence, 40m length of bridge is modelled in SACS conservatively.

Length of Bridge	120 m
Support Condition	Fixed: 001000, 110000, 001000 (SCA Side) Sliding: 011000, 011000 (SCF Side)
No. of directions for environmental loads	8
Wind Speed (3 Sec Gust)	57.19 m/s for extreme and 35.68m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	50/36 ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

ISOMETRIC VIEW OF SCA-SCF Bridge is shown in Figure1.

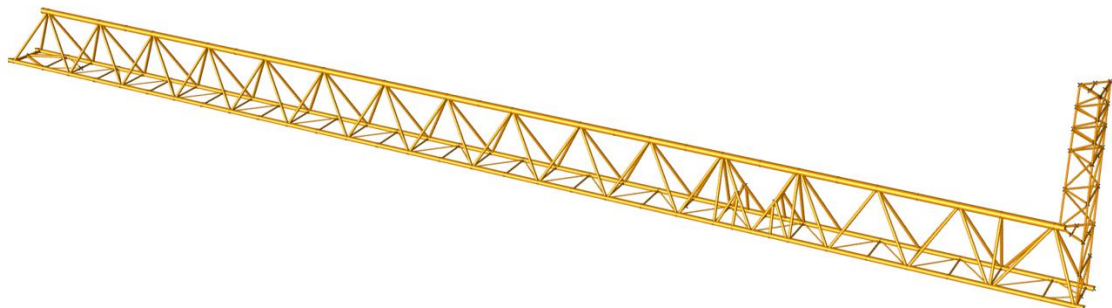
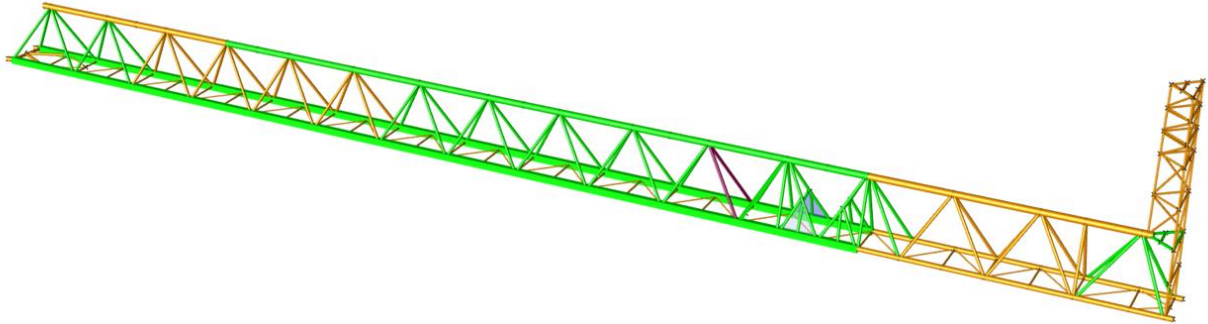
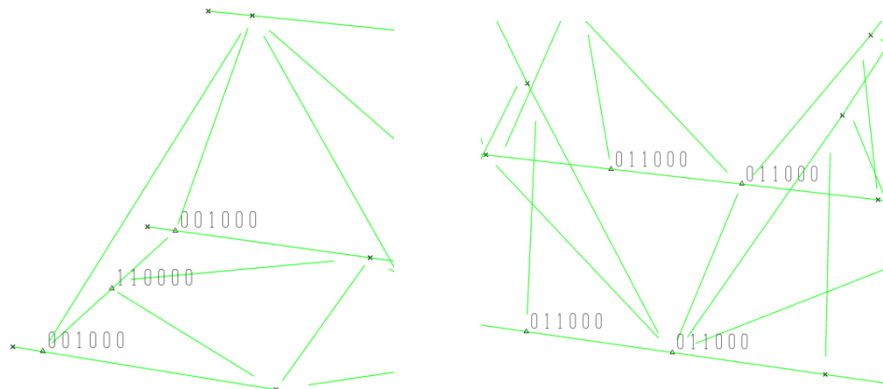


Figure 1: 3D SACS Model (Original)



**Figure 2: 3D SACS Model (Strengthened)**



**Figure 2: SUPPORT CONDITIONS**



**Figure 3: BRIDGE CROSS SECTION**

#### 4.0 PROPOSED STRENGTHENING CONFIGURATION

##### 1. Top Chord-

a) Main Chord:  $\Phi 610$ dia. x 5.3 mm + 12thk wrap plate

##### 2. Bottom Chord-

a) Main Chord:

457dia. x 5.7 mm + 12thk wrap plate + 2 no's Half cut tubular (356dia. x 12.7mm)

##### 3. Inclined Members

a) Diagonal member:

- 2 no's new member (replacement)(273dia. x 15.9mm)
- $\Phi 273$ dia. x 5.3 mm + 12thk wrap plate
- $\Phi 273$ dia. x 5.3 mm + 2 no's channel section (MC200)

##### 4. Flare side:

- MC200 beam is strengthened by providing MC200 as box.

The proposed strengthening and replacement works shall also comprise the following:

- Replacement of walkway members, gratings, and handrails.
- Replacement of stairs on both sides.
- Strengthening of supports at fixed and sliding ends.

#### 5.0 LOADING

##### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (kN)
DL	Self-weight, (Contingency - 13%)	1069.37
NGDL	Cable tray Cable tray Support-Nil	84.143
	Grating Load	
	Handrail Load	
	Monorail, Sheeting Cladding – Nil	
LL	Blanket live load on Walkway (Grating)Area -	186.31
CL	Cable Loading	5.67
PLEM	Piping Load Empty (60% of PLOP)	593.64
PLOP	Piping Load Empty + Operating Contents (By Piping)	989.4
PLTLX	Piping Load Empty + Operating Contents (30% of PLOP)	296.82
PLTLY	Piping Load Empty + Operating Contents (30% of PLOP) Y	296.82
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure

FLX	Bridge Friction Load X (30 % of SW+NGDL+LL+CL+PLOP)	700.46
FLY	Bridge Friction Load Y (30 % of SW+NGDL+LL+CL+PLOP)	700.46

### SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

### NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the Cable tray, cable tray support, grating and handrail loadings.

### LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1.2 m width of walkway is considered.

### CABLE TRAY AND CABLE LOAD

1. For 150mm cable tray, 5kg/3m load is considered. Cable trays consist of 4 cables (4no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km)
2. For 60mm cable tray, 3kg/3m load is considered. Cable trays consist of 4 cables (4no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km)
3. For 60mm cable tray, 3kg/3m load is considered. Cable trays consist of 4 cables (4no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km)

### WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

## Load Combinations

### Load Combinations

BASIC LOAD COMBINATIONS								
LCOMB	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
PLEM	PLOP	0.60						
1000	DL	1.00	NDGL	1.13	CL	1.00	PLEM	1.00
1001	DL	1.00	NDGL	1.13	CL	1.00	PLOP	1.00
1002	1001	1.00	LL	1.00	MRLL	1.00	PLTX	1.00
1003	1001	1.00	LL	1.00	MRLL	1.00	PLTX	-1.00
1004	1001	1.00	LL	1.00	MRLL	1.00	PLTY	1.00
1005	1001	1.00	LL	1.00	MRLL	1.00	PLTY	-1.00
1011	1001	1.00	FLX	1.00				
1012	1001	1.00	FLX	-1.00				
1013	1001	1.00	FLY	1.00				
1014	1001	1.00	FLY	-1.00				
1021	1002	1.00	FLX	1.00				
1022	1002	1.00	FLX	-1.00				
1023	1002	1.00	FLY	1.00				
1024	1002	1.00	FLY	-1.00				
1031	1003	1.00	FLX	1.00				
1032	1003	1.00	FLX	-1.00				
1033	1003	1.00	FLY	1.00				
1034	1003	1.00	FLY	-1.00				
1041	1004	1.00	FLX	1.00				
1042	1004	1.00	FLX	-1.00				
1043	1004	1.00	FLY	1.00				
1044	1004	1.00	FLY	-1.00				
1051	1005	1.00	FLX	1.00				
1052	1005	1.00	FLX	-1.00				
1053	1005	1.00	FLY	1.00				
1054	1005	1.00	FLY	-1.00				
EXTREME WIND CONDITION								
2001 to 2004	1011 to 1014	1.00	201	1.00				
2005 to 2008	1011 to 1014	1.00	202	1.00				
2011 to 2014	1011 to 1014	1.00	203	1.00				
2015 to 2018	1011 to 1014	1.00	204	1.00				

2021 to 2024	1011 to 1014	1.00	205	1.00				
2025 to 2028	1011 to 1014	1.00	206	1.00				
2031 to 2034	1011 to 1014	1.00	207	1.00				
2035 to 2038	1011 to 1014	1.00	208	1.00				
<b>OPERATING WIND CONDITION</b>								
4001 to 4004	1021 to 1024	1.00	301	1.00				
4005 to 4008	1021 to 1024	1.00	302	1.00				
4011 to 4014	1021 to 1024	1.00	303	1.00				
4015 to 4018	1021 to 1024	1.00	304	1.00				
4021 to 4024	1021 to 1024	1.00	305	1.00				
4025 to 4028	1021 to 1024	1.00	306	1.00				
4031 to 4034	1021 to 1024	1.00	307	1.00				
4035 to 4038	1021 to 1024	1.00	308	1.00				
4101 to 4104	1031 to 1034	1.00	301	1.00				
4105 to 4108	1031 to 1034	1.00	302	1.00				
4111 to 4114	1031 to 1034	1.00	303	1.00				
4115 to 4118	1031 to 1034	1.00	304	1.00				
4121 to 4124	1031 to 1034	1.00	305	1.00				
4125 to 4128	1031 to 1034	1.00	306	1.00				
4131 to 4134	1031 to 1034	1.00	307	1.00				
4135 to 4138	1031 to 1034	1.00	308	1.00				
4201 to 4204	1041 to 1044	1.00	301	1.00				
4205 to 4208	1041 to 1044	1.00	302	1.00				
4211 to 4214	1041 to 1044	1.00	303	1.00				
4215 to 4218	1041 to 1044	1.00	304	1.00				
4221 to 4224	1041 to 1044	1.00	305	1.00				
4225 to 4228	1041 to 1044	1.00	306	1.00				
4231 to 4234	1041 to 1044	1.00	307	1.00				
4235 to 4238	1041 to 1044	1.00	308	1.00				
4301 to 4304	1051 to 1054	1.00	301	1.00				
4305 to 4308	1051 to 1054	1.00	302	1.00				
4311 to 4314	1051 to 1054	1.00	303	1.00				
4315 to 4318	1051 to 1054	1.00	304	1.00				
4321 to 4324	1051 to 1054	1.00	305	1.00				
4325 to 4328	1051 to 1054	1.00	306	1.00				
4331 to 4334	1051 to 1054	1.00	307	1.00				
4335 to 4338	1051 to 1054	1.00	308	1.00				

## 6.0 RESULTS & SUMMARY

### A. BASIC LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

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\*\*\*\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*\*\*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	LL	USER GENERATED LOADS
2	NGDL	USER GENERATED LOADS
3	PLOP	USER GENERATED LOADS
4	HTLP	USER GENERATED LOADS
5	PLEM	USER GENERATED LOADS
6	PLTX	USER GENERATED LOADS
7	PLTY	USER GENERATED LOADS
8	CL	USER GENERATED LOADS
9	201	WIND
10	202	WIND
11	203	WIND
12	204	WIND
13	205	WIND
14	206	WIND
15	207	WIND
16	208	WIND
17	301	WIND
18	302	WIND
19	303	WIND
20	304	WIND
21	305	WIND
22	306	WIND
23	307	WIND
24	308	WIND
25	DL	DEAD
26	FLX	USER GENERATED LOADS
27	FLY	USER GENERATED LOADS

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	LL	0.00	0.00	-186.32	-340.0	13469.8	0.0	0.00	0.00
2	NGDL	0.00	0.00	-84.14	-153.6	5912.7	0.0	0.00	0.00
3	PLOP	0.00	0.00	-989.41	-1667.3	60985.3	0.0	0.00	0.00
4	HTLP	0.00	0.00	-666.50	-643.3	43889.7	0.0	0.00	0.00
5	PLEM	0.00	0.00	-600.85	-1013.3	37420.8	0.0	0.00	0.00
6	PLTX	64.37	0.00	0.00	0.0	4047.3	91.3	0.00	0.00
7	PLTY	-6.00	70.37	0.00	-4407.3	-360.0	6672.5	0.00	0.00
8	CL	0.00	0.00	-5.67	-14.5	291.8	0.0	0.00	0.00
9	201	87.58	0.01	-0.20	-0.1	6167.0	-158.2	0.00	0.00
10	202	74.11	254.53	-0.29	-16523.0	5160.5	16170.4	0.00	0.00
11	203	0.01	367.55	-0.15	-23847.7	20.6	23511.6	0.00	0.00
12	204	-74.56	257.61	0.08	-16718.5	-5162.0	16624.1	0.00	0.00
13	205	-106.44	-0.01	0.27	0.0	-7383.8	192.7	0.00	0.00
14	206	-62.78	-161.33	0.20	10629.5	-4423.8	-10645.6	0.00	0.00
15	207	-0.01	-233.41	0.08	15365.5	-12.2	-15489.0	0.00	0.00
16	208	62.34	-157.47	-0.08	10386.0	4380.0	-10672.1	0.00	0.00
17	301	36.02	0.00	-0.08	-0.0	2523.1	-65.1	0.00	0.00
18	302	30.04	113.83	-0.12	-7363.6	2084.5	7132.8	0.00	0.00
19	303	0.00	163.66	-0.07	-10583.2	9.5	10324.9	0.00	0.00
20	304	-30.21	114.92	0.03	-7432.6	-2082.4	7307.4	0.00	0.00
21	305	-43.09	-0.00	0.11	-0.0	-2977.7	78.1	0.00	0.00
22	306	-25.80	-78.31	0.09	5119.6	-1809.3	-4942.1	0.00	0.00
23	307	-0.00	-112.75	0.04	7366.8	-6.2	-7158.9	0.00	0.00
24	308	25.63	-76.83	-0.03	5026.5	1790.4	-4958.9	0.00	0.00
25	DL	0.00	0.00	-581.15	-1082.5	50588.8	0.0	1029.55	448.40

26	FLX	700.40	0.00	0.00	0.0	42024.0	-1278.2	0.00	0.00
27	FLY	0.00	700.40	0.00	-42024.0	0.0	60409.5	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT

***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
28	1000	0.00	0.00	-1282.75	-2283.8	94982.8	0.0
29	1001	0.00	0.00	-1671.32	-2937.8	118547.4	0.0
30	1002	64.37	0.00	-1857.64	-3277.9	136064.5	91.3
31	1003	-64.37	0.00	-1857.64	-3277.9	127969.8	-91.3
32	1004	-6.00	70.37	-1857.64	-7685.2	131657.2	6672.5
33	1005	6.00	-70.37	-1857.64	1129.5	132377.2	-6672.5
34	1011	700.40	0.00	-1671.32	-2937.8	160571.4	-1278.2
35	1012	-700.40	0.00	-1671.32	-2937.8	76523.3	1278.2
36	1013	0.00	700.40	-1671.32	-44961.8	118547.4	60409.5
37	1014	0.00	-700.40	-1671.32	39086.2	118547.4	-60409.5
38	1021	764.77	0.00	-1857.64	-3277.9	178088.5	-1186.9
39	1022	-636.03	0.00	-1857.64	-3277.9	94040.5	1369.5
40	1023	64.37	700.40	-1857.64	-45301.9	136064.5	60500.8
41	1024	64.37	-700.40	-1857.64	38746.1	136064.5	-60318.2
42	1031	636.03	0.00	-1857.64	-3277.9	169993.8	-1369.5
43	1032	-764.77	0.00	-1857.64	-3277.9	85945.8	1186.9
44	1033	-64.37	700.40	-1857.64	-45301.9	127969.8	60318.2
45	1034	-64.37	-700.40	-1857.64	38746.1	127969.8	-60500.8
46	1041	694.40	70.37	-1857.64	-7685.2	173681.2	5394.3
47	1042	-706.40	70.37	-1857.64	-7685.2	89633.2	7950.7
48	1043	-6.00	770.77	-1857.64	-49709.2	131657.2	67082.0
49	1044	-6.00	-630.03	-1857.64	34338.8	131657.2	-53737.0
50	1051	706.40	-70.37	-1857.64	1129.5	174401.2	-7950.7
51	1052	-694.40	-70.37	-1857.64	1129.5	90353.2	-5394.3
52	1053	6.00	630.03	-1857.64	-40894.5	132377.2	53737.0



53	1054	6.00	-770.77	-1857.64	43153.5	132377.2	-67082.0
54	2001	787.98	0.01	-1671.51	-2937.9	166738.3	-1436.5
55	2002	-612.82	0.01	-1671.51	-2937.9	82690.3	1120.0
56	2003	87.58	700.41	-1671.51	-44961.9	124714.3	60251.3
57	2004	87.58	-700.39	-1671.51	39086.1	124714.3	-60567.8
58	2005	774.51	254.53	-1671.61	-19460.9	165731.9	14892.2
59	2006	-626.29	254.53	-1671.61	-19460.9	81683.9	17448.6
60	2007	74.11	954.93	-1671.61	-61484.9	123707.9	76579.9
61	2008	74.11	-445.87	-1671.61	22563.1	123707.9	-44239.1
62	2011	700.41	367.55	-1671.47	-26785.5	160592.0	22233.4
63	2012	-700.39	367.55	-1671.47	-26785.5	76544.0	24789.8
64	2013	0.01	1067.95	-1671.47	-68809.5	118568.0	83921.1
65	2014	0.01	-332.85	-1671.47	15238.5	118568.0	-36897.9
66	2015	625.84	257.61	-1671.24	-19656.4	155409.4	15345.9
67	2016	-774.96	257.61	-1671.24	-19656.4	71361.4	17902.4
68	2017	-74.56	958.01	-1671.24	-61680.4	113385.4	77033.6
69	2018	-74.56	-442.79	-1671.24	22367.6	113385.4	-43785.4
70	2021	593.96	-0.01	-1671.05	-2937.8	153187.6	-1085.5
71	2022	-806.84	-0.01	-1671.05	-2937.8	69139.5	1471.0
72	2023	-106.44	700.39	-1671.05	-44961.8	111163.6	60602.3

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
73	2024	-106.44	-700.41	-1671.05	39086.2	111163.6	-60216.8
74	2025	637.62	-161.33	-1671.12	7691.6	156147.5	-11923.8
75	2026	-763.18	-161.33	-1671.12	7691.6	72099.5	-9367.3
76	2027	-62.78	539.07	-1671.12	-34332.4	114123.5	49763.9
77	2028	-62.78	-861.73	-1671.12	49715.6	114123.5	-71055.1
78	2031	700.39	-233.41	-1671.23	12427.7	160559.1	-16767.2
79	2032	-700.41	-233.41	-1671.23	12427.7	76511.1	-14210.8
80	2033	-0.01	466.99	-1671.23	-29596.3	118535.1	44920.5
81	2034	-0.01	-933.81	-1671.23	54451.7	118535.1	-75898.5
82	2035	762.74	-157.47	-1671.40	7448.1	164951.3	-11950.4
83	2036	-638.06	-157.47	-1671.40	7448.1	80903.3	-9393.9
84	2037	62.34	542.93	-1671.40	-34575.9	122927.3	49737.4
85	2038	62.34	-857.87	-1671.40	49472.1	122927.3	-71081.6
86	4001	800.79	0.00	-1857.72	-3277.9	180611.6	-1252.1
87	4002	-600.01	0.00	-1857.72	-3277.9	96563.6	1304.4
88	4003	100.39	700.40	-1857.72	-45301.9	138587.6	60435.7
89	4004	100.39	-700.40	-1857.72	38746.1	138587.6	-60383.3
90	4005	794.81	113.83	-1857.76	-10641.5	180173.0	5945.9
91	4006	-605.99	113.83	-1857.76	-10641.5	96125.0	8502.4
92	4007	94.41	814.24	-1857.76	-52665.5	138149.0	67633.7
93	4008	94.41	-586.57	-1857.76	31382.5	138149.0	-53185.3
94	4011	764.77	163.66	-1857.71	-13861.1	178098.0	9138.0
95	4012	-636.03	163.66	-1857.71	-13861.1	94050.0	11694.4
96	4013	64.37	864.06	-1857.71	-55885.1	136074.0	70825.7
97	4014	64.37	-536.74	-1857.71	28162.9	136074.0	-49993.3
98	4015	734.56	114.92	-1857.61	-10710.5	176006.1	6120.5
99	4016	-666.24	114.92	-1857.61	-10710.5	91958.1	8676.9
100	4017	34.16	815.32	-1857.61	-52734.5	133982.1	67808.2
101	4018	34.16	-585.48	-1857.61	31313.5	133982.1	-53010.8
102	4021	721.68	-0.00	-1857.53	-3277.9	175110.8	-1108.8
103	4022	-679.12	-0.00	-1857.53	-3277.9	91062.8	1447.6
104	4023	21.28	700.40	-1857.53	-45301.9	133086.8	60578.9
105	4024	21.28	-700.40	-1857.53	38746.1	133086.8	-60240.1
106	4025	738.97	-78.31	-1857.55	1841.7	176279.3	-6129.0
107	4026	-661.83	-78.31	-1857.55	1841.7	92231.3	-3572.5
108	4027	38.57	622.09	-1857.55	-40182.3	134255.3	55558.8
109	4028	38.57	-778.71	-1857.55	43865.7	134255.3	-65260.3
110	4031	764.76	-112.75	-1857.59	4089.0	178082.4	-8345.8
111	4032	-636.04	-112.75	-1857.59	4089.0	94034.4	-5789.3
112	4033	64.36	587.65	-1857.59	-37935.0	136058.4	53341.9
113	4034	64.36	-813.15	-1857.59	46113.0	136058.4	-67477.1
114	4035	790.40	-76.83	-1857.66	1748.6	179878.9	-6145.8
115	4036	-610.40	-76.83	-1857.66	1748.6	95830.9	-3589.3
116	4037	90.00	623.57	-1857.66	-40275.4	137854.9	55542.0
117	4038	90.00	-777.23	-1857.66	43772.6	137854.9	-65277.0

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

LOAD CASE	LOAD LABEL	RELATIVE TO MUDLINE ELEVATION					
		FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
118	4101	672.05	0.00	-1857.72	-3277.9	172516.9	-1434.7
119	4102	-728.75	0.00	-1857.72	-3277.9	88468.9	1121.8
120	4103	-28.35	700.40	-1857.72	-45301.9	130492.9	60253.0
121	4104	-28.35	-700.40	-1857.72	38746.1	130492.9	-60566.0
122	4105	666.07	113.83	-1857.76	-10641.5	172078.3	5763.3
123	4106	-734.73	113.83	-1857.76	-10641.5	88030.3	8319.8
124	4107	-34.33	814.24	-1857.76	-52665.5	130054.3	67451.0
125	4108	-34.33	-586.57	-1857.76	31382.5	130054.3	-53368.0
126	4111	636.03	163.66	-1857.71	-13861.1	170003.3	8955.3
127	4112	-764.77	163.66	-1857.71	-13861.1	85955.3	11511.8
128	4113	-64.37	864.06	-1857.71	-55885.1	127979.3	70643.1
129	4114	-64.37	-536.74	-1857.71	28162.9	127979.3	-50175.9
130	4115	605.82	114.92	-1857.61	-10710.5	167911.4	5937.9
131	4116	-794.98	114.92	-1857.61	-10710.5	83863.4	8494.3
132	4117	-94.58	815.32	-1857.61	-52734.5	125887.4	67625.6
133	4118	-94.58	-585.48	-1857.61	31313.5	125887.4	-53193.4
134	4121	592.94	-0.00	-1857.53	-3277.9	167016.1	-1291.5
135	4122	-807.86	-0.00	-1857.53	-3277.9	82968.1	1265.0
136	4123	-107.46	700.40	-1857.53	-45301.9	124992.1	60396.3
137	4124	-107.46	-700.40	-1857.53	38746.1	124992.1	-60422.7
138	4125	610.23	-78.31	-1857.55	1841.7	168184.6	-6311.6
139	4126	-790.57	-78.31	-1857.55	1841.7	84136.6	-3755.1
140	4127	-90.17	622.09	-1857.55	-40182.3	126160.6	55376.1
141	4128	-90.17	-778.71	-1857.55	43865.7	126160.6	-65442.9
142	4131	636.03	-112.75	-1857.59	4089.0	169987.7	-8528.4
143	4132	-764.77	-112.75	-1857.59	4089.0	85939.7	-5972.0
144	4133	-64.37	587.65	-1857.59	-37935.0	127963.7	53159.3
145	4134	-64.37	-813.15	-1857.59	46113.0	127963.7	-67659.7
146	4135	661.66	-76.83	-1857.66	1748.6	171784.3	-6328.4
147	4136	-739.14	-76.83	-1857.66	1748.6	87736.2	-3771.9
148	4137	-38.74	623.57	-1857.66	-40275.4	129760.3	55359.3
149	4138	-38.74	-777.23	-1857.66	43772.6	129760.3	-65459.7
150	4201	730.42	70.37	-1857.72	-7685.2	176204.2	5329.1
151	4202	-670.38	70.37	-1857.72	-7685.2	92156.2	7885.6
152	4203	30.02	770.77	-1857.72	-49709.2	134180.2	67016.9
153	4204	30.02	-630.03	-1857.72	34338.8	134180.2	-53802.1
154	4205	724.44	184.20	-1857.76	-15048.9	175765.7	12527.1
155	4206	-676.36	184.20	-1857.76	-15048.9	91717.7	15083.6
156	4207	24.04	884.60	-1857.76	-57072.9	133741.7	74214.9
157	4208	24.04	-516.20	-1857.76	26975.1	133741.7	-46604.1
158	4211	694.40	234.03	-1857.71	-18268.4	173690.6	15719.2
159	4212	-706.40	234.03	-1857.71	-18268.4	89642.6	18275.6
160	4213	-6.00	934.43	-1857.71	-60292.4	131666.6	77406.9
161	4214	-6.00	-466.37	-1857.71	23755.6	131666.6	-43412.1
162	4215	664.19	185.29	-1857.61	-15117.8	171598.8	12701.7

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

LOAD CASE	LOAD LABEL	RELATIVE TO MUDLINE ELEVATION					
		FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
163	4216	-736.61	185.29	-1857.61	-15117.8	87550.8	15258.1
164	4217	-36.21	885.69	-1857.61	-57141.8	129574.8	74389.4
165	4218	-36.21	-515.11	-1857.61	26906.2	129574.8	-46429.6
166	4221	651.31	70.37	-1857.53	-7685.2	170703.5	5472.4
167	4222	-749.49	70.37	-1857.53	-7685.2	86655.5	8028.8
168	4223	-49.09	770.77	-1857.53	-49709.2	128679.5	67160.1
169	4224	-49.09	-630.03	-1857.53	34338.8	128679.5	-53658.9
170	4225	668.60	-7.94	-1857.55	-2565.6	171871.9	452.2
171	4226	-732.20	-7.94	-1857.55	-2565.6	87823.9	3008.7
172	4227	-31.80	692.46	-1857.55	-44589.6	129847.9	62140.0
173	4228	-31.80	-708.34	-1857.55	39458.4	129847.9	-58679.0
174	4231	694.40	-42.38	-1857.59	-318.4	173675.0	-1764.6
175	4232	-706.40	-42.38	-1857.59	-318.4	89627.0	791.9
176	4233	-6.00	658.02	-1857.59	-42342.4	131651.0	59923.1
177	4234	-6.00	-742.78	-1857.59	41705.6	131651.0	-60895.9
178	4235	720.03	-6.46	-1857.66	-2658.7	175471.6	435.4
179	4236	-680.77	-6.46	-1857.66	-2658.7	91423.6	2991.9
180	4237	19.63	693.94	-1857.66	-44682.7	133447.6	62123.2
181	4238	19.63	-706.86	-1857.66	39365.3	133447.6	-58695.8
182	4301	742.42	-70.36	-1857.72	1129.5	176924.2	-8015.9
183	4302	-658.38	-70.36	-1857.72	1129.5	92876.2	-5459.4
184	4303	42.02	630.04	-1857.72	-40894.5	134900.2	53671.8
185	4304	42.02	-770.76	-1857.72	43153.5	134900.2	-67147.2
186	4305	736.44	43.47	-1857.76	-6234.2	176485.7	-817.9
187	4306	-664.36	43.47	-1857.76	-6234.2	92437.7	1738.6
188	4307	36.04	743.87	-1857.76	-48258.2	134461.7	60869.8
189	4308	36.04	-656.93	-1857.76	35789.8	134461.7	-59949.2
190	4311	706.40	93.29	-1857.71	-9453.7	174410.6	2374.1
191	4312	-694.40	93.29	-1857.71	-9453.7	90362.6	4930.6
192	4313	6.00	793.69	-1857.71	-51477.7	132386.6	64061.9
193	4314	6.00	-607.11	-1857.71	32570.3	132386.6	-56757.1
194	4315	676.19	44.55	-1857.61	-6303.2	172318.8	-643.4
195	4316	-724.61	44.55	-1857.61	-6303.2	88270.8	1913.1
196	4317	-24.21	744.95	-1857.61	-48327.2	130294.8	61044.4
197	4318	-24.21	-655.85	-1857.61	35720.8	130294.8	-59774.6
198	4321	663.31	-70.37	-1857.53	1129.4	171423.5	-7872.7
199	4322	-737.49	-70.37	-1857.53	1129.4	87375.5	-5316.2
200	4323	-37.09	630.03	-1857.53	-40894.6	129399.5	53815.1
201	4324	-37.09	-770.77	-1857.53	43153.5	129399.5	-67003.9
202	4325	680.60	-148.68	-1857.55	6249.1	172591.9	-12892.8
203	4326	-720.20	-148.68	-1857.55	6249.1	88543.9	-10336.3
204	4327	-19.80	551.72	-1857.55	-35774.9	130567.9	48794.9
205	4328	-19.80	-849.08	-1857.55	48273.1	130567.9	-72024.1
206	4331	706.40	-183.12	-1857.59	8496.3	174395.0	-15109.6
207	4332	-694.40	-183.12	-1857.59	8496.3	90347.0	-12553.2

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
208	4333	6.00	517.28	-1857.59	-33527.7	132371.0	46578.1
209	4334	6.00	-883.52	-1857.59	50520.3	132371.0	-74240.9
210	4335	732.03	-147.20	-1857.66	6155.9	176191.6	-12909.6
211	4336	-668.77	-147.20	-1857.66	6155.9	92143.6	-10353.1
212	4337	31.63	553.20	-1857.66	-35868.1	134167.6	48778.1
213	4338	31.63	-847.60	-1857.66	48180.0	134167.6	-72040.9

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:51:51 SEA PAGE 84

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
1	LL	0.00				0.00				-186.32	72.29	1.83	3.49
2	NGDL	0.00				0.00				-84.14	70.27	1.83	3.61
3	PLOP	0.00				0.00				-989.41	61.64	1.69	1.56
4	HTLP	0.00				0.00				-666.50	65.85	0.97	1.98
5	PLEM	0.00				0.00				-600.85	62.28	1.69	1.77
6	PLTX	64.37	100.52	-1.42	2.88	0.00				0.00			
7	PLTY	-6.00	30.00	3.65	0.00	70.37	94.51	-0.99	2.63	0.00			
8	CL	0.00				0.00				-5.67	51.43	2.55	0.13
9	201	87.58	104.58	1.83	10.35	COUPLE				-0.20	65.86	-5.17	20.47
10	202	74.11	101.89	1.79	9.39	254.53	64.06	1.34	4.94	-0.29	76.73	-10.33	8.99
11	203	COUPLE				367.55	63.97	1.34	4.91	-0.15	127.82	-22.24	-1.58
12	204	-74.56	101.76	1.86	9.35	257.61	64.00	1.36	4.92	0.08	-64.56	21.67	37.46
13	205	-106.44	101.61	1.83	9.31	COUPLE				0.27	45.36	-3.54	14.51
14	206	-62.78	104.43	1.79	10.27	-161.33	66.70	2.09	5.93	0.20	85.23	-9.48	12.63
15	207	COUPLE				-233.41	66.36	2.12	5.87	0.08	135.63	-20.46	-5.90
16	208	62.34	104.50	1.87	10.30	-157.47	67.05	2.11	5.99	-0.08	18.92	4.94	37.77
17	301	36.02	104.11	1.83	9.98	COUPLE				-0.08	65.20	-4.85	20.71
18	302	30.04	101.46	1.79	9.12	113.83	63.14	1.29	4.71	-0.12	78.25	-9.79	8.88
19	303	COUPLE				163.66	63.09	1.30	4.69	-0.07	126.00	-19.71	-0.57
20	304	-30.21	101.33	1.86	9.08	114.92	63.11	1.31	4.70	0.03	-114.34	28.84	45.95
21	305	-43.09	101.18	1.83	9.04	COUPLE				0.11	44.55	-3.32	14.56
22	306	-25.80	103.96	1.79	9.91	-78.31	63.71	2.20	5.41	0.09	87.07	-8.64	12.30
23	307	COUPLE				-112.75	63.50	2.22	5.37	0.04	130.68	-16.17	-3.07
24	308	25.63	104.02	1.87	9.94	-76.83	63.93	2.22	5.45	-0.03	-6.57	7.25	46.17
25	DL	0.00	43.51	1.40	3.20	0.00	30.57	8.16	0.12	-581.15	87.05	1.86	6.56
26	FLX	700.40	86.25	1.82	0.00	0.00				0.00			
27	FLY	0.00				700.40	86.25	1.82	0.00	0.00			
28	1000	0.00	43.51	1.40	3.20	0.00	30.57	8.16	0.12	-1282.75	74.05	1.78	4.07
29	1001	0.00	43.51	1.40	3.20	0.00	30.57	8.16	0.12	-1671.32	70.93	1.76	3.41
30	1002	64.37	100.52	-1.42	2.88	0.00	30.57	8.16	0.12	-1857.64	71.07	1.76	3.42
31	1003	-64.37	100.52	-1.42	2.88	0.00	30.57	8.16	0.12	-1857.64	71.07	1.76	3.42
32	1004	-6.00	30.00	3.65	-0.00	70.37	94.51	-0.99	2.63	-1857.64	71.07	1.76	3.42
33	1005	6.00	30.00	3.65	0.00	-70.37	94.51	-0.99	2.63	-1857.64	71.07	1.76	3.42
34	1011	700.40	86.25	1.82	0.00	0.00	30.57	8.16	0.12	-1671.32	70.93	1.76	3.41
35	1012	-700.40	86.25	1.82	-0.00	0.00	30.57	8.16	0.12	-1671.32	70.93	1.76	3.41
36	1013	0.00	43.51	1.40	3.20	700.40	86.25	1.82	0.00	-1671.32	70.93	1.76	3.41
37	1014	0.00	43.51	1.40	3.20	-700.40	86.25	1.82	-0.00	-1671.32	70.93	1.76	3.41
38	1021	764.77	87.45	1.55	0.24	0.00	30.57	8.16	0.12	-1857.64	71.07	1.76	3.42
39	1022	-636.03	84.81	2.15	-0.29	0.00	30.57	8.16	0.12	-1857.64	71.07	1.76	3.42
40	1023	64.37	100.52	-1.42	2.88	700.40	86.25	1.82	0.00	-1857.64	71.07	1.76	3.42
41	1024	64.37	100.52	-1.42	2.88	-700.40	86.25	1.82	-0.00	-1857.64	71.07	1.76	3.42
42	1031	636.03	84.81	2.15	-0.29	0.00	30.57	8.16	0.12	-1857.64	71.07	1.76	3.42
43	1032	-764.77	87.45	1.55	0.24	0.00	30.57	8.16	0.12	-1857.64	71.07	1.76	3.42
44	1033	-64.37	100.52	-1.42	2.88	700.40	86.25	1.82	0.00	-1857.64	71.07	1.76	3.42
45	1034	-64.37	100.52	-1.42	2.88	-700.40	86.25	1.82	-0.00	-1857.64	71.07	1.76	3.42

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:51:51 SEA PAGE 85

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1041	694.40	86.74	1.81	0.00	70.37	94.51	-0.99	2.63	-1857.64	71.07	1.76	3.42
47	1042	-706.40	85.77	1.84	-0.00	70.37	94.51	-0.99	2.63	-1857.64	71.07	1.76	3.42
48	1043	-6.00	30.00	3.65	-0.00	770.77	87.00	1.57	0.24	-1857.64	71.07	1.76	3.42
49	1044	-6.00	30.00	3.65	-0.00	-630.03	85.33	2.14	-0.29	-1857.64	71.07	1.76	3.42
50	1051	706.40	85.77	1.84	0.00	-70.37	94.51	-0.99	2.63	-1857.64	71.07	1.76	3.42
51	1052	-694.40	86.74	1.81	-0.00	-70.37	94.51	-0.99	2.63	-1857.64	71.07	1.76	3.42
52	1053	6.00	30.00	3.65	0.00	630.03	85.33	2.14	-0.29	-1857.64	71.07	1.76	3.42
53	1054	6.00	30.00	3.65	0.00	-770.77	87.00	1.57	0.24	-1857.64	71.07	1.76	3.42
54	2001	787.98	88.29	1.83	1.15	COUPLE				-1671.51	70.93	1.76	3.41
55	2002	-612.82	83.63	1.82	-1.48	COUPLE				-1671.51	70.93	1.76	3.41
56	2003	87.58	104.58	1.83	10.35	700.41	86.25	1.82	0.00	-1671.51	70.93	1.76	3.41
57	2004	87.58	104.58	1.83	10.35	-700.39	86.25	1.83	-0.00	-1671.51	70.93	1.76	3.41
58	2005	774.51	87.75	1.82	0.90	254.53	64.06	1.34	4.94	-1671.61	70.93	1.76	3.41
59	2006	-626.29	84.40	1.83	-1.11	254.53	64.06	1.34	4.94	-1671.61	70.93	1.76	3.41
60	2007	74.11	101.89	1.79	9.39	954.93	80.34	1.70	1.32	-1671.61	70.93	1.76	3.41
61	2008	74.11	101.89	1.79	9.39	-445.87	98.92	2.10	-2.82	-1671.61	70.93	1.76	3.41
62	2011	700.41	86.25	1.82	0.00	367.55	63.97	1.34	4.91	-1671.47	70.94	1.76	3.41
63	2012	-700.39	86.25	1.83	-0.00	367.55	63.97	1.34	4.91	-1671.47	70.94	1.76	3.41
64	2013	COUPLE				1067.95	78.58	1.66	1.69	-1671.47	70.94	1.76	3.41
65	2014	COUPLE				-332.85	110.86	2.36	-5.42	-1671.47	70.94	1.76	3.41
66	2015	625.84	84.40	1.82	-1.11	257.61	64.00	1.36	4.92	-1671.24	70.94	1.76	3.41
67	2016	-774.96	87.74	1.83	0.90	257.61	64.00	1.36	4.92	-1671.24	70.94	1.76	3.41
68	2017	-74.56	101.76	1.86	9.35	958.01	80.27	1.70	1.32	-1671.24	70.94	1.76	3.41
69	2018	-74.56	101.76	1.86	9.35	-442.79	99.19	2.10	-2.86	-1671.24	70.94	1.76	3.41
70	2021	593.96	83.50	1.82	-1.67	COUPLE				-1671.05	70.93	1.76	3.41
71	2022	-806.84	88.28	1.83	1.23	COUPLE				-1671.05	70.93	1.76	3.41
72	2023	-106.44	101.61	1.83	9.31	700.39	86.25	1.83	-0.00	-1671.05	70.93	1.76	3.41
73	2024	-106.44	101.61	1.83	9.31	-700.41	86.25	1.82	0.00	-1671.05	70.93	1.76	3.41
74	2025	637.62	84.46	1.83	-1.01	-161.33	66.70	2.09	5.93	-1671.12	70.93	1.76	3.41
75	2026	-763.18	87.75	1.82	0.84	-161.33	66.70	2.09	5.93	-1671.12	70.93	1.76	3.41
76	2027	-62.78	104.43	1.79	10.27	539.07	92.10	1.74	-1.77	-1671.12	70.93	1.76	3.41
77	2028	-62.78	104.43	1.79	10.27	-861.73	82.59	1.88	1.11	-1671.12	70.93	1.76	3.41
78	2031	700.39	86.25	1.83	-0.00	-233.41	66.36	2.12	5.87	-1671.23	70.93	1.76	3.41
79	2032	-700.41	86.25	1.82	0.00	-233.41	66.36	2.12	5.87	-1671.23	70.93	1.76	3.41
80	2033	COUPLE				466.99	96.19	1.68	-2.93	-1671.23	70.93	1.76	3.41
81	2034	COUPLE				-933.81	81.28	1.90	1.47	-1671.23	70.93	1.76	3.41
82	2035	762.74	87.74	1.83	0.84	-157.47	67.05	2.11	5.99	-1671.40	70.93	1.76	3.41
83	2036	-638.06	84.47	1.82	-1.01	-157.47	67.05	2.11	5.99	-1671.40	70.93	1.76	3.41
84	2037	62.34	104.50	1.87	10.30	542.93	91.82	1.74	-1.74	-1671.40	70.93	1.76	3.41
85	2038	62.34	104.50	1.87	10.30	-857.87	82.73	1.88	1.10	-1671.40	70.93	1.76	3.41
86	4001	800.79	88.20	1.56	0.68	COUPLE				-1857.72	71.07	1.76	3.42
87	4002	-600.01	83.65	2.17	-0.91	COUPLE				-1857.72	71.07	1.76	3.42
88	4003	100.39	101.81	-0.25	5.43	700.40	86.25	1.82	0.00	-1857.72	71.07	1.76	3.42
89	4004	100.39	101.81	-0.25	5.43	-700.40	86.25	1.83	-0.00	-1857.72	71.07	1.76	3.42
90	4005	794.81	87.98	1.56	0.58	113.83	63.14	1.29	4.71	-1857.76	71.07	1.76	3.42

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	4006	-605.99	83.98	2.17	-0.76	113.83	63.14	1.29	4.71	-1857.76	71.07	1.76	3.42
92	4007	94.41	100.82	-0.40	4.86	814.24	83.02	1.75	0.66	-1857.76	71.07	1.76	3.42
93	4008	94.41	100.82	-0.40	4.86	-586.57	90.73	1.93	-0.91	-1857.76	71.07	1.76	3.42
94	4011	764.77	87.45	1.55	0.24	163.66	63.09	1.30	4.69	-1857.71	71.07	1.76	3.42
95	4012	-636.03	84.80	2.16	-0.29	163.66	63.09	1.30	4.69	-1857.71	71.07	1.76	3.42
96	4013	64.37	100.53	-1.44	2.88	864.06	81.86	1.73	0.89	-1857.71	71.07	1.76	3.42
97	4014	64.37	100.53	-1.44	2.88	-536.74	93.31	1.99	-1.43	-1857.71	71.07	1.76	3.42
98	4015	734.56	86.88	1.54	-0.12	114.92	63.11	1.31	4.70	-1857.61	71.07	1.76	3.42
99	4016	-666.24	85.55	2.14	0.13	114.92	63.11	1.31	4.70	-1857.61	71.07	1.76	3.42
100	4017	34.16	99.81	-4.32	-2.61	815.32	82.99	1.75	0.66	-1857.61	71.07	1.76	3.42
101	4018	34.16	99.81	-4.32	-2.61	-585.48	90.79	1.93	-0.92	-1857.61	71.07	1.76	3.42
102	4021	721.68	86.63	1.54	-0.28	COUPLE				-1857.53	71.07	1.76	3.42
103	4022	-679.12	85.84	2.13	0.30	COUPLE				-1857.53	71.07	1.76	3.42
104	4023	21.28	99.20	-7.99	-9.61	700.40	86.25	1.83	-0.00	-1857.53	71.07	1.76	3.42
105	4024	21.28	99.20	-7.99	-9.61	-700.40	86.25	1.82	0.00	-1857.53	71.07	1.76	3.42
106	4025	738.97	86.88	1.54	-0.10	-78.31	63.71	2.20	5.41	-1857.55	71.07	1.77	3.42
107	4026	-661.83	85.55	2.14	0.11	-78.31	63.71	2.20	5.41	-1857.55	71.07	1.77	3.42
108	4027	38.57	98.23	-3.56	-1.83	622.09	89.09	1.78	-0.68	-1857.55	71.07	1.77	3.42
109	4028	38.57	98.23	-3.56	-1.83	-778.71	83.98	1.86	0.54	-1857.55	71.07	1.77	3.42
110	4031	764.76	87.45	1.55	0.24	-112.75	63.50	2.22	5.37	-1857.59	71.07	1.76	3.42
111	4032	-636.04	84.81	2.15	-0.29	-112.75	63.50	2.22	5.37	-1857.59	71.07	1.76	3.42
112	4033	64.36	100.52	-1.40	2.88	587.65	90.62	1.75	-1.03	-1857.59	71.07	1.76	3.42
113	4034	64.36	100.52	-1.40	2.88	-813.15	83.10	1.88	0.74	-1857.59	71.07	1.76	3.42
114	4035	790.40	87.99	1.56	0.56	-76.83	63.93	2.22	5.45	-1857.66	71.07	1.76	3.42
115	4036	-610.40	84.00	2.17	-0.72	-76.83	63.93	2.22	5.45	-1857.66	71.07	1.76	3.42
116	4037	90.00	101.52	-0.48	4.89	623.57	89.00	1.78	-0.67	-1857.66	71.07	1.76	3.42
117	4038	90.00	101.52	-0.48	4.89	-777.23	84.04	1.86	0.54	-1857.66	71.07	1.76	3.42
118	4101	672.05	85.84	2.14	0.26	COUPLE				-1857.72	71.07	1.76	3.42
119	4102	-728.75	86.63	1.54	-0.24	COUPLE				-1857.72	71.07	1.76	3.42
120	4103	-28.35	95.97	-5.54	-6.15	700.40	86.25	1.82	0.00	-1857.72	71.07	1.76	3.42
121	4104	-28.35	95.97	-5.54	-6.15	-700.40	86.25	1.83	-0.00	-1857.72	71.07	1.76	3.42
122	4105	666.07	85.56	2.14	0.13	113.83	63.14	1.29	4.71	-1857.76	71.07	1.76	3.42
123	4106	-734.73	86.88	1.54	-0.12	113.83	63.14	1.29	4.71	-1857.76	71.07	1.76	3.42
124	4107	-34.33	99.71	-4.23	-2.58	814.24	83.02	1.75	0.66	-1857.76	71.07	1.76	3.42
125	4108	-34.33	99.71	-4.23	-2.58	-586.57	90.73	1.93	-0.91	-1857.76	71.07	1.76	3.42
126	4111	636.03	84.81	2.15	-0.29	163.66	63.09	1.30	4.69	-1857.71	71.07	1.76	3.42
127	4112	-764.77	87.45	1.55	0.24	163.66	63.09	1.30	4.69	-1857.71	71.07	1.76	3.42
128	4113	-64.37	100.52	-1.40	2.88	864.06	81.86	1.73	0.89	-1857.71	71.07	1.76	3.42
129	4114	-64.37	100.52	-1.40	2.88	-536.74	93.31	1.99	-1.43	-1857.71	71.07	1.76	3.42
130	4115	605.82	83.98	2.17	-0.76	114.92	63.11	1.31	4.70	-1857.61	71.07	1.76	3.42
131	4116	-794.98	87.98	1.56	0.58	114.92	63.11	1.31	4.70	-1857.61	71.07	1.76	3.42
132	4117	-94.58	100.78	-0.37	4.86	815.32	82.99	1.75	0.66	-1857.61	71.07	1.76	3.42
133	4118	-94.58	100.78	-0.37	4.86	-585.48	90.79	1.93	-0.92	-1857.61	71.07	1.76	3.42
134	4121	592.94	83.62	2.18	-0.97	COUPLE				-1857.53	71.07	1.76	3.42
135	4122	-807.86	88.18	1.57	0.71	COUPLE				-1857.53	71.07	1.76	3.42



SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:51:51 SEA PAGE 87

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4123	-107.46	100.79	-0.12	5.35	700.40	86.25	1.83	-0.00	-1857.53	71.07	1.76	3.42
137	4124	-107.46	100.79	-0.12	5.35	-700.40	86.25	1.82	0.00	-1857.53	71.07	1.76	3.42
138	4125	610.23	84.00	2.17	-0.72	-78.31	63.71	2.20	5.41	-1857.55	71.07	1.77	3.42
139	4126	-790.57	87.99	1.56	0.56	-78.31	63.71	2.20	5.41	-1857.55	71.07	1.77	3.42
140	4127	-90.17	101.51	-0.50	4.89	622.09	89.09	1.78	-0.68	-1857.55	71.07	1.77	3.42
141	4128	-90.17	101.51	-0.50	4.89	-778.71	83.98	1.86	0.54	-1857.55	71.07	1.77	3.42
142	4131	636.03	84.81	2.16	-0.29	-112.75	63.50	2.22	5.37	-1857.59	71.07	1.76	3.42
143	4132	-764.77	87.45	1.55	0.24	-112.75	63.50	2.22	5.37	-1857.59	71.07	1.76	3.42
144	4133	-64.37	100.53	-1.44	2.88	587.65	90.62	1.75	-1.03	-1857.59	71.07	1.76	3.42
145	4134	-64.37	100.53	-1.44	2.88	-813.15	83.10	1.88	0.74	-1857.59	71.07	1.76	3.42
146	4135	661.66	85.55	2.14	0.11	-76.83	63.93	2.22	5.45	-1857.66	71.07	1.76	3.42
147	4136	-739.14	86.88	1.54	-0.09	-76.83	63.93	2.22	5.45	-1857.66	71.07	1.76	3.42
148	4137	-38.74	98.21	-3.59	-1.80	623.57	89.00	1.78	-0.67	-1857.66	71.07	1.76	3.42
149	4138	-38.74	98.21	-3.59	-1.80	-777.23	84.04	1.86	0.54	-1857.66	71.07	1.76	3.42
150	4201	730.42	87.59	1.81	0.49	70.37	94.51	-1.01	2.63	-1857.72	71.07	1.76	3.42
151	4202	-670.38	84.79	1.84	-0.54	70.37	94.51	-1.01	2.63	-1857.72	71.07	1.76	3.42
152	4203	30.02	118.92	1.46	11.98	770.77	87.00	1.57	0.24	-1857.72	71.07	1.76	3.42
153	4204	30.02	118.92	1.46	11.98	-630.03	85.33	2.14	-0.29	-1857.72	71.07	1.76	3.42
154	4205	724.44	87.35	1.81	0.38	184.20	75.13	0.42	3.92	-1857.76	71.07	1.76	3.42
155	4206	-676.36	85.08	1.84	-0.40	184.20	75.13	0.42	3.92	-1857.76	71.07	1.76	3.42
156	4207	24.04	119.29	1.33	11.39	884.60	83.93	1.53	0.82	-1857.76	71.07	1.76	3.42
157	4208	24.04	119.29	1.33	11.39	-516.20	90.22	2.33	-1.40	-1857.76	71.07	1.76	3.42
158	4211	694.40	86.74	1.81	0.00	234.03	72.53	0.61	4.07	-1857.71	71.07	1.76	3.42
159	4212	-706.40	85.77	1.84	-0.00	234.03	72.53	0.61	4.07	-1857.71	71.07	1.76	3.42
160	4213	-6.00	29.90	3.89	-0.02	934.43	82.82	1.52	1.02	-1857.71	71.07	1.76	3.42
161	4214	-6.00	29.90	3.89	-0.02	-466.37	93.13	2.43	-2.04	-1857.71	71.07	1.76	3.42
162	4215	664.19	86.07	1.81	-0.41	185.29	75.03	0.44	3.91	-1857.61	71.07	1.76	3.42
163	4216	-736.61	86.41	1.84	0.37	185.29	75.03	0.44	3.91	-1857.61	71.07	1.76	3.42
164	4217	-36.21	89.51	2.16	7.58	885.69	83.90	1.53	0.82	-1857.61	71.07	1.76	3.42
165	4218	-36.21	89.51	2.16	7.58	-515.11	90.28	2.32	-1.41	-1857.61	71.07	1.76	3.42
166	4221	651.31	85.78	1.81	-0.60	70.37	94.51	-0.97	2.63	-1857.53	71.07	1.76	3.42
167	4222	-749.49	86.66	1.84	0.52	70.37	94.51	-0.97	2.63	-1857.53	71.07	1.76	3.42
168	4223	-49.09	92.48	2.05	7.94	770.77	87.00	1.57	0.24	-1857.53	71.07	1.76	3.42
169	4224	-49.09	92.48	2.05	7.94	-630.03	85.33	2.14	-0.29	-1857.53	71.07	1.76	3.42
170	4225	668.60	86.07	1.81	-0.38	-7.94	-209.18	30.43	30.04	-1857.55	71.07	1.77	3.42
171	4226	-732.20	86.41	1.84	0.35	-7.94	-209.18	30.43	30.04	-1857.55	71.07	1.77	3.42
172	4227	-31.80	90.00	2.14	8.04	692.46	89.64	1.50	-0.34	-1857.55	71.07	1.77	3.42
173	4228	-31.80	90.00	2.14	8.04	-708.34	82.94	2.15	0.34	-1857.55	71.07	1.77	3.42
174	4231	694.40	86.74	1.81	-0.00	-42.38	12.00	7.54	9.92	-1857.59	71.07	1.76	3.42
175	4232	-706.40	85.77	1.84	0.00	-42.38	12.00	7.54	9.92	-1857.59	71.07	1.76	3.42
176	4233	-6.00	30.10	3.42	0.02	658.02	91.03	1.46	-0.64	-1857.59	71.07	1.76	3.42
177	4234	-6.00	30.10	3.42	0.02	-742.78	82.01	2.15	0.57	-1857.59	71.07	1.76	3.42
178	4235	720.03	87.35	1.81	0.35	-6.46	-268.99	37.09	36.14	-1857.66	71.07	1.76	3.42
179	4236	-680.77	85.09	1.84	-0.37	-6.46	-268.99	37.09	36.14	-1857.66	71.07	1.76	3.42
180	4237	19.63	126.65	1.32	12.98	693.94	89.56	1.50	-0.34	-1857.66	71.07	1.76	3.42

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:51:51 SEA PAGE 88

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
181	4238	19.63	126.65	1.32	12.98	-706.86	83.00	2.15	0.33	-1857.66	71.07	1.76	3.42
182	4301	742.42	86.66	1.84	0.48	-70.36	94.51	-0.97	2.63	-1857.72	71.07	1.76	3.42
183	4302	-658.38	85.79	1.81	-0.55	-70.36	94.51	-0.97	2.63	-1857.72	71.07	1.76	3.42
184	4303	42.02	93.53	2.09	8.56	630.04	85.33	2.14	-0.29	-1857.72	71.07	1.76	3.42
185	4304	42.02	93.53	2.09	8.56	-770.76	87.00	1.57	0.24	-1857.72	71.07	1.76	3.42
186	4305	736.44	86.41	1.84	0.37	43.47	12.36	4.99	8.08	-1857.76	71.07	1.76	3.42
187	4306	-664.36	86.07	1.81	-0.41	43.47	12.36	4.99	8.08	-1857.76	71.07	1.76	3.42
188	4307	36.04	89.56	2.10	7.60	743.87	81.93	2.01	0.47	-1857.76	71.07	1.76	3.42
189	4308	36.04	89.56	2.10	7.60	-656.93	91.14	1.62	-0.53	-1857.76	71.07	1.76	3.42
190	4311	706.40	85.77	1.84	0.00	93.29	39.38	3.02	6.24	-1857.71	71.07	1.76	3.42
191	4312	-694.40	86.74	1.81	-0.00	93.29	39.38	3.02	6.24	-1857.71	71.07	1.76	3.42
192	4313	6.00	30.10	3.41	0.02	793.69	80.74	1.97	0.73	-1857.71	71.07	1.76	3.42
193	4314	6.00	30.10	3.41	0.02	-607.11	93.45	1.64	-0.96	-1857.71	71.07	1.76	3.42
194	4315	676.19	85.08	1.84	-0.41	44.55	13.50	4.94	7.96	-1857.61	71.07	1.76	3.42
195	4316	-724.61	87.34	1.81	0.38	44.55	13.50	4.94	7.96	-1857.61	71.07	1.76	3.42
196	4317	-24.21	119.01	1.42	11.34	744.95	81.90	2.01	0.48	-1857.61	71.07	1.76	3.42
197	4318	-24.21	119.01	1.42	11.34	-655.85	91.19	1.61	-0.54	-1857.61	71.07	1.76	3.42
198	4321	663.31	84.77	1.84	-0.59	-70.37	94.51	-1.01	2.63	-1857.53	71.07	1.76	3.42
199	4322	-737.49	87.58	1.81	0.53	-70.37	94.51	-1.01	2.63	-1857.53	71.07	1.76	3.42
200	4323	-37.09	112.69	1.53	10.51	630.03	85.33	2.14	-0.29	-1857.53	71.07	1.76	3.42
201	4324	-37.09	112.69	1.53	10.51	-770.77	87.00	1.57	0.24	-1857.53	71.07	1.76	3.42
202	4325	680.60	85.08	1.84	-0.38	-148.68	78.29	0.69	4.10	-1857.55	71.07	1.77	3.42
203	4326	-720.20	87.35	1.81	0.36	-148.68	78.29	0.69	4.10	-1857.55	71.07	1.77	3.42
204	4327	-19.80	126.37	1.23	12.91	551.72	88.40	2.13	-1.10	-1857.55	71.07	1.77	3.42
205	4328	-19.80	126.37	1.23	12.91	-849.08	84.86	1.63	0.72	-1857.55	71.07	1.77	3.42
206	4331	706.40	85.77	1.84	-0.00	-183.12	75.42	0.99	4.32	-1857.59	71.07	1.76	3.42
207	4332	-694.40	86.74	1.81	0.00	-183.12	75.42	0.99	4.32	-1857.59	71.07	1.76	3.42
208	4333	6.00	29.90	3.88	-0.02	517.28	90.09	2.12	-1.53	-1857.59	71.07	1.76	3.42
209	4334	6.00	29.90	3.88	-0.02	-883.52	84.00	1.65	0.90	-1857.59	71.07	1.76	3.42
210	4335	732.03	86.41	1.84	0.35	-147.20	78.55	0.69	4.10	-1857.66	71.07	1.76	3.42
211	4336	-668.77	86.07	1.81	-0.38	-147.20	78.55	0.69	4.10	-1857.66	71.07	1.76	3.42
212	4337	31.63	89.98	2.20	8.06	553.20	88.30	2.13	-1.09	-1857.66	71.07	1.76	3.42
213	4338	31.63	89.98	2.20	8.06	-847.60	84.91	1.63	0.71	-1857.66	71.07	1.76	3.42

## B. BASIC LOAD CASE SUMMARY SACS OUTPUT AFTER STRENGTHENING

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 16:26:40 SEA PAGE 65

\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	CL	USER GENERATED LOADS
2	DL	DEAD
3	LL	USER GENERATED LOADS
4	201	WIND
5	202	WIND
6	203	WIND
7	204	WIND
8	205	WIND
9	206	WIND
10	207	WIND
11	208	WIND
12	301	WIND
13	302	WIND
14	303	WIND
15	304	WIND
16	305	WIND
17	306	WIND
18	307	WIND
19	308	WIND
20	FLX	USER GENERATED LOADS
21	FLY	USER GENERATED LOADS
22	HTLP	USER GENERATED LOADS
23	NGDL	USER GENERATED LOADS
24	PLEM	USER GENERATED LOADS
25	PLOP	USER GENERATED LOADS
26	PLTX	USER GENERATED LOADS
27	PLTY	USER GENERATED LOADS

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 16:26:40 SEA PAGE 66

\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	CL	0.00	0.00	-5.67	-14.5	291.8	0.0	0.00	0.00
2	DL	-0.00	0.00	-2151.93	-3936.9	130198.7	0.0	2350.31	198.38
3	LL	0.00	0.00	-186.32	-340.0	13469.8	0.0	0.00	0.00
4	201	88.10	-0.09	-0.47	6.3	6223.0	-167.4	0.00	0.00
5	202	74.54	255.12	-0.71	-16561.2	5223.0	16217.4	0.00	0.00
6	203	-0.14	368.55	-0.36	-23912.4	27.7	23593.2	0.00	0.00
7	204	-75.22	258.42	0.22	-16770.4	-5215.3	16690.8	0.00	0.00
8	205	-107.23	0.15	0.68	-9.5	-7467.9	206.5	0.00	0.00
9	206	-63.09	-161.74	0.50	10656.5	-4467.9	-10678.7	0.00	0.00
10	207	0.09	-234.10	0.23	15410.8	-17.2	-15545.9	0.00	0.00
11	208	62.79	-158.02	-0.18	10421.7	4416.7	-10717.9	0.00	0.00
12	301	36.24	-0.04	-0.20	2.7	2546.9	-69.1	0.00	0.00
13	302	30.22	114.08	-0.30	-7379.5	2110.5	7152.4	0.00	0.00
14	303	-0.06	164.08	-0.16	-10610.1	12.4	10358.8	0.00	0.00
15	304	-30.48	115.26	0.08	-7454.2	-2104.6	7335.1	0.00	0.00
16	305	-43.42	0.06	0.28	-4.0	-3012.6	83.8	0.00	0.00
17	306	-25.93	-78.49	0.22	5131.1	-1828.0	-4956.1	0.00	0.00
18	307	0.04	-113.04	0.11	7386.1	-8.3	-7183.1	0.00	0.00
19	308	25.82	-77.07	-0.07	5041.7	1806.1	-4978.4	0.00	0.00
20	FLX	700.40	0.00	0.00	0.0	42024.0	-1278.2	0.00	0.00
21	FLY	0.00	700.40	0.00	-42024.0	0.0	60409.5	0.00	0.00
22	HTLP	0.00	0.00	-666.50	-643.3	43889.7	0.0	0.00	0.00
23	NGDL	0.00	0.00	-84.14	-153.6	5912.7	0.0	0.00	0.00
24	PLEM	0.00	0.00	-600.85	-1013.3	37420.8	0.0	0.00	0.00
25	PLOP	0.00	0.00	-989.41	-1667.3	60985.3	0.0	0.00	0.00
26	PLTX	64.37	0.00	0.00	0.0	4047.3	91.3	0.00	0.00
27	PLTY	-6.00	70.37	0.00	-4407.3	-360.0	6672.5	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
28	1000	-0.00	0.00	-2853.53	-5138.2	174592.7	0.0
29	1001	-0.00	0.00	-3242.10	-5792.2	198157.2	0.0
30	1002	64.37	0.00	-3428.42	-6132.3	215674.4	91.3
31	1003	-64.37	0.00	-3428.42	-6132.3	207579.7	-91.3
32	1004	-6.00	70.37	-3428.42	-10539.6	211267.0	6672.5
33	1005	6.00	-70.37	-3428.42	-1724.9	211987.0	-6672.5
34	1011	700.40	0.00	-3242.10	-5792.2	240181.2	-1278.2
35	1012	-700.40	0.00	-3242.10	-5792.2	156133.2	1278.2
36	1013	-0.00	700.40	-3242.10	-47816.2	198157.2	60409.5
37	1014	-0.00	-700.40	-3242.10	36231.8	198157.2	-60409.5
38	1021	764.77	0.00	-3428.42	-6132.3	257698.4	-1186.9
39	1022	-636.03	0.00	-3428.42	-6132.3	173650.4	1369.5
40	1023	64.37	700.40	-3428.42	-48156.3	215674.4	60500.8
41	1024	64.37	-700.40	-3428.42	35891.7	215674.4	-60318.2
42	1031	636.03	0.00	-3428.42	-6132.3	249603.7	-1369.5
43	1032	-764.77	0.00	-3428.42	-6132.3	165555.7	1186.9
44	1033	-64.37	700.40	-3428.42	-48156.3	207579.7	60318.2
45	1034	-64.37	-700.40	-3428.42	35891.7	207579.7	-60500.8
46	1041	694.40	70.37	-3428.42	-10539.6	253291.1	5394.3
47	1042	-706.40	70.37	-3428.42	-10539.6	169243.0	7950.7
48	1043	-6.00	770.77	-3428.42	-52563.6	211267.0	67082.0
49	1044	-6.00	-630.03	-3428.42	31484.4	211267.0	-53737.0
50	1051	706.40	-70.37	-3428.42	-1724.9	254011.1	-7950.7
51	1052	-694.40	-70.37	-3428.42	-1724.9	169963.0	-5394.3
52	1053	6.00	630.03	-3428.42	-43748.9	211987.0	53737.0
53	1054	6.00	-770.77	-3428.42	40299.1	211987.0	-67082.0
54	2001	788.50	-0.09	-3242.56	-5786.0	246404.2	-1445.7
55	2002	-612.30	-0.09	-3242.56	-5786.0	162356.2	1110.8
56	2003	88.10	700.31	-3242.56	-47810.0	204380.2	60242.1
57	2004	88.10	-700.49	-3242.56	36238.0	204380.2	-60576.9
58	2005	774.94	255.12	-3242.81	-22353.5	245404.2	14939.1
59	2006	-625.86	255.12	-3242.81	-22353.5	161356.2	17495.6
60	2007	74.54	955.52	-3242.81	-64377.5	203380.2	76626.9
61	2008	74.54	-445.28	-3242.81	19670.5	203380.2	-44192.2
62	2011	700.26	368.55	-3242.46	-29704.6	240208.9	22315.0
63	2012	-700.54	368.55	-3242.46	-29704.6	156160.9	24871.4
64	2013	-0.14	1068.95	-3242.46	-71728.6	198184.9	84002.7
65	2014	-0.14	-331.85	-3242.46	12319.4	198184.9	-36816.3
66	2015	625.18	258.42	-3241.88	-22562.7	234965.9	15412.5
67	2016	-775.62	258.42	-3241.88	-22562.7	150917.9	17969.0
68	2017	-75.22	958.82	-3241.88	-64586.7	192941.9	77100.3
69	2018	-75.22	-441.98	-3241.88	19461.3	192941.9	-43718.7
70	2021	593.17	0.15	-3241.42	-5801.8	232713.3	-1071.7

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71	2022	-807.63	0.15	-3241.42	-5801.8	148665.3	1484.7
72	2023	-107.23	700.55	-3241.42	-47825.8	190689.3	60616.0

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX  (KN)	FY  (KN)	FZ  (KN)	MX  (KN-M)	MY  (KN-M)	MZ  (KN-M)
73	2024	-107.23	-700.26	-3241.42	36222.2	190689.3	-60203.0
74	2025	637.31	-161.74	-3241.60	4864.2	235713.3	-11956.9
75	2026	-763.49	-161.74	-3241.60	4864.2	151665.3	-9400.4
76	2027	-63.09	538.66	-3241.60	-37159.8	193689.3	49730.9
77	2028	-63.09	-862.14	-3241.60	46888.2	193689.3	-71088.2
78	2031	700.49	-234.10	-3241.87	9618.6	240164.1	-16824.2
79	2032	-700.31	-234.10	-3241.87	9618.6	156116.1	-14267.7
80	2033	0.09	466.30	-3241.87	-32405.5	198140.1	44863.6
81	2034	0.09	-934.51	-3241.87	51642.6	198140.1	-75955.5
82	2035	763.19	-158.02	-3242.28	4629.4	244597.9	-11996.2
83	2036	-637.61	-158.02	-3242.28	4629.4	160549.9	-9439.7
84	2037	62.79	542.38	-3242.28	-37394.6	202573.9	49691.6
85	2038	62.79	-858.42	-3242.28	46653.4	202573.9	-71127.4
86	4001	801.01	-0.04	-3428.61	-6129.6	260245.3	-1256.0
87	4002	-599.79	-0.04	-3428.61	-6129.6	176197.3	1300.5
88	4003	100.61	700.36	-3428.61	-48153.6	218221.3	60431.8
89	4004	100.61	-700.44	-3428.61	35894.4	218221.3	-60387.3
90	4005	794.99	114.08	-3428.72	-13511.8	259808.9	5965.5
91	4006	-605.81	114.08	-3428.72	-13511.8	175760.9	8521.9
92	4007	94.59	814.48	-3428.72	-55535.8	217784.9	67653.2
93	4008	94.59	-586.32	-3428.72	28512.2	217784.9	-53165.8
94	4011	764.71	164.08	-3428.58	-16742.3	257710.8	9171.9
95	4012	-636.09	164.08	-3428.58	-16742.3	173662.8	11728.3
96	4013	64.31	864.48	-3428.58	-58766.3	215686.8	70859.6
97	4014	64.31	-536.32	-3428.58	25281.7	215686.8	-49959.4
98	4015	734.29	115.26	-3428.33	-13586.5	255593.8	6148.2
99	4016	-666.51	115.26	-3428.33	-13586.5	171545.8	8704.7
100	4017	33.89	815.66	-3428.33	-55610.5	213569.8	67835.9
101	4018	33.89	-585.14	-3428.33	28437.5	213569.8	-52983.1
102	4021	721.35	0.06	-3428.14	-6136.3	254685.7	-1103.1
103	4022	-679.45	0.06	-3428.14	-6136.3	170637.7	1453.3
104	4023	20.95	700.46	-3428.14	-48160.3	212661.7	60584.6
105	4024	20.95	-700.34	-3428.14	35887.8	212661.7	-60234.4
106	4025	738.84	-78.49	-3428.20	-1001.2	255870.3	-6143.1
107	4026	-661.96	-78.49	-3428.20	-1001.2	171822.3	-3586.6
108	4027	38.44	621.91	-3428.20	-43025.2	213846.3	55544.7
109	4028	38.44	-778.89	-3428.20	41022.8	213846.3	-65274.3
110	4031	764.81	-113.04	-3428.31	1253.8	257690.1	-8370.0
111	4032	-635.99	-113.04	-3428.31	1253.8	173642.1	-5813.6
112	4033	64.41	587.36	-3428.31	-40770.2	215666.1	53317.7

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113	4034	64.41	-813.44	-3428.31	43277.8	215666.1	-67501.3
114	4035	790.59	-77.07	-3428.48	-1090.6	259504.4	-6165.3
115	4036	-610.21	-77.07	-3428.48	-1090.6	175456.4	-3608.8
116	4037	90.19	623.33	-3428.48	-43114.6	217480.4	55522.4
117	4038	90.19	-777.47	-3428.48	40933.4	217480.4	-65296.6



SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
118	4101	672.27	-0.04	-3428.61	-6129.6	252150.6	-1438.6
119	4102	-728.53	-0.04	-3428.61	-6129.6	168102.6	1117.9
120	4103	-28.13	700.36	-3428.61	-48153.6	210126.6	60249.1
121	4104	-28.13	-700.44	-3428.61	35894.4	210126.6	-60569.9
122	4105	666.25	114.08	-3428.72	-13511.8	251714.2	5782.8
123	4106	-734.55	114.08	-3428.72	-13511.8	167666.2	8339.3
124	4107	-34.15	814.48	-3428.72	-55535.8	209690.2	67470.6
125	4108	-34.15	-586.32	-3428.72	28512.2	209690.2	-53348.4
126	4111	635.97	164.08	-3428.58	-16742.3	249616.1	8989.2
127	4112	-764.83	164.08	-3428.58	-16742.3	165568.1	11545.7
128	4113	-64.43	864.48	-3428.58	-58766.3	207592.1	70677.0
129	4114	-64.43	-536.32	-3428.58	25281.7	207592.1	-50142.0
130	4115	605.55	115.26	-3428.33	-13586.5	247499.1	5965.6
131	4116	-795.25	115.26	-3428.33	-13586.5	163451.1	8522.0
132	4117	-94.85	815.66	-3428.33	-55610.5	205475.1	67653.3
133	4118	-94.85	-585.14	-3428.33	28437.5	205475.1	-53165.7
134	4121	592.61	0.06	-3428.14	-6136.3	246591.1	-1285.7
135	4122	-808.19	0.06	-3428.14	-6136.3	162543.1	1270.7
136	4123	-107.79	700.46	-3428.14	-48160.3	204567.1	60402.0
137	4124	-107.79	-700.34	-3428.14	35887.8	204567.1	-60417.0
138	4125	610.10	-78.49	-3428.20	-1001.2	247775.7	-6325.7
139	4126	-790.70	-78.49	-3428.20	-1001.2	163727.7	-3769.2
140	4127	-90.30	621.91	-3428.20	-43025.2	205751.7	55362.1
141	4128	-90.30	-778.89	-3428.20	41022.8	205751.7	-65457.0
142	4131	636.07	-113.04	-3428.31	1253.8	249595.4	-8552.7
143	4132	-764.73	-113.04	-3428.31	1253.8	165547.4	-5996.2
144	4133	-64.33	587.36	-3428.31	-40770.2	207571.4	53135.1
145	4134	-64.33	-813.44	-3428.31	43277.8	207571.4	-67683.9
146	4135	661.85	-77.07	-3428.48	-1090.6	251409.8	-6347.9
147	4136	-738.95	-77.07	-3428.48	-1090.6	167361.8	-3791.5
148	4137	-38.55	623.33	-3428.48	-43114.6	209385.8	55339.8
149	4138	-38.55	-777.47	-3428.48	40933.4	209385.8	-65479.2
150	4201	730.64	70.33	-3428.61	-10536.9	255838.0	5325.2
151	4202	-670.16	70.33	-3428.61	-10536.9	171790.0	7881.7
152	4203	30.24	770.73	-3428.61	-52560.9	213814.0	67013.0
153	4204	30.24	-630.07	-3428.61	31487.1	213814.0	-53806.1
154	4205	724.62	184.45	-3428.72	-17919.1	255401.5	12546.7
155	4206	-676.18	184.45	-3428.72	-17919.1	171353.5	15103.1
156	4207	24.22	884.85	-3428.72	-59943.2	213377.5	74234.4
157	4208	24.22	-515.95	-3428.72	24104.9	213377.5	-46584.6

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158	4211	694.34	234.45	-3428.58	-21149.7	253303.5	15753.1
159	4212	-706.46	234.45	-3428.58	-21149.7	169255.5	18309.5
160	4213	-6.06	934.85	-3428.58	-63173.7	211279.5	77440.8
161	4214	-6.06	-465.95	-3428.58	20874.3	211279.5	-43378.2
162	4215	663.92	185.63	-3428.33	-17993.8	251186.5	12729.4

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL						
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
163	4216	-736.88	185.63	-3428.33	-17993.8	167138.5	15285.9
164	4217	-36.48	886.03	-3428.33	-60017.8	209162.5	74417.1
165	4218	-36.48	-514.77	-3428.33	24030.2	209162.5	-46401.9
166	4221	650.98	70.43	-3428.14	-10543.6	250278.4	5478.1
167	4222	-749.82	70.43	-3428.14	-10543.6	166230.4	8034.5
168	4223	-49.42	770.83	-3428.14	-52567.6	208254.4	67165.8
169	4224	-49.42	-629.97	-3428.14	31480.4	208254.4	-53653.2
170	4225	668.47	-8.12	-3428.20	-5408.5	251463.0	438.1
171	4226	-732.33	-8.12	-3428.20	-5408.5	167415.0	2994.6
172	4227	-31.93	692.28	-3428.20	-47432.5	209439.0	62125.9
173	4228	-31.93	-708.52	-3428.20	36615.5	209439.0	-58693.1
174	4231	694.44	-42.67	-3428.31	-3153.5	253282.8	-1788.8
175	4232	-706.36	-42.67	-3428.31	-3153.5	169234.8	767.6
176	4233	-5.96	657.73	-3428.31	-45177.5	211258.8	59898.9
177	4234	-5.96	-743.07	-3428.31	38870.5	211258.8	-60920.1
178	4235	720.22	-6.70	-3428.48	-5497.9	255097.1	415.9
179	4236	-680.58	-6.70	-3428.48	-5497.9	171049.1	2972.4
180	4237	19.82	693.70	-3428.48	-47521.9	213073.1	62103.7
181	4238	19.82	-707.10	-3428.48	36526.1	213073.1	-58715.4
182	4301	742.64	-70.41	-3428.61	-1722.2	256558.0	-8019.8
183	4302	-658.16	-70.41	-3428.61	-1722.2	172510.0	-5463.4
184	4303	42.24	629.99	-3428.61	-43746.2	214534.0	53667.9
185	4304	42.24	-770.81	-3428.61	40301.8	214534.0	-67151.1
186	4305	736.62	43.71	-3428.72	-9104.5	256121.5	-798.4
187	4306	-664.18	43.71	-3428.72	-9104.5	172073.5	1758.1
188	4307	36.22	744.11	-3428.72	-51128.5	214097.5	60889.4
189	4308	36.22	-656.69	-3428.72	32919.5	214097.5	-59929.6
190	4311	706.34	93.71	-3428.58	-12335.0	254023.5	2408.0
191	4312	-694.46	93.71	-3428.58	-12335.0	169975.5	4964.5
192	4313	5.94	794.11	-3428.58	-54359.0	211999.5	64095.8
193	4314	5.94	-606.69	-3428.58	29689.0	211999.5	-56723.2
194	4315	675.92	44.89	-3428.33	-9179.1	251906.5	-615.6
195	4316	-724.88	44.89	-3428.33	-9179.1	167858.5	1940.8
196	4317	-24.48	745.29	-3428.33	-51203.1	209882.5	61072.1
197	4318	-24.48	-655.51	-3428.33	32844.9	209882.5	-59746.9
198	4321	662.98	-70.31	-3428.14	-1728.9	250998.4	-7866.9
199	4322	-737.82	-70.31	-3428.14	-1728.9	166950.4	-5310.5
200	4323	-37.42	630.09	-3428.14	-43752.9	208974.4	53820.8
201	4324	-37.42	-770.71	-3428.14	40295.1	208974.4	-66998.2
202	4325	680.47	-148.86	-3428.20	3406.2	252183.0	-12906.9

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203	4326	-720.33	-148.86	-3428.20	3406.2	168135.0	-10350.4
204	4327	-19.93	551.54	-3428.20	-38617.8	210159.0	48780.8
205	4328	-19.93	-849.26	-3428.20	45430.2	210159.0	-72038.2
206	4331	706.44	-183.41	-3428.31	5661.2	254002.8	-15133.9
207	4332	-694.36	-183.41	-3428.31	5661.2	169954.8	-12577.4

SACS (2025)

Company: Engineers India Limited

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL						
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
208	4333	6.04	516.99	-3428.31	-36362.8	211978.8	46553.9
209	4334	6.04	-883.81	-3428.31	47685.2	211978.8	-74265.1
210	4335	732.22	-147.44	-3428.48	3316.8	255817.1	-12929.1
211	4336	-668.58	-147.44	-3428.48	3316.8	171769.1	-10372.7
212	4337	31.82	552.96	-3428.48	-38707.2	213793.1	48758.6
213	4338	31.82	-847.84	-3428.48	45340.8	213793.1	-72060.4

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
1	CL	0.00				0.00				-5.67	51.43	2.55	0.13
2	DL	-0.00	260.48	5.41	2.65	0.00	43.64	5.29	1.65	-2151.93	60.50	1.83	4.35
3	LL	0.00				0.00				-186.32	72.29	1.83	3.49
4	201	88.10	104.45	1.83	10.31	-0.09	72.41	39.48	2.36	-0.47	74.97	-1.34	11.33
5	202	74.54	101.77	1.79	9.36	255.12	64.10	1.34	4.94	-0.71	79.48	-3.40	6.27
6	203	-0.14	74.49	26.43	2.85	368.55	64.01	1.34	4.91	-0.36	101.00	-8.65	1.86
7	204	-75.22	101.59	1.86	9.31	258.42	64.06	1.36	4.92	0.22	28.11	8.74	16.47
8	205	-107.23	101.46	1.82	9.27	0.15	74.53	26.17	2.86	0.68	67.13	-0.60	8.38
9	206	-63.09	104.32	1.79	10.24	-161.74	66.74	2.09	5.92	0.50	83.00	-2.92	7.87
10	207	0.09	72.68	37.92	2.43	-234.10	66.41	2.12	5.86	0.23	101.01	-6.47	0.89
11	208	62.79	104.33	1.86	10.27	-158.02	67.10	2.11	5.99	-0.18	51.84	3.09	20.39
12	301	36.24	103.97	1.83	9.95	-0.04	73.27	36.61	2.60	-0.20	74.81	-1.16	11.32
13	302	30.22	101.34	1.79	9.09	114.08	63.18	1.29	4.71	-0.30	80.07	-3.28	6.26
14	303	-0.06	74.91	25.08	2.97	164.08	63.13	1.30	4.69	-0.16	101.60	-8.22	2.14
15	304	-30.48	101.15	1.86	9.04	115.26	63.16	1.31	4.70	0.08	20.94	9.81	17.23
16	305	-43.42	101.03	1.82	9.01	0.06	74.94	24.85	2.98	0.28	66.95	-0.50	8.36
17	306	-25.93	103.85	1.79	9.88	-78.49	63.75	2.20	5.41	0.22	83.81	-2.72	7.84
18	307	0.04	73.48	35.26	2.65	-113.04	63.55	2.22	5.37	0.11	101.93	-5.89	1.48
19	308	25.82	103.86	1.86	9.90	-77.07	63.99	2.21	5.45	-0.07	45.26	3.82	21.79
20	FLX	700.40	86.25	1.82	0.00	0.00				0.00			
21	FLY	0.00				700.40	86.25	1.82	0.00	0.00			
22	HTLP	0.00				0.00				-666.50	65.85	0.97	1.98
23	NGDL	0.00				0.00				-84.14	70.27	1.83	3.61
24	PLEM	0.00				0.00				-600.85	62.28	1.69	1.77
25	PLOP	0.00				0.00				-989.41	61.64	1.69	1.56
26	PLTX	64.37	100.52	-1.42	2.88	0.00				0.00			
27	PLTY	-6.00	30.00	3.65	0.00	70.37	94.51	-0.99	2.63	0.00			
28	1000	-0.00	260.48	5.41	2.65	0.00	43.64	5.29	1.65	-2853.53	61.18	1.80	3.78
29	1001	-0.00	260.48	5.41	2.65	0.00	43.64	5.29	1.65	-3242.10	61.12	1.79	3.47
30	1002	64.37	100.52	-1.42	2.88	0.00	43.64	5.29	1.65	-3428.42	61.73	1.79	3.47
31	1003	-64.37	100.52	-1.42	2.88	0.00	43.64	5.29	1.65	-3428.42	61.73	1.79	3.47
32	1004	-6.00	30.00	3.65	0.00	70.37	94.51	-0.99	2.63	-3428.42	61.73	1.79	3.47
33	1005	6.00	30.00	3.65	-0.00	-70.37	94.51	-0.99	2.63	-3428.42	61.73	1.79	3.47
34	1011	700.40	86.25	1.82	-0.00	0.00	43.64	5.29	1.65	-3242.10	61.12	1.79	3.47
35	1012	-700.40	86.25	1.82	0.00	0.00	43.64	5.29	1.65	-3242.10	61.12	1.79	3.47
36	1013	-0.00	260.48	5.41	2.65	700.40	86.25	1.82	0.00	-3242.10	61.12	1.79	3.47
37	1014	-0.00	260.48	5.41	2.65	-700.40	86.25	1.82	-0.00	-3242.10	61.12	1.79	3.47
38	1021	764.77	87.45	1.55	0.24	0.00	43.64	5.29	1.65	-3428.42	61.73	1.79	3.47
39	1022	-636.03	84.81	2.15	-0.29	0.00	43.64	5.29	1.65	-3428.42	61.73	1.79	3.47
40	1023	64.37	100.52	-1.42	2.88	700.40	86.25	1.82	0.00	-3428.42	61.73	1.79	3.47

41	1024	64.37	100.52	-1.42	2.88	-700.40	86.25	1.82	-0.00	-3428.42	61.73	1.79	3.47
42	1031	636.03	84.81	2.15	-0.29	0.00	43.64	5.29	1.65	-3428.42	61.73	1.79	3.47
43	1032	-764.77	87.45	1.55	0.24	0.00	43.64	5.29	1.65	-3428.42	61.73	1.79	3.47
44	1033	-64.37	100.52	-1.42	2.88	700.40	86.25	1.82	0.00	-3428.42	61.73	1.79	3.47
45	1034	-64.37	100.52	-1.42	2.88	-700.40	86.25	1.82	-0.00	-3428.42	61.73	1.79	3.47

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
46	1041	694.40	86.74	1.81	-0.00	70.37	94.51	-0.99	2.63	-3428.42	61.73	1.79	3.47
47	1042	-706.40	85.77	1.84	0.00	70.37	94.51	-0.99	2.63	-3428.42	61.73	1.79	3.47
48	1043	-6.00	30.00	3.65	0.00	770.77	87.00	1.57	0.24	-3428.42	61.73	1.79	3.47
49	1044	-6.00	30.00	3.65	0.00	-630.03	85.33	2.14	-0.29	-3428.42	61.73	1.79	3.47
50	1051	706.40	85.77	1.84	-0.00	-70.37	94.51	-0.99	2.63	-3428.42	61.73	1.79	3.47
51	1052	-694.40	86.74	1.81	0.00	-70.37	94.51	-0.99	2.63	-3428.42	61.73	1.79	3.47
52	1053	6.00	30.00	3.65	-0.00	630.03	85.33	2.14	-0.29	-3428.42	61.73	1.79	3.47
53	1054	6.00	30.00	3.65	-0.00	-770.77	87.00	1.57	0.24	-3428.42	61.73	1.79	3.47
54	2001	788.50	88.28	1.83	1.15	-0.09	72.41	39.48	2.36	-3242.56	61.12	1.79	3.47
55	2002	-612.30	83.63	1.82	-1.48	-0.09	72.41	39.48	2.36	-3242.56	61.12	1.79	3.47
56	2003	88.10	104.45	1.83	10.31	700.31	86.25	1.82	-0.00	-3242.56	61.12	1.79	3.47
57	2004	88.10	104.45	1.83	10.31	-700.49	86.25	1.83	0.00	-3242.56	61.12	1.79	3.47
58	2005	774.94	87.74	1.82	0.90	255.12	64.10	1.34	4.94	-3242.81	61.12	1.79	3.47
59	2006	-625.86	84.40	1.83	-1.11	255.12	64.10	1.34	4.94	-3242.81	61.12	1.79	3.47
60	2007	74.54	101.77	1.79	9.36	955.52	80.34	1.70	1.32	-3242.81	61.12	1.79	3.47
61	2008	74.54	101.77	1.79	9.36	-445.28	98.94	2.10	-2.83	-3242.81	61.12	1.79	3.47
62	2011	700.26	86.25	1.82	-0.00	368.55	64.01	1.34	4.91	-3242.46	61.12	1.79	3.47
63	2012	-700.54	86.25	1.83	0.00	368.55	64.01	1.34	4.91	-3242.46	61.12	1.79	3.47
64	2013	-0.14	74.49	26.43	2.85	1068.95	78.58	1.66	1.69	-3242.46	61.12	1.79	3.47
65	2014	-0.14	74.49	26.43	2.85	-331.85	110.94	2.36	-5.45	-3242.46	61.12	1.79	3.47
66	2015	625.18	84.40	1.82	-1.12	258.42	64.06	1.36	4.92	-3241.88	61.12	1.79	3.47
67	2016	-775.62	87.74	1.83	0.90	258.42	64.06	1.36	4.92	-3241.88	61.12	1.79	3.47
68	2017	-75.22	101.59	1.86	9.31	958.82	80.27	1.70	1.33	-3241.88	61.12	1.79	3.47
69	2018	-75.22	101.59	1.86	9.31	-441.98	99.23	2.10	-2.88	-3241.88	61.12	1.79	3.47
70	2021	593.17	83.50	1.83	-1.68	0.15	74.53	26.17	2.86	-3241.42	61.12	1.79	3.47
71	2022	-807.63	88.27	1.82	1.23	0.15	74.53	26.17	2.86	-3241.42	61.12	1.79	3.47
72	2023	-107.23	101.46	1.82	9.27	700.55	86.25	1.83	0.00	-3241.42	61.12	1.79	3.47
73	2024	-107.23	101.46	1.82	9.27	-700.26	86.25	1.82	-0.00	-3241.42	61.12	1.79	3.47
74	2025	637.31	84.46	1.83	-1.01	-161.74	66.74	2.09	5.92	-3241.60	61.12	1.79	3.47
75	2026	-763.49	87.74	1.82	0.85	-161.74	66.74	2.09	5.92	-3241.60	61.12	1.79	3.47
76	2027	-63.09	104.32	1.79	10.24	538.66	92.11	1.74	-1.78	-3241.60	61.12	1.79	3.47
77	2028	-63.09	104.32	1.79	10.24	-862.14	82.59	1.88	1.11	-3241.60	61.12	1.79	3.47
78	2031	700.49	86.25	1.83	0.00	-234.10	66.41	2.12	5.86	-3241.87	61.12	1.79	3.47
79	2032	-700.31	86.25	1.82	-0.00	-234.10	66.41	2.12	5.86	-3241.87	61.12	1.79	3.47
80	2033	0.09	72.68	37.92	2.43	466.30	96.21	1.68	-2.94	-3241.87	61.12	1.79	3.47
81	2034	0.09	72.68	37.92	2.43	-934.51	81.28	1.90	1.47	-3241.87	61.12	1.79	3.47
82	2035	763.19	87.74	1.83	0.84	-158.02	67.10	2.11	5.99	-3242.28	61.12	1.79	3.47
83	2036	-637.61	84.47	1.82	-1.01	-158.02	67.10	2.11	5.99	-3242.28	61.12	1.79	3.47
84	2037	62.79	104.33	1.86	10.27	542.38	91.83	1.74	-1.74	-3242.28	61.12	1.79	3.47
85	2038	62.79	104.33	1.86	10.27	-858.42	82.73	1.88	1.10	-3242.28	61.12	1.79	3.47



86	4001	801.01	88.20	1.56	0.68	-0.04	73.27	36.61	2.60	-3428.61	61.73	1.79	3.47
87	4002	-599.79	83.65	2.17	-0.91	-0.04	73.27	36.61	2.60	-3428.61	61.73	1.79	3.47
88	4003	100.61	101.76	-0.25	5.42	700.36	86.25	1.82	-0.00	-3428.61	61.73	1.79	3.47
89	4004	100.61	101.76	-0.25	5.42	-700.44	86.25	1.83	0.00	-3428.61	61.73	1.79	3.47
90	4005	794.99	87.98	1.56	0.58	114.08	63.18	1.29	4.71	-3428.72	61.73	1.79	3.47

SACS (2025)

Company: Engineers India Limited

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
91	4006	-605.81	83.98	2.17	-0.76	114.08	63.18	1.29	4.71	-3428.72	61.73	1.79	3.47
92	4007	94.59	100.78	-0.39	4.86	814.48	83.02	1.75	0.66	-3428.72	61.73	1.79	3.47
93	4008	94.59	100.78	-0.39	4.86	-586.32	90.74	1.93	-0.92	-3428.72	61.73	1.79	3.47
94	4011	764.71	87.45	1.55	0.24	164.08	63.13	1.30	4.69	-3428.58	61.73	1.79	3.47
95	4012	-636.09	84.80	2.16	-0.29	164.08	63.13	1.30	4.69	-3428.58	61.73	1.79	3.47
96	4013	64.31	100.55	-1.44	2.88	864.48	81.86	1.73	0.89	-3428.58	61.73	1.79	3.47
97	4014	64.31	100.55	-1.44	2.88	-536.32	93.32	1.99	-1.43	-3428.58	61.73	1.79	3.47
98	4015	734.29	86.88	1.54	-0.12	115.26	63.16	1.31	4.70	-3428.33	61.73	1.79	3.47
99	4016	-666.51	85.55	2.14	0.14	115.26	63.16	1.31	4.70	-3428.33	61.73	1.79	3.47
100	4017	33.89	99.96	-4.37	-2.67	815.66	82.99	1.75	0.66	-3428.33	61.73	1.79	3.47
101	4018	33.89	99.96	-4.37	-2.67	-585.14	90.80	1.93	-0.93	-3428.33	61.73	1.79	3.47
102	4021	721.35	86.63	1.54	-0.29	0.06	74.94	24.85	2.98	-3428.14	61.73	1.79	3.47
103	4022	-679.45	85.84	2.13	0.30	0.06	74.94	24.85	2.98	-3428.14	61.73	1.79	3.47
104	4023	20.95	99.48	-8.14	-9.83	700.46	86.25	1.83	0.00	-3428.14	61.73	1.79	3.47
105	4024	20.95	99.48	-8.14	-9.83	-700.34	86.25	1.82	-0.00	-3428.14	61.73	1.79	3.47
106	4025	738.84	86.88	1.54	-0.10	-78.49	63.75	2.20	5.41	-3428.20	61.73	1.79	3.47
107	4026	-661.96	85.55	2.14	0.11	-78.49	63.75	2.20	5.41	-3428.20	61.73	1.79	3.47
108	4027	38.44	98.28	-3.58	-1.85	621.91	89.09	1.78	-0.68	-3428.20	61.73	1.79	3.47
109	4028	38.44	98.28	-3.58	-1.85	-778.89	83.98	1.86	0.55	-3428.20	61.73	1.79	3.47
110	4031	764.81	87.45	1.55	0.24	-113.04	63.55	2.22	5.37	-3428.31	61.73	1.79	3.47
111	4032	-635.99	84.81	2.15	-0.29	-113.04	63.55	2.22	5.37	-3428.31	61.73	1.79	3.47
112	4033	64.41	100.51	-1.40	2.88	587.36	90.62	1.75	-1.03	-3428.31	61.73	1.79	3.47
113	4034	64.41	100.51	-1.40	2.88	-813.44	83.09	1.88	0.75	-3428.31	61.73	1.79	3.47
114	4035	790.59	87.99	1.56	0.56	-77.07	63.99	2.21	5.45	-3428.48	61.73	1.79	3.47
115	4036	-610.21	84.00	2.17	-0.72	-77.07	63.99	2.21	5.45	-3428.48	61.73	1.79	3.47
116	4037	90.19	101.48	-0.48	4.89	623.33	89.00	1.78	-0.67	-3428.48	61.73	1.79	3.47
117	4038	90.19	101.48	-0.48	4.89	-777.47	84.04	1.86	0.54	-3428.48	61.73	1.79	3.47
118	4101	672.27	85.84	2.14	0.26	-0.04	73.27	36.61	2.60	-3428.61	61.73	1.79	3.47
119	4102	-728.53	86.63	1.54	-0.24	-0.04	73.27	36.61	2.60	-3428.61	61.73	1.79	3.47
120	4103	-28.13	96.08	-5.60	-6.23	700.36	86.25	1.82	-0.00	-3428.61	61.73	1.79	3.47
121	4104	-28.13	96.08	-5.60	-6.23	-700.44	86.25	1.83	0.00	-3428.61	61.73	1.79	3.47
122	4105	666.25	85.56	2.14	0.13	114.08	63.18	1.29	4.71	-3428.72	61.73	1.79	3.47
123	4106	-734.55	86.88	1.54	-0.12	114.08	63.18	1.29	4.71	-3428.72	61.73	1.79	3.47
124	4107	-34.15	99.80	-4.26	-2.62	814.48	83.02	1.75	0.66	-3428.72	61.73	1.79	3.47
125	4108	-34.15	99.80	-4.26	-2.62	-586.32	90.74	1.93	-0.92	-3428.72	61.73	1.79	3.47
126	4111	635.97	84.81	2.15	-0.29	164.08	63.13	1.30	4.69	-3428.58	61.73	1.79	3.47
127	4112	-764.83	87.45	1.55	0.24	164.08	63.13	1.30	4.69	-3428.58	61.73	1.79	3.47
128	4113	-64.43	100.50	-1.39	2.88	864.48	81.86	1.73	0.89	-3428.58	61.73	1.79	3.47
129	4114	-64.43	100.50	-1.39	2.88	-536.32	93.32	1.99	-1.43	-3428.58	61.73	1.79	3.47
130	4115	605.55	83.98	2.17	-0.76	115.26	63.16	1.31	4.70	-3428.33	61.73	1.79	3.47

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131	4116	-795.25	87.98	1.56	0.58	115.26	63.16	1.31	4.70	-3428.33	61.73	1.79	3.47
132	4117	-94.85	100.73	-0.37	4.86	815.66	82.99	1.75	0.66	-3428.33	61.73	1.79	3.47
133	4118	-94.85	100.73	-0.37	4.86	-585.14	90.80	1.93	-0.93	-3428.33	61.73	1.79	3.47
134	4121	592.61	83.62	2.18	-0.97	0.06	74.94	24.85	2.98	-3428.14	61.73	1.79	3.47
135	4122	-808.19	88.18	1.57	0.71	0.06	74.94	24.85	2.98	-3428.14	61.73	1.79	3.47

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
136	4123	-107.79	100.73	-0.11	5.35	700.46	86.25	1.83	0.00	-3428.14	61.73	1.79	3.47
137	4124	-107.79	100.73	-0.11	5.35	-700.34	86.25	1.82	-0.00	-3428.14	61.73	1.79	3.47
138	4125	610.10	84.00	2.17	-0.72	-78.49	63.75	2.20	5.41	-3428.20	61.73	1.79	3.47
139	4126	-790.70	87.99	1.56	0.56	-78.49	63.75	2.20	5.41	-3428.20	61.73	1.79	3.47
140	4127	-90.30	101.48	-0.50	4.89	621.91	89.09	1.78	-0.68	-3428.20	61.73	1.79	3.47
141	4128	-90.30	101.48	-0.50	4.89	-778.89	83.98	1.86	0.55	-3428.20	61.73	1.79	3.47
142	4131	636.07	84.80	2.16	-0.29	-113.04	63.55	2.22	5.37	-3428.31	61.73	1.79	3.47
143	4132	-764.73	87.45	1.55	0.24	-113.04	63.55	2.22	5.37	-3428.31	61.73	1.79	3.47
144	4133	-64.33	100.54	-1.44	2.88	587.36	90.62	1.75	-1.03	-3428.31	61.73	1.79	3.47
145	4134	-64.33	100.54	-1.44	2.88	-813.44	83.09	1.88	0.75	-3428.31	61.73	1.79	3.47
146	4135	661.85	85.55	2.14	0.11	-77.07	63.99	2.21	5.45	-3428.48	61.73	1.79	3.47
147	4136	-738.95	86.88	1.54	-0.10	-77.07	63.99	2.21	5.45	-3428.48	61.73	1.79	3.47
148	4137	-38.55	98.29	-3.62	-1.83	623.33	89.00	1.78	-0.67	-3428.48	61.73	1.79	3.47
149	4138	-38.55	98.29	-3.62	-1.83	-777.47	84.04	1.86	0.54	-3428.48	61.73	1.79	3.47
150	4201	730.64	87.59	1.81	0.49	70.33	94.52	-1.01	2.63	-3428.61	61.73	1.79	3.47
151	4202	-670.16	84.79	1.84	-0.54	70.33	94.52	-1.01	2.63	-3428.61	61.73	1.79	3.47
152	4203	30.24	118.64	1.46	11.92	770.73	87.00	1.57	0.24	-3428.61	61.73	1.79	3.47
153	4204	30.24	118.64	1.46	11.92	-630.07	85.33	2.14	-0.29	-3428.61	61.73	1.79	3.47
154	4205	724.62	87.34	1.81	0.38	184.45	75.13	0.42	3.92	-3428.72	61.73	1.79	3.47
155	4206	-676.18	85.08	1.84	-0.41	184.45	75.13	0.42	3.92	-3428.72	61.73	1.79	3.47
156	4207	24.22	119.01	1.33	11.34	884.85	83.93	1.53	0.82	-3428.72	61.73	1.79	3.47
157	4208	24.22	119.01	1.33	11.34	-515.95	90.22	2.33	-1.40	-3428.72	61.73	1.79	3.47
158	4211	694.34	86.74	1.81	-0.00	234.45	72.55	0.61	4.07	-3428.58	61.73	1.79	3.47
159	4212	-706.46	85.77	1.84	0.00	234.45	72.55	0.61	4.07	-3428.58	61.73	1.79	3.47
160	4213	-6.06	30.45	3.86	0.03	934.85	82.81	1.52	1.02	-3428.58	61.73	1.79	3.47
161	4214	-6.06	30.45	3.86	0.03	-465.95	93.14	2.43	-2.05	-3428.58	61.73	1.79	3.47
162	4215	663.92	86.07	1.81	-0.42	185.63	75.04	0.44	3.91	-3428.33	61.73	1.79	3.47
163	4216	-736.88	86.41	1.84	0.37	185.63	75.04	0.44	3.91	-3428.33	61.73	1.79	3.47
164	4217	-36.48	89.45	2.15	7.56	886.03	83.90	1.53	0.82	-3428.33	61.73	1.79	3.47
165	4218	-36.48	89.45	2.15	7.56	-514.77	90.29	2.32	-1.41	-3428.33	61.73	1.79	3.47
166	4221	650.98	85.78	1.81	-0.60	70.43	94.49	-0.96	2.63	-3428.14	61.73	1.79	3.47
167	4222	-749.82	86.66	1.84	0.52	70.43	94.49	-0.96	2.63	-3428.14	61.73	1.79	3.47
168	4223	-49.42	92.41	2.05	7.91	770.83	87.00	1.57	0.24	-3428.14	61.73	1.79	3.47
169	4224	-49.42	92.41	2.05	7.91	-629.97	85.33	2.14	-0.29	-3428.14	61.73	1.79	3.47
170	4225	668.47	86.07	1.81	-0.38	-8.12	-202.91	29.80	29.49	-3428.20	61.73	1.79	3.47
171	4226	-732.33	86.41	1.84	0.35	-8.12	-202.91	29.80	29.49	-3428.20	61.73	1.79	3.47
172	4227	-31.93	89.97	2.14	8.03	692.28	89.64	1.50	-0.35	-3428.20	61.73	1.79	3.47
173	4228	-31.93	89.97	2.14	8.03	-708.52	82.94	2.15	0.34	-3428.20	61.73	1.79	3.47
174	4231	694.44	86.74	1.81	0.00	-42.67	12.48	7.50	9.89	-3428.31	61.73	1.79	3.47
175	4232	-706.36	85.77	1.84	-0.00	-42.67	12.48	7.50	9.89	-3428.31	61.73	1.79	3.47

176	4233	-5.96	29.70	3.43	-0.02	657.73	91.04	1.46	-0.64	-3428.31	61.73	1.79	3.47
177	4234	-5.96	29.70	3.43	-0.02	-743.07	82.01	2.15	0.57	-3428.31	61.73	1.79	3.47
178	4235	720.22	87.35	1.81	0.36	-6.70	-256.64	35.84	35.04	-3428.48	61.73	1.79	3.47
179	4236	-680.58	85.09	1.84	-0.38	-6.70	-256.64	35.84	35.04	-3428.48	61.73	1.79	3.47
180	4237	19.82	126.21	1.32	12.90	693.70	89.56	1.50	-0.34	-3428.48	61.73	1.79	3.47

SACS (2025)

Company: Engineers India Limited

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
181	4238	19.82	126.21	1.32	12.90	-707.10	83.00	2.15	0.33	-3428.48	61.73	1.79	3.47
182	4301	742.64	86.66	1.84	0.49	-70.41	94.50	-0.97	2.63	-3428.61	61.73	1.79	3.47
183	4302	-658.16	85.79	1.81	-0.55	-70.41	94.50	-0.97	2.63	-3428.61	61.73	1.79	3.47
184	4303	42.24	93.46	2.08	8.53	629.99	85.33	2.14	-0.29	-3428.61	61.73	1.79	3.47
185	4304	42.24	93.46	2.08	8.53	-770.81	87.00	1.57	0.24	-3428.61	61.73	1.79	3.47
186	4305	736.62	86.41	1.84	0.37	43.71	12.74	4.96	8.06	-3428.72	61.73	1.79	3.47
187	4306	-664.18	86.07	1.81	-0.41	43.71	12.74	4.96	8.06	-3428.72	61.73	1.79	3.47
188	4307	36.22	89.52	2.10	7.58	744.11	81.93	2.01	0.47	-3428.72	61.73	1.79	3.47
189	4308	36.22	89.52	2.10	7.58	-656.69	91.14	1.62	-0.54	-3428.72	61.73	1.79	3.47
190	4311	706.34	85.77	1.84	-0.00	93.71	39.57	3.01	6.23	-3428.58	61.73	1.79	3.47
191	4312	-694.46	86.74	1.81	0.00	93.71	39.57	3.01	6.23	-3428.58	61.73	1.79	3.47
192	4313	5.94	29.54	3.43	-0.03	794.11	80.74	1.97	0.74	-3428.58	61.73	1.79	3.47
193	4314	5.94	29.54	3.43	-0.03	-606.69	93.46	1.64	-0.96	-3428.58	61.73	1.79	3.47
194	4315	675.92	85.08	1.84	-0.41	44.89	14.01	4.91	7.94	-3428.33	61.73	1.79	3.47
195	4316	-724.88	87.34	1.81	0.38	44.89	14.01	4.91	7.94	-3428.33	61.73	1.79	3.47
196	4317	-24.48	118.59	1.42	11.26	745.29	81.90	2.01	0.48	-3428.33	61.73	1.79	3.47
197	4318	-24.48	118.59	1.42	11.26	-655.51	91.20	1.61	-0.54	-3428.33	61.73	1.79	3.47
198	4321	662.98	84.77	1.84	-0.59	-70.31	94.53	-1.01	2.63	-3428.14	61.73	1.79	3.47
199	4322	-737.82	87.58	1.81	0.53	-70.31	94.53	-1.01	2.63	-3428.14	61.73	1.79	3.47
200	4323	-37.42	112.42	1.53	10.45	630.09	85.33	2.14	-0.29	-3428.14	61.73	1.79	3.47
201	4324	-37.42	112.42	1.53	10.45	-770.71	87.01	1.57	0.24	-3428.14	61.73	1.79	3.47
202	4325	680.47	85.08	1.84	-0.38	-148.86	78.29	0.69	4.10	-3428.20	61.73	1.79	3.47
203	4326	-720.33	87.35	1.81	0.36	-148.86	78.29	0.69	4.10	-3428.20	61.73	1.79	3.47
204	4327	-19.93	126.08	1.23	12.86	551.54	88.40	2.13	-1.11	-3428.20	61.73	1.79	3.47
205	4328	-19.93	126.08	1.23	12.86	-849.26	84.86	1.63	0.72	-3428.20	61.73	1.79	3.47
206	4331	706.44	85.77	1.84	0.00	-183.41	75.43	0.99	4.32	-3428.31	61.73	1.79	3.47
207	4332	-694.36	86.74	1.81	-0.00	-183.41	75.43	0.99	4.32	-3428.31	61.73	1.79	3.47
208	4333	6.04	30.30	3.87	0.02	516.99	90.09	2.12	-1.53	-3428.31	61.73	1.79	3.47
209	4334	6.04	30.30	3.87	0.02	-883.81	84.00	1.65	0.90	-3428.31	61.73	1.79	3.47
210	4335	732.22	86.41	1.84	0.35	-147.44	78.56	0.69	4.10	-3428.48	61.73	1.79	3.47
211	4336	-668.58	86.07	1.81	-0.38	-147.44	78.56	0.69	4.10	-3428.48	61.73	1.79	3.47
212	4337	31.82	89.93	2.20	8.04	552.96	88.30	2.13	-1.09	-3428.48	61.73	1.79	3.47
213	4338	31.82	89.93	2.20	8.04	-847.84	84.91	1.63	0.71	-3428.48	61.73	1.79	3.47

## 6.1 Member Unity Check Result

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

#### 6.1a AS-IS CONDITION

##### Member Unity Check Result

Member	Group ID	Load Case	UC
B055-B056	BB1	4031	1.109
B068-B069	BC3	4332	1.283
B075-B076	BB1	4011	1.071
B076-B077	BB1	4311	1.145
B077-B078	BB1	4011	1.15
B087-B088	BC6	4212	1.745
B088-B089	BC7	4212	2.382
B084-B047	DD1	4211	1.779
B089-B068	BC8	4212	1.037
B044-B045	DG5	4122	1.002
B089-B098	BD4	4212	1.044
B069-B090	BD1	4332	1.334
0009-0001	BD5	4336	1.082
0007-0028	DI2	4332	1.061
B049-B140	DH6	4001	1.464
B140-0020	DH6	4035	1.461
0020-0021	DH6	4002	2.317
0020-0036	DH4	4336	1.766
0036-0001	DH4	4336	1.441
0037-0022	DI1	4331	1.206
0000-0038	BD2	4336	1.188

0038-0001	BD2	4332	1.503
0039-0001	BD2	4332	1.51
0011-0040	DDA	4212	1.01
0040-0022	DDA	4211	1.434
0020-0041	DDA	4212	2.1
0041-0011	DDA	4206	1.618
0011-0042	BD6	4212	1.643
0009-0043	BD6	4212	1.211
0043-0011	BD6	4212	1.676
0019-B049	DH6	4005	1.049
0051-0055	BF4	4332	1.223
0055-0044	BF4	4311	1.007

### 6.1b AFTER STRENGTHENING

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

#### Member Unity Check Result

Member	Group ID	Load Case	UC	Remarks
B090-0009	BD5	4212	1.022	Member UC has increased marginally during extreme condition.
B098-0009	ST1	4211	1.052	

### 6.2 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum Vertical Deflection (cm)	Remarks
1.	B043	8.3	Allowable Deflection = (12000 / 400) = 30.00 cm
2.	B058	8.5	
3.	0064	2.4	



S. No.	Joint	Maximum Vertical Deflection (cm)	Remarks
4.	0061	2.6	Allowable deflection= $(1318/400)=3.295$

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	0026	2.29	Allowable Deflection = $(12000/ 500) = 24$ cm
2.	0027	3.37	
3.	0055	5.1	Allowable deflection= $(1318/500)=2.635$
4.	0029	5.5	

Vertical and Horizontal Deflection of bridge are under control.

### 6.3 Reaction Summary

Following is the reaction summary of the bridge supports.

#### Summary of Bridge Reaction

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	B016	0	0	204.716
2.	B015	0	0	277.105
3.	0053	807.862	87.770	0
4.	0038	0	210.225	858.905
5.	0043	0	232.457	774.191
6.	0001	0	822.603	1799.947
7.	0011	0	760.937	1633.163

## 7.0 CONCLUSION

The analysis of bridge has been carried out considering the piping, electrical & instrumentation cable tray and wind loads. Based on the results, the necessary strengthening requirements, as outlined in Clause 4.0, have been recommended. With the implementation of these strengthening measures of the top chord, bottom chord, and associated framing members, the bridge is found to be structurally adequate and safe under all load combinations.

Also, functionally the deflection is under the limits. The adequacy of the bridge landing locations, adequacy of deck members are performed separately.

It is also recommended that no additional structural loading/modifications shall be carried out on SCA-SCF bridge without adequate structural analysis.

**ANNEXURE-1  
LOAD CALCULATIONS**

## WIND LOAD:

S.No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulance Intensity at height "z"	t <sub>o</sub>	t	Design Wind Speed at Height "z"	
			U <sub>o</sub>			z		U(z)	Iu(z)			u(z,t)	
			kmph	ft/sec		m	ft	ft/sec				sec	sec
1	Extreme	0	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
2	Extreme	45	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
3	Extreme	90	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
4	Extreme	135	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
5	Extreme	180	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
6	Extreme	225	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
7	Extreme	270	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
8	Extreme	315	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	15	187.59	57.19
1	Operating	All	99.22	90.40	0.130	10.00	32.80	90.40	0.131	3600	15	117.02	35.68

## CABLE LOAD & CABLE TRAY LOAD:

CABLE TRAY LOAD													
60mm,60mm,150mm													
4 run 3C X2.5 SQ. MM armoured cu. conductor cable													
FOR CABLE LOAD for 3C X2.5 SQ. MM armoured cu. conductor cable= 162 kg/km													
0.162		0.00162 kn/m		0.00648 kn/m									
FOR 150 mm CABLE TRAY LOAD =5KG/3 MTR LONG													
KG/m		1.666667				Total cable and cable tray load							
		0.016667 kn/m				For,							
						150 mm		0.023147		0.1736 kn			
						60 mm		0.01648		0.1236 kn			
FOR 60 mm CABLE TRAY LOAD =3KG/3 MTR LONG													
						Span-0.287 mm-SOUTH SIDE							
						SPAN-0.785mm-north side							
kg/m		1				span-60mm+150mm=0.805m,0.905mm		0.039627 kn/m					
		0.01 kn/m				SPAN-CANTILEVER-7.225M		0.119068					

## GRATING LOAD

Grating load of 50 kg/m<sup>2</sup> is considered

## HANDRAIL LOAD

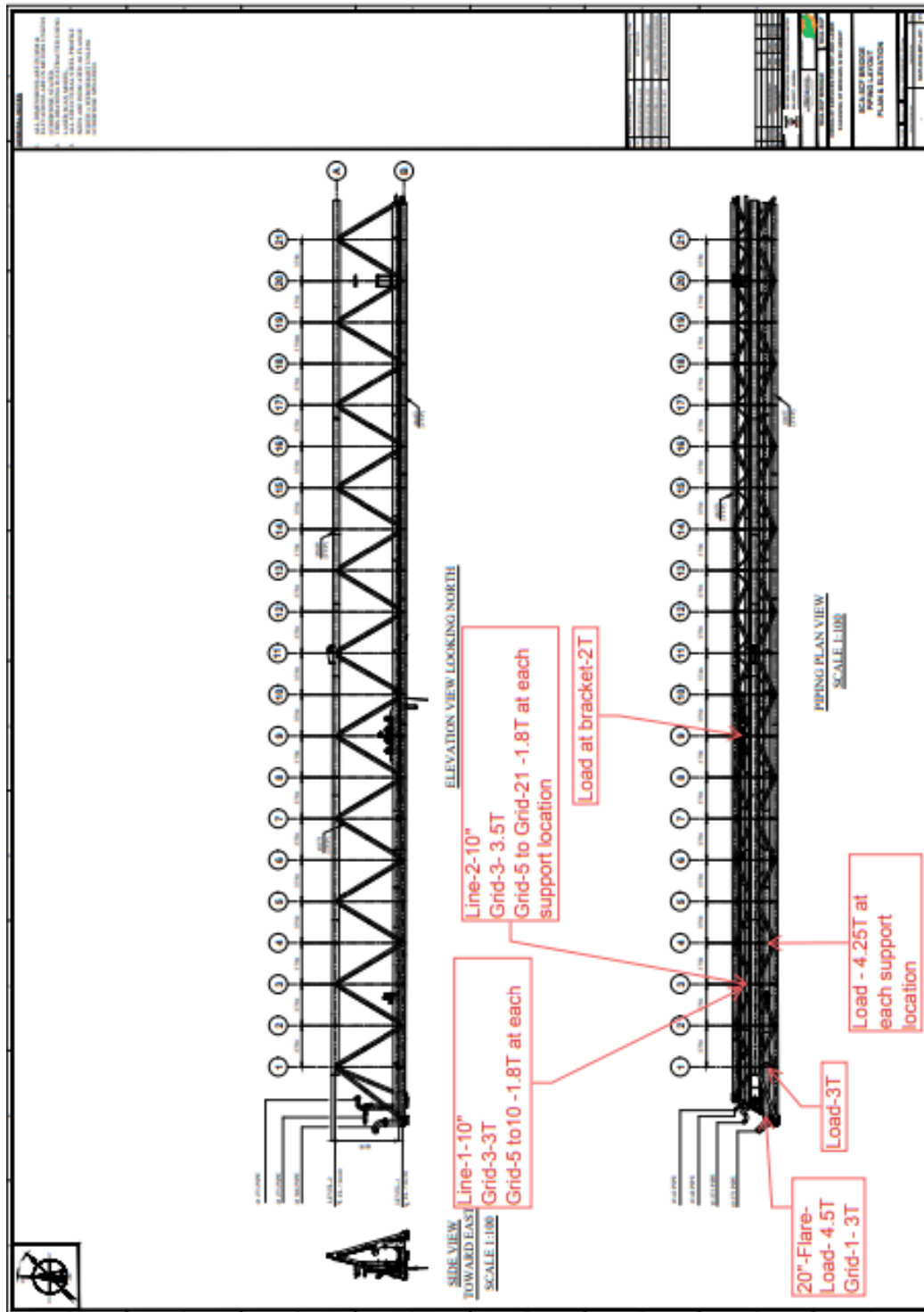
Handrail Load of 50Kg/m is considered.

## PIPING LOAD

<b>NEW PIPE LOAD</b>				
PIPE LOAD -SOUTH SIDE				
LINE 1				
DIA-273mm				
GRID 3	3 T		30 KN	
GRIDE-5 T	1.8 T		18 KN	
LINE 2				
DIA-273mm				
GRID 3	3.5 T		35 KN	
GRIDE-5 T	1.8 T		18 KN	
BRACKET				
	2 T		20 KN	
2" PIPES				
	25 kg/m		0.25 KN/m	
FLARE SIDE				
DIA	508 mm			
Gride 1	3 T		30 KN	
ALL GRIDE	4.25 T		42.5 KN	













## **BRIDGE REPORT FOR REFURBISHMENT / REPLACEMENT OF BRIDGES IN MH ASSET (SC1-SCA BRIDGE)**

**PROJECT : ENGINEERING / TECHNICAL CONSULTANCY  
SERVICES FOR PREPERATION OF EXECUTION  
METHODOLOGY, SOW AND COST ESTIMATES  
FOR REPLACEMENT /REFURBISHMENT OF  
BRIDGES IN MH ASSET**

**LOCATION: MH ASSET (NORTH AND SOUTH FIELD)**

**OWNER : ONGC, MUMBAI**

**JOB NO : B774**

0	23.09.2025	ISSUED AS STUDY	RS	DP	CS
<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>

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Annexures : 1

## Symbols and Abbreviations

### Organisations – India

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### Other abbreviations

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge

## 1.0 INTRODUCTION

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges have deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## 2.0 GENERAL

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### **IC Complex:**

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### **BHS Complex:**

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### **NQO Complex:**

7. NQO-NQD Bridge

### **WIN Complex:**

8. WIN-NC Bridge

Three Bridges are additionally added.

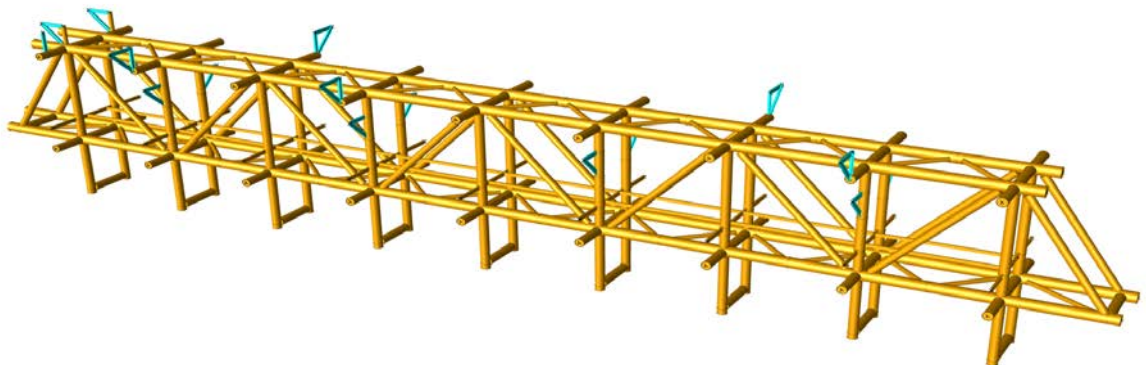
1. ICD-ICP Bridge
2. SC1-SCA Bridge
3. SCA-SCF Bridge

### 3.0 SC1-SCA BRIDGE DESCRIPTION

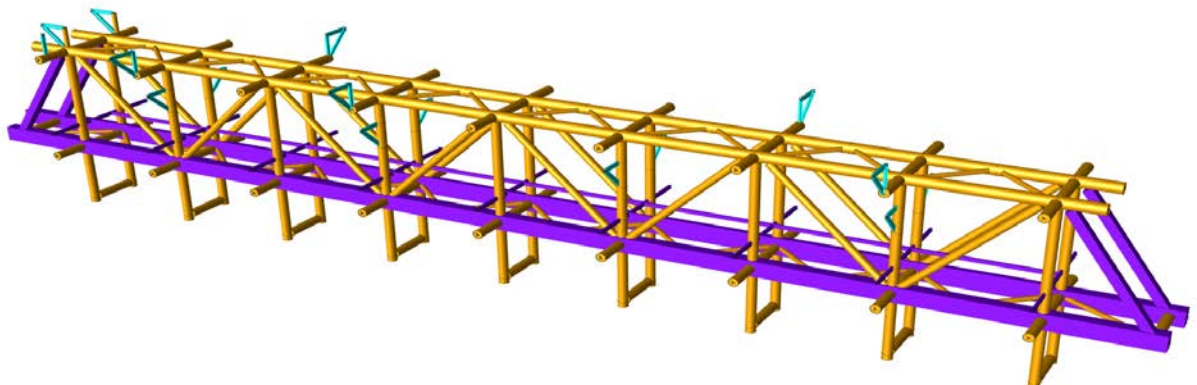
Approximate length of bridge is measured from 3D model as 40m. Hence, 40m length of bridge is modelled in SACS conservatively.

Length of Bridge	40 m
Support Condition	Fixed: 111000, 111000 (SCA Side) Sliding: 001000, 001000 (SC1 Side)
No. of directions for environmental loads	8
Wind Speed (5 Sec Gust)	63.31 m/s for extreme and 38.88 m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	36 ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

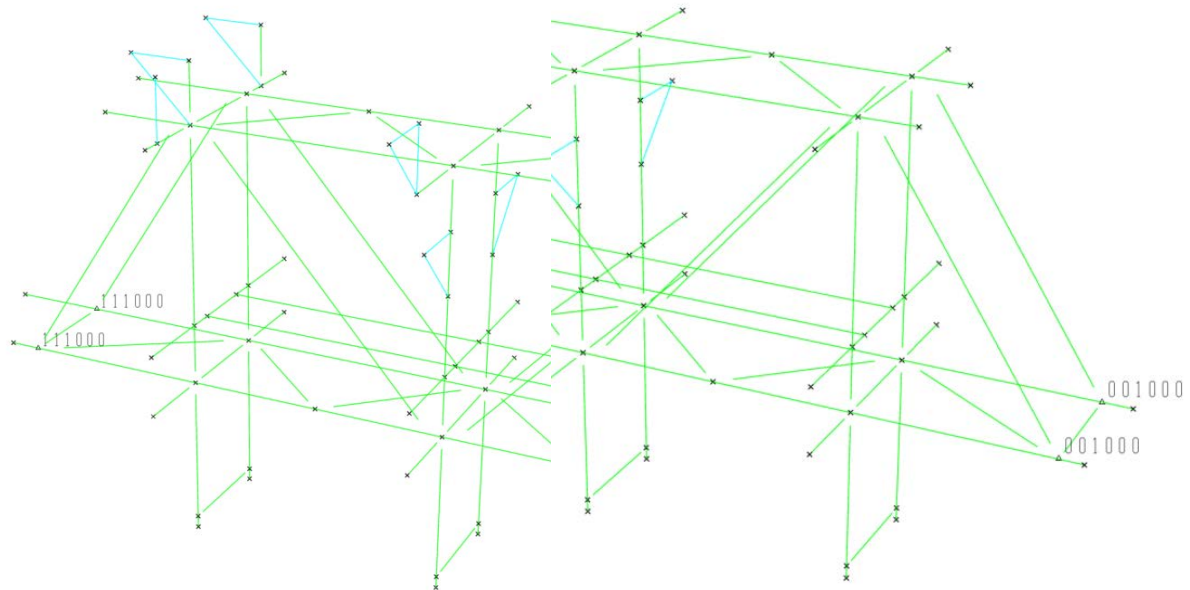
ISOMETRIC VIEW OF **SC1-SCA Bridge** is shown in Figure1.



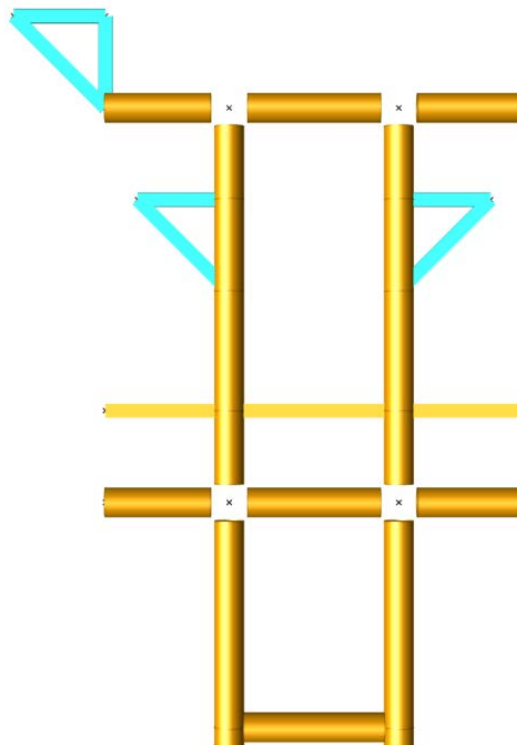
**Figure 1: 3D SACS Model (Original)**



**Figure 2: 3D SACS Model (Strengthened)**



**Figure 2: SUPPORT CONDITIONS**



**Figure 3: BRIDGE CROSS SECTION**

## 4.0 PROPOSED STRENGTHENING CONFIGURATION

### 1. Top Chord-

Nil

### 2. Bottom Chord-

#### a) Main Chord:

406dia. x 8.3 mm +12thk wrap plate + 2 no's Half cut tubular (273dia. x 12.7mm) Complete Length

### 3. Framing Elevation Row-A & Row-B:

#### a) Diagonal member:

- 12mm wrap plate provided around 273dia. member (2no's each at both ends )

### 4. Framing Cross Section:

#### a) Piping Support Member below walkway:

- MB150 Boxed with 10 thk plate at Top & Bottom + 10 thk Plate at flange ends.

The proposed strengthening and replacement works shall also comprise the following:

- Replacement of walkway members, gratings, and handrails. (Walkway member shall be MC150 instead of existing MC125)
- Replacement of stairs on both sides.
- Replacement of monorail member.
- Strengthening of supports at fixed and sliding ends.

## 5.0 LOADING

### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (kN)
DL	Self-weight, (Contingency - 13%)	-682.55
NGDL	Cable tray	-82.48
	Cable tray Support	
	Grating Load	
	Handrail Load	
LL	Blanket live load on Walkway	-85.05
MRLL	Monorail Live Load	-20.00
CL	Cable Loading	-45.46
PLEM	Piping Load Empty (60% of PLOP)	-533.38
PLOP	Piping Load Empty + Operating Contents (By Piping)	-865.18
PLTLX	Piping Load Empty + Operating Contents (15% of PLOP) X	129.78
PLTLY	Piping Load Empty + Operating Contents (15% of PLOP) Y	129.78
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure
FLX	Bridge Friction Load X (30 % of SW+NGDL+LL+CL+PLOP)	155.00
FLY	Bridge Friction Load Y (30 % of SW+NGDL+LL+CL+PLOP)	155.00



## SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

## NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the Cable tray, cable tray support, grating and handrail loadings.

## LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1.0 m width of walkway is considered.

## CABLE TRAY AND CABLE LOAD

### Bottom Tier

1. For 750mm cable tray, 35.9kg/3m load is considered. Cable trays consist of (16 run 3.5CX120 SQ. MM) with load 4617kg/km
2. For 2 Nos 450mm cable tray, 21.85kg/3m load is considered. Cable trays consist of (2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM) with load 162kg/km
3. For 3 Nos 150mm cable tray, 5kg/3m load is considered. Cable trays consist of (2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM) with load 162kg/km

### Side of Walkway

4. For 450mm cable tray, 21.85 kg/3m load is considered. Cable trays consist of (2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM) with load 162kg/km
5. For 300mm cable tray, 7.7 kg/3m load is considered. Cable trays consist of (2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM) with load 162kg/km
6. For 2 Nos 150mm cable tray, 5 kg/3m load is considered. Cable trays consist of (2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM) with load 162kg/km

## WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

## Load Combinations

### Load Combinations

BASIC LOAD COMBINATIONS								
LComb	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
PLEM	PLOP	0.60						
1000	DL	1.00	NDGL	1.13	CL	1.00	PLEM	1.00
1001	DL	1.00	NDGL	1.13	CL	1.00	PLOP	1.00
1002	1001	1.00	LL	1.00	MRLl	1.00	PLTX	1.00

1003	1001	1.00	LL	1.00	MRL	1.00	PLTX	-1.00
1004	1001	1.00	LL	1.00	MRL	1.00	PLTY	1.00
1005	1001	1.00	LL	1.00	MRL	1.00	PLTY	-1.00
1011	1001	1.00	FLX	1.00				
1012	1001	1.00	FLX	-1.00				
1013	1001	1.00	FLY	1.00				
1014	1001	1.00	FLY	-1.00				
1021	1002	1.00	FLX	1.00				
1022	1002	1.00	FLX	-1.00				
1023	1002	1.00	FLY	1.00				
1024	1002	1.00	FLY	-1.00				
1031	1003	1.00	FLX	1.00				
1032	1003	1.00	FLX	-1.00				
1033	1003	1.00	FLY	1.00				
1034	1003	1.00	FLY	-1.00				
1041	1004	1.00	FLX	1.00				
1042	1004	1.00	FLX	-1.00				
1043	1004	1.00	FLY	1.00				
1044	1004	1.00	FLY	-1.00				
1051	1005	1.00	FLX	1.00				
1052	1005	1.00	FLX	-1.00				
1053	1005	1.00	FLY	1.00				
1054	1005	1.00	FLY	-1.00				
<b>EXTREME WIND CONDITION</b>								
2001 to 2004	1011 to 1014	1.00	201	1.00				
2005 to 2008	1011 to 1014	1.00	202	1.00				
2011 to 2014	1011 to 1014	1.00	203	1.00				
2015 to 2018	1011 to 1014	1.00	204	1.00				
2021 to 2024	1011 to 1014	1.00	205	1.00				
2025 to 2028	1011 to 1014	1.00	206	1.00				
2031 to 2034	1011 to 1014	1.00	207	1.00				
2035 to 2038	1011 to 1014	1.00	208	1.00				
<b>OPERATING WIND CONDITION</b>								
4001 to 4004	1021 to 1024	1.00	301	1.00				
4005 to 4008	1021 to 1024	1.00	302	1.00				
4011 to 4014	1021 to 1024	1.00	303	1.00				
4015 to 4018	1021 to 1024	1.00	304	1.00				

4021 to 4024	1021 to 1024	1.00	305	1.00				
4025 to 4028	1021 to 1024	1.00	306	1.00				
4031 to 4034	1021 to 1024	1.00	307	1.00				
4035 to 4038	1021 to 1024	1.00	308	1.00				
4101 to 4104	1031 to 1034	1.00	301	1.00				
4105 to 4108	1031 to 1034	1.00	302	1.00				
4111 to 4114	1031 to 1034	1.00	303	1.00				
4115 to 4118	1031 to 1034	1.00	304	1.00				
4121 to 4124	1031 to 1034	1.00	305	1.00				
4125 to 4128	1031 to 1034	1.00	306	1.00				
4131 to 4134	1031 to 1034	1.00	307	1.00				
4135 to 4138	1031 to 1034	1.00	308	1.00				
4201 to 4204	1041 to 1044	1.00	301	1.00				
4205 to 4208	1041 to 1044	1.00	302	1.00				
4211 to 4214	1041 to 1044	1.00	303	1.00				
4215 to 4218	1041 to 1044	1.00	304	1.00				
4221 to 4224	1041 to 1044	1.00	305	1.00				
4225 to 4228	1041 to 1044	1.00	306	1.00				
4231 to 4234	1041 to 1044	1.00	307	1.00				
4235 to 4238	1041 to 1044	1.00	308	1.00				
4301 to 4304	1051 to 1054	1.00	301	1.00				
4305 to 4308	1051 to 1054	1.00	302	1.00				
4311 to 4314	1051 to 1054	1.00	303	1.00				
4315 to 4318	1051 to 1054	1.00	304	1.00				
4321 to 4324	1051 to 1054	1.00	305	1.00				
4325 to 4328	1051 to 1054	1.00	306	1.00				
4331 to 4334	1051 to 1054	1.00	307	1.00				
4335 to 4338	1051 to 1054	1.00	308	1.00				

## 6.0 RESULTS & SUMMARY

### A. BASIC LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	CL	USER GENERATED LOADS
2	DL	DEAD
3	LL	USER GENERATED LOADS
4	201	WIND
5	202	WIND

6	203	WIND
7	204	WIND
8	205	WIND
9	206	WIND
10	207	WIND
11	208	WIND
12	301	WIND
13	302	WIND
14	303	WIND
15	304	WIND
16	305	WIND
17	306	WIND
18	307	WIND
19	308	WIND
20	FLX	USER GENERATED LOADS
21	FLY	USER GENERATED LOADS
22	HYDR	USER GENERATED LOADS
23	MRL	USER GENERATED LOADS
24	NGDL	USER GENERATED LOADS
25	PLEM	USER GENERATED LOADS
26	PLOP	USER GENERATED LOADS
27	PLTX	USER GENERATED LOADS
28	PLTY	USER GENERATED LOADS

SACS (2025)

Company: Company

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KIPS)	FY (KIPS)	FZ (KIPS)	MX (FT-KIPS)	MY (FT-KIPS)	MZ (FT-KIPS)	DEAD LOAD (KIPS)	MARINE METHOD BUOYANCY (KIPS)
1	CL	0.00	0.00	-10.24	-27.1	672.0	0.0	0.00	0.00
2	DL	0.00	0.00	-153.44	-452.2	11824.4	0.0	153.44	0.00
3	LL	0.00	0.00	-19.12	-58.0	1254.6	0.0	0.00	0.00
4	201	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
5	202	0.00	0.00	0.00	-0.1	0.0	0.1	0.00	0.00
6	203	0.00	0.00	0.00	-0.2	0.0	0.1	0.00	0.00
7	204	0.00	0.00	0.00	-0.1	0.0	0.1	0.00	0.00
8	205	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
9	206	0.00	-0.00	0.00	0.1	0.0	-0.1	0.00	0.00
10	207	0.00	-0.00	0.00	0.2	0.0	-0.1	0.00	0.00
11	208	0.00	-0.00	0.00	0.1	0.0	-0.1	0.00	0.00
12	301	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
13	302	0.00	0.00	0.00	-0.1	0.0	0.0	0.00	0.00
14	303	0.00	0.00	0.00	-0.1	0.0	0.0	0.00	0.00
15	304	0.00	0.00	0.00	-0.1	0.0	0.0	0.00	0.00
16	305	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
17	306	0.00	-0.00	0.00	0.1	0.0	-0.0	0.00	0.00
18	307	0.00	-0.00	0.00	0.1	0.0	-0.0	0.00	0.00
19	308	0.00	-0.00	0.00	0.1	0.0	-0.0	0.00	0.00
20	FLX	34.85	0.00	0.00	0.0	4268.6	-105.8	0.00	0.00
21	FLY	0.00	0.00	34.85	105.8	-2286.5	0.0	0.00	0.00
22	HYDR	0.00	0.00	-29.23	-225.4	1918.1	0.0	0.00	0.00
23	MRL	0.00	0.00	-4.50	-16.6	295.0	0.0	0.00	0.00
24	NGDL	0.00	0.00	-18.54	-58.4	1216.6	0.0	0.00	0.00
25	PLEM	0.00	0.00	-119.91	-320.1	7810.9	0.0	0.00	0.00
26	PLOP	0.00	0.00	-194.50	-535.6	12582.1	0.0	0.00	0.00
27	PLTX	-29.18	0.00	0.00	0.0	-3782.6	80.3	0.00	0.00
28	PLTY	0.00	-29.18	0.00	3782.6	0.0	-1887.3	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

SACS (2025)

Company: Company

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KIPS)	FY (KIPS)	FZ (KIPS)	MX (FT-KIPS)	MY (FT-KIPS)	MZ (FT-KIPS)
29	1000	0.00	0.00	-304.55	-865.5	21682.2	0.0
30	1001	0.00	0.00	-379.14	-1080.9	26453.4	0.0
31	1002	-29.18	0.00	-402.75	-1155.5	24220.3	80.3
32	1003	29.18	0.00	-402.75	-1155.5	31785.5	-80.3
33	1004	0.00	-29.18	-402.75	2627.0	28002.9	-1887.3
34	1005	0.00	29.18	-402.75	-4938.1	28002.9	1887.3
35	1006	0.00	0.00	-333.78	-1090.8	23600.3	0.0
36	1011	34.85	0.00	-379.14	-1080.9	30721.9	-105.8
37	1012	-34.85	0.00	-379.14	-1080.9	22184.8	105.8
38	1013	0.00	0.00	-344.29	-975.1	24166.9	0.0
39	1014	0.00	0.00	-413.98	-1186.6	28739.8	0.0
40	1021	5.67	0.00	-402.75	-1155.5	28488.9	-25.4
41	1022	-64.02	0.00	-402.75	-1155.5	19951.8	186.1
42	1023	-29.18	0.00	-367.91	-1049.8	21933.9	80.3

43	1024	-29.18	0.00	-437.60	-1261.3	26506.8	80.3
44	1031	64.02	0.00	-402.75	-1155.5	36054.1	-186.1
45	1032	-5.67	0.00	-402.75	-1155.5	27517.0	25.4
46	1033	29.18	0.00	-367.91	-1049.8	29499.1	-80.3
47	1034	29.18	0.00	-437.60	-1261.3	34072.0	-80.3
48	1041	34.85	-29.18	-402.75	2627.0	32271.5	-1993.1
49	1042	-34.85	-29.18	-402.75	2627.0	23734.4	-1781.6
50	1043	0.00	-29.18	-367.91	2732.8	25716.5	-1887.3
51	1044	0.00	-29.18	-437.60	2521.3	30289.4	-1887.3
52	1051	34.85	29.18	-402.75	-4938.1	32271.5	1781.6
53	1052	-34.85	29.18	-402.75	-4938.1	23734.4	1993.1
54	1053	0.00	29.18	-367.91	-4832.4	25716.5	1887.3
55	1054	0.00	29.18	-437.60	-5043.9	30289.4	1887.3
56	2001	34.85	0.00	-379.14	-1080.9	30721.9	-105.8
57	2002	-34.85	0.00	-379.14	-1080.9	22184.8	105.8
58	2003	0.00	0.00	-344.29	-975.1	24166.9	0.0
59	2004	0.00	0.00	-413.98	-1186.6	28739.8	0.0
60	2005	34.85	0.00	-379.14	-1081.0	30721.9	-105.7
61	2006	-34.85	0.00	-379.14	-1081.0	22184.8	105.8
62	2007	0.00	0.00	-344.29	-975.3	24166.9	0.1
63	2008	0.00	0.00	-413.98	-1186.8	28739.8	0.1
64	2011	34.85	0.00	-379.14	-1081.1	30721.9	-105.6
65	2012	-34.85	0.00	-379.14	-1081.1	22184.8	105.9
66	2013	0.00	0.00	-344.29	-975.3	24166.9	0.1
67	2014	0.00	0.00	-413.98	-1186.8	28739.8	0.1
68	2015	34.85	0.00	-379.14	-1081.0	30721.9	-105.7
69	2016	-34.85	0.00	-379.14	-1081.0	22184.8	105.8
70	2017	0.00	0.00	-344.29	-975.3	24166.9	0.1
71	2018	0.00	0.00	-413.98	-1186.8	28739.8	0.1
72	2021	34.85	0.00	-379.14	-1080.9	30721.9	-105.8
73	2022	-34.85	0.00	-379.14	-1080.9	22184.8	105.8

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

LOAD CASE	LOAD LABEL	RELATIVE TO MUDLINE ELEVATION					
		FX	FY	FZ	MX	MY	MZ
		(KIPS)	(KIPS)	(KIPS)	(FT-KIPS)	(FT-KIPS)	(FT-KIPS)
74	2023	0.00	0.00	-344.29	-975.1	24166.9	0.0
75	2024	0.00	0.00	-413.98	-1186.6	28739.8	0.0
76	2025	34.85	-0.00	-379.14	-1080.7	30721.9	-105.8
77	2026	-34.85	-0.00	-379.14	-1080.7	22184.8	105.7
78	2027	0.00	-0.00	-344.29	-975.0	24166.9	-0.1
79	2028	0.00	-0.00	-413.98	-1186.5	28739.8	-0.1
80	2031	34.85	-0.00	-379.14	-1080.7	30721.9	-105.9
81	2032	-34.85	-0.00	-379.14	-1080.7	22184.8	105.6
82	2033	0.00	-0.00	-344.29	-974.9	24166.9	-0.1
83	2034	0.00	-0.00	-413.98	-1186.4	28739.8	-0.1
84	2035	34.85	-0.00	-379.14	-1080.7	30721.9	-105.8
85	2036	-34.85	-0.00	-379.14	-1080.7	22184.8	105.7
86	2037	0.00	-0.00	-344.29	-975.0	24166.9	-0.1
87	2038	0.00	-0.00	-413.98	-1186.5	28739.8	-0.1
88	4001	5.67	0.00	-402.75	-1155.5	28488.9	-25.4
89	4002	-64.02	0.00	-402.75	-1155.5	19951.8	186.1
90	4003	-29.18	0.00	-367.91	-1049.8	21933.9	80.3
91	4004	-29.18	0.00	-437.60	-1261.3	26506.8	80.3
92	4005	5.67	0.00	-402.75	-1155.6	28488.9	-25.4
93	4006	-64.02	0.00	-402.75	-1155.6	19951.8	186.1
94	4007	-29.18	0.00	-367.91	-1049.8	21933.9	80.4
95	4008	-29.18	0.00	-437.60	-1261.4	26506.8	80.4
96	4011	5.67	0.00	-402.75	-1155.6	28488.9	-25.4
97	4012	-64.02	0.00	-402.75	-1155.6	19951.8	186.1
98	4013	-29.18	0.00	-367.91	-1049.9	21933.9	80.4
99	4014	-29.18	0.00	-437.60	-1261.4	26506.8	80.4
100	4015	5.67	0.00	-402.75	-1155.6	28488.9	-25.4
101	4016	-64.02	0.00	-402.75	-1155.6	19951.8	186.1
102	4017	-29.18	0.00	-367.91	-1049.8	21933.9	80.4
103	4018	-29.18	0.00	-437.60	-1261.4	26506.8	80.4
104	4021	5.67	0.00	-402.75	-1155.5	28488.9	-25.4
105	4022	-64.02	0.00	-402.75	-1155.5	19951.8	186.1
106	4023	-29.18	0.00	-367.91	-1049.8	21933.9	80.3
107	4024	-29.18	0.00	-437.60	-1261.3	26506.8	80.3
108	4025	5.67	-0.00	-402.75	-1155.5	28488.9	-25.4
109	4026	-64.02	-0.00	-402.75	-1155.5	19951.8	186.1
110	4027	-29.18	-0.00	-367.91	-1049.7	21933.9	80.3
111	4028	-29.18	-0.00	-437.60	-1261.2	26506.8	80.3
112	4031	5.67	-0.00	-402.75	-1155.5	28488.9	-25.5
113	4032	-64.02	-0.00	-402.75	-1155.5	19951.8	186.1
114	4033	-29.18	-0.00	-367.91	-1049.7	21933.9	80.3
115	4034	-29.18	-0.00	-437.60	-1261.2	26506.8	80.3
116	4035	5.67	-0.00	-402.75	-1155.5	28488.9	-25.4
117	4036	-64.02	-0.00	-402.75	-1155.5	19951.8	186.1
118	4037	-29.18	-0.00	-367.91	-1049.7	21933.9	80.3

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

LOAD CASE	LOAD LABEL	RELATIVE TO MUDLINE ELEVATION					
		FX	FY	FZ	MX	MY	MZ
		(KIPS)	(KIPS)	(KIPS)	(FT-KIPS)	(FT-KIPS)	(FT-KIPS)
119	4038	-29.18	-0.00	-437.60	-1261.2	26506.8	80.3
120	4101	64.02	0.00	-402.75	-1155.5	36054.1	-186.1
121	4102	-5.67	0.00	-402.75	-1155.5	27517.0	25.4
122	4103	29.18	0.00	-367.91	-1049.8	29499.1	-80.3
123	4104	29.18	0.00	-437.60	-1261.3	34072.0	-80.3
124	4105	64.02	0.00	-402.75	-1155.6	36054.1	-186.1
125	4106	-5.67	0.00	-402.75	-1155.6	27517.0	25.4
126	4107	29.18	0.00	-367.91	-1049.8	29499.1	-80.3
127	4108	29.18	0.00	-437.60	-1261.4	34072.0	-80.3
128	4111	64.02	0.00	-402.75	-1155.6	36054.1	-186.1
129	4112	-5.67	0.00	-402.75	-1155.6	27517.0	25.5
130	4113	29.18	0.00	-367.91	-1049.9	29499.1	-80.3
131	4114	29.18	0.00	-437.60	-1261.4	34072.0	-80.3
132	4115	64.02	0.00	-402.75	-1155.6	36054.1	-186.1
133	4116	-5.67	0.00	-402.75	-1155.6	27517.0	25.4
134	4117	29.18	0.00	-367.91	-1049.8	29499.1	-80.3
135	4118	29.18	0.00	-437.60	-1261.4	34072.0	-80.3
136	4121	64.02	0.00	-402.75	-1155.5	36054.1	-186.1
137	4122	-5.67	0.00	-402.75	-1155.5	27517.0	25.4
138	4123	29.18	0.00	-367.91	-1049.8	29499.1	-80.3
139	4124	29.18	0.00	-437.60	-1261.3	34072.0	-80.3
140	4125	64.02	-0.00	-402.75	-1155.5	36054.1	-186.1
141	4126	-5.67	-0.00	-402.75	-1155.5	27517.0	25.4
142	4127	29.18	-0.00	-367.91	-1049.7	29499.1	-80.4
143	4128	29.18	-0.00	-437.60	-1261.2	34072.0	-80.4
144	4131	64.02	-0.00	-402.75	-1155.5	36054.1	-186.1
145	4132	-5.67	-0.00	-402.75	-1155.5	27517.0	25.4
146	4133	29.18	-0.00	-367.91	-1049.7	29499.1	-80.4
147	4134	29.18	-0.00	-437.60	-1261.2	34072.0	-80.4
148	4135	64.02	-0.00	-402.75	-1155.5	36054.1	-186.1
149	4136	-5.67	-0.00	-402.75	-1155.5	27517.0	25.4
150	4137	29.18	-0.00	-367.91	-1049.7	29499.1	-80.4
151	4138	29.18	-0.00	-437.60	-1261.2	34072.0	-80.4
152	4201	34.85	-29.18	-402.75	2627.0	32271.5	-1993.1
153	4202	-34.85	-29.18	-402.75	2627.0	23734.4	-1781.6
154	4203	0.00	-29.18	-367.91	2732.8	25716.5	-1887.3
155	4204	0.00	-29.18	-437.60	2521.3	30289.4	-1887.3
156	4205	34.85	-29.17	-402.75	2627.0	32271.5	-1993.0
157	4206	-34.85	-29.17	-402.75	2627.0	23734.4	-1781.5
158	4207	0.00	-29.17	-367.91	2732.7	25716.5	-1887.3
159	4208	0.00	-29.17	-437.60	2521.2	30289.4	-1887.3
160	4211	34.85	-29.17	-402.75	2627.0	32271.5	-1993.0
161	4212	-34.85	-29.17	-402.75	2627.0	23734.4	-1781.5
162	4213	0.00	-29.17	-367.91	2732.7	25716.5	-1887.3
163	4214	0.00	-29.17	-437.60	2521.2	30289.4	-1887.3

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

LOAD CASE	LOAD LABEL	RELATIVE TO MUDLINE ELEVATION					
		FX	FY	FZ	MX	MY	MZ
		(KIPS)	(KIPS)	(KIPS)	(FT-KIPS)	(FT-KIPS)	(FT-KIPS)
164	4215	34.85	-29.17	-402.75	2627.0	32271.5	-1993.0
165	4216	-34.85	-29.17	-402.75	2627.0	23734.4	-1781.5
166	4217	0.00	-29.17	-367.91	2732.7	25716.5	-1887.3
167	4218	0.00	-29.17	-437.60	2521.2	30289.4	-1887.3
168	4221	34.85	-29.18	-402.75	2627.0	32271.5	-1993.1
169	4222	-34.85	-29.18	-402.75	2627.0	23734.4	-1781.6
170	4223	0.00	-29.18	-367.91	2732.8	25716.5	-1887.3
171	4224	0.00	-29.18	-437.60	2521.3	30289.4	-1887.3
172	4225	34.85	-29.18	-402.75	2627.1	32271.5	-1993.1
173	4226	-34.85	-29.18	-402.75	2627.1	23734.4	-1781.6
174	4227	0.00	-29.18	-367.91	2732.8	25716.5	-1887.3
175	4228	0.00	-29.18	-437.60	2521.3	30289.4	-1887.3
176	4231	34.85	-29.18	-402.75	2627.1	32271.5	-1993.1
177	4232	-34.85	-29.18	-402.75	2627.1	23734.4	-1781.6
178	4233	0.00	-29.18	-367.91	2732.9	25716.5	-1887.3
179	4234	0.00	-29.18	-437.60	2521.3	30289.4	-1887.3
180	4235	34.85	-29.18	-402.75	2627.1	32271.5	-1993.1
181	4236	-34.85	-29.18	-402.75	2627.1	23734.4	-1781.6
182	4237	0.00	-29.18	-367.91	2732.8	25716.5	-1887.3
183	4238	0.00	-29.18	-437.60	2521.3	30289.4	-1887.3
184	4301	34.85	-29.18	-402.75	-4938.1	32271.5	1781.6
185	4302	-34.85	29.18	-402.75	-4938.1	23734.4	1993.1
186	4303	0.00	29.18	-367.91	-4832.4	25716.5	1887.3
187	4304	0.00	29.18	-437.60	-5043.9	30289.4	1887.3
188	4305	34.85	29.18	-402.75	-4938.2	32271.5	1781.6
189	4306	-34.85	29.18	-402.75	-4938.2	23734.4	1993.1

190	4307	0.00	29.18	-367.91	-4832.4	25716.5	1887.3
191	4308	0.00	29.18	-437.60	-5043.9	30289.4	1887.3
192	4311	34.85	29.18	-402.75	-4938.2	32271.5	1781.6
193	4312	-34.85	29.18	-402.75	-4938.2	23734.4	1993.1
194	4313	0.00	29.18	-367.91	-4832.4	25716.5	1887.3
195	4314	0.00	29.18	-437.60	-5043.9	30289.4	1887.3
196	4315	34.85	29.18	-402.75	-4938.2	32271.5	1781.6
197	4316	-34.85	29.18	-402.75	-4938.2	23734.4	1993.1
198	4317	0.00	29.18	-367.91	-4832.4	25716.5	1887.3
199	4318	0.00	29.18	-437.60	-5043.9	30289.4	1887.3
200	4321	34.85	29.18	-402.75	-4938.1	32271.5	1781.6
201	4322	-34.85	29.18	-402.75	-4938.1	23734.4	1993.1
202	4323	0.00	29.18	-367.91	-4832.4	25716.5	1887.3
203	4324	0.00	29.18	-437.60	-5043.9	30289.4	1887.3
204	4325	34.85	29.17	-402.75	-4938.1	32271.5	1781.5
205	4326	-34.85	29.17	-402.75	-4938.1	23734.4	1993.0
206	4327	0.00	29.17	-367.91	-4832.3	25716.5	1887.3
207	4328	0.00	29.17	-437.60	-5043.8	30289.4	1887.3
208	4331	34.85	29.17	-402.75	-4938.0	32271.5	1781.5

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KIPS)	FY (KIPS)	FZ (KIPS)	MX (FT-KIPS)	MY (FT-KIPS)	MZ (FT-KIPS)
209	4332	-34.85	29.17	-402.75	-4938.0	23734.4	1993.0
210	4333	0.00	29.17	-367.91	-4832.3	25716.5	1887.3
211	4334	0.00	29.17	-437.60	-5043.8	30289.4	1887.3
212	4335	34.85	29.17	-402.75	-4938.1	32271.5	1781.5
213	4336	-34.85	29.17	-402.75	-4938.1	23734.4	1993.0
214	4337	0.00	29.17	-367.91	-4832.3	25716.5	1887.3
215	4338	0.00	29.17	-437.60	-5043.8	30289.4	1887.3

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION ***** FORCE X (KIPS) (FT)	Y (FT)	Z (FT)	***** Y - DIRECTION ***** FORCE Y (KIPS) (FT)	X (FT)	Z (FT)	***** Z - DIRECTION ***** FORCE Z (KIPS) (FT)	X (FT)	Y (FT)	Z (FT)
1	CL	0.00			0.00			-10.24	65.62	2.64	63.04
2	DL	0.00			0.00			-153.44	77.06	2.95	70.27
3	LL	0.00			0.00			-19.12	65.62	3.03	65.78
4	201	0.00			0.00			0.00			
5	202	0.00			0.00	65.62	6.07	64.52	0.00		
6	203	0.00			0.00	65.62	6.07	64.52	0.00		
7	204	0.00			0.00	65.62	6.07	64.52	0.00		
8	205	0.00			0.00			0.00			
9	206	0.00			-0.00	65.62	0.00	64.52	0.00		
10	207	0.00			-0.00	65.62	0.00	64.52	0.00		
11	208	0.00			-0.00	65.62	0.00	64.52	0.00		
12	301	0.00			0.00			0.00			
13	302	0.00			0.00	65.62	6.07	64.52	0.00		
14	303	0.00			0.00	65.62	6.07	64.52	0.00		
15	304	0.00			0.00	65.62	6.07	64.52	0.00		
16	305	0.00			0.00			0.00			
17	306	0.00			-0.00	65.62	0.00	64.52	0.00		
18	307	0.00			-0.00	65.62	0.00	64.52	0.00		
19	308	0.00			-0.00	65.62	0.00	64.52	0.00		
20	FLX	34.85	65.62	3.03	62.50	0.00		0.00			
21	FLY	0.00			0.00			34.85	65.62	3.03	62.50
22	HYDR	0.00			0.00			-29.23	65.62	7.71	70.17
23	MRLL	0.00			0.00			-4.50	65.62	3.70	76.61
24	NGDL	0.00			0.00			-18.54	65.62	3.15	67.67
25	PLEM	0.00			0.00			-119.91	65.14	2.67	69.29
26	PLOP	0.00			0.00			-194.50	64.69	2.75	69.65
27	PLTX	-29.18	64.69	2.75	69.65	0.00		0.00			
28	PLTY	0.00			-29.18	64.69	2.75	69.65	0.00		
29	1000	0.00			0.00			-304.55	71.19	2.84	69.46
30	1001	0.00			0.00			-379.14	69.77	2.85	69.61
31	1002	-29.18	64.69	2.75	69.65	0.00		-402.75	69.53	2.87	69.51
32	1003	29.18	64.69	2.75	69.65	0.00		-402.75	69.53	2.87	69.51
33	1004	0.00			-29.18	64.69	2.75	69.65	-402.75	69.53	2.87
34	1005	0.00			29.18	64.69	2.75	69.65	-402.75	69.53	2.87
35	1006	0.00			0.00			-333.78	70.71	3.27	69.52
36	1011	34.85	65.62	3.03	62.50	0.00		-379.14	69.77	2.85	69.61
37	1012	-34.85	65.62	3.03	62.50	0.00		-379.14	69.77	2.85	69.61
38	1013	0.00			0.00			-344.29	70.19	2.83	70.33
39	1014	0.00			0.00			-413.98	69.42	2.87	69.01
40	1021	5.67	70.39	4.48	25.71	0.00		-402.75	69.53	2.87	69.51
41	1022	-64.02	65.19	2.91	65.76	0.00		-402.75	69.53	2.87	69.51
42	1023	-29.18	64.69	2.75	69.65	0.00		-367.91	69.90	2.85	70.17
43	1024	-29.18	64.69	2.75	69.65	0.00		-437.60	69.22	2.88	68.95
44	1031	64.02	65.19	2.91	65.76	0.00		-402.75	69.53	2.87	69.51
45	1032	-5.67	70.39	4.48	25.71	0.00		-402.75	69.53	2.87	69.51

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)
46	1033	29.18	64.69	2.75	69.65	0.00				-367.91	69.90	2.85	70.17
47	1034	29.18	64.69	2.75	69.65	0.00				-437.60	69.22	2.88	68.95
48	1041	34.85	65.62	3.03	62.50	-29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
49	1042	-34.85	65.62	3.03	62.50	-29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
50	1043	0.00				-29.18	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
51	1044	0.00				-29.18	64.69	2.75	69.65	-437.60	69.22	2.88	68.95
52	1051	34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
53	1052	-34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
54	1053	0.00				29.18	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
55	1054	0.00				29.18	64.69	2.75	69.65	-437.60	69.22	2.88	68.95
56	2001	34.85	65.62	3.03	62.50	0.00				-379.14	69.77	2.85	69.61
57	2002	-34.85	65.62	3.03	62.50	0.00				-379.14	69.77	2.85	69.61
58	2003	0.00				0.00				-344.29	70.19	2.83	70.33
59	2004	0.00				0.00				-413.98	69.42	2.87	69.01
60	2005	34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-379.14	69.77	2.85	69.61
61	2006	-34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-379.14	69.77	2.85	69.61
62	2007	0.00				0.00	65.62	6.07	64.52	-344.29	70.19	2.83	70.33
63	2008	0.00				0.00	65.62	6.07	64.52	-413.98	69.42	2.87	69.01
64	2011	34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-379.14	69.77	2.85	69.61
65	2012	-34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-379.14	69.77	2.85	69.61
66	2013	0.00				0.00	65.62	6.07	64.52	-344.29	70.19	2.83	70.33
67	2014	0.00				0.00	65.62	6.07	64.52	-413.98	69.42	2.87	69.01
68	2015	34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-379.14	69.77	2.85	69.61
69	2016	-34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-379.14	69.77	2.85	69.61
70	2017	0.00				0.00	65.62	6.07	64.52	-344.29	70.19	2.83	70.33
71	2018	0.00				0.00	65.62	6.07	64.52	-413.98	69.42	2.87	69.01
72	2021	34.85	65.62	3.03	62.50	0.00				-379.14	69.77	2.85	69.61
73	2022	-34.85	65.62	3.03	62.50	0.00				-379.14	69.77	2.85	69.61
74	2023	0.00				0.00				-344.29	70.19	2.83	70.33
75	2024	0.00				0.00				-413.98	69.42	2.87	69.01
76	2025	34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-379.14	69.77	2.85	69.61
77	2026	-34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-379.14	69.77	2.85	69.61
78	2027	0.00				-0.00	65.62	0.00	64.52	-344.29	70.19	2.83	70.33
79	2028	0.00				-0.00	65.62	0.00	64.52	-413.98	69.42	2.87	69.01
80	2031	34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-379.14	69.77	2.85	69.61
81	2032	-34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-379.14	69.77	2.85	69.61
82	2033	0.00				-0.00	65.62	0.00	64.52	-344.29	70.19	2.83	70.33
83	2034	0.00				-0.00	65.62	0.00	64.52	-413.98	69.42	2.87	69.01
84	2035	34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-379.14	69.77	2.85	69.61
85	2036	-34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-379.14	69.77	2.85	69.61
86	2037	0.00				-0.00	65.62	0.00	64.52	-344.29	70.19	2.83	70.33
87	2038	0.00				-0.00	65.62	0.00	64.52	-413.98	69.42	2.87	69.01
88	4001	5.67	70.39	4.48	25.71	0.00				-402.75	69.53	2.87	69.51
89	4002	-64.02	65.19	2.91	65.76	0.00				-402.75	69.53	2.87	69.51
90	4003	-29.18	64.69	2.75	69.65	0.00				-367.91	69.90	2.85	70.17

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Company  
DATE 23-SEP-2025 TIME 10:05:20

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)
91	4004	-29.18	64.69	2.75	69.65	0.00				-437.60	69.22	2.88	68.95
92	4005	5.67	70.39	4.48	25.71	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
93	4006	-64.02	65.19	2.91	65.76	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
94	4007	-29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-367.91	69.90	2.85	70.17
95	4008	-29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-437.60	69.22	2.88	68.95
96	4011	5.67	70.39	4.48	25.71	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
97	4012	-64.02	65.19	2.91	65.76	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
98	4013	-29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-367.91	69.90	2.85	70.17
99	4014	-29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-437.60	69.22	2.88	68.95
100	4015	5.67	70.39	4.48	25.71	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
101	4016	-64.02	65.19	2.91	65.76	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
102	4017	-29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-367.91	69.90	2.85	70.17
103	4018	-29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-437.60	69.22	2.88	68.95
104	4021	5.67	70.39	4.48	25.71	0.00				-402.75	69.53	2.87	69.51
105	4022	-64.02	65.19	2.91	65.76	0.00				-402.75	69.53	2.87	69.51
106	4023	-29.18	64.69	2.75	69.65	0.00				-367.91	69.90	2.85	70.17
107	4024	-29.18	64.69	2.75	69.65	0.00				-437.60	69.22	2.88	68.95
108	4025	5.67	70.39	4.48	25.71	-0.00	65.62	0.00	64.52	-402.75	69.53	2.87	69.51
109	4026	-64.02	65.19	2.91	65.76	-0.00	65.62	0.00	64.52	-402.75	69.53	2.87	69.51
110	4027	-29.18	64.69	2.75	69.65	-0.00	65.62	0.00	64.52	-367.91	69.90	2.85	70.17
111	4028	-29.18	64.69	2.75	69.65	-0.00	65.62	0.00	64.52	-437.60	69.22	2.88	68.95
112	4031	5.67	70.39	4.48	25.71	-0.00	65.62	0.00	64.52	-402.75	69.53	2.87	69.51
113	4032	-64.02	65.19	2.91	65.76	-0.00	65.62	0.00	64.52	-402.75	69.53	2.87	69.51
114	4033	-29.18	64.69	2.75	69.65	-0.00	65.62	0.00	64.52	-367.91	69.90	2.85	70.17
115	4034	-29.18	64.69	2.75	69.65	-0.00	65.62	0.00	64.52	-437.60	69.22	2.88	68.95
116	4035	5.67	70.39	4.48	25.71	-0.00	65.62	0.00	64.52	-402.75	69.53	2.87	69.51



117	4036	-64.02	65.19	2.91	65.76	-0.00	65.62	0.00	64.52	-402.75	69.53	2.87	69.51
118	4037	-29.18	64.69	2.75	69.65	-0.00	65.62	0.00	64.52	-367.91	69.90	2.85	70.17
119	4038	-29.18	64.69	2.75	69.65	-0.00	65.62	0.00	64.52	-437.60	69.22	2.88	68.95
120	4101	64.02	65.19	2.91	65.76	0.00				-402.75	69.53	2.87	69.51
121	4102	-5.67	70.39	4.48	25.71	0.00				-402.75	69.53	2.87	69.51
122	4103	29.18	64.69	2.75	69.65	0.00				-367.91	69.90	2.85	70.17
123	4104	29.18	64.69	2.75	69.65	0.00				-437.60	69.22	2.88	68.95
124	4105	64.02	65.19	2.91	65.76	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
125	4106	-5.67	70.39	4.48	25.71	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
126	4107	29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-367.91	69.90	2.85	70.17
127	4108	29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-437.60	69.22	2.88	68.95
128	4111	64.02	65.19	2.91	65.76	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
129	4112	-5.67	70.39	4.48	25.71	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
130	4113	29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-367.91	69.90	2.85	70.17
131	4114	29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-437.60	69.22	2.88	68.95
132	4115	64.02	65.19	2.91	65.76	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
133	4116	-5.67	70.39	4.48	25.71	0.00	65.62	6.07	64.52	-402.75	69.53	2.87	69.51
134	4117	29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-367.91	69.90	2.85	70.17
135	4118	29.18	64.69	2.75	69.65	0.00	65.62	6.07	64.52	-437.60	69.22	2.88	68.95

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
***** Y - DIRECTION *****													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z
		(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)
136	4121	64.02 65.19 2.91 65.76	0.00	-402.75 69.53 2.87 69.51									
137	4122	-5.67 70.39 4.48 25.71	0.00	-402.75 69.53 2.87 69.51									
138	4123	29.18 64.69 2.75 69.65	0.00	-367.91 69.90 2.85 70.17									
139	4124	29.18 64.69 2.75 69.65	0.00	-437.60 69.22 2.88 68.95									
140	4125	64.02 65.19 2.91 65.76	-0.00 65.62 0.00 64.52	-402.75 69.53 2.87 69.51									
141	4126	-5.67 70.39 4.48 25.71	-0.00 65.62 0.00 64.52	-402.75 69.53 2.87 69.51									
142	4127	29.18 64.69 2.75 69.65	-0.00 65.62 0.00 64.52	-367.91 69.90 2.85 70.17									
143	4128	29.18 64.69 2.75 69.65	-0.00 65.62 0.00 64.52	-437.60 69.22 2.88 68.95									
144	4131	64.02 65.19 2.91 65.76	-0.00 65.62 0.00 64.52	-402.75 69.53 2.87 69.51									
145	4132	-5.67 70.39 4.48 25.71	-0.00 65.62 0.00 64.52	-402.75 69.53 2.87 69.51									
146	4133	29.18 64.69 2.75 69.65	-0.00 65.62 0.00 64.52	-367.91 69.90 2.85 70.17									
147	4134	29.18 64.69 2.75 69.65	-0.00 65.62 0.00 64.52	-437.60 69.22 2.88 68.95									
148	4135	64.02 65.19 2.91 65.76	-0.00 65.62 0.00 64.52	-402.75 69.53 2.87 69.51									
149	4136	-5.67 70.39 4.48 25.71	-0.00 65.62 0.00 64.52	-402.75 69.53 2.87 69.51									
150	4137	29.18 64.69 2.75 69.65	-0.00 65.62 0.00 64.52	-367.91 69.90 2.85 70.17									
151	4138	29.18 64.69 2.75 69.65	-0.00 65.62 0.00 64.52	-437.60 69.22 2.88 68.95									
152	4201	34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
153	4202	-34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
154	4203	0.00	-29.18 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
155	4204	0.00	-29.18 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									
156	4205	34.85 65.62 3.03 62.50	-29.17 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
157	4206	-34.85 65.62 3.03 62.50	-29.17 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
158	4207	0.00	-29.17 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
159	4208	0.00	-29.17 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									
160	4211	34.85 65.62 3.03 62.50	-29.17 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
161	4212	-34.85 65.62 3.03 62.50	-29.17 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
162	4213	0.00	-29.17 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
163	4214	0.00	-29.17 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									
164	4215	34.85 65.62 3.03 62.50	-29.17 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
165	4216	-34.85 65.62 3.03 62.50	-29.17 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
166	4217	0.00	-29.17 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
167	4218	0.00	-29.17 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									
168	4221	34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
169	4222	-34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
170	4223	0.00	-29.18 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
171	4224	0.00	-29.18 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									
172	4225	34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
173	4226	-34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
174	4227	0.00	-29.18 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
175	4228	0.00	-29.18 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									
176	4231	34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
177	4232	-34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
178	4233	0.00	-29.18 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
179	4234	0.00	-29.18 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									
180	4235	34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
***** Y - DIRECTION *****													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z	FORCE X Y Z
		(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)	(KIPS) (FT) (FT) (FT)
181	4236	-34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
182	4237	0.00	-29.18 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
183	4238	0.00	-29.18 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									
184	4301	34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
185	4302	-34.85 65.62 3.03 62.50	-29.18 64.69 2.75 69.65	-402.75 69.53 2.87 69.51									
186	4303	0.00	-29.18 64.69 2.75 69.65	-367.91 69.90 2.85 70.17									
187	4304	0.00	-29.18 64.69 2.75 69.65	-437.60 69.22 2.88 68.95									

188	4305	34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
189	4306	-34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
190	4307	0.00				29.18	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
191	4308	0.00				29.18	64.69	2.75	69.65	-437.60	69.22	2.88	68.95
192	4311	34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
193	4312	-34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
194	4313	0.00				29.18	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
195	4314	0.00				29.18	64.69	2.75	69.65	-437.60	69.22	2.88	68.95
196	4315	34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
197	4316	-34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
198	4317	0.00				29.18	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
199	4318	0.00				29.18	64.69	2.75	69.65	-437.60	69.22	2.88	68.95
200	4321	34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
201	4322	-34.85	65.62	3.03	62.50	29.18	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
202	4323	0.00				29.18	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
203	4324	0.00				29.18	64.69	2.75	69.65	-437.60	69.22	2.88	68.95
204	4325	34.85	65.62	3.03	62.50	29.17	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
205	4326	-34.85	65.62	3.03	62.50	29.17	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
206	4327	0.00				29.17	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
207	4328	0.00				29.17	64.69	2.75	69.65	-437.60	69.22	2.88	68.95
208	4331	34.85	65.62	3.03	62.50	29.17	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
209	4332	-34.85	65.62	3.03	62.50	29.17	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
210	4333	0.00				29.17	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
211	4334	0.00				29.17	64.69	2.75	69.65	-437.60	69.22	2.88	68.95
212	4335	34.85	65.62	3.03	62.50	29.17	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
213	4336	-34.85	65.62	3.03	62.50	29.17	64.69	2.75	69.65	-402.75	69.53	2.87	69.51
214	4337	0.00				29.17	64.69	2.75	69.65	-367.91	69.90	2.85	70.17
215	4338	0.00				29.17	64.69	2.75	69.65	-437.60	69.22	2.88	68.95

## B. BASIC LOAD CASE SUMMARY SACS OUTPUT AFTER STRENGTHENING

SACS (2025) \*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\* Company: Company  
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\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	CL	USER GENERATED LOADS
2	DL	DEAD
3	LL	USER GENERATED LOADS
4	201	WIND
5	202	WIND
6	203	WIND
7	204	WIND
8	205	WIND
9	206	WIND
10	207	WIND
11	208	WIND
12	301	WIND
13	302	WIND
14	303	WIND
15	304	WIND
16	305	WIND
17	306	WIND
18	307	WIND
19	308	WIND
20	FLX	USER GENERATED LOADS
21	FLY	USER GENERATED LOADS
22	HYDR	USER GENERATED LOADS
23	MRL	USER GENERATED LOADS
24	NGDL	USER GENERATED LOADS
25	PLEM	USER GENERATED LOADS
26	PLOP	USER GENERATED LOADS
27	PLTX	USER GENERATED LOADS
28	PLTY	USER GENERATED LOADS

SACS (2025) \*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\* Company: Company  
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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KIPS)	FY (KIPS)	FZ (KIPS)	MX (FT-KIPS)	MY (FT-KIPS)	MZ (FT-KIPS)	DEAD LOAD (KIPS)	MARINE METHOD BUOYANCY (KIPS)
1	CL	0.00	0.00	-10.38	-27.6	678.3	0.0	0.00	0.00
2	DL	-0.00	0.00	-187.58	-555.6	14147.4	0.0	187.58	0.00
3	LL	0.00	0.00	-19.12	-58.0	1254.6	0.0	0.00	0.00
4	201	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
5	202	0.00	0.00	0.00	-0.1	0.0	0.1	0.00	0.00
6	203	0.00	0.00	0.00	-0.2	0.0	0.1	0.00	0.00
7	204	0.00	0.00	0.00	-0.1	0.0	0.1	0.00	0.00

8	205	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
9	206	0.00	-0.00	0.00	0.1	0.0	-0.1	0.00	0.00
10	207	0.00	-0.00	0.00	0.2	0.0	-0.1	0.00	0.00
11	208	0.00	-0.00	0.00	0.1	0.0	-0.1	0.00	0.00
12	301	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
13	302	0.00	0.00	0.00	-0.1	0.0	0.0	0.00	0.00
14	303	0.00	0.00	0.00	-0.1	0.0	0.0	0.00	0.00
15	304	0.00	0.00	0.00	-0.1	0.0	0.0	0.00	0.00
16	305	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
17	306	0.00	-0.00	0.00	0.1	0.0	-0.0	0.00	0.00
18	307	0.00	-0.00	0.00	0.1	0.0	-0.0	0.00	0.00
19	308	0.00	-0.00	0.00	0.1	0.0	-0.0	0.00	0.00
20	FLX	34.85	0.00	0.00	0.0	4268.6	-105.8	0.00	0.00
21	FLY	0.00	0.00	34.85	105.8	-2286.5	0.0	0.00	0.00
22	HYDR	0.00	0.00	-29.23	-225.4	1918.1	0.0	0.00	0.00
23	MRLL	0.00	0.00	-4.50	-16.6	295.0	0.0	0.00	0.00
24	NGDL	0.00	0.00	-18.54	-58.4	1216.6	0.0	0.00	0.00
25	PLEM	0.00	0.00	-120.07	-319.7	7819.0	0.0	0.00	0.00
26	PLOP	0.00	0.00	-194.66	-535.2	12590.2	0.0	0.00	0.00
27	PLTX	-29.20	0.00	0.00	0.0	-3785.5	80.3	0.00	0.00
28	PLTY	0.00	-29.20	0.00	3785.5	0.0	-1888.5	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT AFTER STRENGTHENING

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	Fx	Fy	Fz	Mx	My	Mz
		(KIPS)	(KIPS)	(KIPS)	(FT-KIPS)	(FT-KIPS)	(FT-KIPS)
29	1000	-0.00	0.00	-338.97	-968.9	24019.5	0.0
30	1001	-0.00	0.00	-413.57	-1184.4	28790.6	0.0
31	1002	-29.20	0.00	-437.18	-1259.0	26554.8	80.3
32	1003	29.20	0.00	-437.18	-1259.0	34125.7	-80.3
33	1004	-0.00	-29.20	-437.18	2526.4	30340.2	-1888.5
34	1005	-0.00	29.20	-437.18	-5044.5	30340.2	1888.5
35	1006	-0.00	0.00	-368.21	-1194.3	25937.6	0.0
36	1011	34.85	0.00	-413.57	-1184.4	33059.2	-105.8
37	1012	-34.85	0.00	-413.57	-1184.4	24522.1	105.8
38	1013	-0.00	0.00	-378.72	-1078.6	26504.2	0.0
39	1014	-0.00	0.00	-448.41	-1290.1	31077.1	0.0
40	1021	5.65	0.00	-437.18	-1259.0	30823.3	-25.5
41	1022	-64.04	0.00	-437.18	-1259.0	22286.2	186.0
42	1023	-29.20	0.00	-402.34	-1153.3	24268.3	80.3
43	1024	-29.20	0.00	-472.03	-1364.8	28841.2	80.3
44	1031	64.04	0.00	-437.18	-1259.0	38394.2	-186.0
45	1032	-5.65	0.00	-437.18	-1259.0	29857.1	25.5
46	1033	29.20	0.00	-402.34	-1153.3	31839.2	-80.3
47	1034	29.20	0.00	-472.03	-1364.8	36412.1	-80.3
48	1041	34.85	-29.20	-437.18	2526.4	34608.8	-1994.3
49	1042	-34.85	-29.20	-437.18	2526.4	26071.7	-1782.8
50	1043	-0.00	-29.20	-402.34	2632.2	28053.8	-1888.5
51	1044	-0.00	-29.20	-472.03	2420.7	32626.7	-1888.5
52	1051	34.85	29.20	-437.18	-5044.5	34608.8	1782.8
53	1052	-34.85	29.20	-437.18	-5044.5	26071.7	1994.3
54	1053	-0.00	29.20	-402.34	-4938.7	28053.8	1888.5
55	1054	-0.00	29.20	-472.03	-5150.3	32626.7	1888.5
56	2001	34.85	0.00	-413.57	-1184.4	33059.2	-105.8
57	2002	-34.85	0.00	-413.57	-1184.4	24522.1	105.8
58	2003	-0.00	0.00	-378.72	-1078.6	26504.2	0.0
59	2004	-0.00	0.00	-448.41	-1290.1	31077.1	0.0
60	2005	34.85	0.00	-413.57	-1184.5	33059.2	-105.7
61	2006	-34.85	0.00	-413.57	-1184.5	24522.1	105.8
62	2007	-0.00	0.00	-378.72	-1078.8	26504.2	0.1
63	2008	-0.00	0.00	-448.41	-1290.3	31077.1	0.1
64	2011	34.85	0.00	-413.57	-1184.6	33059.2	-105.6
65	2012	-34.85	0.00	-413.57	-1184.6	24522.1	105.9
66	2013	-0.00	0.00	-378.72	-1078.8	26504.2	0.1
67	2014	-0.00	0.00	-448.41	-1290.3	31077.1	0.1
68	2015	34.85	0.00	-413.57	-1184.5	33059.2	-105.7
69	2016	-34.85	0.00	-413.57	-1184.5	24522.1	105.8
70	2017	-0.00	0.00	-378.72	-1078.8	26504.2	0.1
71	2018	-0.00	0.00	-448.41	-1290.3	31077.1	0.1
72	2021	34.85	0.00	-413.57	-1184.4	33059.2	-105.8
73	2022	-34.85	0.00	-413.57	-1184.4	24522.1	105.8

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	Fx	Fy	Fz	Mx	My	Mz
		(KIPS)	(KIPS)	(KIPS)	(FT-KIPS)	(FT-KIPS)	(FT-KIPS)

74	2023	-0.00	0.00	-378.72	-1078.6	26504.2	0.0
75	2024	-0.00	0.00	-448.41	-1290.1	31077.1	0.0
76	2025	34.85	-0.00	-413.57	-1184.2	33059.2	-105.8
77	2026	-34.85	-0.00	-413.57	-1184.2	24522.1	105.7
78	2027	-0.00	-0.00	-378.72	-1078.5	26504.2	-0.1
79	2028	-0.00	-0.00	-448.41	-1290.0	31077.1	-0.1
80	2031	34.85	-0.00	-413.57	-1184.2	33059.2	-105.9
81	2032	-34.85	-0.00	-413.57	-1184.2	24522.1	105.6
82	2033	-0.00	-0.00	-378.72	-1078.4	26504.2	-0.1
83	2034	-0.00	-0.00	-448.41	-1289.9	31077.1	-0.1
84	2035	34.85	-0.00	-413.57	-1184.2	33059.2	-105.8
85	2036	-34.85	-0.00	-413.57	-1184.2	24522.1	105.7
86	2037	-0.00	-0.00	-378.72	-1078.5	26504.2	-0.1
87	2038	-0.00	-0.00	-448.41	-1290.0	31077.1	-0.1
88	4001	5.65	0.00	-437.18	-1259.0	30823.3	-25.5
89	4002	-64.04	0.00	-437.18	-1259.0	22286.2	186.0
90	4003	-29.20	0.00	-402.34	-1153.3	24268.3	80.3
91	4004	-29.20	0.00	-472.03	-1364.8	28841.2	80.3
92	4005	5.65	0.00	-437.18	-1259.1	30823.3	-25.5
93	4006	-64.04	0.00	-437.18	-1259.1	22286.2	186.1
94	4007	-29.20	0.00	-402.34	-1153.3	24268.3	80.3
95	4008	-29.20	0.00	-472.03	-1364.9	28841.2	80.3
96	4011	5.65	0.00	-437.18	-1259.1	30823.3	-25.4
97	4012	-64.04	0.00	-437.18	-1259.1	22286.2	186.1
98	4013	-29.20	0.00	-402.34	-1153.4	24268.3	80.3
99	4014	-29.20	0.00	-472.03	-1364.9	28841.2	80.3
100	4015	5.65	0.00	-437.18	-1259.1	30823.3	-25.5
101	4016	-64.04	0.00	-437.18	-1259.1	22286.2	186.1
102	4017	-29.20	0.00	-402.34	-1153.3	24268.3	80.3
103	4018	-29.20	0.00	-472.03	-1364.9	28841.2	80.3
104	4021	5.65	0.00	-437.18	-1259.0	30823.3	-25.5
105	4022	-64.04	0.00	-437.18	-1259.0	22286.2	186.0
106	4023	-29.20	0.00	-402.34	-1153.3	24268.3	80.3
107	4024	-29.20	0.00	-472.03	-1364.8	28841.2	80.3
108	4025	5.65	-0.00	-437.18	-1259.0	30823.3	-25.5
109	4026	-64.04	-0.00	-437.18	-1259.0	22286.2	186.0
110	4027	-29.20	-0.00	-402.34	-1153.2	24268.3	80.2
111	4028	-29.20	-0.00	-472.03	-1364.7	28841.2	80.2
112	4031	5.65	-0.00	-437.18	-1259.0	30823.3	-25.5
113	4032	-64.04	-0.00	-437.18	-1259.0	22286.2	186.0
114	4033	-29.20	-0.00	-402.34	-1153.2	24268.3	80.2
115	4034	-29.20	-0.00	-472.03	-1364.7	28841.2	80.2
116	4035	5.65	-0.00	-437.18	-1259.0	30823.3	-25.5
117	4036	-64.04	-0.00	-437.18	-1259.0	22286.2	186.0
118	4037	-29.20	-0.00	-402.34	-1153.2	24268.3	80.2

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KIPS)	FY (KIPS)	FZ (KIPS)	MX (FT-KIPS)	MY (FT-KIPS)	MZ (FT-KIPS)
119	4038	-29.20	-0.00	-472.03	-1364.7	28841.2	80.2
120	4101	64.04	0.00	-437.18	-1259.0	38394.2	-186.0
121	4102	-5.65	0.00	-437.18	-1259.0	29857.1	25.5
122	4103	29.20	0.00	-402.34	-1153.3	31839.2	-80.3
123	4104	29.20	0.00	-472.03	-1364.8	36412.1	-80.3
124	4105	64.04	0.00	-437.18	-1259.1	38394.2	-186.0
125	4106	-5.65	0.00	-437.18	-1259.1	29857.1	25.5
126	4107	29.20	0.00	-402.34	-1153.3	31839.2	-80.2
127	4108	29.20	0.00	-472.03	-1364.9	36412.1	-80.2
128	4111	64.04	0.00	-437.18	-1259.1	38394.2	-186.0
129	4112	-5.65	0.00	-437.18	-1259.1	29857.1	25.5
130	4113	29.20	0.00	-402.34	-1153.4	31839.2	-80.2
131	4114	29.20	0.00	-472.03	-1364.9	36412.1	-80.2
132	4115	64.04	0.00	-437.18	-1259.1	38394.2	-186.0
133	4116	-5.65	0.00	-437.18	-1259.1	29857.1	25.5
134	4117	29.20	0.00	-402.34	-1153.3	31839.2	-80.2
135	4118	29.20	0.00	-472.03	-1364.9	36412.1	-80.2
136	4121	64.04	0.00	-437.18	-1259.0	38394.2	-186.0
137	4122	-5.65	0.00	-437.18	-1259.0	29857.1	25.5
138	4123	29.20	0.00	-402.34	-1153.3	31839.2	-80.3
139	4124	29.20	0.00	-472.03	-1364.8	36412.1	-80.3
140	4125	64.04	-0.00	-437.18	-1259.0	38394.2	-186.1
141	4126	-5.65	-0.00	-437.18	-1259.0	29857.1	25.5
142	4127	29.20	-0.00	-402.34	-1153.2	31839.2	-80.3
143	4128	29.20	-0.00	-472.03	-1364.7	36412.1	-80.3
144	4131	64.04	-0.00	-437.18	-1259.0	38394.2	-186.1
145	4132	-5.65	-0.00	-437.18	-1259.0	29857.1	25.4
146	4133	29.20	-0.00	-402.34	-1153.2	31839.2	-80.3
147	4134	29.20	-0.00	-472.03	-1364.7	36412.1	-80.3
148	4135	64.04	-0.00	-437.18	-1259.0	38394.2	-186.1
149	4136	-5.65	-0.00	-437.18	-1259.0	29857.1	25.5
150	4137	29.20	-0.00	-402.34	-1153.2	31839.2	-80.3
151	4138	29.20	-0.00	-472.03	-1364.7	36412.1	-80.3
152	4201	34.85	-29.20	-437.18	2526.4	34608.8	-1994.3
153	4202	-34.85	-29.20	-437.18	2526.4	26071.7	-1782.8
154	4203	-0.00	-29.20	-402.34	2632.2	28053.8	-1888.5
155	4204	-0.00	-29.20	-472.03	2420.7	32626.7	-1888.5

156	4205	34.85	-29.20	-437.18	2526.4	34608.8	-1994.3
157	4206	-34.85	-29.20	-437.18	2526.4	26071.7	-1782.7
158	4207	-0.00	-29.20	-402.34	2632.1	28053.8	-1888.5
159	4208	-0.00	-29.20	-472.03	2420.6	32626.7	-1888.5
160	4211	34.85	-29.20	-437.18	2526.3	34608.8	-1994.2
161	4212	-34.85	-29.20	-437.18	2526.3	26071.7	-1782.7
162	4213	-0.00	-29.20	-402.34	2632.1	28053.8	-1888.5
163	4214	-0.00	-29.20	-472.03	2420.6	32626.7	-1888.5

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KIPS)	FY (KIPS)	FZ (KIPS)	MX (FT-KIPS)	MY (FT-KIPS)	MZ (FT-KIPS)
164	4215	34.85	-29.20	-437.18	2526.4	34608.8	-1994.3
165	4216	-34.85	-29.20	-437.18	2526.4	26071.7	-1782.7
166	4217	-0.00	-29.20	-402.34	2632.1	28053.8	-1888.5
167	4218	-0.00	-29.20	-472.03	2420.6	32626.7	-1888.5
168	4221	34.85	-29.20	-437.18	2526.4	34608.8	-1994.3
169	4222	-34.85	-29.20	-437.18	2526.4	26071.7	-1782.8
170	4223	-0.00	-29.20	-402.34	2632.2	28053.8	-1888.5
171	4224	-0.00	-29.20	-472.03	2420.7	32626.7	-1888.5
172	4225	34.85	-29.20	-437.18	2526.5	34608.8	-1994.3
173	4226	-34.85	-29.20	-437.18	2526.5	26071.7	-1782.8
174	4227	-0.00	-29.20	-402.34	2632.2	28053.8	-1888.6
175	4228	-0.00	-29.20	-472.03	2420.7	32626.7	-1888.6
176	4231	34.85	-29.20	-437.18	2526.5	34608.8	-1994.3
177	4232	-34.85	-29.20	-437.18	2526.5	26071.7	-1782.8
178	4233	-0.00	-29.20	-402.34	2632.2	28053.8	-1888.6
179	4234	-0.00	-29.20	-472.03	2420.7	32626.7	-1888.6
180	4235	34.85	-29.20	-437.18	2526.5	34608.8	-1994.3
181	4236	-34.85	-29.20	-437.18	2526.5	26071.7	-1782.8
182	4237	-0.00	-29.20	-402.34	2632.2	28053.8	-1888.6
183	4238	-0.00	-29.20	-472.03	2420.7	32626.7	-1888.6
184	4301	34.85	29.20	-437.18	-5044.5	34608.8	1782.8
185	4302	-34.85	29.20	-437.18	-5044.5	26071.7	1994.3
186	4303	-0.00	29.20	-402.34	-4938.7	28053.8	1888.5
187	4304	-0.00	29.20	-472.03	-5150.3	32626.7	1888.5
188	4305	34.85	29.20	-437.18	-5044.6	34608.8	1782.8
189	4306	-34.85	29.20	-437.18	-5044.6	26071.7	1994.3
190	4307	-0.00	29.20	-402.34	-4938.8	28053.8	1888.6
191	4308	-0.00	29.20	-472.03	-5150.3	32626.7	1888.6
192	4311	34.85	29.20	-437.18	-5044.6	34608.8	1782.8
193	4312	-34.85	29.20	-437.18	-5044.6	26071.7	1994.3
194	4313	-0.00	29.20	-402.34	-4938.8	28053.8	1888.6
195	4314	-0.00	29.20	-472.03	-5150.3	32626.7	1888.6
196	4315	34.85	29.20	-437.18	-5044.6	34608.8	1782.8
197	4316	-34.85	29.20	-437.18	-5044.6	26071.7	1994.3
198	4317	-0.00	29.20	-402.34	-4938.8	28053.8	1888.6
199	4318	-0.00	29.20	-472.03	-5150.3	32626.7	1888.6
200	4321	34.85	29.20	-437.18	-5044.5	34608.8	1782.8
201	4322	-34.85	29.20	-437.18	-5044.5	26071.7	1994.3
202	4323	-0.00	29.20	-402.34	-4938.7	28053.8	1888.5
203	4324	-0.00	29.20	-472.03	-5150.3	32626.7	1888.5
204	4325	34.85	29.20	-437.18	-5044.4	34608.8	1782.7
205	4326	-34.85	29.20	-437.18	-5044.4	26071.7	1994.3
206	4327	-0.00	29.20	-402.34	-4938.7	28053.8	1888.5
207	4328	-0.00	29.20	-472.03	-5150.2	32626.7	1888.5
208	4331	34.85	29.20	-437.18	-5044.4	34608.8	1782.7

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KIPS)	FY (KIPS)	FZ (KIPS)	MX (FT-KIPS)	MY (FT-KIPS)	MZ (FT-KIPS)
209	4332	-34.85	29.20	-437.18	-5044.4	26071.7	1994.2
210	4333	-0.00	29.20	-402.34	-4938.7	28053.8	1888.5
211	4334	-0.00	29.20	-472.03	-5150.2	32626.7	1888.5
212	4335	34.85	29.20	-437.18	-5044.4	34608.8	1782.7
213	4336	-34.85	29.20	-437.18	-5044.4	26071.7	1994.3
214	4337	-0.00	29.20	-402.34	-4938.7	28053.8	1888.5
215	4338	-0.00	29.20	-472.03	-5150.2	32626.7	1888.5

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Company  
DATE 23-SEP-2025 TIME 12:06:15

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*  
RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE X (KIPS)	FORCE Y (FT)	FORCE Z (FT)

SACS (2025)

Company: Company  
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LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)
46	1033	29.20	64.68	2.75	69.65	0.00				-402.34	69.73	2.87	69.64
47	1034	29.20	64.68	2.75	69.65	0.00				-472.03	69.12	2.89	68.59
48	1041	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
49	1042	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
50	1043	-0.00				-29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
51	1044	-0.00				-29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
52	1051	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
53	1052	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
54	1053	-0.00				29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
55	1054	-0.00				29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
56	2001	34.85	65.62	3.03	62.50	0.00				-413.57	69.62	2.86	69.14
57	2002	-34.85	65.62	3.03	62.50	0.00				-413.57	69.62	2.86	69.14
58	2003	-0.00				0.00				-378.72	69.98	2.85	69.75
59	2004	-0.00				0.00				-448.41	69.30	2.88	68.63
60	2005	34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-413.57	69.62	2.86	69.14
61	2006	-34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-413.57	69.62	2.86	69.14
62	2007	-0.00				0.00	65.62	6.07	64.52	-378.72	69.98	2.85	69.75
63	2008	-0.00				0.00	65.62	6.07	64.52	-448.41	69.30	2.88	68.63
64	2011	34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-413.57	69.62	2.86	69.14
65	2012	-34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-413.57	69.62	2.86	69.14
66	2013	-0.00				0.00	65.62	6.07	64.52	-378.72	69.98	2.85	69.75
67	2014	-0.00				0.00	65.62	6.07	64.52	-448.41	69.30	2.88	68.63
68	2015	34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-413.57	69.62	2.86	69.14
69	2016	-34.85	65.62	3.03	62.50	0.00	65.62	6.07	64.52	-413.57	69.62	2.86	69.14
70	2017	-0.00				0.00	65.62	6.07	64.52	-378.72	69.98	2.85	69.75
71	2018	-0.00				0.00	65.62	6.07	64.52	-448.41	69.30	2.88	68.63
72	2021	34.85	65.62	3.03	62.50	0.00				-413.57	69.62	2.86	69.14
73	2022	-34.85	65.62	3.03	62.50	0.00				-413.57	69.62	2.86	69.14
74	2023	-0.00				0.00				-378.72	69.98	2.85	69.75
75	2024	-0.00				0.00				-448.41	69.30	2.88	68.63
76	2025	34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-413.57	69.62	2.86	69.14
77	2026	-34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-4			

83	2034	-0.00				-0.00	65.62	0.00	64.52	-448.41	69.30	2.88	68.63
84	2035	34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-413.57	69.62	2.86	69.14
85	2036	-34.85	65.62	3.03	62.50	-0.00	65.62	0.00	64.52	-413.57	69.62	2.86	69.14
86	2037	-0.00				-0.00	65.62	0.00	64.52	-378.72	69.98	2.85	69.75
87	2038	-0.00				-0.00	65.62	0.00	64.52	-448.41	69.30	2.88	68.63
88	4001	5.65	70.47	4.51	25.55	0.00				-437.18	69.40	2.88	69.07
89	4002	-64.04	65.19	2.90	65.76	0.00				-437.18	69.40	2.88	69.07
90	4003	-29.20	64.68	2.75	69.65	0.00				-402.34	69.73	2.87	69.64

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
***** Y - DIRECTION *****													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****									
		FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)
91	4004	-29.20	64.68	2.75	69.65	0.00				-472.03	69.12	2.89	68.59
92	4005	5.65	70.47	4.51	25.55	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
93	4006	-64.04	65.19	2.90	65.76	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
94	4007	-29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-402.34	69.73	2.87	69.64
95	4008	-29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-472.03	69.12	2.89	68.59
96	4011	5.65	70.47	4.51	25.55	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
97	4012	-64.04	65.19	2.90	65.76	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
98	4013	-29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-402.34	69.73	2.87	69.64
99	4014	-29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-472.03	69.12	2.89	68.59
100	4015	5.65	70.47	4.51	25.55	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
101	4016	-64.04	65.19	2.90	65.76	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
102	4017	-29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-402.34	69.73	2.87	69.64
103	4018	-29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-472.03	69.12	2.89	68.59
104	4021	5.65	70.47	4.51	25.55	0.00				-437.18	69.40	2.88	69.07
105	4022	-64.04	65.19	2.90	65.76	0.00				-437.18	69.40	2.88	69.07
106	4023	-29.20	64.68	2.75	69.65	0.00				-402.34	69.73	2.87	69.64
107	4024	-29.20	64.68	2.75	69.65	0.00				-472.03	69.12	2.89	68.59
108	4025	5.65	70.47	4.51	25.55	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
109	4026	-64.04	65.19	2.90	65.76	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
110	4027	-29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-402.34	69.73	2.87	69.64
111	4028	-29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-472.03	69.12	2.89	68.59
112	4031	5.65	70.47	4.51	25.55	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
113	4032	-64.04	65.19	2.90	65.76	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
114	4033	-29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-402.34	69.73	2.87	69.64
115	4034	-29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-472.03	69.12	2.89	68.59
116	4035	5.65	70.47	4.51	25.55	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
117	4036	-64.04	65.19	2.90	65.76	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
118	4037	-29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-402.34	69.73	2.87	69.64
119	4038	-29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-472.03	69.12	2.89	68.59
120	4101	64.04	65.19	2.90	65.76	0.00				-437.18	69.40	2.88	69.07
121	4102	-5.65	70.47	4.51	25.55	0.00				-437.18	69.40	2.88	69.07
122	4103	29.20	64.68	2.75	69.65	0.00				-402.34	69.73	2.87	69.64
123	4104	29.20	64.68	2.75	69.65	0.00				-472.03	69.12	2.89	68.59
124	4105	64.04	65.19	2.90	65.76	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
125	4106	-5.65	70.47	4.51	25.55	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
126	4107	29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-402.34	69.73	2.87	69.64
127	4108	29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-472.03	69.12	2.89	68.59
128	4111	64.04	65.19	2.90	65.76	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
129	4112	-5.65	70.47	4.51	25.55	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
130	4113	29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-402.34	69.73	2.87	69.64
131	4114	29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-472.03	69.12	2.89	68.59
132	4115	64.04	65.19	2.90	65.76	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
133	4116	-5.65	70.47	4.51	25.55	0.00	65.62	6.07	64.52	-437.18	69.40	2.88	69.07
134	4117	29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-402.34	69.73	2.87	69.64
135	4118	29.20	64.68	2.75	69.65	0.00	65.62	6.07	64.52	-472.03	69.12	2.89	68.59

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
***** Y - DIRECTION *****													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****									
		FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)
136	4121	64.04	65.19	2.90	65.76	0.00				-437.18	69.40	2.88	69.07
137	4122	-5.65	70.47	4.51	25.55	0.00				-437.18	69.40	2.88	69.07
138	4123	29.20	64.68	2.75	69.65	0.00				-402.34	69.73	2.87	69.64
139	4124	29.20	64.68	2.75	69.65	0.00				-472.03	69.12	2.89	68.59
140	4125	64.04	65.19	2.90	65.76	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
141	4126	-5.65	70.47	4.51	25.55	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
142	4127	29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-402.34	69.73	2.87	69.64
143	4128	29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-472.03	69.12	2.89	68.59
144	4131	64.04	65.19	2.90	65.76	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
145	4132	-5.65	70.47	4.51	25.55	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
146	4133	29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-402.34	69.73	2.87	69.64
147	4134	29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-472.03	69.12	2.89	68.59
148	4135	64.04	65.19	2.90	65.76	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
149	4136	-5.65	70.47	4.51	25.55	-0.00	65.62	0.00	64.52	-437.18	69.40	2.88	69.07
150	4137	29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-402.34	69.73	2.87	69.64
151	4138	29.20	64.68	2.75	69.65	-0.00	65.62	0.00	64.52	-472.03	69.12	2.89	68.59
152	4201	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
153	4202	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07

154	4203	-0.00				-29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
155	4204	-0.00				-29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
156	4205	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
157	4206	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
158	4207	-0.00				-29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
159	4208	-0.00				-29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
160	4211	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
161	4212	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
162	4213	-0.00				-29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
163	4214	-0.00				-29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
164	4215	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
165	4216	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
166	4217	-0.00				-29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
167	4218	-0.00				-29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
168	4221	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
169	4222	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
170	4223	-0.00				-29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
171	4224	-0.00				-29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
172	4225	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
173	4226	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
174	4227	-0.00				-29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
175	4228	-0.00				-29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
176	4231	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.64	-437.18	69.40	2.88	69.07
177	4232	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.64	-437.18	69.40	2.88	69.07
178	4233	-0.00				-29.20	64.68	2.75	69.64	-402.34	69.73	2.87	69.64
179	4234	-0.00				-29.20	64.68	2.75	69.64	-472.03	69.12	2.89	68.59
180	4235	34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)	FORCE (KIPS)	X (FT)	Y (FT)	Z (FT)
181	4236	-34.85	65.62	3.03	62.50	-29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
182	4237	-0.00				-29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
183	4238	-0.00				-29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
184	4301	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
185	4302	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
186	4303	-0.00				29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
187	4304	-0.00				29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
188	4305	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
189	4306	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
190	4307	-0.00				29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
191	4308	-0.00				29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
192	4311	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.64	-437.18	69.40	2.88	69.07
193	4312	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.64	-437.18	69.40	2.88	69.07
194	4313	-0.00				29.20	64.68	2.75	69.64	-402.34	69.73	2.87	69.64
195	4314	-0.00				29.20	64.68	2.75	69.64	-472.03	69.12	2.89	68.59
196	4315	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
197	4316	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
198	4317	-0.00				29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
199	4318	-0.00				29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
200	4321	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
201	4322	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
202	4323	-0.00				29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
203	4324	-0.00				29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
204	4325	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
205	4326	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
206	4327	-0.00				29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
207	4328	-0.00				29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
208	4331	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
209	4332	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
210	4333	-0.00				29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
211	4334	-0.00				29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59
212	4335	34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
213	4336	-34.85	65.62	3.03	62.50	29.20	64.68	2.75	69.65	-437.18	69.40	2.88	69.07
214	4337	-0.00				29.20	64.68	2.75	69.65	-402.34	69.73	2.87	69.64
215	4338	-0.00				29.20	64.68	2.75	69.65	-472.03	69.12	2.89	68.59



## 6.1 Member Unity Check Result

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

### 6.1a AS-IS CONDITION

#### Member Unity Check Result

Member	Group ID	Load Case	UC
0000-0001	BCA	4311	1.175
0001-0172	BCA	4311	1.145
0002-0173	BCA	4311	1.227
0003-0174	BCA	4311	1.095
0004-0175	BCA	4311	1.157
0020-0021	BCA	4231	1.276
0173-0003	BCA	4311	1.039
0175-0005	BCA	4311	1.061
0005-0176	BCB	4311	1.213
0006-0177	BCB	4311	1.005
0176-0006	BCB	4111	1.143
0039-0030	EBD	4332	1.008
0020-0031	EBE	4312	1.921
0000-0011	WBA	4232	1.89
0019-0010	WBD	4212	1.058
0084-0120	WWP	1002	1.524
0084-0188	WWP	4311	3.472
0085-0147	WWP	1002	1.524
0086-0192	WWP	4311	2.954
0088-0122	WWP	1002	1.524
0088-0193	WWP	4231	2.87
0089-0149	WWP	1002	1.524
0090-0194	WWP	4231	1.682
0092-0124	WWP	1002	1.524
0092-0195	WWP	4231	1.248
0093-0151	WWP	1002	1.524
0094-0196	WWP	4311	1.511
0096-0126	WWP	1002	1.524
0096-0197	WWP	4311	2.544
0097-0153	WWP	1002	1.524
0098-0198	WWP	4311	2.884
0100-0128	WWP	1002	1.524
0100-0199	WWP	4311	3.309
0101-0155	WWP	1002	1.524
0188-0191	WWP	4311	1.372
0191-0085	WWP	4231	3.559
0192-0200	WWP	4311	1.07

Member	Group ID	Load Case	UC
0200-0087	WWP	4231	2.626
0201-0089	WWP	4311	2.865
0202-0091	WWP	4311	1.798
0203-0093	WWP	4311	1.346
0204-0095	WWP	4231	1.356
0205-0097	WWP	4231	2.515
0206-0101	WWP	4231	3.336
0207-0099	WWP	4231	2.781
0188-0192	WWS	4305	1.509
0191-0200	WWS	4231	1.872
0192-0193	WWS	4311	1.807
0193-0194	WWS	4305	1.292
0194-0195	WWS	1051	1.223
0195-0196	WWS	4311	1.183
0196-0197	WWS	4305	1.276
0197-0198	WWS	1031	1.758
0198-0199	WWS	1031	1.508
0200-0201	WWS	1041	1.484
0201-0202	WWS	1031	1.33
0202-0203	WWS	4305	1.158
0203-0204	WWS	4225	1.137
0204-0205	WWS	1041	1.316
0205-0207	WWS	1041	1.475
0207-0206	WWS	4131	1.886

#### 6.1b AFTER STRENGTHENING

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

##### Member Unity Check Result

Member	Group ID	Load Case	UC	Remarks
0020-0031	WBX	4312	1.012	Member UC increased marginally during extreme condition.

#### 6.2 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum Vertical Deflection (cm)	Remarks
1.	0005	1.8	Allowable Deflection = (4000 / 400) = 10.00 cm
2.	0024	1.8	

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	0005	0.8	Allowable Deflection = (4000 / 500) = 8.00 cm
2.	0024	0.8	

Vertical and Horizontal Deflection of bridge are under control.

### 6.3 Reaction Summary

Following is the reaction summary of the bridge supports.

#### Summary of Bridge Reaction

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	0000	328.355	-29.497	-146.245
2.	0020	-328.355	3.258	-127.593
3.	0010	0	0	-117.931
4.	0030	0	0	-114.569

## 7.0 CONCLUSION

The analysis of bridge has been carried out considering the piping, electrical & instrumentation cable tray and wind loads. Based on the results, the necessary strengthening requirements, as outlined in Clause 4.0, have been recommended. With the implementation of these strengthening measures of the top chord, bottom chord, and associated framing members, the bridge is found to be structurally adequate and safe under all load combinations.

Also, functionally the deflection is under the limits. The adequacy of the bridge landing locations, adequacy of deck members are performed separately.

It is also recommended that no additional structural loading/modifications shall be carried out on SC1-SCA bridge without adequate structural analysis.

**ANNEXURE-1**  
**LOAD CALCULATIONS**

## WIND LOAD:

S.No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulence Intensity at height "z"	t <sub>o</sub>	t	Design Wind Speed at Height "z"	
			U <sub>o</sub>			z		U(z)	Iu(z)			u(z,t)	
			kmph	ft/sec		m	ft	ft/sec				ft/sec	m/sec
1	Extreme	0	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
2	Extreme	45	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
3	Extreme	90	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
4	Extreme	135	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
5	Extreme	180	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
6	Extreme	225	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
7	Extreme	270	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
8	Extreme	315	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
1	Operating	All	99.22	90.40	0.130	10.00	32.80	90.40	0.131	3600	3	124.84	38.06

## CABLE LOAD & CABLE TRAY LOAD:

CABLE TRAY LOADING													
BOTTOM TIER							SIDE TIER						
750 Tray							450 Tray						
Tray load		36 Kg/3m			12 Kg/m		Tray load		21.85 Kg/3m			7.283333 Kg/m	
16 nos	16 run 3.5CX120 SQ. MM	4617 kg/km	4.617 Kg/m		73.872 Kg/m		2Nos+2Nos	2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM	162 kg/km	1.024 Kg/m		2.048 Kg/m	
450 Tray							300 Tray						
Tray load		21.85 Kg/3m			7.283333 Kg/m		Tray load		7.7 Kg/3m			2.566667 Kg/m	
2Nos+2Nos	2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM	162 kg/km	1.024 Kg/m		2.048 Kg/m		2Nos+2Nos	2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM	162 kg/km	1.024 Kg/m		2.048 Kg/m	
150 Tray							150 Tray						
Tray load		5 Kg/3m			5 Kg/m		Tray load		5 Kg/3m			3.333333 Kg/m	
2Nos+2Nos	2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM	162 kg/km	0.512 Kg/m		3.072 Kg/m		2Nos+2Nos	2 run 3C X2.5 SQ. MM+2 run 4CX16 SQ. MM	162 kg/km	0.512 Kg/m		2.048 Kg/m	
					103.2753 Kg/m <sup>2</sup>							19.32733 Kg/m	
				UDL	2.926134 Kn/m						Point Load	0.821412 Kn	

## GRATING LOAD

Grating load of 50 kg/m<sup>2</sup> is considered

## HANDRAIL LOAD

Handrail Load of 50Kg/m is considered.

# Piping Loads for SC1 to SCA Bridge

Piping Loads for SC1 to SCA Bridge														
Sr. No.	Piping Diameter	Schedule	Unit Weight	Wt with Water / m	EMPTY, kn					Operatng, kn				
					L1 - 4.25	L2-(8.5+2.5*2)	L3-4.25+3.15	L4-4.25+3.60	L5=4.25+5.7	L1 - 4.25	L2-(8.5+2.5*2)	L3-4.25+3.15	L4-4.25+3.60	L5=4.25+5.7
1	219	STD	42.55	74.81	1.81						3.18			
2	324	STD	73.86	146.76	3.14						6.24			
3	219	STD	42.55	74.81	1.81						3.18			
4	273	STD	60.29	111.11		8.14					15.00			
5	457	STD	105.17	255.72	4.47		7.78				10.87		18.92	
6	457	STD	105.17	255.72	4.47		7.78				10.87		18.92	
Extra	324	STD	73.86	146.76	3.14						6.24			
7	273	STD	60.29	111.11				4.73	6.00				8.72	11.06
8	273	STD	60.29	111.11				4.73	6.00				8.72	11.06
9	Less than 219 Dia		Load of 2Kn/m2	(Load in Kn/m)	8.50	Kn/m					8.50	Kn/m		



## **BRIDGE REPORT FOR REFURBISHMENT / REPLACEMENT OF BRIDGES IN MH ASSET (WIN-NC BRIDGE)**

**PROJECT :** ENGINEERING / TECHNICAL CONSULTANCY  
 SERVICES FOR PREPERATION OF EXECUTION  
 METHODOLOGY, SOW AND COST ESTIMATES  
 FOR REPLACEMENT /REFURBISHMENT OF  
 BRIDGES IN MH ASSET

**LOCATION:** MH ASSET (NORTH AND SOUTH FIELD)

**OWNER :** ONGC, MUMBAI

**JOB NO :** B774

0	06-10-2025	ISSUED AS STUDY	AMS	DP	CS
<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>

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## Symbols and Abbreviations

### Organisations – India

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### Other abbreviations

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge

## 1.0 INTRODUCTION

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges have deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## 2.0 GENERAL

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### **IC Complex:**

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### **BHS Complex:**

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### **NQO Complex:**

7. NQO-NQD Bridge

### **WIN Complex:**

8. WIN-NC Bridge

### **ADDITIONAL BRIDGES:**

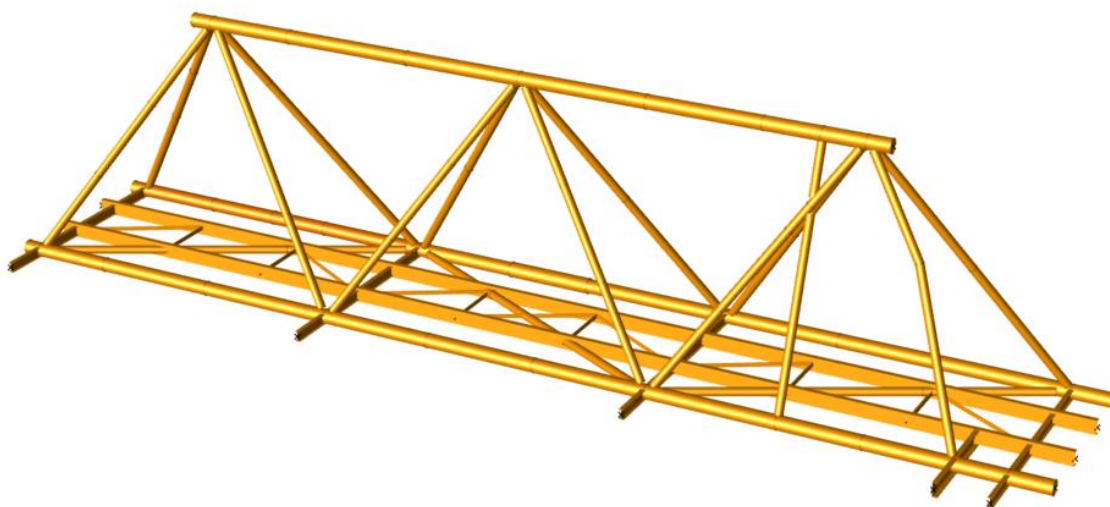
9. SC1-SCA Bridge
10. SCA-SCF Bridge
11. ICP-ICD Bridge

### 3.0 WIN-NC BRIDGE DESCRIPTION

Approximate length of bridge is measured from 3D model as 18.3m. Hence, 18.3m length of bridge is modelled in SACS conservatively.

Length of Bridge	18.3 m
Support Condition	Fixed: 111000, 11100, (WIN Side) Sliding: 011000, 011000 (NC Side)
No. of directions for environmental loads	8
Wind Speed (3 Sec Gust)	61.78 m/s for extreme and 38.06 m/s for Operating.
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	50/36 ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

ISOMETRIC VIEW OF **WIN-NC Bridge** is shown in Figure1.



**Figure 1: 3D SACS Model (Original)**

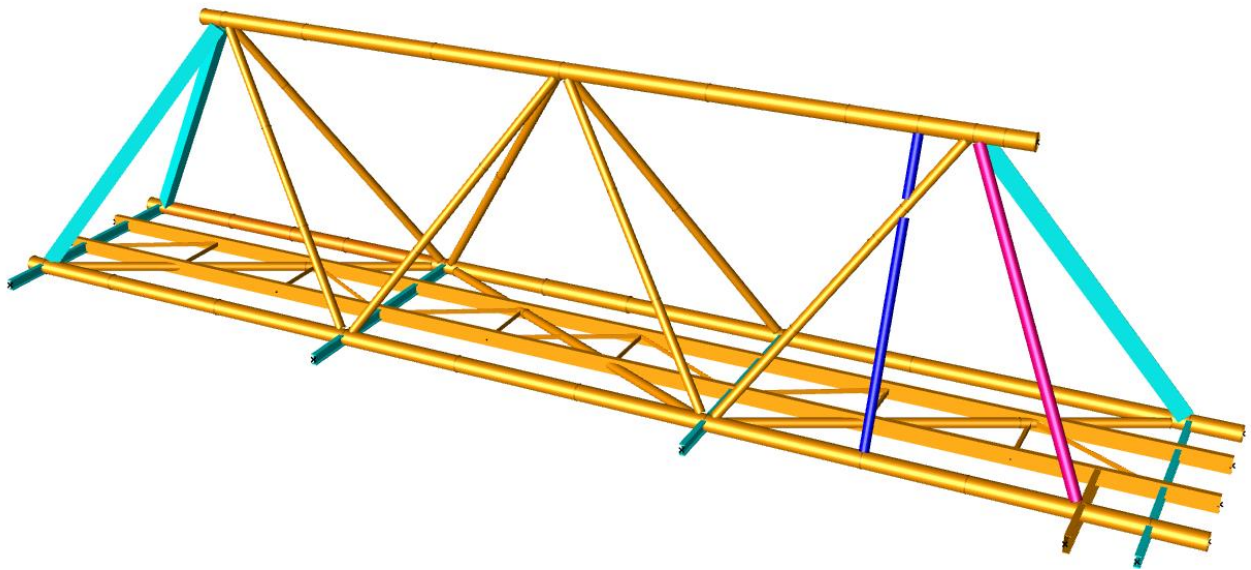


Figure 2: 3D SACS Model (Strengthened)

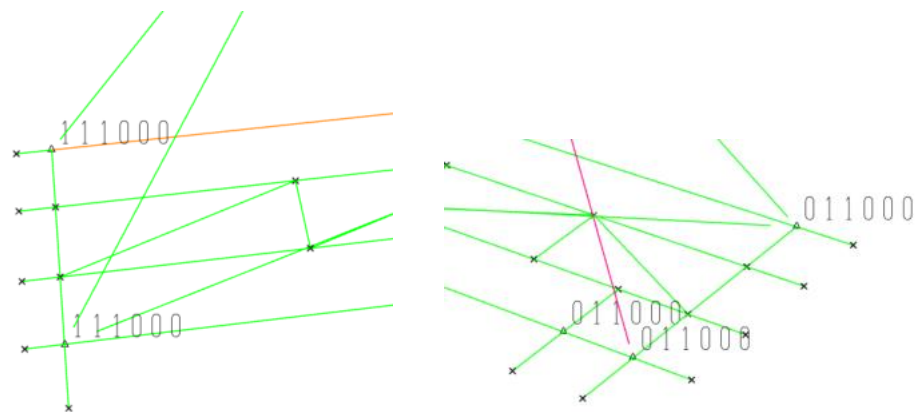
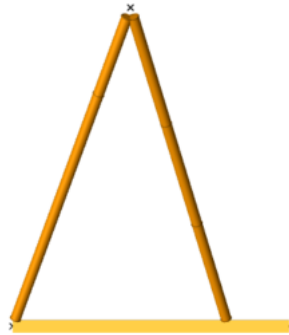


Figure 2: SUPPORT CONDITIONS



**Figure 3: BRIDGE CROSS SECTION**

#### 4.0 PROPOSED STRENGTHENING CONFIGURATION

##### 1. Bottom Chord-

- H175 beam is strengthened by providing 8 thk. Plate along flange on both sides.

##### 2. Inclined Members

###### a) Diagonal member:

- 1 new member (vertical member) (141.3 x 7.1mm)
- 1 new member (vertical member) (168 x 9.5 mm)
- $\Phi 147$ dia. x 6.4mm +12thk wrap plate +2 no's Half cut tubular (101.6dia. x 12.7mm)

The proposed strengthening and replacement works shall also comprise the following:

- Replacement of walkway members, gratings, and handrails.
- Replacement of stairs on both sides.
- Strengthening of supports at fixed and sliding ends.

#### 5.0 LOADING

##### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (KN)
DL	Self-weight, (Contingency - 13%)	60.70
NGDL	Cable tray Cable tray Support	32.31
	Grating Load	
	Handrail Load	
	Monorail, Sheeting Cladding – Nil	
LL	Blanket live load on Walkway (Grating)Area -	49.36
CL	Cable Loading	40.09
PLEM	Piping Load Empty (60% of PLOP)	107.26

PLOP	Piping Load Empty + Operating Contents (By Piping)	170.56
PLTLX	Piping Load Empty + Operating Contents (30% of PLOP)	49.96
PLTLY	Piping Load Empty + Operating Contents (30% of PLOP) Y	49.96
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure
FLX	Bridge Friction Load X (30 % of SW+NGDL+LL+CL+PLOP)	141.94
FLY	Bridge Friction Load Y (30 % of SW+NGDL+LL+CL+PLOP)	141.94

### SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

### NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the Cable tray, cable tray support, grating and handrail loadings.

### LIVE LOAD

Blanket live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1.2 m width of walkway is considered.

### CABLE TRAY AND CABLE LOAD

1. For 600mm cable tray, 5kg/3m load is considered. Cable trays consist of 4 cables (4no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km, 2 no.3.5C x 2.4 m<sup>2</sup> load 8711 kg/km, 2 no.3.5C x 1.2 m<sup>2</sup> load 4617 kg/km, 6 run. 2Px0.15 m<sup>2</sup> of load 585 kg/km, 10 run 2C X 0.4 m<sup>2</sup> of load 403 kg/km)
2. For 400mm cable tray, 5kg/3m load is considered. Cable trays consist of 4 cables (4no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km, 2 no.3.5C x 2.4 m<sup>2</sup> load 8711 kg/km, 2 no.3.5C x 1.2 m<sup>2</sup> load 4617 kg/km, 6 run. 2Px0.15 m<sup>2</sup> of load 585 kg/km, 10 run 2C X 0.4 m<sup>2</sup> of load 403 kg/km)
3. For 95mm cable tray, 5kg/3m load is considered. Cable trays consist of 4 cables (4no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km, 2 no.3.5C x 2.4 m<sup>2</sup> load 8711 kg/km, 2 no.3.5C x 1.2 m<sup>2</sup> load 4617 kg/km, 6 run. 2Px0.15 m<sup>2</sup> of load 585 kg/km, 10 run 2C X 0.4 m<sup>2</sup> of load 403 kg/km)
4. For 55mm cable tray, 5kg/3m load is considered. Cable trays consist of 4 cables (4no.s 3C x 2.5 m<sup>2</sup> with load 162kg/km, 2 no.3.5C x 2.4 m<sup>2</sup> load 8711 kg/km, 2 no.3.5C x 1.2 m<sup>2</sup> load 4617 kg/km, 6 run. 2Px0.15 m<sup>2</sup> of load 585 kg/km, 10 run 2C X 0.4 m<sup>2</sup> of load 403 kg/km)

### WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

## Load Combinations

### Load Combinations

BASIC LOAD COMBINATIONS								
LCOMB	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
PLEM	PLOP	0.60						
1000	DL	1.00	NDGL	1.13	CL	1.00	PLEM	1.00
1001	DL	1.00	NDGL	1.13	CL	1.00	PLOP	1.00
1002	1001	1.00	LL	1.00	MRLL	1.00	PLTX	1.00
1003	1001	1.00	LL	1.00	MRLL	1.00	PLTX	-1.00
1004	1001	1.00	LL	1.00	MRLL	1.00	PLTY	1.00
1005	1001	1.00	LL	1.00	MRLL	1.00	PLTY	-1.00
1011	1001	1.00	FLX	1.00				
1012	1001	1.00	FLX	-1.00				
1013	1001	1.00	FLY	1.00				
1014	1001	1.00	FLY	-1.00				
1021	1002	1.00	FLX	1.00				
1022	1002	1.00	FLX	-1.00				
1023	1002	1.00	FLY	1.00				
1024	1002	1.00	FLY	-1.00				
1031	1003	1.00	FLX	1.00				
1032	1003	1.00	FLX	-1.00				
1033	1003	1.00	FLY	1.00				
1034	1003	1.00	FLY	-1.00				
1041	1004	1.00	FLX	1.00				
1042	1004	1.00	FLX	-1.00				
1043	1004	1.00	FLY	1.00				
1044	1004	1.00	FLY	-1.00				
1051	1005	1.00	FLX	1.00				
1052	1005	1.00	FLX	-1.00				
1053	1005	1.00	FLY	1.00				
1054	1005	1.00	FLY	-1.00				
EXTREME WIND CONDITION								
2001 to 2004	1011 to 1014	1.00	201	1.00				
2005 to 2008	1011 to 1014	1.00	202	1.00				
2011 to 2014	1011 to 1014	1.00	203	1.00				

2015 to 2018	1011 to 1014	1.00	204	1.00				
2021 to 2024	1011 to 1014	1.00	205	1.00				
2025 to 2028	1011 to 1014	1.00	206	1.00				
2031 to 2034	1011 to 1014	1.00	207	1.00				
2035 to 2038	1011 to 1014	1.00	208	1.00				
<b>OPERATING WIND CONDITION</b>								
4001 to 4004	1021 to 1024	1.00	301	1.00				
4005 to 4008	1021 to 1024	1.00	302	1.00				
4011 to 4014	1021 to 1024	1.00	303	1.00				
4015 to 4018	1021 to 1024	1.00	304	1.00				
4021 to 4024	1021 to 1024	1.00	305	1.00				
4025 to 4028	1021 to 1024	1.00	306	1.00				
4031 to 4034	1021 to 1024	1.00	307	1.00				
4035 to 4038	1021 to 1024	1.00	308	1.00				
4101 to 4104	1031 to 1034	1.00	301	1.00				
4105 to 4108	1031 to 1034	1.00	302	1.00				
4111 to 4114	1031 to 1034	1.00	303	1.00				
4115 to 4118	1031 to 1034	1.00	304	1.00				
4121 to 4124	1031 to 1034	1.00	305	1.00				
4125 to 4128	1031 to 1034	1.00	306	1.00				
4131 to 4134	1031 to 1034	1.00	307	1.00				
4135 to 4138	1031 to 1034	1.00	308	1.00				
4201 to 4204	1041 to 1044	1.00	301	1.00				
4205 to 4208	1041 to 1044	1.00	302	1.00				
4211 to 4214	1041 to 1044	1.00	303	1.00				
4215 to 4218	1041 to 1044	1.00	304	1.00				
4221 to 4224	1041 to 1044	1.00	305	1.00				
4225 to 4228	1041 to 1044	1.00	306	1.00				
4231 to 4234	1041 to 1044	1.00	307	1.00				
4235 to 4238	1041 to 1044	1.00	308	1.00				
4301 to 4304	1051 to 1054	1.00	301	1.00				
4305 to 4308	1051 to 1054	1.00	302	1.00				
4311 to 4314	1051 to 1054	1.00	303	1.00				
4315 to 4318	1051 to 1054	1.00	304	1.00				
4321 to 4324	1051 to 1054	1.00	305	1.00				
4325 to 4328	1051 to 1054	1.00	306	1.00				
4331 to 4334	1051 to 1054	1.00	307	1.00				



4335 to 4338	1051 to 1054	1.00	308	1.00				
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## 6.0 RESULTS & SUMMARY

### A. BASIC LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

SACS (2025) \*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\* Company: Company  
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\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	CL	USER GENERATED LOADS
2	DL	USER GENERATED LOADS
3	LL	USER GENERATED LOADS
4	201	WIND
5	202	WIND
6	203	WIND
7	204	WIND
8	205	WIND
9	206	WIND
10	207	WIND
11	208	WIND
12	301	WIND
13	302	WIND
14	303	WIND
15	304	WIND
16	305	WIND
17	306	WIND
18	307	WIND
19	308	WIND
20	FLX	USER GENERATED LOADS
21	FLY	USER GENERATED LOADS
22	HTLP	USER GENERATED LOADS
23	NGDL	USER GENERATED LOADS
24	PLEM	USER GENERATED LOADS
25	PLOP	USER GENERATED LOADS
26	PLTX	USER GENERATED LOADS
27	PLTY	USER GENERATED LOADS

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	CL	0.00	0.00	-40.09	-77.0	355.3	0.0	0.00	0.00
2	DL	0.00	0.00	-60.71	-90.2	590.8	0.0	0.00	0.00
3	LL	0.00	0.00	-49.37	-75.3	466.5	0.0	0.00	0.00
4	201	30.01	-1.59	-0.13	35.5	685.6	-48.0	0.00	0.00
5	202	20.10	279.75	-0.31	-6746.1	463.1	2632.9	0.00	0.00
6	203	-1.59	396.88	-0.31	-9567.8	-30.9	3768.3	0.00	0.00
7	204	-22.00	277.75	-0.13	-6694.1	-498.8	2660.1	0.00	0.00
8	205	-29.56	1.57	0.13	-34.9	-675.5	47.3	0.00	0.00
9	206	-19.81	-275.95	0.31	6654.6	-456.5	-2597.2	0.00	0.00
10	207	1.57	-391.65	0.31	9441.8	30.5	-3718.6	0.00	0.00
11	208	22.36	-282.12	0.13	6799.2	507.2	-2702.0	0.00	0.00
12	301	10.86	-0.58	-0.05	12.9	248.1	-17.4	0.00	0.00
13	302	7.27	100.96	-0.11	-2434.4	167.5	950.2	0.00	0.00
14	303	-0.58	143.25	-0.11	-3453.2	-11.2	1360.2	0.00	0.00
15	304	-7.98	100.50	-0.05	-2422.0	-181.0	962.6	0.00	0.00
16	305	-10.73	0.57	0.05	-12.7	-245.0	17.2	0.00	0.00
17	306	-7.19	-99.82	0.11	2407.0	-165.6	-939.5	0.00	0.00
18	307	0.57	-141.68	0.11	3415.4	11.1	-1345.3	0.00	0.00
19	308	8.09	-101.81	0.05	2453.4	183.5	-975.1	0.00	0.00
20	FLX	141.95	0.00	0.00	0.0	3165.4	-216.5	0.00	0.00
21	FLY	0.00	141.95	0.00	-3165.4	0.0	2640.2	0.00	0.00
22	HTLP	0.00	0.00	-2.39	1.0	22.6	0.0	0.00	0.00
23	NGDL	0.00	0.00	-32.31	-49.8	315.3	0.0	0.00	0.00
24	PLEM	0.00	0.00	-107.21	-170.1	885.6	0.0	0.00	0.00
25	PLOP	0.00	0.00	-170.57	-233.9	1521.6	0.0	0.00	0.00
26	PLTX	-170.57	0.00	0.00	-0.0	-3825.8	233.9	0.00	0.00
27	PLTY	0.00	-170.57	0.00	3825.8	-0.0	-1521.6	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
28	1000	0.00	0.00	-244.52	-393.6	2188.0	0.0
29	1001	0.00	0.00	-307.88	-457.4	2824.0	0.0
30	1002	-51.17	0.00	-357.25	-532.7	2142.8	70.2
31	1003	51.17	0.00	-357.25	-532.7	4438.3	-70.2
32	1004	0.00	-51.17	-357.25	615.0	3290.5	-456.5
33	1005	0.00	51.17	-357.25	-1680.5	3290.5	456.5
34	1011	141.95	0.00	-307.88	-457.4	5989.4	-216.5
35	1012	-141.95	0.00	-307.88	-457.4	-341.5	216.5
36	1013	0.00	141.95	-307.88	-3622.9	2824.0	2640.2
37	1014	0.00	-141.95	-307.88	2708.0	2824.0	-2640.2
38	1021	90.78	0.00	-357.25	-532.7	5308.2	-146.3
39	1022	-193.12	0.00	-357.25	-532.7	-1022.7	286.6
40	1023	-51.17	141.95	-357.25	-3698.2	2142.8	2710.4
41	1024	-51.17	-141.95	-357.25	2632.7	2142.8	-2570.1
42	1031	193.12	0.00	-357.25	-532.7	7603.7	-286.6
43	1032	-90.78	0.00	-357.25	-532.7	1272.8	146.3
44	1033	51.17	141.95	-357.25	-3698.2	4438.3	2570.1
45	1034	51.17	-141.95	-357.25	2632.7	4438.3	-2710.4
46	1041	141.95	-51.17	-357.25	615.0	6455.9	-672.9
47	1042	-141.95	-51.17	-357.25	615.0	125.1	-240.0
48	1043	0.00	90.78	-357.25	-2550.4	3290.5	2183.8
49	1044	0.00	-193.12	-357.25	3780.5	3290.5	-3096.7
50	1051	141.95	51.17	-357.25	-1680.5	6455.9	240.0
51	1052	-141.95	51.17	-357.25	-1680.5	125.1	672.9
52	1053	0.00	193.12	-357.25	-4845.9	3290.5	3096.7
53	1054	0.00	-90.78	-357.25	1485.0	3290.5	-2183.8
54	2001	171.96	-1.59	-308.01	-422.0	6675.0	-264.5
55	2002	-111.94	-1.59	-308.01	-422.0	344.2	168.5
56	2003	30.01	140.36	-308.01	-3587.4	3509.6	2592.2
57	2004	30.01	-143.54	-308.01	2743.5	3509.6	-2688.2
58	2005	162.05	279.75	-308.20	-7203.5	6452.5	2416.4
59	2006	-121.85	279.75	-308.20	-7203.5	121.7	2849.4
60	2007	20.10	421.70	-308.20	-10369.0	3287.1	5273.2
61	2008	20.10	137.80	-308.20	-4038.1	3287.1	-7.3
62	2011	140.36	396.88	-308.20	-10025.2	5958.5	3551.8
63	2012	-143.54	396.88	-308.20	-10025.2	-372.4	3984.8
64	2013	-1.59	538.83	-308.20	-13190.6	2793.0	6408.6
65	2014	-1.59	254.93	-308.20	-6859.8	2793.0	1128.1
66	2015	119.95	277.75	-308.01	-7151.5	5490.6	2443.6
67	2016	-163.95	277.75	-308.01	-7151.5	-840.3	2876.6
68	2017	-22.00	419.70	-308.01	-10317.0	2325.1	5300.3
69	2018	-22.00	135.80	-308.01	-3986.1	2325.1	19.9
70	2021	112.39	1.57	-307.76	-492.4	5314.0	-169.2
71	2022	-171.51	1.57	-307.76	-492.4	-1016.9	263.8
72	2023	-29.56	143.51	-307.76	-3657.8	2148.5	2687.5

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

LOAD CASE	LOAD LABEL	RELATIVE TO MUDLINE ELEVATION					
		FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
73	2024	-29.56	-140.38	-307.76	2673.1	2148.5	-2592.9
74	2025	122.13	-275.95	-307.58	6197.2	5532.9	-2813.6
75	2026	-161.76	-275.95	-307.58	6197.2	-798.0	-2380.7
76	2027	-19.81	-134.00	-307.58	3031.7	2367.5	43.1
77	2028	-19.81	-417.90	-307.58	9362.6	2367.5	-5237.4
78	2031	143.52	-391.65	-307.58	8984.4	6019.9	-3935.1
79	2032	-140.38	-391.65	-307.58	8984.4	-311.0	-3502.1
80	2033	1.57	-249.70	-307.58	5818.9	2854.4	-1078.4
81	2034	1.57	-533.59	-307.58	12149.8	2854.4	-6358.8
82	2035	164.31	-282.12	-307.75	6341.7	6496.6	-2918.5
83	2036	-119.58	-282.12	-307.75	6341.7	165.7	-2485.5
84	2037	22.36	-140.17	-307.75	3176.3	3331.1	-61.8
85	2038	22.36	-424.07	-307.75	9507.2	3331.1	-5342.2
86	4001	101.64	-0.58	-357.30	-519.9	5556.3	-163.7
87	4002	-182.26	-0.58	-357.30	-519.9	-774.6	269.3
88	4003	-40.31	141.37	-357.30	-3685.3	2390.8	2693.0
89	4004	-40.31	-142.53	-357.30	2645.6	2390.8	-2587.4
90	4005	98.05	100.96	-357.37	-2967.1	5475.7	803.9
91	4006	-185.84	100.96	-357.37	-2967.1	-855.1	1236.8
92	4007	-43.90	242.91	-357.37	-6132.5	2310.3	3660.6
93	4008	-43.90	-40.99	-357.37	198.3	2310.3	-1619.9
94	4011	90.20	143.25	-357.37	-3985.9	5297.0	1213.9
95	4012	-193.69	143.25	-357.37	-3985.9	-1033.9	1646.8
96	4013	-51.75	285.20	-357.37	-7151.3	2131.5	4070.6
97	4014	-51.75	1.30	-357.37	-820.4	2131.5	-1209.9
98	4015	82.80	100.50	-357.30	-2954.7	5127.2	816.3
99	4016	-201.10	100.50	-357.30	-2954.7	-1203.7	1249.2
100	4017	-59.15	242.45	-357.30	-6120.1	1961.8	3673.0
101	4018	-59.15	-41.45	-357.30	210.7	1961.8	-1607.5
102	4021	80.05	0.57	-357.21	-545.4	5063.2	-129.1
103	4022	-203.84	0.57	-357.21	-545.4	-1267.7	303.8
104	4023	-61.90	142.52	-357.21	-3710.9	1897.7	2727.6
105	4024	-61.90	-141.38	-357.21	2620.0	1897.7	-2552.9
106	4025	83.59	-99.82	-357.14	1874.3	5142.7	-1085.8
107	4026	-200.30	-99.82	-357.14	1874.3	-1188.2	-652.8
108	4027	-58.36	42.13	-357.14	-1291.2	1977.2	1770.9
109	4028	-58.36	-241.77	-357.14	5039.7	1977.2	-3509.5
110	4031	91.35	-141.68	-357.14	2882.7	5319.3	-1491.6
111	4032	-192.55	-141.68	-357.14	2882.7	-1011.6	-1058.7
112	4033	-50.60	0.26	-357.14	-282.7	2153.8	1365.1
113	4034	-50.60	-283.63	-357.14	6048.2	2153.8	-3915.4
114	4035	98.87	-101.81	-357.21	1920.7	5491.7	-1121.4
115	4036	-185.03	-101.81	-357.21	1920.7	-839.2	-688.5
116	4037	-43.08	40.14	-357.21	-1244.7	2326.3	1735.3
117	4038	-43.08	-243.76	-357.21	5086.1	2326.3	-3545.2

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

LOAD CASE	LOAD LABEL	RELATIVE TO MUDLINE ELEVATION					
		FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
118	4101	203.98	-0.58	-357.30	-519.9	7851.8	-304.0
119	4102	-79.92	-0.58	-357.30	-519.9	1520.9	128.9
120	4103	62.03	141.37	-357.30	-3685.3	4686.3	2552.7
121	4104	62.03	-142.53	-357.30	2645.6	4686.3	-2727.8
122	4105	200.39	100.96	-357.37	-2967.1	7771.2	663.5
123	4106	-83.50	100.96	-357.37	-2967.1	1440.4	1096.5
124	4107	58.44	242.91	-357.37	-6132.5	4605.8	3520.3
125	4108	58.44	-40.99	-357.37	198.3	4605.8	-1760.2
126	4111	192.54	143.25	-357.37	-3985.9	7592.5	1073.5
127	4112	-91.35	143.25	-357.37	-3985.9	1261.6	1506.5
128	4113	50.59	285.20	-357.37	-7151.3	4427.0	3930.2
129	4114	50.59	1.30	-357.37	-820.4	4427.0	-1350.2
130	4115	185.14	100.50	-357.30	-2954.7	7422.7	675.9
131	4116	-98.76	100.50	-357.30	-2954.7	1091.8	1108.9
132	4117	43.19	242.45	-357.30	-6120.1	4257.3	3532.6
133	4118	43.19	-41.45	-357.30	210.7	4257.3	-1747.8
134	4121	182.39	0.57	-357.21	-545.4	7358.7	-269.5
135	4122	-101.50	0.57	-357.21	-545.4	1027.8	163.5
136	4123	40.44	142.52	-357.21	-3710.9	4193.2	2587.2
137	4124	40.44	-141.38	-357.21	2620.0	4193.2	-2693.2
138	4125	185.93	-99.82	-357.14	1874.3	7438.1	-1226.1
139	4126	-97.96	-99.82	-357.14	1874.3	1107.3	-793.2
140	4127	43.98	42.13	-357.14	-1291.2	4272.7	1630.6
141	4128	43.98	-241.77	-357.14	5039.7	4272.7	-3649.9
142	4131	193.69	-141.68	-357.14	2882.7	7614.8	-1631.9
143	4132	-90.21	-141.68	-357.14	2882.7	1283.9	-1199.0
144	4133	51.74	0.26	-357.14	-282.7	4449.3	1224.8
145	4134	51.74	-283.63	-357.14	6048.2	4449.3	-4055.7
146	4135	201.21	-101.81	-357.21	1920.7	7787.2	-1261.7
147	4136	-82.69	-101.81	-357.21	1920.7	1456.3	-828.8
148	4137	59.26	40.14	-357.21	-1244.7	4621.7	1595.0
149	4138	59.26	-243.76	-357.21	5086.1	4621.7	-3685.5
150	4201	152.81	-51.75	-357.30	627.9	6704.0	-690.3
151	4202	-131.09	-51.75	-357.30	627.9	373.1	-257.4
152	4203	10.86	90.20	-357.30	-2537.6	3538.6	2166.4
153	4204	10.86	-193.70	-357.30	3793.3	3538.6	-3114.1
154	4205	149.22	49.79	-357.37	-1819.4	6623.5	277.2
155	4206	-134.67	49.79	-357.37	-1819.4	292.6	710.2
156	4207	7.27	191.74	-357.37	-4984.8	3458.0	3133.9
157	4208	7.27	-92.16	-357.37	1346.1	3458.0	-2146.5
158	4211	141.37	92.08	-357.37	-2838.1	6444.7	687.2
159	4212	-142.52	92.08	-357.37	-2838.1	113.8	1120.2
160	4213	-0.58	234.03	-357.37	-6003.6	3279.3	3543.9
161	4214	-0.58	-49.87	-357.37	327.3	3279.3	-1736.5
162	4215	133.97	49.33	-357.30	-1807.0	6274.9	289.6

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

LOAD CASE	LOAD LABEL	RELATIVE TO MUDLINE ELEVATION					
		FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
163	4216	-149.93	49.33	-357.30	-1807.0	-55.9	722.6
164	4217	-7.98	191.28	-357.30	-4972.4	3109.5	3146.3
165	4218	-7.98	-92.62	-357.30	1358.5	3109.5	-2134.1
166	4221	131.22	-50.60	-357.21	602.3	6210.9	-655.8
167	4222	-152.67	-50.60	-357.21	602.3	-120.0	-222.8
168	4223	-10.73	91.35	-357.21	-2563.1	3045.5	2200.9
169	4224	-10.73	-192.55	-357.21	3767.8	3045.5	-3079.6
170	4225	134.76	-150.99	-357.14	3022.0	6290.4	-1612.4
171	4226	-149.13	-150.99	-357.14	3022.0	-40.5	-1179.5
172	4227	-7.19	-9.04	-357.14	-143.4	3125.0	1244.3
173	4228	-7.19	-292.94	-357.14	6187.4	3125.0	-4036.2
174	4231	142.52	-192.85	-357.14	4030.5	6467.0	-2018.2
175	4232	-141.38	-192.85	-357.14	4030.5	136.2	-1585.3
176	4233	0.57	-50.91	-357.14	865.0	3301.6	838.5
177	4234	0.57	-334.80	-357.14	7195.9	3301.6	-4442.0
178	4235	150.04	-152.98	-357.21	3068.5	6639.4	-1648.1
179	4236	-133.86	-152.98	-357.21	3068.5	308.6	-1215.1
180	4237	8.09	-11.03	-357.21	-97.0	3474.0	1208.7
181	4238	8.09	-294.93	-357.21	6233.9	3474.0	-4071.8
182	4301	152.81	50.59	-357.30	-1667.6	6704.0	222.6
183	4302	-131.09	50.59	-357.30	-1667.6	373.1	655.6
184	4303	10.86	192.54	-357.30	-4833.1	3538.6	3079.3
185	4304	10.86	-91.35	-357.30	1497.8	3538.6	-2201.1
186	4305	149.22	152.13	-357.37	-4114.9	6623.5	1190.2
187	4306	-134.67	152.13	-357.37	-4114.9	292.6	1623.1
188	4307	7.27	294.08	-357.37	-7280.3	3458.0	4046.9
189	4308	7.27	10.18	-357.37	-949.4	3458.0	-1233.6
190	4311	141.37	194.42	-357.37	-5133.6	6444.7	1600.2
191	4312	-142.52	194.42	-357.37	-5133.6	113.8	2033.1
192	4313	-0.58	336.37	-357.37	-8299.1	3279.3	4456.9
193	4314	-0.58	52.47	-357.37	-1968.2	3279.3	-823.6
194	4315	133.97	151.67	-357.30	-4102.5	6274.9	1202.6
195	4316	-149.93	151.67	-357.30	-4102.5	-55.9	1635.5
196	4317	-7.98	293.62	-357.30	-7267.9	3109.5	4059.3
197	4318	-7.98	9.72	-357.30	-937.0	3109.5	-1221.2
198	4321	131.22	51.74	-357.21	-1693.2	6210.9	257.2
199	4322	-152.67	51.74	-357.21	-1693.2	-120.0	690.1
200	4323	-10.73	193.69	-357.21	-4858.6	3045.5	3113.9
201	4324	-10.73	-90.21	-357.21	1472.3	3045.5	-2166.6
202	4325	134.76	-48.65	-357.14	726.5	6290.4	-699.5
203	4326	-149.13	-48.65	-357.14	726.5	-40.5	-266.5
204	4327	-7.19	93.30	-357.14	-2438.9	3125.0	2157.2
205	4328	-7.19	-190.60	-357.14	3891.9	3125.0	-3123.2
206	4331	142.52	-90.51	-357.14	1735.0	6467.0	-1105.3
207	4332	-141.38	-90.51	-357.14	1735.0	136.2	-672.3

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
208	4333	0.57	51.43	-357.14	-1430.5	3301.6	1751.4
209	4334	0.57	-232.46	-357.14	4900.4	3301.6	-3529.1
210	4335	150.04	-50.64	-357.21	773.0	6639.4	-735.1
211	4336	-133.86	-50.64	-357.21	773.0	308.6	-302.2
212	4337	8.09	91.31	-357.21	-2392.5	3474.0	2121.6
213	4338	8.09	-192.59	-357.21	3938.4	3474.0	-3158.9

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
1	CL	0.00				0.00				-40.09	8.86	1.92	23.81
2	DL	0.00				0.00				-60.71	9.73	1.49	23.35
3	LL	0.00				0.00				-49.37	9.45	1.53	22.30
4	201	30.01	10.21	1.22	23.08	-1.59	7.18	1.50	22.34	-0.13	-55.59	0.52	23.78
5	202	20.10	10.37	1.20	23.13	279.75	9.50	2.12	24.12	-0.31	-5.57	-4.68	24.18
6	203	-1.59	7.18	1.50	22.34	396.88	9.49	0.93	24.11	-0.31	14.74	-6.80	24.35
7	204	-22.00	10.05	1.23	23.05	277.75	9.48	0.93	24.11	-0.13	62.77	-11.79	24.73
8	205	-29.56	10.20	1.22	23.09	1.57	7.18	1.50	22.34	0.13	-55.58	0.52	23.78
9	206	-19.81	10.37	1.20	23.13	-275.95	9.50	0.92	24.12	0.31	-5.56	-4.68	24.18
10	207	1.57	7.18	1.50	22.34	-391.65	9.49	2.12	24.11	0.31	14.74	-6.79	24.35
11	208	22.36	10.05	1.23	23.05	-282.12	9.48	2.12	24.11	0.13	62.80	-11.80	24.73
12	301	10.86	10.21	1.22	23.08	-0.58	7.18	1.50	22.34	-0.05	-55.61	0.52	23.78
13	302	7.27	10.38	1.20	23.12	100.96	9.50	2.12	24.12	-0.11	-5.59	-4.69	24.18
14	303	-0.58	7.18	1.50	22.34	143.25	9.49	0.93	24.11	-0.11	14.74	-6.81	24.34
15	304	-7.98	10.05	1.23	23.04	100.50	9.48	0.93	24.10	-0.05	62.89	-11.82	24.73
16	305	-10.73	10.21	1.22	23.08	0.57	7.18	1.50	22.34	0.05	-55.60	0.52	23.78
17	306	-7.19	10.38	1.20	23.12	-99.82	9.50	0.92	24.12	0.11	-5.59	-4.69	24.18
18	307	0.57	7.18	1.50	22.34	-141.68	9.49	2.12	24.11	0.11	14.74	-6.81	24.34
19	308	8.09	10.05	1.23	23.04	-101.81	9.48	2.12	24.10	0.05	62.92	-11.83	24.73
20	FLX	141.95	18.60	1.52	22.30	0.00				0.00			
21	FLY	0.00				141.95	18.60	1.52	22.30	0.00			
22	HTLP	0.00				0.00				-2.39	9.45	-0.43	22.30
23	NGDL	0.00				0.00				-32.31	9.76	1.54	22.31
24	PLEM	0.00				0.00				-107.21	8.26	1.59	23.16
25	PLOP	0.00				0.00				-170.57	8.92	1.37	22.43
26	PLTX	-170.57	8.92	1.37	22.43	0.00				0.00			
27	PLTY	0.00				-170.57	8.92	1.37	22.43	0.00			
28	1000	0.00				0.00				-244.52	8.95	1.61	23.19
29	1001	0.00				0.00				-307.88	9.17	1.49	22.78
30	1002	-51.17	8.92	1.37	22.43	0.00				-357.25	9.21	1.49	22.71
31	1003	51.17	8.92	1.37	22.43	0.00				-357.25	9.21	1.49	22.71
32	1004	0.00				-51.17	8.92	1.37	22.43	-357.25	9.21	1.49	22.71
33	1005	0.00				51.17	8.92	1.37	22.43	-357.25	9.21	1.49	22.71
34	1011	141.95	18.60	1.52	22.30	0.00				-307.88	9.17	1.49	22.78
35	1012	-141.95	18.60	1.52	22.30	0.00				-307.88	9.17	1.49	22.78
36	1013	0.00				141.95	18.60	1.52	22.30	-307.88	9.17	1.49	22.78
37	1014	0.00				-141.95	18.60	1.52	22.30	-307.88	9.17	1.49	22.78
38	1021	90.78	24.06	1.61	22.23	0.00				-357.25	9.21	1.49	22.71
39	1022	-193.12	16.04	1.48	22.33	0.00				-357.25	9.21	1.49	22.71
40	1023	-51.17	8.92	1.37	22.43	141.95	18.60	1.52	22.30	-357.25	9.21	1.49	22.71
41	1024	-51.17	8.92	1.37	22.43	-141.95	18.60	1.52	22.30	-357.25	9.21	1.49	22.71
42	1031	193.12	16.04	1.48	22.33	0.00				-357.25	9.21	1.49	22.71
43	1032	-90.78	24.06	1.61	22.23	0.00				-357.25	9.21	1.49	22.71
44	1033	51.17	8.92	1.37	22.43	141.95	18.60	1.52	22.30	-357.25	9.21	1.49	22.71
45	1034	51.17	8.92	1.37	22.43	-141.95	18.60	1.52	22.30	-357.25	9.21	1.49	22.71



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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1041	141.95	18.60	1.52	22.30	-51.17	8.92	1.37	22.43	-357.25	9.21	1.49	22.71
47	1042	-141.95	18.60	1.52	22.30	-51.17	8.92	1.37	22.43	-357.25	9.21	1.49	22.71
48	1043	0.00				90.78	24.06	1.61	22.23	-357.25	9.21	1.49	22.71
49	1044	0.00				-193.12	16.04	1.48	22.33	-357.25	9.21	1.49	22.71
50	1051	141.95	18.60	1.52	22.30	51.17	8.92	1.37	22.43	-357.25	9.21	1.49	22.71
51	1052	-141.95	18.60	1.52	22.30	51.17	8.92	1.37	22.43	-357.25	9.21	1.49	22.71
52	1053	0.00				193.12	16.04	1.48	22.33	-357.25	9.21	1.49	22.71
53	1054	0.00				-90.78	24.06	1.61	22.23	-357.25	9.21	1.49	22.71
54	2001	171.96	17.14	1.47	22.44	-1.59	7.18	1.50	22.34	-308.01	9.15	1.49	22.78
55	2002	-111.94	20.85	1.61	22.09	-1.59	7.18	1.50	22.34	-308.01	9.15	1.49	22.78
56	2003	30.01	10.21	1.22	23.08	140.36	18.73	1.53	22.30	-308.01	9.15	1.49	22.78
57	2004	30.01	10.21	1.22	23.08	-143.54	18.47	1.52	22.30	-308.01	9.15	1.49	22.78
58	2005	162.05	17.58	1.49	22.40	279.75	9.50	2.12	24.12	-308.20	9.16	1.48	22.78
59	2006	-121.85	19.96	1.58	22.16	279.75	9.50	2.12	24.12	-308.20	9.16	1.48	22.78
60	2007	20.10	10.37	1.20	23.13	421.70	12.56	1.92	23.51	-308.20	9.16	1.48	22.78
61	2008	20.10	10.37	1.20	23.13	137.80	0.12	2.74	25.99	-308.20	9.16	1.48	22.78
62	2011	140.36	18.73	1.53	22.30	396.88	9.49	0.93	24.11	-308.20	9.18	1.48	22.78
63	2012	-143.54	18.47	1.52	22.30	396.88	9.49	0.93	24.11	-308.20	9.18	1.48	22.78
64	2013	-1.59	7.18	1.50	22.34	538.83	11.89	1.08	23.64	-308.20	9.18	1.48	22.78
65	2014	-1.59	7.18	1.50	22.34	254.93	4.42	0.59	25.12	-308.20	9.18	1.48	22.78
66	2015	119.95	20.17	1.58	22.16	277.75	9.48	0.93	24.11	-308.01	9.19	1.48	22.78
67	2016	-163.95	17.45	1.49	22.40	277.75	9.48	0.93	24.11	-308.01	9.19	1.48	22.78
68	2017	-22.00	10.05	1.23	23.05	419.70	12.56	1.13	23.50	-308.01	9.19	1.48	22.78
69	2018	-22.00	10.05	1.23	23.05	135.80	-0.05	0.30	25.99	-308.01	9.19	1.48	22.78
70	2021	112.39	20.81	1.61	22.09	1.57	7.18	1.50	22.34	-307.76	9.20	1.49	22.78
71	2022	-171.51	17.15	1.47	22.44	1.57	7.18	1.50	22.34	-307.76	9.20	1.49	22.78
72	2023	-29.56	10.20	1.22	23.09	143.51	18.48	1.52	22.30	-307.76	9.20	1.49	22.78
73	2024	-29.56	10.20	1.22	23.09	-140.38	18.73	1.53	22.30	-307.76	9.20	1.49	22.78
74	2025	122.13	19.93	1.58	22.17	-275.95	9.50	0.92	24.12	-307.58	9.19	1.49	22.77
75	2026	-161.76	17.59	1.49	22.40	-275.95	9.50	0.92	24.12	-307.58	9.19	1.49	22.77
76	2027	-19.81	10.37	1.20	23.13	-134.00	-0.14	0.29	26.05	-307.58	9.19	1.49	22.77
77	2028	-19.81	10.37	1.20	23.13	-417.90	12.59	1.13	23.50	-307.58	9.19	1.49	22.77
78	2031	143.52	18.48	1.52	22.30	-391.65	9.49	2.12	24.11	-307.58	9.17	1.49	22.77
79	2032	-140.38	18.73	1.53	22.30	-391.65	9.49	2.12	24.11	-307.58	9.17	1.49	22.77
80	2033	1.57	7.18	1.50	22.34	-249.70	4.31	2.46	25.14	-307.58	9.17	1.49	22.77
81	2034	1.57	7.18	1.50	22.34	-533.59	11.91	1.96	23.63	-307.58	9.17	1.49	22.77
82	2035	164.31	17.44	1.49	22.40	-282.12	9.48	2.12	24.11	-307.75	9.15	1.49	22.78
83	2036	-119.58	20.20	1.58	22.16	-282.12	9.48	2.12	24.11	-307.75	9.15	1.49	22.78
84	2037	22.36	10.05	1.23	23.05	-140.17	0.24	2.72	25.93	-307.75	9.15	1.49	22.78
85	2038	22.36	10.05	1.23	23.05	-424.07	12.53	1.92	23.50	-307.75	9.15	1.49	22.78
86	4001	101.64	22.58	1.57	22.32	-0.58	7.18	1.50	22.34	-357.30	9.20	1.49	22.71
87	4002	-182.26	16.38	1.50	22.29	-0.58	7.18	1.50	22.34	-357.30	9.20	1.49	22.71
88	4003	-40.31	8.57	1.41	22.25	141.37	18.65	1.53	22.30	-357.30	9.20	1.49	22.71
89	4004	-40.31	8.57	1.41	22.25	-142.53	18.55	1.52	22.30	-357.30	9.20	1.49	22.71
90	4005	98.05	23.04	1.58	22.29	100.96	9.50	2.12	24.12	-357.37	9.21	1.49	22.71

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	4006	-185.84	16.26	1.50	22.30	100.96	9.50	2.12	24.12	-357.37	9.21	1.49	22.71
92	4007	-43.90	8.68	1.40	22.32	242.91	14.82	1.77	23.06	-357.37	9.21	1.49	22.71
93	4008	-43.90	8.68	1.40	22.32	-40.99	41.02	0.05	17.82	-357.37	9.21	1.49	22.71
94	4011	90.20	24.16	1.61	22.23	143.25	9.49	0.93	24.11	-357.37	9.21	1.49	22.71
95	4012	-193.69	16.01	1.48	22.33	143.25	9.49	0.93	24.11	-357.37	9.21	1.49	22.71
96	4013	-51.75	8.90	1.37	22.43	285.20	14.02	1.22	23.21	-357.37	9.21	1.49	22.71
97	4014	-51.75	8.90	1.37	22.43	1.30	-982.40	-64.28	221.27	-357.37	9.21	1.49	22.71
98	4015	82.80	25.41	1.65	22.15	100.50	9.48	0.93	24.10	-357.30	9.22	1.49	22.71
99	4016	-201.10	15.80	1.47	22.36	100.50	9.48	0.93	24.10	-357.30	9.22	1.49	22.71
100	4017	-59.15	9.07	1.35	22.51	242.45	14.82	1.28	23.05	-357.30	9.22	1.49	22.71
101	4018	-59.15	9.07	1.35	22.51	-41.45	40.72	2.97	17.92	-357.30	9.22	1.49	22.71
102	4021	80.05	25.91	1.66	22.11	0.57	7.18	1.50	22.34	-357.21	9.22	1.49	22.71
103	4022	-203.84	15.73	1.47	22.37	0.57	7.18	1.50	22.34	-357.21	9.22	1.49	22.71
104	4023	-61.90	9.14	1.34	22.54	142.52	18.55	1.52	22.30	-357.21	9.22	1.49	22.71
105	4024	-61.90	9.14	1.34	22.54	-141.38	18.65	1.53	22.30	-357.21	9.22	1.49	22.71
106	4025	83.59	25.23	1.65	22.15	-99.82	9.50	0.92	24.12	-357.14	9.22	1.49	22.71
107	4026	-200.30	15.83	1.47	22.36	-99.82	9.50	0.92	24.12	-357.14	9.22	1.49	22.71
108	4027	-58.36	9.10	1.35	22.52	42.13	40.17	2.95	17.99	-357.14	9.22	1.49	22.71
109	4028	-58.36	9.10	1.35	22.52	-241.77	14.84	1.28	23.05	-357.14	9.22	1.49	22.71
110	4031	91.35	23.95	1.61	22.23	-141.68	9.49	2.12	24.11	-357.14	9.21	1.49	22.71
111	4032	-192.55	16.06	1.48	22.33	-141.68	9.49	2.12	24.11	-357.14	9.21	1.49	22.71
112	4033	-50.60	8.94	1.37	22.43	COUPLE				-357.14	9.21	1.49	22.71
113	4034	-50.60	8.94	1.37	22.43	-283.63	14.05	1.82	23.20	-357.14	9.21	1.49	22.71
114	4035	98.87	22.91	1.58	22.29	-101.81	9.48	2.12	24.10	-357.21	9.20	1.49	22.71
115	4036	-185.03	16.30	1.50	22.30	-101.81	9.48	2.12	24.10	-357.21	9.20	1.49	22.71
116	4037	-43.08	8.71	1.40	22.31	40.14	41.73	0.02	17.72	-357.21	9.20	1.49	22.71
117	4038	-43.08	8.71	1.40	22.31	-243.76	14.79	1.77	23.05	-357.21	9.20	1.49	22.71
118	4101	203.98	15.72	1.47	22.37	-0.58	7.18	1.50	22.34	-357.30	9.20	1.49	22.71
119	4102	-79.92	25.94	1.67	22.11	-0.58	7.18	1.50	22.34	-357.30	9.20	1.49	22.71
120	4103	62.03	9.15	1.34	22.54	141.37	18.65	1.53	22.30	-357.30	9.20	1.49	22.71
121	4104	62.03	9.15	1.34	22.54	-142.53	18.55	1.52	22.30	-357.30	9.20	1.49	22.71
122	4105	200.39	15.83	1.47	22.36	100.96	9.50	2.12	24.12	-357.37	9.21	1.49	22.71
123	4106	-83.50	25.25	1.65	22.15	100.96	9.50	2.12	24.12	-357.37	9.21	1.49	22.71
124	4107	58.44	9.10	1.35	22.52	242.91	14.82	1.77	23.06	-357.37	9.21	1.49	22.71
125	4108	58.44	9.10	1.35	22.52	-40.99	41.02	0.05	17.82	-357.37	9.21	1.49	22.71
126	4111	192.54	16.06	1.48	22.33	143.25	9.49	0.93	24.11	-357.37	9.21	1.49	22.71
127	4112	-91.35	23.95	1.61	22.23	143.25	9.49	0.93	24.11	-357.37	9.21	1.49	22.71
128	4113	50.59	8.94	1.37	22.43	285.20	14.02	1.22	23.21	-357.37	9.21	1.49	22.71
129	4114	50.59	8.94	1.37	22.43	1.30	-982.40	-64.28	221.27	-357.37	9.21	1.49	22.71
130	4115	185.14	16.29	1.50	22.30	100.50	9.48	0.93	24.10	-357.30	9.22	1.49	22.71
131	4116	-98.76	22.92	1.58	22.29	100.50	9.48	0.93	24.10	-357.30	9.22	1.49	22.71
132	4117	43.19	8.71	1.40	22.32	242.45	14.82	1.28	23.05	-357.30	9.22	1.49	22.71
133	4118	43.19	8.71	1.40	22.32	-41.45	40.72	2.97	17.92	-357.30	9.22	1.49	22.71
134	4121	182.39	16.38	1.50	22.29	0.57	7.18	1.50	22.34	-357.21	9.22	1.49	22.71
135	4122	-101.50	22.59	1.57	22.32	0.57	7.18	1.50	22.34	-357.21	9.22	1.49	22.71

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4123	40.44	8.58	1.41	22.26	142.52	18.55	1.52	22.30	-357.21	9.22	1.49	22.71
137	4124	40.44	8.58	1.41	22.26	-141.38	18.65	1.53	22.30	-357.21	9.22	1.49	22.71
138	4125	185.93	16.25	1.50	22.30	-99.82	9.50	0.92	24.12	-357.14	9.22	1.49	22.71
139	4126	-97.96	23.05	1.58	22.29	-99.82	9.50	0.92	24.12	-357.14	9.22	1.49	22.71
140	4127	43.98	8.68	1.40	22.32	42.13	40.17	2.95	17.99	-357.14	9.22	1.49	22.71
141	4128	43.98	8.68	1.40	22.32	-241.77	14.84	1.28	23.05	-357.14	9.22	1.49	22.71
142	4131	193.69	16.01	1.48	22.33	-141.68	9.49	2.12	24.11	-357.14	9.21	1.49	22.71
143	4132	-90.21	24.16	1.61	22.23	-141.68	9.49	2.12	24.11	-357.14	9.21	1.49	22.71
144	4133	51.74	8.90	1.37	22.43	COUPLE				-357.14	9.21	1.49	22.71
145	4134	51.74	8.90	1.37	22.43	-283.63	14.05	1.82	23.20	-357.14	9.21	1.49	22.71
146	4135	201.21	15.79	1.47	22.36	-101.81	9.48	2.12	24.10	-357.21	9.20	1.49	22.71
147	4136	-82.69	25.43	1.65	22.15	-101.81	9.48	2.12	24.10	-357.21	9.20	1.49	22.71
148	4137	59.26	9.08	1.35	22.51	40.14	41.73	0.02	17.72	-357.21	9.20	1.49	22.71
149	4138	59.26	9.08	1.35	22.51	-243.76	14.79	1.77	23.05	-357.21	9.20	1.49	22.71
150	4201	152.81	18.00	1.50	22.36	-51.75	8.90	1.37	22.43	-357.30	9.20	1.49	22.71
151	4202	-131.09	19.30	1.55	22.24	-51.75	8.90	1.37	22.43	-357.30	9.20	1.49	22.71
152	4203	10.86	10.21	1.22	23.08	90.20	24.16	1.61	22.23	-357.30	9.20	1.49	22.71
153	4204	10.86	10.21	1.22	23.08	-193.70	16.01	1.48	22.33	-357.30	9.20	1.49	22.71
154	4205	149.22	18.20	1.51	22.34	49.79	10.09	2.90	25.85	-357.37	9.21	1.49	22.71
155	4206	-134.67	19.04	1.54	22.26	49.79	10.09	2.90	25.85	-357.37	9.21	1.49	22.71
156	4207	7.27	10.38	1.20	23.12	191.74	16.39	1.88	23.22	-357.37	9.21	1.49	22.71
157	4208	7.27	10.38	1.20	23.12	-92.16	23.20	0.78	20.38	-357.37	9.21	1.49	22.71
158	4211	141.37	18.65	1.53	22.30	92.08	9.80	0.68	25.05	-357.37	9.21	1.49	22.71
159	4212	-142.52	18.55	1.52	22.30	92.08	9.80	0.68	25.05	-357.37	9.21	1.49	22.71
160	4213	-0.58	7.18	1.50	22.34	234.03	15.14	1.19	23.38	-357.37	9.21	1.49	22.71
161	4214	-0.58	7.18	1.50	22.34	-49.87	34.84	3.09	17.23	-357.37	9.21	1.49	22.71
162	4215	133.97	19.11	1.54	22.26	49.33	10.06	0.47	25.84	-357.30	9.22	1.49	22.71
163	4216	-149.93	18.14	1.51	22.34	49.33	10.06	0.47	25.84	-357.30	9.22	1.49	22.71
164	4217	-7.98	10.05	1.23	23.04	191.28	16.40	1.25	23.21	-357.30	9.22	1.49	22.71
165	4218	-7.98	10.05	1.23	23.04	-92.62	23.15	2.09	20.41	-357.30	9.22	1.49	22.71
166	4221	131.22	19.29	1.55	22.24	-50.60	8.94	1.37	22.43	-357.21	9.22	1.49	22.71
167	4222	-152.67	18.01	1.50	22.35	-50.60	8.94	1.37	22.43	-357.21	9.22	1.49	22.71
168	4223	-10.73	10.21	1.22	23.08	91.35	23.95	1.61	22.23	-357.21	9.22	1.49	22.71
169	4224	-10.73	10.21	1.22	23.08	-192.55	16.06	1.48	22.33	-357.21	9.22	1.49	22.71
170	4225	134.76	19.04	1.54	22.26	-150.99	9.30	1.08	23.55	-357.14	9.22	1.49	22.71
171	4226	-149.13	18.20	1.51	22.34	-150.99	9.30	1.08	23.55	-357.14	9.22	1.49	22.71
172	4227	-7.19	10.38	1.20	23.12	-9.04	-136.65	-5.98	43.11	-357.14	9.22	1.49	22.71
173	4228	-7.19	10.38	1.20	23.12	-292.94	13.81	1.29	22.94	-357.14	9.22	1.49	22.71
174	4231	142.52	18.55	1.52	22.30	-192.85	9.34	1.92	23.67	-357.14	9.21	1.49	22.71
175	4232	-141.38	18.65	1.53	22.30	-192.85	9.34	1.92	23.67	-357.14	9.21	1.49	22.71
176	4233	0.57	7.18	1.50	22.34	-50.91	-16.49	3.03	27.47	-357.14	9.21	1.49	22.71
177	4234	0.57	7.18	1.50	22.34	-334.80	13.26	1.75	23.09	-357.14	9.21	1.49	22.71
178	4235	150.04	18.14	1.51	22.34	-152.98	9.29	1.87	23.54	-357.21	9.20	1.49	22.71
179	4236	-133.86	19.12	1.54	22.26	-152.98	9.29	1.87	23.54	-357.21	9.20	1.49	22.71
180	4237	8.09	10.05	1.23	23.04	-11.03	-110.46	6.29	39.55	-357.21	9.20	1.49	22.71

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
181	4238	8.09	10.05	1.23	23.04	-294.93	13.77	1.70	22.95	-357.21	9.20	1.49	22.71
182	4301	152.81	18.00	1.50	22.36	50.59	8.94	1.37	22.43	-357.30	9.20	1.49	22.71
183	4302	-131.09	19.30	1.55	22.24	50.59	8.94	1.37	22.43	-357.30	9.20	1.49	22.71
184	4303	10.86	10.21	1.22	23.08	192.54	16.06	1.48	22.33	-357.30	9.20	1.49	22.71
185	4304	10.86	10.21	1.22	23.08	-91.35	23.95	1.61	22.23	-357.30	9.20	1.49	22.71
186	4305	149.22	18.20	1.51	22.34	152.13	9.30	1.87	23.55	-357.37	9.21	1.49	22.71
187	4306	-134.67	19.04	1.54	22.26	152.13	9.30	1.87	23.55	-357.37	9.21	1.49	22.71
188	4307	7.27	10.38	1.20	23.12	294.08	13.79	1.70	22.95	-357.37	9.21	1.49	22.71
189	4308	7.27	10.38	1.20	23.12	10.18	-120.32	6.69	40.98	-357.37	9.21	1.49	22.71
190	4311	141.37	18.65	1.53	22.30	194.42	9.34	1.04	23.67	-357.37	9.21	1.49	22.71
191	4312	-142.52	18.55	1.52	22.30	194.42	9.34	1.04	23.67	-357.37	9.21	1.49	22.71
192	4313	-0.58	7.18	1.50	22.34	336.37	13.25	1.25	23.09	-357.37	9.21	1.49	22.71
193	4314	-0.58	7.18	1.50	22.34	52.47	-15.71	-0.26	27.37	-357.37	9.21	1.49	22.71
194	4315	133.97	19.11	1.54	22.26	151.67	9.29	1.08	23.54	-357.30	9.22	1.49	22.71
195	4316	-149.93	18.14	1.51	22.34	151.67	9.29	1.08	23.54	-357.30	9.22	1.49	22.71
196	4317	-7.98	10.05	1.23	23.04	293.62	13.79	1.29	22.94	-357.30	9.22	1.49	22.71
197	4318	-7.98	10.05	1.23	23.04	9.72	-126.60	-5.45	41.63	-357.30	9.22	1.49	22.71
198	4321	131.22	19.29	1.55	22.24	51.74	8.90	1.37	22.43	-357.21	9.22	1.49	22.71
199	4322	-152.67	18.01	1.50	22.35	51.74	8.90	1.37	22.43	-357.21	9.22	1.49	22.71
200	4323	-10.73	10.21	1.22	23.08	193.69	16.01	1.48	22.33	-357.21	9.22	1.49	22.71
201	4324	-10.73	10.21	1.22	23.08	-90.21	24.16	1.61	22.23	-357.21	9.22	1.49	22.71
202	4325	134.76	19.04	1.54	22.26	-48.65	10.11	0.45	25.89	-357.14	9.22	1.49	22.71
203	4326	-149.13	18.20	1.51	22.34	-48.65	10.11	0.45	25.89	-357.14	9.22	1.49	22.71
204	4327	-7.19	10.38	1.20	23.12	93.30	23.03	2.08	20.43	-357.14	9.22	1.49	22.71
205	4328	-7.19	10.38	1.20	23.12	-190.60	16.43	1.25	23.22	-357.14	9.22	1.49	22.71
206	4331	142.52	18.55	1.52	22.30	-90.51	9.81	2.55	25.06	-357.14	9.21	1.49	22.71
207	4332	-141.38	18.65	1.53	22.30	-90.51	9.81	2.55	25.06	-357.14	9.21	1.49	22.71
208	4333	0.57	7.18	1.50	22.34	51.43	34.07	-0.27	17.44	-357.14	9.21	1.49	22.71
209	4334	0.57	7.18	1.50	22.34	-232.46	15.18	1.92	23.38	-357.14	9.21	1.49	22.71
210	4335	150.04	18.14	1.51	22.34	-50.64	10.04	2.87	25.80	-357.21	9.20	1.49	22.71
211	4336	-133.86	19.12	1.54	22.26	-50.64	10.04	2.87	25.80	-357.21	9.20	1.49	22.71
212	4337	8.09	10.05	1.23	23.04	91.31	23.34	0.78	20.36	-357.21	9.20	1.49	22.71
213	4338	8.09	10.05	1.23	23.04	-192.59	16.35	1.88	23.22	-357.21	9.20	1.49	22.71

## B. BASIC LOAD CASE SUMMARY SACS OUTPUT AFTER STRENGTHENING

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\* SEASTATE BASIC LOAD CASE DESCRIPTIONS \*\*

LOAD CASE	LOAD LABEL	***** DESCRIPTION *****
1	CL	USER GENERATED LOADS
2	DL	USER GENERATED LOADS
3	LL	USER GENERATED LOADS
4	201	WIND
5	202	WIND
6	203	WIND
7	204	WIND
8	205	WIND
9	206	WIND
10	207	WIND
11	208	WIND
12	301	WIND
13	302	WIND
14	303	WIND
15	304	WIND
16	305	WIND
17	306	WIND
18	307	WIND
19	308	WIND
20	FLX	USER GENERATED LOADS
21	FLY	USER GENERATED LOADS
22	HTLP	USER GENERATED LOADS
23	NGDL	USER GENERATED LOADS
24	PLEM	USER GENERATED LOADS
25	PLOP	USER GENERATED LOADS
26	PLTX	USER GENERATED LOADS
27	PLTY	USER GENERATED LOADS

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	CL	0.00	0.00	-39.62	-76.5	347.4	0.0	0.00	0.00
2	DL	0.00	0.00	-64.79	-96.9	627.5	0.0	0.00	0.00
3	LL	0.00	0.00	-49.37	-75.3	466.5	0.0	0.00	0.00
4	201	36.60	-2.98	-1.09	68.6	832.3	-83.3	0.00	0.00
5	202	23.79	287.96	-0.64	-6946.2	537.0	2673.8	0.00	0.00
6	203	-2.97	409.86	0.18	-9883.6	-73.2	3861.4	0.00	0.00
7	204	-27.56	287.76	0.88	-6937.4	-630.5	2749.6	0.00	0.00
8	205	-36.07	2.93	1.07	-67.6	-820.1	82.1	0.00	0.00
9	206	-23.45	-284.04	0.64	6852.1	-529.3	-2637.5	0.00	0.00
10	207	2.93	-404.45	-0.17	9753.6	72.2	-3810.4	0.00	0.00
11	208	28.01	-292.29	-0.90	7046.3	640.9	-2792.8	0.00	0.00
12	301	13.24	-1.08	-0.39	24.8	301.0	-30.1	0.00	0.00
13	302	8.60	103.92	-0.23	-2506.5	194.2	964.9	0.00	0.00
14	303	-1.08	147.93	0.06	-3567.1	-26.5	1393.7	0.00	0.00
15	304	-9.99	104.12	0.32	-2509.9	-228.6	994.9	0.00	0.00
16	305	-13.08	1.06	0.39	-24.5	-297.3	29.7	0.00	0.00
17	306	-8.50	-102.75	0.23	2478.3	-191.9	-954.1	0.00	0.00
18	307	1.06	-146.31	-0.06	3528.1	26.2	-1378.5	0.00	0.00
19	308	10.13	-105.48	-0.32	2542.5	231.7	-1007.9	0.00	0.00
20	FLX	141.95	0.00	0.00	0.0	3165.4	-216.5	0.00	0.00
21	FLY	0.00	141.95	0.00	-3165.4	0.0	2640.2	0.00	0.00
22	HTLP	0.00	0.00	-2.39	1.0	22.6	0.0	0.00	0.00
23	NGDL	0.00	0.00	-32.31	-49.8	315.2	0.0	0.00	0.00
24	PLEM	0.00	0.00	-107.21	-170.1	885.6	0.0	0.00	0.00
25	PLOP	0.00	0.00	-170.28	-233.6	1516.8	0.0	0.00	0.00
26	PLTX	-170.28	0.00	0.00	-0.0	-3818.5	233.6	0.00	0.00
27	PLTY	0.00	-170.28	0.00	3818.5	-0.0	-1516.8	0.00	0.00

## COMBINED LOAD CASE SUMMARY SACS OUTPUT AS IN CASE

SACS (2025)

Company: Company

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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### \*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

		RELATIVE TO MUDLINE ELEVATION					
LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
28	1000	0.00	0.00	-248.13	-399.7	2216.7	0.0
29	1001	0.00	0.00	-311.19	-463.2	2847.9	0.0
30	1002	-51.08	0.00	-360.56	-538.5	2168.9	70.1
31	1003	51.08	0.00	-360.56	-538.5	4459.9	-70.1
32	1004	0.00	-51.08	-360.56	607.0	3314.4	-455.0
33	1005	0.00	51.08	-360.56	-1684.1	3314.4	455.0
34	1011	141.95	0.00	-311.19	-463.2	6013.3	-216.5
35	1012	-141.95	0.00	-311.19	-463.2	-317.6	216.5
36	1013	0.00	141.95	-311.19	-3628.7	2847.9	2640.2
37	1014	0.00	-141.95	-311.19	2702.2	2847.9	-2640.2
38	1021	90.87	0.00	-360.56	-538.5	5334.3	-146.4
39	1022	-193.03	0.00	-360.56	-538.5	-996.6	286.5
40	1023	-51.08	141.95	-360.56	-3704.0	2168.9	2710.3
41	1024	-51.08	-141.95	-360.56	2626.9	2168.9	-2570.2
42	1031	193.03	0.00	-360.56	-538.5	7625.4	-286.5
43	1032	-90.87	0.00	-360.56	-538.5	1294.5	146.4
44	1033	51.08	141.95	-360.56	-3704.0	4459.9	2570.2
45	1034	51.08	-141.95	-360.56	2626.9	4459.9	-2710.3
46	1041	141.95	-51.08	-360.56	607.0	6479.8	-671.5
47	1042	-141.95	-51.08	-360.56	607.0	149.0	-238.6
48	1043	0.00	90.87	-360.56	-2558.4	3314.4	2185.2
49	1044	0.00	-193.03	-360.56	3772.4	3314.4	-3095.3
50	1051	141.95	51.08	-360.56	-1684.1	6479.8	238.6
51	1052	-141.95	51.08	-360.56	-1684.1	149.0	671.5
52	1053	0.00	193.03	-360.56	-4849.5	3314.4	3095.3
53	1054	0.00	-90.87	-360.56	1481.4	3314.4	-2185.2
54	2001	178.55	-2.98	-312.28	-394.6	6845.6	-299.8
55	2002	-105.34	-2.98	-312.28	-394.6	514.7	133.2
56	2003	36.60	138.97	-312.28	-3560.1	3680.1	2556.9
57	2004	36.60	-144.92	-312.28	2770.8	3680.1	-2723.5
58	2005	165.74	287.96	-311.84	-7409.4	6550.2	2457.3
59	2006	-118.16	287.96	-311.84	-7409.4	219.4	2890.3
60	2007	23.79	429.90	-311.84	-10574.9	3384.8	5314.0
61	2008	23.79	146.01	-311.84	-4244.0	3384.8	33.6
62	2011	138.97	409.86	-311.02	-10346.9	5940.1	3644.9
63	2012	-144.92	409.86	-311.02	-10346.9	-390.8	4077.8
64	2013	-2.97	551.80	-311.02	-13512.3	2774.6	6501.6
65	2014	-2.97	267.91	-311.02	-7181.4	2774.6	1221.1

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66	2015	114.39	287.76	-310.31	-7400.6	5382.8	2533.1
67	2016	-169.51	287.76	-310.31	-7400.6	-948.1	2966.0
68	2017	-27.56	429.71	-310.31	-10566.1	2217.3	5389.8
69	2018	-27.56	145.82	-310.31	-4235.2	2217.3	109.3
70	2021	105.88	2.93	-310.12	-530.8	5193.2	-134.4
71	2022	-178.01	2.93	-310.12	-530.8	-1137.7	298.6
72	2023	-36.07	144.88	-310.12	-3696.3	2027.8	2722.3



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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
73	2024	-36.07	-139.02	-310.12	2634.6	2027.8	-2558.1
74	2025	118.50	-284.04	-310.56	6388.8	5484.0	-2854.0
75	2026	-165.40	-284.04	-310.56	6388.8	-846.9	-2421.0
76	2027	-23.45	-142.10	-310.56	3223.4	2318.5	2.7
77	2028	-23.45	-425.99	-310.56	9554.2	2318.5	-5277.7
78	2031	144.88	-404.45	-311.37	9290.3	6085.5	-4026.9
79	2032	-139.02	-404.45	-311.37	9290.3	-245.4	-3594.0
80	2033	2.93	-262.51	-311.37	6124.9	2920.1	-1170.2
81	2034	2.93	-546.40	-311.37	12455.8	2920.1	-6450.7
82	2035	169.96	-292.29	-312.09	6583.0	6654.2	-3009.3
83	2036	-113.94	-292.29	-312.09	6583.0	323.3	-2576.4
84	2037	28.01	-150.34	-312.09	3417.6	3488.7	-152.6
85	2038	28.01	-434.24	-312.09	9748.5	3488.7	-5433.1
86	4001	104.10	-1.08	-360.96	-513.7	5635.3	-176.5
87	4002	-179.79	-1.08	-360.96	-513.7	-695.6	256.4
88	4003	-37.84	140.87	-360.96	-3679.2	2469.8	2680.2
89	4004	-37.84	-143.02	-360.96	2651.7	2469.8	-2600.3
90	4005	99.47	103.92	-360.80	-3045.1	5528.5	818.5
91	4006	-184.43	103.92	-360.80	-3045.1	-802.4	1251.5
92	4007	-42.48	245.86	-360.80	-6210.5	2363.0	3675.2
93	4008	-42.48	-38.03	-360.80	120.4	2363.0	-1605.2
94	4011	89.79	147.93	-360.50	-4105.6	5307.8	1247.3
95	4012	-194.11	147.93	-360.50	-4105.6	-1023.1	1680.3
96	4013	-52.16	289.88	-360.50	-7271.0	2142.4	4104.0
97	4014	-52.16	5.98	-360.50	-940.2	2142.4	-1176.4
98	4015	80.87	104.12	-360.25	-3048.5	5105.7	848.5
99	4016	-203.02	104.12	-360.25	-3048.5	-1225.2	1281.5
100	4017	-61.08	246.07	-360.25	-6213.9	1940.3	3705.2
101	4018	-61.08	-37.83	-360.25	117.0	1940.3	-1575.2
102	4021	77.79	1.06	-360.18	-563.0	5037.0	-116.7
103	4022	-206.11	1.06	-360.18	-563.0	-1293.9	316.3
104	4023	-64.16	143.01	-360.18	-3728.5	1871.6	2740.1
105	4024	-64.16	-140.89	-360.18	2602.4	1871.6	-2540.4
106	4025	82.36	-102.75	-360.33	1939.8	5142.4	-1100.4
107	4026	-201.53	-102.75	-360.33	1939.8	-1188.5	-667.5
108	4027	-59.58	39.20	-360.33	-1225.6	1977.0	1756.3
109	4028	-59.58	-244.69	-360.33	5105.3	1977.0	-3524.2
110	4031	91.93	-146.31	-360.63	2989.6	5360.5	-1524.9
111	4032	-191.97	-146.31	-360.63	2989.6	-970.4	-1091.9
112	4033	-50.02	-4.37	-360.63	-175.8	2195.0	1331.8

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113	4034	-50.02	-288.26	-360.63	6155.0	2195.0	-3948.6
114	4035	100.99	-105.48	-360.89	2004.0	5566.0	-1154.3
115	4036	-182.90	-105.48	-360.89	2004.0	-764.9	-721.3
116	4037	-40.95	36.47	-360.89	-1161.4	2400.6	1702.4
117	4038	-40.95	-247.42	-360.89	5169.4	2400.6	-3578.0

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
118	4101	206.27	-1.08	-360.96	-513.7	7926.3	-316.6
119	4102	-77.63	-1.08	-360.96	-513.7	1595.5	116.3
120	4103	64.32	140.87	-360.96	-3679.2	4760.9	2540.1
121	4104	64.32	-143.02	-360.96	2651.7	4760.9	-2740.4
122	4105	201.63	103.92	-360.80	-3045.1	7819.5	678.4
123	4106	-82.26	103.92	-360.80	-3045.1	1488.6	1111.3
124	4107	59.69	245.86	-360.80	-6210.5	4654.1	3535.1
125	4108	59.69	-38.03	-360.80	120.4	4654.1	-1745.4
126	4111	191.95	147.93	-360.50	-4105.6	7598.9	1107.2
127	4112	-91.94	147.93	-360.50	-4105.6	1268.0	1540.1
128	4113	50.01	289.88	-360.50	-7271.0	4433.5	3963.9
129	4114	50.01	5.98	-360.50	-940.2	4433.5	-1316.6
130	4115	183.04	104.12	-360.25	-3048.5	7396.8	708.4
131	4116	-100.86	104.12	-360.25	-3048.5	1065.9	1141.3
132	4117	41.09	246.07	-360.25	-6213.9	4231.3	3565.1
133	4118	41.09	-37.83	-360.25	117.0	4231.3	-1715.4
134	4121	179.95	1.06	-360.18	-563.0	7328.1	-256.8
135	4122	-103.94	1.06	-360.18	-563.0	997.2	176.1
136	4123	38.01	143.01	-360.18	-3728.5	4162.6	2599.9
137	4124	38.01	-140.89	-360.18	2602.4	4162.6	-2680.6
138	4125	184.53	-102.75	-360.33	1939.8	7433.5	-1240.6
139	4126	-99.37	-102.75	-360.33	1939.8	1102.6	-807.7
140	4127	42.58	39.20	-360.33	-1225.6	4268.1	1616.1
141	4128	42.58	-244.69	-360.33	5105.3	4268.1	-3664.4
142	4131	194.09	-146.31	-360.63	2989.6	7651.5	-1665.0
143	4132	-89.80	-146.31	-360.63	2989.6	1320.7	-1232.1
144	4133	52.15	-4.37	-360.63	-175.8	4486.1	1191.7
145	4134	52.15	-288.26	-360.63	6155.0	4486.1	-4088.8
146	4135	203.16	-105.48	-360.89	2004.0	7857.1	-1294.4
147	4136	-80.74	-105.48	-360.89	2004.0	1526.2	-861.5
148	4137	61.21	36.47	-360.89	-1161.4	4691.6	1562.3
149	4138	61.21	-247.42	-360.89	5169.4	4691.6	-3718.2
150	4201	155.19	-52.16	-360.96	631.8	6780.8	-701.6
151	4202	-128.71	-52.16	-360.96	631.8	449.9	-268.7
152	4203	13.24	89.79	-360.96	-2533.6	3615.4	2155.1
153	4204	13.24	-194.11	-360.96	3797.3	3615.4	-3125.4
154	4205	150.55	52.83	-360.80	-1899.5	6674.0	293.4
155	4206	-133.34	52.83	-360.80	-1899.5	343.1	726.4
156	4207	8.60	194.78	-360.80	-5065.0	3508.5	3150.1
157	4208	8.60	-89.11	-360.80	1265.9	3508.5	-2130.3

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158	4211	140.87	96.85	-360.50	-2960.1	6453.4	722.2
159	4212	-143.02	96.85	-360.50	-2960.1	122.5	1155.2
160	4213	-1.08	238.80	-360.50	-6125.5	3287.9	3578.9
161	4214	-1.08	-45.10	-360.50	205.4	3287.9	-1701.5
162	4215	131.95	53.04	-360.25	-1902.9	6251.2	323.4

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
163	4216	-151.94	53.04	-360.25	-1902.9	-79.7	756.4
164	4217	-9.99	194.99	-360.25	-5068.4	3085.8	3180.1
165	4218	-9.99	-88.91	-360.25	1262.5	3085.8	-2100.4
166	4221	128.87	-50.02	-360.18	582.5	6182.5	-641.8
167	4222	-155.02	-50.02	-360.18	582.5	-148.3	-208.8
168	4223	-13.08	91.93	-360.18	-2582.9	3017.1	2214.9
169	4224	-13.08	-191.97	-360.18	3747.9	3017.1	-3065.5
170	4225	133.45	-153.83	-360.33	3085.4	6288.0	-1625.5
171	4226	-150.45	-153.83	-360.33	3085.4	-42.9	-1192.6
172	4227	-8.50	-11.88	-360.33	-80.1	3122.5	1231.2
173	4228	-8.50	-295.78	-360.33	6250.8	3122.5	-4049.3
174	4231	143.01	-197.40	-360.63	4135.1	6506.0	-2050.0
175	4232	-140.88	-197.40	-360.63	4135.1	175.1	-1617.0
176	4233	1.06	-55.45	-360.63	969.7	3340.6	806.7
177	4234	1.06	-339.35	-360.63	7300.6	3340.6	-4473.7
178	4235	152.08	-156.56	-360.89	3149.5	6711.5	-1679.4
179	4236	-131.82	-156.56	-360.89	3149.5	380.7	-1246.4
180	4237	10.13	-14.61	-360.89	-15.9	3546.1	1177.3
181	4238	10.13	-298.51	-360.89	6315.0	3546.1	-4103.1
182	4301	155.19	50.01	-360.96	-1659.3	6780.8	208.5
183	4302	-128.71	50.01	-360.96	-1659.3	449.9	641.4
184	4303	13.24	191.95	-360.96	-4824.7	3615.4	3065.2
185	4304	13.24	-91.94	-360.96	1506.2	3615.4	-2215.3
186	4305	150.55	155.00	-360.80	-4190.6	6674.0	1203.5
187	4306	-133.34	155.00	-360.80	-4190.6	343.1	1636.4
188	4307	8.60	296.95	-360.80	-7356.0	3508.5	4060.2
189	4308	8.60	13.05	-360.80	-1025.2	3508.5	-1220.3
190	4311	140.87	199.01	-360.50	-5251.1	6453.4	1632.3
191	4312	-143.02	199.01	-360.50	-5251.1	122.5	2065.2
192	4313	-1.08	340.96	-360.50	-8416.6	3287.9	4489.0
193	4314	-1.08	57.07	-360.50	-2085.7	3287.9	-791.5
194	4315	131.95	155.20	-360.25	-4194.0	6251.2	1233.5
195	4316	-151.94	155.20	-360.25	-4194.0	-79.7	1666.4
196	4317	-9.99	297.15	-360.25	-7359.4	3085.8	4090.2
197	4318	-9.99	13.26	-360.25	-1028.6	3085.8	-1190.3
198	4321	128.87	52.15	-360.18	-1708.6	6182.5	268.3
199	4322	-155.02	52.15	-360.18	-1708.6	-148.3	701.2
200	4323	-13.08	194.09	-360.18	-4874.0	3017.1	3125.0
201	4324	-13.08	-89.80	-360.18	1456.9	3017.1	-2155.5
202	4325	133.45	-51.66	-360.33	794.3	6288.0	-715.5

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203	4326	-150.45	-51.66	-360.33	794.3	-42.9	-282.6
204	4327	-8.50	90.28	-360.33	-2371.2	3122.5	2141.2
205	4328	-8.50	-193.61	-360.33	3959.7	3122.5	-3139.3
206	4331	143.01	-95.23	-360.63	1844.1	6506.0	-1139.9
207	4332	-140.88	-95.23	-360.63	1844.1	175.1	-707.0

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\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*

		RELATIVE TO MUDLINE ELEVATION					
LOAD	LOAD	FX	FY	FZ	MX	MY	MZ
CASE	LABEL	(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
208	4333	1.06	46.72	-360.63	-1321.4	3340.6	1716.8
209	4334	1.06	-237.18	-360.63	5009.5	3340.6	-3563.7
210	4335	152.08	-54.39	-360.89	858.5	6711.5	-769.3
211	4336	-131.82	-54.39	-360.89	858.5	380.7	-336.4
212	4337	10.13	87.55	-360.89	-2307.0	3546.1	2087.4
213	4338	10.13	-196.34	-360.89	4023.9	3546.1	-3193.1

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Company: Company

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
1	CL	0.00				0.00				-39.62	8.77	1.93	23.79
2	DL	0.00				0.00				-64.79	9.68	1.49	23.42
3	LL	0.00				0.00				-49.37	9.45	1.53	22.30
4	201	36.60	9.63	1.32	23.34	-2.98	11.79	1.16	23.34	-1.09	-20.08	0.77	24.47
5	202	23.79	9.44	1.33	23.33	287.96	9.40	2.12	24.13	-0.64	-28.16	-3.54	24.45
6	203	-2.97	11.79	1.16	23.34	409.86	9.41	0.95	24.12	0.18	21.49	22.93	24.59
7	204	-27.56	9.79	1.31	23.34	287.76	9.43	0.95	24.12	0.88	-14.25	3.87	24.49
8	205	-36.07	9.63	1.32	23.34	2.93	11.79	1.16	23.34	1.07	-20.07	0.77	24.47
9	206	-23.45	9.44	1.33	23.34	-284.04	9.40	0.95	24.13	0.64	-28.15	-3.54	24.45
10	207	2.93	11.79	1.16	23.34	-404.45	9.41	2.11	24.13	-0.17	21.49	22.92	24.59
11	208	28.01	9.79	1.31	23.34	-292.29	9.43	2.10	24.12	-0.90	-14.26	3.87	24.49
12	301	13.24	9.63	1.32	23.33	-1.08	11.78	1.16	23.34	-0.39	-20.10	0.77	24.47
13	302	8.60	9.44	1.33	23.33	103.92	9.40	2.12	24.13	-0.23	-28.19	-3.55	24.44
14	303	-1.08	11.78	1.16	23.34	147.93	9.41	0.95	24.12	0.06	21.50	22.96	24.59
15	304	-9.99	9.79	1.31	23.33	104.12	9.43	0.95	24.12	0.32	-14.27	3.87	24.48
16	305	-13.08	9.63	1.32	23.33	1.06	11.78	1.16	23.34	0.39	-20.09	0.77	24.47
17	306	-8.50	9.44	1.33	23.33	-102.75	9.40	0.95	24.13	0.23	-28.18	-3.55	24.44
18	307	1.06	11.78	1.16	23.34	-146.31	9.41	2.11	24.12	-0.06	21.50	22.96	24.59
19	308	10.13	9.79	1.31	23.33	-105.48	9.43	2.10	24.12	-0.32	-14.28	3.88	24.48
20	FLX	141.95	18.60	1.52	22.30	0.00				0.00			
21	FLY	0.00				141.95	18.60	1.52	22.30	0.00			
22	HTLP	0.00				0.00				-2.39	9.45	-0.43	22.30
23	NGDL	0.00				0.00				-32.31	9.76	1.54	22.31
24	PLEM	0.00				0.00				-107.21	8.26	1.59	23.16
25	PLOP	0.00				0.00				-170.28	8.91	1.37	22.43
26	PLTX	-170.28	8.91	1.37	22.43	0.00				0.00			
27	PLTY	0.00				-170.28	8.91	1.37	22.43	0.00			
28	1000	0.00				0.00				-248.13	8.93	1.61	23.20
29	1001	0.00				0.00				-311.19	9.15	1.49	22.79
30	1002	-51.08	8.91	1.37	22.43	0.00				-360.56	9.19	1.49	22.72
31	1003	51.08	8.91	1.37	22.43	0.00				-360.56	9.19	1.49	22.72
32	1004	0.00				-51.08	8.91	1.37	22.43	-360.56	9.19	1.49	22.72
33	1005	0.00				51.08	8.91	1.37	22.43	-360.56	9.19	1.49	22.72
34	1011	141.95	18.60	1.52	22.30	0.00				-311.19	9.15	1.49	22.79
35	1012	-141.95	18.60	1.52	22.30	0.00				-311.19	9.15	1.49	22.79
36	1013	0.00				141.95	18.60	1.52	22.30	-311.19	9.15	1.49	22.79
37	1014	0.00				-141.95	18.60	1.52	22.30	-311.19	9.15	1.49	22.79
38	1021	90.87	24.05	1.61	22.23	0.00				-360.56	9.19	1.49	22.72
39	1022	-193.03	16.04	1.48	22.33	0.00				-360.56	9.19	1.49	22.72
40	1023	-51.08	8.91	1.37	22.43	141.95	18.60	1.52	22.30	-360.56	9.19	1.49	22.72



41	1024	-51.08	8.91	1.37	22.43	-141.95	18.60	1.52	22.30	-360.56	9.19	1.49	22.72
42	1031	193.03	16.04	1.48	22.33	0.00				-360.56	9.19	1.49	22.72
43	1032	-90.87	24.05	1.61	22.23	0.00				-360.56	9.19	1.49	22.72
44	1033	51.08	8.91	1.37	22.43	141.95	18.60	1.52	22.30	-360.56	9.19	1.49	22.72
45	1034	51.08	8.91	1.37	22.43	-141.95	18.60	1.52	22.30	-360.56	9.19	1.49	22.72

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
46	1041	141.95	18.60	1.52	22.30	-51.08	8.91	1.37	22.43	-360.56	9.19	1.49	22.72
47	1042	-141.95	18.60	1.52	22.30	-51.08	8.91	1.37	22.43	-360.56	9.19	1.49	22.72
48	1043	0.00				90.87	24.05	1.61	22.23	-360.56	9.19	1.49	22.72
49	1044	0.00				-193.03	16.04	1.48	22.33	-360.56	9.19	1.49	22.72
50	1051	141.95	18.60	1.52	22.30	51.08	8.91	1.37	22.43	-360.56	9.19	1.49	22.72
51	1052	-141.95	18.60	1.52	22.30	51.08	8.91	1.37	22.43	-360.56	9.19	1.49	22.72
52	1053	0.00				193.03	16.04	1.48	22.33	-360.56	9.19	1.49	22.72
53	1054	0.00				-90.87	24.05	1.61	22.23	-360.56	9.19	1.49	22.72
54	2001	178.55	16.76	1.48	22.51	-2.98	11.79	1.16	23.34	-312.28	9.05	1.49	22.80
55	2002	-105.34	21.72	1.60	21.94	-2.98	11.79	1.16	23.34	-312.28	9.05	1.49	22.80
56	2003	36.60	9.63	1.32	23.34	138.97	18.75	1.53	22.28	-312.28	9.05	1.49	22.80
57	2004	36.60	9.63	1.32	23.34	-144.92	18.46	1.52	22.32	-312.28	9.05	1.49	22.80
58	2005	165.74	17.29	1.50	22.45	287.96	9.40	2.12	24.13	-311.84	9.07	1.48	22.80
59	2006	-118.16	20.44	1.56	22.09	287.96	9.40	2.12	24.13	-311.84	9.07	1.48	22.80
60	2007	23.79	9.44	1.33	23.33	429.90	12.43	1.92	23.53	-311.84	9.07	1.48	22.80
61	2008	23.79	9.44	1.33	23.33	146.01	0.45	2.69	25.91	-311.84	9.07	1.48	22.80
62	2011	138.97	18.75	1.53	22.28	409.86	9.41	0.95	24.12	-311.02	9.14	1.48	22.79
63	2012	-144.92	18.46	1.52	22.32	409.86	9.41	0.95	24.12	-311.02	9.14	1.48	22.79
64	2013	-2.97	11.79	1.16	23.34	551.80	11.78	1.10	23.66	-311.02	9.14	1.48	22.79
65	2014	-2.97	11.79	1.16	23.34	267.91	4.55	0.65	25.09	-311.02	9.14	1.48	22.79
66	2015	114.39	20.72	1.58	22.05	287.76	9.43	0.95	24.12	-310.31	9.22	1.48	22.79
67	2016	-169.51	17.17	1.49	22.47	287.76	9.43	0.95	24.12	-310.31	9.22	1.48	22.79
68	2017	-27.56	9.79	1.31	23.34	429.71	12.46	1.14	23.52	-310.31	9.22	1.48	22.79
69	2018	-27.56	9.79	1.31	23.34	145.82	0.50	0.40	25.89	-310.31	9.22	1.48	22.79
70	2021	105.88	21.66	1.60	21.95	2.93	11.79	1.16	23.34	-310.12	9.25	1.49	22.79
71	2022	-178.01	16.78	1.48	22.51	2.93	11.79	1.16	23.34	-310.12	9.25	1.49	22.79
72	2023	-36.07	9.63	1.32	23.34	144.88	18.46	1.52	22.32	-310.12	9.25	1.49	22.79
73	2024	-36.07	9.63	1.32	23.34	-139.02	18.74	1.53	22.28	-310.12	9.25	1.49	22.79
74	2025	118.50	20.41	1.56	22.09	-284.04	9.40	0.95	24.13	-310.56	9.23	1.50	22.79
75	2026	-165.40	17.30	1.50	22.45	-284.04	9.40	0.95	24.13	-310.56	9.23	1.50	22.79
76	2027	-23.45	9.44	1.33	23.34	-142.10	0.20	0.38	25.96	-310.56	9.23	1.50	22.79
77	2028	-23.45	9.44	1.33	23.34	-425.99	12.46	1.14	23.52	-310.56	9.23	1.50	22.79
78	2031	144.88	18.46	1.52	22.32	-404.45	9.41	2.11	24.13	-311.37	9.16	1.50	22.79
79	2032	-139.02	18.74	1.53	22.28	-404.45	9.41	2.11	24.13	-311.37	9.16	1.50	22.79
80	2033	2.93	11.79	1.16	23.34	-262.51	4.44	2.43	25.11	-311.37	9.16	1.50	22.79
81	2034	2.93	11.79	1.16	23.34	-546.40	11.80	1.96	23.65	-311.37	9.16	1.50	22.79
82	2035	169.96	17.15	1.49	22.47	-292.29	9.43	2.10	24.12	-312.09	9.08	1.50	22.80
83	2036	-113.94	20.77	1.58	22.05	-292.29	9.43	2.10	24.12	-312.09	9.08	1.50	22.80
84	2037	28.01	9.79	1.31	23.34	-150.34	0.77	2.65	25.84	-312.09	9.08	1.50	22.80
85	2038	28.01	9.79	1.31	23.34	-434.24	12.43	1.91	23.52	-312.09	9.08	1.50	22.80

86	4001	104.10	22.22	1.57	22.37	-1.08	11.78	1.16	23.34	-360.96	9.16	1.49	22.73
87	4002	-179.79	16.51	1.50	22.26	-1.08	11.78	1.16	23.34	-360.96	9.16	1.49	22.73
88	4003	-37.84	8.65	1.39	22.11	140.87	18.65	1.53	22.29	-360.96	9.16	1.49	22.73
89	4004	-37.84	8.65	1.39	22.11	-143.02	18.55	1.52	22.31	-360.96	9.16	1.49	22.73
90	4005	99.47	22.79	1.59	22.32	103.92	9.40	2.12	24.13	-360.80	9.17	1.49	22.73

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
91	4006	-184.43	16.34	1.49	22.29	103.92	9.40	2.12	24.13	-360.80	9.17	1.49	22.73
92	4007	-42.48	8.80	1.38	22.24	245.86	14.71	1.78	23.07	-360.80	9.17	1.49	22.73
93	4008	-42.48	8.80	1.38	22.24	-38.03	43.75	-0.09	17.30	-360.80	9.17	1.49	22.73
94	4011	89.79	24.20	1.62	22.22	147.93	9.41	0.95	24.12	-360.50	9.19	1.49	22.72
95	4012	-194.11	16.01	1.48	22.34	147.93	9.41	0.95	24.12	-360.50	9.19	1.49	22.72
96	4013	-52.16	8.97	1.37	22.44	289.88	13.91	1.23	23.23	-360.50	9.19	1.49	22.72
97	4014	-52.16	8.97	1.37	22.44	5.98	-208.50	-12.62	67.36	-360.50	9.19	1.49	22.72
98	4015	80.87	25.81	1.65	22.09	104.12	9.43	0.95	24.12	-360.25	9.21	1.49	22.72
99	4016	-203.02	15.73	1.48	22.38	104.12	9.43	0.95	24.12	-360.25	9.21	1.49	22.72
100	4017	-61.08	9.05	1.36	22.57	246.07	14.72	1.28	23.07	-360.25	9.21	1.49	22.72
101	4018	-61.08	9.05	1.36	22.57	-37.83	43.84	3.10	17.30	-360.25	9.21	1.49	22.72
102	4021	77.79	26.47	1.66	22.04	1.06	11.78	1.16	23.34	-360.18	9.22	1.49	22.72
103	4022	-206.11	15.63	1.47	22.40	1.06	11.78	1.16	23.34	-360.18	9.22	1.49	22.72
104	4023	-64.16	9.06	1.36	22.61	143.01	18.55	1.52	22.31	-360.18	9.22	1.49	22.72
105	4024	-64.16	9.06	1.36	22.61	-140.89	18.65	1.53	22.29	-360.18	9.22	1.49	22.72
106	4025	82.36	25.56	1.64	22.12	-102.75	9.40	0.95	24.13	-360.33	9.22	1.50	22.72
107	4026	-201.53	15.76	1.48	22.38	-102.75	9.40	0.95	24.13	-360.33	9.22	1.50	22.72
108	4027	-59.58	8.98	1.37	22.55	39.20	42.72	3.03	17.51	-360.33	9.22	1.50	22.72
109	4028	-59.58	8.98	1.37	22.55	-244.69	14.74	1.28	23.07	-360.33	9.22	1.50	22.72
110	4031	91.93	23.91	1.61	22.24	-146.31	9.41	2.11	24.12	-360.63	9.19	1.50	22.73
111	4032	-191.97	16.06	1.49	22.33	-146.31	9.41	2.11	24.12	-360.63	9.19	1.50	22.73
112	4033	-50.02	8.85	1.38	22.41	-4.37	-289.23	21.14	83.39	-360.63	9.19	1.50	22.73
113	4034	-50.02	8.85	1.38	22.41	-288.26	13.94	1.82	23.23	-360.63	9.19	1.50	22.73
114	4035	100.99	22.62	1.58	22.34	-105.48	9.43	2.10	24.12	-360.89	9.17	1.50	22.73
115	4036	-182.90	16.38	1.49	22.28	-105.48	9.43	2.10	24.12	-360.89	9.17	1.50	22.73
116	4037	-40.95	8.69	1.39	22.20	36.47	45.12	-0.15	17.04	-360.89	9.17	1.50	22.73
117	4038	-40.95	8.69	1.39	22.20	-247.42	14.69	1.77	23.07	-360.89	9.17	1.50	22.73
118	4101	206.27	15.62	1.47	22.40	-1.08	11.78	1.16	23.34	-360.96	9.16	1.49	22.73
119	4102	-77.63	26.51	1.66	22.04	-1.08	11.78	1.16	23.34	-360.96	9.16	1.49	22.73
120	4103	64.32	9.06	1.36	22.61	140.87	18.65	1.53	22.29	-360.96	9.16	1.49	22.73
121	4104	64.32	9.06	1.36	22.61	-143.02	18.55	1.52	22.31	-360.96	9.16	1.49	22.73
122	4105	201.63	15.75	1.48	22.38	103.92	9.40	2.12	24.13	-360.80	9.17	1.49	22.73
123	4106	-82.26	25.58	1.64	22.11	103.92	9.40	2.12	24.13	-360.80	9.17	1.49	22.73
124	4107	59.69	8.98	1.37	22.56	245.86	14.71	1.78	23.07	-360.80	9.17	1.49	22.73
125	4108	59.69	8.98	1.37	22.56	-38.03	43.75	-0.09	17.30	-360.80	9.17	1.49	22.73
126	4111	191.95	16.06	1.49	22.33	147.93	9.41	0.95	24.12	-360.50	9.19	1.49	22.72
127	4112	-91.94	23.91	1.61	22.24	147.93	9.41	0.95	24.12	-360.50	9.19	1.49	22.72
128	4113	50.01	8.85	1.38	22.41	289.88	13.91	1.23	23.23	-360.50	9.19	1.49	22.72
129	4114	50.01	8.85	1.38	22.41	5.98	-208.50	-12.62	67.36	-360.50	9.19	1.49	22.72
130	4115	183.04	16.38	1.49	22.28	104.12	9.43	0.95	24.12	-360.25	9.21	1.49	22.72

131	4116	-100.86	22.64	1.58	22.34	104.12	9.43	0.95	24.12	-360.25	9.21	1.49	22.72
132	4117	41.09	8.69	1.39	22.20	246.07	14.72	1.28	23.07	-360.25	9.21	1.49	22.72
133	4118	41.09	8.69	1.39	22.20	-37.83	43.84	3.10	17.30	-360.25	9.21	1.49	22.72
134	4121	179.95	16.50	1.50	22.26	1.06	11.78	1.16	23.34	-360.18	9.22	1.49	22.72
135	4122	-103.94	22.24	1.57	22.37	1.06	11.78	1.16	23.34	-360.18	9.22	1.49	22.72

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
136	4123	38.01	8.66	1.39	22.11	143.01	18.55	1.52	22.31	-360.18	9.22	1.49	22.72
137	4124	38.01	8.66	1.39	22.11	-140.89	18.65	1.53	22.29	-360.18	9.22	1.49	22.72
138	4125	184.53	16.34	1.49	22.29	-102.75	9.40	0.95	24.13	-360.33	9.22	1.50	22.72
139	4126	-99.37	22.80	1.59	22.32	-102.75	9.40	0.95	24.13	-360.33	9.22	1.50	22.72
140	4127	42.58	8.80	1.38	22.24	39.20	42.72	3.03	17.51	-360.33	9.22	1.50	22.72
141	4128	42.58	8.80	1.38	22.24	-244.69	14.74	1.28	23.07	-360.33	9.22	1.50	22.72
142	4131	194.09	16.01	1.48	22.34	-146.31	9.41	2.11	24.12	-360.63	9.19	1.50	22.73
143	4132	-89.80	24.19	1.62	22.22	-146.31	9.41	2.11	24.12	-360.63	9.19	1.50	22.73
144	4133	52.15	8.97	1.37	22.44	-4.37	-289.23	21.14	83.39	-360.63	9.19	1.50	22.73
145	4134	52.15	8.97	1.37	22.44	-288.26	13.94	1.82	23.23	-360.63	9.19	1.50	22.73
146	4135	203.16	15.72	1.48	22.38	-105.48	9.43	2.10	24.12	-360.89	9.17	1.50	22.73
147	4136	-80.74	25.84	1.65	22.09	-105.48	9.43	2.10	24.12	-360.89	9.17	1.50	22.73
148	4137	61.21	9.05	1.36	22.58	36.47	45.12	-0.15	17.04	-360.89	9.17	1.50	22.73
149	4138	61.21	9.05	1.36	22.58	-247.42	14.69	1.77	23.07	-360.89	9.17	1.50	22.73
150	4201	155.19	17.84	1.51	22.39	-52.16	8.97	1.37	22.44	-360.96	9.16	1.49	22.73
151	4202	-128.71	19.52	1.55	22.19	-52.16	8.97	1.37	22.44	-360.96	9.16	1.49	22.73
152	4203	13.24	9.63	1.32	23.33	89.79	24.20	1.62	22.22	-360.96	9.16	1.49	22.73
153	4204	13.24	9.63	1.32	23.33	-194.11	16.01	1.48	22.34	-360.96	9.16	1.49	22.73
154	4205	150.55	18.08	1.51	22.36	52.83	9.87	2.84	25.78	-360.80	9.17	1.49	22.73
155	4206	-133.34	19.19	1.54	22.23	52.83	9.87	2.84	25.78	-360.80	9.17	1.49	22.73
156	4207	8.60	9.44	1.33	23.33	194.78	16.23	1.88	23.24	-360.80	9.17	1.49	22.73
157	4208	8.60	9.44	1.33	23.33	-89.11	23.78	0.75	20.24	-360.80	9.17	1.49	22.73
158	4211	140.87	18.65	1.53	22.29	96.85	9.68	0.73	25.02	-360.50	9.19	1.49	22.72
159	4212	-143.02	18.55	1.52	22.31	96.85	9.68	0.73	25.02	-360.50	9.19	1.49	22.72
160	4213	-1.08	11.78	1.16	23.34	238.80	14.98	1.20	23.40	-360.50	9.19	1.49	22.72
161	4214	-1.08	11.78	1.16	23.34	-45.10	37.76	3.23	16.46	-360.50	9.19	1.49	22.72
162	4215	131.95	19.27	1.54	22.22	53.04	9.93	0.55	25.75	-360.25	9.21	1.49	22.72
163	4216	-151.94	18.02	1.51	22.37	53.04	9.93	0.55	25.75	-360.25	9.21	1.49	22.72
164	4217	-9.99	9.79	1.31	23.33	194.99	16.24	1.26	23.24	-360.25	9.21	1.49	22.72
165	4218	-9.99	9.79	1.31	23.33	-88.91	23.77	2.11	20.24	-360.25	9.21	1.49	22.72
166	4221	128.87	19.51	1.55	22.20	-50.02	8.85	1.38	22.41	-360.18	9.22	1.49	22.72
167	4222	-155.02	17.84	1.51	22.39	-50.02	8.85	1.38	22.41	-360.18	9.22	1.49	22.72
168	4223	-13.08	9.63	1.32	23.33	91.93	23.91	1.61	22.24	-360.18	9.22	1.49	22.72
169	4224	-13.08	9.63	1.32	23.33	-191.97	16.06	1.49	22.33	-360.18	9.22	1.49	22.72
170	4225	133.45	19.18	1.54	22.23	-153.83	9.23	1.09	23.56	-360.33	9.22	1.50	22.72
171	4226	-150.45	18.08	1.51	22.36	-153.83	9.23	1.09	23.56	-360.33	9.22	1.50	22.72
172	4227	-8.50	9.44	1.33	23.33	-11.88	-102.67	-4.10	38.66	-360.33	9.22	1.50	22.72
173	4228	-8.50	9.44	1.33	23.33	-295.78	13.73	1.30	22.96	-360.33	9.22	1.50	22.72
174	4231	143.01	18.55	1.52	22.31	-197.40	9.28	1.92	23.68	-360.63	9.19	1.50	22.73
175	4232	-140.88	18.65	1.53	22.29	-197.40	9.28	1.92	23.68	-360.63	9.19	1.50	22.73

176	4233	1.06	11.78	1.16	23.34	-55.45	-14.57	2.93	27.23	-360.63	9.19	1.50	22.73
177	4234	1.06	11.78	1.16	23.34	-339.35	13.18	1.75	23.11	-360.63	9.19	1.50	22.73
178	4235	152.08	18.01	1.51	22.37	-156.56	9.26	1.86	23.57	-360.89	9.17	1.50	22.73
179	4236	-131.82	19.28	1.54	22.22	-156.56	9.26	1.86	23.57	-360.89	9.17	1.50	22.73
180	4237	10.13	9.79	1.31	23.33	-14.61	-81.48	5.17	35.86	-360.89	9.17	1.50	22.73

SACS (2025)

Company: Company

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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\*\*\*\*\* SEASTATE LOAD CASE CENTER REPORT \*\*\*\*\*

RELATIVE TO STRUCTURAL ORIGIN

LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE	X	Y	Z	FORCE	X	Y	Z	FORCE	X	Y	Z
		(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)	(KN)	(M)	(M)	(M)
181	4238	10.13	9.79	1.31	23.33	-298.51	13.70	1.70	22.96	-360.89	9.17	1.50	22.73
182	4301	155.19	17.84	1.51	22.39	50.01	8.85	1.38	22.41	-360.96	9.16	1.49	22.73
183	4302	-128.71	19.52	1.55	22.19	50.01	8.85	1.38	22.41	-360.96	9.16	1.49	22.73
184	4303	13.24	9.63	1.32	23.33	191.95	16.06	1.49	22.33	-360.96	9.16	1.49	22.73
185	4304	13.24	9.63	1.32	23.33	-91.94	23.91	1.61	22.24	-360.96	9.16	1.49	22.73
186	4305	150.55	18.08	1.51	22.36	155.00	9.23	1.87	23.57	-360.80	9.17	1.49	22.73
187	4306	-133.34	19.19	1.54	22.23	155.00	9.23	1.87	23.57	-360.80	9.17	1.49	22.73
188	4307	8.60	9.44	1.33	23.33	296.95	13.71	1.71	22.96	-360.80	9.17	1.49	22.73
189	4308	8.60	9.44	1.33	23.33	13.05	-92.62	5.64	37.35	-360.80	9.17	1.49	22.73
190	4311	140.87	18.65	1.53	22.29	199.01	9.28	1.06	23.69	-360.50	9.19	1.49	22.72
191	4312	-143.02	18.55	1.52	22.31	199.01	9.28	1.06	23.69	-360.50	9.19	1.49	22.72
192	4313	-1.08	11.78	1.16	23.34	340.96	13.16	1.25	23.11	-360.50	9.19	1.49	22.72
193	4314	-1.08	11.78	1.16	23.34	57.07	-13.89	-0.10	27.14	-360.50	9.19	1.49	22.72
194	4315	131.95	19.27	1.54	22.22	155.20	9.26	1.09	23.56	-360.25	9.21	1.49	22.72
195	4316	-151.94	18.02	1.51	22.37	155.20	9.26	1.09	23.56	-360.25	9.21	1.49	22.72
196	4317	-9.99	9.79	1.31	23.33	297.15	13.72	1.30	22.96	-360.25	9.21	1.49	22.72
197	4318	-9.99	9.79	1.31	23.33	13.26	-90.78	-3.55	37.06	-360.25	9.21	1.49	22.72
198	4321	128.87	19.51	1.55	22.20	52.15	8.97	1.37	22.44	-360.18	9.22	1.49	22.72
199	4322	-155.02	17.84	1.51	22.39	52.15	8.97	1.37	22.44	-360.18	9.22	1.49	22.72
200	4323	-13.08	9.63	1.32	23.33	194.09	16.01	1.48	22.34	-360.18	9.22	1.49	22.72
201	4324	-13.08	9.63	1.32	23.33	-89.80	24.19	1.62	22.22	-360.18	9.22	1.49	22.72
202	4325	133.45	19.18	1.54	22.23	-51.66	9.88	0.53	25.81	-360.33	9.22	1.50	22.72
203	4326	-150.45	18.08	1.51	22.36	-51.66	9.88	0.53	25.81	-360.33	9.22	1.50	22.72
204	4327	-8.50	9.44	1.33	23.33	90.28	23.59	2.09	20.29	-360.33	9.22	1.50	22.72
205	4328	-8.50	9.44	1.33	23.33	-193.61	16.27	1.26	23.24	-360.33	9.22	1.50	22.72
206	4331	143.01	18.55	1.52	22.31	-95.23	9.68	2.51	25.03	-360.63	9.19	1.50	22.73
207	4332	-140.88	18.65	1.53	22.29	-95.23	9.68	2.51	25.03	-360.63	9.19	1.50	22.73
208	4333	1.06	11.78	1.16	23.34	46.72	36.78	-0.48	16.73	-360.63	9.19	1.50	22.73
209	4334	1.06	11.78	1.16	23.34	-237.18	15.02	1.92	23.40	-360.63	9.19	1.50	22.73
210	4335	152.08	18.01	1.51	22.37	-54.39	9.92	2.79	25.71	-360.89	9.17	1.50	22.73
211	4336	-131.82	19.28	1.54	22.22	-54.39	9.92	2.79	25.71	-360.89	9.17	1.50	22.73
212	4337	10.13	9.79	1.31	23.33	87.55	23.99	0.74	20.18	-360.89	9.17	1.50	22.73
213	4338	10.13	9.79	1.31	23.33	-196.34	16.20	1.88	23.24	-360.89	9.17	1.50	22.73



## 6.1 Member Unity Check Result

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

### 6.1a AS-IS CONDITION

#### Member Unity Check Result

Member	Group ID	Load Case	UC
0001-0030	C01	2031	1.184
0030-0016	C07	2012	1.220
0005-0061	D02	4311	1.154
0032-0002	C06	2032	1.632
0002-0006	C16	2032	1.764

### 6.1b AFTER STRENGTHENING

Member having Unity check ratio between 0 to 0.9 for the bridge members are summarized below.

#### Member Unity Check Result

Member	Group ID	Load Case	UC	Remarks
0030-0016	TUA	4312	0.763	Member UC has decreased marginally.
0001-0030	TUA	4232	0.532	
0032-0024	TUA	4212	0.589	

## 6.2 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum Vertical Deflection (cm)	Remarks
1.	0059	1	Allowable Deflection = (1830 / 400) = 4.575 cm
2.	0076	0.9	

The Bridge deflection (Horizontal) along with Relative deflection between two supports have been tabulated below

#### Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Lateral Deflection (cm)	Remarks
1.	0031	0.9	Allowable Deflection = (1830/ 500) = 3.66 cm
2.	0064	0.7	

Vertical and Horizontal Deflection of bridge are under control.

### 6.3 Reaction Summary

Following is the reaction summary of the bridge supports.

#### Summary of Bridge Reaction

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	0016	295.620	92.823	225.431
2.	0001	305.954	163.085	214.674
3.	0024	0	173.645	172.442
4.	0006	0	87.652	196.329
5.	0010	0	109.005	10.774

## 7.0 CONCLUSION

The analysis of bridge has been carried out considering the piping, electrical & instrumentation cable tray and wind loads. Based on the results, the necessary strengthening requirements, as outlined in Clause 4.0, have been recommended. With the implementation of these strengthening measures of the top chord, bottom chord, and associated framing members, the bridge is found to be structurally adequate and safe under all load combinations.

Also, functionally the deflection is under the limits. The adequacy of the bridge landing locations, adequacy of deck members are performed separately.

It is also recommended that no additional structural loading/modifications shall be carried out on WIN-NC bridge without adequate structural analysis.

**ANNEXURE-1  
LOAD CALCULATIONS**

### WIND LOAD:

S.No.	STORM CONDI TION	DIREC TION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbula nce Intensit y at height "z"	t <sub>o</sub>	t	Design Wind Speed at Height "z"	
			U <sub>o</sub>			z		U(z)	Iu(z)			u(z,t)	
			kmph	ft/sec		m	ft	ft/sec				ft/sec	m/sec
1	Extreme	0	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
2	Extreme	45	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
3	Extreme	90	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
4	Extreme	135	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
5	Extreme	180	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
6	Extreme	225	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
7	Extreme	270	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
8	Extreme	315	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
1	Operating	All	99.22	90.40	0.130	10.00	32.80	90.40	0.131	3600	3	124.84	38.06

### CABLE LOAD & CABLE TRAY LOAD:

					A	B	C	D	E				
Total point load on each span(NC-WIN)					2.125551	2.686595	2.042038	1.514579	1.955888				
COMBINING 600mm&60mm													
					L	M	N	O	P	Q			
					1.062775	2.406073	2.364317	1.778309	1.735234	0.977944			
<b>E&amp;I TRAY 400x95</b>													
C127x64x15 (TYP)													
Length fom TC to channel section													1.577
Self wt.													
0.957072 kg													
0.00957072 KN													
0.00478536													
					A	B	C	D	E				
Span from north from NC to WIN					2.259	3.727	2.307	3.851	2.151				
					0.951656	1.570086	0.971878	1.622324	0.906159				
point load as per span (KN)					0.951656	1.570086	0.971878	1.622324	0.906159				
					L	M	N	O	P	Q			
					0.475828	1.260871	1.270982	1.297101	1.264241	0.45308			
For 450mm cable tray load					21.85kg/3 meter								
					7.283333 kg/m								
					0.072833 KN/m								
Total cable load					34844 kg/km								
					34.844 Kg/m								
					0.34844 KN/m								

win to nc side-load given									
E&I TRAY 600x85									
Total cable load				34844 kg/km					
L 70x7				34.844 Kg/m		Total load from win to nc			
Self wt.				0.34844 KN/m		0.49689			
				7.4 kg/m					
				0.074 kn/m					
				0.07215 KN					
For 600mm cable tray load				22.89kg/3 meter		Span fromWIN TO NC (m)			
				7.63 kg/m					
				0.0763 KN/m					
E&I TRAY 55x155									
L55x6									
self wt.				5 kg/m					
				0.05 KN/m					
For 60mm cable tray load				3kg/3 meter		Total load from win to nc			
				1 kg/m		0.40844 kn/m			
				0.01 KN/m					
Total cable load				34844 kg/km		Span fromWIN TO NC (m)			
				34.844 Kg/m					
				0.34844 KN/m					
						A	B	C	
						5.766	5.882	2.24	
						2.449051	2.498321	0.951418	
						L	M	N	O
						1.2606	2.473686	1.724869	0.475709

## GRATING LOAD

Grating load of 50 kg/m<sup>2</sup> is considered

## HANDRAIL LOAD

Handrail Load of 50Kg/m is considered.

## PIPING LOAD

### NEW PIPE LOAD

IN NORTH SIDE OF BRIDGE-ALL PIPES ARE CARRYING WATER AS CONTENT

PIPE SUPPORT POINTS					
	A	B	C	D	E
	0.976	2.242	3.429	3.776	4.29
DEAD LOAD(KN)(60%	0	0	0	0	0
CONTENT WT.(KN)	5	20	12.5	12.5	20

IN SOUTH SIDE OF BRIDGE-ALL PIPES ARE CARRYING GAS AND LIQUID AS CONTENT

PIPE SUPPORT						
	A	B	C	D	E	F
	1.023	2.234	3.191	2.872	3.247	2.733
DEAD LOAD(KN)	0	0	0	0	0	0
CONTENT WT.(KN)	4	2.5	2.5	2.5	2.5	4
		1.25	1.25	1.25	1.25	

### PIPE SUPPORT-FOR GRIDE 2 & 3

	B	C
DEAD LOAD(KN)	0	0
	0	0
CONTENT WT.(KN)	37.5	37.5

FOR TOP PIPE LINE

			A	B	C	D	E	
Span from north from NC to WI			2.259	3.727	2.307	3.851	2.151	
			L	M	N	O	P	Q
point load as per span (KN)			7.5	4	4	4	4	7.5
			3.75	2	2	2	2	3.75





## BRIDGE PRELIMINARY REPORT FOR BRIDGES IN NH ASSET (SLQ- WIS DECK BRIDGE)

**PROJECT :** ENGINEERING / TECHNICAL CONSULTANCY  
 SERVICES FOR PREPERATION OF EXECUTION  
 METHODOLOGY, SOW AND COST ESTIMATES  
 FOR REPLACEMENT /REFURBISHMENT OF  
 BRIDGES IN MH ASSET

**LOCATION:** MH ASSET (NORTH AND SOUTH FIELD)

**OWNER :** ONGC, MUMBAI

**JOB NO :** B774

0	24.09.2025	RE-ISSUED AS STUDY	MM	DP	CS
A	07.08.2025	ISSUED AS STUDY	MM	DP	CS
<b>Rev. No</b>	<b>Date</b>	<b>Purpose</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>



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Annexure-1 – Loads Details

Annexure-2 – Member Unity Check Output

## **Symbols and Abbreviations**

### **Organisations – India**

IS	Indian Standard
ONGC	Oil and Natural Gas Corporation
EIL	Engineers India Limited

### **Other abbreviations**

CD	Chart Datum
g	Acceleration due to Gravity
H	Unsupported Length of pile
HAT	Highest Astronomical Tide
Hmax	Maximum Wave Height
Hs	Significant Wave Height
l	Length of a Structural Member
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
SS	Storm Surge

## **1.0 INTRODUCTION**

M/S Oil & Natural Gas Corporation Ltd. (ONGC) owns and operates number of offshore platforms located on west coast of India. The platforms are operating in the Mumbai high field. With the ageing of field, condition of existing platform, bridges have deteriorated.

M/S Oil & Natural Gas Corporation Ltd. (ONGC) intends to carry out the refurbishment / replacement of existing bridges in offshore location at its MH asset. For this purpose, the existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges need to be assessed by conducting laser scanning and Non-Destructive Test (UT Survey, Radiography survey of Joints) for each of these items.

For ascertaining the scope of work for extent of laser scanning and scope of work for the NDT survey, the site visit was performed by the joint team of EIL (Multi-disciplinary), ONGC – Offshore Engineering Services and ONGC – MH asset team of respective complexes (IC Complex, BHS complex, NQ Complex and WIN Complex).

## **2.0 GENERAL**

Site visit for refurbishment / replacement of 8 number of offshore bridges is undertaken by the combined team of ONGC / EIL – Multi disciplinary team for making the visual observations, drawing sketches, identifying the new landing locations, identifying temporary supporting arrangements, etc. for performing the NDT works, Laser scanning works.

The existing condition of the existing structural items such as tubular members, girders, rolled sections, plate girders, plating of the existing offshore platform, bridges are assessed by conducting Non- Destructive Test (Ultrasonic thickness Survey, dye penetration testing for welds, Ultrasonic testing of fillet welds and alternating current field measurements for welds) for each of these items.

Further, the Laser scanning of the bridge and landing area platform are also performed for assessing the piping, cables, other facilities, etc.

Following is the list of bridges envisaged in the scope of work.

### **IC Complex:**

1. ICP-ICG Lower Deck bridge
2. ICW-ICG Lower Deck bridge
3. ICP-ICG Upper Deck bridge
4. ICW-ICG Upper Deck bridge

### **BHS Complex:**

5. BHS-SLQ Lower Deck bridge
6. SLQ-WIS Lower Deck bridge

### **NQO Complex:**

7. NQO-NQD

### **WIN Complex:**

8. WIN-NC

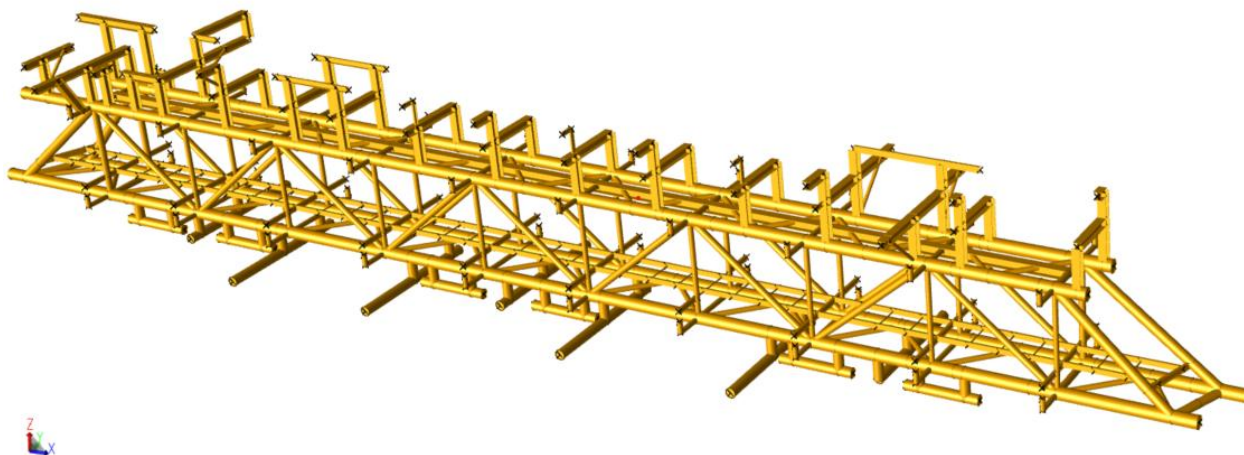
### 3.0 SLQ-WIS DECK BRIDGE DESCRIPTION

Approximate length of bridge modelled is 43.5m measured from 3D model & drawing available. Loading of Piping, Cable tray supports & cable is considered in analysis of bridge.

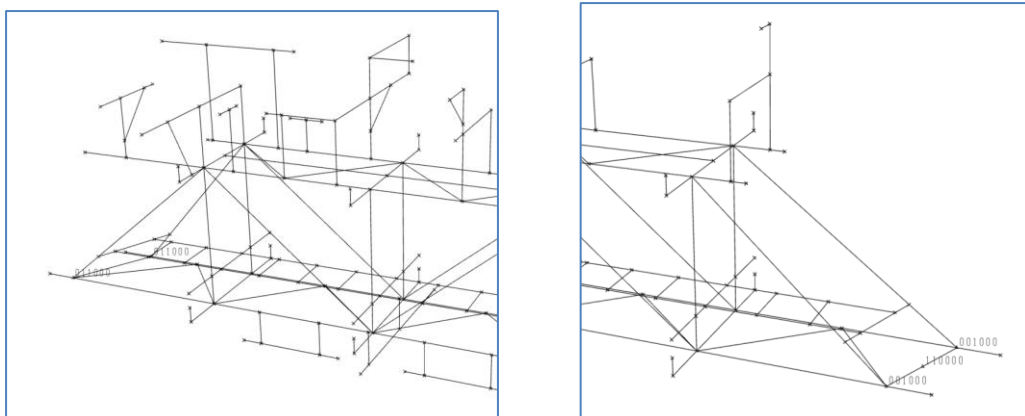
Brief description of SLQ-WIS bridge is detailed below: -

Approximate Length of Bridge	43.5 m
Support Condition	Pinned: 001000, 110000, 001000 (SLQ Side) Sliding: 011000, 011000 (WIS Side)
No. of directions for environmental loads	8
Wind Speed (3 Sec Gust)	61.78 m/s for Extreme wind condition 38.06 m/s for Operating wind condition
Density of steel	7.850 T/m <sup>3</sup>
Density of water	1.025 T /m <sup>3</sup>
Yield strength of steel	36ksi
Environmental parameters	As per design basis (DC-3.4-Part-1-Rev.14)

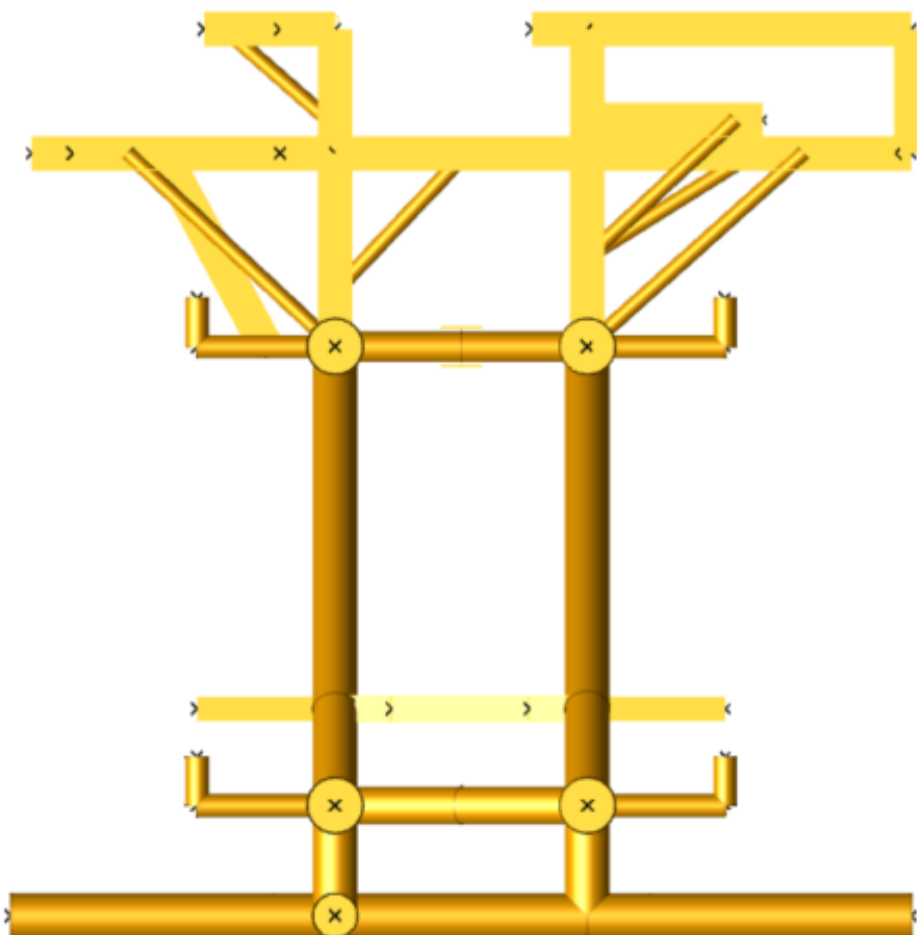
ISOMETRIC VIEW OF SLQ-WIS Deck Bridge is shown in Figure1.



**Figure 1: 3D SACS MODEL**



**Figure 2: SUPPORT CONDITIONS**



**Figure 3: BRIDGE CROSS SECTION**

## 4.0 LOADING

### Basic Load Cases

LOADCN	DESCRIPTION	LOAD (KN)
DL	Self-weight, (Contingency - 13%)	960.16
NGDL	Cable tray	117.43
	Cable tray Support	
	Grating Load	
	Handrail Load	
	Monorail, Sheeting Cladding – Nil	
LL	Live load on Walkway (Grating) Area -250 Kg/m <sup>2</sup> )	108.42
MRL	Monorail Live Load	20.0
CL	Cable Loading	16.28
PLEM	Piping Load Empty (60% of PLOP)	866.1
PLOP	(Piping Load Empty + Operating Contents) (By Piping)	1443.50
PLTX	30% of PLOP (Piping Load Empty + Operating Contents) in X direction	439.35
PLTY	30% of PLOP (Piping Load Empty + Operating Contents) in Y direction	439.35
201 to 208	Extreme Wind load	See Annexure
301 to 308	Operating Wind Load	See Annexure
FLX	Bridge Friction Load in X direction 30 % of (SW+NGDL+LL+CL+PLOP)	612
FLY	Bridge Friction Load in Y direction 30 % of (SW+NGDL+LL+CL+PLOP)	612

### SELF WEIGHT

Members are modelled and the self-weight is considered in the model. Contingency (13 %) on the modelled structural steel has been captured by increasing the density of the modelled members.

### NON-GENERATED DEAD LOAD

The weight of members which are not modelled in SACS is considered as NGDL. This includes the grating and handrail loadings.

### LIVE LOAD

Live load (grating area live load) on the walkway is considered as 250kg/m<sup>2</sup>. 1m width of walkway is considered as per drawing.

### CABLE TRAY AND CABLE LOAD

For Cable tray and cable load, refer Annexure-1.

### WIND LOAD

Wind load approaching the bridge are considered in 8 directions at 45-degree sectors for both 1-year operating and 100-year extreme storm in the structural analysis. Wind load in each direction is calculated based on projected areas with the applicable shape factor (Cs).

For all the load cases, the detailed calculation is provided in ANNEXURE-1.

#### 4.1 Load Combinations

##### Load Combinations

BASIC LOAD COMBINATIONS								
LComb	Load Case	Factor	Load Case	Factor	Load Case	Factor	Load Case	Factor
PLEM	PLOP	0.60						
1000	DL	1.00	NDGL	1.13	CL	1.00	PLEM	1.00
1001	DL	1.00	NDGL	1.13	CL	1.00	PLOP	1.00
1002	1001	1.00	LL	1.00	MRLl	1.00	PLTX	1.00
1003	1001	1.00	LL	1.00	MRLl	1.00	PLTX	-1.00
1004	1001	1.00	LL	1.00	MRLl	1.00	PLTY	1.00
1005	1001	1.00	LL	1.00	MRLl	1.00	PLTY	-1.00
1011	1001	1.00	FLX	1.00				
1012	1001	1.00	FLX	-1.00				
1013	1001	1.00	FLY	1.00				
1014	1001	1.00	FLY	-1.00				
1021	1002	1.00	FLX	1.00				
1022	1002	1.00	FLX	-1.00				
1023	1002	1.00	FLY	1.00				
1024	1002	1.00	FLY	-1.00				
1031	1003	1.00	FLX	1.00				
1032	1003	1.00	FLX	-1.00				
1033	1003	1.00	FLY	1.00				
1034	1003	1.00	FLY	-1.00				
1041	1004	1.00	FLX	1.00				
1042	1004	1.00	FLX	-1.00				
1043	1004	1.00	FLY	1.00				
1044	1004	1.00	FLY	-1.00				
1051	1005	1.00	FLX	1.00				
1052	1005	1.00	FLX	-1.00				
1053	1005	1.00	FLY	1.00				
1054	1005	1.00	FLY	-1.00				
EXTREME WIND CONDITION								
2001 to 2004	1011 to 1014	1.00	201	1.00				
2005 to 2008	1011 to 1014	1.00	202	1.00				
2011 to 2014	1011 to 1014	1.00	203	1.00				
2015 to 2018	1011 to 1014	1.00	204	1.00				

2021 to 2024	1011 to 1014	1.00	205	1.00				
2025 to 2028	1011 to 1014	1.00	206	1.00				
2031 to 2034	1011 to 1014	1.00	207	1.00				
2035 to 2038	1011 to 1014	1.00	208	1.00				
<b>OPERATING WIND CONDITION</b>								
4001 to 4004	1021 to 1024	1.00	301	1.00				
4005 to 4008	1021 to 1024	1.00	302	1.00				
4011 to 4014	1021 to 1024	1.00	303	1.00				
4015 to 4018	1021 to 1024	1.00	304	1.00				
4021 to 4024	1021 to 1024	1.00	305	1.00				
4025 to 4028	1021 to 1024	1.00	306	1.00				
4031 to 4034	1021 to 1024	1.00	307	1.00				
4035 to 4038	1021 to 1024	1.00	308	1.00				
4101 to 4104	1031 to 1034	1.00	301	1.00				
4105 to 4108	1031 to 1034	1.00	302	1.00				
4111 to 4114	1031 to 1034	1.00	303	1.00				
4115 to 4118	1031 to 1034	1.00	304	1.00				
4121 to 4124	1031 to 1034	1.00	305	1.00				
4125 to 4128	1031 to 1034	1.00	306	1.00				
4131 to 4134	1031 to 1034	1.00	307	1.00				
4135 to 4138	1031 to 1034	1.00	308	1.00				
4201 to 4204	1041 to 1044	1.00	301	1.00				
4205 to 4208	1041 to 1044	1.00	302	1.00				
4211 to 4214	1041 to 1044	1.00	303	1.00				
4215 to 4218	1041 to 1044	1.00	304	1.00				
4221 to 4224	1041 to 1044	1.00	305	1.00				
4225 to 4228	1041 to 1044	1.00	306	1.00				
4231 to 4234	1041 to 1044	1.00	307	1.00				
4235 to 4238	1041 to 1044	1.00	308	1.00				
4301 to 4304	1051 to 1054	1.00	301	1.00				
4305 to 4308	1051 to 1054	1.00	302	1.00				
4311 to 4314	1051 to 1054	1.00	303	1.00				
4315 to 4318	1051 to 1054	1.00	304	1.00				



4321 to 4324	1051 to 1054	1.00	305	1.00				
4325 to 4328	1051 to 1054	1.00	306	1.00				
4331 to 4334	1051 to 1054	1.00	307	1.00				
4335 to 4338	1051 to 1054	1.00	308	1.00				

## 5.0 RESULTS & SUMMARY

### 5.1 SACS OUTPUT – BEFORE STRENGTHENING (AS-IN CASE)

\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	DL	0.00	-0.00	-533.33	-467.7	11667.2	-0.0	533.33	0.00
2	NGDL	0.00	0.00	-62.72	-57.3	1390.9	0.0	0.00	0.00
3	LL	0.00	0.00	-10.45	-9.6	231.8	0.0	0.00	0.00
4	MRL	0.00	0.00	-20.00	-18.3	400.0	0.0	0.00	0.00
5	CL	0.00	0.00	-16.28	-21.5	359.0	0.0	0.00	0.00
6	PLOP	0.00	0.00	-1443.50	-1002.4	30647.0	0.0	0.00	0.00
7	PLTX	439.35	0.00	0.00	0.0	8880.7	-308.3	0.00	0.00
8	PLTY	0.00	439.35	0.00	-8880.7	0.0	9400.4	0.00	0.00
9	FLX	612.00	0.00	0.00	0.0	11467.7	-560.0	0.00	0.00
10	FLY	0.00	612.00	0.00	-11467.7	0.0	13600.3	0.00	0.00
11	201	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
12	202	0.00	290.90	0.00	-6268.9	0.0	6394.0	0.00	0.00
13	203	0.00	411.40	0.00	-8865.6	0.0	9042.5	0.00	0.00
14	204	0.00	290.90	0.00	-6268.9	0.0	6394.0	0.00	0.00
15	205	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
16	206	0.00	-290.90	0.00	6268.9	0.0	-6417.3	0.00	0.00
17	207	0.00	-411.40	0.00	8865.6	0.0	-9075.4	0.00	0.00
18	208	0.00	-290.90	0.00	6268.9	0.0	-6417.3	0.00	0.00
19	301	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
20	302	0.00	105.24	0.00	-2267.9	0.0	2313.1	0.00	0.00
21	303	0.00	148.83	0.00	-3207.3	0.0	3271.3	0.00	0.00
22	304	0.00	105.24	0.00	-2267.9	0.0	2313.1	0.00	0.00
23	305	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
24	306	0.00	-105.24	0.00	2267.9	0.0	-2321.6	0.00	0.00
25	307	0.00	-148.83	0.00	3207.3	0.0	-3283.2	0.00	0.00
26	308	0.00	-105.24	0.00	2267.9	0.0	-2321.6	0.00	0.00

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX  (KN)	FY  (KN)	FZ  (KN)	MX  (KN-M)	MY  (KN-M)	MZ  (KN-M)
27	PLEM	0.00	0.00	-866.10	-601.4	18388.2	0.0
28	1000	0.00	-0.00	-1486.59	-1155.4	31986.1	-0.0
29	1001	0.00	-0.00	-2063.99	-1556.4	44244.9	-0.0
30	1002	439.35	-0.00	-2094.44	-1584.2	53757.5	-308.3
31	1003	-439.35	-0.00	-2094.44	-1584.2	35996.0	308.3
32	1004	0.00	439.35	-2094.44	-10465.0	44876.8	9400.4
33	1005	0.00	-439.35	-2094.44	7296.5	44876.8	-9400.4
34	1011	612.00	-0.00	-2063.99	-1556.4	55712.6	-560.0
35	1012	-612.00	-0.00	-2063.99	-1556.4	32777.3	560.0
36	1013	0.00	612.00	-2063.99	-13024.0	44244.9	13600.3
37	1014	0.00	-612.00	-2063.99	9911.3	44244.9	-13600.3
38	1021	1051.35	-0.00	-2094.44	-1584.2	65225.2	-868.3
39	1022	-172.65	-0.00	-2094.44	-1584.2	42289.8	251.7
40	1023	439.35	612.00	-2094.44	-13051.9	53757.5	13292.1
41	1024	439.35	-612.00	-2094.44	9883.4	53757.5	-13908.6
42	1031	172.65	-0.00	-2094.44	-1584.2	47463.7	-251.7
43	1032	-1051.35	-0.00	-2094.44	-1584.2	24528.4	868.3
44	1033	-439.35	612.00	-2094.44	-13051.9	35996.0	13908.6
45	1034	-439.35	-612.00	-2094.44	9883.4	35996.0	-13292.1
46	1041	612.00	439.35	-2094.44	-10465.0	56344.4	8840.5
47	1042	-612.00	439.35	-2094.44	-10465.0	33409.1	9960.4
48	1043	0.00	1051.35	-2094.44	-21932.6	44876.8	23000.8
49	1044	0.00	-172.65	-2094.44	1002.7	44876.8	-4199.9
50	1051	612.00	-439.35	-2094.44	7296.5	56344.4	-9960.4
51	1052	-612.00	-439.35	-2094.44	7296.5	33409.1	-8840.5
52	1053	0.00	172.65	-2094.44	-4171.1	44876.8	4199.9
53	1054	0.00	-1051.35	-2094.44	18764.2	44876.8	-23000.8
54	2001	612.00	-0.00	-2063.99	-1556.4	55712.6	-560.0
55	2002	-612.00	-0.00	-2063.99	-1556.4	32777.3	560.0
56	2003	0.00	612.00	-2063.99	-13024.0	44244.9	13600.3
57	2004	0.00	-612.00	-2063.99	9911.3	44244.9	-13600.3
58	2005	612.00	290.90	-2063.99	-7825.3	55712.6	5834.0
59	2006	-612.00	290.90	-2063.99	-7825.3	32777.3	6954.0
60	2007	0.00	902.90	-2063.99	-19292.9	44244.9	19994.3
61	2008	0.00	-321.10	-2063.99	3642.4	44244.9	-7206.3
62	2011	612.00	411.40	-2063.99	-10421.9	55712.6	8482.5
63	2012	-612.00	411.40	-2063.99	-10421.9	32777.3	9602.5
64	2013	0.00	1023.40	-2063.99	-21889.6	44244.9	22642.8
65	2014	0.00	-200.60	-2063.99	1045.7	44244.9	-4557.8
66	2015	612.00	290.90	-2063.99	-7825.3	55712.6	5834.0
67	2016	-612.00	290.90	-2063.99	-7825.3	32777.3	6954.0
68	2017	0.00	902.90	-2063.99	-19292.9	44244.9	19994.3
69	2018	0.00	-321.10	-2063.99	3642.4	44244.9	-7206.3
70	2021	612.00	-0.00	-2063.99	-1556.4	55712.6	-560.0
71	2022	-612.00	-0.00	-2063.99	-1556.4	32777.3	560.0

**BRIDGE PRELIMINARY REPORT FOR  
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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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		***** SEASTATE COMBINED LOAD CASE SUMMARY *****					
		RELATIVE TO MUDLINE ELEVATION					
LOAD CASE	LOAD LABEL	FX	FY	FZ	MX	MY	MZ
		(KN)	(KN)	(KN)	(KN-M)	(KN-M)	(KN-M)
72	2023	0.00	612.00	-2063.99	-13024.0	44244.9	13600.3
73	2024	0.00	-612.00	-2063.99	9911.3	44244.9	-13600.3
74	2025	612.00	-290.90	-2063.99	4712.6	55712.6	-6977.3
75	2026	-612.00	-290.90	-2063.99	4712.6	32777.3	-5857.3
76	2027	0.00	321.10	-2063.99	-6755.1	44244.9	7183.0
77	2028	0.00	-902.90	-2063.99	16180.2	44244.9	-20017.6
78	2031	612.00	-411.40	-2063.99	7309.2	55712.6	-9635.4
79	2032	-612.00	-411.40	-2063.99	7309.2	32777.3	-8515.4
80	2033	0.00	200.60	-2063.99	-4158.4	44244.9	4524.9
81	2034	0.00	-1023.40	-2063.99	18776.9	44244.9	-22675.7
82	2035	612.00	-290.90	-2063.99	4712.6	55712.6	-6977.3
83	2036	-612.00	-290.90	-2063.99	4712.6	32777.3	-5857.3
84	2037	0.00	321.10	-2063.99	-6755.1	44244.9	7183.0
85	2038	0.00	-902.90	-2063.99	16180.2	44244.9	-20017.6
86	4001	1051.35	-0.00	-2094.44	-1584.2	65225.2	-868.3
87	4002	-172.65	-0.00	-2094.44	-1584.2	42289.8	251.7
88	4003	439.35	612.00	-2094.44	-13051.9	53757.5	13292.1
89	4004	439.35	-612.00	-2094.44	9883.4	53757.5	-13908.6
90	4005	1051.35	105.24	-2094.44	-3852.1	65225.2	1444.9
91	4006	-172.65	105.24	-2094.44	-3852.1	42289.8	2564.8
92	4007	439.35	717.24	-2094.44	-15319.8	53757.5	15605.2
93	4008	439.35	-506.76	-2094.44	7615.6	53757.5	-11595.5
94	4011	1051.35	148.83	-2094.44	-4791.5	65225.2	2403.0
95	4012	-172.65	148.83	-2094.44	-4791.5	42289.8	3523.0
96	4013	439.35	760.83	-2094.44	-16259.1	53757.5	16563.3
97	4014	439.35	-463.17	-2094.44	6676.2	53757.5	-10637.3
98	4015	1051.35	105.24	-2094.44	-3852.1	65225.2	1444.9
99	4016	-172.65	105.24	-2094.44	-3852.1	42289.8	2564.8
100	4017	439.35	717.24	-2094.44	-15319.8	53757.5	15605.2
101	4018	439.35	-506.76	-2094.44	7615.6	53757.5	-11595.5
102	4021	1051.35	-0.00	-2094.44	-1584.2	65225.2	-868.3
103	4022	-172.65	-0.00	-2094.44	-1584.2	42289.8	251.7
104	4023	439.35	612.00	-2094.44	-13051.9	53757.5	13292.1
105	4024	439.35	-612.00	-2094.44	9883.4	53757.5	-13908.6
106	4025	1051.35	-105.24	-2094.44	683.7	65225.2	-3189.8
107	4026	-172.65	-105.24	-2094.44	683.7	42289.8	-2069.8
108	4027	439.35	506.76	-2094.44	-10784.0	53757.5	10970.5
109	4028	439.35	-717.24	-2094.44	12151.3	53757.5	-16230.1
110	4031	1051.35	-148.83	-2094.44	1623.1	65225.2	-4151.4
111	4032	-172.65	-148.83	-2094.44	1623.1	42289.8	-3031.5
112	4033	439.35	463.17	-2094.44	-9844.6	53757.5	10008.9
113	4034	439.35	-760.83	-2094.44	13090.7	53757.5	-17191.8
114	4035	1051.35	-105.24	-2094.44	683.7	65225.2	-3189.8
115	4036	-172.65	-105.24	-2094.44	683.7	42289.8	-2069.8
116	4037	439.35	506.76	-2094.44	-10784.0	53757.5	10970.5

**BRIDGE PRELIMINARY REPORT FOR  
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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
117	4038	439.35	-717.24	-2094.44	12151.3	53757.5	-16230.1
118	4101	172.65	-0.00	-2094.44	-1584.2	47463.7	-251.7
119	4102	-1051.35	-0.00	-2094.44	-1584.2	24528.4	868.3
120	4103	-439.35	612.00	-2094.44	-13051.9	35996.0	13908.6
121	4104	-439.35	-612.00	-2094.44	9883.4	35996.0	-13292.1
122	4105	172.65	105.24	-2094.44	-3852.1	47463.7	2061.4
123	4106	-1051.35	105.24	-2094.44	-3852.1	24528.4	3181.4
124	4107	-439.35	717.24	-2094.44	-15319.8	35996.0	16221.7
125	4108	-439.35	-506.76	-2094.44	7615.6	35996.0	-10978.9
126	4111	172.65	148.83	-2094.44	-4791.5	47463.7	3019.6
127	4112	-1051.35	148.83	-2094.44	-4791.5	24528.4	4139.5
128	4113	-439.35	760.83	-2094.44	-16259.1	35996.0	17179.9
129	4114	-439.35	-463.17	-2094.44	6676.2	35996.0	-10020.8
130	4115	172.65	105.24	-2094.44	-3852.1	47463.7	2061.4
131	4116	-1051.35	105.24	-2094.44	-3852.1	24528.4	3181.4
132	4117	-439.35	717.24	-2094.44	-15319.8	35996.0	16221.7
133	4118	-439.35	-506.76	-2094.44	7615.6	35996.0	-10978.9
134	4121	172.65	-0.00	-2094.44	-1584.2	47463.7	-251.7
135	4122	-1051.35	-0.00	-2094.44	-1584.2	24528.4	868.3
136	4123	-439.35	612.00	-2094.44	-13051.9	35996.0	13908.6
137	4124	-439.35	-612.00	-2094.44	9883.4	35996.0	-13292.1
138	4125	172.65	-105.24	-2094.44	683.7	47463.7	-2573.3
139	4126	-1051.35	-105.24	-2094.44	683.7	24528.4	-1453.3
140	4127	-439.35	506.76	-2094.44	-10784.0	35996.0	11587.0
141	4128	-439.35	-717.24	-2094.44	12151.3	35996.0	-15613.6
142	4131	172.65	-148.83	-2094.44	1623.1	47463.7	-3534.9
143	4132	-1051.35	-148.83	-2094.44	1623.1	24528.4	-2414.9
144	4133	-439.35	463.17	-2094.44	-9844.6	35996.0	10625.4
145	4134	-439.35	-760.83	-2094.44	13090.7	35996.0	-16575.2
146	4135	172.65	-105.24	-2094.44	683.7	47463.7	-2573.3
147	4136	-1051.35	-105.24	-2094.44	683.7	24528.4	-1453.3
148	4137	-439.35	506.76	-2094.44	-10784.0	35996.0	11587.0
149	4138	-439.35	-717.24	-2094.44	12151.3	35996.0	-15613.6
150	4201	612.00	439.35	-2094.44	-10465.0	56344.4	8840.5
151	4202	-612.00	439.35	-2094.44	-10465.0	33409.1	9960.4
152	4203	0.00	1051.35	-2094.44	-21932.6	44876.8	23000.8
153	4204	0.00	-172.65	-2094.44	1002.7	44876.8	-4199.9
154	4205	612.00	544.59	-2094.44	-12732.8	56344.4	11153.6
155	4206	-612.00	544.59	-2094.44	-12732.8	33409.1	12273.5
156	4207	0.00	1156.59	-2094.44	-24200.5	44876.8	25313.9
157	4208	0.00	-67.41	-2094.44	-1265.2	44876.8	-1886.8
158	4211	612.00	588.18	-2094.44	-13672.2	56344.4	12111.7
159	4212	-612.00	588.18	-2094.44	-13672.2	33409.1	13231.7
160	4213	0.00	1200.18	-2094.44	-25139.9	44876.8	26272.0
161	4214	0.00	-23.82	-2094.44	-2204.6	44876.8	-928.6

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)  
Limited

Company: Engineers India

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
162	4215	612.00	544.59	-2094.44	-12732.8	56344.4	11153.6
163	4216	-612.00	544.59	-2094.44	-12732.8	33409.1	12273.5
164	4217	0.00	1156.59	-2094.44	-24200.5	44876.8	25313.9
165	4218	0.00	-67.41	-2094.44	-1265.2	44876.8	-1886.8
166	4221	612.00	439.35	-2094.44	-10465.0	56344.4	8840.5
167	4222	-612.00	439.35	-2094.44	-10465.0	33409.1	9960.4
168	4223	0.00	1051.35	-2094.44	-21932.6	44876.8	23000.8
169	4224	0.00	-172.65	-2094.44	1002.7	44876.8	-4199.9
170	4225	612.00	334.11	-2094.44	-8197.1	56344.4	6518.9
171	4226	-612.00	334.11	-2094.44	-8197.1	33409.1	7638.9
172	4227	0.00	946.11	-2094.44	-19664.7	44876.8	20679.2
173	4228	0.00	-277.89	-2094.44	3270.6	44876.8	-6521.4
174	4231	612.00	290.52	-2094.44	-7257.7	56344.4	5557.3
175	4232	-612.00	290.52	-2094.44	-7257.7	33409.1	6677.2
176	4233	0.00	902.52	-2094.44	-18725.3	44876.8	19717.6
177	4234	0.00	-321.48	-2094.44	4210.0	44876.8	-7483.1
178	4235	612.00	334.11	-2094.44	-8197.1	56344.4	6518.9
179	4236	-612.00	334.11	-2094.44	-8197.1	33409.1	7638.9
180	4237	0.00	946.11	-2094.44	-19664.7	44876.8	20679.2
181	4238	0.00	-277.89	-2094.44	3270.6	44876.8	-6521.4
182	4301	612.00	-439.35	-2094.44	7296.5	56344.4	-9960.4
183	4302	-612.00	-439.35	-2094.44	7296.5	33409.1	-8840.5
184	4303	0.00	172.65	-2094.44	-4171.1	44876.8	4199.9
185	4304	0.00	-1051.35	-2094.44	18764.2	44876.8	-23000.8
186	4305	612.00	-334.11	-2094.44	5028.6	56344.4	-7647.3
187	4306	-612.00	-334.11	-2094.44	5028.6	33409.1	-6527.3
188	4307	0.00	277.89	-2094.44	-6439.0	44876.8	6513.0
189	4308	0.00	-946.11	-2094.44	16496.3	44876.8	-20687.6
190	4311	612.00	-290.52	-2094.44	4089.2	56344.4	-6689.2
191	4312	-612.00	-290.52	-2094.44	4089.2	33409.1	-5569.2
192	4313	0.00	321.48	-2094.44	-7378.4	44876.8	7471.2
193	4314	0.00	-902.52	-2094.44	15556.9	44876.8	-19729.5
194	4315	612.00	-334.11	-2094.44	5028.6	56344.4	-7647.3
195	4316	-612.00	-334.11	-2094.44	5028.6	33409.1	-6527.3
196	4317	0.00	277.89	-2094.44	-6439.0	44876.8	6513.0
197	4318	0.00	-946.11	-2094.44	16496.3	44876.8	-20687.6
198	4321	612.00	-439.35	-2094.44	7296.5	56344.4	-9960.4
199	4322	-612.00	-439.35	-2094.44	7296.5	33409.1	-8840.5
200	4323	0.00	172.65	-2094.44	-4171.1	44876.8	4199.9
201	4324	0.00	-1051.35	-2094.44	18764.2	44876.8	-23000.8
202	4325	612.00	-544.59	-2094.44	9564.4	56344.4	-12282.0
203	4326	-612.00	-544.59	-2094.44	9564.4	33409.1	-11162.0
204	4327	0.00	67.41	-2094.44	-1903.3	44876.8	1878.3
205	4328	0.00	-1156.59	-2094.44	21032.1	44876.8	-25322.3
206	4331	612.00	-588.18	-2094.44	10503.8	56344.4	-13243.6

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

**Document No.  
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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
207	4332	-612.00	-588.18	-2094.44	10503.8	33409.1	-12123.6
208	4333	0.00	23.82	-2094.44	-963.9	44876.8	916.7
209	4334	0.00	-1200.18	-2094.44	21971.4	44876.8	-26283.9
210	4335	612.00	-544.59	-2094.44	9564.4	56344.4	-12282.0
211	4336	-612.00	-544.59	-2094.44	9564.4	33409.1	-11162.0
212	4337	0.00	67.41	-2094.44	-1903.3	44876.8	1878.3
213	4338	0.00	-1156.59	-2094.44	21032.1	44876.8	-25322.3

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** FORCE (KN)	X - DIRECTION X (M)	Y (M)	Z (M)	***** FORCE (KN)	X - DIRECTION X (M)	Y (M)	Z (M)	***** FORCE (KN)	X - DIRECTION X (M)	Y (M)	Z (M)
1	DL	0.00				-0.00				-533.33	21.88	0.88	20.68
2	NGDL	0.00				0.00				-62.72	22.18	0.91	19.44
3	LL	0.00				0.00				-10.45	22.18	0.91	19.44
4	MRLL	0.00				0.00				-20.00	20.00	0.91	22.06
5	CL	0.00				0.00				-16.28	22.05	1.32	19.41
6	PLOP	0.00				0.00				-1443.50	21.23	0.69	20.17
7	PLTX	439.35	21.40	0.70	20.21	0.00				0.00			
8	PLTY	0.00				439.35	21.40	0.70	20.21	0.00			
9	FLX	612.00	22.22	0.92	18.74	0.00				0.00			
10	FLY	0.00				612.00	22.22	0.92	18.74	0.00			
11	201	0.00				0.00				0.00			
12	202	0.00				290.90	21.98	0.00	21.55	0.00			
13	203	0.00				411.40	21.98	0.00	21.55	0.00			
14	204	0.00				290.90	21.98	0.00	21.55	0.00			
15	205	0.00				0.00				0.00			
16	206	0.00				-290.90	22.06	1.83	21.55	0.00			
17	207	0.00				-411.40	22.06	1.83	21.55	0.00			
18	208	0.00				-290.90	22.06	1.83	21.55	0.00			
19	301	0.00				0.00				0.00			
20	302	0.00				105.24	21.98	0.00	21.55	0.00			
21	303	0.00				148.83	21.98	0.00	21.55	0.00			
22	304	0.00				105.24	21.98	0.00	21.55	0.00			
23	305	0.00				0.00				0.00			
24	306	0.00				-105.24	22.06	1.83	21.55	0.00			
25	307	0.00				-148.83	22.06	1.83	21.55	0.00			
26	308	0.00				-105.24	22.06	1.83	21.55	0.00			
27	PLEM	0.00				0.00				-866.10	21.23	0.69	20.17
28	1000	0.00				-0.00				-1486.59	21.52	0.78	20.31
29	1001	0.00				-0.00				-2063.99	21.44	0.75	20.27
30	1002	439.35	21.40	0.70	20.21	-0.00				-2094.44	21.43	0.76	20.28
31	1003	-439.35	21.40	0.70	20.21	-0.00				-2094.44	21.43	0.76	20.28
32	1004	0.00				439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
33	1005	0.00				-439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
34	1011	612.00	22.22	0.92	18.74	-0.00				-2063.99	21.44	0.75	20.27
35	1012	-612.00	22.22	0.92	18.74	-0.00				-2063.99	21.44	0.75	20.27
36	1013	0.00				612.00	22.22	0.92	18.74	-2063.99	21.44	0.75	20.27
37	1014	0.00				-612.00	22.22	0.92	18.74	-2063.99	21.44	0.75	20.27
38	1021	1051.35	21.88	0.83	19.35	-0.00				-2094.44	21.43	0.76	20.28
39	1022	-172.65	24.33	1.46	14.98	-0.00				-2094.44	21.43	0.76	20.28
40	1023	439.35	21.40	0.70	20.21	612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
41	1024	439.35	21.40	0.70	20.21	-612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
42	1031	172.65	24.33	1.46	14.98	-0.00				-2094.44	21.43	0.76	20.28
43	1032	-1051.35	21.88	0.83	19.35	-0.00				-2094.44	21.43	0.76	20.28
44	1033	-439.35	21.40	0.70	20.21	612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
45	1034	-439.35	21.40	0.70	20.21	-612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1041	612.00	22.22	0.92	18.74	439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
47	1042	-612.00	22.22	0.92	18.74	439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
48	1043	0.00				1051.35	21.88	0.83	19.35	-2094.44	21.43	0.76	20.28
49	1044	0.00				-172.65	24.33	1.46	14.98	-2094.44	21.43	0.76	20.28
50	1051	612.00	22.22	0.92	18.74	-439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
51	1052	-612.00	22.22	0.92	18.74	-439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
52	1053	0.00				172.65	24.33	1.46	14.98	-2094.44	21.43	0.76	20.28
53	1054	0.00				-1051.35	21.88	0.83	19.35	-2094.44	21.43	0.76	20.28
54	2001	612.00	22.22	0.92	18.74	-0.00				-2063.99	21.44	0.75	20.27
55	2002	-612.00	22.22	0.92	18.74	-0.00				-2063.99	21.44	0.75	20.27
56	2003	0.00				612.00	22.22	0.92	18.74	-2063.99	21.44	0.75	20.27
57	2004	0.00				-612.00	22.22	0.92	18.74	-2063.99	21.44	0.75	20.27
58	2005	612.00	22.22	0.92	18.74	290.90	21.98	0.00	21.55	-2063.99	21.44	0.75	20.27
59	2006	-612.00	22.22	0.92	18.74	290.90	21.98	0.00	21.55	-2063.99	21.44	0.75	20.27
60	2007	0.00				902.90	22.14	0.62	19.64	-2063.99	21.44	0.75	20.27
61	2008	0.00				-321.10	22.44	1.74	16.19	-2063.99	21.44	0.75	20.27
62	2011	612.00	22.22	0.92	18.74	411.40	21.98	0.00	21.55	-2063.99	21.44	0.75	20.27
63	2012	-612.00	22.22	0.92	18.74	411.40	21.98	0.00	21.55	-2063.99	21.44	0.75	20.27
64	2013	0.00				1023.40	22.13	0.55	19.87	-2063.99	21.44	0.75	20.27
65	2014	0.00				-200.60	22.72	2.79	12.97	-2063.99	21.44	0.75	20.27
66	2015	612.00	22.22	0.92	18.74	290.90	21.98	0.00	21.55	-2063.99	21.44	0.75	20.27
67	2016	-612.00	22.22	0.92	18.74	290.90	21.98	0.00	21.55	-2063.99	21.44	0.75	20.27
68	2017	0.00				902.90	22.14	0.62	19.64	-2063.99	21.44	0.75	20.27
69	2018	0.00				-321.10	22.44	1.74	16.19	-2063.99	21.44	0.75	20.27
70	2021	612.00	22.22	0.92	18.74	-0.00				-2063.99	21.44	0.75	20.27
71	2022	-612.00	22.22	0.92	18.74	-0.00				-2063.99	21.44	0.75	20.27
72	2023	0.00				612.00	22.22	0.92	18.74	-2063.99	21.44	0.75	20.27
73	2024	0.00				-612.00	22.22	0.92	18.74	-2063.99	21.44	0.75	20.27
74	2025	612.00	22.22	0.92	18.74	-290.90	22.06	1.83	21.55	-2063.99	21.44	0.75	20.27
75	2026	-612.00	22.22	0.92	18.74	-290.90	22.06	1.83	21.55	-2063.99	21.44	0.75	20.27
76	2027	0.00				321.10	22.37	0.09	16.19	-2063.99	21.44	0.75	20.27
77	2028	0.00				-902.90	22.17	1.21	19.64	-2063.99	21.44	0.75	20.27
78	2031	612.00	22.22	0.92	18.74	-411.40	22.06	1.83	21.55	-2063.99	21.44	0.75	20.27
79	2032	-612.00	22.22	0.92	18.74	-411.40	22.06	1.83	21.55	-2063.99	21.44	0.75	20.27
80	2033	0.00				200.60	22.56	-0.96	12.97	-2063.99	21.44	0.75	20.27
81	2034	0.00				-1023.40	22.16	1.28	19.87	-2063.99	21.44	0.75	20.27
82	2035	612.00	22.22	0.92	18.74	-290.90	22.06	1.83	21.55	-2063.99	21.44	0.75	20.27
83	2036	-612.00	22.22	0.92	18.74	-290.90	22.06	1.83	21.55	-2063.99	21.44	0.75	20.27
84	2037	0.00				321.10	22.37	0.09	16.19	-2063.99	21.44	0.75	20.27
85	2038	0.00				-902.90	22.17	1.21	19.64	-2063.99	21.44	0.75	20.27
86	4001	1051.35	21.88	0.83	19.35	-0.00				-2094.44	21.43	0.76	20.28
87	4002	-172.65	24.33	1.46	14.98	-0.00				-2094.44	21.43	0.76	20.28
88	4003	439.35	21.40	0.70	20.21	612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
89	4004	439.35	21.40	0.70	20.21	-612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
90	4005	1051.35	21.88	0.83	19.35	105.24	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	4006	-172.65	24.33	1.46	14.98	105.24	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
92	4007	439.35	21.40	0.70	20.21	717.24	22.19	0.78	19.15	-2094.44	21.43	0.76	20.28
93	4008	439.35	21.40	0.70	20.21	-506.76	22.27	1.11	18.15	-2094.44	21.43	0.76	20.28
94	4011	1051.35	21.88	0.83	19.35	148.83	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
95	4012	-172.65	24.33	1.46	14.98	148.83	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
96	4013	439.35	21.40	0.70	20.21	760.83	22.18	0.74	19.29	-2094.44	21.43	0.76	20.28
97	4014	439.35	21.40	0.70	20.21	-463.17	22.30	1.21	17.83	-2094.44	21.43	0.76	20.28
98	4015	1051.35	21.88	0.83	19.35	105.24	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
99	4016	-172.65	24.33	1.46	14.98	105.24	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
100	4017	439.35	21.40	0.70	20.21	717.24	22.19	0.78	19.15	-2094.44	21.43	0.76	20.28
101	4018	439.35	21.40	0.70	20.21	-506.76	22.27	1.11	18.15	-2094.44	21.43	0.76	20.28
102	4021	1051.35	21.88	0.83	19.35	-0.00				-2094.44	21.43	0.76	20.28
103	4022	-172.65	24.33	1.46	14.98	-0.00				-2094.44	21.43	0.76	20.28
104	4023	439.35	21.40	0.70	20.21	612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
105	4024	439.35	21.40	0.70	20.21	-612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
106	4025	1051.35	21.88	0.83	19.35	-105.24	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
107	4026	-172.65	24.33	1.46	14.98	-105.24	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
108	4027	439.35	21.40	0.70	20.21	506.76	22.26	0.72	18.15	-2094.44	21.43	0.76	20.28
109	4028	439.35	21.40	0.70	20.21	-717.24	22.20	1.05	19.15	-2094.44	21.43	0.76	20.28
110	4031	1051.35	21.88	0.83	19.35	-148.83	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
111	4032	-172.65	24.33	1.46	14.98	-148.83	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
112	4033	439.35	21.40	0.70	20.21	463.17	22.28	0.62	17.83	-2094.44	21.43	0.76	20.28
113	4034	439.35	21.40	0.70	20.21	-760.83	22.19	1.09	19.29	-2094.44	21.43	0.76	20.28
114	4035	1051.35	21.88	0.83	19.35	-105.24	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
115	4036	-172.65	24.33	1.46	14.98	-105.24	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
116	4037	439.35	21.40	0.70	20.21	506.76	22.26	0.72	18.15	-2094.44	21.43	0.76	20.28
117	4038	439.35	21.40	0.70	20.21	-717.24	22.20	1.05	19.15	-2094.44	21.43	0.76	20.28
118	4101	172.65	24.33	1.46	14.98	-0.00				-2094.44	21.43	0.76	20.28
119	4102	-1051.35	21.88	0.83	19.35	-0.00				-2094.44	21.43	0.76	20.28
120	4103	-439.35	21.40	0.70	20.21	612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
121	4104	-439.35	21.40	0.70	20.21	-612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
122	4105	172.65	24.33	1.46	14.98	105.24	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
123	4106	-1051.35	21.88	0.83	19.35	105.24	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
124	4107	-439.35	21.40	0.70	20.21	717.24	22.19	0.78	19.15	-2094.44	21.43	0.76	20.28
125	4108	-439.35	21.40	0.70	20.21	-506.76	22.27	1.11	18.15	-2094.44	21.43	0.76	20.28
126	4111	172.65	24.33	1.46	14.98	148.83	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
127	4112	-1051.35	21.88	0.83	19.35	148.83	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
128	4113	-439.35	21.40	0.70	20.21	760.83	22.18	0.74	19.29	-2094.44	21.43	0.76	20.28
129	4114	-439.35	21.40	0.70	20.21	-463.17	22.30	1.21	17.83	-2094.44	21.43	0.76	20.28
130	4115	172.65	24.33	1.46	14.98	105.24	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
131	4116	-1051.35	21.88	0.83	19.35	105.24	21.98	0.00	21.55	-2094.44	21.43	0.76	20.28
132	4117	-439.35	21.40	0.70	20.21	717.24	22.19	0.78	19.15	-2094.44	21.43	0.76	20.28
133	4118	-439.35	21.40	0.70	20.21	-506.76	22.27	1.11	18.15	-2094.44	21.43	0.76	20.28
134	4121	172.65	24.33	1.46	14.98	-0.00				-2094.44	21.43	0.76	20.28
135	4122	-1051.35	21.88	0.83	19.35	-0.00				-2094.44	21.43	0.76	20.28



**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 07-AUG-2025 TIME 11:44:56 SEA PAGE 106

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4123	-439.35	21.40	0.70	20.21	612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
137	4124	-439.35	21.40	0.70	20.21	-612.00	22.22	0.92	18.74	-2094.44	21.43	0.76	20.28
138	4125	172.65	24.33	1.46	14.98	-105.24	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
139	4126	-1051.35	21.88	0.83	19.35	-105.24	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
140	4127	-439.35	21.40	0.70	20.21	506.76	22.26	0.72	18.15	-2094.44	21.43	0.76	20.28
141	4128	-439.35	21.40	0.70	20.21	-717.24	22.20	1.05	19.15	-2094.44	21.43	0.76	20.28
142	4131	172.65	24.33	1.46	14.98	-148.83	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
143	4132	-1051.35	21.88	0.83	19.35	-148.83	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
144	4133	-439.35	21.40	0.70	20.21	463.17	22.28	0.62	17.83	-2094.44	21.43	0.76	20.28
145	4134	-439.35	21.40	0.70	20.21	-760.83	22.19	1.09	19.29	-2094.44	21.43	0.76	20.28
146	4135	172.65	24.33	1.46	14.98	-105.24	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
147	4136	-1051.35	21.88	0.83	19.35	-105.24	22.06	1.83	21.55	-2094.44	21.43	0.76	20.28
148	4137	-439.35	21.40	0.70	20.21	506.76	22.26	0.72	18.15	-2094.44	21.43	0.76	20.28
149	4138	-439.35	21.40	0.70	20.21	-717.24	22.20	1.05	19.15	-2094.44	21.43	0.76	20.28
150	4201	612.00	22.22	0.92	18.74	439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
151	4202	-612.00	22.22	0.92	18.74	439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
152	4203	0.00				1051.35	21.88	0.83	19.35	-2094.44	21.43	0.76	20.28
153	4204	0.00				-172.65	24.33	1.46	14.98	-2094.44	21.43	0.76	20.28
154	4205	612.00	22.22	0.92	18.74	544.59	21.51	0.57	20.47	-2094.44	21.43	0.76	20.28
155	4206	-612.00	22.22	0.92	18.74	544.59	21.51	0.57	20.47	-2094.44	21.43	0.76	20.28
156	4207	0.00				1156.59	21.89	0.75	19.55	-2094.44	21.43	0.76	20.28
157	4208	0.00				-67.41	27.99	3.73	4.73	-2094.44	21.43	0.76	20.28
158	4211	612.00	22.22	0.92	18.74	588.18	21.54	0.52	20.55	-2094.44	21.43	0.76	20.28
159	4212	-612.00	22.22	0.92	18.74	588.18	21.54	0.52	20.55	-2094.44	21.43	0.76	20.28
160	4213	0.00				1200.18	21.89	0.72	19.63	-2094.44	21.43	0.76	20.28
161	4214	0.00				-23.82	38.98	10.57	-26.04	-2094.44	21.43	0.76	20.28
162	4215	612.00	22.22	0.92	18.74	544.59	21.51	0.57	20.47	-2094.44	21.43	0.76	20.28
163	4216	-612.00	22.22	0.92	18.74	544.59	21.51	0.57	20.47	-2094.44	21.43	0.76	20.28
164	4217	0.00				1156.59	21.89	0.75	19.55	-2094.44	21.43	0.76	20.28
165	4218	0.00				-67.41	27.99	3.73	4.73	-2094.44	21.43	0.76	20.28
166	4221	612.00	22.22	0.92	18.74	439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
167	4222	-612.00	22.22	0.92	18.74	439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
168	4223	0.00				1051.35	21.88	0.83	19.35	-2094.44	21.43	0.76	20.28
169	4224	0.00				-172.65	24.33	1.46	14.98	-2094.44	21.43	0.76	20.28
170	4225	612.00	22.22	0.92	18.74	334.11	21.19	0.35	19.79	-2094.44	21.43	0.76	20.28
171	4226	-612.00	22.22	0.92	18.74	334.11	21.19	0.35	19.79	-2094.44	21.43	0.76	20.28
172	4227	0.00				946.11	21.86	0.71	19.11	-2094.44	21.43	0.76	20.28
173	4228	0.00				-277.89	23.47	1.60	17.47	-2094.44	21.43	0.76	20.28
174	4231	612.00	22.22	0.92	18.74	290.52	21.06	0.12	19.53	-2094.44	21.43	0.76	20.28
175	4232	-612.00	22.22	0.92	18.74	290.52	21.06	0.12	19.53	-2094.44	21.43	0.76	20.28
176	4233	0.00				902.52	21.85	0.66	18.99	-2094.44	21.43	0.76	20.28
177	4234	0.00				-321.48	23.28	1.63	18.02	-2094.44	21.43	0.76	20.28
178	4235	612.00	22.22	0.92	18.74	334.11	21.19	0.35	19.79	-2094.44	21.43	0.76	20.28
179	4236	-612.00	22.22	0.92	18.74	334.11	21.19	0.35	19.79	-2094.44	21.43	0.76	20.28
180	4237	0.00				946.11	21.86	0.71	19.11	-2094.44	21.43	0.76	20.28

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 07-AUG-2025 TIME 11:44:56 SEA PAGE 107

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
181	4238	0.00				-277.89	23.47	1.60	17.47	-2094.44	21.43	0.76	20.28
182	4301	612.00	22.22	0.92	18.74	-439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
183	4302	-612.00	22.22	0.92	18.74	-439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
184	4303	0.00				172.65	24.33	1.46	14.98	-2094.44	21.43	0.76	20.28
185	4304	0.00				-1051.35	21.88	0.83	19.35	-2094.44	21.43	0.76	20.28
186	4305	612.00	22.22	0.92	18.74	-334.11	21.21	0.92	19.79	-2094.44	21.43	0.76	20.28
187	4306	-612.00	22.22	0.92	18.74	-334.11	21.21	0.92	19.79	-2094.44	21.43	0.76	20.28
188	4307	0.00				277.89	23.44	0.91	17.47	-2094.44	21.43	0.76	20.28
189	4308	0.00				-946.11	21.87	0.92	19.11	-2094.44	21.43	0.76	20.28
190	4311	612.00	22.22	0.92	18.74	-290.52	21.10	1.06	19.53	-2094.44	21.43	0.76	20.28
191	4312	-612.00	22.22	0.92	18.74	-290.52	21.10	1.06	19.53	-2094.44	21.43	0.76	20.28
192	4313	0.00				321.48	23.24	0.78	18.02	-2094.44	21.43	0.76	20.28
193	4314	0.00				-902.52	21.86	0.96	18.99	-2094.44	21.43	0.76	20.28
194	4315	612.00	22.22	0.92	18.74	-334.11	21.21	0.92	19.79	-2094.44	21.43	0.76	20.28
195	4316	-612.00	22.22	0.92	18.74	-334.11	21.21	0.92	19.79	-2094.44	21.43	0.76	20.28
196	4317	0.00				277.89	23.44	0.91	17.47	-2094.44	21.43	0.76	20.28
197	4318	0.00				-946.11	21.87	0.92	19.11	-2094.44	21.43	0.76	20.28
198	4321	612.00	22.22	0.92	18.74	-439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
199	4322	-612.00	22.22	0.92	18.74	-439.35	21.40	0.70	20.21	-2094.44	21.43	0.76	20.28
200	4323	0.00				172.65	24.33	1.46	14.98	-2094.44	21.43	0.76	20.28
201	4324	0.00				-1051.35	21.88	0.83	19.35	-2094.44	21.43	0.76	20.28
202	4325	612.00	22.22	0.92	18.74	-544.59	21.52	0.92	20.47	-2094.44	21.43	0.76	20.28
203	4326	-612.00	22.22	0.92	18.74	-544.59	21.52	0.92	20.47	-2094.44	21.43	0.76	20.28
204	4327	0.00				67.41	27.86	0.88	4.73	-2094.44	21.43	0.76	20.28
205	4328	0.00				-1156.59	21.89	0.92	19.55	-2094.44	21.43	0.76	20.28
206	4331	612.00	22.22	0.92	18.74	-588.18	21.56	0.99	20.55	-2094.44	21.43	0.76	20.28
207	4332	-612.00	22.22	0.92	18.74	-588.18	21.56	0.99	20.55	-2094.44	21.43	0.76	20.28
208	4333	0.00				23.82	38.48	-0.87	-26.04	-2094.44	21.43	0.76	20.28
209	4334	0.00				-1200.18	21.90	0.95	19.63	-2094.44	21.43	0.76	20.28
210	4335	612.00	22.22	0.92	18.74	-544.59	21.52	0.92	20.47	-2094.44	21.43	0.76	20.28
211	4336	-612.00	22.22	0.92	18.74	-544.59	21.52	0.92	20.47	-2094.44	21.43	0.76	20.28
212	4337	0.00				67.41	27.86	0.88	4.73	-2094.44	21.43	0.76	20.28
213	4338	0.00				-1156.59	21.89	0.92	19.55	-2094.44	21.43	0.76	20.28

## 5.2 SACS OUTPUT – AFTER STRENGTHENING

\*\*\*\*\* SEASTATE BASIC LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)	DEAD LOAD (KN)	MARINE METHOD BUOYANCY (KN)
1	CL	0.00	0.00	-16.28	-21.5	359.0	0.0	0.00	0.00
2	DL	-0.00	-0.00	-960.16	-849.9	21361.8	0.0	960.17	0.00
3	LL	0.00	0.00	-108.42	-99.1	2409.3	0.0	0.00	0.00
4	201	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
5	202	0.00	290.90	0.00	-6268.9	0.0	6394.0	0.00	0.00
6	203	0.00	411.40	0.00	-8865.6	0.0	9042.5	0.00	0.00
7	204	0.00	290.90	0.00	-6268.9	0.0	6394.0	0.00	0.00
8	205	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
9	206	0.00	-290.90	0.00	6268.9	0.0	-6417.3	0.00	0.00
10	207	0.00	-411.40	0.00	8865.6	0.0	-9075.4	0.00	0.00
11	208	0.00	-290.90	0.00	6268.9	0.0	-6417.3	0.00	0.00
12	301	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
13	302	0.00	105.24	0.00	-2267.9	0.0	2313.1	0.00	0.00
14	303	0.00	148.83	0.00	-3207.3	0.0	3271.3	0.00	0.00
15	304	0.00	105.24	0.00	-2267.9	0.0	2313.1	0.00	0.00
16	305	0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00
17	306	0.00	-105.24	0.00	2267.9	0.0	-2321.6	0.00	0.00
18	307	0.00	-148.83	0.00	3207.3	0.0	-3283.2	0.00	0.00
19	308	0.00	-105.24	0.00	2267.9	0.0	-2321.6	0.00	0.00
20	FLX	612.00	0.00	0.00	0.0	11467.7	-560.0	0.00	0.00
21	FLY	0.00	612.00	0.00	-11467.7	0.0	13600.3	0.00	0.00
22	MRLL	0.00	0.00	-20.00	-18.3	400.0	0.0	0.00	0.00
23	NGDL	0.00	0.00	-101.15	-92.5	2239.5	0.0	0.00	0.00
24	PLOP	0.00	0.00	-1443.50	-1002.4	30600.4	0.0	0.00	0.00
25	PLTX	439.35	0.00	0.00	0.0	8880.7	-308.3	0.00	0.00
26	PLTY	0.00	439.35	0.00	-8880.7	0.0	9386.4	0.00	0.00

\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
27	PLEM	0.00	0.00	-866.10	-601.4	18360.2	0.0
28	1000	-0.00	-0.00	-1956.84	-1577.3	42611.6	0.0
29	1001	-0.00	-0.00	-2534.24	-1978.2	54851.8	0.0
30	1002	439.35	-0.00	-2662.66	-2095.6	66541.8	-308.3
31	1003	-439.35	-0.00	-2662.66	-2095.6	48780.3	308.3
32	1004	-0.00	439.35	-2662.66	-10976.4	57661.1	9386.4
33	1005	-0.00	-439.35	-2662.66	6785.1	57661.1	-9386.4
34	1011	612.00	-0.00	-2534.24	-1978.2	66319.5	-560.0
35	1012	-612.00	-0.00	-2534.24	-1978.2	43384.2	560.0
36	1013	-0.00	612.00	-2534.24	-13445.9	54851.8	13600.3
37	1014	-0.00	-612.00	-2534.24	9489.4	54851.8	-13600.3
38	1021	1051.35	-0.00	-2662.66	-2095.6	78009.5	-868.2
39	1022	-172.65	-0.00	-2662.66	-2095.6	55074.1	251.7
40	1023	439.35	612.00	-2662.66	-13563.3	66541.8	13292.1
41	1024	439.35	-612.00	-2662.66	9372.0	66541.8	-13908.6
42	1031	172.65	-0.00	-2662.66	-2095.6	60248.0	-251.7
43	1032	-1051.35	-0.00	-2662.66	-2095.6	37312.7	868.2
44	1033	-439.35	612.00	-2662.66	-13563.3	48780.3	13908.6
45	1034	-439.35	-612.00	-2662.66	9372.0	48780.3	-13292.1
46	1041	612.00	439.35	-2662.66	-10976.4	69128.7	8826.5
47	1042	-612.00	439.35	-2662.66	-10976.4	46193.4	9946.4
48	1043	-0.00	1051.35	-2662.66	-22444.0	57661.1	22986.8
49	1044	-0.00	-172.65	-2662.66	491.3	57661.1	-4213.9
50	1051	612.00	-439.35	-2662.66	6785.1	69128.7	-9946.4
51	1052	-612.00	-439.35	-2662.66	6785.1	46193.4	-8826.5
52	1053	-0.00	172.65	-2662.66	-4682.5	57661.1	4213.9
53	1054	-0.00	-1051.35	-2662.66	18252.8	57661.1	-22986.8
54	2001	612.00	-0.00	-2534.24	-1978.2	66319.5	-560.0
55	2002	-612.00	-0.00	-2534.24	-1978.2	43384.1	560.0
56	2003	-0.00	612.00	-2534.24	-13445.9	54851.8	13600.3
57	2004	-0.00	-612.00	-2534.24	9489.4	54851.8	-13600.3
58	2005	612.00	290.90	-2534.24	-8247.1	66319.5	5834.0
59	2006	-612.00	290.90	-2534.24	-8247.1	43384.1	6954.0
60	2007	-0.00	902.90	-2534.24	-19714.8	54851.8	19994.3
61	2008	-0.00	-321.10	-2534.24	3220.5	54851.8	-7206.3
62	2011	612.00	411.40	-2534.24	-10843.8	66319.5	8482.5
63	2012	-612.00	411.40	-2534.24	-10843.8	43384.1	9602.5
64	2013	-0.00	1023.40	-2534.24	-22311.5	54851.8	22642.8
65	2014	-0.00	-200.60	-2534.24	623.8	54851.8	-4557.8
66	2015	612.00	290.90	-2534.24	-8247.1	66319.5	5834.0
67	2016	-612.00	290.90	-2534.24	-8247.1	43384.1	6954.0
68	2017	-0.00	902.90	-2534.24	-19714.8	54851.8	19994.3
69	2018	-0.00	-321.10	-2534.24	3220.5	54851.8	-7206.3
70	2021	612.00	-0.00	-2534.24	-1978.2	66319.5	-560.0
71	2022	-612.00	-0.00	-2534.24	-1978.2	43384.1	560.0

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:55:26 SEA PAGE 100

\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\*  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
72	2023	-0.00	612.00	-2534.24	-13445.9	54851.8	13600.3
73	2024	-0.00	-612.00	-2534.24	9489.4	54851.8	-13600.3
74	2025	612.00	-290.90	-2534.24	4290.7	66319.5	-6977.3
75	2026	-612.00	-290.90	-2534.24	4290.7	43384.1	-5857.3
76	2027	-0.00	321.10	-2534.24	-7177.0	54851.8	7183.0
77	2028	-0.00	-902.90	-2534.24	15758.4	54851.8	-20017.6
78	2031	612.00	-411.40	-2534.24	6887.4	66319.5	-9635.4
79	2032	-612.00	-411.40	-2534.24	6887.4	43384.1	-8515.4
80	2033	-0.00	200.60	-2534.24	-4580.3	54851.8	4524.9
81	2034	-0.00	-1023.40	-2534.24	18355.0	54851.8	-22675.7
82	2035	612.00	-290.90	-2534.24	4290.7	66319.5	-6977.3
83	2036	-612.00	-290.90	-2534.24	4290.7	43384.1	-5857.3
84	2037	-0.00	321.10	-2534.24	-7177.0	54851.8	7183.0
85	2038	-0.00	-902.90	-2534.24	15758.4	54851.8	-20017.6
86	4001	1051.35	-0.00	-2662.66	-2095.6	78009.5	-868.2
87	4002	-172.65	-0.00	-2662.66	-2095.6	55074.1	251.7
88	4003	439.35	612.00	-2662.66	-13563.3	66541.8	13292.1
89	4004	439.35	-612.00	-2662.66	9372.0	66541.8	-13908.6
90	4005	1051.35	105.24	-2662.66	-4363.5	78009.5	1444.9
91	4006	-172.65	105.24	-2662.66	-4363.5	55074.1	2564.8
92	4007	439.35	717.24	-2662.66	-15831.2	66541.8	15605.2
93	4008	439.35	-506.76	-2662.66	7104.2	66541.8	-11595.5
94	4011	1051.35	148.83	-2662.66	-5302.9	78009.5	2403.0
95	4012	-172.65	148.83	-2662.66	-5302.9	55074.1	3523.0
96	4013	439.35	760.83	-2662.66	-16770.5	66541.8	16563.3
97	4014	439.35	-463.17	-2662.66	6164.8	66541.8	-10637.3
98	4015	1051.35	105.24	-2662.66	-4363.5	78009.5	1444.9
99	4016	-172.65	105.24	-2662.66	-4363.5	55074.1	2564.8
100	4017	439.35	717.24	-2662.66	-15831.2	66541.8	15605.2
101	4018	439.35	-506.76	-2662.66	7104.2	66541.8	-11595.5
102	4021	1051.35	-0.00	-2662.66	-2095.6	78009.5	-868.2
103	4022	-172.65	-0.00	-2662.66	-2095.6	55074.1	251.7
104	4023	439.35	612.00	-2662.66	-13563.3	66541.8	13292.1
105	4024	439.35	-612.00	-2662.66	9372.0	66541.8	-13908.6
106	4025	1051.35	-105.24	-2662.66	172.3	78009.5	-3189.8
107	4026	-172.65	-105.24	-2662.66	172.3	55074.1	-2069.8
108	4027	439.35	506.76	-2662.66	-11295.4	66541.8	10970.5
109	4028	439.35	-717.24	-2662.66	11639.9	66541.8	-16230.1
110	4031	1051.35	-148.83	-2662.66	1111.6	78009.5	-4151.4
111	4032	-172.65	-148.83	-2662.66	1111.6	55074.1	-3031.5
112	4033	439.35	463.17	-2662.66	-10356.0	66541.8	10008.9
113	4034	439.35	-760.83	-2662.66	12579.3	66541.8	-17191.8
114	4035	1051.35	-105.24	-2662.66	172.3	78009.5	-3189.8
115	4036	-172.65	-105.24	-2662.66	172.3	55074.1	-2069.8
116	4037	439.35	506.76	-2662.66	-11295.4	66541.8	10970.5

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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**\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\***  
**RELATIVE TO MUDLINE ELEVATION**

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
117	4038	439.35	-717.24	-2662.66	11639.9	66541.8	-16230.1
118	4101	172.65	-0.00	-2662.66	-2095.6	60248.0	-251.7
119	4102	-1051.35	-0.00	-2662.66	-2095.6	37312.7	868.2
120	4103	-439.35	612.00	-2662.66	-13563.3	48780.3	13908.6
121	4104	-439.35	-612.00	-2662.66	9372.0	48780.3	-13292.1
122	4105	172.65	105.24	-2662.66	-4363.5	60248.0	2061.4
123	4106	-1051.35	105.24	-2662.66	-4363.5	37312.7	3181.4
124	4107	-439.35	717.24	-2662.66	-15831.2	48780.3	16221.7
125	4108	-439.35	-506.76	-2662.66	7104.2	48780.3	-10978.9
126	4111	172.65	148.83	-2662.66	-5302.9	60248.0	3019.6
127	4112	-1051.35	148.83	-2662.66	-5302.9	37312.7	4139.5
128	4113	-439.35	760.83	-2662.66	-16770.5	48780.3	17179.9
129	4114	-439.35	-463.17	-2662.66	6164.8	48780.3	-10020.8
130	4115	172.65	105.24	-2662.66	-4363.5	60248.0	2061.4
131	4116	-1051.35	105.24	-2662.66	-4363.5	37312.7	3181.4
132	4117	-439.35	717.24	-2662.66	-15831.2	48780.3	16221.7
133	4118	-439.35	-506.76	-2662.66	7104.2	48780.3	-10978.9
134	4121	172.65	-0.00	-2662.66	-2095.6	60248.0	-251.7
135	4122	-1051.35	-0.00	-2662.66	-2095.6	37312.7	868.2
136	4123	-439.35	612.00	-2662.66	-13563.3	48780.3	13908.6
137	4124	-439.35	-612.00	-2662.66	9372.0	48780.3	-13292.1
138	4125	172.65	-105.24	-2662.66	172.3	60248.0	-2573.3
139	4126	-1051.35	-105.24	-2662.66	172.3	37312.7	-1453.3
140	4127	-439.35	506.76	-2662.66	-11295.4	48780.3	11587.0
141	4128	-439.35	-717.24	-2662.66	11639.9	48780.3	-15613.6
142	4131	172.65	-148.83	-2662.66	1111.6	60248.0	-3534.9
143	4132	-1051.35	-148.83	-2662.66	1111.6	37312.7	-2414.9
144	4133	-439.35	463.17	-2662.66	-10356.0	48780.3	10625.4
145	4134	-439.35	-760.83	-2662.66	12579.3	48780.3	-16575.2
146	4135	172.65	-105.24	-2662.66	172.3	60248.0	-2573.3
147	4136	-1051.35	-105.24	-2662.66	172.3	37312.7	-1453.3
148	4137	-439.35	506.76	-2662.66	-11295.4	48780.3	11587.0
149	4138	-439.35	-717.24	-2662.66	11639.9	48780.3	-15613.6
150	4201	612.00	439.35	-2662.66	-10976.4	69128.7	8826.5
151	4202	-612.00	439.35	-2662.66	-10976.4	46193.4	9946.4
152	4203	-0.00	1051.35	-2662.66	-22444.0	57661.1	22986.8
153	4204	-0.00	-172.65	-2662.66	491.3	57661.1	-4213.9
154	4205	612.00	544.59	-2662.66	-13244.2	69128.7	11139.6
155	4206	-612.00	544.59	-2662.66	-13244.2	46193.4	12259.6
156	4207	-0.00	1156.59	-2662.66	-24711.9	57661.1	25299.9
157	4208	-0.00	-67.41	-2662.66	-1776.6	57661.1	-1900.7
158	4211	612.00	588.18	-2662.66	-14183.6	69128.7	12097.7
159	4212	-612.00	588.18	-2662.66	-14183.6	46193.4	13217.7
160	4213	-0.00	1200.18	-2662.66	-25651.3	57661.1	26258.0
161	4214	-0.00	-23.82	-2662.66	-2716.0	57661.1	-942.6

**BRIDGE PRELIMINARY REPORT FOR  
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IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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**\*\*\*\*\* SEASTATE COMBINED LOAD CASE SUMMARY \*\*\*\*\***  
RELATIVE TO MUDLINE ELEVATION

LOAD CASE	LOAD LABEL	FX (KN)	FY (KN)	FZ (KN)	MX (KN-M)	MY (KN-M)	MZ (KN-M)
162	4215	612.00	544.59	-2662.66	-13244.2	69128.7	11139.6
163	4216	-612.00	544.59	-2662.66	-13244.2	46193.4	12259.6
164	4217	-0.00	1156.59	-2662.66	-24711.9	57661.1	25299.9
165	4218	-0.00	-67.41	-2662.66	-1776.6	57661.1	-1900.7
166	4221	612.00	439.35	-2662.66	-10976.4	69128.7	8826.5
167	4222	-612.00	439.35	-2662.66	-10976.4	46193.4	9946.4
168	4223	-0.00	1051.35	-2662.66	-22444.0	57661.1	22986.8
169	4224	-0.00	-172.65	-2662.66	491.3	57661.1	-4213.9
170	4225	612.00	334.11	-2662.66	-8708.5	69128.7	6504.9
171	4226	-612.00	334.11	-2662.66	-8708.5	46193.4	7624.9
172	4227	-0.00	946.11	-2662.66	-20176.1	57661.1	20665.2
173	4228	-0.00	-277.89	-2662.66	2759.2	57661.1	-6535.4
174	4231	612.00	290.52	-2662.66	-7769.1	69128.7	5543.3
175	4232	-612.00	290.52	-2662.66	-7769.1	46193.4	6663.3
176	4233	-0.00	902.52	-2662.66	-19236.7	57661.1	19703.6
177	4234	-0.00	-321.48	-2662.66	3698.6	57661.1	-7497.1
178	4235	612.00	334.11	-2662.66	-8708.5	69128.7	6504.9
179	4236	-612.00	334.11	-2662.66	-8708.5	46193.4	7624.9
180	4237	-0.00	946.11	-2662.66	-20176.1	57661.1	20665.2
181	4238	-0.00	-277.89	-2662.66	2759.2	57661.1	-6535.4
182	4301	612.00	-439.35	-2662.66	6785.1	69128.7	-9946.4
183	4302	-612.00	-439.35	-2662.66	6785.1	46193.4	-8826.5
184	4303	-0.00	172.65	-2662.66	-4682.5	57661.1	4213.9
185	4304	-0.00	-1051.35	-2662.66	18252.8	57661.1	-22986.8
186	4305	612.00	-334.11	-2662.66	4517.2	69128.7	-7633.3
187	4306	-612.00	-334.11	-2662.66	4517.2	46193.4	-6513.3
188	4307	-0.00	277.89	-2662.66	-6950.4	57661.1	6527.0
189	4308	-0.00	-946.11	-2662.66	15984.9	57661.1	-20673.6
190	4311	612.00	-290.52	-2662.66	3577.8	69128.7	-6675.2
191	4312	-612.00	-290.52	-2662.66	3577.8	46193.4	-5555.2
192	4313	-0.00	321.48	-2662.66	-7889.8	57661.1	7485.1
193	4314	-0.00	-902.52	-2662.66	15045.5	57661.1	-19715.5
194	4315	612.00	-334.11	-2662.66	4517.2	69128.7	-7633.3
195	4316	-612.00	-334.11	-2662.66	4517.2	46193.4	-6513.3
196	4317	-0.00	277.89	-2662.66	-6950.4	57661.1	6527.0
197	4318	-0.00	-946.11	-2662.66	15984.9	57661.1	-20673.6
198	4321	612.00	-439.35	-2662.66	6785.1	69128.7	-9946.4
199	4322	-612.00	-439.35	-2662.66	6785.1	46193.4	-8826.5
200	4323	-0.00	172.65	-2662.66	-4682.5	57661.1	4213.9
201	4324	-0.00	-1051.35	-2662.66	18252.8	57661.1	-22986.8
202	4325	612.00	-544.59	-2662.66	9053.0	69128.7	-12268.0
203	4326	-612.00	-544.59	-2662.66	9053.0	46193.4	-11148.0
204	4327	-0.00	67.41	-2662.66	-2414.7	57661.1	1892.3
205	4328	-0.00	-1156.59	-2662.66	20520.6	57661.1	-25308.3
206	4331	612.00	-588.18	-2662.66	9992.4	69128.7	-13229.6

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Company: Engineers India Limited  
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***** SEASTATE COMBINED LOAD CASE SUMMARY *****							
RELATIVE TO MUDLINE ELEVATION							
LOAD CASE	LOAD LABEL	FX  (KN)	FY  (KN)	FZ  (KN)	MX  (KN-M)	MY  (KN-M)	MZ  (KN-M)
207	4332	-612.00	-588.18	-2662.66	9992.4	46193.4	-12109.6
208	4333	-0.00	23.82	-2662.66	-1475.3	57661.1	930.7
209	4334	-0.00	-1200.18	-2662.66	21460.0	57661.1	-26269.9
210	4335	612.00	-544.59	-2662.66	9053.0	69128.7	-12268.0
211	4336	-612.00	-544.59	-2662.66	9053.0	46193.4	-11148.0
212	4337	-0.00	67.41	-2662.66	-2414.7	57661.1	1892.3
213	4338	-0.00	-1156.59	-2662.66	20520.7	57661.1	-25308.3

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
1	CL	0.00				0.00				-16.28	22.05	1.32	19.41
2	DL	-0.00	32.01	0.60	19.92	-0.00				-960.16	22.25	0.89	20.47
3	LL	0.00				0.00				-108.42	22.22	0.91	19.44
4	201	0.00				0.00				0.00			
5	202	0.00				290.90	21.98	0.00	21.55	0.00			
6	203	0.00				411.40	21.98	0.00	21.55	0.00			
7	204	0.00				290.90	21.98	0.00	21.55	0.00			
8	205	0.00				0.00				0.00			
9	206	0.00				-290.90	22.06	1.83	21.55	0.00			
10	207	0.00				-411.40	22.06	1.83	21.55	0.00			
11	208	0.00				-290.90	22.06	1.83	21.55	0.00			
12	301	0.00				0.00				0.00			
13	302	0.00				105.24	21.98	0.00	21.55	0.00			
14	303	0.00				148.83	21.98	0.00	21.55	0.00			
15	304	0.00				105.24	21.98	0.00	21.55	0.00			
16	305	0.00				0.00				0.00			
17	306	0.00				-105.24	22.06	1.83	21.55	0.00			
18	307	0.00				-148.83	22.06	1.83	21.55	0.00			
19	308	0.00				-105.24	22.06	1.83	21.55	0.00			
20	FLX	612.00	22.22	0.92	18.74	0.00				0.00			
21	FLY	0.00				612.00	22.22	0.92	18.74	0.00			
22	MRLL	0.00				0.00				-20.00	20.00	0.91	22.06
23	NGDL	0.00				0.00				-101.15	22.14	0.91	20.37
24	PLOP	0.00				0.00				-1443.50	21.20	0.69	20.17
25	PLTX	439.35	21.36	0.70	20.21	0.00				0.00			
26	PLTY	0.00				439.35	21.36	0.70	20.21	0.00			
27	PLEM	0.00				0.00				-866.10	21.20	0.69	20.17
28	1000	-0.00	32.01	0.60	19.92	-0.00				-1956.84	21.78	0.81	20.32
29	1001	-0.00	32.01	0.60	19.92	-0.00				-2534.24	21.64	0.78	20.29
30	1002	439.35	21.36	0.70	20.21	-0.00				-2662.66	21.66	0.79	20.27
31	1003	-439.35	21.36	0.70	20.21	-0.00				-2662.66	21.66	0.79	20.27
32	1004	-0.00	32.01	0.60	19.92	439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
33	1005	-0.00	32.01	0.60	19.92	-439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
34	1011	612.00	22.22	0.92	18.74	-0.00				-2534.24	21.64	0.78	20.29
35	1012	-612.00	22.22	0.92	18.74	-0.00				-2534.24	21.64	0.78	20.29
36	1013	-0.00	32.01	0.60	19.92	612.00	22.22	0.92	18.74	-2534.24	21.64	0.78	20.29
37	1014	-0.00	32.01	0.60	19.92	-612.00	22.22	0.92	18.74	-2534.24	21.64	0.78	20.29
38	1021	1051.35	21.86	0.83	19.35	-0.00				-2662.66	21.66	0.79	20.27
39	1022	-172.65	24.41	1.46	14.98	-0.00				-2662.66	21.66	0.79	20.27
40	1023	439.35	21.36	0.70	20.21	612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
41	1024	439.35	21.36	0.70	20.21	-612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
42	1031	172.65	24.41	1.46	14.98	-0.00				-2662.66	21.66	0.79	20.27
43	1032	-1051.35	21.86	0.83	19.35	-0.00				-2662.66	21.66	0.79	20.27
44	1033	-439.35	21.36	0.70	20.21	612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
45	1034	-439.35	21.36	0.70	20.21	-612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27



**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:55:26 SEA PAGE 105

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
46	1041	612.00	22.22	0.92	18.74	439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
47	1042	-612.00	22.22	0.92	18.74	439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
48	1043	-0.00	32.01	0.60	19.92	1051.35	21.86	0.83	19.35	-2662.66	21.66	0.79	20.27
49	1044	-0.00	32.01	0.60	19.92	-172.65	24.41	1.46	14.98	-2662.66	21.66	0.79	20.27
50	1051	612.00	22.22	0.92	18.74	-439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
51	1052	-612.00	22.22	0.92	18.74	-439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
52	1053	-0.00	32.01	0.60	19.92	172.65	24.41	1.46	14.98	-2662.66	21.66	0.79	20.27
53	1054	-0.00	32.01	0.60	19.92	-1051.35	21.86	0.83	19.35	-2662.66	21.66	0.79	20.27
54	2001	612.00	22.22	0.92	18.74	-0.00				-2534.24	21.64	0.78	20.29
55	2002	-612.00	22.22	0.92	18.74	-0.00				-2534.24	21.64	0.78	20.29
56	2003	-0.00	32.01	0.60	19.92	612.00	22.22	0.92	18.74	-2534.24	21.64	0.78	20.29
57	2004	-0.00	32.01	0.60	19.92	-612.00	22.22	0.92	18.74	-2534.24	21.64	0.78	20.29
58	2005	612.00	22.22	0.92	18.74	290.90	21.98	0.00	21.55	-2534.24	21.64	0.78	20.29
59	2006	-612.00	22.22	0.92	18.74	290.90	21.98	0.00	21.55	-2534.24	21.64	0.78	20.29
60	2007	-0.00	32.01	0.60	19.92	902.90	22.14	0.62	19.64	-2534.24	21.64	0.78	20.29
61	2008	-0.00	32.01	0.60	19.92	-321.10	22.44	1.74	16.19	-2534.24	21.64	0.78	20.29
62	2011	612.00	22.22	0.92	18.74	411.40	21.98	0.00	21.55	-2534.24	21.64	0.78	20.29
63	2012	-612.00	22.22	0.92	18.74	411.40	21.98	0.00	21.55	-2534.24	21.64	0.78	20.29
64	2013	-0.00	32.01	0.60	19.92	1023.40	22.13	0.55	19.87	-2534.24	21.64	0.78	20.29
65	2014	-0.00	32.01	0.60	19.92	-200.60	22.72	2.79	12.97	-2534.24	21.64	0.78	20.29
66	2015	612.00	22.22	0.92	18.74	290.90	21.98	0.00	21.55	-2534.24	21.64	0.78	20.29
67	2016	-612.00	22.22	0.92	18.74	290.90	21.98	0.00	21.55	-2534.24	21.64	0.78	20.29
68	2017	-0.00	32.01	0.60	19.92	902.90	22.14	0.62	19.64	-2534.24	21.64	0.78	20.29
69	2018	-0.00	32.01	0.60	19.92	-321.10	22.44	1.74	16.19	-2534.24	21.64	0.78	20.29
70	2021	612.00	22.22	0.92	18.74	-0.00				-2534.24	21.64	0.78	20.29
71	2022	-612.00	22.22	0.92	18.74	-0.00				-2534.24	21.64	0.78	20.29
72	2023	-0.00	32.01	0.60	19.92	612.00	22.22	0.92	18.74	-2534.24	21.64	0.78	20.29
73	2024	-0.00	32.01	0.60	19.92	-612.00	22.22	0.92	18.74	-2534.24	21.64	0.78	20.29
74	2025	612.00	22.22	0.92	18.74	-290.90	22.06	1.83	21.55	-2534.24	21.64	0.78	20.29
75	2026	-612.00	22.22	0.92	18.74	-290.90	22.06	1.83	21.55	-2534.24	21.64	0.78	20.29
76	2027	-0.00	32.01	0.60	19.92	321.10	22.37	0.09	16.19	-2534.24	21.64	0.78	20.29
77	2028	-0.00	32.01	0.60	19.92	-902.90	22.17	1.21	19.64	-2534.24	21.64	0.78	20.29
78	2031	612.00	22.22	0.92	18.74	-411.40	22.06	1.83	21.55	-2534.24	21.64	0.78	20.29
79	2032	-612.00	22.22	0.92	18.74	-411.40	22.06	1.83	21.55	-2534.24	21.64	0.78	20.29
80	2033	-0.00	32.01	0.60	19.92	200.60	22.56	-0.96	12.97	-2534.24	21.64	0.78	20.29
81	2034	-0.00	32.01	0.60	19.92	-1023.40	22.16	1.28	19.87	-2534.24	21.64	0.78	20.29
82	2035	612.00	22.22	0.92	18.74	-290.90	22.06	1.83	21.55	-2534.24	21.64	0.78	20.29
83	2036	-612.00	22.22	0.92	18.74	-290.90	22.06	1.83	21.55	-2534.24	21.64	0.78	20.29
84	2037	-0.00	32.01	0.60	19.92	321.10	22.37	0.09	16.19	-2534.24	21.64	0.78	20.29
85	2038	-0.00	32.01	0.60	19.92	-902.90	22.17	1.21	19.64	-2534.24	21.64	0.78	20.29
86	4001	1051.35	21.86	0.83	19.35	-0.00				-2662.66	21.66	0.79	20.27
87	4002	-172.65	24.41	1.46	14.98	-0.00				-2662.66	21.66	0.79	20.27
88	4003	439.35	21.36	0.70	20.21	612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
89	4004	439.35	21.36	0.70	20.21	-612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
90	4005	1051.35	21.86	0.83	19.35	105.24	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:55:26 SEA PAGE 106

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
91	4006	-172.65	24.41	1.46	14.98	105.24	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
92	4007	439.35	21.36	0.70	20.21	717.24	22.19	0.78	19.15	-2662.66	21.66	0.79	20.27
93	4008	439.35	21.36	0.70	20.21	-506.76	22.27	1.11	18.15	-2662.66	21.66	0.79	20.27
94	4011	1051.35	21.86	0.83	19.35	148.83	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
95	4012	-172.65	24.41	1.46	14.98	148.83	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
96	4013	439.35	21.36	0.70	20.21	760.83	22.18	0.74	19.29	-2662.66	21.66	0.79	20.27
97	4014	439.35	21.36	0.70	20.21	-463.17	22.30	1.21	17.83	-2662.66	21.66	0.79	20.27
98	4015	1051.35	21.86	0.83	19.35	105.24	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
99	4016	-172.65	24.41	1.46	14.98	105.24	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
100	4017	439.35	21.36	0.70	20.21	717.24	22.19	0.78	19.15	-2662.66	21.66	0.79	20.27
101	4018	439.35	21.36	0.70	20.21	-506.76	22.27	1.11	18.15	-2662.66	21.66	0.79	20.27
102	4021	1051.35	21.86	0.83	19.35	-0.00				-2662.66	21.66	0.79	20.27
103	4022	-172.65	24.41	1.46	14.98	-0.00				-2662.66	21.66	0.79	20.27
104	4023	439.35	21.36	0.70	20.21	612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
105	4024	439.35	21.36	0.70	20.21	-612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
106	4025	1051.35	21.86	0.83	19.35	-105.24	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
107	4026	-172.65	24.41	1.46	14.98	-105.24	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
108	4027	439.35	21.36	0.70	20.21	506.76	22.26	0.72	18.15	-2662.66	21.66	0.79	20.27
109	4028	439.35	21.36	0.70	20.21	-717.24	22.20	1.05	19.15	-2662.66	21.66	0.79	20.27
110	4031	1051.35	21.86	0.83	19.35	-148.83	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
111	4032	-172.65	24.41	1.46	14.98	-148.83	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
112	4033	439.35	21.36	0.70	20.21	463.17	22.28	0.62	17.83	-2662.66	21.66	0.79	20.27
113	4034	439.35	21.36	0.70	20.21	-760.83	22.19	1.09	19.29	-2662.66	21.66	0.79	20.27
114	4035	1051.35	21.86	0.83	19.35	-105.24	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
115	4036	-172.65	24.41	1.46	14.98	-105.24	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
116	4037	439.35	21.36	0.70	20.21	506.76	22.26	0.72	18.15	-2662.66	21.66	0.79	20.27
117	4038	439.35	21.36	0.70	20.21	-717.24	22.20	1.05	19.15	-2662.66	21.66	0.79	20.27
118	4101	172.65	24.41	1.46	14.98	-0.00				-2662.66	21.66	0.79	20.27
119	4102	-1051.35	21.86	0.83	19.35	-0.00				-2662.66	21.66	0.79	20.27
120	4103	-439.35	21.36	0.70	20.21	612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
121	4104	-439.35	21.36	0.70	20.21	-612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
122	4105	172.65	24.41	1.46	14.98	105.24	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
123	4106	-1051.35	21.86	0.83	19.35	105.24	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
124	4107	-439.35	21.36	0.70	20.21	717.24	22.19	0.78	19.15	-2662.66	21.66	0.79	20.27
125	4108	-439.35	21.36	0.70	20.21	-506.76	22.27	1.11	18.15	-2662.66	21.66	0.79	20.27
126	4111	172.65	24.41	1.46	14.98	148.83	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
127	4112	-1051.35	21.86	0.83	19.35	148.83	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
128	4113	-439.35	21.36	0.70	20.21	760.83	22.18	0.74	19.29	-2662.66	21.66	0.79	20.27
129	4114	-439.35	21.36	0.70	20.21	-463.17	22.30	1.21	17.83	-2662.66	21.66	0.79	20.27
130	4115	172.65	24.41	1.46	14.98	105.24	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
131	4116	-1051.35	21.86	0.83	19.35	105.24	21.98	0.00	21.55	-2662.66	21.66	0.79	20.27
132	4117	-439.35	21.36	0.70	20.21	717.24	22.19	0.78	19.15	-2662.66	21.66	0.79	20.27
133	4118	-439.35	21.36	0.70	20.21	-506.76	22.27	1.11	18.15	-2662.66	21.66	0.79	20.27
134	4121	172.65	24.41	1.46	14.98	-0.00				-2662.66	21.66	0.79	20.27
135	4122	-1051.35	21.86	0.83	19.35	-0.00				-2662.66	21.66	0.79	20.27

BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)

SACS (2025)

\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:55:26 SEA PAGE 107

***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****				***** Y - DIRECTION *****				***** Z - DIRECTION *****			
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
136	4123	-439.35	21.36	0.70	20.21	612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
137	4124	-439.35	21.36	0.70	20.21	-612.00	22.22	0.92	18.74	-2662.66	21.66	0.79	20.27
138	4125	172.65	24.41	1.46	14.98	-105.24	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
139	4126	-1051.35	21.86	0.83	19.35	-105.24	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
140	4127	-439.35	21.36	0.70	20.21	506.76	22.26	0.72	18.15	-2662.66	21.66	0.79	20.27
141	4128	-439.35	21.36	0.70	20.21	-717.24	22.20	1.05	19.15	-2662.66	21.66	0.79	20.27
142	4131	172.65	24.41	1.46	14.98	-148.83	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
143	4132	-1051.35	21.86	0.83	19.35	-148.83	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
144	4133	-439.35	21.36	0.70	20.21	463.17	22.28	0.62	17.83	-2662.66	21.66	0.79	20.27
145	4134	-439.35	21.36	0.70	20.21	-760.83	22.19	1.09	19.29	-2662.66	21.66	0.79	20.27
146	4135	172.65	24.41	1.46	14.98	-105.24	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
147	4136	-1051.35	21.86	0.83	19.35	-105.24	22.06	1.83	21.55	-2662.66	21.66	0.79	20.27
148	4137	-439.35	21.36	0.70	20.21	506.76	22.26	0.72	18.15	-2662.66	21.66	0.79	20.27
149	4138	-439.35	21.36	0.70	20.21	-717.24	22.20	1.05	19.15	-2662.66	21.66	0.79	20.27
150	4201	612.00	22.22	0.92	18.74	439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
151	4202	-612.00	22.22	0.92	18.74	439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
152	4203	-0.00	32.01	0.60	19.92	1051.35	21.86	0.83	19.35	-2662.66	21.66	0.79	20.27
153	4204	-0.00	32.01	0.60	19.92	-172.65	24.41	1.46	14.98	-2662.66	21.66	0.79	20.27
154	4205	612.00	22.22	0.92	18.74	544.59	21.48	0.57	20.47	-2662.66	21.66	0.79	20.27
155	4206	-612.00	22.22	0.92	18.74	544.59	21.48	0.57	20.47	-2662.66	21.66	0.79	20.27
156	4207	-0.00	32.01	0.60	19.92	1156.59	21.87	0.75	19.55	-2662.66	21.66	0.79	20.27
157	4208	-0.00	32.01	0.60	19.92	-67.41	28.20	3.73	4.73	-2662.66	21.66	0.79	20.27
158	4211	612.00	22.22	0.92	18.74	588.18	21.52	0.52	20.55	-2662.66	21.66	0.79	20.27
159	4212	-612.00	22.22	0.92	18.74	588.18	21.52	0.52	20.55	-2662.66	21.66	0.79	20.27
160	4213	-0.00	32.01	0.60	19.92	1200.18	21.88	0.72	19.63	-2662.66	21.66	0.79	20.27
161	4214	-0.00	32.01	0.60	19.92	-23.82	39.57	10.57	-26.04	-2662.66	21.66	0.79	20.27
162	4215	612.00	22.22	0.92	18.74	544.59	21.48	0.57	20.47	-2662.66	21.66	0.79	20.27
163	4216	-612.00	22.22	0.92	18.74	544.59	21.48	0.57	20.47	-2662.66	21.66	0.79	20.27
164	4217	-0.00	32.01	0.60	19.92	1156.59	21.87	0.75	19.55	-2662.66	21.66	0.79	20.27
165	4218	-0.00	32.01	0.60	19.92	-67.41	28.20	3.73	4.73	-2662.66	21.66	0.79	20.27
166	4221	612.00	22.22	0.92	18.74	439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
167	4222	-612.00	22.22	0.92	18.74	439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
168	4223	-0.00	32.01	0.60	19.92	1051.35	21.86	0.83	19.35	-2662.66	21.66	0.79	20.27
169	4224	-0.00	32.01	0.60	19.92	-172.65	24.41	1.46	14.98	-2662.66	21.66	0.79	20.27
170	4225	612.00	22.22	0.92	18.74	334.11	21.15	0.35	19.79	-2662.66	21.66	0.79	20.27
171	4226	-612.00	22.22	0.92	18.74	334.11	21.15	0.35	19.79	-2662.66	21.66	0.79	20.27
172	4227	-0.00	32.01	0.60	19.92	946.11	21.84	0.71	19.11	-2662.66	21.66	0.79	20.27
173	4228	-0.00	32.01	0.60	19.92	-277.89	23.52	1.60	17.47	-2662.66	21.66	0.79	20.27
174	4231	612.00	22.22	0.92	18.74	290.52	21.01	0.12	19.53	-2662.66	21.66	0.79	20.27
175	4232	-612.00	22.22	0.92	18.74	290.52	21.01	0.12	19.53	-2662.66	21.66	0.79	20.27
176	4233	-0.00	32.01	0.60	19.92	902.52	21.83	0.66	18.99	-2662.66	21.66	0.79	20.27
177	4234	-0.00	32.01	0.60	19.92	-321.48	23.32	1.63	18.02	-2662.66	21.66	0.79	20.27
178	4235	612.00	22.22	0.92	18.74	334.11	21.15	0.35	19.79	-2662.66	21.66	0.79	20.27
179	4236	-612.00	22.22	0.92	18.74	334.11	21.15	0.35	19.79	-2662.66	21.66	0.79	20.27
180	4237	-0.00	32.01	0.60	19.92	946.11	21.84	0.71	19.11	-2662.66	21.66	0.79	20.27

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\*\*\*\*\* SACS IV SEASTATE PROGRAM \*\*\*\*\*

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***** SEASTATE LOAD CASE CENTER REPORT *****													
RELATIVE TO STRUCTURAL ORIGIN													
LOAD CASE	LOAD LABEL	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****	***** X - DIRECTION *****	***** Y - DIRECTION *****	***** Z - DIRECTION *****
		FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)	FORCE (KN)	X (M)	Y (M)	Z (M)
181	4238	-0.00	32.01	0.60	19.92	-277.89	23.52	1.60	17.47	-2662.66	21.66	0.79	20.27
182	4301	612.00	22.22	0.92	18.74	-439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
183	4302	-612.00	22.22	0.92	18.74	-439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
184	4303	-0.00	32.01	0.60	19.92	172.65	24.41	1.46	14.98	-2662.66	21.66	0.79	20.27
185	4304	-0.00	32.01	0.60	19.92	-1051.35	21.86	0.83	19.35	-2662.66	21.66	0.79	20.27
186	4305	612.00	22.22	0.92	18.74	-334.11	21.17	0.92	19.79	-2662.66	21.66	0.79	20.27
187	4306	-612.00	22.22	0.92	18.74	-334.11	21.17	0.92	19.79	-2662.66	21.66	0.79	20.27
188	4307	-0.00	32.01	0.60	19.92	277.89	23.49	0.91	17.47	-2662.66	21.66	0.79	20.27
189	4308	-0.00	32.01	0.60	19.92	-946.11	21.85	0.92	19.11	-2662.66	21.66	0.79	20.27
190	4311	612.00	22.22	0.92	18.74	-290.52	21.05	1.06	19.53	-2662.66	21.66	0.79	20.27
191	4312	-612.00	22.22	0.92	18.74	-290.52	21.05	1.06	19.53	-2662.66	21.66	0.79	20.27
192	4313	-0.00	32.01	0.60	19.92	321.48	23.28	0.78	18.02	-2662.66	21.66	0.79	20.27
193	4314	-0.00	32.01	0.60	19.92	-902.52	21.84	0.96	18.99	-2662.66	21.66	0.79	20.27
194	4315	612.00	22.22	0.92	18.74	-334.11	21.17	0.92	19.79	-2662.66	21.66	0.79	20.27
195	4316	-612.00	22.22	0.92	18.74	-334.11	21.17	0.92	19.79	-2662.66	21.66	0.79	20.27
196	4317	-0.00	32.01	0.60	19.92	277.89	23.49	0.91	17.47	-2662.66	21.66	0.79	20.27
197	4318	-0.00	32.01	0.60	19.92	-946.11	21.85	0.92	19.11	-2662.66	21.66	0.79	20.27
198	4321	612.00	22.22	0.92	18.74	-439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
199	4322	-612.00	22.22	0.92	18.74	-439.35	21.36	0.70	20.21	-2662.66	21.66	0.79	20.27
200	4323	-0.00	32.01	0.60	19.92	172.65	24.41	1.46	14.98	-2662.66	21.66	0.79	20.27
201	4324	-0.00	32.01	0.60	19.92	-1051.35	21.86	0.83	19.35	-2662.66	21.66	0.79	20.27
202	4325	612.00	22.22	0.92	18.74	-544.59	21.50	0.92	20.47	-2662.66	21.66	0.79	20.27
203	4326	-612.00	22.22	0.92	18.74	-544.59	21.50	0.92	20.47	-2662.66	21.66	0.79	20.27
204	4327	-0.00	32.01	0.60	19.92	67.41	28.07	0.88	4.73	-2662.66	21.66	0.79	20.27
205	4328	-0.00	32.01	0.60	19.92	-1156.59	21.88	0.92	19.55	-2662.66	21.66	0.79	20.27
206	4331	612.00	22.22	0.92	18.74	-588.18	21.54	0.99	20.55	-2662.66	21.66	0.79	20.27
207	4332	-612.00	22.22	0.92	18.74	-588.18	21.54	0.99	20.55	-2662.66	21.66	0.79	20.27
208	4333	-0.00	32.01	0.60	19.92	23.82	39.07	-0.87	-26.04	-2662.66	21.66	0.79	20.27
209	4334	-0.00	32.01	0.60	19.92	-1200.18	21.89	0.95	19.63	-2662.66	21.66	0.79	20.27
210	4335	612.00	22.22	0.92	18.74	-544.59	21.50	0.92	20.47	-2662.66	21.66	0.79	20.27
211	4336	-612.00	22.22	0.92	18.74	-544.59	21.50	0.92	20.47	-2662.66	21.66	0.79	20.27
212	4337	-0.00	32.01	0.60	19.92	67.41	28.07	0.88	4.73	-2662.66	21.66	0.79	20.27
213	4338	-0.00	32.01	0.60	19.92	-1156.59	21.88	0.92	19.55	-2662.66	21.66	0.79	20.27

### 5.3 Member Unity Check Result (Before Strengthening – AS-IN condition)

Member having Unity check ratio above 1.0 for the bridge members are summarized below.

#### Member Unity Check Result

S. No.	Member	Group ID	UC (BEFORE STRENGTHNING)	Load Case	Remarks
1.	0070-B292	B5C	1.474	4132	
2.	B003-0071	B5D	1.493	4332	
3.	0071-0072	B5D	1.315	4332	
4.	0072-B286	B5D	1.649	4332	
5.	B286-B004	B5D	1.621	4332	
6.	B004-B005	B5E	1.606	4332	
7.	B005-B279	BSF	1.676	4332	
8.	B279-0081	B5F	1.755	4332	
9.	0081-0082	B5F	1.394	4332	
10.	0082-B006	B5F	1.705	4332	
11.	B006-B274	B5G	2.254	4332	

12.	B274-0083	B5G	2.287	4332	
13.	0083-0084	B5G	2.082	4332	
14.	0084-B007	B5G	2.118	4332	
15.	B007-B268	B5H	1.851	4332	
16.	B268-B008	B5H	1.838	4332	
17.	B008-B262	B5J	1.875	4332	
18.	B262-B255	B5J	1.906	4332	
19.	B255-B009	B5J	1.775	4332	
20.	B009-B259	B5R	1.365	4332	
21.	B259-B252	B5K	1.41	4332	
22.	B252-B245	B5Q	1.514	4332	
23.	B245-B010	B5P	1.102	4332	
24.	B010-B244	B5O	1.726	4332	
25.	B244-B011	B5L	2.461	4332	
26.	B064-B016	B1C	1.238	4332	
27.	B016-B055	B1D	1.196	4332	
28.	B055-B291	B1E	1.041	4212	
29.	B017-B056	B1F	1.451	4212	
30.	B056-B281	B1F	1.574	4212	
31.	B281-B018	B1F	1.63	4212	
32.	B018-B057	B1G	1.806	4212	
33.	B057-B019	B1G	1.848	4212	
34.	B019-B280	B1H	2.26	4212	
35.	B280-B058	B1H	2.159	4212	
36.	B058-B020	B1H	2.38	4212	
37.	B020-B273	B1J	2.171	4212	
38.	B273-B059	B1J	2.102	4212	
39.	B059-B021	B1J	2.137	4212	
40.	B021-B267	B1K	2.021	4212	
41.	B267-B060	B1K	1.964	4212	
42.	B060-B022	B1K	2.026	4212	

43.	B022-B061	B1L	2.114	4212	
44.	B061-B261	B1L	1.781	4212	
45.	B261-B023	B1L	1.862	4212	
46.	B023-B062	B1M	2.17	4212	
47.	B062-B250	B1T	1.97	4212	
48.	B250-B024	B1N	1.979	4212	
49.	B024-B063	B1O	1.87	4212	
50.	B063-B025	B1P	1.574	4212	
51.	B025-B065	B1Q	1.227	4212	
52.	B065-B026	B1R	1.325	4112	
53.	B000-B014	B63	4.374	4212	
54.	B064-B002	B61	1.373	4211	
55.	B012-0086	B11	3.923	4031	
56.	0086-B026	B11	3.642	4112	
57.	B127-0099	B3S	1.33	4331	
58.	0099-B227	B3C	1.344	4331	
59.	B228-B128	STN	1.001	4031	
60.	B129-B330	STM	1.559	4211	
61.	B330-B229	STM	1.373	4211	
62.	B229-B348	STR	1.57	4212	
63.	B348-B130	STL	1.648	4211	
64.	B130-B230	STK	1.521	4211	
65.	B230-B131	STJ	1.62	4212	
66.	B131-B327	STJ	1.697	4211	
67.	B327-B231	STJ	1.575	4212	
68.	B231-B132	STJ	1.832	4211	
69.	B132-B232	STJ	1.808	4211	
70.	B232-B336	STQ	1.731	4212	
71.	B336-B133	STH	1.73	4212	
72.	B133-B233	STG	1.101	4212	
73.	B233-B134	STF	1.282	4212	

74.	B134-B328	STF	1.181	4212	
75.	B328-B234	STF	1.15	4212	
76.	B234-B329	STF	1.247	4212	
77.	B329-B135	STF	1.327	4212	
78.	B235-B136	STB	1.123	4212	
79.	0118-0122	TNX	1.479	4332	
80.	0122-0093	TNK	1.252	4212	
81.	B347-B142	TNH	1.009	4332	
82.	B142-B334	TNG	1.569	4332	
83.	B334-B143	TNO	1.574	4332	
84.	B143-B326	TNF	1.727	4332	
85.	B326-B144	TNF	1.803	4332	
86.	B144-B335	TNP	1.762	4332	
87.	B335-B145	TNE	1.687	4332	
88.	B145-B337	TNQ	1.012	4332	
89.	B337-B146	TND	1.015	4333	
90.	0114-B127	T2V	1.123	4212	
91.	B127-B320	T2W	4.116	4331	
92.	B320-B139	T2W	4.319	4212	
93.	B128-B324	T2R	3.047	4332	
94.	B324-B140	T2R	2.949	4212	
95.	B129-B325	T2M	2.502	4332	
96.	B325-B141	T2M	2.536	4212	
97.	B130-B331	T2G	1.809	4332	
98.	B331-B142	T2G	1.879	4212	
99.	B370-B143	T2B	1.113	4112	
100.	B133-B372	T1R	1.411	4332	
101.	B372-B145	T1R	1.172	4331	
102.	B134-B373	T1M	1.479	4332	
103.	B373-B146	T1M	1.257	4212	
104.	B135-B374	T1G	2.099	4332	

105.	B374-B147	T1G	1.875	4212	
106.	B136-B375	T1B	3.173	4332	
107.	B375-B148	T1B	2.356	4211	
108.	B014-0001	BNV	2.216	4212	
109.	0001-B139	BNV	2.229	4212	
110.	B139-B017	BNT	1.349	4212	
111.	B017-B141	BNR	1.011	4212	
112.	B023-B087	BNF	1.103	4112	
113.	B147-B025	BNC	1.447	4331	
114.	B025-B089	BNB	1.339	4332	
115.	B089-B148	BNB	2.128	4332	
116.	B148-B238	BNA	1.37	4211	
117.	B238-B026	BNA	1.618	4331	
118.	B080-B139	BNU	1.624	4212	
119.	B000-0000	BSW	2.098	4331	
120.	0000-B127	BSW	2.622	4331	
121.	B002-B068	BSV	1.718	4332	
122.	B068-B127	BSV	1.741	4331	
123.	B003-B129	BSR	1.129	4211	
124.	B133-B009	BSG	1.169	4211	
125.	B135-B011	BSC	2.328	4212	
126.	B011-B077	BSB	2.042	4331	
127.	B077-B136	BSB	2.226	4332	
128.	B136-B239	BSA	1.862	4332	
129.	B239-B012	BSA	1.598	4332	
130.	0000-B066	B2A	5.034	4212	
131.	B066-B079	B2A	1.919	4212	
132.	B079-0001	B2A	5.744	4332	
133.	B222-B221	B2D	1.309	4212	
134.	B220-B219	B2D	1.489	4332	
135.	B068-B101	B2B	3.646	4332	



136.	B101-B123	B2B	2.029	4212	
137.	B123-B080	B2B	4.254	4212	
138.	B069-B175	B2B	3.027	4332	
139.	B175-B124	B2B	1.444	4212	
140.	B124-B081	B2B	3.107	4212	
141.	B104-B070	B2B	1.544	4001	
142.	B070-B176	B2B	1.729	4332	
143.	B176-B126	B2B	1.148	4212	
144.	B126-B082	B2B	2.147	4212	
145.	B082-B093	B2B	1.46	4001	
146.	B071-B177	B2B	1.174	4332	
147.	B138-B083	B2B	1.677	4212	
148.	B107-B073	B2B	1.544	4001	
149.	B085-B096	B2B	1.46	4001	
150.	B074-B180	B2D	2.299	4211	
151.	B171-B086	B2D	2.627	4331	
152.	B109-B075	B2B	1.74	4001	
153.	B075-B181	B2B	1.492	4332	
154.	B172-B087	B2B	1.518	4112	
155.	B087-B098	B2B	1.74	4001	
156.	B076-B236	B2B	1.76	4332	
157.	B173-B088	B2B	1.768	4212	
158.	B077-B237	B2B	3.676	4332	
159.	B237-B174	B2B	1.903	4332	
160.	B174-B089	B2B	3.77	4212	
161.	B224-B223	B2D	1.064	4212	
162.	B226-B225	B2D	1.343	4332	
163.	B239-B241	B2A	4.707	4332	
164.	B241-B240	B2A	2.712	4332	
165.	B240-B238	B2A	6.163	4332	
166.	B066-B222	B2C	2.325	4212	

167.	B222-B220	B2C	1.223	4332	
168.	B220-B101	B2C	1.349	4212	
169.	B101-B202	B2C	1.093	4112	
170.	B219-B123	B2C	1.719	4332	
171.	B123-B200	B2C	1.502	4332	
172.	B189-B124	B2C	1.149	4332	
173.	B205-B175	B2C	1.411	4112	
174.	B124-B192	B2C	1.497	4132	
175.	B175-B201	B2C	1.124	4112	
176.	B126-B113	B2C	1.232	4112	
177.	B207-B176	B2C	1.113	4112	
178.	B210-B177	B2C	1.029	4132	
179.	B138-B195	B2C	1.165	4212	
180.	B184-B172	B2C	1.342	4212	
181.	B181-B217	B2C	1.158	4332	
182.	B196-B173	B2C	1.292	4212	
183.	B236-B213	B2C	1.035	4112	
184.	B185-B174	B2C	1.683	4112	
185.	B218-B237	B2C	1.221	4212	
186.	B174-B223	B2C	1.267	4132	
187.	B237-B224	B2C	1.673	4212	
188.	B225-B240	B2C	2.687	4132	
189.	B226-B241	B2C	2.186	4112	
190.	0124-0123	PSE	1.313	4201	

#### 5.4 Member Unity Check Result (After Strengthening)

No member is having Unity check ratio above 1.0 for the bridge members. Refer Annexure-2 for SACS output of member unity check.

#### 6.0 PROPOSED STRENGTHENING CONFIGURATION

##### 1. Top Chord -

- Main Chord:  $\Phi 406$ dia. + 12thk wrap plate + 2 no's Half cut tubular (324dia. x 12.7mm)
- Main chord member extended on WIS & SLQ side with strengthening above.
- 1 no. new member modelled (324dia. x 15.9mm) – SLQ side
- 1 no. new member modelled (324dia. x 15.9mm) – WIS side

- e) Horizontal framing member:  $\Phi 219$ dia. + 12thk wrap plate + 2 no's Half cut tubular (168dia. x 12.7mm)
- f) Diagonal Framing members: 2 no's new members modelled (168dia. x 9.5mm)

## 2. Bottom Chord-

- a) Main Chord:  
Main Chord:  $\Phi 406$ dia. + 12thk wrap plate + 2 no's Half cut tubular (324dia. x 12.7mm)
- b) Horizontal Framing members:  
1 no. new members modelled (168dia. x 9.5mm) on WIS side.  
1 no. new members modelled (168dia. x 9.5mm) on WIS side
- c) Diagonal Framing members:  
1 no. 273 dia x 7.2mm member to replaced with 273 dia x 15.9mm member  
1 no. new members modelled (168dia. x 9.5mm) as X-brace member on WIS side  
1 no. new members modelled (168dia. x 9.5mm) as X-brace member on SLQ side

## 3. Framing Elevation Section A-A:

- a) Vertical member:
  - 1 no. new member modelled (324dia. x 15.9mm) on WIS side
  - $\Phi 219$ dia. + 12thk wrap plate + 2 no's Half cut tubular (168dia. x 12.7mm) – 1 no. on WIS side
  - 1 no. new member modelled (324dia. x 15.9mm) on SLQ side
- b) Diagonal member:
  - 1 no. new member modelled (324dia. x 15.9mm) on WIS side as X-brace member
  - $\Phi 324$ dia. + 12thk wrap plate + 2 no's Half cut tubular (273dia. x 12.7mm) on WIS side
  - $\Phi 219$ dia. + 12thk wrap plate + 2 no's Half cut tubular (168dia. x 12.7mm) – 2 nos. on WIS side
  - $\Phi 219$ dia. + 12thk wrap plate + 2 no's Half cut tubular (168dia. x 12.7mm) – 3 nos. on SLQ side
  - $\Phi 324$ dia. + 12thk wrap plate + 2 no's Half cut tubular (273dia. x 12.7mm) on SLQ side
  - 1 no. new member modelled (324dia. x 15.9mm) on SLQ side as X-brace member

## 4. Framing Elevation Section B-B:

- a) Vertical member:
  - 1 no. new member modelled (324dia. x 15.9mm) on WIS side
  - $\Phi 219$ dia. + 12thk wrap plate + 2 no's Half cut tubular (168dia. x 12.7mm) – 1 no. on WIS side
  - $\Phi 219$ dia. + 12thk wrap plate + 2 no's Half cut tubular (168dia. x 12.7mm) – 1 no. on SLQ side
  - 1 no. new member modelled (324dia. x 15.9mm) on SLQ side
- b) Diagonal member:
  - 1 no. new member modelled (324dia. x 15.9mm) on WIS side as X-brace member
  - $\Phi 324$ dia. + 12thk wrap plate + 2 no's Half cut tubular (273dia. x 12.7mm) on WIS side
  - $\Phi 219$ dia. + 12thk wrap plate + 2 no's Half cut tubular (168dia. x 12.7mm) – 1 no. on WIS side
  - $\Phi 219$ dia. + 12thk wrap plate + 2 no's Half cut tubular (168dia. x 12.7mm) – 1 no. on SLQ side
  - $\Phi 324$ dia. + 12thk wrap plate + 2 no's Half cut tubular (273dia. x 12.7mm) on SLQ side – 1 no.
  - 1 no. new member modelled (324dia. x 15.9mm) on SLQ side as X-brace member

The proposed strengthening and replacement works shall also comprise the following:

- Replacement of walkway members, gratings, and handrails.
- Replacement of stairs on both sides.
- Replacement of monorail member.
- Strengthening of supports at fixed and sliding ends.

## 6.1 Bridge deflection

The Bridge deflection (Vertical) along with Relative deflection between two supports for main chord members have been tabulated below

Summary of Bridge Vertical Deflections

S. No.	Joint	Maximum Deflection (cm)	Allowable Deflection (cm)	Remarks
1.	B274	5.200	(4350 / 400) = 10.875	
2.	B059	5.1		

The Bridge deflection (Horizontal) along with Relative deflection between two supports for main chord members have been tabulated below

Summary of Bridge Horizontal Deflections

S. No.	Joint	Maximum Deflection (cm)	Allowable Deflection (cm)	Remarks
1.	B059	1.8 (Y direction)	(4350 / 400) = 10.875	
2.	B130	2.3 (Y direction)		

Horizontal Deflection of bridge are under control. Vertical Deflection of bridge is more than allowable.

## 6.2 Reaction Summary

Following is the reaction summary of the bridge supports.

Summary of Bridge Reactions

S. No.	Joint	Reaction in X Direction	Reaction in Y Direction	Reaction in Z Direction
1.	B000	0	-985.354	979.354
2.	B014	0	1256.441	888.218
3.	B012	-1627	-379.743	1113.641
4.	B026	1630	281.9	832.576

## 7.0 CONCLUSION

The analysis of bridge has been carried out considering the piping loads, electrical & instrumentation cable tray loads and wind loads. Based on the results, the necessary strengthening requirements, as outlined in Clause 6.0, have been recommended. With the implementation of these strengthening measures of the top chord, bottom chord, and associated framing members, the bridge is found to be structurally adequate and safe under all load combinations.

Also, functionally the deflection is under the limits. The adequacy of the bridge landing locations, adequacy of deck members are performed separately.

It is also recommended that no additional structural loading/modifications shall be carried out on WIS-SLQ bridge without adequate structural analysis.

**ANNEXURE-1  
LOAD CALCULATIONS**

**WIND LOAD:**

S. No.	STORM CONDITION	DIRECTION FROM NORTH	1 hr. Mean Wind Speed at 10m above SWL		C	Height above SWL		1 hr. Mean Vel. at "z"	Turbulence Intensity at height "z"	to	t	Design Wind Speed at Height "z"	
			Uo			z		U(z)				Iu(z)	u(z,t)
			kmph	ft/sec		m	ft	ft/sec		sec	sec	ft/sec	m/sec
1	Extreme	0	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
2	Extreme	45	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
3	Extreme	90	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
4	Extreme	135	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
5	Extreme	180	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
6	Extreme	225	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
7	Extreme	270	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
8	Extreme	315	149.67	136.37	0.154	10.00	32.80	136.37	0.167	3600	3	202.64	61.78
1	Operating	All	99.22	90.40	0.130	10.00	32.80	90.40	0.131	3600	3	124.84	38.06

**GRATING LOAD**

Grating load of 50 kg/m<sup>2</sup> is considered

**HANDRAIL LOAD**

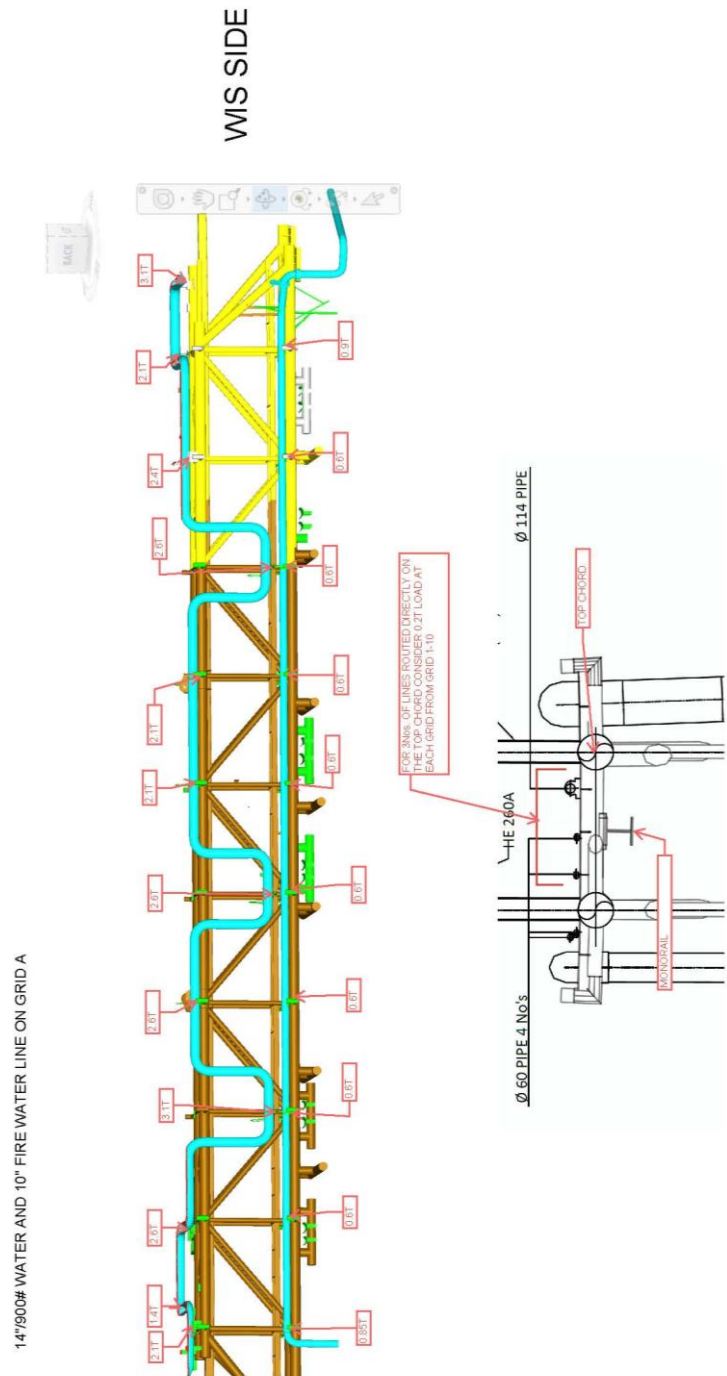
Handrail Load of 50Kg/m is considered.

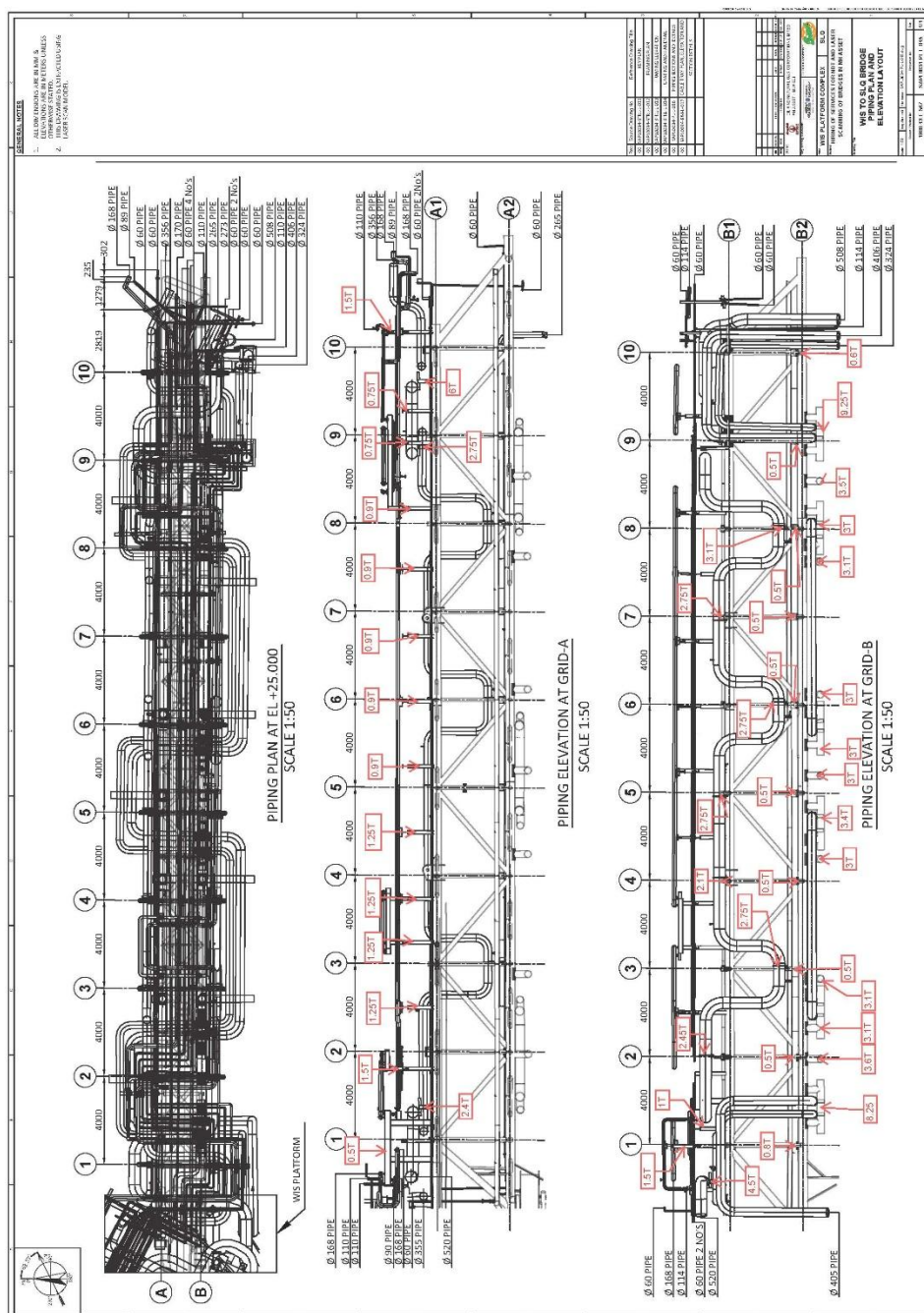
**CABLE TRAY & CABLE LOAD:**

Tray nos.	Tray Load	Cable nos.	Cable load	Cable tray load at end span	Cable tray load at middle spans	Cable load at ends	Cable load at middle spans	Total load at End Span	Total load at middle spans
2 nos. 150MM tray at both side of walkway	FOR 150 mm CABLE TRAY LOAD =5KG/3 MTR LONG	12 run 3CX10 SQ. MM Cu. conductor armored cable	for 3CX10 SQ. MM Cu conductor armored cables=551 kg/km	0.067	0.133	0.066	0.132	0.13	0.27
2 nos. 150MM tray at above the bridge	FOR 150 mm CABLE TRAY LOAD =5KG/3 MTR LONG	4 run 2Px1.5 SQ. MM CABLE	for 2PX1.5 SQ. MM Cu conductor armored cables=585 kg/km	0.067	0.133	0.047	0.094	0.11	0.23
3 nos. 300mm tray left side (WIS platform side)	FOR 300 mm CABLE TRAY LOAD = 7.7KG/3 MTR LONG	5 run 3C X2.5 SQ. MM armored cu. conductor cable	for 3C X2.5 SQ. MM armored cu. conductor cable= 162 kg/km	0.154	0.308	0.016	0.032	0.17	0.34

## **PIPING LOADS**







**ANNEXURE-2**  
**SACS OUTPUT FOR MEMBER UNITY CHECK**  
**(AFTER STRENGTHENING)**

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING STRESS Y N/MM2	STRESS Z N/MM2	SHEAR STRESS Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	HIGHEST LOAD COND	THIRD-HIGHEST UNITY CHECK	HIGHEST LOAD COND
B012-B026	B11	0.357	4332	0.0	0.00	-55.41	-36.65	8.04	-1.03	21.5	21.6	0.355	4333	0.355	4334
0137-B012	B12	0.529	4212	0.9	59.39	14.87	-19.13	2.35	-1.59	40.5	15.8	0.512	4213	0.512	4214
B065-0137	B12	0.518	4212	0.0	59.09	-10.43	19.84	1.74	0.89	40.5	24.8	0.500	4213	0.500	4214
B011-B065	B13	0.622	4211	0.0	-70.97	7.61	7.90	0.37	0.30	50.0	50.0	0.615	4213	0.615	4214
B025-B039	B14	0.158	4001	0.0	0.00	-28.31	-7.88	4.40	0.00	17.7	17.7	0.158	4002	0.158	4003
B053-B011	B14	0.115	4001	1.0	0.00	-20.58	-5.57	3.17	0.00	17.7	17.7	0.115	4002	0.115	4003
B011-B025	B15	0.432	4332	0.0	-6.18	-61.15	-38.17	7.83	0.70	24.6	24.6	0.426	4333	0.426	4334
B063-B011	B16	0.657	4212	2.7	78.76	15.83	-17.64	1.18	0.45	47.7	47.7	0.645	4213	0.645	4214
B010-B063	B17	0.536	4211	2.7	-58.61	-14.21	-2.93	0.81	-0.70	48.0	48.0	0.531	4213	0.531	4214
B052-B010	B18	0.123	4001	1.0	0.00	-22.02	-5.93	3.47	0.00	17.5	17.5	0.123	4002	0.123	4003
B010-B024	B19	0.275	4212	1.8	-7.77	-28.94	-28.35	3.10	-0.27	31.9	31.9	0.265	4213	0.265	4214
B015-B014	B1A	0.002	1000	0.8	0.00	-0.32	0.00	0.00	-0.09	5.1	8.0	0.002	1001	0.002	4001
B014-B064	B1B	0.300	4332	0.0	25.07	5.49	-14.14	1.06	-0.50	18.5	29.3	0.288	4326	0.288	4336
B064-B016	B1C	0.221	4212	1.6	14.70	-7.25	-10.98	-0.43	-0.51	18.5	29.3	0.221	4332	0.219	4216
B016-B055	B1D	0.341	4312	0.0	25.09	-13.99	-11.60	0.57	0.86	26.2	21.8	0.340	4306	0.340	4316
B055-B291	B1E	0.387	4212	1.9	28.36	5.10	-24.19	-1.17	0.18	26.1	21.5	0.383	4206	0.383	4216
B017-B056	B1F	0.585	4212	2.0	59.88	8.49	18.69	1.23	0.24	25.4	20.1	0.581	4206	0.581	4216
B056-B281	B1F	0.646	4212	1.5	64.03	9.72	-22.35	-1.66	0.02	25.4	20.1	0.637	4206	0.637	4216
B281-B018	B1F	0.669	4212	0.5	64.11	13.36	-22.07	-0.22	0.89	25.4	20.1	0.660	4206	0.660	4216
B018-B057	B1G	0.670	4212	0.0	63.97	13.36	-22.34	1.19	0.10	25.4	20.1	0.661	4206	0.661	4216
B057-B019	B1G	0.651	4212	2.0	65.61	8.76	-22.47	-1.21	-0.35	25.4	20.1	0.643	4206	0.643	4216
B019-B280	B1H	0.730	4212	0.0	80.94	5.28	-22.34	0.69	0.20	25.4	20.1	0.722	4206	0.722	4216

**BRIDGE PRELIMINARY REPORT FOR  
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IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
DATE 24-SEP-2025 TIME 10:55:29 PST PAGE 549

**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B280-B058	B1H	0.775	4212	1.0	80.82	13.20	21.34	2.19	0.81	25.4	20.1	0.769	4206	0.769	4216
B021-B267	B1K	0.742	4212	0.0	77.80	6.03	-26.59	0.47	-0.04	25.4	20.1	0.734	4206	0.734	4216
B060-B022	B1K	0.772	4212	2.0	72.75	19.84	-22.23	-1.29	0.30	25.4	20.1	0.763	4206	0.763	4216
B267-B060	B1K	0.751	4212	1.5	77.62	12.83	21.35	1.93	0.53	25.4	20.1	0.745	4206	0.745	4216
B022-B061	B1L	0.775	4212	0.0	72.85	18.93	-23.54	1.32	-0.29	25.4	20.1	0.766	4206	0.766	4216
B061-B261	B1L	0.671	4112	0.0	65.75	12.97	21.15	-1.96	-0.40	25.4	20.1	0.667	4106	0.667	4116
B261-B023	B1L	0.602	4212	1.5	66.62	10.47	-12.54	-0.46	0.11	25.4	20.1	0.598	4206	0.598	4216
B023-B062	B1M	0.601	4112	2.0	55.45	18.39	15.63	0.93	0.29	25.1	20.2	0.599	4106	0.599	4116
B250-B024	B1N	0.540	4112	1.8	50.34	-18.69	-11.34	-0.48	-2.50	25.8	20.9	0.538	4106	0.538	4116
B024-B063	B1O	0.431	4112	0.0	41.81	-10.67	-11.69	0.75	0.88	25.8	20.9	0.427	4106	0.427	4116
B063-B025	B1P	0.497	4332	2.0	48.37	11.74	-13.80	-0.70	0.40	25.7	20.7	0.492	4326	0.492	4336
B025-B065	B1Q	0.385	4332	2.1	35.39	1.92	-19.98	-0.73	-0.40	27.2	21.5	0.368	4326	0.368	4336
B065-B026	B1R	0.428	4332	0.0	45.64	1.86	-16.18	0.44	0.00	27.2	21.5	0.408	4326	0.408	4336
B026-B040	B1S	0.002	1000	0.0	0.00	-0.30	0.00	0.00	0.08	4.9	7.8	0.002	1001	0.002	4001
B062-B250	B1T	0.579	4102	0.0	52.48	17.98	15.68	-1.87	0.28	25.3	20.5	0.579	4122	0.579	4126
B291-B017	B1U	0.374	4212	0.0	28.48	5.43	-21.68	0.50	-2.18	25.4	20.1	0.370	4206	0.370	4216
B024-B038	B20	0.104	4001	0.0	0.00	-18.63	-5.03	2.84	0.00	17.8	17.8	0.104	4002	0.104	4003
B062-B010	B21	0.491	4212	0.0	64.95	-1.33	10.08	0.59	0.01	47.7	47.7	0.478	4213	0.478	4214
B009-B062	B22	0.267	4332	0.0	29.77	-8.92	-8.57	0.73	-0.71	48.3	48.3	0.261	4333	0.261	4334
B051-B009	B23	0.106	4001	1.0	0.00	-19.01	-5.10	2.96	0.00	17.6	17.6	0.106	4002	0.106	4003
B009-B023	B24	0.185	4332	1.7	-13.40	14.17	7.98	1.13	2.56	30.4	30.4	0.183	4212	0.179	4333
B023-B037	B25	0.122	4001	0.0	0.00	-21.82	-5.92	3.39	0.00	17.6	17.6	0.122	4002	0.122	4003

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B061-B009	B26	0.438	4212	2.7	51.70	4.94	-16.11	0.88	0.22	47.7	47.7	0.427	4206	0.427	4216
B008-B061	B27	0.212	4332	2.7	22.17	1.37	11.65	0.59	-0.68	47.7	47.7	0.205	4333	0.205	4334
B050-B008	B28	0.095	4001	1.0	0.00	-17.04	-4.50	2.60	0.00	17.7	17.7	0.095	4002	0.095	4003
B008-B022	B29	0.205	4212	0.0	-12.59	-9.63	18.52	1.67	0.21	32.6	32.6	0.202	4206	0.202	4216
B070-B176	B2B	0.471	4032	0.0	1.22	-13.14	-71.08	7.54	3.51	3.0	15.7	0.465	4026	0.465	4036
B071-B177	B2B	0.212	4112	0.0	-1.14	10.88	-25.52	3.67	1.45	3.0	15.7	0.205	4312	0.205	4116
B072-B178	B2B	0.154	4111	0.4	-0.87	9.54	16.66	2.35	2.22	3.0	15.7	0.154	4113	0.154	4114
B073-B179	B2B	0.300	4132	0.0	0.10	-21.31	31.37	-1.81	4.94	3.0	15.7	0.296	4126	0.296	4136
B074-B180	B2B	0.283	4332	0.4	-1.12	3.43	-47.21	-6.47	5.41	3.0	15.7	0.281	4326	0.281	4336
B075-B181	B2B	0.625	4132	0.0	0.85	-29.57	81.48	-9.28	5.85	3.0	15.7	0.616	4126	0.616	4136
B082-B093	B2B	0.626	4001	0.0	0.00	-27.69	-85.00	5.42	12.97	7.1	37.9	0.626	4002	0.626	4003
B083-B094	B2B	0.002	1000	0.0	0.00	-0.38	0.00	0.00	0.18	7.1	37.9	0.002	1001	0.002	4001
B084-B095	B2B	0.002	1000	0.0	0.00	-0.38	0.00	0.00	0.18	7.1	37.9	0.002	1001	0.002	4001
B085-B096	B2B	0.626	4001	0.0	0.00	-27.69	-85.00	5.42	12.97	7.1	37.9	0.626	4002	0.626	4003
B086-B097	B2B	0.002	1000	0.0	0.00	-0.38	0.00	0.00	0.18	7.1	37.9	0.002	1001	0.002	4001
B087-B098	B2B	0.746	4001	0.0	0.00	-32.94	-101.34	6.46	15.43	7.1	37.9	0.746	4002	0.746	4003
B104-B070	B2B	0.662	4001	1.0	0.00	-29.27	-89.90	-5.73	-13.71	7.1	37.9	0.662	4002	0.662	4003
B105-B071	B2B	0.002	1000	1.0	0.00	-0.38	0.00	0.00	-0.18	7.1	37.9	0.002	1001	0.002	4001
B106-B072	B2B	0.002	1000	1.0	0.00	-0.38	0.00	0.00	-0.18	7.1	37.9	0.002	1001	0.002	4001
B107-B073	B2B	0.662	4001	1.0	0.00	-29.27	-89.90	-5.73	-13.71	7.1	37.9	0.662	4002	0.662	4003
B108-B074	B2B	0.002	1000	1.0	0.00	-0.38	0.00	0.00	-0.18	7.1	37.9	0.002	1001	0.002	4001
B109-B075	B2B	0.746	4001	1.0	0.00	-32.94	-101.34	-6.46	-15.43	7.1	37.9	0.746	4002	0.746	4003

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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B126-B082	B2B	0.561	4012	0.4	1.20	-32.76	-65.55	-6.74	-8.53	3.0	15.7	0.555	4006	0.555	4016
B138-B083	B2B	0.186	4112	0.4	-1.14	-18.46	-12.14	-2.19	-9.03	3.0	15.7	0.183	4106	0.183	4116
B149-B084	B2B	0.142	4311	0.4	-1.04	-16.61	6.17	0.71	-7.94	3.0	15.7	0.140	4313	0.140	4314
B160-B085	B2B	0.345	4011	0.4	1.89	-28.86	-28.96	-2.23	-7.72	3.0	15.7	0.340	4013	0.340	4014
B171-B086	B2B	0.264	4212	0.4	-0.97	-11.46	34.74	5.92	-6.83	3.0	15.7	0.259	4012	0.254	4206
B172-B087	B2B	0.526	4112	0.4	0.69	-30.20	62.15	5.08	-6.31	3.0	15.7	0.523	4106	0.523	4116
B176-B126	B2B	0.293	4212	1.0	1.30	-19.11	31.18	0.84	-4.14	7.1	37.9	0.285	4213	0.285	4214
B177-B138	B2B	0.158	4312	0.0	-1.25	14.16	11.42	-0.35	-4.14	7.1	37.9	0.154	4306	0.154	4316
B178-B149	B2B	0.120	4111	0.0	-0.86	9.53	10.22	-0.42	-2.42	7.1	37.9	0.119	4113	0.119	4114
B179-B160	B2B	0.190	4111	1.0	0.39	-18.65	13.58	0.36	-2.48	7.1	37.9	0.188	4113	0.188	4114
B180-B171	B2B	0.212	4332	0.0	-1.12	3.42	-33.85	1.34	0.61	7.1	37.9	0.208	4326	0.208	4336
B181-B172	B2B	0.427	4332	0.0	1.15	-23.59	-51.01	2.17	3.21	7.1	37.9	0.413	4326	0.413	4336
B013-B205	B2C	0.202	4332	1.0	11.23	-4.28	14.49	0.83	1.11	10.7	57.0	0.198	4326	0.198	4336
B027-B207	B2C	0.246	4332	1.0	19.26	-6.15	11.22	0.88	1.35	10.7	57.0	0.242	4326	0.242	4336
B028-B210	B2C	0.238	4332	0.0	22.85	-11.16	1.38	0.05	0.06	10.7	57.0	0.235	4326	0.235	4336
B029-B212	B2C	0.262	4332	0.0	24.00	-14.04	0.89	0.07	0.15	10.7	57.0	0.259	4326	0.259	4336
B041-B215	B2C	0.270	4332	0.0	24.54	-14.14	1.48	0.09	0.16	10.7	57.0	0.267	4326	0.267	4336
B042-B203	B2C	0.262	4332	0.0	23.78	-12.05	3.21	0.28	0.29	10.7	57.0	0.259	4326	0.259	4336
B043-B216	B2C	0.242	4332	0.0	20.72	-12.51	2.72	0.30	0.32	10.7	57.0	0.239	4326	0.239	4336
B066-B222	B2C	0.061	4312	1.8	0.00	-8.73	0.00	0.19	0.42	18.8	100.0	0.061	4306	0.061	4316
B067-B206	B2C	0.185	4332	0.0	16.25	-8.57	2.75	0.56	0.64	10.7	57.0	0.184	4326	0.184	4336
B079-B221	B2C	0.036	4232	1.2	0.00	5.40	0.00	0.05	0.11	12.5	66.5	0.036	4226	0.036	4236

**BRIDGE PRELIMINARY REPORT FOR  
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Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B101-B202	B2C	0.590	4212	0.0	7.53	17.01	63.23	3.26	3.87	10.7	57.0	0.587	4206	0.587	4216
B112-B218	B2C	0.161	4332	1.0	7.63	-2.82	-21.07	1.13	1.40	10.7	57.0	0.158	4326	0.158	4336
B113-B116	B2C	0.248	4212	1.0	23.36	10.66	2.83	0.29	0.31	10.7	57.0	0.245	4206	0.245	4216
B114-B189	B2C	0.200	4212	1.0	12.99	3.53	13.17	0.81	1.16	10.7	57.0	0.196	4206	0.196	4216
B115-B188	B2C	0.246	4212	1.0	20.17	5.71	10.75	0.84	1.30	10.7	57.0	0.242	4206	0.242	4216
B116-B194	B2C	0.236	4212	0.0	23.38	10.66	1.09	0.09	0.10	10.7	57.0	0.234	4206	0.234	4216
B117-B197	B2C	0.261	4212	0.0	24.06	14.16	0.55	0.17	0.25	10.7	57.0	0.258	4206	0.258	4216
B118-B191	B2C	0.260	4212	0.0	23.73	14.16	0.74	0.12	0.24	10.7	57.0	0.257	4206	0.257	4216
B119-B199	B2C	0.267	4212	0.0	24.25	11.90	3.53	0.31	0.34	10.7	57.0	0.264	4206	0.264	4216
B120-B184	B2C	0.244	4212	0.0	21.52	12.96	1.77	0.29	0.31	10.7	57.0	0.241	4206	0.241	4216
B121-B196	B2C	0.221	4212	0.0	19.87	9.47	3.57	0.55	0.62	10.7	57.0	0.219	4206	0.219	4216
B122-B185	B2C	0.151	4112	0.0	14.01	6.10	2.32	0.45	0.48	10.7	57.0	0.150	4106	0.150	4116
B123-B200	B2C	0.634	4332	0.0	9.97	-16.06	68.32	3.34	3.92	10.7	57.0	0.630	4326	0.630	4336
B124-B192	B2C	0.431	4132	0.0	17.02	-9.00	38.14	2.35	3.02	10.7	57.0	0.430	4126	0.430	4136
B126-B113	B2C	0.455	4112	0.0	21.55	-8.46	37.72	2.39	3.05	10.7	57.0	0.455	4106	0.455	4116
B138-B195	B2C	0.272	4112	0.0	22.38	-8.09	9.96	1.54	2.77	10.7	57.0	0.270	4106	0.270	4116
B149-B193	B2C	0.236	4212	1.0	23.74	11.15	-0.73	0.60	1.05	10.7	57.0	0.234	4206	0.234	4216
B160-B190	B2C	0.290	4112	0.0	22.95	-7.76	12.52	1.50	2.62	10.7	57.0	0.286	4106	0.286	4116
B171-B187	B2C	0.240	4212	1.0	21.58	8.31	5.80	1.04	1.42	10.7	57.0	0.238	4206	0.238	4216
B172-B186	B2C	0.284	4032	0.0	15.40	-6.27	-36.06	2.21	2.79	10.7	57.0	0.279	4026	0.279	4036
B173-B198	B2C	0.391	4332	0.0	12.46	-13.29	-44.85	2.47	3.12	10.7	57.0	0.387	4326	0.387	4336
B174-B223	B2C	0.500	4112	0.0	0.01	-13.15	-61.26	3.34	4.01	10.7	57.0	0.499	4106	0.499	4116



**BRIDGE PRELIMINARY REPORT FOR  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B175-B201	B2C	0.409	4112	0.0	15.73	7.76	37.36	2.31	2.97	10.7	57.0	0.408	4106	0.408	4116
B176-B208	B2C	0.466	4132	0.0	20.75	8.62	39.92	2.44	3.11	10.7	57.0	0.465	4126	0.465	4136
B177-B211	B2C	0.286	4132	0.0	22.07	7.22	13.30	1.58	2.72	10.7	57.0	0.284	4126	0.284	4136
B178-B204	B2C	0.242	4332	1.0	24.56	-10.58	0.94	0.58	1.11	10.7	57.0	0.239	4326	0.239	4336
B179-B214	B2C	0.269	4132	0.0	22.11	6.69	11.19	1.47	2.56	10.7	57.0	0.264	4126	0.264	4136
B180-B209	B2C	0.229	4332	1.0	20.78	-7.69	5.57	1.06	1.44	10.7	57.0	0.227	4326	0.227	4336
B181-B217	B2C	0.290	4012	0.0	11.98	5.92	-37.23	2.16	2.74	10.7	57.0	0.287	4006	0.287	4016
B184-B172	B2C	0.395	4032	1.0	16.09	-6.28	36.41	2.32	2.99	10.7	57.0	0.392	4026	0.392	4036
B185-B174	B2C	0.622	4332	1.0	12.61	-12.48	67.52	3.15	3.67	10.7	57.0	0.621	4132	0.619	4326
B186-B121	B2C	0.249	4212	0.0	19.91	6.38	10.79	0.75	1.12	10.7	57.0	0.246	4206	0.246	4216
B187-B120	B2C	0.255	4212	0.0	21.55	8.31	8.09	0.79	1.29	10.7	57.0	0.251	4206	0.251	4216
B188-B126	B2C	0.334	4132	1.0	16.99	-8.68	-41.01	2.43	3.07	10.7	57.0	0.330	4126	0.330	4136
B189-B124	B2C	0.364	4332	1.0	9.82	-8.71	-45.47	2.34	2.88	10.7	57.0	0.360	4326	0.360	4336
B190-B119	B2C	0.250	4212	1.0	24.28	11.90	1.06	0.09	0.11	10.7	57.0	0.248	4206	0.248	4216
B191-B160	B2C	0.223	4112	1.0	22.29	-7.72	-11.00	1.53	2.75	10.7	57.0	0.220	4106	0.220	4116
B192-B115	B2C	0.222	4212	1.0	20.14	10.25	2.62	0.41	0.44	10.7	57.0	0.219	4206	0.219	4216
B193-B118	B2C	0.255	4212	1.0	23.73	14.16	0.08	0.10	0.22	10.7	57.0	0.253	4206	0.253	4216
B194-B138	B2C	0.220	4212	1.0	23.39	-8.29	-3.94	1.28	2.50	10.7	57.0	0.219	4206	0.219	4216
B195-B117	B2C	0.267	4212	1.0	24.05	14.16	1.57	0.22	0.28	10.7	57.0	0.265	4206	0.265	4216
B196-B173	B2C	0.479	4332	1.0	15.03	-13.26	42.94	2.52	3.27	10.7	57.0	0.476	4326	0.476	4336
B197-B149	B2C	0.256	4212	0.0	24.07	11.16	2.91	0.52	1.03	10.7	57.0	0.253	4206	0.253	4216
B198-B122	B2C	0.183	4212	0.0	12.98	1.14	13.09	0.88	1.31	10.7	57.0	0.181	4206	0.181	4216

**BRIDGE PRELIMINARY REPORT FOR  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B199-B171	B2C	0.308	4132	1.0	21.00	-6.47	18.43	1.70	2.63	10.7	57.0	0.308	4126	0.308	4136
B200-B114	B2C	0.158	4212	1.0	12.94	6.72	3.91	0.69	0.76	10.7	57.0	0.157	4206	0.157	4216
B201-B027	B2C	0.222	4332	1.0	19.21	-11.04	2.71	0.42	0.44	10.7	57.0	0.218	4326	0.218	4336
B202-B013	B2C	0.148	4332	1.0	11.17	-6.74	4.12	0.79	0.88	10.7	57.0	0.146	4326	0.146	4336
B203-B180	B2C	0.307	4232	1.0	17.14	7.43	21.13	1.80	2.73	10.7	57.0	0.307	4226	0.307	4236
B204-B041	B2C	0.264	4332	1.0	24.55	-14.14	0.63	0.09	0.15	10.7	57.0	0.262	4326	0.262	4336
B205-B175	B2C	0.338	4212	1.0	7.41	7.53	-42.74	2.25	2.78	10.7	57.0	0.333	4206	0.333	4216
B206-B236	B2C	0.462	4212	1.0	11.60	13.07	44.14	2.57	3.31	10.7	57.0	0.460	4206	0.460	4216
B207-B176	B2C	0.331	4112	1.0	15.71	8.95	-40.28	2.44	3.10	10.7	57.0	0.327	4106	0.327	4116
B208-B028	B2C	0.244	4332	1.0	22.84	-11.16	2.29	0.26	0.28	10.7	57.0	0.241	4326	0.241	4336
B209-B043	B2C	0.245	4332	0.0	20.75	-7.69	8.07	0.78	1.30	10.7	57.0	0.242	4326	0.242	4336
B210-B177	B2C	0.216	4332	1.0	22.86	7.38	-6.87	1.32	2.49	10.7	57.0	0.214	4326	0.214	4336
B211-B029	B2C	0.262	4332	1.0	24.00	-14.04	0.93	0.13	0.19	10.7	57.0	0.259	4326	0.259	4336
B212-B178	B2C	0.238	4332	0.0	24.00	-10.53	0.82	0.55	1.09	10.7	57.0	0.235	4326	0.235	4336
B213-B112	B2C	0.151	4332	0.0	7.68	-0.70	14.04	1.04	1.52	10.7	57.0	0.149	4326	0.149	4336
B214-B042	B2C	0.245	4332	1.0	23.81	-12.05	0.58	0.05	0.06	10.7	57.0	0.243	4326	0.243	4336
B215-B179	B2C	0.234	4132	0.0	23.03	-8.56	3.29	0.97	1.49	10.7	57.0	0.233	4332	0.232	4136
B216-B181	B2C	0.388	4012	1.0	14.77	5.96	37.03	2.27	2.94	10.7	57.0	0.388	4006	0.388	4016
B217-B067	B2C	0.222	4332	0.0	16.30	-5.89	10.81	0.77	1.09	10.7	57.0	0.218	4326	0.218	4336
B218-B237	B2C	0.558	4212	1.0	7.32	11.55	64.16	3.14	3.65	10.7	57.0	0.553	4206	0.553	4216
B219-B123	B2C	0.507	4132	1.0	-0.00	-15.77	-59.64	3.15	3.72	10.7	57.0	0.507	4126	0.507	4136
B220-B101	B2C	0.517	4132	1.0	0.00	17.07	-59.92	3.29	3.95	10.7	57.0	0.516	4126	0.516	4136

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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B221-B219	B2C	0.100	4132	1.0	-0.00	-0.53	14.33	0.99	1.49	10.7	57.0	0.100	4126	0.100	4136
B222-B220	B2C	0.099	4132	1.0	0.00	-0.52	14.20	1.12	1.79	10.7	57.0	0.099	4126	0.099	4136
B223-B225	B2C	0.131	4132	0.0	0.00	4.98	14.47	1.16	1.83	10.7	57.0	0.130	4126	0.130	4136
B224-B226	B2C	0.133	4132	0.0	-0.00	-5.06	14.75	1.03	1.55	10.7	57.0	0.133	4126	0.133	4136
B225-B240	B2C	0.114	4332	0.0	0.00	13.53	0.00	0.20	0.46	22.7	120.7	0.114	4326	0.114	4336
B226-B241	B2C	0.076	4332	0.0	0.00	-11.26	0.00	0.07	0.17	18.2	96.6	0.076	4326	0.076	4336
B236-B213	B2C	0.380	4212	0.0	7.22	13.12	-43.38	2.44	3.11	10.7	57.0	0.376	4206	0.376	4216
B237-B224	B2C	0.480	4112	0.0	-0.01	11.07	-60.35	3.22	3.80	10.7	57.0	0.479	4106	0.479	4116
B013-B114	B2D	0.269	4332	0.0	-0.34	-12.84	26.59	-1.03	-0.07	52.0	102.2	0.265	4333	0.265	4334
B027-B115	B2D	0.198	4332	0.0	-0.11	-9.42	19.79	-0.77	-0.04	52.0	102.2	0.195	4333	0.195	4334
B028-B116	B2D	0.090	4211	0.0	-0.25	3.81	-9.10	0.35	0.15	52.0	102.2	0.089	4213	0.089	4214
B029-B117	B2D	0.060	4211	0.0	-0.02	2.69	-6.13	0.23	0.13	52.0	102.2	0.059	4213	0.059	4214
B041-B118	B2D	0.043	4332	0.0	0.01	1.90	-4.54	0.16	0.13	52.0	102.2	0.043	4333	0.043	4334
B042-B119	B2D	0.136	4332	0.0	-0.32	6.10	-13.52	0.50	0.17	52.0	102.2	0.134	4333	0.134	4334
B043-B120	B2D	0.169	4332	0.0	-0.09	7.91	-17.15	0.63	0.19	52.0	102.2	0.167	4333	0.167	4334
B067-B121	B2D	0.253	4332	0.0	-0.13	11.80	-25.65	0.96	0.24	52.0	102.2	0.249	4333	0.249	4334
B112-B122	B2D	0.281	4332	0.0	-0.30	13.43	-27.87	1.04	0.25	52.0	102.2	0.272	4333	0.272	4334
B201-B192	B2D	0.199	4332	1.0	1.93	9.03	-18.63	-0.65	-0.19	52.0	102.2	0.195	4333	0.195	4334
B202-B200	B2D	0.271	4332	1.0	3.28	12.42	-24.60	-0.85	-0.20	52.0	102.2	0.262	4333	0.262	4334
B203-B199	B2D	0.126	4332	1.0	1.14	-5.92	11.73	0.46	0.00	52.0	102.2	0.124	4333	0.124	4334
B204-B193	B2D	0.039	4211	1.0	0.20	1.86	-3.75	-0.13	-0.12	52.0	102.2	0.039	4213	0.039	4214
B205-B189	B2D	0.259	4332	1.0	-1.83	11.56	-23.82	-0.86	-0.21	52.0	102.2	0.253	4333	0.253	4334

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B206-B196	B2D	0.223	4332	1.0	1.93	-10.32	20.99	0.78	0.03	52.0	102.2	0.217	4333	0.217	4334
B207-B188	B2D	0.200	4332	1.0	-1.47	8.59	-18.64	-0.66	-0.19	52.0	102.2	0.196	4333	0.196	4334
B208-B113	B2D	0.111	4212	0.0	1.58	4.78	-10.14	0.33	0.14	52.0	102.2	0.109	4213	0.109	4214
B209-B187	B2D	0.152	4332	1.0	-1.05	-6.92	13.87	0.54	0.00	52.0	102.2	0.148	4333	0.148	4334
B210-B194	B2D	0.083	4212	0.0	-0.41	3.91	-7.77	0.28	0.13	52.0	102.2	0.081	4213	0.081	4214
B211-B195	B2D	0.062	4212	0.0	0.48	2.98	-5.80	0.21	0.12	52.0	102.2	0.061	4213	0.061	4214
B212-B197	B2D	0.045	4212	0.0	-0.22	1.94	-4.39	0.15	0.13	52.0	102.2	0.045	4213	0.045	4214
B213-B198	B2D	0.259	4332	1.0	-1.84	-11.71	23.64	0.89	0.04	52.0	102.2	0.248	4326	0.248	4336
B214-B190	B2D	0.114	4332	0.0	0.22	5.05	-11.67	0.44	0.15	52.0	102.2	0.114	4333	0.114	4334
B215-B191	B2D	0.056	4331	0.0	-0.21	2.33	-5.70	0.20	0.12	52.0	102.2	0.056	4333	0.056	4334
B216-B184	B2D	0.171	4332	1.0	1.46	-8.38	15.62	0.60	0.01	52.0	102.2	0.166	4333	0.166	4334
B217-B186	B2D	0.240	4332	1.0	-1.37	-11.37	22.07	0.86	0.04	52.0	102.2	0.234	4333	0.234	4334
B218-B185	B2D	0.244	4332	1.0	3.14	-10.76	22.34	0.78	0.04	52.0	102.2	0.234	4326	0.234	4336
B220-B219	B2D	0.103	4212	0.0	-3.08	4.06	-6.05	0.13	0.10	52.0	102.2	0.102	4332	0.101	4216
B222-B221	B2D	0.032	4212	1.0	0.50	-1.82	2.45	0.00	-0.13	52.0	102.2	0.031	4206	0.031	4216
B224-B223	B2D	0.088	4212	0.0	-3.20	-3.27	4.44	0.00	0.12	52.0	102.2	0.087	4206	0.087	4216
B226-B225	B2D	0.040	4212	1.0	0.53	2.29	-3.08	-0.08	-0.10	52.0	102.2	0.039	4206	0.039	4216
0086-B066	B2E	0.513	4331	0.0	10.58	-61.66	11.77	-0.75	22.21	2.9	12.5	0.508	4333	0.508	4334
0140-B241	B2E	0.539	4332	0.0	1.25	-68.77	-20.40	0.82	22.29	2.7	11.7	0.535	4333	0.535	4334
B066-B079	B2E	0.476	4331	1.2	10.58	52.60	-15.40	-0.73	20.74	7.0	30.1	0.473	4333	0.473	4334
B068-B101	B2E	0.785	4212	0.0	2.38	65.36	-68.78	12.96	-18.75	2.5	10.7	0.743	4206	0.743	4216
B069-B175	B2E	0.352	4332	0.4	-0.63	3.49	60.71	9.82	2.76	2.5	10.7	0.350	4326	0.350	4336

**BRIDGE PRELIMINARY REPORT FOR  
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SACS (2025)

Company: Engineers India Limited  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B076-B236	B2E	0.393	4332	0.4	-1.05	-2.29	-68.84	-9.90	6.72	2.5	10.7	0.383	4326	0.383	4336
B077-B237	B2E	0.416	4132	0.4	-1.36	1.55	-73.40	-12.70	9.16	2.5	10.7	0.414	4126	0.414	4136
B079-0138	B2E	0.713	4331	0.5	10.58	83.93	-23.59	-0.75	19.78	2.9	12.5	0.708	4333	0.708	4334
B080-B091	B2E	0.002	1000	0.0	0.00	-0.32	0.00	0.00	0.20	6.1	25.9	0.002	1001	0.002	4001
B081-B092	B2E	0.002	1000	0.0	0.00	-0.32	0.00	0.00	0.20	6.1	25.9	0.002	1001	0.002	4001
B088-B099	B2E	0.002	1000	0.0	0.00	-0.32	0.00	0.00	0.20	6.1	25.9	0.002	1001	0.002	4001
B089-B100	B2E	0.002	1000	0.0	0.00	-0.32	0.00	0.00	0.20	6.1	25.9	0.002	1001	0.002	4001
B101-B123	B2E	0.624	4212	1.0	2.35	-34.79	73.59	1.91	-22.84	6.1	25.9	0.596	4206	0.596	4216
B102-B068	B2E	0.002	1000	1.0	0.00	-0.32	0.00	0.00	-0.20	6.1	25.9	0.002	1001	0.002	4001
B103-B069	B2E	0.002	1000	1.0	0.00	-0.32	0.00	0.00	-0.20	6.1	25.9	0.002	1001	0.002	4001
B110-B076	B2E	0.002	1000	1.0	0.00	-0.32	0.00	0.00	-0.20	6.1	25.9	0.002	1001	0.002	4001
B111-B077	B2E	0.002	1000	1.0	0.00	-0.32	0.00	0.00	-0.20	6.1	25.9	0.002	1001	0.002	4001
B124-B081	B2E	0.323	4212	0.0	-0.31	-2.89	56.44	-9.03	-7.11	2.5	10.7	0.315	4206	0.315	4216
B173-B088	B2E	0.315	4212	0.0	0.53	-1.46	-56.15	8.86	-6.30	2.5	10.7	0.304	4206	0.304	4216
B175-B124	B2E	0.305	4332	0.0	-0.64	3.50	51.95	-1.76	-0.27	6.1	25.9	0.302	4326	0.302	4336
B236-B173	B2E	0.346	4332	0.0	-1.06	-2.30	-60.26	2.50	3.23	6.1	25.9	0.335	4326	0.335	4336
B237-B174	B2E	0.550	4332	1.0	-2.67	42.23	-50.71	0.10	12.77	6.1	25.9	0.539	4212	0.532	4326
B240-0139	B2E	0.502	4332	0.5	1.25	66.55	16.19	0.82	19.18	2.7	11.7	0.498	4333	0.498	4334
B241-B240	B2E	0.294	4332	0.0	1.25	-35.94	-12.11	0.82	20.92	6.6	28.1	0.292	4333	0.292	4334
B022-B036	B30	0.116	4001	0.0	0.00	-20.74	-5.68	3.22	0.00	17.7	17.7	0.116	4002	0.116	4003
B060-B008	B31	0.388	4212	0.0	42.93	8.65	16.42	0.98	0.70	47.8	47.8	0.382	4206	0.382	4216
B007-B060	B32	0.182	4332	2.7	18.42	-3.09	10.41	0.65	-0.71	47.6	47.6	0.177	4326	0.177	4336

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B049-B007	B33	0.107	4001	1.0	0.00	-19.26	-5.16	3.00	0.00	17.6	17.6	0.107	4002	0.107	4003
B007-B021	B34	0.111	4212	0.0	-8.48	2.24	8.80	0.65	-0.17	32.6	32.6	0.111	4312	0.109	4216
B021-B035	B35	0.106	4001	0.0	0.00	-18.99	-5.21	2.93	0.00	17.8	17.8	0.106	4002	0.106	4003
B059-B007	B36	0.253	4212	2.7	24.92	-1.07	-15.82	0.89	0.54	48.1	48.1	0.250	4206	0.250	4216
B006-B059	B37	0.111	4132	2.7	9.61	2.33	8.32	0.48	-1.26	47.8	47.8	0.110	4126	0.110	4136
B048-B006	B38	0.111	4001	1.0	0.00	-20.01	-5.35	3.12	0.00	17.6	17.6	0.111	4002	0.111	4003
B006-B020	B39	0.140	4332	0.0	-9.49	11.56	5.99	0.89	1.61	32.6	32.6	0.139	4326	0.139	4336
0088-0104	B3B	0.324	4332	0.0	-7.91	-5.17	-34.17	0.93	0.86	25.4	40.1	0.324	4333	0.324	4334
0104-B127	B3B	0.223	4331	2.0	-7.29	-12.17	12.80	0.41	-1.51	25.4	40.1	0.218	4333	0.218	4334
B125-0088	B3B	0.002	1000	0.7	0.00	-0.24	0.00	0.00	-0.08	4.4	7.0	0.002	1001	0.002	4001
0099-B227	B3C	0.447	4331	0.0	-43.20	-8.78	14.52	-0.12	1.11	25.3	20.0	0.441	4333	0.441	4334
B127-0099	B3S	0.521	4331	0.0	-43.20	-19.82	14.55	-0.00	1.65	25.4	20.1	0.513	4333	0.513	4334
B020-B034	B40	0.139	4001	0.0	0.00	-25.00	-6.83	3.94	0.00	17.5	17.5	0.139	4002	0.139	4003
B058-B006	B41	0.291	4332	2.7	30.31	10.73	-12.13	0.77	0.54	47.7	47.7	0.290	4326	0.290	4336
B005-B058	B42	0.139	4212	0.0	13.97	0.57	-8.44	0.44	-0.64	48.3	48.3	0.137	4206	0.137	4216
B047-B005	B43	0.092	4001	1.0	0.00	-16.46	-4.34	2.50	0.00	17.8	17.8	0.092	4002	0.092	4003
B005-B019	B44	0.147	4312	0.0	-8.83	8.25	12.80	1.11	0.50	32.6	32.6	0.146	4332	0.146	4316
B019-B033	B45	0.120	4001	0.0	0.00	-21.49	-5.86	3.34	0.00	17.7	17.7	0.120	4002	0.120	4003
B057-B005	B46	0.254	4332	0.0	25.89	3.66	14.44	0.82	0.37	48.2	48.2	0.249	4326	0.249	4336
B004-B057	B47	0.204	4212	0.0	18.45	-5.24	-13.95	0.81	-0.61	48.1	48.1	0.199	4213	0.199	4214
B046-B004	B48	0.092	4001	1.0	0.00	-16.48	-4.34	2.50	0.00	17.8	17.8	0.092	4002	0.092	4003
B004-B018	B49	0.134	4332	1.8	-8.69	-1.91	-12.90	0.97	0.94	32.4	32.4	0.131	4326	0.131	4336

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B018-B032	B50	0.124	4001	0.0	0.00	-22.24	-6.12	3.49	0.00	17.6	17.6	0.124	4002	0.124	4003
B056-B004	B51	0.376	4332	0.0	46.25	-3.07	11.81	0.74	0.72	47.3	47.3	0.366	4326	0.366	4336
B003-B056	B52	0.331	4212	2.7	38.65	-5.04	12.18	0.83	0.06	47.7	47.7	0.325	4213	0.325	4214
B045-B003	B53	0.090	4001	1.0	0.00	-16.18	-4.26	2.46	0.00	17.8	17.8	0.090	4002	0.090	4003
B003-B017	B54	0.168	4312	0.0	-1.05	25.86	14.71	2.37	0.35	32.1	32.1	0.164	4306	0.164	4316
B017-B031	B55	0.133	4001	0.0	0.00	-23.75	-6.58	3.76	0.00	17.6	17.6	0.133	4002	0.133	4003
B055-B003	B56	0.470	4332	0.0	60.13	-5.82	10.82	0.79	-0.24	47.2	47.2	0.455	4333	0.455	4334
B002-B055	B57	0.491	4212	0.0	55.56	12.81	-17.67	1.11	0.29	47.5	47.5	0.485	4213	0.485	4214
B044-B002	B58	0.165	4001	1.0	0.00	-29.49	-8.26	4.64	0.00	17.6	17.6	0.165	4002	0.165	4003
B002-B016	B59	0.361	4211	1.8	1.94	-51.85	38.68	7.33	-0.77	24.4	24.4	0.357	4213	0.357	4214
B001-B000	B5A	0.002	1000	0.7	0.00	-0.24	0.00	0.00	-0.08	4.4	7.0	0.002	1001	0.002	4001
0134-B002	B5B	0.429	4212	0.0	23.54	-5.80	34.52	-2.08	-0.11	25.4	15.7	0.411	4206	0.411	4216
B000-0134	B5B	0.421	4212	2.4	28.07	-6.26	28.28	0.79	-0.36	25.4	24.5	0.402	4206	0.402	4216
0070-B292	B5C	0.398	4332	0.0	32.56	17.14	9.56	-0.43	-1.50	24.5	39.5	0.394	4326	0.394	4336
0071-0072	B5D	0.546	4332	1.5	62.34	9.15	9.70	0.33	0.45	25.4	40.1	0.538	4326	0.538	4336
0072-B286	B5D	0.655	4332	0.0	64.43	22.99	10.05	0.13	-0.20	25.4	40.1	0.646	4326	0.646	4336
B003-0071	B5D	0.552	4332	1.2	64.43	15.39	2.27	0.50	1.31	25.4	40.1	0.544	4326	0.544	4336
B286-B004	B5D	0.650	4332	0.0	64.56	22.37	9.72	-1.08	-2.34	25.4	40.1	0.640	4326	0.640	4336
B004-B005	B5E	0.568	4332	0.0	68.47	13.93	2.14	-0.04	-0.10	25.4	40.1	0.558	4326	0.558	4336
0081-0082	B5F	0.674	4332	0.0	78.05	12.94	9.32	-0.38	-0.11	25.4	40.1	0.666	4326	0.666	4336
0082-B006	B5F	0.749	4332	0.0	80.88	29.45	1.14	-0.52	-1.01	25.4	40.1	0.738	4326	0.738	4336
0083-0084	B5G	0.641	4332	0.0	80.86	8.25	6.27	-0.21	-0.48	25.4	40.2	0.633	4326	0.633	4336

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
0084-B007	B5G	0.681	4332	0.0	83.36	16.78	1.18	-0.40	-1.32	25.4	40.2	0.673	4326	0.673	4336
B006-B274	B5G	0.762	4332	0.8	83.16	19.32	10.98	1.27	-0.66	25.4	40.2	0.752	4326	0.752	4336
B274-0083	B5G	0.772	4332	1.4	83.36	24.81	6.66	-0.05	0.16	25.4	40.2	0.762	4326	0.762	4336
B007-B268	B5H	0.710	4332	0.5	75.64	21.87	8.07	1.19	1.61	25.4	40.1	0.702	4326	0.702	4336
B268-B008	B5H	0.710	4332	0.0	75.70	22.59	7.34	-0.15	-0.44	25.4	40.1	0.703	4326	0.703	4336
B008-B262	B5J	0.797	4332	2.5	74.73	31.46	12.38	0.36	1.15	25.4	40.1	0.792	4326	0.792	4336
B255-B009	B5J	0.588	4332	0.0	72.70	12.07	2.69	-1.29	-1.70	25.4	40.1	0.583	4326	0.583	4336
B259-B252	B5K	0.468	4112	0.0	48.44	18.08	-3.14	0.70	-1.34	25.4	40.1	0.467	4106	0.467	4116
B244-B011	B5L	0.459	4212	0.0	46.63	10.89	-10.83	0.42	-0.10	25.1	41.0	0.451	4206	0.451	4216
0136-B012	B5M	0.450	4212	0.0	43.42	4.17	19.33	-0.74	0.04	8.7	13.8	0.427	4206	0.427	4216
B011-0136	B5M	0.463	4212	2.1	40.58	4.21	24.17	1.02	-0.09	13.6	21.5	0.440	4206	0.440	4216
B012-B054	B5N	0.002	1000	0.0	0.00	-0.30	0.00	0.00	0.08	4.9	7.8	0.002	1001	0.002	4001
B010-B244	B5O	0.425	4212	0.0	42.57	-13.11	-7.54	-0.10	1.86	25.4	40.4	0.420	4206	0.420	4216
B245-B010	B5P	0.528	4332	0.5	42.03	-23.48	-13.11	-1.41	-2.79	25.4	40.1	0.524	4326	0.524	4336
B252-B245	B5Q	0.407	4132	1.4	47.71	-9.52	-3.29	-0.67	-0.88	25.4	40.1	0.403	4126	0.403	4136
B009-B259	B5R	0.444	4112	0.0	46.25	8.25	-11.57	0.63	-0.52	25.4	40.1	0.442	4106	0.442	4116
B292-B003	B5S	0.249	4332	0.1	30.10	1.23	-5.68	-1.52	-0.45	25.4	40.1	0.248	4326	0.248	4336
B002-0069	B5T	0.332	4332	0.0	29.89	-13.68	-5.78	0.58	2.28	25.4	40.1	0.331	4326	0.331	4336
0069-0070	B5U	0.315	4332	1.5	30.80	7.45	8.62	0.05	0.33	25.2	42.0	0.311	4326	0.311	4336
B016-B030	B60	0.193	4001	0.0	0.00	-34.50	-9.74	5.47	0.00	17.6	17.6	0.193	4002	0.193	4003
B064-B002	B61	0.550	4211	0.0	-53.98	-20.89	-17.43	1.76	-0.40	42.4	42.4	0.540	4213	0.540	4214
0135-B064	B62	0.191	4212	1.1	19.53	-7.81	7.87	0.62	-3.13	53.0	19.0	0.187	4206	0.187	4216



**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B000-0135	B62	0.229	4212	2.0	13.64	-11.67	22.67	1.73	0.53	53.0	34.1	0.220	4206	0.220	4216
B044-0012	B7A	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B045-0013	B7B	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B046-0014	B7C	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B047-0015	B7D	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B048-0016	B7E	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B049-0017	B7F	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B050-0018	B7G	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B051-0019	B7H	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B052-0020	B7J	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B053-0021	B7K	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B030-0002	B8A	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B031-0003	B8B	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B032-0004	B8C	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B033-0005	B8D	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B034-0006	B8E	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B035-0007	B8F	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B036-0008	B8G	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B037-0009	B8H	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B038-0010	B8J	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B039-0011	B8K	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B019-B083	BBO	0.333	4212	0.6	-19.42	34.09	-14.70	9.12	2.45	10.6	10.6	0.327	4206	0.327	4216

**BRIDGE PRELIMINARY REPORT FOR  
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IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

**GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80**

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B083-B142	BBO	0.385	4212	0.0	-15.46	35.44	-34.11	2.73	-0.03	46.4	46.4	0.378	4213	0.378	4214
0131-B026	BNA	0.467	4211	2.7	-38.78	5.28	17.27	0.39	0.06	19.6	59.5	0.454	4213	0.454	4214
B148-0131	BNA	0.452	4211	0.0	-38.02	-9.45	-12.36	0.49	0.64	19.6	59.5	0.443	4213	0.443	4214
B025-B089	BNB	0.433	4132	0.0	-4.05	-5.56	-54.67	4.59	0.78	7.2	12.2	0.432	4332	0.426	4136
B089-B148	BNB	0.663	4332	0.0	-7.19	-61.69	28.63	-0.75	3.69	27.1	45.7	0.633	4333	0.633	4334
0126-B025	BNC	0.464	4211	0.0	-33.86	6.09	-10.40	0.33	-0.07	26.9	90.6	0.460	4213	0.460	4214
B147-0126	BNC	0.549	4211	0.0	-35.75	-9.48	-15.89	0.31	0.48	26.9	90.6	0.535	4213	0.535	4214
B024-B088	BND	0.470	4212	0.0	-29.28	-15.07	-48.58	9.11	-7.03	12.4	12.4	0.464	4206	0.464	4216
B088-B147	BND	0.444	4212	0.0	-24.38	38.50	35.09	2.85	2.62	46.4	46.4	0.428	4213	0.428	4214
B023-B147	BNE	0.441	4212	0.0	56.49	-3.69	10.78	0.60	-0.38	70.2	70.2	0.441	4213	0.441	4214
B087-B146	BNF	0.381	4112	0.0	-6.52	6.83	61.08	3.35	-1.97	45.3	45.3	0.373	4106	0.373	4116
B145-B023	BNG	0.380	4011	5.2	-39.14	3.13	5.16	0.31	0.46	70.1	70.1	0.373	4013	0.373	4014
B022-B086	BNH	0.161	4212	0.0	-2.51	19.47	-18.17	5.25	-3.62	12.3	12.3	0.154	4206	0.154	4216
B086-B145	BNH	0.207	2011	0.0	3.56	-12.97	44.92	2.64	0.91	44.3	44.3	0.205	2013	0.205	2014
B021-B145	BNJ	0.175	4012	0.0	17.70	-2.29	10.25	0.54	-1.36	70.0	70.0	0.174	4013	0.174	4014
B021-B085	BNK	0.403	4112	0.0	-16.65	-52.69	-10.41	9.74	10.56	10.6	10.6	0.396	4106	0.396	4116
B085-B144	BNK	0.236	2012	2.6	-8.16	-44.97	-11.63	2.67	-0.09	46.4	46.4	0.233	2013	0.233	2014
B143-B021	BNL	0.188	4112	0.0	17.46	4.57	-12.36	0.52	0.27	69.7	69.7	0.182	4106	0.182	4116
B020-B084	BNM	0.258	4311	0.7	15.90	-24.89	-12.98	4.87	0.53	12.2	12.2	0.257	4313	0.257	4314
B084-B143	BNM	0.348	4311	0.0	20.98	13.01	36.33	2.36	0.74	44.1	44.1	0.345	4313	0.345	4314
B019-B143	BNN	0.684	4311	0.0	-65.47	7.35	14.88	0.46	-0.36	69.1	69.1	0.684	4313	0.684	4314
B141-B019	BNP	0.651	4112	0.0	83.74	8.63	-13.90	0.48	0.16	69.5	69.5	0.644	4312	0.642	4114

**BRIDGE PRELIMINARY REPORT FOR  
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SACS (2025)

Company: Engineers India Limited  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B018-B082	BNQ	0.261	4331	0.7	3.15	38.48	-22.62	6.53	6.13	12.2	12.2	0.260	4333	0.260	4334
B082-B141	BNQ	0.404	4312	2.5	14.88	35.74	43.75	3.32	-0.61	44.1	44.1	0.403	4313	0.403	4314
B017-B081	BNS	0.426	4212	0.7	-23.14	-23.66	-44.47	10.37	8.66	12.3	12.3	0.417	4206	0.417	4216
B081-B140	BNS	0.510	4212	0.0	-17.23	53.97	-44.47	3.84	-2.24	46.2	46.2	0.497	4213	0.497	4214
B139-B017	BNT	0.605	4212	5.2	66.67	-10.59	12.72	0.17	-0.44	53.7	90.6	0.599	4213	0.599	4214
B016-B080	BNV	0.464	4212	0.7	-15.24	-20.91	-32.45	-3.71	-1.61	7.2	12.2	0.450	4206	0.450	4216
B080-B139	BNV	0.749	4212	0.0	-8.44	69.21	-32.45	0.91	-3.28	27.1	45.7	0.723	4213	0.723	4214
0108-B139	BNV	0.453	4211	2.2	-34.95	-21.78	-8.58	-0.70	-1.47	16.0	48.4	0.447	4213	0.447	4214
B014-0108	BNV	0.368	4212	0.0	-33.87	-5.34	11.57	-0.29	0.93	16.0	48.4	0.365	4213	0.365	4214
0130-B012	BSA	0.457	4331	2.4	-35.54	0.85	-27.08	-0.82	-0.32	18.2	51.0	0.453	4332	0.450	4333
B136-0130	BSA	0.587	4331	0.0	-34.78	-22.26	29.11	-1.05	1.56	18.2	51.0	0.583	4333	0.583	4334
B011-B077	BSB	0.648	4332	0.7	16.33	89.54	44.75	19.72	10.69	12.3	12.3	0.647	4333	0.647	4334
B077-B136	BSB	0.605	4332	0.0	30.71	-59.35	44.43	4.01	-2.93	46.0	46.0	0.603	4333	0.603	4334
0127-B011	BSC	0.660	4331	2.6	-45.82	11.35	-16.99	-0.48	0.37	26.9	85.0	0.648	4333	0.648	4334
B135-0127	BSC	0.665	4331	0.0	-48.10	-8.69	16.42	-0.48	0.36	26.9	85.0	0.656	4333	0.656	4334
B076-B135	BSD	0.703	4332	0.0	-48.27	-46.10	45.65	3.60	-2.01	45.9	45.9	0.679	4326	0.679	4336
B009-B135	BSE	0.554	4332	5.2	58.07	12.69	11.73	0.14	0.18	53.7	90.6	0.548	4333	0.548	4334
B009-B075	BSF	0.416	4132	0.0	-17.41	-1.90	-54.91	11.48	-2.22	12.2	12.2	0.411	4126	0.411	4136
B075-B134	BSF	0.299	4112	0.0	-2.47	27.09	44.48	2.79	1.09	45.9	45.9	0.291	4106	0.291	4116
B133-B009	BSG	0.618	4332	5.2	-43.29	17.41	-6.88	-0.06	0.17	53.7	90.6	0.616	4333	0.616	4334
B008-B074	BSH	0.296	4232	0.7	23.18	20.03	16.84	4.04	5.83	12.2	12.2	0.295	4032	0.292	4233
B074-B133	BSH	0.336	4212	2.6	25.93	-24.68	-17.27	1.73	-0.60	45.9	45.9	0.336	4213	0.336	4214

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RY	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B007-B133	BSJ	0.412	4332	0.0	57.26	-0.36	5.01	0.43	0.26	69.4	69.4	0.409	4326	0.409	4336
B007-B073	BSK	0.392	4132	0.0	-12.23	-57.23	1.55	11.20	-9.21	10.5	10.5	0.385	4126	0.385	4136
B073-B132	BSK	0.266	2011	0.0	2.99	61.51	8.71	3.43	0.61	45.9	45.9	0.265	2013	0.265	2014
B131-B007	BSL	0.173	4012	0.0	-11.89	0.65	-12.76	0.57	-0.06	69.2	69.2	0.173	4013	0.173	4014
B006-B072	BSM	0.163	4231	0.7	14.67	11.94	-1.49	1.35	-1.19	12.2	12.2	0.163	4233	0.163	4234
B072-B131	BSM	0.273	2011	2.5	14.30	3.30	49.66	3.03	1.26	44.0	44.0	0.271	2013	0.271	2014
B005-B131	BSN	0.424	4211	0.0	-37.67	8.86	14.12	0.50	-1.05	69.3	69.3	0.415	4205	0.415	4215
B005-B071	BSO	0.186	4332	0.6	-9.25	21.75	6.50	4.81	-0.97	10.7	10.7	0.185	4132	0.181	4326
B071-B130	BSO	0.293	4312	2.6	-6.68	-39.37	21.33	2.50	1.64	46.8	46.8	0.290	4313	0.290	4314
B129-B005	BSP	0.440	4112	0.0	57.37	4.48	-9.04	0.34	0.62	69.8	69.8	0.439	4212	0.438	4114
B004-B070	BSQ	0.417	4211	0.7	23.46	-44.71	-18.17	9.86	-5.24	12.3	12.3	0.415	4213	0.415	4214
B070-B129	BSQ	0.493	4012	0.0	28.15	47.04	-31.33	3.01	-0.40	46.2	46.2	0.491	4013	0.491	4014
B003-B129	BSR	0.728	4211	0.0	-49.70	11.73	14.74	-0.18	-0.10	53.7	90.6	0.722	4213	0.722	4214
B003-B069	BSS	0.347	4332	0.0	-8.41	-16.03	51.37	10.22	-8.01	12.4	12.4	0.341	4326	0.341	4336
B069-B128	BSS	0.348	4212	0.0	0.42	54.51	-33.77	3.58	3.31	46.4	46.4	0.343	4213	0.343	4214
B127-B003	BST	0.468	4332	5.2	56.61	-5.44	-7.64	-0.08	-0.32	53.7	90.6	0.466	4212	0.466	4333
B002-B068	BSV	0.460	4332	0.0	-13.58	-17.00	37.44	-3.55	3.88	7.1	12.6	0.458	4212	0.447	4336
B068-B127	BSV	0.787	4212	0.0	-17.92	65.03	-31.23	0.79	-3.26	26.6	47.3	0.758	4213	0.758	4214
0121-B127	BSW	0.463	4331	2.6	-39.71	-6.94	14.90	0.86	-0.42	18.8	57.0	0.455	4333	0.455	4334
B000-0121	BSW	0.519	4331	0.0	-39.91	2.24	-27.44	0.48	0.29	18.8	57.0	0.505	4333	0.505	4334
0086-0088	NMA	0.509	4332	0.0	-24.14	-56.65	-30.66	6.58	-0.87	24.1	24.1	0.507	4333	0.507	4334
0088-0087	NMA	0.511	4331	2.1	-3.25	63.46	-64.83	11.65	-2.30	19.5	19.5	0.506	4333	0.506	4334

**BRIDGE PRELIMINARY REPORT FOR  
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SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
0138-0087	NMA	0.269	4212	2.6	-18.95	-24.70	2.35	2.36	0.70	24.1	24.1	0.263	4213	0.263	4214
B000-0086	NMA	0.273	4332	0.7	-28.44	-14.10	-5.57	2.86	-0.30	6.4	6.4	0.269	4333	0.269	4334
B014-0138	NMA	0.324	4212	0.7	-21.87	-22.72	-23.45	11.63	-0.53	6.4	6.4	0.319	4213	0.319	4214
0087-0108	NMB	0.178	4212	0.0	19.54	-1.55	-8.46	0.42	-2.95	20.3	20.3	0.173	4213	0.173	4214
0088-0121	NMB	0.218	4332	0.0	25.31	8.73	1.69	0.57	4.06	23.8	23.8	0.213	4326	0.213	4336
0108-B016	NMB	0.272	4212	2.2	21.29	-19.76	13.75	2.36	3.59	20.3	20.3	0.267	4206	0.267	4216
0121-B002	NMB	0.341	4212	2.6	22.10	-27.69	22.68	3.23	2.51	23.8	23.8	0.338	4206	0.338	4216
0126-B148	NMB	0.233	4212	0.0	23.32	13.93	2.42	1.06	1.22	23.8	23.8	0.229	4206	0.229	4216
0127-B136	NMB	0.368	4332	2.6	33.58	-15.12	21.64	2.57	-2.93	23.8	23.8	0.366	4333	0.366	4334
0129-0128	NMB	0.313	4332	0.0	-0.96	-55.48	-13.06	8.40	-2.04	18.2	18.2	0.311	4333	0.311	4334
0130-0129	NMB	0.256	4332	2.4	26.74	0.30	14.28	1.02	-3.29	22.2	22.2	0.251	4333	0.251	4334
0131-0128	NMB	0.205	4212	2.7	24.73	3.26	-6.43	0.52	2.05	24.9	24.9	0.202	4332	0.200	4326
0139-0128	NMB	0.300	4332	0.0	-10.21	-41.50	-8.35	4.65	1.69	24.1	24.1	0.295	4333	0.295	4334
0140-0129	NMB	0.400	4332	0.0	-23.70	-44.76	-2.62	4.94	1.83	24.1	24.1	0.395	4333	0.395	4334
B010-0127	NMB	0.391	4332	0.0	33.45	-22.76	-21.00	2.92	2.10	23.8	23.8	0.383	4333	0.383	4334
B011-0130	NMB	0.302	4332	0.0	28.53	3.37	-20.20	1.84	2.25	22.2	22.2	0.298	4333	0.298	4334
B012-0140	NMB	0.326	4332	0.0	-28.15	-12.22	22.38	4.08	0.79	6.4	6.4	0.323	4333	0.323	4334
B024-0126	NMB	0.305	4212	0.0	23.70	-25.16	9.90	2.64	-1.09	23.8	23.8	0.299	4206	0.299	4216
B025-0131	NMB	0.274	4332	0.0	22.56	-11.26	-19.76	2.02	1.90	24.9	24.9	0.269	4326	0.269	4336
B026-0139	NMB	0.238	4212	0.0	-21.11	5.83	16.63	3.97	-1.30	6.4	6.4	0.236	4213	0.236	4214
0133-0128	NMC	0.192	4332	0.0	18.62	-12.42	-1.37	0.88	0.21	52.3	52.3	0.191	4333	0.191	4334
0134-B064	NMC	0.385	4211	1.8	23.74	-25.41	33.28	3.14	-0.26	32.6	32.6	0.379	4213	0.379	4214

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
0135-0134	NMC	0.511	4332	1.5	49.45	-19.63	-26.75	3.02	-0.40	26.1	26.1	0.502	4333	0.502	4334
0136-0137	NMC	0.318	4332	0.0	32.86	-14.28	-11.04	1.00	-3.42	19.6	19.6	0.304	4333	0.304	4334
0136-B065	NMC	0.310	4332	0.0	-12.79	-31.84	-24.45	3.21	0.25	32.6	32.6	0.303	4333	0.303	4334
0137-B026	NMC	0.344	4332	1.7	33.48	19.68	10.21	1.46	2.26	30.7	30.7	0.332	4333	0.332	4334
B014-0135	NMC	0.506	4211	0.0	-49.92	-26.22	17.79	4.78	3.31	14.5	14.5	0.504	4213	0.504	4214
B148-0133	NMC	0.360	4332	2.7	-31.51	-21.03	8.87	1.41	-0.31	48.3	48.3	0.358	4333	0.358	4334
0048-0061	PBA	0.185	4032	0.0	6.26	-26.54	0.06	9.56	-0.04	13.5	13.5	0.184	4026	0.184	4036
0048-0069	PBA	0.245	4032	0.8	4.89	-0.19	39.37	12.53	-0.03	7.2	7.2	0.244	4026	0.244	4036
0061-0062	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
0061-0070	PBA	0.252	4132	0.8	4.83	0.27	-40.89	12.68	0.18	7.2	7.2	0.251	4126	0.251	4136
0063-0048	PBA	0.001	1000	0.4	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
0065-0066	PBA	0.158	4032	0.0	6.73	-20.98	1.09	3.74	0.23	13.5	13.5	0.157	4332	0.157	4036
0065-0071	PBA	0.283	4332	0.8	1.79	-3.78	50.17	13.50	-0.69	7.2	7.2	0.281	4032	0.280	4326
0066-0067	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
0066-0072	PBA	0.288	4332	0.8	1.70	-6.13	-51.15	13.51	0.36	7.2	7.2	0.286	4326	0.286	4336
0068-0065	PBA	0.001	1000	0.4	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
0073-0074	PBA	0.204	4132	1.5	9.25	-26.29	1.91	4.08	-0.87	13.5	13.5	0.202	4126	0.202	4136
0073-0081	PBA	0.396	4332	0.8	1.87	-8.90	70.81	18.29	0.45	7.2	7.2	0.393	4326	0.393	4336
0074-0075	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
0074-0082	PBA	0.397	4132	0.8	2.14	3.28	-71.01	18.50	0.95	7.2	7.2	0.393	4126	0.393	4136
0076-0073	PBA	0.001	1000	0.4	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
0077-0078	PBA	0.186	4132	0.0	8.02	-24.64	0.56	3.62	-0.13	13.5	13.5	0.185	4332	0.185	4136

**BRIDGE PRELIMINARY REPORT FOR  
 REFURBISHMENT / REPLACEMENT OF BRIDGES  
 IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RY	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
0077-0084	PBA	0.335	4332	0.8	1.74	-5.14	-60.01	16.08	0.01	7.2	7.2	0.334	4132	0.333	4326
0078-0079	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
0078-0083	PBA	0.340	4332	0.8	1.65	-4.44	61.03	16.07	-0.40	7.2	7.2	0.338	4326	0.338	4336
0080-0077	PBA	0.001	1000	0.5	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B246-B245	PBA	0.188	4012	0.0	5.48	-0.08	-28.08	9.38	0.62	7.2	7.2	0.187	4006	0.187	4016
B246-B247	PBA	0.190	4112	1.5	5.76	-28.14	-1.59	10.39	-0.02	13.5	13.5	0.189	4106	0.189	4116
B247-B244	PBA	0.210	4112	0.8	5.30	-0.05	-32.49	11.52	-0.80	7.2	7.2	0.207	4106	0.207	4116
B247-B248	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B249-B246	PBA	0.001	1000	0.4	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B251-B250	PBA	0.280	4232	0.0	5.81	-44.81	0.07	8.63	-3.78	7.2	7.2	0.278	4233	0.278	4234
B251-B254	PBA	0.435	4001	0.0	0.00	-77.70	-22.36	7.80	0.00	21.2	21.2	0.435	4002	0.435	4003
B253-B251	PBA	0.266	4011	1.8	-2.96	-42.49	-16.54	5.79	-1.51	16.5	16.5	0.264	4013	0.264	4014
B253-B252	PBA	0.156	4312	0.0	-2.80	25.47	-1.70	6.62	0.92	7.2	7.2	0.154	4313	0.154	4314
B256-B259	PBA	0.301	4132	0.8	1.86	4.42	-53.55	14.31	0.14	7.2	7.2	0.301	4126	0.301	4136
B256-B260	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B257-B255	PBA	0.283	4332	0.8	1.72	-10.44	49.31	13.03	2.69	7.2	7.2	0.282	4326	0.282	4336
B257-B256	PBA	0.165	4132	1.5	7.15	-21.67	0.29	3.54	-0.95	14.0	14.0	0.164	4126	0.164	4136
B258-B257	PBA	0.001	1000	0.4	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B263-B262	PBA	0.264	4312	0.0	5.19	42.57	-2.58	7.02	-0.27	7.2	7.2	0.263	4306	0.263	4316
B263-B264	PBA	0.221	4231	0.0	-3.91	-35.64	5.57	5.22	0.54	16.5	16.5	0.220	4225	0.220	4235
B264-B261	PBA	0.153	4232	0.0	-2.38	-25.34	1.21	8.16	-1.96	7.2	7.2	0.151	4226	0.151	4236
B264-B265	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B266-B263	PBA	0.387	4001	2.3	0.00	-69.18	-19.81	6.95	0.00	21.2	21.2	0.387	4002	0.387	4003
B269-B268	PBA	0.250	4312	0.0	5.06	40.20	-0.21	6.98	-0.97	7.2	7.2	0.249	4313	0.249	4314
B269-B270	PBA	0.218	4231	0.0	-3.67	-35.45	5.31	5.06	-0.07	16.5	16.5	0.218	4233	0.218	4234
B270-B267	PBA	0.138	4232	0.0	-2.28	-22.70	-0.15	7.58	-3.74	7.2	7.2	0.137	4233	0.137	4234
B270-B271	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B272-B269	PBA	0.375	4001	2.3	0.00	-67.05	-19.17	6.74	0.00	21.2	21.2	0.375	4002	0.375	4003
B275-B274	PBA	0.159	4332	0.0	-2.57	26.27	-1.84	6.87	-3.33	7.2	7.2	0.159	4326	0.159	4336
B275-B276	PBA	0.236	4331	1.8	-3.28	-38.86	-8.26	5.66	0.93	16.5	16.5	0.236	4325	0.236	4335
B276-B273	PBA	0.253	4212	0.0	5.06	-40.77	0.35	7.99	-3.74	7.2	7.2	0.253	4206	0.253	4216
B276-B277	PBA	0.375	4001	0.0	0.00	-67.05	-19.17	6.74	0.00	21.2	21.2	0.375	4002	0.375	4003
B278-B275	PBA	0.001	1000	0.4	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B282-B279	PBA	0.258	4312	0.0	4.84	41.90	-0.19	6.54	-3.77	7.2	7.2	0.257	4306	0.257	4316
B282-B283	PBA	0.217	4231	0.0	-3.78	-35.48	2.28	5.06	0.02	16.5	16.5	0.217	4225	0.217	4235
B283-B280	PBA	0.143	4232	0.0	-2.31	-23.66	0.10	7.81	-3.24	7.2	7.2	0.142	4226	0.142	4236
B283-B285	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B284-B282	PBA	0.375	4001	2.3	0.00	-67.05	-19.17	6.74	0.00	21.2	21.2	0.375	4002	0.375	4003
B287-B286	PBA	0.252	4312	0.0	5.16	40.42	-1.56	6.31	-1.86	7.2	7.2	0.252	4306	0.252	4316
B287-B288	PBA	0.233	4231	0.0	-3.65	-38.58	-1.93	5.36	1.26	16.5	16.5	0.233	4225	0.233	4235
B288-B281	PBA	0.148	4232	0.0	-2.47	-24.17	2.56	7.45	1.47	7.2	7.2	0.147	4226	0.147	4236
B288-B289	PBA	0.001	1000	0.0	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
B290-B287	PBA	0.387	4001	2.3	0.00	-69.18	-19.81	6.95	0.00	21.2	21.2	0.387	4002	0.387	4003
B293-B292	PBA	0.191	4312	0.0	-3.20	31.44	0.36	5.96	-2.96	7.2	7.2	0.190	4313	0.190	4314



**BRIDGE PRELIMINARY REPORT FOR  
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SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RY	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B293-B294	PBA	0.285	4311	1.8	-2.83	-48.81	-7.52	6.88	-0.18	16.5	16.5	0.285	4313	0.285	4314
B294-B291	PBA	0.230	4232	0.0	5.65	-35.63	1.24	8.62	1.81	7.2	7.2	0.229	4233	0.229	4234
B294-B295	PBA	0.387	4001	0.0	0.00	-69.18	-19.81	6.95	0.00	21.2	21.2	0.387	4002	0.387	4003
B296-B293	PBA	0.001	1000	0.4	0.00	-0.12	0.00	0.08	0.00	4.1	4.1	0.001	1001	0.001	4001
0129-B137	STA	0.002	1000	0.0	0.00	-0.30	0.00	0.00	0.08	4.9	7.8	0.002	1001	0.002	4001
0133-0129	STA	0.232	4332	1.5	-9.28	-8.47	-16.39	-1.12	-0.50	9.6	15.2	0.229	4333	0.229	4334
B136-B341	STA	0.159	4331	0.0	-3.27	-7.47	-12.82	0.81	0.77	4.6	7.2	0.156	4325	0.156	4335
B341-0133	STA	0.109	4332	1.3	-3.64	-2.31	10.14	0.64	-0.13	8.1	12.8	0.108	4212	0.108	4333
B235-B136	STB	0.465	4331	2.0	-35.57	-18.20	-15.48	-0.81	-1.44	25.4	20.0	0.464	4333	0.464	4334
B368-B235	STC	0.357	4212	0.9	-35.06	4.90	13.13	0.93	-0.15	25.4	20.1	0.351	4206	0.351	4216
B134-B328	STF	0.658	4211	0.0	-61.81	16.10	-19.97	0.93	-0.30	25.4	20.1	0.657	4213	0.657	4214
B233-B134	STF	0.646	4211	2.0	-61.92	15.07	-19.08	-1.01	0.10	25.4	20.1	0.645	4213	0.645	4214
B234-B329	STF	0.572	4232	0.0	-60.21	9.65	14.32	-0.95	-0.43	25.4	20.1	0.570	4226	0.570	4236
B328-B234	STF	0.582	4212	1.2	-62.00	9.47	13.89	1.10	-0.43	25.4	20.1	0.580	4213	0.580	4214
B329-B135	STF	0.535	4231	0.4	-59.88	-1.84	-16.27	-0.92	-0.82	25.4	20.1	0.533	4233	0.533	4234
B133-B233	STG	0.610	4212	2.0	-63.69	11.80	14.16	1.07	0.39	25.4	20.1	0.607	4213	0.607	4214
B336-B133	STH	0.709	4211	1.1	-78.93	-2.71	-21.61	-1.04	-1.04	25.4	20.0	0.705	4213	0.705	4214
B131-B327	STJ	0.743	4212	0.0	-78.49	8.48	-21.96	1.06	0.70	25.4	20.1	0.737	4213	0.737	4214
B230-B131	STJ	0.741	4212	2.0	-75.39	11.47	-22.43	-1.09	-0.47	25.4	20.1	0.735	4213	0.735	4214
B327-B231	STJ	0.762	4212	1.0	-78.49	17.97	15.63	1.23	0.34	25.4	20.1	0.760	4213	0.760	4214
B130-B230	STK	0.762	4211	0.0	-73.01	19.44	-20.85	1.03	-0.02	25.4	20.1	0.761	4213	0.761	4214
B348-B130	STL	0.777	4211	1.1	-72.89	20.83	-21.86	-1.07	0.44	25.5	20.2	0.776	4213	0.776	4214

**BRIDGE PRELIMINARY REPORT FOR  
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SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B129-B330	STM	0.632	4211	0.0	-70.38	-6.01	-15.68	0.90	1.06	25.3	20.2	0.625	4205	0.625	4215
B228-B129	STM	0.448	4211	2.0	-47.92	-1.97	-15.90	-0.70	-0.70	25.3	20.2	0.443	4212	0.442	4213
B330-B229	STM	0.656	4212	1.0	-70.24	9.96	15.79	0.99	0.66	25.3	20.2	0.653	4213	0.653	4214
B228-B128	STN	0.465	4211	2.0	-43.07	14.63	11.46	0.55	0.23	25.5	20.3	0.462	4213	0.462	4214
0092-B128	STO	0.486	4211	0.8	-42.93	16.19	-13.17	-0.57	0.93	25.4	20.1	0.484	4213	0.484	4214
B227-0092	STO	0.390	4211	1.2	-42.81	8.22	-6.07	-0.87	0.68	25.4	20.1	0.390	4213	0.390	4214
B232-B336	STQ	0.743	4212	0.0	-79.22	13.91	15.62	-1.27	-0.61	25.4	20.1	0.740	4213	0.740	4214
B229-B348	STR	0.687	4212	0.0	-74.04	9.84	16.64	-1.29	0.69	25.3	20.2	0.684	4213	0.684	4214
B135-B368	STS	0.374	4212	0.0	-35.06	5.54	-15.10	0.81	0.08	25.4	20.1	0.371	4206	0.371	4216
B170-B136	T1A	0.010	1000	1.0	0.00	-1.88	0.00	0.23	0.00	17.9	17.9	0.010	1001	0.010	4001
B136-B148	T1B	0.724	4332	1.8	0.36	77.08	30.25	1.38	5.47	19.8	30.2	0.722	4333	0.722	4334
B148-B159	T1C	0.430	4001	0.0	0.00	-76.79	-22.46	12.28	0.00	17.6	17.6	0.430	4002	0.430	4003
B235-B148	T1D	0.363	4332	0.0	38.16	-19.42	-3.56	1.22	0.52	48.4	48.4	0.361	4333	0.361	4334
B147-B235	T1E	0.564	4332	0.0	-59.31	13.99	-12.88	0.82	0.09	47.8	47.8	0.560	4333	0.560	4334
B169-B135	T1F	0.011	1000	1.0	0.00	-1.98	0.00	0.23	0.00	17.9	17.9	0.011	1001	0.011	4001
B135-B147	T1G	0.307	4332	0.0	9.31	-31.51	-32.72	4.46	1.38	32.4	32.4	0.305	4333	0.305	4334
B147-B158	T1H	0.010	1000	0.0	0.00	-1.78	0.00	0.22	0.00	17.7	17.7	0.010	1001	0.010	4001
B234-B147	T1J	0.364	4332	0.0	47.71	-8.09	-0.26	0.57	0.26	47.2	47.2	0.360	4333	0.360	4334
B146-B234	T1K	0.591	4332	0.0	-63.45	9.47	-15.23	0.94	0.44	47.4	47.4	0.586	4333	0.586	4334
B168-B134	T1L	0.012	1000	1.0	0.00	-2.16	0.00	0.25	0.00	17.6	17.6	0.012	1001	0.012	4001
B134-B146	T1M	0.258	4332	0.0	11.56	-22.49	-24.91	3.63	0.80	32.3	32.3	0.256	4333	0.256	4334
B146-B157	T1N	0.011	1000	0.0	0.00	-1.98	0.00	0.23	0.00	17.9	17.9	0.011	1001	0.011	4001

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B233-B146	T1O	0.244	4332	0.0	30.47	-6.69	2.83	0.58	-0.57	47.6	47.6	0.241	4333	0.241	4334
B145-B233	T1P	0.419	4332	2.7	-43.22	1.72	15.71	0.87	0.80	48.0	48.0	0.415	4333	0.415	4334
B167-B133	T1Q	0.759	4001	1.0	0.00	-135.31	-39.98	22.24	0.00	17.4	17.4	0.759	4002	0.759	4003
B133-B145	T1R	0.322	4332	0.0	19.52	-29.42	-19.69	3.86	1.22	31.9	31.9	0.320	4333	0.320	4334
B145-B156	T1S	0.530	4001	0.0	0.00	-94.60	-27.81	15.15	0.00	17.6	17.6	0.530	4002	0.530	4003
B232-B145	T1T	0.216	4211	2.7	-16.99	-9.64	-12.23	0.88	-0.95	47.2	47.2	0.212	4213	0.212	4214
B144-B232	T1U	0.406	4332	2.7	-41.43	2.97	16.00	0.93	0.83	47.5	47.5	0.401	4333	0.401	4334
B166-B132	T1V	0.010	1000	1.0	0.00	-1.79	0.00	0.22	0.00	17.6	17.6	0.010	1001	0.010	4001
B132-B144	T1W	0.258	4212	1.8	16.57	-27.24	1.51	3.65	0.74	31.9	31.9	0.258	4213	0.258	4214
B144-B155	T1X	0.012	1000	0.0	0.00	-2.21	0.00	0.26	0.00	17.4	17.4	0.012	1001	0.012	4001
B231-B144	T1Y	0.136	4211	2.7	-8.65	-5.62	-11.39	0.83	-1.02	47.7	47.7	0.133	4213	0.133	4214
B143-B231	T1Z	0.362	4332	2.7	-35.90	7.86	14.46	0.76	1.14	47.2	47.2	0.358	4326	0.358	4336
B165-B131	T2A	0.679	4001	1.0	0.00	-121.10	-35.60	19.69	0.00	17.4	17.4	0.679	4002	0.679	4003
B131-B143	T2B	0.492	4311	1.8	16.74	-70.25	7.76	10.73	1.04	31.8	31.8	0.492	4313	0.492	4314
B143-B154	T2C	0.487	4001	0.0	0.00	-86.93	-25.62	14.11	0.00	17.5	17.5	0.487	4002	0.487	4003
B230-B143	T2D	0.093	4331	0.0	-5.40	2.73	9.03	0.45	-1.21	47.4	47.4	0.091	4031	0.089	4325
B142-B230	T2E	0.330	4212	2.7	-31.08	13.75	11.24	0.83	1.34	47.3	47.3	0.325	4213	0.325	4214
B164-B130	T2F	0.580	4001	1.0	0.00	-103.48	-30.53	17.01	0.00	17.4	17.4	0.580	4002	0.580	4003
B130-B142	T2G	0.301	4212	1.8	13.46	-37.65	10.75	4.34	0.53	31.9	31.9	0.300	4213	0.300	4214
B142-B153	T2H	0.545	4001	0.0	0.00	-97.28	-28.52	15.87	0.00	17.4	17.4	0.545	4002	0.545	4003
B229-B142	T2J	0.231	4331	0.0	-22.19	2.17	11.85	0.62	-1.30	47.4	47.4	0.227	4333	0.227	4334
B141-B229	T2K	0.346	4212	0.0	-34.02	-5.07	-15.30	1.01	0.24	47.6	47.6	0.342	4213	0.342	4214

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B163-B129	T2L	0.011	1000	1.0	0.00	-2.00	0.00	0.24	0.00	17.6	17.6	0.011	1001	0.011	4001
B129-B141	T2M	0.249	4212	1.8	11.15	-30.07	11.99	4.07	0.81	31.9	31.9	0.248	4213	0.248	4214
B141-B152	T2N	0.011	1000	0.0	0.00	-2.09	0.00	0.25	0.00	17.7	17.7	0.011	1001	0.011	4001
B228-B141	T2O	0.220	4331	2.7	-21.30	-4.11	-10.21	0.69	-0.38	48.4	48.4	0.217	4333	0.217	4334
B140-B228	T2P	0.388	4212	2.7	-37.71	16.76	8.44	0.83	1.21	47.3	47.3	0.384	4213	0.384	4214
B162-B128	T2Q	0.569	4001	1.0	0.00	-101.49	-29.89	16.46	0.00	17.5	17.5	0.569	4002	0.569	4003
B128-B140	T2R	0.355	4212	1.7	5.15	-57.63	15.01	6.61	0.86	29.9	29.9	0.354	4213	0.354	4214
B140-B151	T2S	0.574	4001	0.0	0.00	-102.49	-30.15	16.64	0.00	17.4	17.4	0.574	4002	0.574	4003
B227-B140	T2T	0.382	4331	0.0	-41.54	-7.40	8.42	0.64	-1.59	47.8	47.8	0.378	4333	0.378	4334
B139-B227	T2U	0.595	4212	0.0	-46.91	-37.68	-23.96	2.44	0.84	47.6	47.6	0.589	4213	0.589	4214
0114-B127	T2V	0.416	4212	0.5	-4.11	-71.92	4.78	15.65	2.63	8.7	8.7	0.414	4213	0.414	4214
B161-0114	T2V	0.004	1000	0.5	0.00	-0.75	0.00	0.16	0.00	8.7	8.7	0.004	1001	0.004	4001
B127-B139	T2W	0.658	4212	1.8	14.29	-96.07	41.11	9.52	0.30	31.9	31.9	0.653	4213	0.653	4214
B139-B150	T2X	0.010	1000	0.0	0.00	-1.81	0.00	0.22	0.00	17.8	17.8	0.010	1001	0.010	4001
B161-0032	T3A	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B162-0033	T3B	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B163-0034	T3C	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B164-0035	T3D	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.0	6.0	0.000	1001	0.000	4001
B165-0036	T3E	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.3	6.3	0.000	1001	0.000	4001
B166-0037	T3F	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B167-0038	T3G	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B168-0039	T3H	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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**SACS-IV MEMBER UNITY CHECK RANGE SUMMARY**

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RX	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B169-0040	T3J	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.3	6.3	0.000	1001	0.000	4001
B170-0041	T3K	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B150-0022	T4A	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B151-0023	T4B	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B152-0024	T4C	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B153-0025	T4D	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B154-0026	T4E	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.0	6.0	0.000	1001	0.000	4001
B155-0027	T4F	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B156-0028	T4G	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B157-0029	T4H	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
B158-0030	T4J	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.1	6.1	0.000	1001	0.000	4001
B159-0031	T4K	0.000	1000	0.0	-0.03	0.00	0.00	0.00	0.00	6.2	6.2	0.000	1001	0.000	4001
0128-B183	TNA	0.002	1000	0.0	0.00	-0.30	0.00	0.00	0.08	4.9	7.8	0.002	1001	0.002	4001
B148-B340	TNA	0.102	4211	0.0	-7.95	-4.99	2.15	-0.07	0.90	4.6	7.2	0.102	4205	0.102	4215
B340-0128	TNA	0.167	4332	3.6	-9.91	-5.92	-7.96	-0.12	-0.49	22.7	35.9	0.165	4333	0.165	4334
0132-B148	TNB	0.371	4312	0.0	-31.65	16.47	5.91	-0.39	-1.14	25.4	40.1	0.369	4306	0.369	4316
B367-0132	TNB	0.371	4312	0.9	-31.65	16.47	5.91	0.31	1.22	25.4	40.1	0.369	4306	0.369	4316
B338-B339	TNC	0.503	4331	0.0	-52.35	12.84	4.95	-0.17	-0.42	25.3	40.1	0.503	4333	0.503	4334
B337-B146	TND	0.560	4332	0.0	-59.68	13.89	4.07	-0.09	0.15	25.4	40.1	0.557	4333	0.557	4334
B335-B145	TNE	0.632	4332	0.0	-72.17	11.13	3.03	-0.24	-0.60	25.3	40.0	0.628	4333	0.628	4334
B143-B326	TNF	0.715	4332	1.0	-76.31	17.18	5.17	0.08	0.46	25.4	40.3	0.710	4333	0.710	4334
B326-B144	TNF	0.715	4332	0.0	-76.31	17.18	5.17	-0.08	0.18	25.4	40.3	0.710	4333	0.710	4334

BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)

SACS (2025)

Company: Engineers India Limited  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP I - UNITY CHECKS GREATER THAN 0.00 AND LESS THAN 0.80															
MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING Y N/MM2	STRESS Z N/MM2	SHEAR Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B142-B334	TNG	0.673	4332	2.0	-70.14	17.80	5.63	0.11	0.10	25.4	40.2	0.671	4333	0.671	4334
B347-B142	TNH	0.654	4332	0.0	-69.35	16.55	4.70	-0.15	-0.01	25.4	40.1	0.652	4333	0.652	4334
B140-B332	TNJ	0.417	4331	0.0	-44.54	5.26	-7.95	0.27	0.30	25.4	40.1	0.415	4333	0.415	4334
0122-0093	TNK	0.445	4332	0.0	-42.12	1.10	19.28	-0.55	0.47	25.2	41.3	0.442	4333	0.442	4334
0087-0116	TNL	0.392	4331	0.0	-7.75	5.66	-44.25	1.57	-0.38	18.5	29.3	0.390	4333	0.390	4334
0116-B139	TNL	0.328	4331	0.8	-7.78	-10.11	30.24	1.53	-0.94	18.5	29.3	0.321	4333	0.321	4334
B182-0087	TNL	0.002	1000	0.8	0.00	-0.32	0.00	0.00	-0.09	5.1	8.0	0.002	1001	0.002	4001
B332-B141	TNM	0.399	4332	0.0	-44.63	9.38	0.93	0.05	-0.19	25.4	40.1	0.396	4333	0.396	4334
B141-B333	TNN	0.593	4332	1.0	-69.35	7.66	3.56	0.11	1.02	25.4	40.1	0.588	4333	0.588	4334
B334-B143	TNO	0.673	4332	0.0	-70.14	17.80	5.63	-0.11	-0.26	25.4	40.2	0.671	4333	0.671	4334
B144-B335	TNP	0.672	4331	0.0	-72.20	17.84	2.84	0.01	-0.14	25.4	40.3	0.671	4333	0.671	4334
B145-B337	TNQ	0.560	4332	2.0	-59.68	13.90	4.06	0.09	0.32	25.4	40.1	0.557	4333	0.557	4334
B146-B338	TNR	0.516	4331	0.0	-52.41	15.44	4.58	0.02	-0.14	25.4	40.1	0.516	4333	0.516	4334
B339-B147	TNS	0.518	4331	0.4	-52.40	-11.84	-8.22	-0.55	-2.00	25.4	40.1	0.517	4325	0.517	4335
B333-B347	TNT	0.645	4332	2.0	-69.28	15.19	4.70	0.04	0.39	25.4	40.1	0.643	4333	0.643	4334
B147-B367	TNU	0.332	4211	0.0	-30.93	-12.54	4.15	-0.32	1.76	25.4	40.1	0.330	4205	0.330	4215
0093-B140	TNV	0.368	4331	0.8	-39.45	6.87	-4.75	-0.67	0.01	25.4	40.1	0.367	4333	0.367	4334
B139-0118	TNW	0.584	4331	0.0	-39.47	-23.09	24.33	-0.22	1.83	25.4	40.1	0.576	4333	0.576	4334
0118-0122	TNX	0.520	4331	0.0	-41.88	-9.43	23.78	-0.26	1.65	25.2	41.4	0.515	4333	0.515	4334

**BRIDGE PRELIMINARY REPORT FOR  
REFURBISHMENT / REPLACEMENT OF BRIDGES  
IN MH ASSET (SLQ- WIS DECK BRIDGE)**

SACS (2025)

Company: Engineers India Limited  
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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP II - UNITY CHECKS GREATER THAN 0.80 AND LESS THAN 1.00

MEMBER	GROUP ID	MAXIMUM COMBINED UNITY CK	LOAD COND NO.	DIST FROM END	AXIAL STRESS N/MM2	BENDING STRESS Y N/MM2	STRESS Z N/MM2	SHEAR STRESS Y N/MM2	STRESS Z N/MM2	KLY/RZ	KLZ/RZ	SECOND-HIGHEST UNITY CHECK	LOAD COND	THIRD-HIGHEST UNITY CHECK	LOAD COND
B058-B020	B1H	0.864	4212	2.0	80.74	25.12	-22.66	-1.33	0.56	25.4	20.1	0.852	4206	0.852	4216
B020-B273	B1J	0.870	4212	0.8	80.72	33.46	-15.29	0.58	1.19	25.4	20.1	0.860	4206	0.860	4216
B059-B021	B1J	0.828	4212	0.0	78.54	22.66	22.05	-1.45	-0.93	25.4	20.1	0.822	4206	0.822	4216
B273-B059	B1J	0.884	4212	0.0	80.57	32.00	-18.91	2.12	-0.80	25.4	20.1	0.873	4206	0.873	4216
B123-B080	B2E	0.802	4212	0.4	2.33	-70.67	-65.99	-16.97	-26.46	2.5	10.7	0.770	4206	0.770	4216
B174-B089	B2E	0.891	4332	0.4	-2.65	54.68	100.01	18.58	9.08	2.5	10.7	0.856	4326	0.856	4336
B005-B279	B5F	0.805	4332	1.0	80.66	25.01	14.08	1.12	2.65	25.4	40.1	0.796	4326	0.796	4336
B279-0081	B5F	0.819	4332	0.8	80.88	32.10	8.88	-0.12	0.62	25.4	40.1	0.809	4326	0.809	4336
B262-B255	B5J	0.803	4332	0.0	74.71	32.33	12.49	-0.99	-0.95	25.4	40.1	0.800	4132	0.797	4326
B000-B014	B63	0.842	4331	2.1	70.18	57.22	-38.31	6.07	-0.34	23.3	23.3	0.838	4333	0.838	4334
B023-B087	BNF	0.842	4112	0.0	-25.32	-124.91	-1.70	24.89	11.02	10.4	10.4	0.833	4106	0.833	4116
B017-B141	BNR	0.912	4312	0.0	-88.90	7.51	13.88	0.41	0.29	70.2	70.2	0.911	4313	0.911	4314
B010-B076	BSD	0.807	4332	0.0	-55.14	-25.57	-77.03	15.43	9.04	12.2	12.2	0.797	4326	0.797	4336
B132-B232	STJ	0.841	4211	0.0	-79.08	23.35	-22.71	1.17	-0.46	25.4	20.1	0.841	4213	0.841	4214
B231-B132	STJ	0.839	4211	2.0	-79.11	22.75	-22.95	-1.18	0.20	25.4	20.1	0.839	4213	0.839	4214

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SACS-IV MEMBER UNITY CHECK RANGE SUMMARY

GROUP III - UNITY CHECKS GREATER THAN 1.00 AND LESS THAN 500.00

\*\* NO UNITY CHECKS IN THIS GROUP \*\*