

# DETAILED INSPECTION REPORT

**FOR**

## PARTIALLY EXECUTED WORK OF MAJOR BRIDGE

**AT**

**KM 28+400 OVER MAHANADI ON NH-153 RAIGARH  
SARANGARH SARAIPALI IN THE DISTRICT SAKTI  
OF CHHATTISGARH UNDER THE PWD, NH  
DIVISION BILASPUR**

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## **1. INTRODUCTION**

### **1. INTRODUCTION**

IDDC Engineers Pvt. Ltd. Obtained the responsibility to assess the condition of partially executed work of Major Bridge at Km 28+400 over Mahanadi on NH-153 Raigarh Sarangarh Saraipali in the District Sakti of Chhattisgarh under the PWD, NH Division Bilaspur.

#### **1.1 THE CLIENT:**

Ministry of Road Transport & Highways Govt. of India &  
Chief Engineer Public Works Department,  
NH Zone, Govt. of Chhattisgarh.

#### **1.2 BACKGROUND**

This is a partially executed Major Bridge at Km 28+400 over Mahanadi river on NH-153 connecting Mahadevpali – Viswaspur villages in Chandrapur area, Raigarh district in the state of Chhattisgarh. This bridge construction is initiated and partially executed in the period of 2017 - 2019 tentatively. As per details given by the client this bridge is designed for 47 spans but there is total 37 structures are partially executed in site (18 structures up to pier cap level, 3 structures up to pile cap level and 16 structures up to pile level are constructed) at Km 28+400 over Mahanadi on NH-153 Raigarh Sarangarh Saraipali in the District Sakti of Chhattisgarh under the PWD, NH Division Bilaspur which briefly describes about the identification of defects observed during investigation.

#### **1.3 SCOPE OF WORK:**

Conducting consultancy services for partially executed work of Major Bridge at Km 28+400 over Mahanadi river on NH-153 connecting Mahadevpali – Viswaspur villages in Chandrapur area, Raigarh district in the state of Chhattisgarh.

#### **1.4 CONSULTANT:**

IDDC Engineers Pvt Ltd has been established with the aim to provide design and development input to infrastructure Projects and also sustain them for the full designed life with inspection testing and asset management systems for all types of structures and continued to retain the original expertise and talent over decades. IDDC is one of the oldest and respected Engineering Consulting firm in india and is an ISO 9001:2015 certified organization. Pioneers in non-destructive testing and structural stability certification since 4 decades. Capabilities of Geotechnical studies, Topography surveys, Geophysical study, Digital



platforms such as drone surveys, Bridge management system and Structural designs are the add on services for all Infra projects . Collaboration with established educational institutes and professors to update the new technologies and implement them practically at site with their support as part of new developments and mentoring of young minds.

### **1.5 REFERENCES:**

- a) Bid No. 78/CE/NH/TC/44-59/2025
- b) Letter acceptance No. 1234/CE/NH/TC/44-59/2025/Raipur Dated 19.09.2025.

### **1.6 FIELD WORK:**

The main purpose was to inspect the total accessible structure and assess the structural integrity, strength, and distress plotting of structural members.

### **1.7 DISCLAIMER AND VALIDITY OF THE INVESTIGATION:**

The findings, observations, test results, and opinions presented in this report by **IDDC Engineers Pvt Ltd** have been prepared exclusively for the National Highways Authority of India (NHAI) for the purpose of condition assessment, inspection, and testing of the specified RCC bridge. The observations, measurements, and test results presented herein are based on the site conditions prevailing on the dates of inspection and on the scope of work approved by NHAI.

The assessment is limited to the components that were accessible and could be examined through visual inspection and the non-destructive/destructive tests conducted. Portions of the structure that were inaccessible or concealed are not covered, and the authors cannot be held responsible for any defects or deterioration that could not be observed or detected within the defined scope.

The conclusions and recommendations provided are professional opinions based on the available data, relevant codes, and standard engineering practices. These should not be construed as a guarantee of structural performance. Future deterioration, environmental impacts, overloading, or events such as seismic activity, flooding, fire, or vehicular impact may alter the condition of the structure beyond the findings of this report.

This report shall not be reproduced, quoted, or transmitted to third parties without prior written consent of NHAI or the issuing agency. No liability is accepted for misuse, partial use, or interpretation outside the intended purpose.

This inspection and testing report is valid for a period of **twelve (12) months** from the date of issue, provided that no major structural alterations, damage, unusual loading, natural events (such as flooding or seismic activity), or deterioration mechanisms affecting the RCC bridge occur during this period

## 2. LEGEND SHEET

DISTRESS-NOMENCLATURE			
LEGEND	DESCRIPTION	LEGEND	DESCRIPTION
BG	BULGING	SC	STEEL CORRODED
CRA	MAP CRACK/CRAZING	SE	STEEL EXPOSED
RC	CRACK ALONG MAIN REINFORCEMENT	SPE	SEEPAGE EVIDENT
RP	CRACK PERPENDICULAR TO MAIN REINFORCEMENT	SPM	SEEPAGE MARKS
MC	MINOR CRACK	SG/(G)(S)	SAG IN GIRDER, SLAB
WC	WIDE CRACK	EFF	EFFLORESCENCE
SPL	SPALLING	STL	SETTLEMENT
DLM	DELAMINATED SECTION	GUN	GUNITING
HC	HONEY COMBING	H	HOLLOW SECTION
TL	TILT	VEG	VEGETATION GROWTH

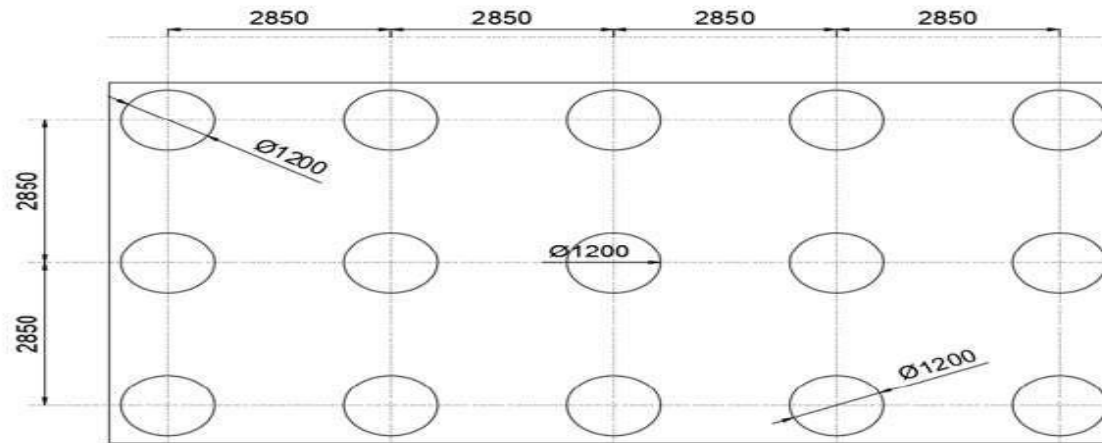
### 3. BRIDGE INVENTORY DATA

<b>FORMAT A</b>		
PROFORMA FOR CONDTION SURVEY OF BRIDGE		
1.	Road name	NH – 153
2.	Location of bridge in Km	28+400
3.	Name of River/Water Body/Bridge	Mahanadi
4.	Year of completion of bridge	Partially executed (2014 – 2017) tentatively
5.	Type of bridge (RCC/PSC, slab, timber, steel)	RCC Bridge
6.	Total length of bridge in 'm' with span arrangement	47 spans x 31mts (Partially executed)
7.	Width of carriageway and footpaths	Not constructed
8.	Whether located in back waters/chemical zone?	No
	Condition of the various bridge components:	-
	<b>Name of components</b>	<b>Condition</b>
9.	<b>Approaches:</b>	-
9.1	Condition of pavement surface	Not Applicable
9.2	Side slopes	Not Applicable
9.3	Approach slab	Not Applicable
9.4	Retaining walls	Not Applicable
10.	<b>Protection Works:</b>	Not Applicable
10.1	Slope pitching, apron, floor protection, toe walls	Not Available
10.2	Scour in river bed	Not observed
11.	<b>Waterway:</b>	-
11.1	Obstruction in waterways, island formation, Vegetation growth etc.	Not Available
11.2	Flow pattern and banks	Inflow is high and there is uniform flow
12.	<b>Foundation:</b>	-
12.1	Type	Pile Foundation
12.2	Material	RCC
12.3	Condition of foundation	Will be updated in final report.
12.4	Piers/Abutments	Abutments are not constructed and settlement /scour not observed.
		Thermal and corrosion cracks observed on all partially executed structures of the bridge.

13.	<b>Substructure</b>	-
13.1	Type	Circular
13.2	Condition	Thermal and corrosion cracks observed on all 18 piers.
14.	<b>Bearing:</b>	-
14.1	Type	Not constructed
14.2	Condition	Not constructed
15.	<b>Superstructure:</b>	-
15.1	Structural System	Not constructed
15.2	Type	Not constructed
15.3	Arrangement	Not constructed
15.4	Condition (girder)	Not constructed
15.5	Condition (Deck)	Not constructed
15.6	In case of steel bridges	Not constructed
15.7	In case of masonry bridges	Not constructed
16.	<b>Expansion joint:</b>	-
16.1	Type	Not constructed
16.2	Condition	Not constructed
17.	<b>Wearing coat:</b>	-
17.1	Type	Not constructed
17.2	Surface condition	Not constructed
17.3	Drainage Spouts	Not constructed
18	<b>Gabdraks/Parapet:</b>	-
18.1	Type	Not constructed
18.2	Damage/missing parts if any	Not constructed
19.	<b>Footpaths:</b>	-
20.	Type	Not constructed
21	Leakage/Damage if any	Not constructed
22	Special Observation/Remarks if any	Not constructed

## 4 DETAILED INSPECTION REPORT (SITE OBSERVATIONS) 4.1 ABUTMENT – 1

### 4.1.1 LAYOUT



AB-1 PILE FOUNDATION PLAN

PROJECT:

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR.

DRAWING TITLE:

PLAN OF ABUTMENT-1 PILE FOUNDATION

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### 4.1.2 OBSERVATIONS

1. Abutment – 1 is partially executed and this foundation is constructed up to pile level only.
2. Total 15 Nos piles are observed in this foundation and no other structural members are not constructed.

### 4.1.3 PHOTOGRAPHS:



Picture-1 & 2: Abutment – 1 foundation view

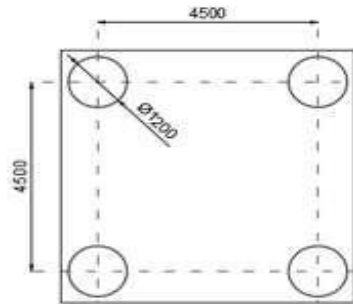


Picture-3 & 4: Abutment – 1 foundation view

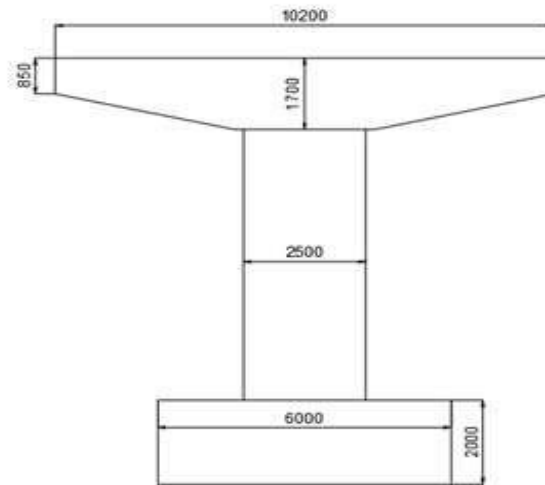


## 4.2 PIER – 1

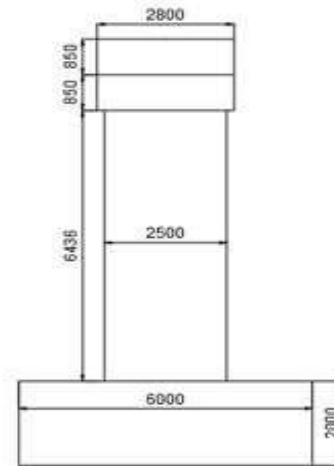
### 4.2.1 LAYOUT



PILE FOUNDATION PLAN



PIER-01 FRONT VIEW



PIER-01 SIDE VIEW

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

FOUNDATION AND PIER-1 PLAN & ELEVATION

**CONSULTANT:**



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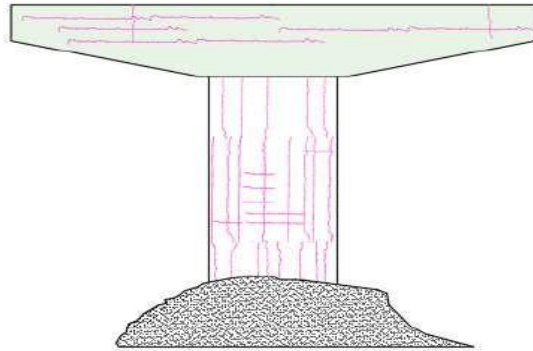
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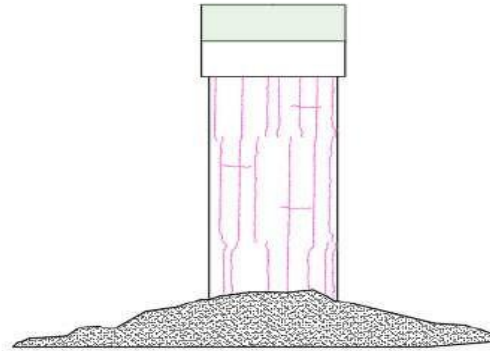
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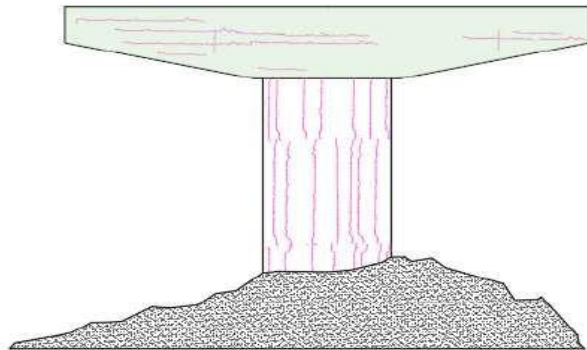
## 4.2.2 DISTRESS PLOTTING



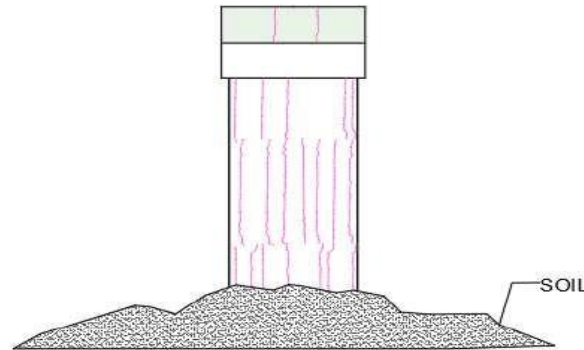
PIER-1 AT AB-1 FACE



PIER-1 AT EAST FACE



PIER-1 AT PR-2 FACE



PIER-1 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

DISTRESS MAPPING ON PIER-01

**CONSULTANT:**



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### 4.2.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 1</b>		
Pier cap	L	Leaching observed on pier cap top and all side faces at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
	R & SC	Rust & Steel corrosion observed on pedestal reinforcement over pier cap
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor cracks observed on pier surface at all faces along the main reinforcement direction.

#### 4.2.4 PHOTOGRAPHS:



Picture-1: Pier – 1 view



Picture-2: Cracks on pier surface.



Picture-3: Cracks on pier surface.



Picture-4: Leaching & Minor cracks on pier cap.

## 4.2.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pier-01 at 1 meter height	0°	48	48	50	47	53	The surface strength of concrete is in Good to Very Good condition as per IS 516 (Part5/Sec1):2020
			50	50	50			
			44	40	40			
2	On Pier-01 at 2 meter height	0°	48	48	50	50	58	
			46	50	46			
			54	56	48			
3	On Pier-01 at 5.5 meter height	0°	36	34	40	36	33	
			34	36	36			
			36	36	34			
4	On Pier cap-01 in North face at left side	0°	44	44	46	44	48	
			52	40	42			
			46	36	44			
5	On Pier cap-01 in North face at centre	0°	42	42	40	41	42	
			42	40	42			
			40	38	40			
6	On Pier cap-01 in North face at Right side	0°	40	40	42	40	40	
			36	38	44			
			40	42	40			
7	On Pier cap-01 in South face at left side	0°	44	40	42	41	42	
			38	40	38			
			38	42	44			
8	On Pier cap-01 in South face at centre	0°	36	42	44	44	48	
			46	48	42			
			44	44	48			
9	On Pier cap-01 in South face at Right side	0°	42	44	46	43	46	
			48	42	38			
			42	44	42			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S. No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pier-01 at 1 meters height	D	2500	666.8	3.75	3.75	Doubtful	The UPV result are in Doubtful to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
2	On Pier-01 at 2 meters height	D	2500	667.5	3.75	3.75	Doubtful	
3	On Pier-01 at 5.5 meters height	ID	150	35.1	4.27	4.07	Good	
			300	77.5	3.87			
4	On Pier cap-01 in North face at left side	ID	150	37.5	4.00	4.01	Good	
			300	74.5	4.03			
5	On Pier cap-01 in North face at center	ID	150	31.6	4.75	4.93	Excellent	
			300	58.6	5.12			
6	On Pier cap-01 in North face at Right side	ID	150	34	4.41	4.34	Good	
			300	70.2	4.27			
7	On Pier cap-01 in South face at left side	ID	150	32.8	4.57	4.55	Excellent	
			300	66.3	4.52			
8	On Pier cap-01 in South face at center	ID	150	31.3	4.79	4.73	Excellent	
			300	64.2	4.67			
9	On Pier cap-01 in South face at Right side	ID	150	36.6	4.10	4.33	Good	
			300	65.7	4.57			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pier-01 at 1 meters height	20	10	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pier cap-01 in North face at left side	20	10	Dark pink	
3	On Pier cap-01 in South face at Right side	20	10	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 1 at 1mts level in the direction of main reinforcement	77	77	As per Design
		81		
		78		
		71		
2	On Pier cap- 1 in South face	62	65	
		68		
		59		
		72		

## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 1	244	216	208	195	215	201	Uncertain	The level of corrosion is in Uncertain at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		193	182	174	155	129			
		207	224	190	225	251			

## CRACK WIDTH

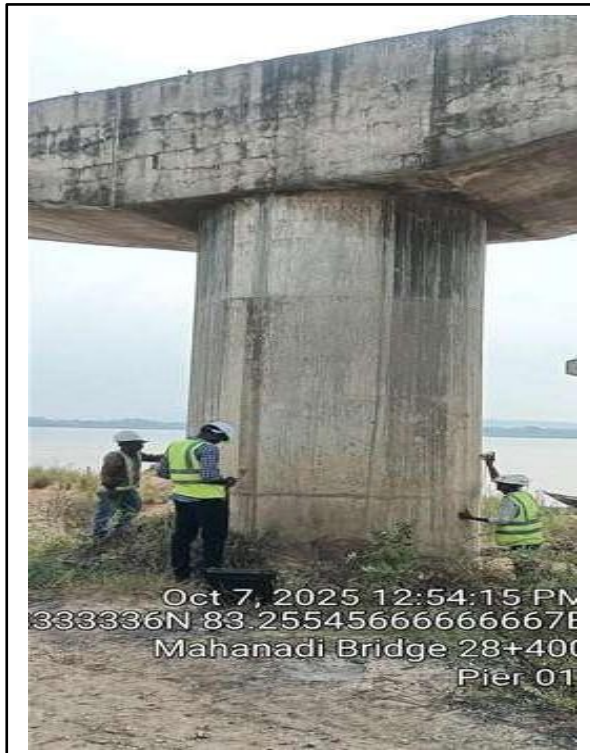
S.No	Location		Crack Width In Mm
1	Pier -1	Pier	0.1 to 1
2		Pier Cap	0.1 to 0.3

## CORE COMPRESSIVE STRENGTH TEST RESULTS

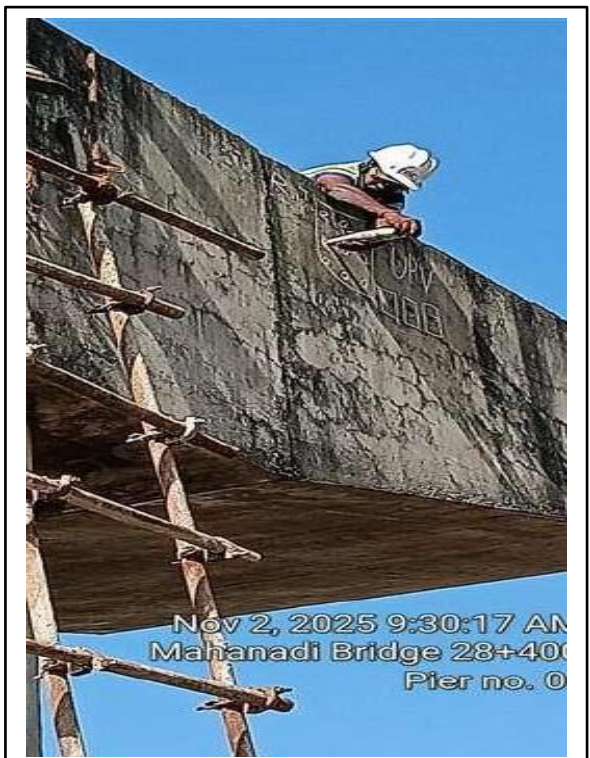
S. No	Location	Equivalent cube compressive strength in (N/mm <sup>2</sup> )
1	On Pier -1	25.09



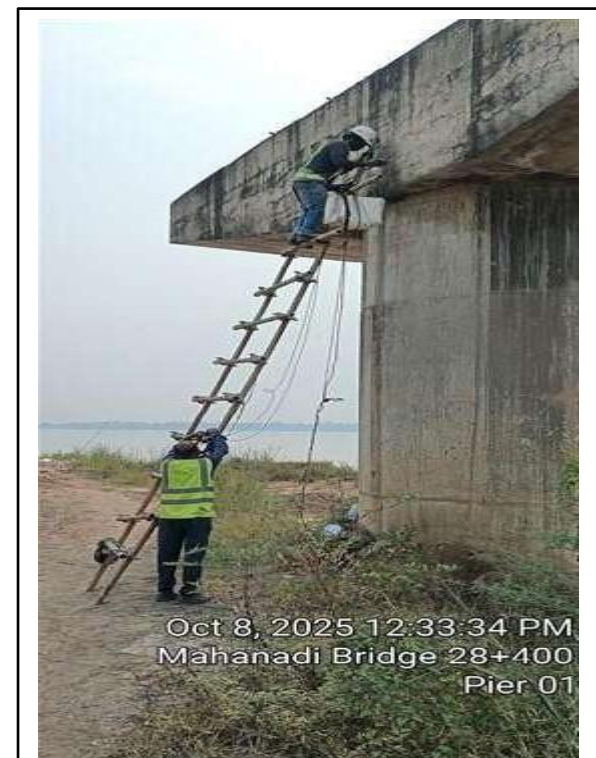
#### 4.2.6 TESTING PHOTOGRAPHS:



Conducting UPV tests



Conducting RHT tests



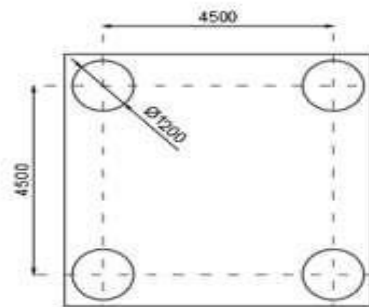
Conducting CD tests

## **SUMMARY OF TEST RESULTS**

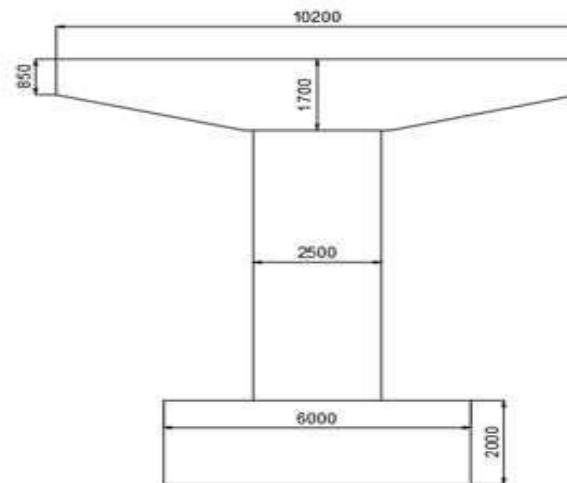
1. Rebound hammer test results revealed that quality of concrete is Good to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Excellent" at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 65mm to 77mm which is as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of Uncertain.
6. Crack width was in the range for pier 0.1mm to 1mm and pier cap 0.1mm to 0.3mm.
7. The Core Compressive test results are carried out on pier-1 is 25.09 N/mm<sup>2</sup>.

## 4.3 PIER – 2

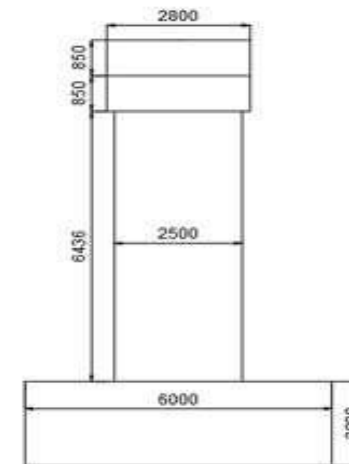
### 4.3.1 LAYOUT



PILE FOUNDATION PLAN



PIER-02 FRONT VIEW



PIER-02 SIDE VIEW

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

FOUNDATION AND PIER-02 PLAN & ELEVATION

**CONSULTANT:**



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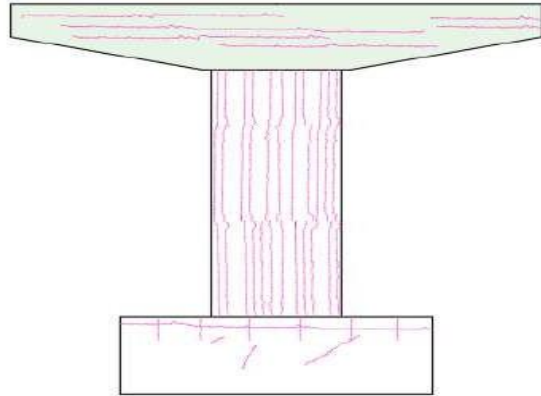
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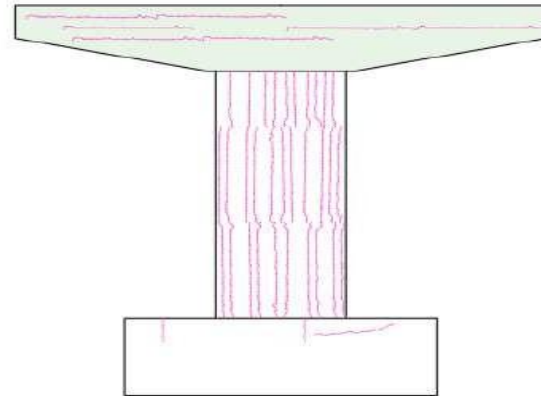
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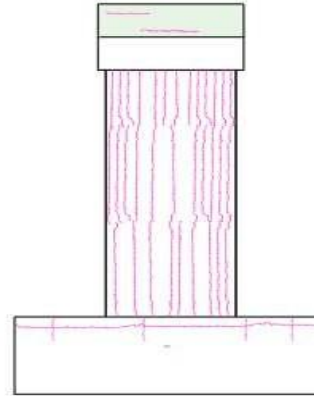
### 4.3.2 DISTRESS PLOTTING



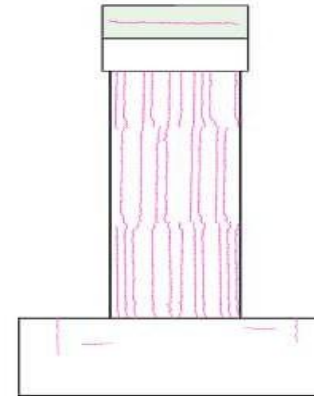
PIER-2 AT PR-1 FACE



PIER-2 AT PR-3 FACE



PIER-2 AT EAST FACE



PIER-2 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

DISTRESS MAPPING ON PIER-02

**CONSULTANT:**



**IDDC Engineers Pvt. Ltd**

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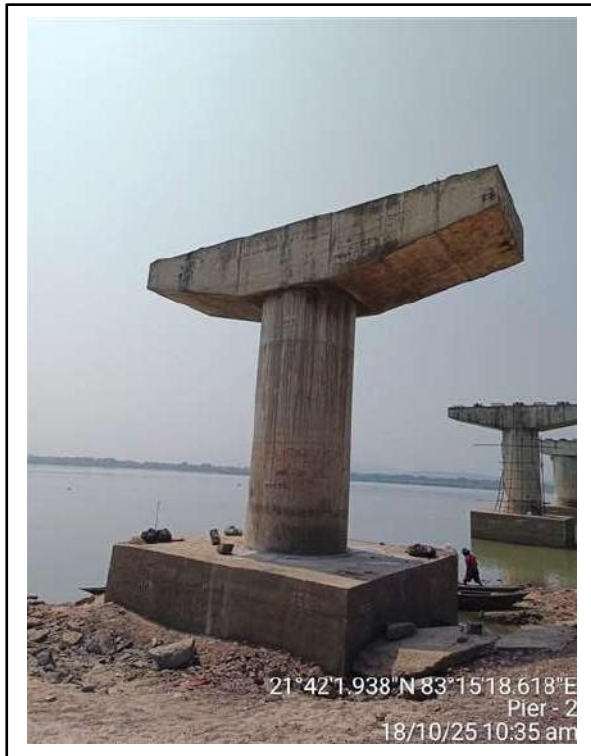
Mob: 984893666 \*URL: [www.iddcindia.com](http://www.iddcindia.com)

e-mail: [iddcvizag@yahoo.co.in](mailto:iddcvizag@yahoo.co.in) / [vizag@iddcindia.com](mailto:vizag@iddcindia.com)

### 4.3.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 2</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.

#### 4.3.4 PHOTOGRAPHS:



Picture-1: Pier – 2 view



Picture-2: Cracks on pier surface.



Picture-3 & 4: Cracks on pier surface





Picture-5 & 6: Surface cracks on pier cap.



Picture-7 & 8: Cracks on pile cap surface

## 4.3.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-02 in West face at Left side	0°	44	38	38	39	39	The surface strength of concrete is in Good to Very Good condition as per IS 516 (Part5/Sec1):2020
			38	32	42			
			38	42	40			
2	On Pile cap-02 in West face at Right side	0°	42	40	38	40	40	
			44	44	34			
			36	40	40			
3	On Pile cap-02 in North face at Left side	0°	52	44	48	47	53	
			48	48	54			
			48	40	40			
4	On Pile cap-02 in North face at Right side	0°	40	38	36	38	37	
			36	36	36			
			40	38	38			
5	On Pier-02 at 1mt level in South face	0°	42	44	54	46	51	
			46	44	48			
			46	44	44			
6	On Pier-02 at 2mt level in West face	0°	42	46	48	49	56	
			42	54	56			
			50	48	52			
7	On Pier-02 at 6mt level in north face	0°	34	40	36	38	37	
			36	44	38			
			38	36	40			
8	On Pier-02 at 4mt level in south face	0°	40	38	34	40	40	
			36	40	40			
			44	48	42			
9	On Pier cap-02 in north face at LHS	0°	46	44	44	40	40	
			40	38	42			
			38	38	32			
10	On Pier cap-02 in north face at middle	0°	48	40	40	43	46	
			40	46	46			
			40	44	46			
11	On Pier cap-02 in south face at LHS	0°	36	34	34	36	33	
			36	42	32			
			40	38	34			
12	On Pier cap-02 in south face at RHS	0°	44	40	38	41	42	
			46	40	34			
			42	40	42			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S. No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-02 in west face at LHS	ID	150	39.2	3.83	3.67	Doubtful	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	85.5	3.51			
2	On Pile cap-02 in west face at RHS	ID	150	38	3.95	3.31	Doubtful	
			300	112.1	2.68			
3	On Pile cap-02 in north face at LHS	ID	150	43.2	3.47	3.39	Doubtful	
			300	90.7	3.31			
4	On Pile cap-02 in north face at RHS	ID	150	33.2	4.52	3.87	Good	
			300	92.9	3.23			
5	On Pier-02 at 1mt level in East face	D	2500	661.1	3.78	3.78	Good	
6	On Pier-02 at 2mt level in South face	D	2500	683.1	3.66	3.66	Doubtful	
7	On Pier-02 at 4mt level in north south face	D	2500	652.7	3.83	3.83	Good	
8	On Pier-02 at 5.5mt level in north face	ID	150	48.2	3.11	2.98	Doubtful	
			300	105.7	2.84			
9	On Pier cap-02 in north face at LHS	ID	150	37.5	4.00	3.85	Good	
			300	81.3	3.69			
10	On Pier cap-02 in north face at middle	ID	150	34.6	4.34	3.95	Good	
			300	84.2	3.56			
11	On Pier cap-02 in south face at LHS	ID	150	35.1	4.27	3.89	Good	
			300	85.5	3.51			
12	On Pier cap-02 in south face at RHS	ID	150	35.2	4.26	4.01	Good	
			300	79.7	3.76			

## CARBONATION DEPTH TEST RESULTS

S No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-02 in west face at RHS	20	10	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm to 20mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-02 in north face at RHS	20	10	Dark pink	
3	On Pier-02 in north face at 2mt level	25	20	Dark pink	
4	On Pier cap-02 in south face at LHS	30	20	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 2 at 1.5mts level in the direction of main reinforcement	66	65	As per Design
		59		
		72		
		64		
2	On Pile cap - 2 In North face	87	79	
		67		
		79		
		84		

## CRACK WIDTH

S.No	Location		Crack Width In (MM)
1	Pier -2	Pile cap	0.1 to 0.3
2		Pier	0.1 to 0.8
3		Pier Cap	0.1 to 0.3

## CORE COMPRESSIVE STRENGTH TEST RESULTS

S. No	Location	Equivalent Cube Compressive Strength In N/mm <sup>2</sup>
1	On Pier -2	21.44

#### 4.3.6 TESTING PHOTOGRAPHS:



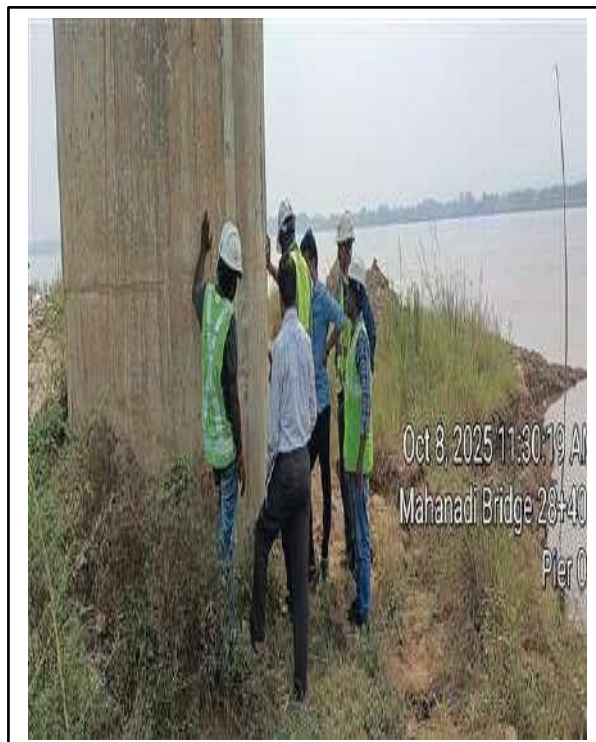
Conducting UPV tests



Conducting CD tests



Conducting RHT tests



Conducting COVER METER tests

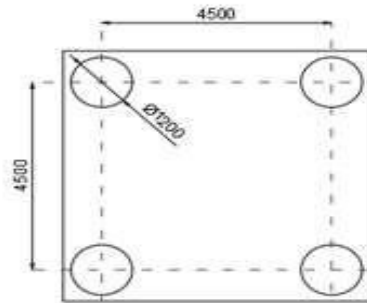


## **SUMMARY OF TEST RESULTS**

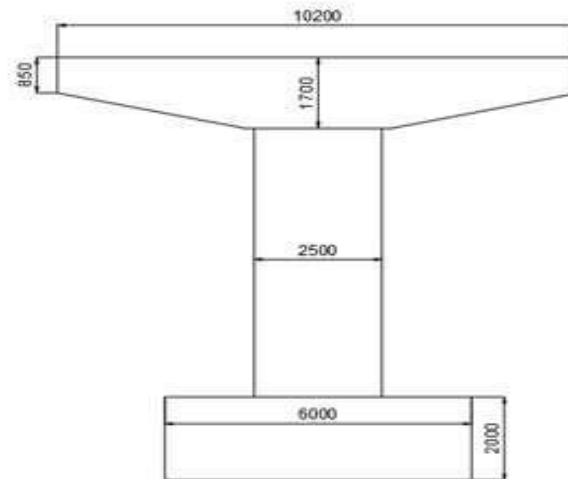
1. Rebound hammer test results revealed that quality of concrete is Good to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good" at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10 to 20mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 65 to 79 as per design.
5. Crack width was in the range for pile cap 0.1mm to 0.3mm, pier 0.1mm to 0.8mm and pier cap 0.1mm to 0.3mm.
6. The Core Compressive test results are carried out on pier-2 is 21.44 N/mm<sup>2</sup>.

## 4.4 PIER – 3

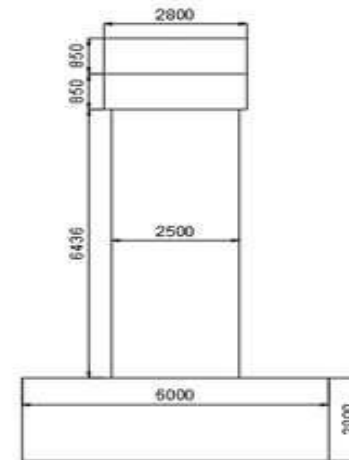
### 4.4.1 LAYOUT



PILE FOUNDATION PLAN



PIER-03 FRONT VIEW



PIER-03 SIDE VIEW

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
FOUNDATION AND PIER-03 PLAN & ELEVATION

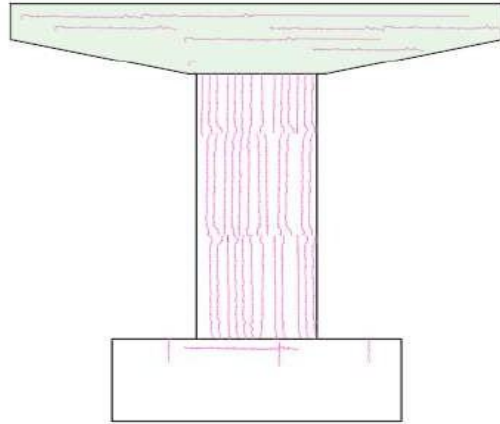
CONSULTANT:



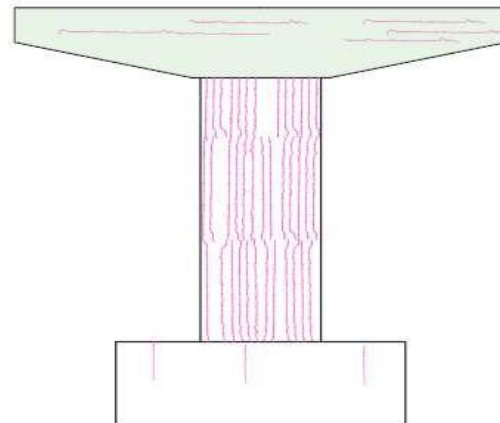
**IDDC Engineers Pvt. Ltd**

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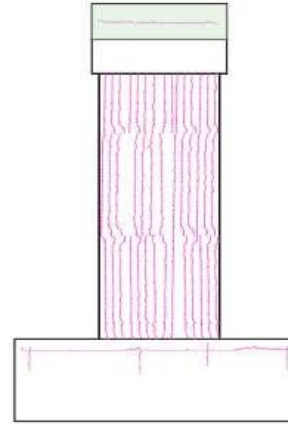
#### 4.4.2 DISTRESS PLOTTING



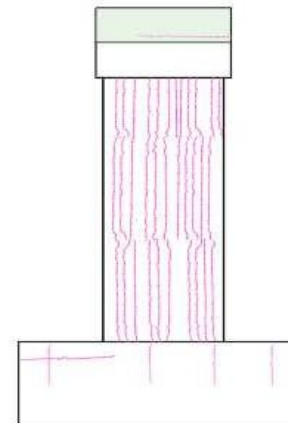
PIER-3 AT PR-2 FACE



PIER-3 AT PR-4 FACE



PIER-3 AT EAST FACE



PIER-3 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

DISTRESS MAPPING ON PIER-03

**CONSULTANT:**



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### 4.4.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
Pier – 3		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.

#### 4.4.4 PHOTOGRAPHS:



Picture-1: Pier – 3 view



Picture-2: Cracks on pier surface.



Picture-3 & 4: Cracks on pier surface





**Picture- 5 & 6: Minor cracks & leaching on pier cap.**



**Picture-7 & 8: Cracks on pile cap surface**

## 4.4.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-03 in north face at LHS	0 <sup>0</sup>	26	26	26	28	20	The surface strength of concrete is in Poor to Very Good condition as per IS 516 (Part5/Sec1):2020
			30	28	30			
			24	32	30			
2	On Pile cap-03 in north face at RHS	0 <sup>0</sup>	30	26	32	27	19	
			30	24	28			
			24	22	26			
3	On Pile cap-03 in east face at LHS	0 <sup>0</sup>	38	32	38	34	30	
			38	34	32			
			30	30	34			
4	On Pile cap-03 in east face at RHS	0 <sup>0</sup>	36	32	36	36	33	
			30	40	38			
			32	36	40			
5	On Pier-03 in north face at 1mt level	0 <sup>0</sup>	48	50	40	42	44	
			40	42	46			
			40	40	36			
6	On Pier-03 in south face at 1mt level	0 <sup>0</sup>	44	44	40	41	42	
			38	44	40			
			38	38	40			
7	On Pier-03 in east face at 2mt level	0 <sup>0</sup>	42	44	34	39	39	
			40	42	36			
			42	30	40			
8	On Pier-03 in west face at 2mt level	0 <sup>0</sup>	36	34	28	36	33	
			34	36	42			
			42	40	28			
9	On Pier-03 in north face at 5.5mts level	0 <sup>0</sup>	44	34	40	41	42	
			46	38	42			
			44	40	42			
10	On Pier cap-03 in north face at LHS	0 <sup>0</sup>	38	38	46	41	40	
			40	44	40			
			40	42	40			
11	On Pier cap-03 in north face at centre	0 <sup>0</sup>	46	46	46	44	48	
			44	40	44			
			38	48	42			

12	On Pier cap-03 in north face at RHS	0 <sup>0</sup>	42	44	40	46	51	
			48	46	42			
			48	52	50			
13	On Pier cap-03 in south face at LHS	0 <sup>0</sup>	52	50	48	48	54	
			48	48	52			
			48	42	46			
14	On Pier cap-03 in south face at centre	0 <sup>0</sup>	48	48	48	50	58	
			52	50	50			
			48	50	52			
15	On Pier cap-03 in south face at RHS	0 <sup>0</sup>	52	48	48	49	56	
			50	50	48			
			46	48	48			

### ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-03 in north face at LHS	ID	150	43.6	3.44	3.36	Doubtful	The UPV result are in Doubtful to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	91.7	3.27			
2	On Pile cap-03 in north face at RHS	ID	150	49.2	3.05	3.08	Doubtful	
			300	96.3	3.12			
3	On Pile cap-03 in east face at LHS	ID	150	47.5	3.16	3.32	Doubtful	
			300	86.4	3.47			
4	On Pile cap-03 in east face at RHS	ID	150	48.7	3.08	3.08	Doubtful	
			300	97.2	3.09			
5	On Pier-03 at 1 mt level in north face	D	2520	646.2	3.90	3.90	Good	
6	On Pier-03 at 2 mt level in east face	D	2520	701.2	3.59	3.59	Doubtful	
7	On Pier-03 at 5.5 mt level in north face	D	2520	678.4	3.71	3.71	Doubtful	
8	On Pier cap-03 in north face at LHS	ID	150	32.4	4.63	4.58	Excellent	
			300	66.1	4.54			
9	On Pier cap-03 in north face at centre	ID	150	39.2	3.83	3.73	Doubtful	
			300	82.6	3.63			



10	On Pier cap-03 in north face at RHS	ID	150	30.2	4.97	4.98	Excellent	
			300	60.1	4.99			
11	On Pier cap-03 in south face at LHS	ID	150	28.6	5.24	4.82	Excellent	
			300	68.4	4.39			
12	On Pier cap-03 in south face at centre	ID	150	32.6	4.60	4.47	Good	
			300	69.2	4.34			
13	On Pier cap-03 in south face at RHS	ID	150	30.1	4.98	4.71	Excellent	
			300	67.6	4.44			

### CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-03 in east face at RHS	20	10	Dark pink	The results indicate concrete is Carbonated up to a depth of 6mm to 20mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pier-03	30	20	Dark pink	
3	On Pier-03 at north face	10	6	Dark pink	

### CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 3 at 2mts level in the direction of main reinforcement	58	62	As per Design
		60		
		66		
		62		
2	On Pile cap - 3 In North face	70	69	
		69		
		66		
		72		

## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 3	193	210	184	170	164	184	10%	The level of corrosion is in 10% at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		208	228	201	194	188			
		181	169	170	154	141			

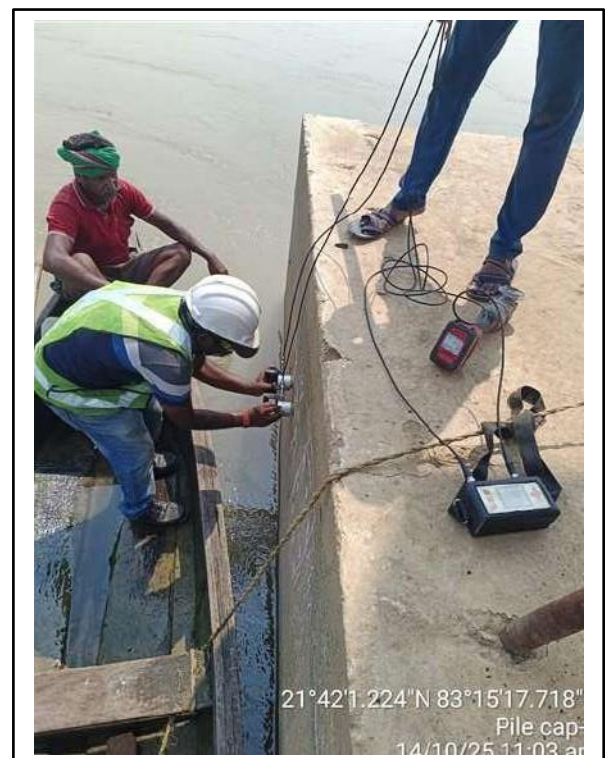
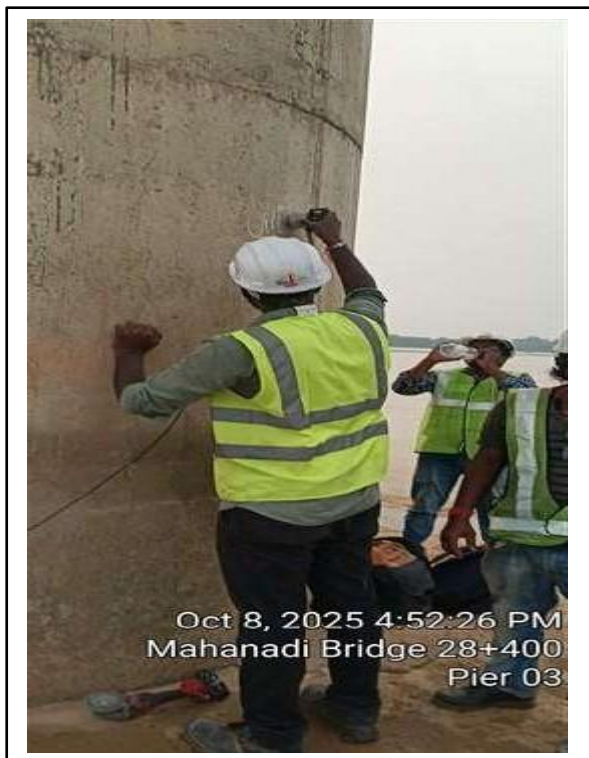
## CRACK WIDTH

S.No	Location		Crack Width In mm
1	Pier -3	Pile cap	0.1 to 0.5
2		Pier	0.1 to 1.5
3		Pier Cap	0.1 to 0.3

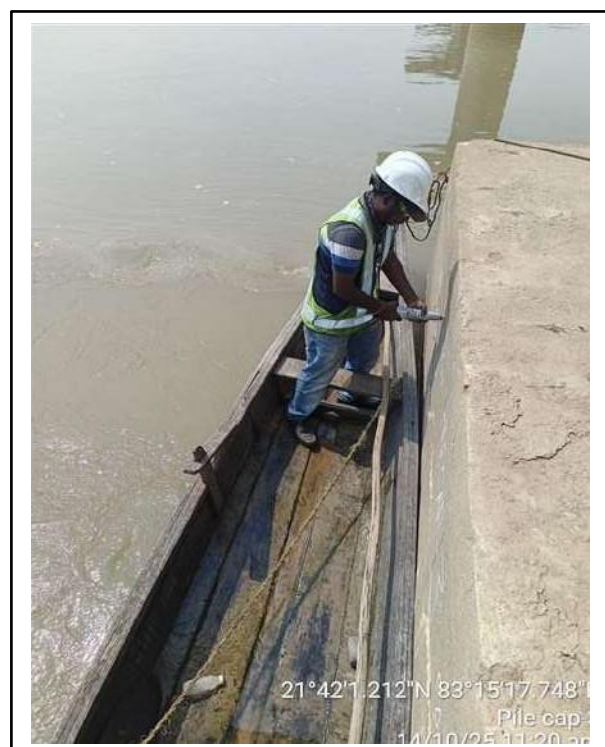
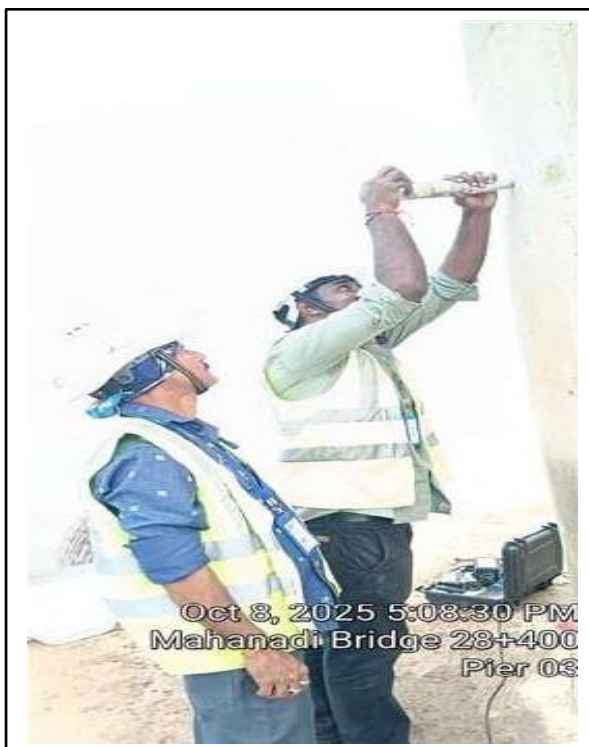
## CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent Cube Compressive Strength In N/mm2
1	On Pier -3	22.77

#### 4.4.6 TESTING PHOTOGRAPHS:



Conducting UPV test



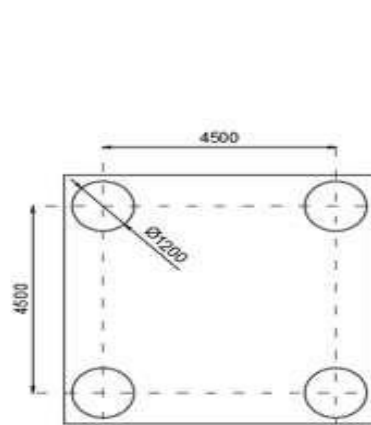
Conducting RHT test

## **SUMMARY OF TEST RESULTS**

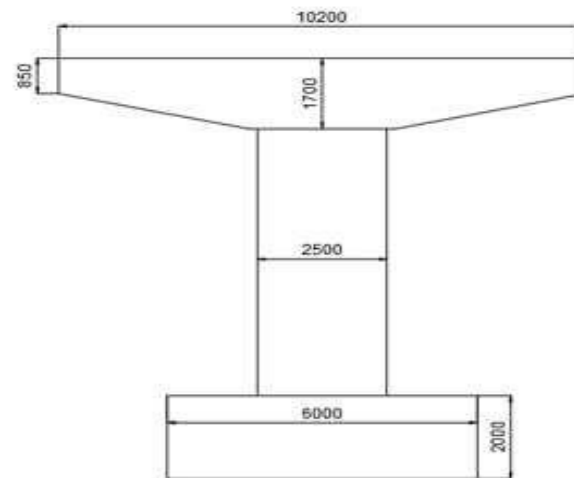
1. Rebound hammer test results revealed that quality of concrete is Poor to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Excellent" at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 6mm to 20mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 62 to 69 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of 10%.
6. Crack width was in the range for pile cap 0.1 to 0.5, pier 0.1mm to 0.5mm and pier cap 0.1mm to 0.3mm.
7. The Core Compressive test results are carried out on pier-3 is of 22.77 N/mm<sup>2</sup>

## 4.5 PIER – 4

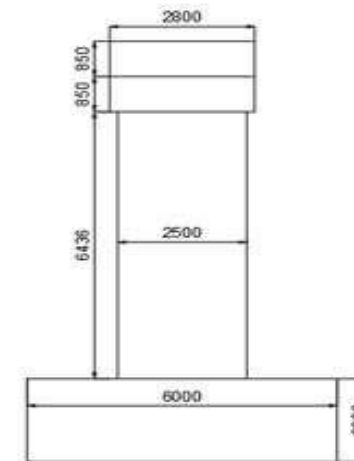
### 4.5.1 LAYOUT



PILE FOUNDATION PLAN



PIER-04 FRONT VIEW



PIER-04 SIDE VIEW

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATTISGARH UNDER PWD, NH DIVISION BILASPUR

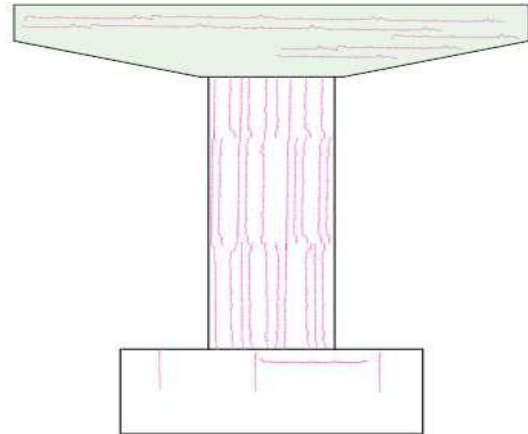
DRAWING TITLE:  
FOUNDATION AND PIER-04 PLAN & ELEVATION

CONSULTANT:

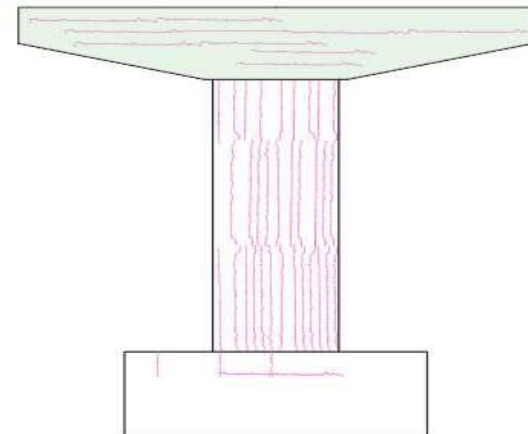


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[vizag@iddcindia.com](mailto:vizag@iddcindia.com)

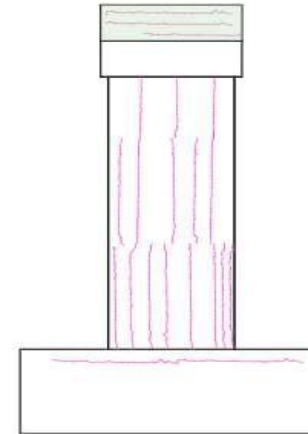
## 4.5.2 DISTRESS PLOTTING



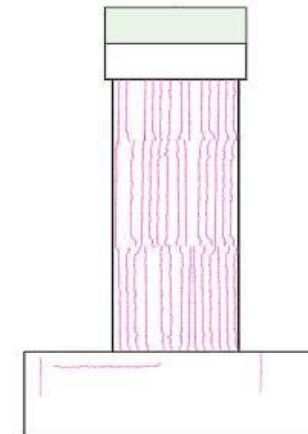
PIER-4 AT PR-3 FACE



PIER-4 AT PR-5 FACE



PIER-4 AT EAST FACE



PIER-4 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

DISTRESS MAPPING ON PIER-04

**CONSULTANT:**



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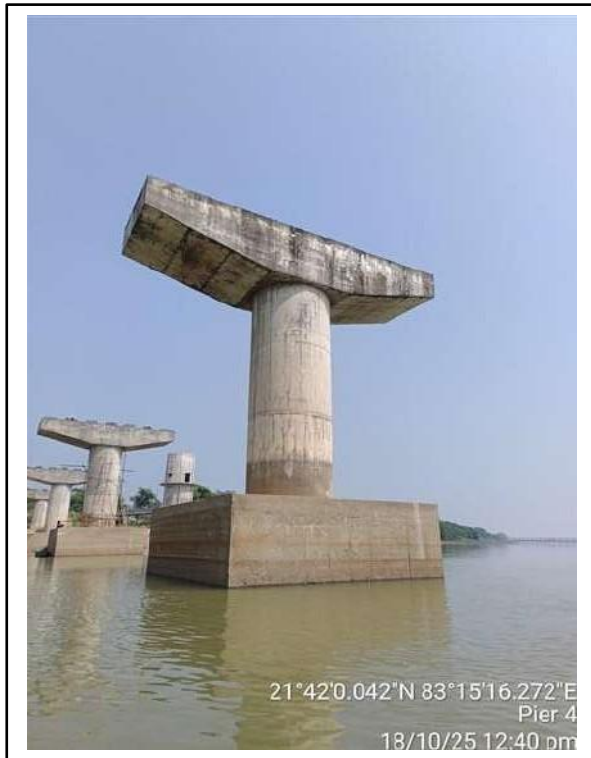
[vizag@iddcindia.com](mailto:vizag@iddcindia.com)



### 4.5.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 4</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.

#### 4.5.4 PHOTOGRAPHS:



Picture-1: Pier – 4 view



Picture-2: Cracks on pier surface.



Picture-3 & 4: Cracks on pier surface



Picture- 5 & 6: Minor cracks & leaching on pier cap.



Picture-7 & 8: Cracks on pile cap surface

## 4.5.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-04 in north face at LHS	0 <sup>0</sup>	30	30	30	28	20	The surface strength of concrete is in Fair condition as per IS 516 (Part5/Sec1):2020
			26	26	24			
			38	24	24			
2	On Pile cap-04 in north face at RHS	0 <sup>0</sup>	30	28	32	39	39	
			44	46	48			
			46	38	40			
3	On Pile cap-04 in east face at LHS	0 <sup>0</sup>	40	34	30	36	33	
			32	32	30			
			40	42	44			
4	On Pile cap-04 in east face at RHS	0 <sup>0</sup>	32	32	42	33	28	
			38	30	36			
			30	30	28			
5	On Pier-04 at 1mt level in north face	0 <sup>0</sup>	40	32	40	41	42	
			42	44	40			
			42	42	46			
6	On Pier-04 at 1mt level in east face	0 <sup>0</sup>	36	40	52	44	48	
			52	40	44			
			46	42	42			
7	On Pier-04 at 2mt level in north face	0 <sup>0</sup>	34	40	38	38	37	
			38	40	32			
			36	42	38			
8	On Pier-04 at 2mt level in west face	0 <sup>0</sup>	40	32	30	38	37	
			32	40	46			
			38	36	50			
9	On Pier-04 at 5.5mts level at north face	0 <sup>0</sup>	48	46	40	44	48	
			48	42	46			
			38	46	40			
10	On Pier cap -04 in north face at LHS	0 <sup>0</sup>	40	52	52	48	54	
			50	50	48			
			46	44	48			
11	On Pier cap -04 in north face at center	0 <sup>0</sup>	56	50	50	50	58	
			52	50	48			
			48	50	45			
12	On Pier cap -04 in north face at RHS	0 <sup>0</sup>	54	50	52	50	58	
			48	48	50			
			48	52	50			

13	On Pier cap -04 in south face at LHS	0°	54	52	54	51	60	
			52	48	46			
			50	52	50			
14	On Pier cap -04 in south face at center	0°	48	50	48	48	54	
			42	52	46			
			52	48	48			
15	On Pier cap -04 in south face at RHS	0°	54	50	52	50	58	
			48	50	48			
			52	48	52			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-04 in north face at LHS	ID	150	37.5	4.00	3.85	Good	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	81.3	3.69			
2	On Pile cap-04 in north face at RHS	ID	150	34.6	4.34	3.95	Good	
			300	84.2	3.56			
3	On Pile cap-04 in east face at LHS	ID	150	35.1	4.27	3.89	Good	
			300	85.5	3.51			
4	On Pile cap-04 in east face at RHS	ID	150	35.2	4.26	4.01	Good	
			300	79.7	3.76			
5	On Pier-04 at 1mt level at north south face	D	2500	650.3	3.84	3.84	Good	
6	On Pier-04 at 2mt level at east west face	D	2500	666.4	3.75	3.75	Good	
7	On Pier-04 at 2mt level at north south face	D	2500	748.3	3.34	3.34	Doubtful	
8		D	2500	674.2	3.71	3.71	Doubtful	
9	On Pier cap-04 in north face at LHS	ID	150	30.2	4.97	4.40	Good	
300			78.4	3.83				
10	On Pier cap-04 in north face at centre	ID	150	54.7	2.74	3.21	Doubtful	
			300	81.4	3.69			
11	On Pier cap-04 in north face at RHS	ID	150	30.9	4.85	4.44	Good	
			300	74.6	4.02			
12	On Pier cap-04 in south face at LHS	ID	150	36.8	4.08	3.85	Good	
			300	82.6	3.63			
13	On Pier cap-04 in south face at centre	ID	150	35.6	4.21	3.82	Good	
			300	87.6	3.42			
14	On Pier cap-04 in south face at RHS	ID	150	30.2	4.97	4.30	Good	
			300	82.7	3.63			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-04 in north face at RHS	20	15	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm to 20mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-04 in east face at RHS	30	20	Dark pink	
3	On Pier-04 at north face	20	15	Dark pink	
4	On Pier-04 at 2mt level in west face	20	10	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 4 at 1mts level	62	64	As per Design
		58		
		66		
		71		
2	On Pile cap - 4 In West face	77	73	
		68		
		65		
		81		

## CRACK WIDTH

S.NO	LOCATION		CRACK WIDTH IN MM
1	Pier -4	Pile cap	0.1 to 0.5
2		Pier	0.2 to 1.5
3		Pier Cap	0.1 to 0.4

## CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -4	21.80



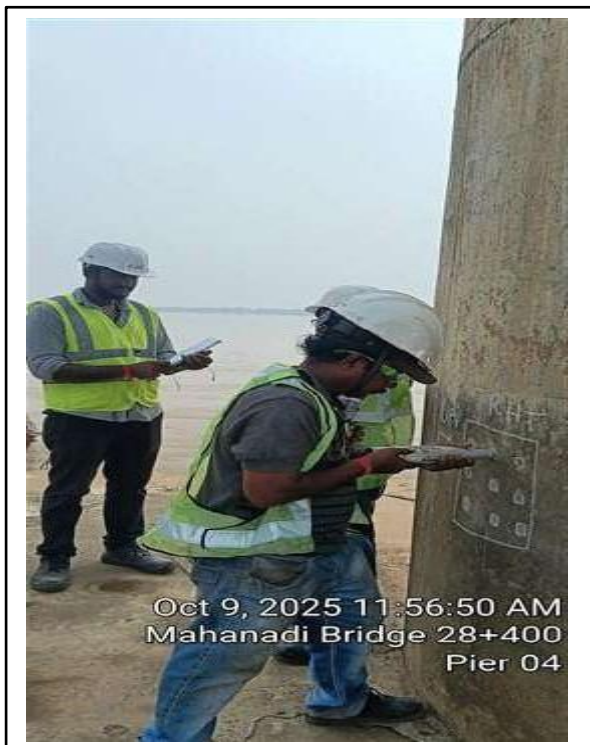
#### 4.5.6 TESTING PHOTOGRAPHS:



Conducting UPV tests



Conducting Concrete cover meter tests



Conducting RHT tests



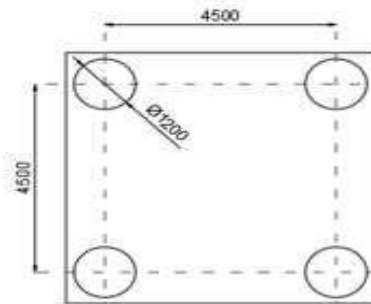
Conducting CD tests

## **SUMMARY OF TEST RESULTS**

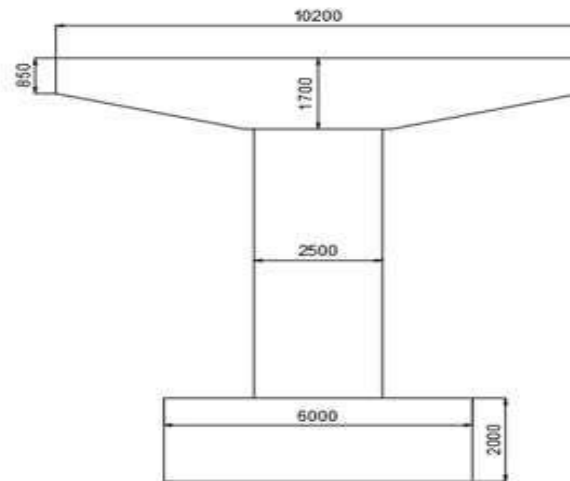
1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm to 20mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 64 to 73 as per design.
5. Crack width was in the range for pile cap 0.1 to 0.5, pier 0.2mm to 1.5mm and pier cap 0.1mm to 0.4mm.
6. The Core Compressive test results are carried out on pier-4 is in the range of 21.80 N/mm<sup>2</sup>

## 4.6 PIER – 5

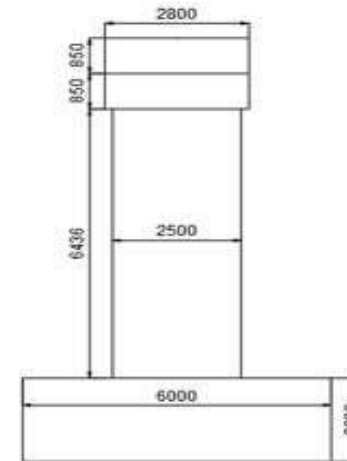
### 4.6.1 LAYOUT



PILE FOUNDATION PLAN



PIER-05 FRONT VIEW



PIER-05 SIDE VIEW

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
FOUNDATION AND PIER-05 PLAN & ELEVATION

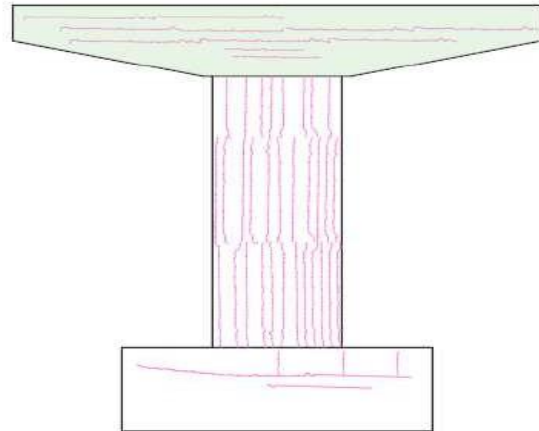
CONSULTANT:



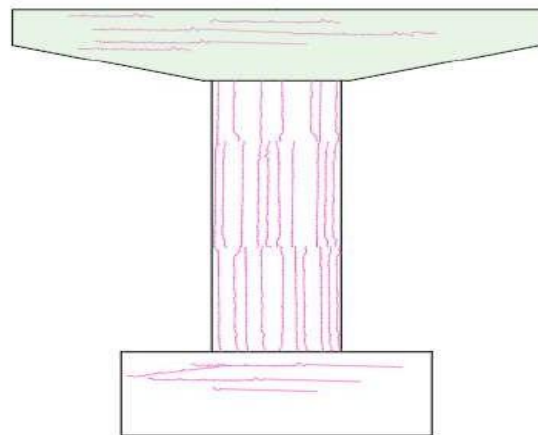
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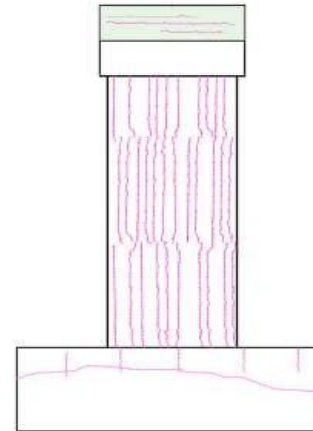
## 4.6.2 DISTRESS PLOTTING



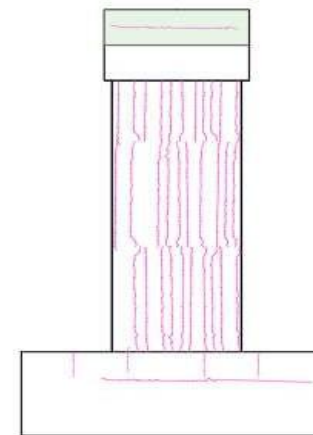
PIER-5 AT PR-4 FACE



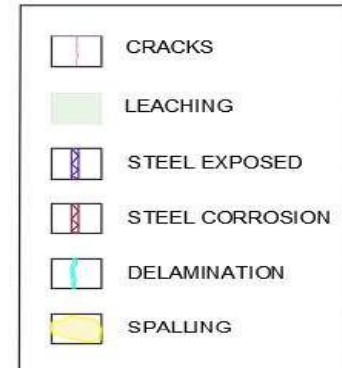
PIER-5 AT PR-6 FACE



PIER-5 AT EAST FACE



PIER-5 AT WEST FACE



**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

DISTRESS MAPPING ON PIER-05

**CONSULTANT:**



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### 4.6.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 5</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.



#### 4.6.4 PHOTOGRAPHS:



Picture-1: Pier – 5 view



Picture-2: Cracks on pier surface



Picture-3 & 4: Cracks on pier surface





Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.



Picture-7 & 8: Cracks on pile cap surface

## 4.6.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-05 in north face at LHS	0 <sup>0</sup>	40	44	40	42	44	The surface strength of concrete is in  Good condition as per IS 516 (Part5/Sec1):2020
			40	40	42			
			46	46	38			
2	On Pile cap-05 in north face at RHS	0 <sup>0</sup>	46	40	38	42	44	
			44	38	46			
			42	48	40			
3	On Pile cap-05 in east face at LHS	0 <sup>0</sup>	38	38	36	37	35	
			34	40	32			
			32	36	46			
4	On Pile cap-05 in east face at RHS	0 <sup>0</sup>	30	34	30	35	32	
			32	38	40			
			38	40	34			
5	On Pier-05 at 1 mts in north face	0 <sup>0</sup>	46	46	44	46	51	
			46	46	46			
			44	46	46			
6	On Pier-05 at 2 mts in west face	0 <sup>0</sup>	44	40	34	41	42	
			34	36	46			
			46	44	44			
7	On Pier-05 at 5.5 mts in north face	0 <sup>0</sup>	36	32	32	36	33	
			36	38	32			
			40	38	40			
8	On Pier cap-05 in north face at LHS	0 <sup>0</sup>	44	40	48	44	48	
			44	50	42			
			46	42	44			
9	On Pier cap-05 in north face at centre	0 <sup>0</sup>	44	38	40	40	40	
			40	42	40			
			36	40	38			
10	On Pier cap-05 in north face at RHS	0 <sup>0</sup>	54	48	48	47	53	
			46	50	44			
			42	46	48			
11	On Pier cap-05 in south face at LHS	0 <sup>0</sup>	50	48	42	47	53	
			46	46	48			
			50	48	46			
12	On Pier cap-05 in south face at centre	0 <sup>0</sup>	48	50	48	48	54	
			42	44	46			
			50	48	52			

13	On Pier cap-05 in south face at RHS	0°	52	46	48	49	56	
			50	50	52			
			48	46	48			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (µs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-05 in north face at LHS	ID	150	46.6	3.22	3.42	Doubtful	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	82.7	3.63			
2	On Pile cap-05 in north face at RHS	ID	150	51.6	2.91	3.19	Doubtful	
			300	86.6	3.46			
3	On Pile cap-05 in east face at LHS	ID	150	44.9	3.34	2.93	Doubtful	
			300	119.3	2.51			
4	On Pile cap-05 in east face at RHS	ID	150	42.1	3.56	3.10	Doubtful	
			300	113.7	2.64			
5	On Pier-05 in north face at 1 mt level	D	2500	642.5	3.89	3.89	Good	
6	On Pier-05 in west face at 2 mt level	D	2500	709	3.53	3.53	Doubtful	
7	On Pier-05 in west face at 5.5 mt level	D	2500	684.2	3.65	3.65	Doubtful	
8	On Pier cap-05 in north face at LHS	ID	150	38.9	3.86	3.80	Good	
			300	80.1	3.75			
9	On Pier cap-05 in north face at centre	ID	150	38.7	3.88	3.72	Doubtful	
			300	84.2	3.56			
10	On Pier cap-05 in north face at RHS	ID	150	42.6	3.52	3.52	Doubtful	
			300	85.1	3.53			
11	On Pier cap-05 in south face at LHS	ID	150	43.8	3.42	3.49	Doubtful	
			300	84.2	3.56			
12	On Pier cap-05 in south face at centre	ID	150	35.8	4.19	4.11	Good	
			300	74.3	4.04			
13	On Pier cap-05 in south face at RHS	ID	150	44.7	3.36	3.31	Doubtful	
			300	92.1	3.26			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pier cap-05 at north face	20	15	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm to
2	On Pier-05 at north south face	20	10	Dark pink	

3	On Pier-05 at west face	20	10	Dark pink	15mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
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## CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 5 at 2mts level	58	50	As per Design
		52		
		47		
		41		
2	On Pier cap- 5 in North face	63	65	
		67		
		60		
		71		

## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 5	283	276	301	346	318	289	Uncertain	The level of corrosion is in Uncertain at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		295	315	278	244	258			
		305	289	292	274	268			

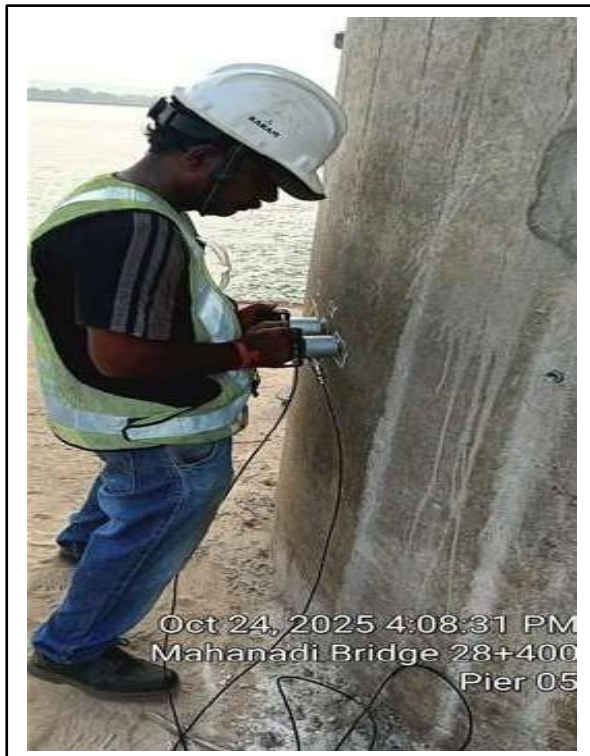
## CRACK WIDTH

S.No	Location		Crack Width In mm
1	Pier -5	Pile cap	0.1 to 0.5
2		Pier	0.1 to 1
3		Pier Cap	0.1 to 0.4

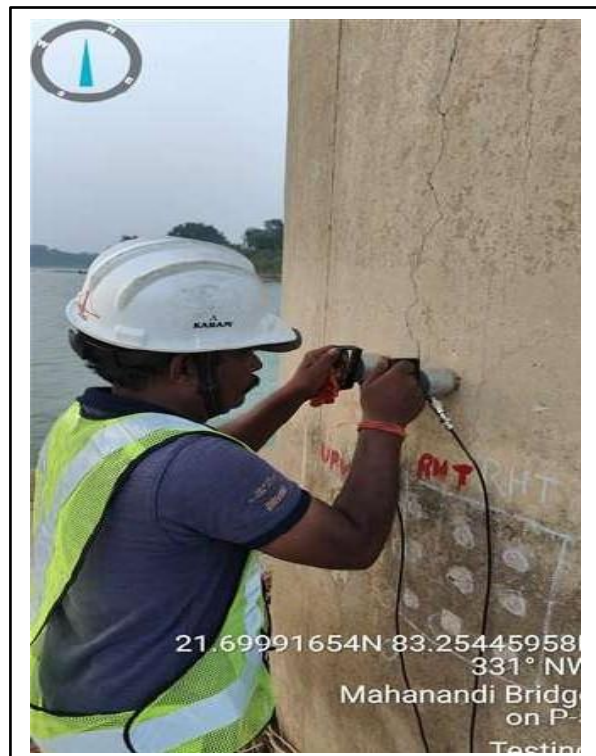
## CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent Cube Compressive Strength In N/mm <sup>2</sup>
1	On Pier -5	34.03

#### 4.6.6 TESTING PHOTOGRAPHS:



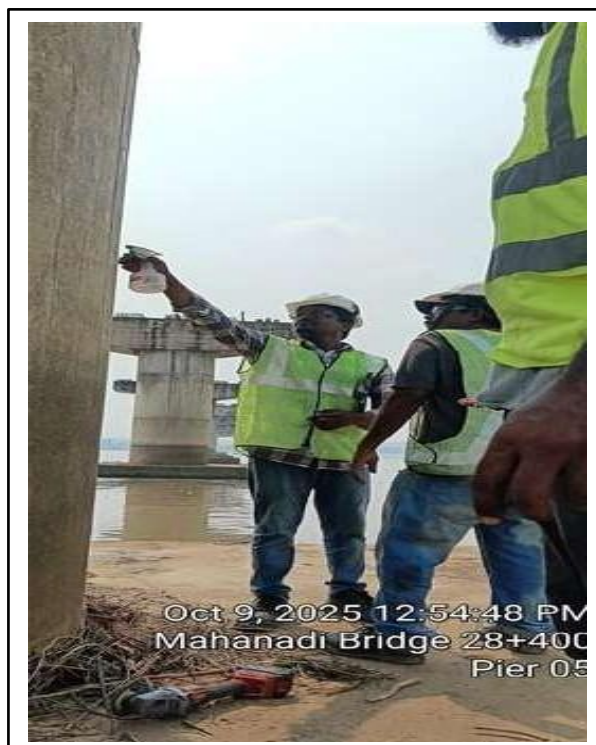
Conducting UPV tests



Measuring Crack depth



Conducting RHT tests



Conducting CD tests

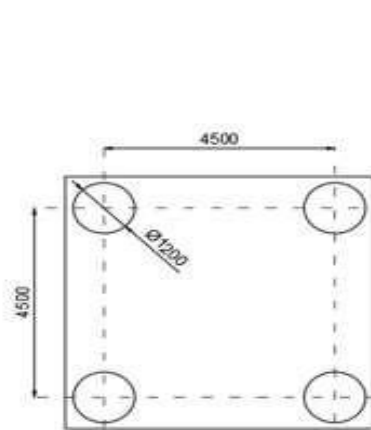
## **SUMMARY OF TEST RESULTS**

1. Rebound hammer test results revealed that quality of concrete is Good to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm to 15mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 50 to 65 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of Uncertain as per the guidelines of ASTM C 876.
6. Crack width was in the range for pile cap 0.1mm to 0.5mm, pier 0.1mm to 1mm and pier cap 0.1mm to 0.4mm.
7. The Core Compressive test results are carried out on pier-5 is in the range of 34.03 N/mm<sup>2</sup>

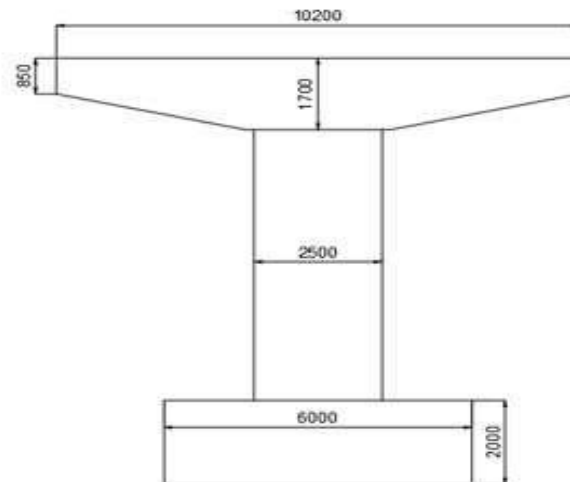


## 4.7 PIER – 6

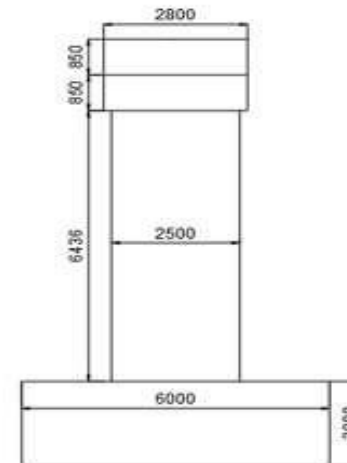
### 4.7.1 LAYOUT



PILE FOUNDATION PLAN



PIER-06 FRONT VIEW



PIER-06 SIDE VIEW

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR.

DRAWING TITLE:  
FOUNDATION AND PIER-06 PLAN & ELEVATION

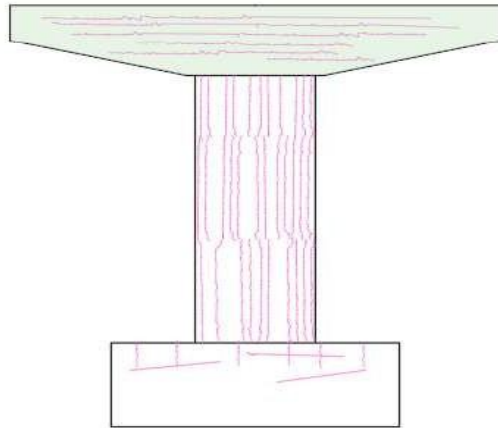
CONSULTANT:



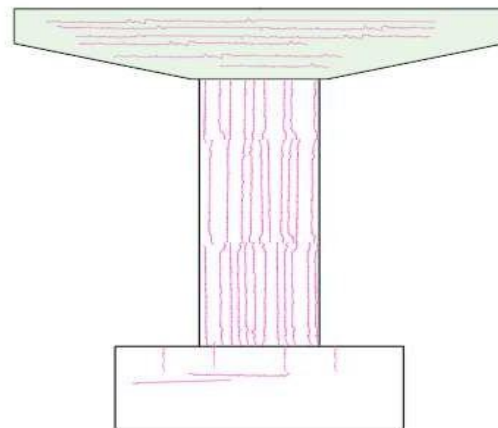
**IDDC Engineers Pvt. Ltd**

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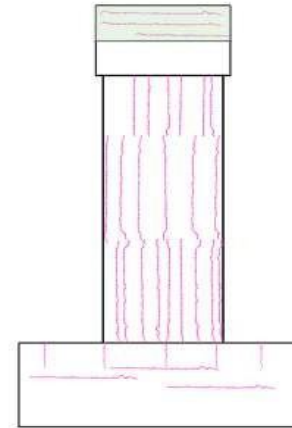
## 4.7.2 DISTRESS PLOTTING



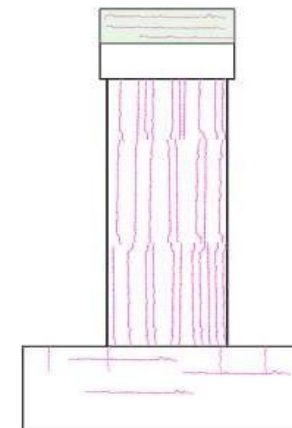
PIER-6 AT PR-5 FACE



PIER-6 AT PR-7 FACE



PIER-6 AT EAST FACE



PIER-6 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

DISTRESS MAPPING ON PIER-06

**CONSULTANT:**



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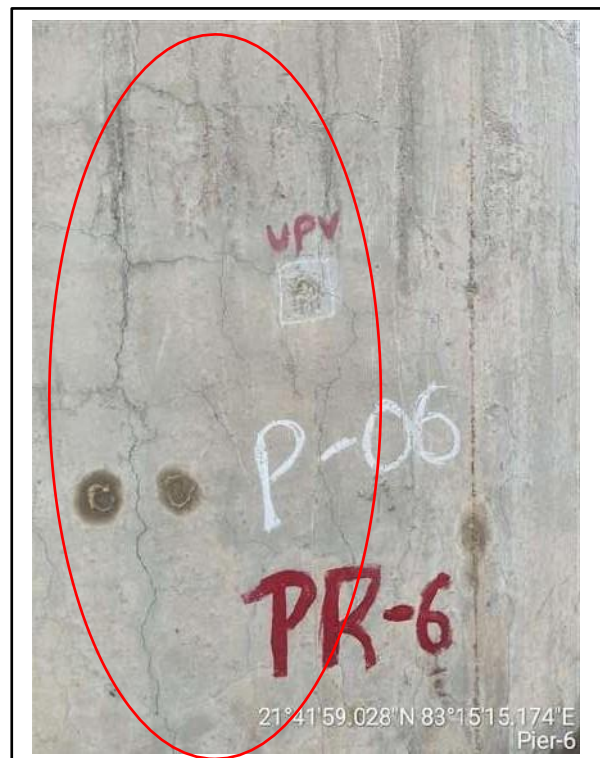
### 4.7.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
Pier - 6		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on all side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.

#### 4.7.4 PHOTOGRAPHS:



Picture-1: Pier - 6 view

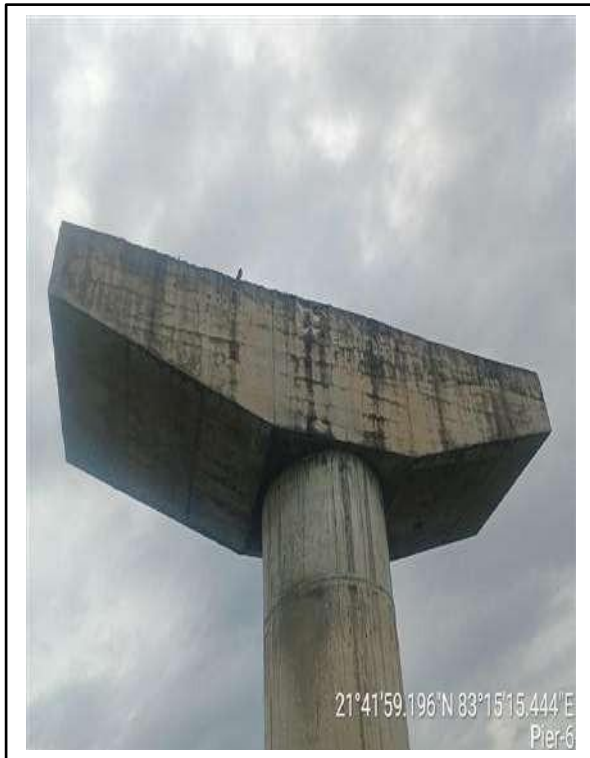


Picture-2: Cracks on pier surface



Picture-3 & 4: Cracks on pier surface





**Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.**



**Picture-7 & 8: Cracks on pile cap surface**

## 4.7.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-06 in north face at LHS	0 <sup>0</sup>	30	28	30	33	28	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			32	34	38			
			30	38	38			
2	On Pile cap-06 in north face at RHS	0 <sup>0</sup>	38	34	30	32	27	
			34	30	30			
			32	36	28			
3	On Pile cap-06 in east face at LHS	0 <sup>0</sup>	42	42	34	38	37	
			38	40	40			
			36	38	32			
4	On Pile cap-06 in east face at RHS	0 <sup>0</sup>	40	40	44	39	39	
			38	44	30			
			46	38	32			
5	On Pier-06 in north face at 1m level	0 <sup>0</sup>	42	46	40	42	44	
			40	44	40			
			44	42	44			
6	On Pier-06 at 2mt level in west face	0 <sup>0</sup>	40	38	42	40	40	
			40	46	34			
			40	46	34			
	On Pier-06 at 5.5mt level in north face	0 <sup>0</sup>	44	42	44	42	44	
			40	42	44			
			38	48	40			
7	On Pier cap-06 in north face at LHS	0 <sup>0</sup>	48	44	46	45	50	
			50	42	50			
			46	38	42			
8	On Pier cap-06 in north face at centre	0 <sup>0</sup>	50	44	48	45	50	
			42	44	46			
			44	44	42			
9	On Pier cap-06 in north face at RHS	0 <sup>0</sup>	50	46	46	41	42	
			44	42	40			
			32	34	32			
10	On Pier cap-06 in north face at LHS	0 <sup>0</sup>	42	38	48	46	51	
			50	48	52			
			48	48	42			
11	On Pier cap-06 in north face at centre	0 <sup>0</sup>	44	52	40	46	51	
			44	48	50			
			42	48	44			



12	On Pier cap-06 in north face at RHS	0°	46	44	48	46	51	
			52	46	44			
			42	46	42			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-06 in north face at LHS	ID	150	48.9	3.07	3.34	Doubtful	The UPV result are in Doubtful to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	83.1	3.61			
2	On Pile cap-06 in north face at RHS	ID	150	44.3	3.39	3.29	Doubtful	
			300	93.7	3.20			
3	On Pile cap-06 in east face at LHS	ID	150	48.5	3.09	3.33	Doubtful	
			300	83.9	3.58			
4	On Pile cap-06 in east face at RHS	ID	150	52.1	2.88	2.50	Doubtful	
			300	141.6	2.12			
5	On Pier-06 in north face at 1m level	D	2500	676.3	3.70	3.70	Doubtful	
6	On Pier-06 at 2mt level in west face	D	2500	672.7	3.72	3.72	Doubtful	
7	On Pier-06 in west face at 5.5 mt level	D	2500	724.6	3.45	3.45	Doubtful	
8	On Pier cap-06 in north face at LHS	ID	150	39.4	3.81	3.72	Doubtful	
			300	82.8	3.62			
9	On Pier cap-06 in north face at centre	ID	150	31.6	4.75	4.02	Good	
			300	91.2	3.29			
10	On Pier cap-06 in north face at RHS	ID	150	42.3	3.55	3.47	Doubtful	
			300	88.5	3.39			
11	On Pier cap-06 in south face at LHS	ID	150	37.2	4.03	3.75	Good	
			300	86.4	3.47			
12	On Pier cap-06 in south face at centre	ID	150	35.3	4.25	3.97	Good	
			300	81.2	3.69			
13	On Pier cap-06 in south face at RHS	ID	150	28.1	5.34	4.53	Excellent	
			300	80.7	3.72			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pier cap-06 in east face	25	20	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm to 25mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pier-06 in north face at 1m level	30	25	Dark pink	
3	On Pier-06 at 2mt level in west face	20	10	Dark pink	
4	On Pier-06 at 5.5mt level in north face	25	15	Dark pink	
5	On Pier-06 in south face at centre	20	15	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 6 at 1mts level	48	42	As per Design
		39		
		42		
		38		
2	On Pier cap- 6 in South face	58	66	
		61		
		69		
		76		

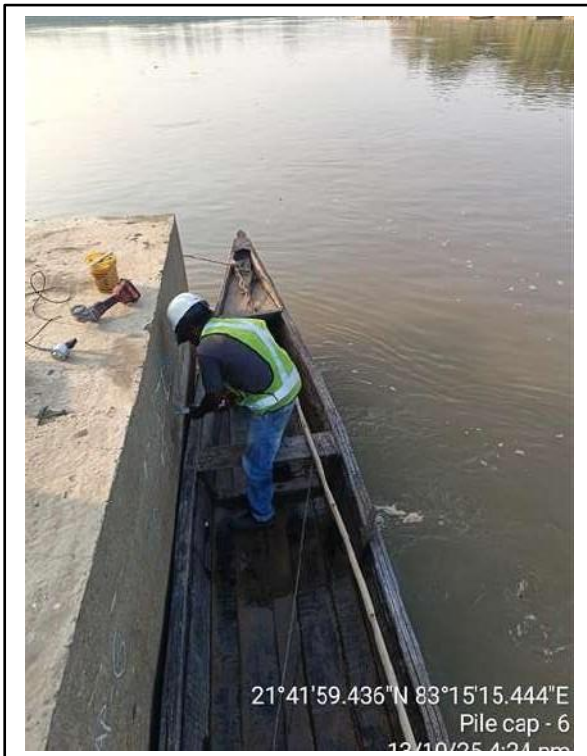
## CRACK WIDTH

S.NO	LOCATION		CRACK WIDTH IN MM
1	Pier -6	Pile cap	0.1 to 0.4
2		Pier	0.1 to 1
3		Pier Cap	0.1 to 0.3

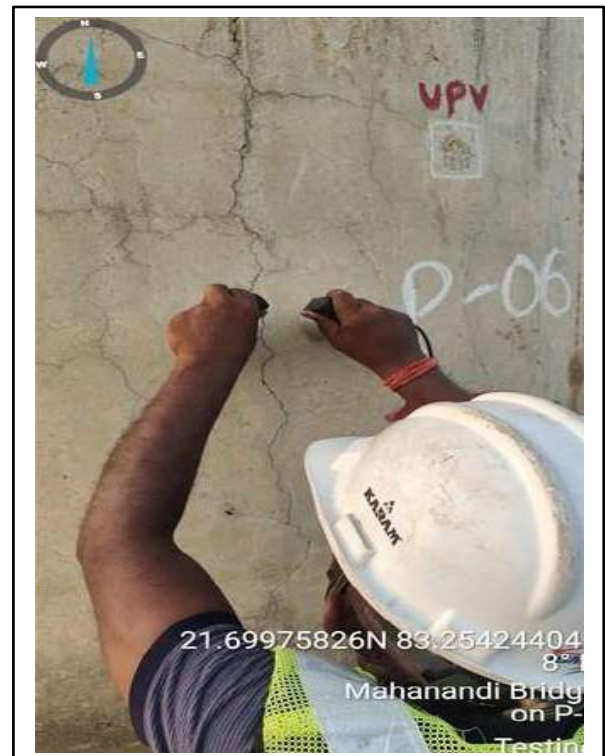
## CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -6	23.84

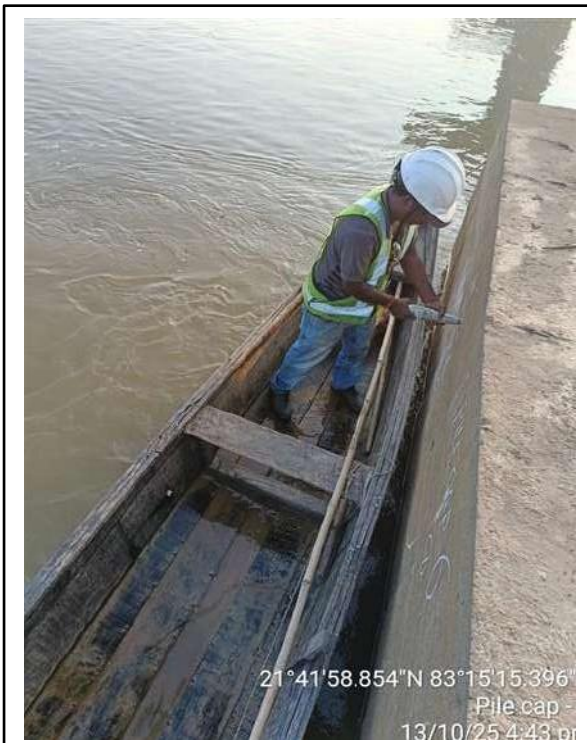
#### 4.7.6 TESTING PHOTOGRAPHS:



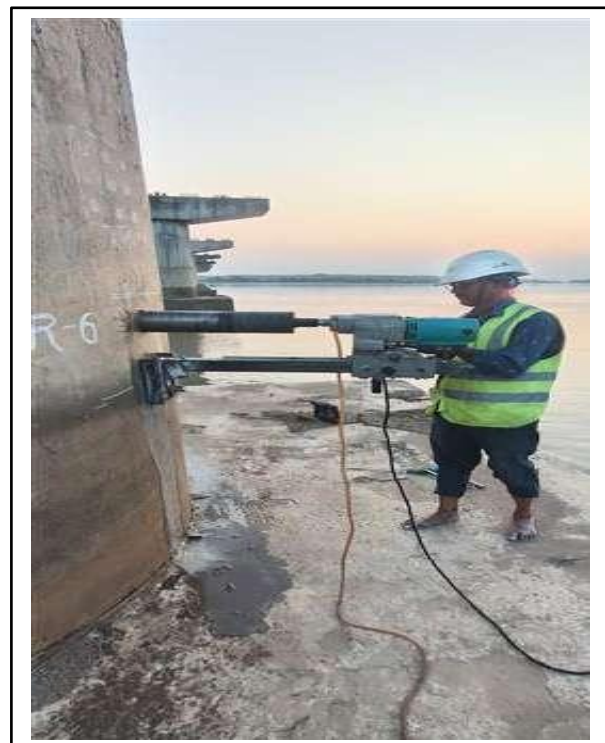
Conducting UPV tests



Measuring Crack depth



Conducting RHT tests



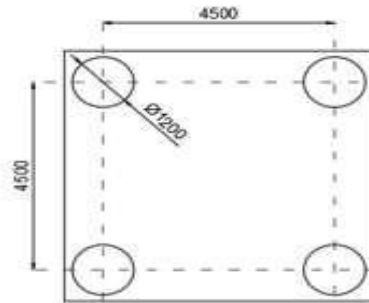
Conducting Core cutting tests

## **SUMMARY OF TEST RESULTS**

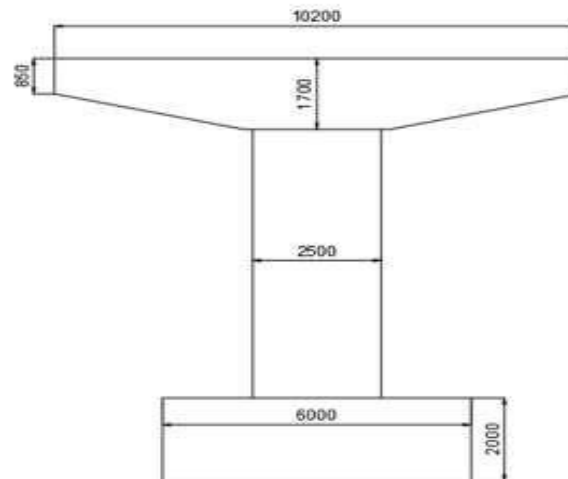
1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Excellent" at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm to 25mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 42 to 66 as per design.
5. Crack width was in the range for pile cap 0.1 to 0.4, pier 0.1mm to 1mm and pier cap 0.1mm to 0.3mm.
6. The Core Compressive test results are carried out on pier-6 is in the range of 23.84 N/mm<sup>2</sup>

## 4.8 PIER – 7

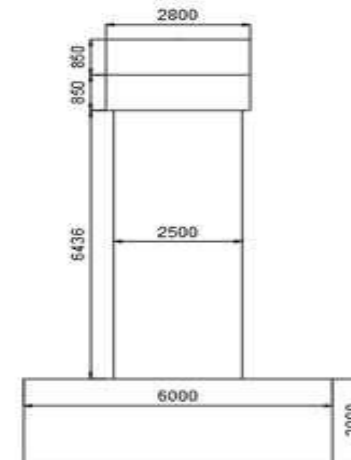
### 4.8.1 LAYOUT



PILE FOUNDATION PLAN



PIER-07 FRONT VIEW



PIER-07 SIDE VIEW

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

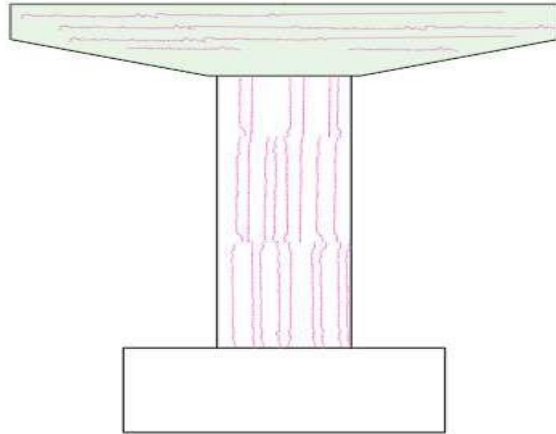
DRAWING TITLE:  
FOUNDATION AND PIER-07 PLAN & ELEVATION

CONSULTANT:

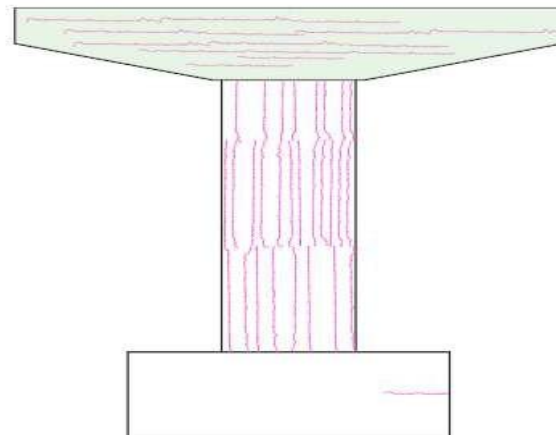


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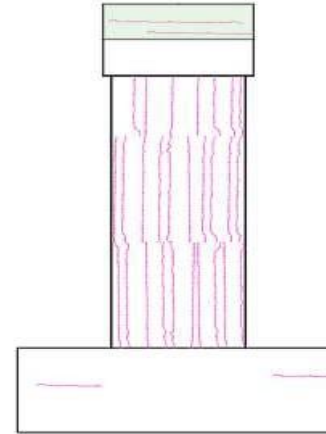
## 4.8.2 DISTRESS PLOTTING



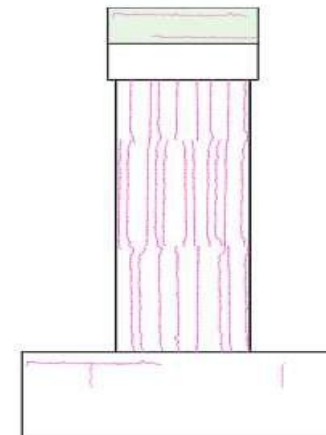
PIER-7 AT PR-6 FACE



PIER-7 AT PR-8 FACE



PIER-7 AT EAST FACE



PIER-7 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

### PROJECT:

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

### DRAWING TITLE:

DISTRESS MAPPING ON PIER-07

### CONSULTANT:



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[vizag@iddcindia.com](mailto:vizag@iddcindia.com)



### 4.8.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 7</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on all side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.

#### 4.8.4 PHOTOGRAPHS:



Picture-1: Pier – 7 view



Picture-2: Cracks on pier surface



Picture-3 & 4: Cracks on pier surface



Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.



Picture-7 & 8: Cracks on pile cap surface

## 4.8.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-07 in north face at LHS	0 <sup>0</sup>	28	34	28	33	28	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			28	38	38			
			32	36	36			
2	On Pile cap-07 in north face at RHS	0 <sup>0</sup>	30	32	28	31	27	
			34	30	28			
			28	40	30			
3	On Pile cap-07 in east face at LHS	0 <sup>0</sup>	34	34	32	31	37	
			34	30	28			
			30	34	26			
4	On Pile cap-07 in east face at RHS	0 <sup>0</sup>	32	32	30	34	39	
			38	36	36			
			32	30	36			
5	On Pier-07 in north face at 1m level	0 <sup>0</sup>	48	42	46	42	44	
			40	40	40			
			34	44	44			
6	On Pier-07 at 2mt level in west face	0 <sup>0</sup>	44	34	40	40	40	
			42	40	40			
			42	38	42			
7	On Pier-07 at 5.5mts level in north face	0 <sup>0</sup>	40	38	42	42	44	
			46	48	44			
			40	40	38			
8	On Pier cap -07 at in north face at LHS.	0 <sup>0</sup>	38	42	40	41	42	
			44	42	40			
			46	40	40			
9	On Pier cap -07 at in north face at centre.	0 <sup>0</sup>	46	48	42	42	44	
			38	32	42			
			44	42	44			
10	On Pier cap -07 at in north face at RHS.	0 <sup>0</sup>	38	42	48	46	51	
			42	52	50			
			50	48	44			
11	On Pier cap -07 at in south face at RHS.	0 <sup>0</sup>	54	50	46	50	58	
			54	50	50			
			48	48	46			
12	On Pier cap -07 at in south face at RHS.	0 <sup>0</sup>	44	42	46	43	46	
			44	46	48			
			34	38	42			
13	On Pier cap -07 at in south face at RHS.	0 <sup>0</sup>	40	40	48	41	42	
			50	42	42			
			42	32	32			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-07 in north face at LHS	ID	150	33.2	4.52	4.44	Good	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	68.9	4.35			
2	On Pile cap-07 in north face at RHS	ID	150	32.1	4.67	4.05	Good	
			300	87.4	3.43			
3	On Pile cap-07 in east face at LHS	ID	150	35.8	4.19	3.92	Good	
			300	82.1	3.65			
4	On Pile cap-07 in east face at RHS	ID	150	35.7	4.20	3.87	Good	
			300	84.7	3.54			
5	On Pier-07 in north south face at 1m level	D	2500	676.2	3.70	3.70	Doubtful	
6	On Pier-07 at 2mt level in east west face	D	2500	655	3.82	3.82	Good	
7	On Pier-07 in west face at 5.5 mt level	D	2500	789.6	3.17	3.17	Doubtful	
8	On Pier cap-07 in north face at LHS	ID	150	40.1	3.74	3.62	Doubtful	
			300	85.7	3.50			
9	On Pier cap-07 in north face at centre	ID	150	35.3	4.25	3.85	Good	
			300	86.9	3.45			
10	On Pier cap-07 in north face at RHS	ID	150	37.9	3.96	3.66	Doubtful	
			300	89.1	3.37			
11	On Pier cap-07 in south face at LHS	ID	150	30.4	4.93	4.45	Good	
			300	75.7	3.96			
12	On Pier cap-07 in south face at centre	ID	150	41.8	3.59	3.53	Doubtful	
			300	86.5	3.47			
13	On Pier cap-07 in south face at RHS	ID	150	37.9	3.96	3.69	Doubtful	
			300	87.5	3.43			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-07 in north face at LHS	10	5	Dark pink	The results indicate concrete is Carbonated up to a depth of 5mm to 15mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-07 in east face at RHS	20	10	Dark pink	
3	On Pier-07 in north face at 1m level	20	10	Dark pink	
4	On Pier-07 at 2mt level in west face	20	10	Dark pink	
5	On Pier cap-07 in north face at centre	25	15	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 7 at 2mts level	54	54	As per Design
		58		
		56		
		49		
2	On Pile cap - 7 In West face	77	73	
		68		
		65		
		81		

## CRACK WIDTH

S.No	Location		Crack Width In mm
1	Pier -7	Pile cap	0.1 to 0.6
2		Pier	0.1 to 1.5
3		Pier Cap	0.1 to 0.6



#### 4.8.5 TESTING PHOTOGRAPHS:



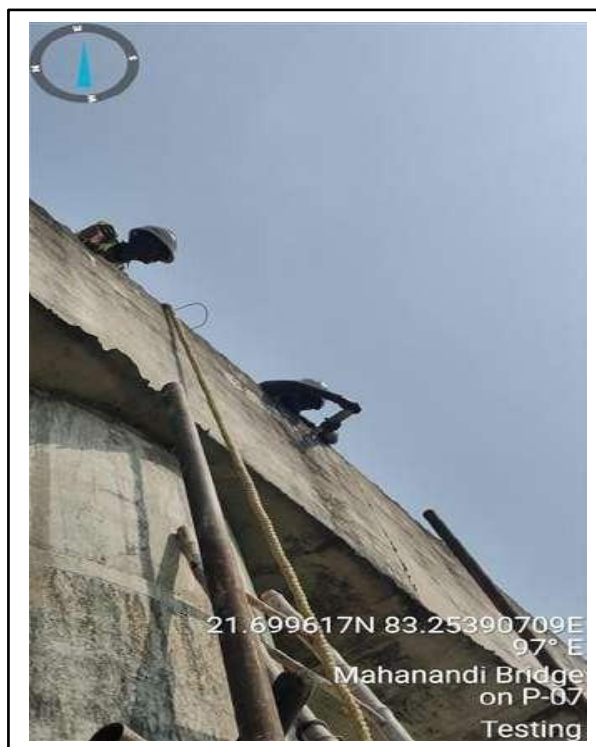
Conducting UPV test



Measuring Crack depth



Conducting RHT test

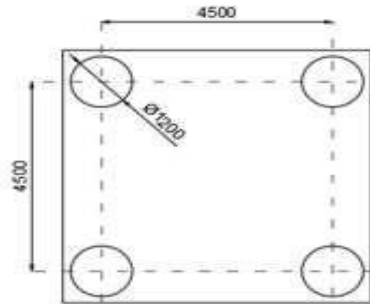


## **SUMMARY OF TEST RESULTS**

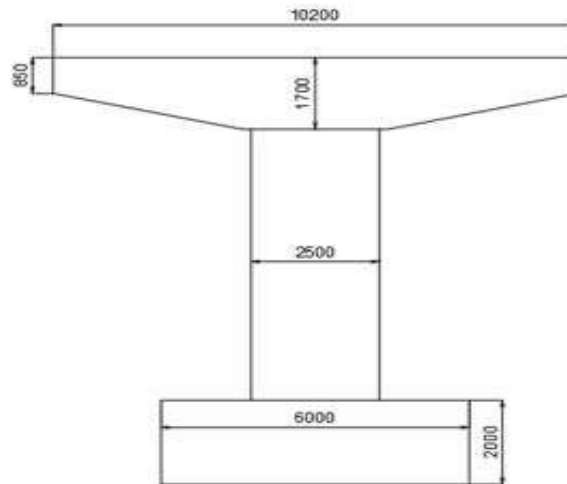
1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 5mm to 15mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 54 to 73 as per design.
5. Crack width was in the range for pile cap 0.1mm to 0.6mm, pier 0.1mm to 1.5mm and pier cap 0.1mm to 0.6mm.

## 4.9 PIER – 8

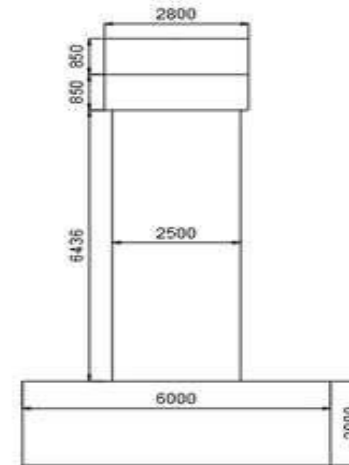
### 4.9.1 LAYOUT



PILE FOUNDATION PLAN



PIER-08 FRONT VIEW



PIER-08 SIDE VIEW

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR.

DRAWING TITLE:  
FOUNDATION AND PIER-08 PLAN & ELEVATION

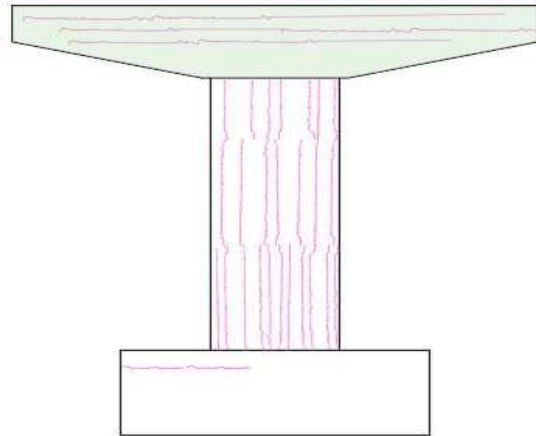
CONSULTANT:



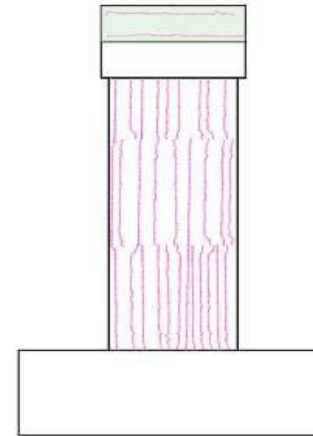
**IDDC Engineers Pvt. Ltd**

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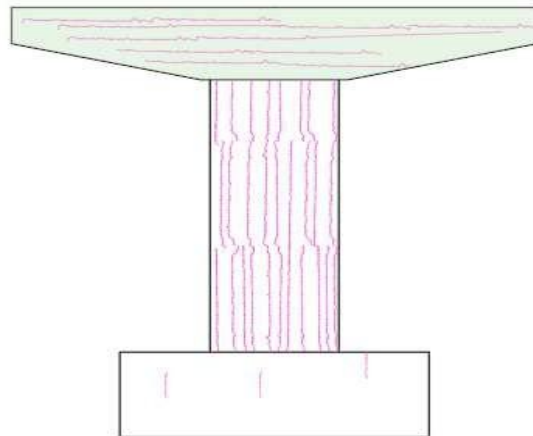
## 4.9.2 DISTRESS PLOTTING



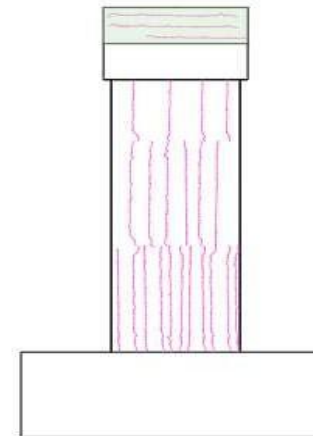
PIER-8 AT PR-7 FACE



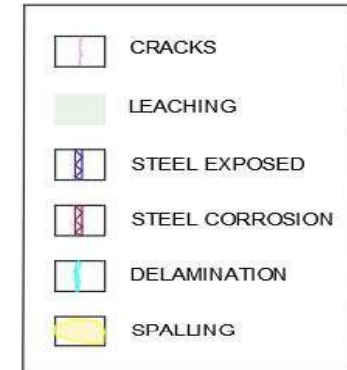
PIER-8 AT EAST FACE



PIER-8 AT PR-9 FACE



PIER-8 AT WEST FACE



PROJECT:

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR.

DRAWING TITLE:

DISTRESS MAPPING ON PIER-08

CONSULTANT:



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e-mail: [iddcvizag@yahoo.co.in](mailto:iddcvizag@yahoo.co.in) /

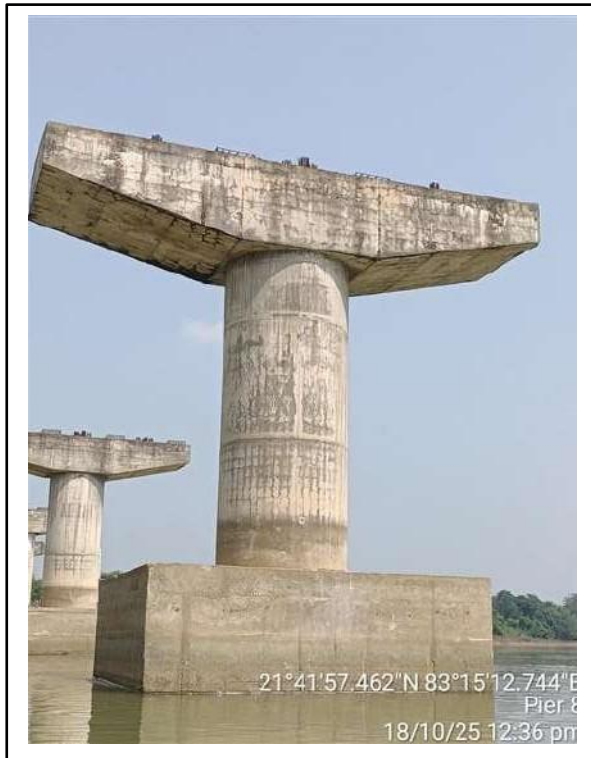
[vizag@iddcindia.com](mailto:vizag@iddcindia.com)

### 4.9.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 8</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on all side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.



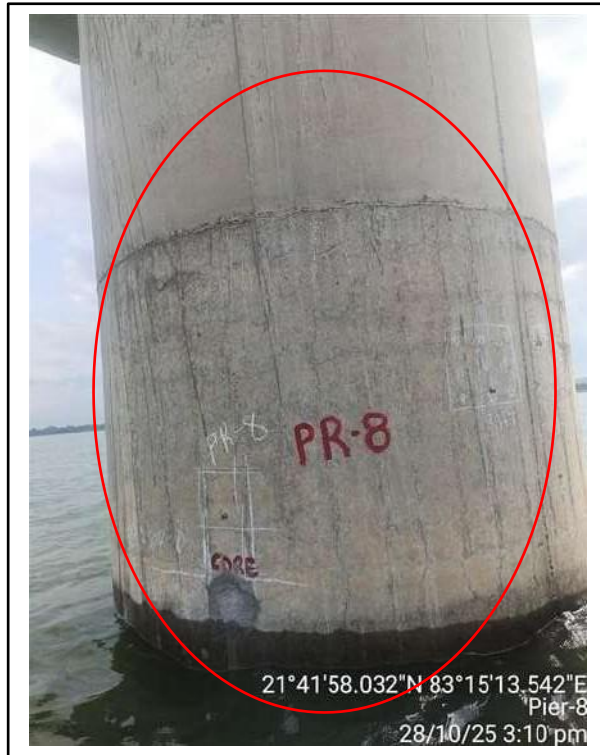
#### 4.9.4 PHOTOGRAPHS:



Picture-1: Pier – 8 view



Picture-2: Cracks on pier surface



Picture-3 & 4: Cracks on pier surface





Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.



Picture-7 & 8: Cracks on pile cap surface

## 4.9.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Compressive Strength N/Mm <sup>2</sup>	Remarks
1	On Pile cap-08 in north face at LHS	0 <sup>0</sup>	34	38	40	35	32	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			38	38	34			
			30	28	36			
2	On Pile cap-08 in north face at RHS	0 <sup>0</sup>	36	32	30	33	28	
			30	30	28			
			28	38	42			
3	On Pile cap-08 in east face at LHS	0 <sup>0</sup>	38	38	36	33	28	
			24	28	28			
			34	32	36			
4	On Pile cap-08 in east face at RHS	0 <sup>0</sup>	34	44	38	35	32	
			34	30	32			
			34	34	32			
5	On Pier-08 in north face at 1m level	0 <sup>0</sup>	40	46	40	43	46	
			40	42	44			
			42	46	44			
6	On Pier-08 at 2mt level in east face	0 <sup>0</sup>	34	32	32	35	32	
			42	38	36			
			36	30	32			
7	On Pier-08 at 5.5mt level in north face	0 <sup>0</sup>	40	36	40	35	32	
			32	34	30			
			34	38	32			
8	On Pier cap -08 at in north face at LHS.	0 <sup>0</sup>	42	40	38	38	37	
			36	34	38			
			38	40	36			
9	On Pier cap -08 at in north face at centre.	0 <sup>0</sup>	44	40	44	44	48	
			50	48	52			
			46	38	38			
10	On Pier cap -08 at in north face at RHS.	0 <sup>0</sup>	42	38	34	35	32	
			32	34	46			
			30	28	28			
11	On Pier cap -08 at in south face at LHS.	0 <sup>0</sup>	54	46	40	45	50	
			48	44	42			
			42	48	40			
12	On Pier cap -08 at in south face at centre.	0 <sup>0</sup>	42	38	40	42	44	
			48	46	30			
			40	46	46			
13	On Pier cap -08 at in south face at RHS.	0 <sup>0</sup>	40	44	46	37	35	
			34	34	34			
			36	34	32			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (Mm)	Time (μs)	Velocity (Km/Sec)	Avg. Velocity (Km/Sec)	Condition	Remarks
1	On Pile cap-08 in north face at LHS	ID	150	39.2	3.83	3.62	Doubtful	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	87.9	3.41			
2	On Pile cap-08 in north face at RHS	ID	150	33.6	4.46	4.02	Good	
			300	83.7	3.58			
3	On Pile cap-08 in east face at LHS	ID	150	48.8	3.07	3.25	Doubtful	
			300	87.7	3.42			
4	On Pile cap-08 in east face at RHS	ID	150	32.2	4.66	4.48	Good	
			300	69.9	4.29			
5	On Pier-08 in north south face at 1m level	D	2500	631.7	3.96	3.96	Good	
6	On Pier-08 at 2mt level in east west face	D	2500	680.5	3.67	3.67	Doubtful	
7	On Pier-08 in west face at 5.5 mt level	D	2500	709.6	3.52	3.52	Doubtful	
8	On Pier cap-08 in north face at LHS	ID	150	36.9	4.07	3.74	Doubtful	
			300	88.1	3.41			
9	On Pier cap-08 in north face at centre	ID	150	40.2	3.73	3.89	Good	
			300	74.1	4.05			
10	On Pier cap-08 in north face at RHS	ID	150	35.5	4.23	3.83	Good	
			300	87.5	3.43			
11	On Pier cap-08 in south face at LHS	ID	150	32.9	4.56	3.99	Good	
			300	87.5	3.43			
12	On Pier cap-08 in south face at centre	ID	150	40.2	3.73	3.63	Doubtful	
			300	84.9	3.53			
13	On Pier cap-08 in south face at RHS	ID	150	50.4	2.98	2.88	Doubtful	
			300	107.8	2.78			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-08 in east face at LHS	20	10	Dark pink	The results indicate concrete

2	On Pile cap-08 in east face at RHS	20	10	Dark pink	is Carbonated up to a depth of 10mm to 30mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
3	On Pile-08 in north face at 5.5mt level	30	20	Dark pink	

### CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 8 at 1mts level	64	60	As per Design
		55		
		59		
		62		
2	On Pile cap - 8 In North face	70	74	
		82		
		74		
		70		

### HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 8	183	172	160	152	134	182	10%	The level of corrosion is in 10% at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		191	183	180	177	169			
		217	210	207	196	195			

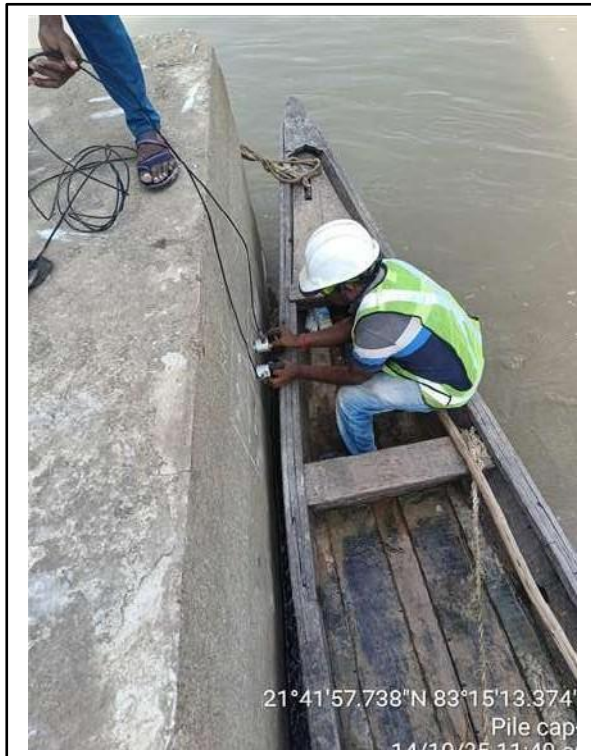
### CRACK WIDTH

S.NO	LOCATION		CRACK WIDTH IN MM
1	Pier -8	Pile cap	0.1 to 0.8
2		Pier	0.1 to 0.8
3		Pier Cap	0.1 to 0.4

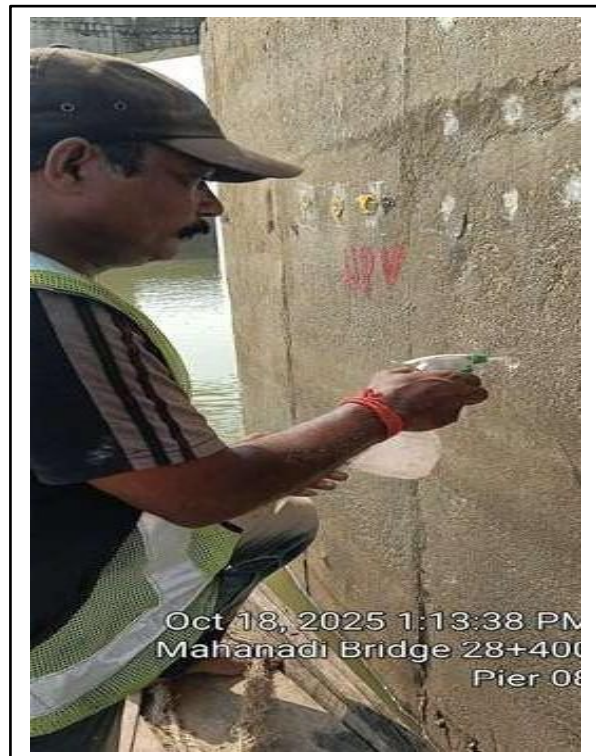
### CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent Cube Compressive Strength In N/mm <sup>2</sup>
1	On Pier -8	16.44

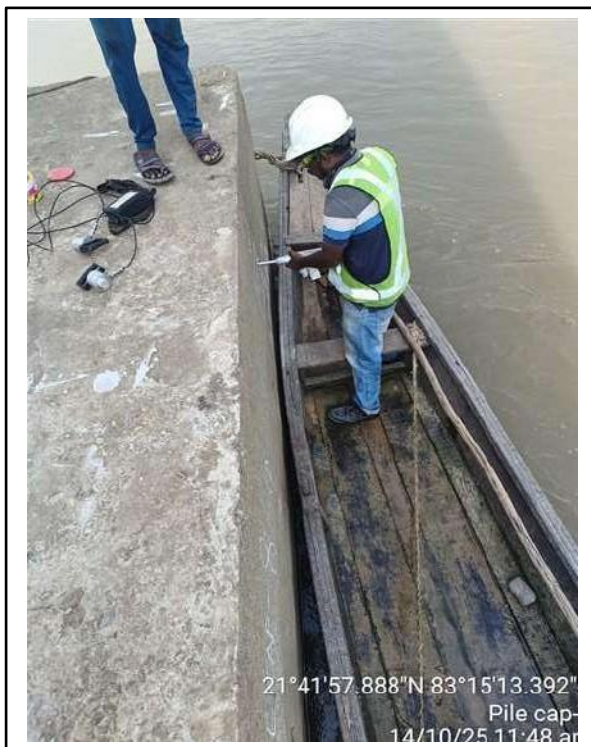
#### 4.9.6 TESTING PHOTOGRAPHS:



Conducting UPV test



Conducting CD test



Conducting RHT test



Conducting Core cutting test



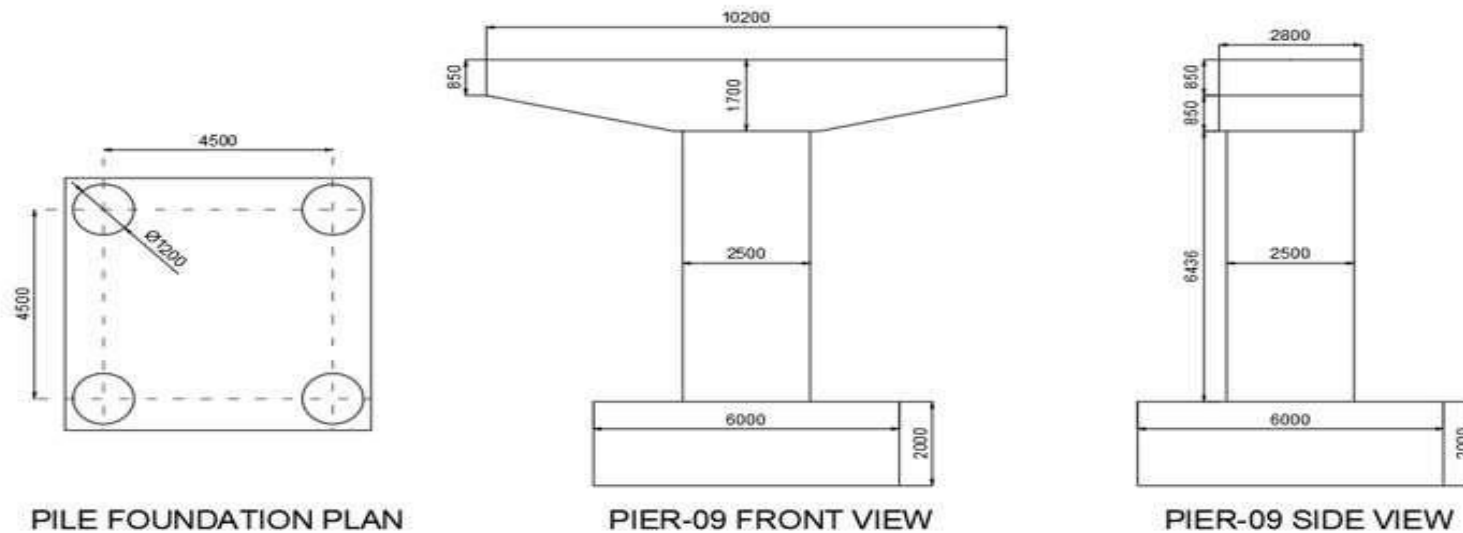
## **SUMMARY OF TEST RESULTS**

1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm to 30mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 60 to 74 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of 10% as per the guidelines of ASTM C 876.
6. Crack width was in the range for pile cap 0.1mm to 0.8mm, pier 0.1mm to 0.8mm and pier cap 0.1mm to 0.4mm.
7. The Core Compressive test results are carried out on pier-8 is in the range of 16.44 N/mm<sup>2</sup>



## 4.10 PIER – 9

### 4.10.1 LAYOUT



**PROJECT:**  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**  
FOUNDATION AND PIER-09 PLAN & ELEVATION

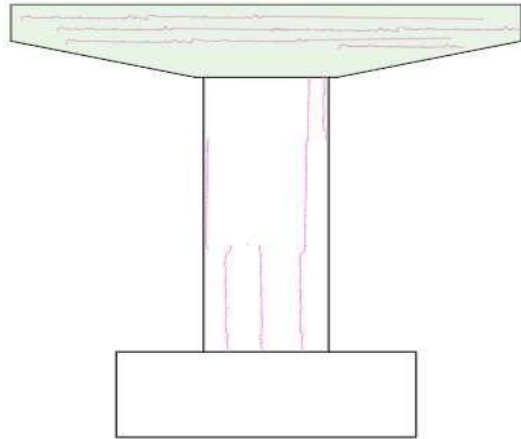
**CONSULTANT:**



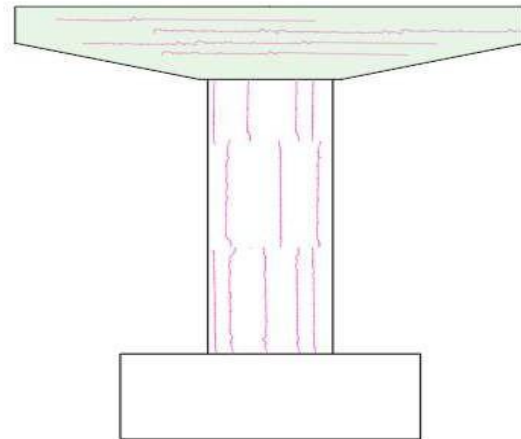
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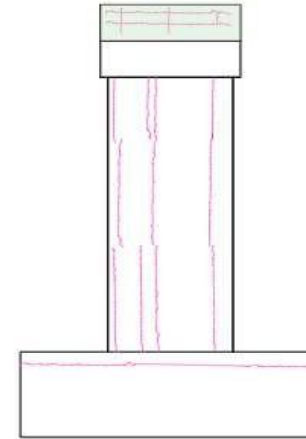
## 4.10.2 DISTRESS PLOTTING



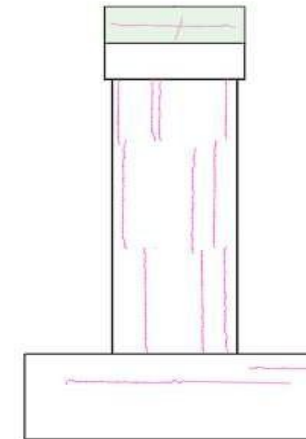
PIER-9 AT PR-8 FACE









PIER-9 AT PR-10 FACE



PIER-9 AT EAST FACE



PIER-9 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

### PROJECT:

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

### DRAWING TITLE:

DISTRESS MAPPING ON PIER-09

### CONSULTANT:



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[vizag@iddcindia.com](mailto:vizag@iddcindia.com)

### 4.10.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 9</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on all side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.

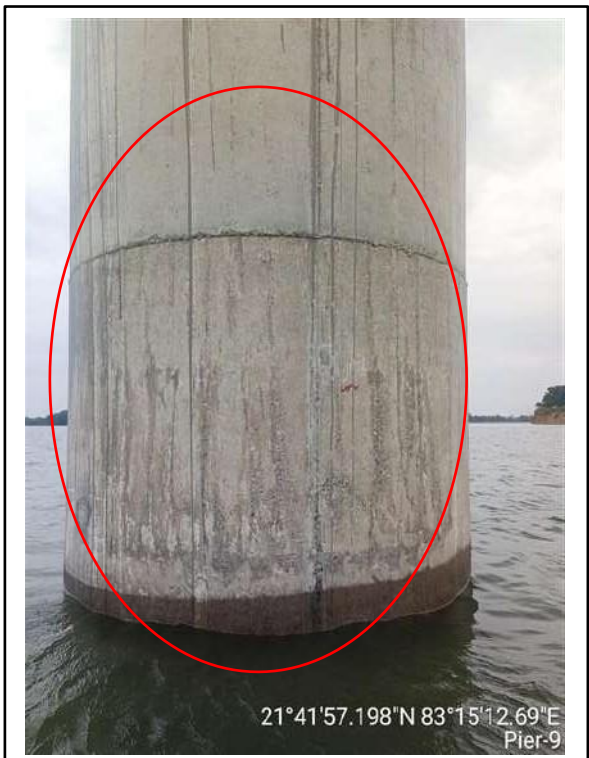
#### 4.10.4 PHOTOGRAPHS:



Picture-1: Pier – 9 view



Picture-2: Cracks on pier surface



Picture-3 & 4: Cracks on pier surface



**Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.**



**Picture-7 & 8: Cracks on pile cap surface**



## 4.10.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Compressive Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-09 in north face at LHS	0 <sup>0</sup>	30	34	34	33	28	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			30	34	32			
			32	34	36			
2	On Pile cap-09 in north face at RHS	0 <sup>0</sup>	30	32	34	30	23	
			30	28	28			
			32	28	30			
3	On Pile cap-09 in east face at LHS	0 <sup>0</sup>	34	30	36	38	37	
			38	38	40			
			38	38	46			
4	On Pile cap-09 in east face at RHS	0 <sup>0</sup>	38	36	34	37	35	
			38	36	38			
			32	42	42			
5	On Pier-09 in north face at 1m level	0 <sup>0</sup>	44	42	40	44	48	
			44	44	46			
			40	50	42			
6	On Pier-09 at 2mt level in west face	0 <sup>0</sup>	34	32	30	38	37	
			40	38	38			
			42	38	46			
7	On Pier-09 at 5.5mt level in north face	0 <sup>0</sup>	42	44	46	42	44	
			42	42	44			
			40	40	42			
8	On Pier cap - 09 at in north face at LHS.	0 <sup>0</sup>	40	40	40	44	48	
			48	52	46			
			42	44	40			
9	On Pier cap - 09 at in north face at centre.	0 <sup>0</sup>	42	46	42	44	48	
			46	48	44			
			44	42	42			
10	On Pier cap - 09 at in north face at RHS.	0 <sup>0</sup>	44	42	46	45	50	
			46	48	44			
			48	42	48			
11	On Pier cap - 09 at in south face at LHS.	0 <sup>0</sup>	38	40	40	39	39	
			36	36	42			
			40	42	40			
12	On Pier cap - 09 at in south face at centre.	0 <sup>0</sup>	38	42	40	40	40	
			42	40	42			
			38	36	40			
13	On Pier cap - 09 at in south face at RHS.	0 <sup>0</sup>	42	40	40	42	44	
			42	42	42			
			40	42	46			



## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-09 in north face at LHS	ID	150	32.8	4.57	4.20	Good	The UPV result are in Doubtful to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	78.5	3.82			
2	On Pile cap-09 in north face at RHS	ID	150	33.1	4.53	4.19	Good	
			300	77.9	3.85			
3	On Pile cap-09 in east face at LHS	ID	150	30.8	4.87	4.31	Good	
			300	80.1	3.75			
3	On Pile cap-09 in east face at RHS	ID	150	35.6	4.21	3.93	Good	
			300	82.4	3.64			
4	On Pier-09 in north south face at 1m level	D	2500	569.2	4.39	4.39	Good	
5	On Pier-09 in east west face at 2m level	D	2500	624.6	4.00	4.00	Good	
6	On Pier-09 in west face at 5.5 mt level	D	2500	649.7	3.85	3.85	Good	
7	On Pier cap-09 in north face at LHS	ID	150	32.3	4.64	4.01	Good	
			300	89	3.37			
8	On Pier cap-09 in north face at centre	ID	150	42.4	3.54	3.49	Doubtful	
			300	87.2	3.44			
9	On Pier cap-09 in north face at RHS	ID	150	35.1	4.27	3.92	Good	
			300	84.2	3.56			
10	On Pier cap-09 in south face at LHS	ID	150	33.7	4.45	4.55	Excellent	
			300	64.5	4.65			
11	On Pier cap-09 in south face at centre	ID	150	38.6	3.89	4.34	Good	
			300	62.6	4.79			
12	On Pier cap-09 in south face at RHS	ID	150	35.2	4.26	4.42	Good	
			300	65.6	4.57			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-09 in east face at LHS	10	5	Dark pink	The results indicate concrete is Carbonated up to a depth of 5mm to 25mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-09 in east face at RHS	20	10	Dark pink	
3	On Pier-09 in north face at 5.5mts level	35	25	Dark pink	
4	On Pier cap-09 in north face at RHS	30	20	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 9 at 2mts level	69	68	As per Design
		61		
		72		
		68		
2	On Pier cap - 9 In South face	69	65	
		62		
		64		
		65		

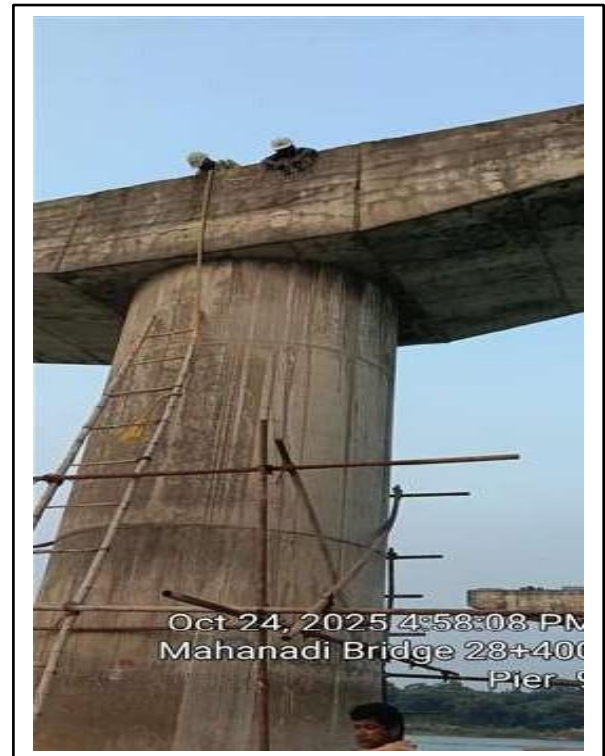
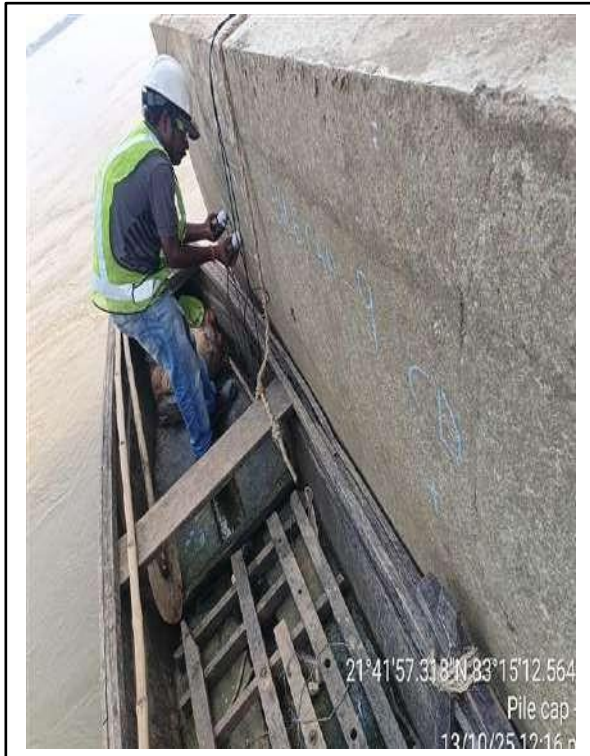
## CRACK WIDTH

S.No	Location		Crack Width In mm
1	Pier -9	Pile cap	0.1 to 0.3
2		Pier	0.1 to 0.9
3		Pier Cap	0.1 to 0.3

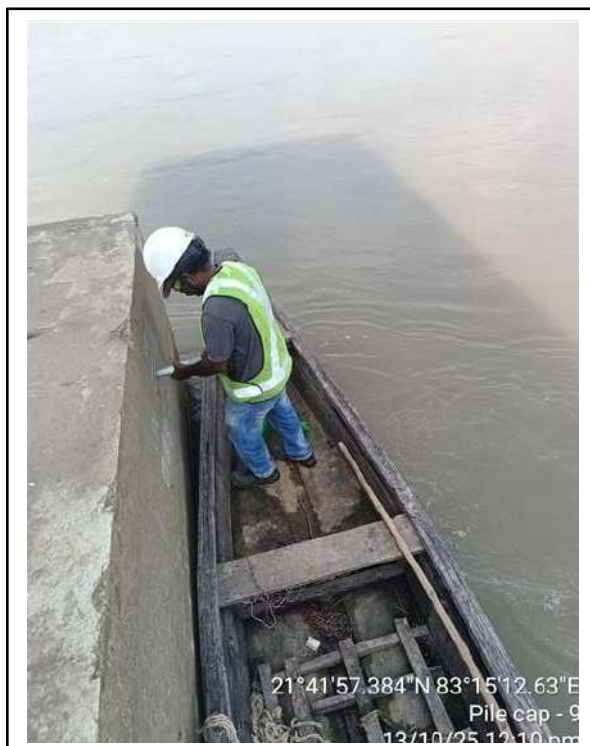
## CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -9	42.99

#### 4.10.6 PHOTOGRAPHS:



Conducting UPV test



Conducting RHT test

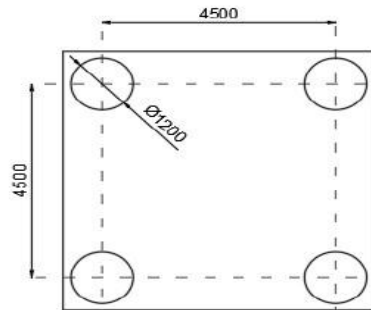
Conducting CD test

## **SUMMARY OF TEST RESULTS**

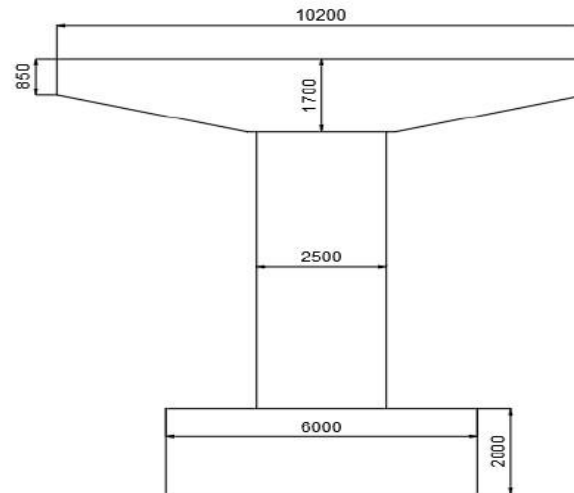
1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Excellent" at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 5mm to 25mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 65 to 68 as per design.
5. Crack width was in the range for pile cap 0.1mm to 0.3mm, pier 0.1mm to 0.9mm and pier cap 0.1mm to 0.3mm.
6. The Core Compressive test results are carried out on pier-9 is 42.99 N/mm<sup>2</sup>

## 4.11 PIER – 10

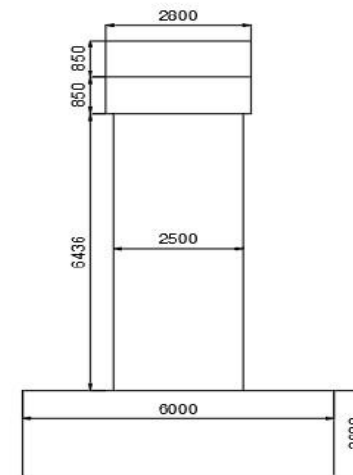
### 4.11.1 LAYOUT



PILE FOUNDATION PLAN



PIER-10 FRONT VIEW



PIER-10 SIDE VIEW

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

FOUNDATION AND PIER-10 PLAN & ELEVATION

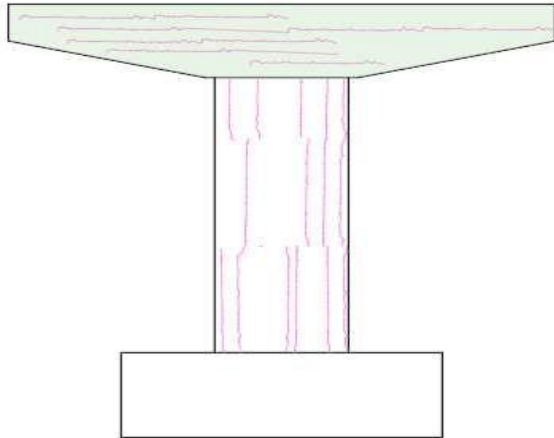
**CONSULTANT:**



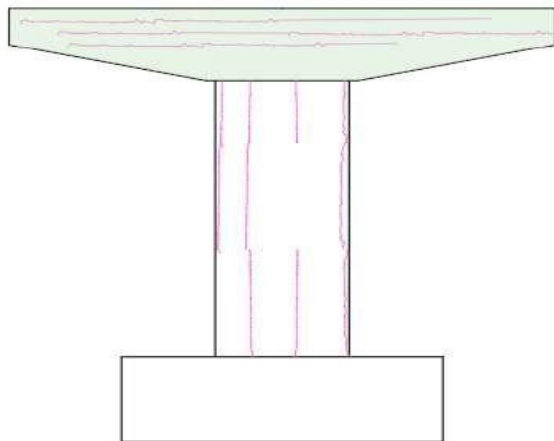
**IDDC Engineers Pvt. Ltd**

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[vizag@iddcindia.com](mailto:vizag@iddcindia.com)

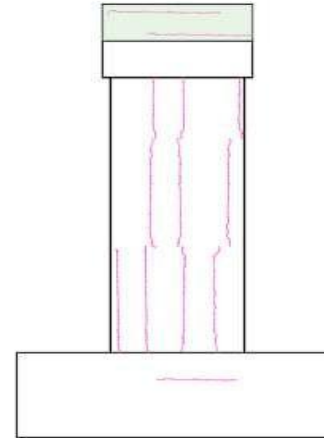
#### 4.11.2 DISTRESS PLOTTING



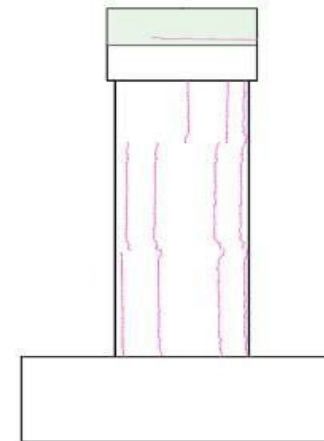
PIER-10 AT PR-9 FACE









PIER-10 AT PR-11 FACE



PIER-10 AT EAST FACE



PIER-10 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

PROJECT:  
CONSULTANCY SERVICES FOR THIRD  
PARTY CONDITION SURVEY & TESTS OF  
PARTIALLY EXECUTED WORK OF MAJOR  
BRIDGE AT KM 28+400 OVER MAHANADI  
ON NH-153 RAIGARH SARANGARH  
SARAIPALI IN THE DISTRICT SAKTI OF  
CHHATISGARH UNDER PWD, NH  
DIVISION BILASPUR

DRAWING TITLE:  
DISTRESS MAPPING ON PIER-10

CONSULTANT:



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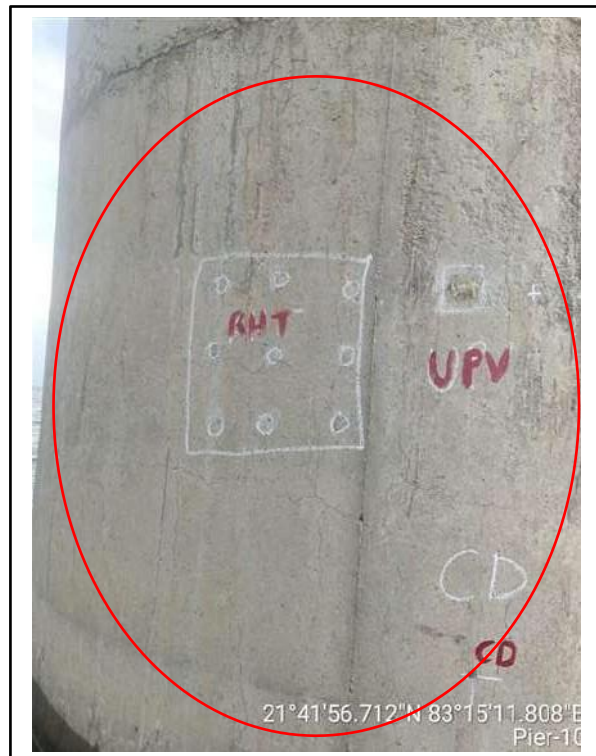
### 4.11.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 10</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on all side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at numerous locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at numerous locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.

#### 4.11.4 PHOTOGRAPHS:



Picture-1: Pier – 10 view



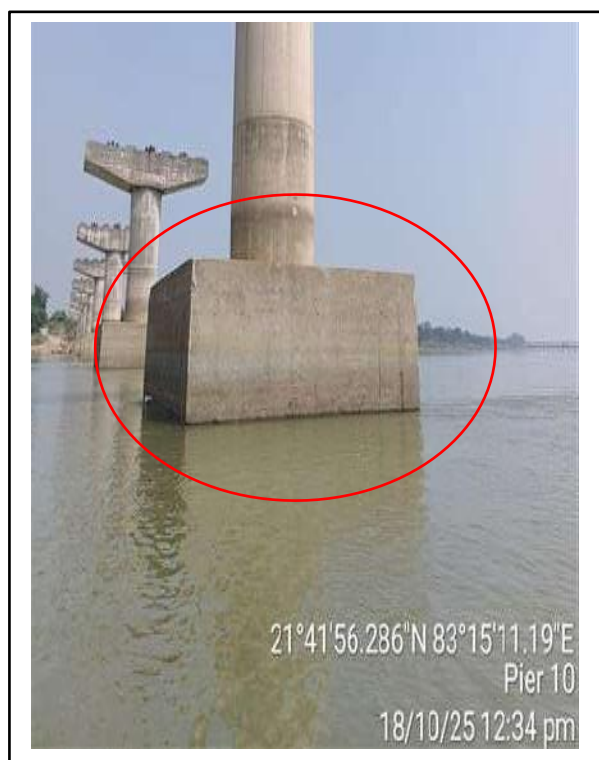
Picture-2: Cracks on pier surface



Picture-3 & 4: Cracks on pier surface



**Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.**



**Picture-7 & 8: Cracks on pile cap surface**

## 4.11.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-10 in north face at LHS	0 <sup>0</sup>	32	32	40	37	35	The surface strength of concrete is in Good condition as per IS 516 (Part5/Sec1):2020
			48	40	40			
			32	36	34			
2	On Pile cap-10 in north face at RHS	0 <sup>0</sup>	42	44	40	42	44	
			44	40	46			
			40	42	40			
3	On Pile cap-10 in east face at LHS	0 <sup>0</sup>	40	40	38	38	37	
			38	34	42			
			40	32	38			
4	On Pile cap-10 in east face at RHS	0 <sup>0</sup>	38	36	32	39	39	
			40	38	38			
			40	46	40			
5	On Pier-10 at 1mt level in north face	0 <sup>0</sup>	46	42	44	44	48	
			48	40	46			
			42	42	44			
6	On Pier-10 at 2mt level in west face	0 <sup>0</sup>	40	36	40	39	39	
			36	36	40			
			40	38	42			
7	On Pier-10 at 5.5mt level in north face	0 <sup>0</sup>	34	38	32	32	27	
			30	30	34			
			34	32	28			
8	On Pier cap -10 at in north face at LHS.	0 <sup>0</sup>	40	38	38	34	30	
			28	36	34			
			36	28	32			
9	On Pier cap -10 at in north face at centre.	0 <sup>0</sup>	28	26	30	33	28	
			32	38	38			
			38	36	30			
10	On Pier cap -10 at in north face at RHS.	0 <sup>0</sup>	32	38	32	34	30	
			28	36	38			
			32	34	36			
11	On Pier cap -10 at in south face at LHS.	0 <sup>0</sup>	38	32	40	35	32	
			32	34	34			
			36	34	34			
12	On Pier cap -10 at in south face at centre.	0 <sup>0</sup>	30	32	32	33	28	
			30	32	30			
			42	36	30			

13	On Pier cap -10 at in south face at RHS.	0°	40	48	46	37	35	
			34	36	30			
			28	38	34			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-10 in north face at LHS	ID	150	48.3	3.11	2.60	Doubtful	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	142.7	2.10			
2	On Pile cap-10 in north face at RHS	ID	150	47.5	3.16	3.34	Doubtful	
			300	85.1	3.53			
3	On Pile cap-10 in east face at LHS	ID	150	49.7	3.02	2.57	Doubtful	
			300	141.2	2.12			
4	On Pile cap-10 in east face at RHS	ID	150	33.2	4.52	3.94	Good	
			300	89.2	3.36			
5	On Pier-10 at 1mt level at north south face	D	2500	610.3	4.10	4.10	Good	
6	On Pier-10 at 2mt level at east west face	D	2500	621.7	4.02	4.02	Good	
7	On Pier-10 in west face at 5.5 mt level	D	2500	796.8	3.14	3.14	Doubtful	
8	On Pier cap-10 in north face at LHS	ID	150	37.9	3.96	3.62	Doubtful	
			300	91.5	3.28			
9	On Pier cap-10 in north face at centre	ID	150	41.2	3.64	3.29	Doubtful	
			300	101.9	2.94			
10	On Pier cap-10 in north face at RHS	ID	150	38.7	3.88	3.71	Doubtful	
			300	84.6	3.55			
11	On Pier cap-10 in south face at LHS	ID	150	32.1	4.67	4.09	Good	
			300	85.5	3.51			
12	On Pier cap-10 in south face at centre	ID	150	42.6	3.52	3.21	Doubtful	
			300	103.6	2.90			
13	On Pier cap-10 in south face at RHS	ID	150	33.7	4.45	3.97	Good	
			300	86.1	3.48			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-10 in north face at RHS	20	10	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm to 15mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-10 in east face at RHS	20	10	Dark pink	
3	On Pier-10 at 1mt level in north face	20	10	Dark pink	
4	On Pier-10 at 2mt level in west face	20	10	Dark pink	
5	On Pier cap-10 in north face at centre	20	15	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 10 at 1mts level	82	80	As per Design
		79		
		75		
		85		
2	On Pile cap - 10 In South face	68	64	
		61		
		63		
		64		

## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 10	225	289	266	249	233	213	Uncertain	The level of corrosion is in Uncertain at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		219	196	188	162	158			
		233	221	208	180	173			

## CRACK WIDTH

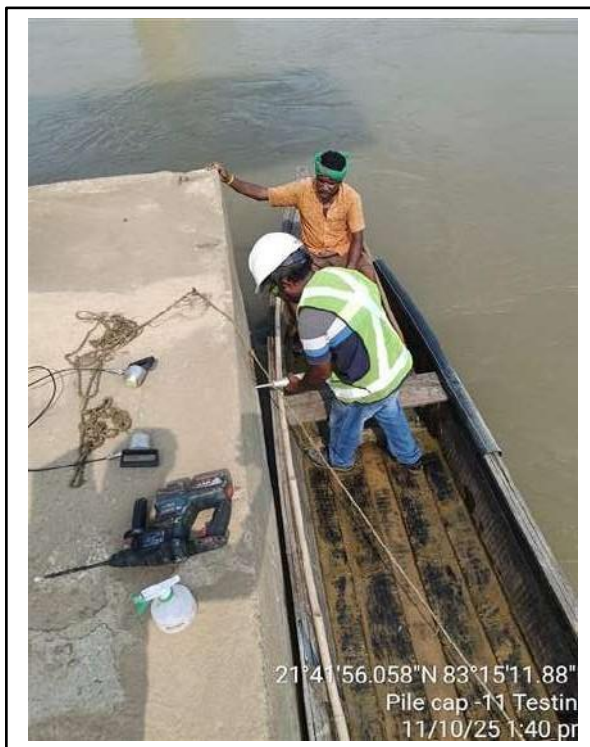
S.No	Location		Crack Width In mm
1	Pier -10	Pile cap	0.1 to 0.3
2		Pier	0.1 to 0.6
3		Pier Cap	0.1 to 0.5



#### 4.11.6 PHOTOGRAPHS:



Conducting UPV test



Conducting RHT test



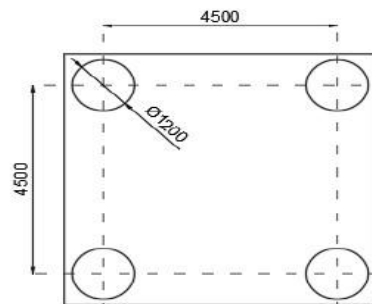
Conducting concrete cover meter test

## **SUMMARY OF TEST RESULTS**

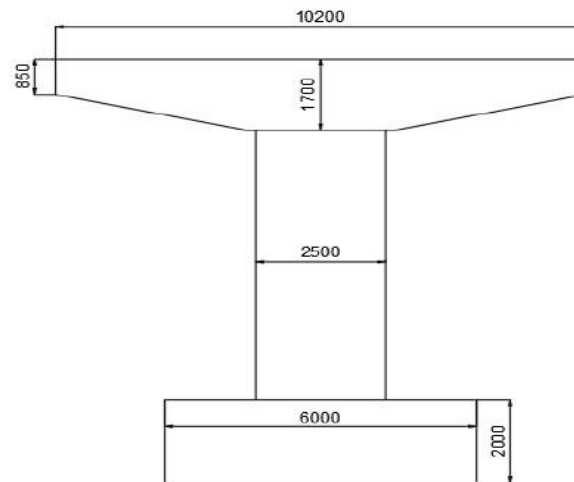
1. Rebound hammer test results revealed that quality of concrete is Good to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm to 15mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 64 to 80 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of Uncertain.
6. Crack width was in the range for pile cap 0.1mm to 0.3mm, pier 0.1mm to 0.6mm and pier cap 0.1mm to 0.5mm.

## 4.12 PIER – 11

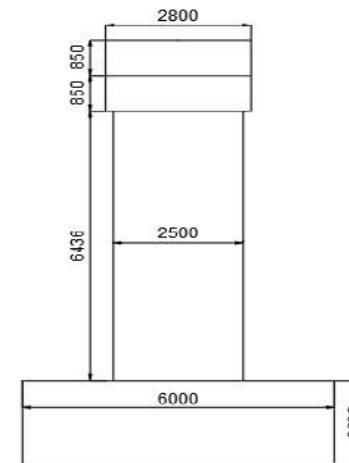
### 4.12.1 LAYOUT



PILE FOUNDATION PLAN



PIER-11 FRONT VIEW



PIER-11 SIDE VIEW

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
FOUNDATION AND PIER-11 PLAN & ELEVATION

CONSULTANT:



**IDDC Engineers Pvt. Ltd**

D No: 45-58-14/1, Narasimhanagar, visakhapatnam-530024

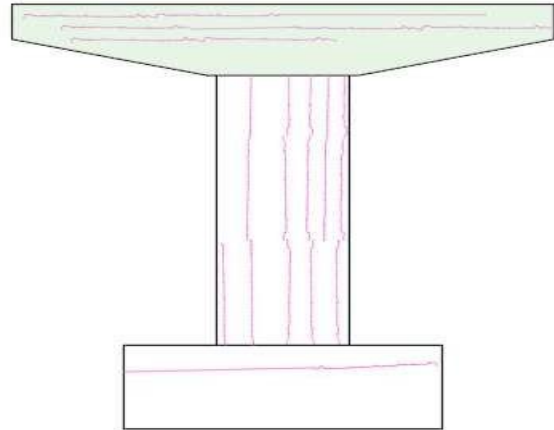
Tel: +91-891-2503914, 2794402

Mob: 984893666 \*URL: www.iddcindia.com

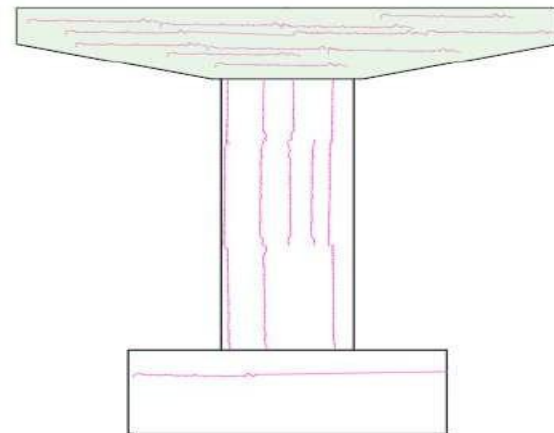
e-mail: iddcvizag@yahoo.co.in /

vizag@iddcindia.com

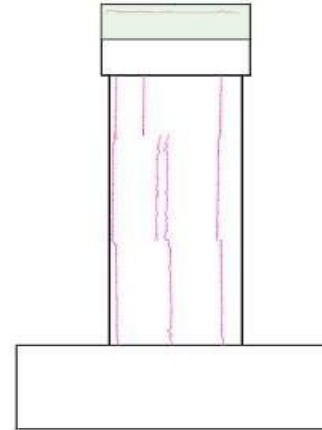
## 4.12.2 DISTRESS PLOTTING



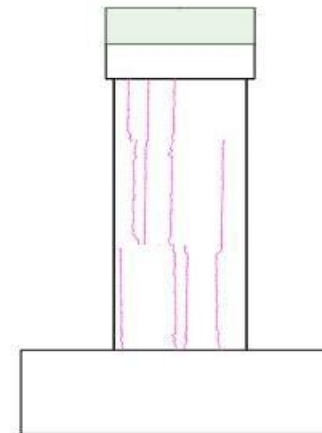
PIER-11 AT PR-10 FACE



PIER-11 AT PR-12 FACE



PIER-11 AT EAST FACE



PIER-11 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
DISTRESS MAPPING ON PIER-11

CONSULTANT:



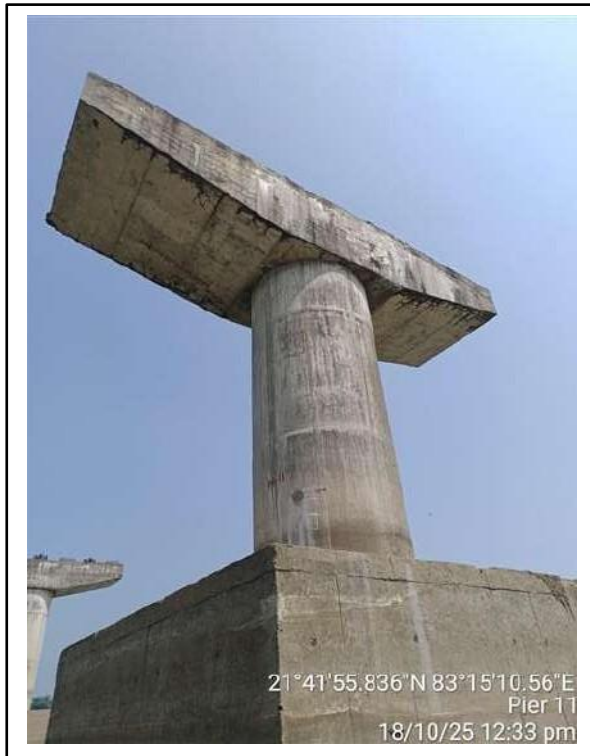
**IDDC Engineers Pvt. Ltd**  
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Mob: 984893666 \*URL: www.iddcindia.com  
e-mail: iddcvizag@yahoo.co.in / vizag@iddcindia.com

### 4.12.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 11</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on all side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.



#### 4.12.4 PHOTOGRAPHS:



Picture-1: Pier – 11 view



Picture-2: Cracks on pier surface



Picture-3 & 4: Cracks on pier surface





Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.



Picture-7 & 8: Cracks on pile cap surface

## 4.12.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-11 in north face at LHS	0 <sup>0</sup>	46	28	36	37	35	The surface strength of concrete is in Fair condition as per IS 516 (Part5/Sec1):2020
			36	34	34			
			34	36	48			
2	On Pile cap-11 in north face at RHS	0 <sup>0</sup>	28	30	28	35	32	
			38	34	40			
			38	38	38			
3	On Pile cap-11 in east face at LHS	0 <sup>0</sup>	34	38	32	33	28	
			32	36	36			
			32	30	28			
4	On Pile cap-11 in east face at RHS	0 <sup>0</sup>	40	38	36	34	30	
			34	32	30			
			32	34	34			
5	On Pier-11 at 1mt level in west face	0 <sup>0</sup>	38	40	44	41	42	
			42	40	46			
			44	28	44			
6	On Pier-11 at 2mt level in south face	0 <sup>0</sup>	38	30	32	34	30	
			32	32	36			
			36	38	36			
7	On Pier-11 at 5.5mt level in north face	0 <sup>0</sup>	30	32	30	33	28	
			32	34	30			
			40	34	36			
8	On Pier cap -11 at in north face at LHS.	0 <sup>0</sup>	48	40	42	41	42	
			42	40	38			
			48	38	34			
9	On Pier cap -11 at in north face at centre.	0 <sup>0</sup>	40	38	42	36	33	
			32	26	28			
			42	38	38			
10	On Pier cap -11 at in north face at RHS.	0 <sup>0</sup>	38	36	32	36	33	
			38	40	36			
			40	34	32			
11	On Pier cap -11 at in south face at LHS.	0 <sup>0</sup>	36	32	38	38	37	
			40	38	44			
			38	40	38			
12	On Pier cap -11 at in south face at centre.	0 <sup>0</sup>	34	32	32	30	23	
			24	28	30			
			28	28	36			

13	On Pier cap -11 at in south face at RHS.	0°	36	38	34	35	32	
			30	32	34			
			38	38	36			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-11 in north face at LHS	ID	150	35.9	4.18	3.81	Good	The UPV result are in Doubtful to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	87.2	3.44			
2	On Pile cap-11 in north face at RHS	ID	150	31.2	4.81	3.88	Good	
			300	101.7	2.95			
3	On Pile cap-11 in east face at LHS	ID	150	38.6	3.89	3.52	Doubtful	
			300	95.1	3.15			
4	On Pile cap-11 in east face at RHS	ID	150	41.1	3.65	3.63	Doubtful	
			300	82.9	3.62			
5	On Pier-11 at 1mt level at east west face	D	2500	613.2	4.08	4.08	Good	
6	On Pier-11 at 2mt level at north south face	D	2500	619.5	4.04	4.04	Good	
7	On Pier-11 in west face at 5.5 mt level	D	2500	793.7	3.15	3.15	Doubtful	
8	On Pier cap-11 in north face at LHS	ID	150	35	4.29	4.33	Good	
			300	68.6	4.37			
9	On Pier cap-11 in north face at centre	ID	150	26.7	5.62	4.55	Excellent	
			300	86.2	3.48			
10	On Pier cap-11 in north face at RHS	ID	150	41.1	3.65	3.48	Doubtful	
			300	90.6	3.31			
11	On Pier cap-11 in south face at LHS	ID	150	31.5	4.76	4.35	Good	
			300	76.1	3.94			
12	On Pier cap-11 in south face at centre	ID	150	35.2	4.26	3.78	Good	
			300	90.8	3.30			
13	On Pier cap-11 in south face at RHS	ID	150	29.5	5.08	4.91	Excellent	
			300	63.4	4.73			

### CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-11 in north face at RHS	10	5	Dark pink	The results indicate concrete is Carbonated up to a depth of 5mm to 15mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-11 in east face at RHS	20	10	Dark pink	
3	On Pier-11 at 1mt level in west face	20	10	Dark pink	
4	On Pier-11 at 2mt level in south face	20	15	Dark pink	
5	On Pier cap-11 in north face at centre	20	15	Dark pink	

### CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 11 at 1mts level in the direction of main reinforcement	66	70	As per Design
		67		
		71		
		74		
2	On Pier - 11 in the direction of stirrups reinforcement	36	48	
		45		
		52		
		60		
3	On Pier - 11 at 2.5mts level in the direction of main reinforcement	65	68	
		67		
		68		
		70		

### CRACK WIDTH

S.No	Location		Crack Width In mm
1	Pier -11	Pile cap	0.1 to 0.3
2		Pier	0.1 to 1
3		Pier Cap	0.1 to 0.5

### CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -11	18.56

#### 4.12.6 PHOTOGRAPHS:



Conducting UPV test



Conducting core cutting test



Conducting RHT test



Conducting CD test

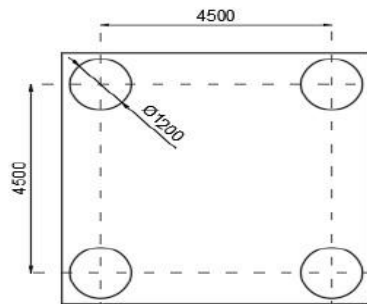
## **SUMMARY OF TEST RESULTS**

1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Excellent" at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 5mm to 15mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 48 to 68 to 70 as per design.
5. Crack width was in the range for pile cap 0.1mm to 0.3mm, pier 0.1mm to 1mm and pier cap 0.1mm to 0.5mm.
6. The Core Compressive test results are carried out on pier-11 is 18.56 N/mm<sup>2</sup>

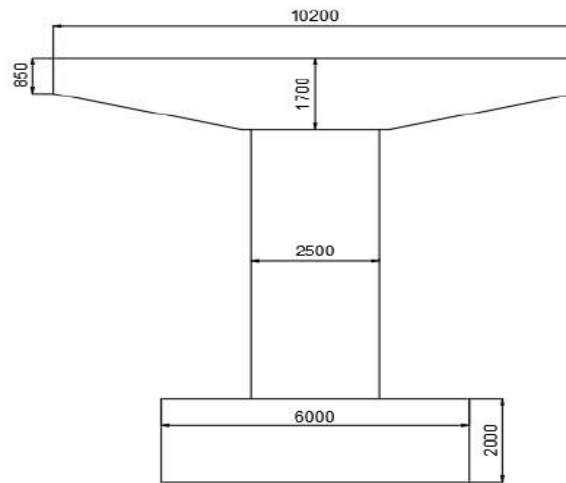


## 4.13 PIER – 12

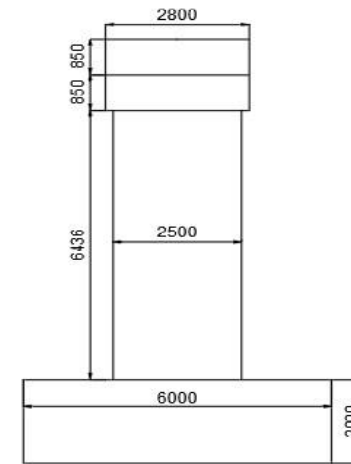
### 4.13.1 LAYOUT



PILE FOUNDATION PLAN



PIER-12 FRONT VIEW



PIER-12 SIDE VIEW

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

FOUNDATION AND PIER-12 PLAN & ELEVATION

**CONSULTANT:**



**IDDC Engineers Pvt. Ltd**

D No: 45-58-14/1, Narasimhanagar, visakhapatnam-530024

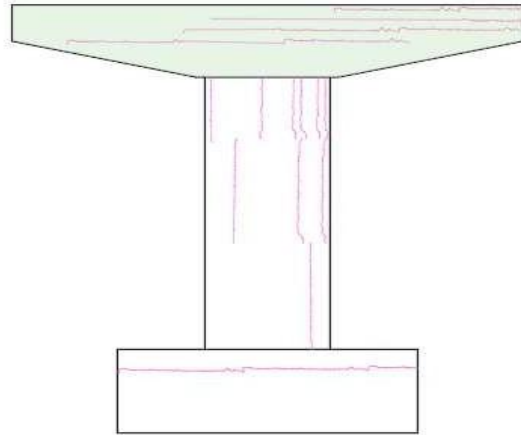
Tel: +91-891-2503914, 2794402

Mob: 984893666 \*URL: www.iddcindia.com

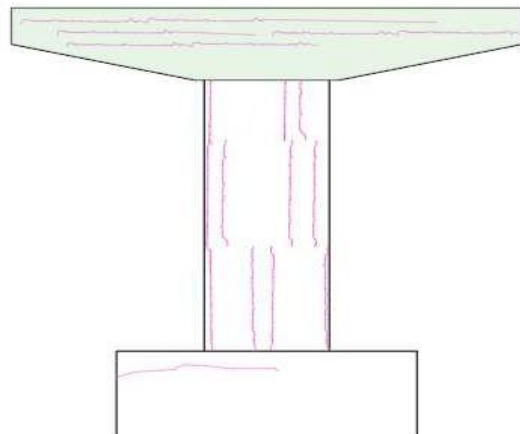
e-mail: iddcvizag@yahoo.co.in /

vizag@iddcindia.com

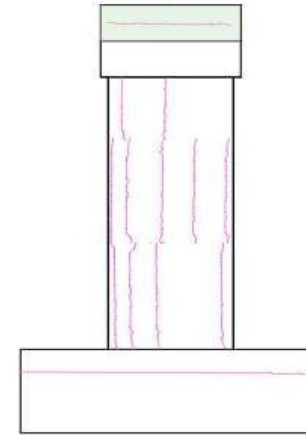
## 4.13.2 DISTRESS PLOTTING



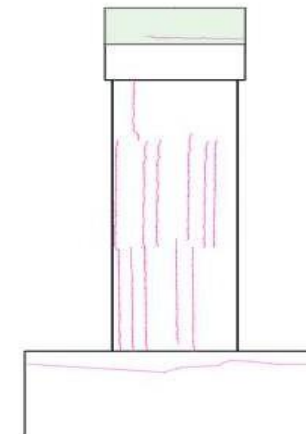
PIER-12 AT PR-11 FACE



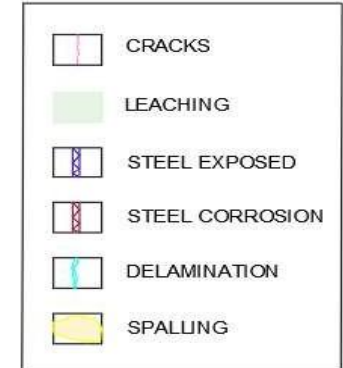
PIER-12 AT PR-13 FACE



PIER-12 AT EAST FACE



PIER-12 AT WEST FACE



PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
DISTRESS MAPPING ON PIER-12

CONSULTANT:

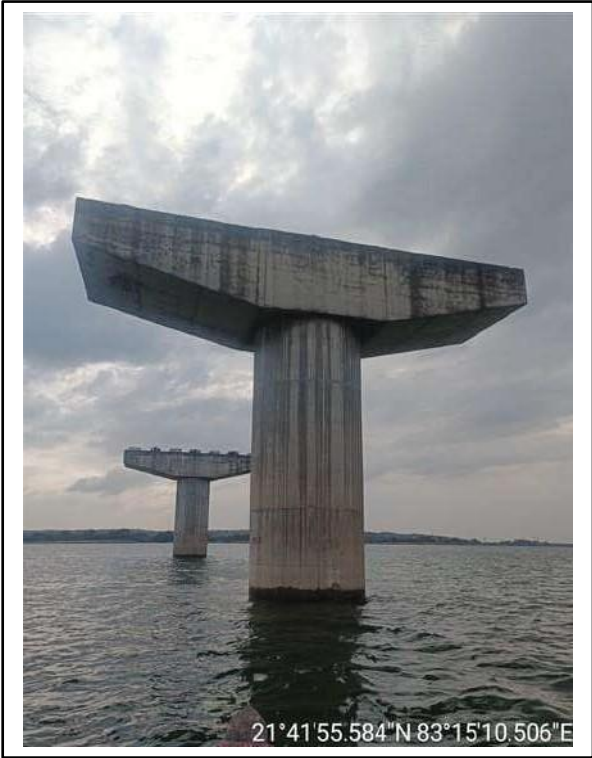


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e-mail: iddcvizag@yahoo.co.in / vizag@iddcindia.com

### 4.13.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
Pier – 12		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on all side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.

**4.13.4 PHOTOGRAPHS:**



**Picture-1: Pier – 12 view**



**Picture-2: Cracks on pier surface**



**Picture-3 & 4: Cracks on pier surface**





**Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.**



**Picture-7 & 8: Cracks on pile cap surface**

### 4.13.5 TEST RESULTS

#### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-12 in east face at LHS	0 <sup>0</sup>	38	30	32	34	30	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			36	40	38			
			34	32	28			
2	On Pile cap-12 in east face at RHS	0 <sup>0</sup>	32	28	24	31	25	
			32	34	28			
			30	38	30			
3	On Pile cap-12 in south face at LHS	0 <sup>0</sup>	40	38	40	38	37	
			38	38	40			
			42	40	28			
4	On Pile cap-12 in south face at RHS	0 <sup>0</sup>	34	30	30	31	25	
			38	28	32			
			28	28	28			
5	On Pier-12 at 1mt level in west face	0 <sup>0</sup>	40	44	40	42	44	
			42	46	42			
			40	38	42			
6	On Pier-12 at 2mt level in south face	0 <sup>0</sup>	38	30	32	34	30	
			32	32	36			
			36	38	36			

#### ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-12 in east face at LHS	ID	150	88.8	1.69	2.02	Doubtful	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	127.4	2.35			
2	On Pile cap-12 in east face at RHS	ID	150	47.2	3.18	3.31	Doubtful	
			300	87.3	3.44			
3	On Pile cap-12 in south face at LHS	ID	150	47.9	3.13	3.02	Doubtful	
			300	103.2	2.91			
4	On Pile cap-12 in south face at RHS	ID	150	68.7	2.18	2.18	Doubtful	
			300	137.2	2.19			
5	On Pier-12 at 1mt level in west face	D	2500	575.2	4.35	4.35	Good	



6	On Pier-12 at 2mt level in south face	D	2500	643.8	3.88	3.88	Good	
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### CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-12 in east face at RHS	30	20	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm to 20mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-12 in south face at LHS	20	10	Dark pink	
3	On Pier-12 in east face at 1mt level	20	10	Dark pink	

### CONCRETE COVER METER TEST RESULTS

S.No	Location	Cover Meter Readings	Avg Reading	Remarks
1	On Pier - 12 at 1mts level in the direction of main reinforcement	64	68	As per Design
		68		
		73		
		67		
2	On Pier - 12 at 2.5mts level in the direction of main reinforcement	73	65	
		69		
		63		
		56		

### CRACK WIDTH

S.No	Location		Crack Width In mm
1	Pier -12	Pile cap	0.1 to 0.3
2		Pier	0.1 to 0.7
3		Pier Cap	0.1 to 0.3

### CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -12	21.41

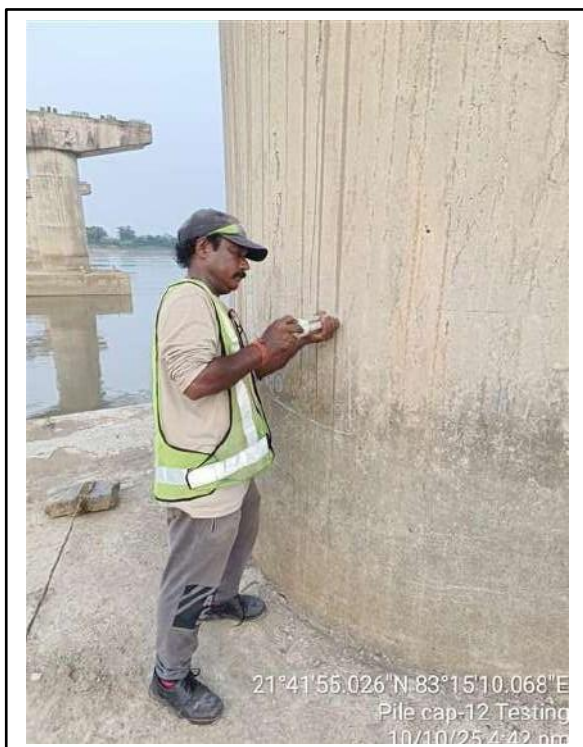
#### 4.13.6 PHOTOGRAPHS:



Conducting UPV test



Conducting core cutting test



Conducting RHT test



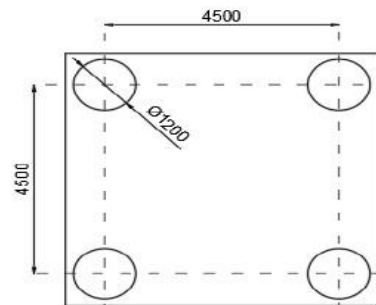
Conducting CD test

## **SUMMARY OF TEST RESULTS**

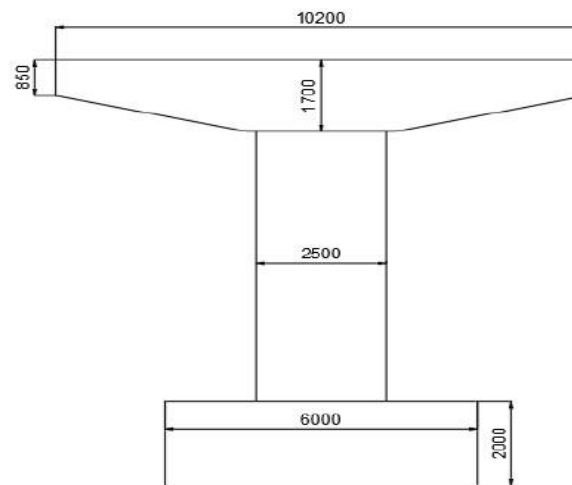
1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm to 20mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 65 to 68 as per design.
5. Crack width was in the range for pile cap 0.1mm to 0.3mm, pier 0.1mm to 0.7mm and pier cap 0.1mm to 0.3mm.
6. The Core Compressive test results are carried out on pier-12 is 21.41 N/mm<sup>2</sup>

## 4.14 PIER – 13

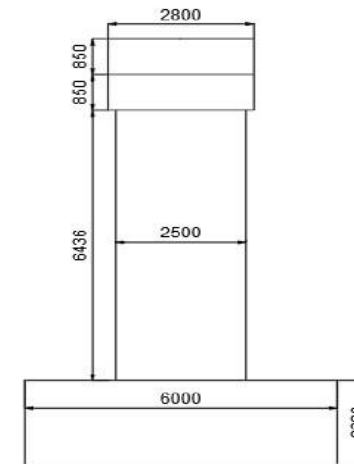
### 4.14.1 LAYOUT



PILE FOUNDATION PLAN



PIER-13 FRONT VIEW



PIER-13 SIDE VIEW

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

FOUNDATION AND PIER-13 PLAN & ELEVATION

**CONSULTANT:**



**IDDC Engineers Pvt. Ltd**

D No: 45-58-14/1, Narasimhanagar,

visakhapatnam-530024

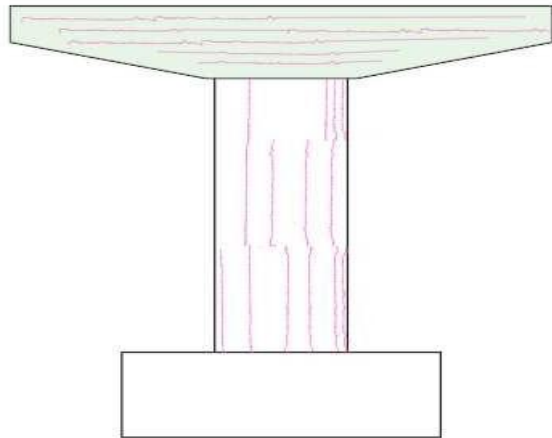
Tel: +91-891-2503914, 2794402

Mob: 984893666 \*URL: [www.iddcindia.com](http://www.iddcindia.com)

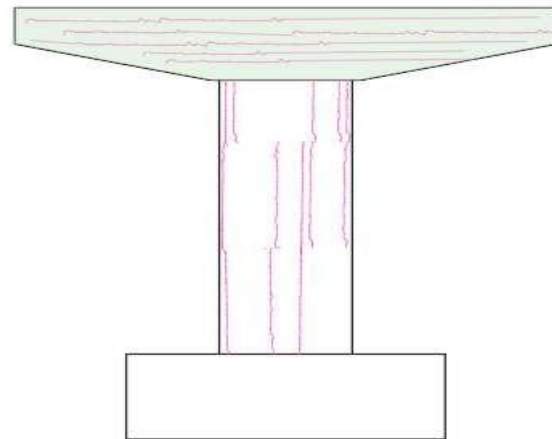
e-mail: [iddcvizag@yahoo.co.in](mailto:iddcvizag@yahoo.co.in) /

[vizag@iddcindia.com](mailto:vizag@iddcindia.com)

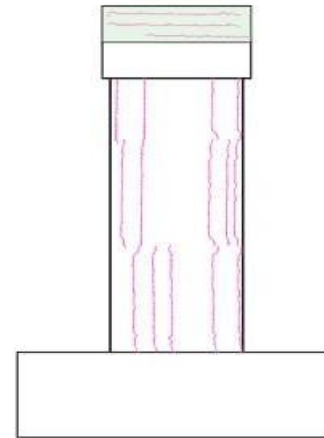
## 4.14.2 DISTRESS PLOTTING



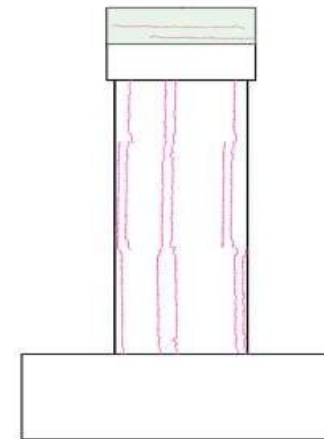
PIER-13 AT PR-12 FACE









PIER-13 AT SOUTH FACE



PIER-13 AT EAST FACE



PIER-13 AT WEST FACE

	CRACKS
	LEACHING
	STEEL EXPOSED
	STEEL CORROSION
	DELAMINATION
	SPALLING

### PROJECT:

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

### DRAWING TITLE:

DISTRESS MAPPING ON PIER-13

### CONSULTANT:



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[vizag@iddcindia.com](mailto:vizag@iddcindia.com)

### 4.14.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 13</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	EFF	Efflorescence observed on all side faces of the pier cap.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.
Pile cap	MC	Minor cracks observed on pile cap all faces at various locations.



#### 4.14.4 PHOTOGRAPHS:



Picture-1: Pier – 13 view



Picture-2: Minor cracks on pier surface



Picture-3 & 4: Minor cracks on pier surface



Picture- 5 & 6: Minor cracks, leaching & efflorescence on pier cap.



Picture-7 & 8: Cracks on pile cap surface

#### 4.14.5 TEST RESULTS

##### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-13 in north face at LHS	0 <sup>0</sup>	34	40	44	40	40	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			40	36	36			
			46	44	40			
2	On Pile cap-13 in north face at RHS	0 <sup>0</sup>	36	38	28	37	35	
			40	40	34			
			40	42	34			
3	On Pile cap-13 in east face at LHS	0 <sup>0</sup>	44	46	42	44	48	
			46	46	42			
			42	42	42			
4	On Pile cap-13 in east face at RHS	0 <sup>0</sup>	38	44	40	42	44	
			40	44	46			
			42	42	40			
5	On Pier-13 at 1mt level in north face	0 <sup>0</sup>	24	30	34	28	20	
			24	26	26			
			32	30	30			
6	On Pier-13 at 2mt level in south west face	0 <sup>0</sup>	40	38	36	38	37	
			38	38	42			
			38	34	38			

##### ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-13 in north face at LHS	ID	150	27.1	5.54	5.46	Excellent	The UPV result are in Good to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	55.7	5.39			
2	On Pile cap-13 in north face at RHS	ID	150	30.1	4.98	4.43	Good	
			300	77.2	3.89			
3	On Pile cap-13 in east face at LHS	ID	150	37.4	4.01	4.04	Good	
			300	73.7	4.07			
4	On Pile cap-13 in east face at RHS	ID	150	41.5	3.61	3.79	Good	
			300	75.6	3.97			
5	On Pier-13 at 1mt level in north south face	D	2500	621.7	4.02	4.02	Good	
6	On Pier-13 at 2mt level in east west face	D	2500	661.8	3.78	3.78	Good	

### CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-13 in north face at LHS	20	15	Dark pink	The results indicate concrete is Carbonated up to a depth of 5mm to 15mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-13 in east face at LHS	20	10	Dark pink	
3	On Pile cap-13 in east face at RHS	10	5	Dark pink	
4	On Pier-13 at 1mt level in north face	20	15	Dark pink	

### CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 13 at 1mts level in the direction of main reinforcement	67	70	As per Design
		69		
		74		
		71		
2	On Pile cap - 13 In South face	70	63	
		59		
		58		
		64		

### HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 13	286	274	280	254	260	278	Uncertain	The level of corrosion is in Uncertain at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		314	308	288	265	240			
		299	280	282	275	260			

### CRACK WIDTH

S.NO	LOCATION			CRACK WIDTH IN MM
1	Pier -13			Pile cap 0.1 to 0.3
2				Pier 0.1 to 0.6
3				Pier Cap 0.1 to 0.5

### CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -13	15.03



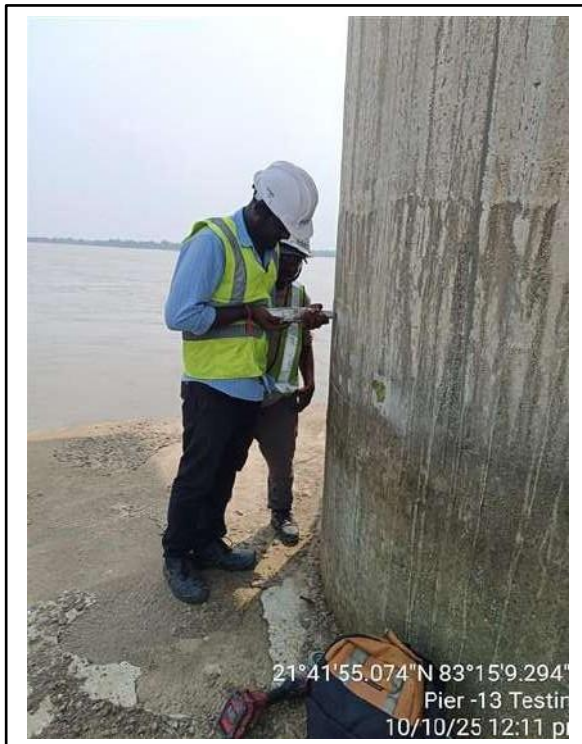
#### 4.14.6 PHOTOGRAPHS:



Conducting UPV test



Conducting core cutting test



Conducting RHT test



Conducting CD test

## **SUMMARY OF TEST RESULTS**

1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is " Good to Excellent" at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 5mm to 15mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 63 to 70 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of Uncertain.
6. Crack width was in the range for pile cap 0.1mm to 0.3mm, pier 0.1mm to 0.6mm and pier cap 0.1mm to 0.5mm.
7. The Core Compressive test results are carried out on pier-13 is N/mm<sup>2</sup>.



## **4.15 PILE FOUNDATION – 14**

### **4.15.1 OBSERVATIONS**

1. Pier – 14 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 6 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Damages observed on 2 piles concrete above the water level.
4. Debris observed near the piles.

#### 4.15.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 14 view



Picture-2: Debris near piles.



Picture-3: Pile concrete damage.



Picture-4: Pile foundation – 14 view

## **4.16 PILE FOUNDATION – 15**

### **4.16.1 OBSERVATIONS**

1. Pier – 15 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 6 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Severe crack observed on pile concrete above the water level.
4. Damages observed on pile liners above the water level.
5. Debris observed near the piles.

#### 4.16.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 15 view



Picture-2: Severe crack on pile concrete



Picture-3: Debris near piles.



Picture-4: Piles foundation – 15 view

## **4.17 PILE FOUNDATION – 16**

### **4.17.1 OBSERVATIONS**

1. Pier – 16 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 3 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Steel liner observed for 3 piles.

#### 4.17.2 PHOTOGRAPHS:



Picture-1 & 2: Piles foundation – 16 view



## **4.18 PILE FOUNDATION – 17**

### **4.18.1 OBSERVATIONS**

1. Pier – 17 is not constructed and its pile foundation is executed up to pile cap level.
2. Several minor and major cracks observed on cap all faces and on cap top level.
3. Efflorescence observed on pile cap side faces at all crack locations.

#### 4.18.2 PHOTOGRAPHS:



Picture-1: Pile foundation – 17 view



Picture-2: Cracks on Pile cap side face.



Picture-3 & 4: Cracks on pile cap top face

### 4.18.3 TEST RESULTS

#### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-17 in east face at LHS	0 <sup>0</sup>	32	34	28	36	33	The surface strength of concrete is in Good condition as per IS 516 (Part5/Sec1):2020
			34	40	44			
			40	38	38			
2	On Pile cap-17 in east face at RHS	0 <sup>0</sup>	40	38	32	37	35	
			36	36	40			
			32	42	40			
3	On Pile cap-17 in west face at LHS	0 <sup>0</sup>	38	40	34	34	30	
			32	32	38			
			32	30	32			
4	On Pile cap-17 in west face at RHS	0 <sup>0</sup>	34	38	34	36	33	
			30	36	40			
			38	38	36			

#### ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-17 in east face at LHS	ID	150	82.1	1.83	1.68	Doubtful	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	196.5	1.53			
2	On Pile cap-17 in east face at RHS	ID	150	32.8	4.57	3.37	Doubtful	
			300	138.8	2.16			
3	On Pile cap-17 in west face at LHS	ID	150	30.3	4.95	3.91	Good	
			300	104.7	2.87			
4	On Pile cap-17 in west face at RHS	ID	150	32.8	4.57	4.36	Good	
			300	72.2	4.16			

#### CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pile cap - 17 In North face	61	64	As per Design
		68		
		65		
		62		

## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pile cap - 17	349	333	330	389	375	328	Uncertain	The level of corrosion is in Uncertain at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		336	318	307	392	264			
		341	326	311	286	263			

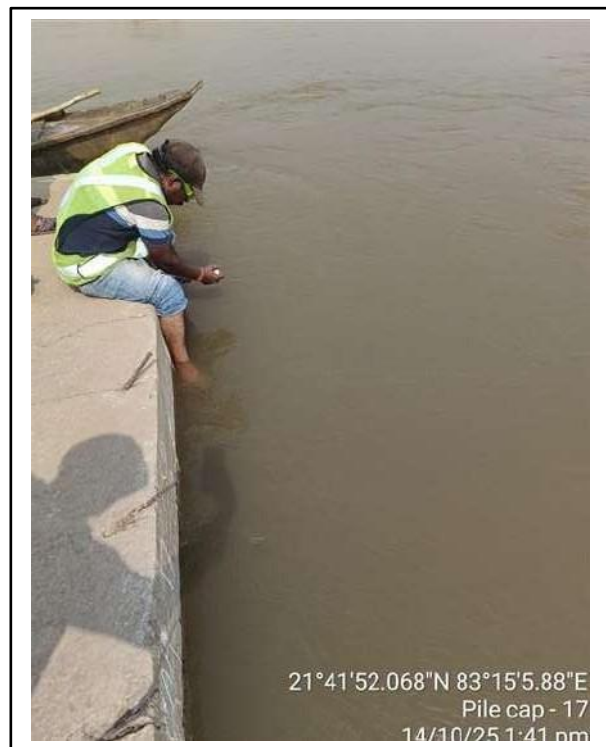
## CRACK WIDTH

S.NO	LOCATION		CRACK WIDTH IN MM
1	Pile cap-17	Pile cap	0.1 to 1.5

#### 4.18.4 PHOTOGRAPHS:



Conducting UPV tests



Conducting RHT tests

## **SUMMARY OF TEST RESULTS**

1. Rebound hammer test results revealed that quality of concrete is Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. As per concrete cover meter, Concrete cover results are ranging from 64 as per design.
4. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of Uncertain
5. Crack width was in the range for pile cap 0.1mm to 1.5mm.

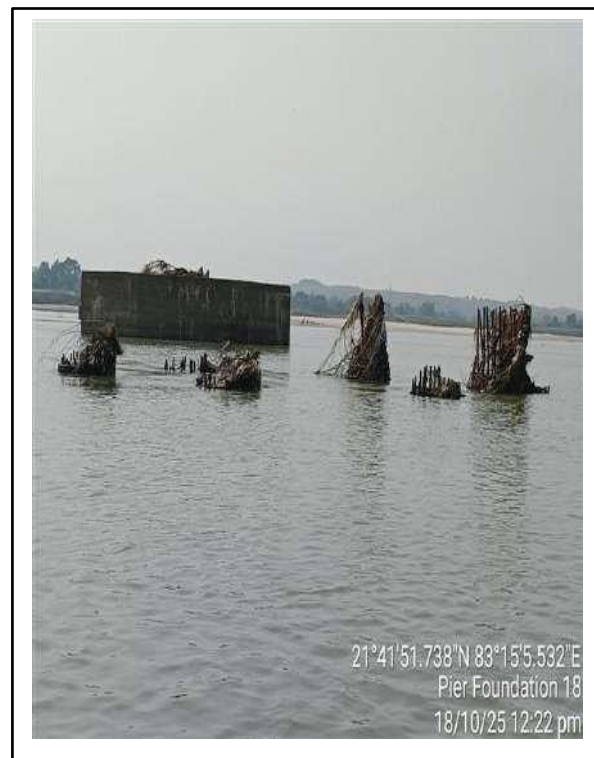


## **4.19 PILE FOUNDATION – 18**

### **4.19.1 OBSERVATIONS**

1. Pier – 18 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 6 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Debris observed near all piles.

#### 4.19.2 PHOTOGRAPHS:



Picture-1 & 2: Pile foundation – 19 views



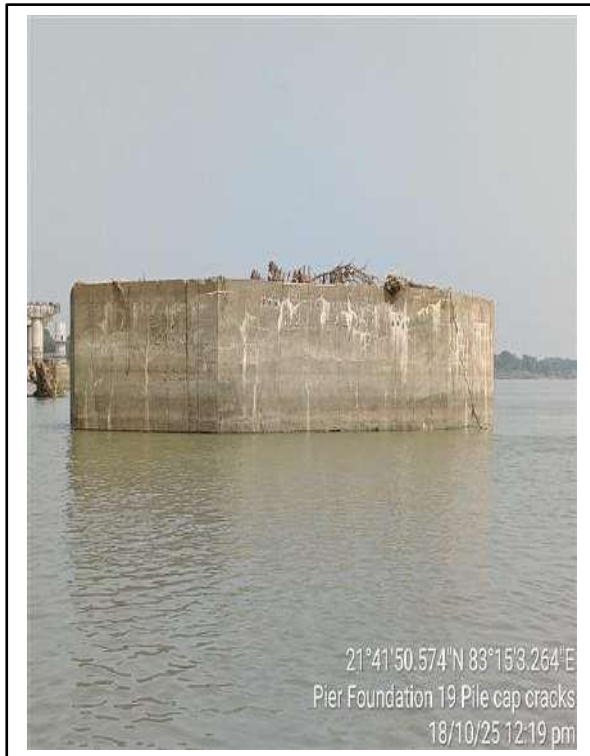
Picture-3 & 4: Debris near all piles.

## **4.20 PILE FOUNDATION – 19**

### **4.20.1 OBSERVATIONS**

1. Pier – 19 is not constructed and its pile foundation is executed up to pile cap level.
2. Several minor and major cracks observed on cap all faces and on cap top level.
3. Efflorescence observed on pile cap side faces at all crack locations.

#### 4.20.2 PHOTOGRAPHS:



Picture-1: Pile cap – 19 view



Picture-2: Cracks on pile cap.



Picture-3: Cracks on pile cap.



Picture-4: Cracks & Debris on cap.

### 4.20.3 TEST RESULTS

#### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-19 in south east face at LHS	0 <sup>0</sup>	42	44	44	42	44	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			40	42	40			
			46	40	44			
2	On Pile cap-19 in south east face at RHS	0 <sup>0</sup>	46	42	44	40	40	
			40	38	36			
			40	40	38			
3	On Pile cap-19 in south face at LHS	0 <sup>0</sup>	54	50	44	48	54	
			54	54	46			
			44	42	48			
4	On Pile cap-19 in south face at RHS	0 <sup>0</sup>	38	46	48	45	50	
			48	42	48			
			48	38	46			
5	On Pile cap-19 in north east face at LHS	0 <sup>0</sup>	32	38	44	36	33	
			30	40	38			
			34	32	32			
6	On Pile cap-19 in north east face at RHS	0 <sup>0</sup>	32	32	38	33	28	
			30	34	32			
			32	30	36			

#### ULTRA SONIC PULSE VELOCITY TEST RESULTS

S. No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-19 in south east face at LHS	ID	150	26.7	5.62	5.06	Excellent	The UPV result are in Doubtful to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	66.6	4.50			
2	On Pile cap-19 in south east face at RHS	ID	150	32.2	4.66	3.43	Doubtful	
			300	136.1	2.20			
3	On Pile cap-19 in south face at LHS	ID	150	32.7	4.59	4.46	Good	
			300	69.3	4.33			
4	On Pile cap-19 in south face at RHS	ID	150	31.4	4.78	4.16	Good	
			300	84.8	3.54			

5	On Pile cap-19 in north east face at LHS	ID	150	43.4	3.46	3.53	Doubtful
			300	83.2	3.61		
6	On Pile cap-19 in north east face at RHS	ID	150	48.1	3.12	2.77	Doubtful
			300	123.7	2.43		

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On Pile cap-19 in south east face at RHS	20	10	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On Pile cap-19 in north east face at RHS	20	10	Dark pink	

## CONCRETE COVER METER TEST RESULTS

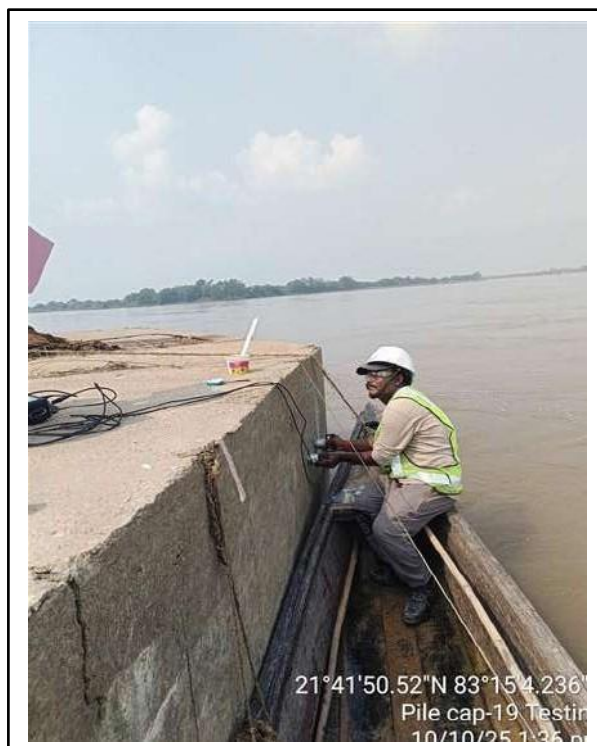
S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pile cap - 19 In North face	74	77	As per Design
		81		
		76		
		78		

## CRACK WIDTH

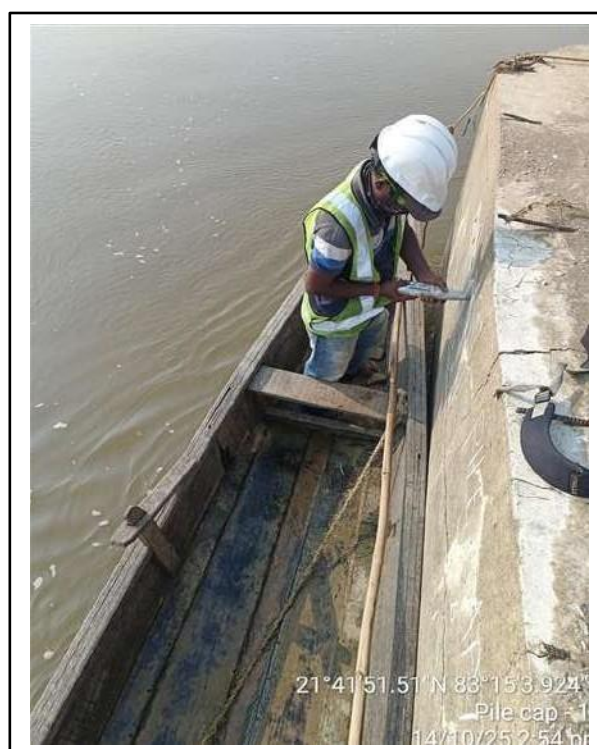
S.NO	LOCATION		CRACK WIDTH IN MM
1	Pile cap-19	Pile cap	0.1 to 1.5



#### 4.20.4 PHOTOGRAPHS



Conducting UPV tests



Conducting RHT tests

## **SUMMARY OF TEST RESULTS**

1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Excellent " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 77 as per design.
5. Crack width was in the range for pile cap 0.1mm to 1.5mm.

## **4.21 PILE FOUNDATION – 20**

### **4.21.1 OBSERVATIONS**

1. Pier – 20 is not constructed and its pile foundation is executed up to pile cap level.
2. Several minor and major cracks observed on pile cap all faces and on cap top level.
3. Efflorescence observed on pile cap side faces at all crack locations.

#### 4.21.2 PHOTOGRAPHS:



Picture-1: Pile foundation – 20 view



Picture-2: Cracks on pile side face.



Picture-3: Cracks & Efflorescence on pile side face.



Picture-4: Cracks on pile cap top level.



### 4.21.3 TEST RESULTS

#### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pile cap-20 in east face at LHS	0 <sup>0</sup>	44	40	44	42	44	The surface strength of concrete is in Very Good condition as per IS 516 (Part5/Sec1):2020
			48	40	50			
			34	48	34			
2	On Pile cap-20 in east face at RHS	0 <sup>0</sup>	48	50	48	42	44	
			38	44	34			
			38	36	40			
3	On Pile cap-20 in west face at LHS	0 <sup>0</sup>	44	48	38	45	50	
			48	50	46			
			40	48	40			
4	On Pile cap-20 in west face at RHS	0 <sup>0</sup>	40	50	38	41	42	
			40	32	48			
			44	32	46			

#### ULTRA SONIC PULSE VELOCITY TEST RESULTS

S. No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pile cap-20 in east face at LHS	ID	150	37.5	4.00	3.57	Doubtful	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
			300	95.5	3.14			
2	On Pile cap-20 in east face at RHS	ID	150	30.2	4.97	4.37	Good	
			300	79.7	3.76			
3	On Pile cap-20 in west face at LHS	ID	150	30.9	4.85	4.26	Good	
			300	81.8	3.67			
4	On Pile cap-20 in west face at RHS	ID	150	45	3.33	3.07	Doubtful	
			300	106.8	2.81			

## CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pile cap - 20 In West face	63	74	As per Design
		76		
		82		
		73		

## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pile cap - 20 at South face	210	215	220	211	203	225	Uncertain	The level of corrosion is in Uncertain at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		365	291	282	218	198			
		214	202	191	181	172			
2	On Pile cap - 20 at West face	314	302	289	214	203	266	Uncertain	
		290	274	277	264	251			
		281	272	266	281	209			

## CRACK WIDTH

S.NO	LOCATION		CRACK WIDTH IN MM
1	Pile cap-20	Pile cap	0.1 to 1.5



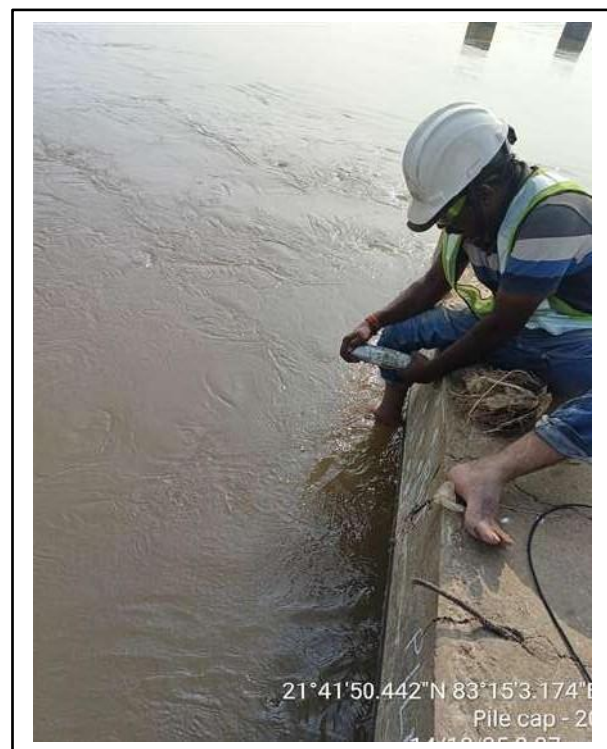
#### 4.21.4 TESTING PHOTOGRAPHS:



Conducting UPV tests



Conducting HCP tests



Conducting RHT tests

## **SUMMARY OF TEST RESULTS**

1. Rebound hammer test results revealed that quality of concrete is Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. As per concrete cover meter, Concrete cover results are ranging from 74 as per design.
4. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of Uncertain.
5. Crack width was in the range for pile cap 0.1mm to 1.5mm.

## **4.22 PILE FOUNDATION – 21**

### **4.22.1 OBSERVATIONS**

1. Pier – 21 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 3 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Debris observed near piles.

#### 4.22.2 PHOTOGRAPHS:



**Picture-1: Piles foundation – 21 view**



**Picture-2: Piles side view.**

## **4.23 PILE FOUNDATION – 32**

### **4.23.1 OBSERVATIONS**

1. Pier – 32 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Pile concrete damages are observed above the ground level.



#### 4.23.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 32 view



Picture-2: Cracks on pile concrete.



Picture-3: Cracks on pile concrete.



Picture-4: Debris near pile.



## **4.24 PILE FOUNDATION – 33**

### **4.24.1 OBSERVATIONS**

1. Pier – 33 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Pile concrete damages are observed above the ground level.

#### 4.24.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 33 view



Picture-2: Cracks on pile concrete.



Picture-3 & 4: Cracks and debris on pile concrete

## **4.25 PILE FOUNDATION – 34**

### **4.25.1 OBSERVATIONS**

1. Pier – 34 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Pile concrete damages are observed above the ground level

#### 4.25.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 34 view



Picture-2: Crack on pile concrete.



Picture-3: Crack on pile concrete.

## **4.26 PILE FOUNDATION – 35**

### **4.26.1 OBSERVATIONS**

1. Pier – 35 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Pile concrete damages and reinforcement corrosion are observed above the ground level.



#### 4.26.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 35 view



Picture-2: Concrete damage on piles



## **4.27 PILE FOUNDATION – 36**

### **4.27.1 OBSERVATIONS**

1. Pier – 36 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Pile concrete crack on 1 pile and other 3 piles are covered by steel liners above the ground level.

#### 4.27.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 36 view



Picture-2: Damage on pile concrete.



Picture-3: Steel liners for piles above the ground level

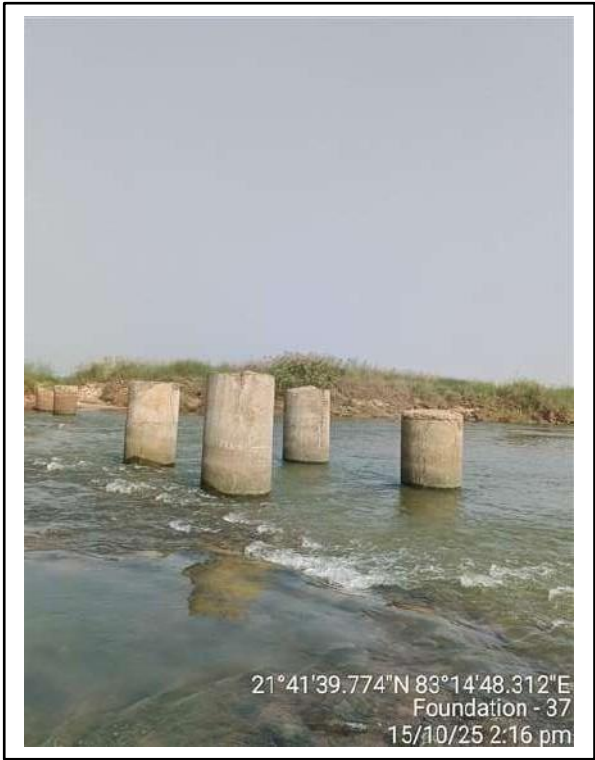
## **4.28 PILE FOUNDATION – 37**

### **4.28.1 OBSERVATIONS**

1. Pier – 37 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Cracks on all pile concrete above the ground level



4.28.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 37 view



Picture-2: Cracks on pile concrete



Picture-3 & 4: Cracks on pile concrete

## **4.29 PILE FOUNDATION – 38**

### **4.29.1 OBSERVATIONS**

1. Pier – 38 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Cracks on all pile concrete above the ground level



#### 4.29.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 38 view



Picture-2: Cracks on pile concrete.



Picture-3 & 4: Cracks on pile concrete.



## **4.30 PILE FOUNDATION – 39**

### **4.30.1 OBSERVATIONS**

1. Pier – 39 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Cracks on all pile concrete above the ground level

#### 4.30.2 PHOTOGRAPHS:



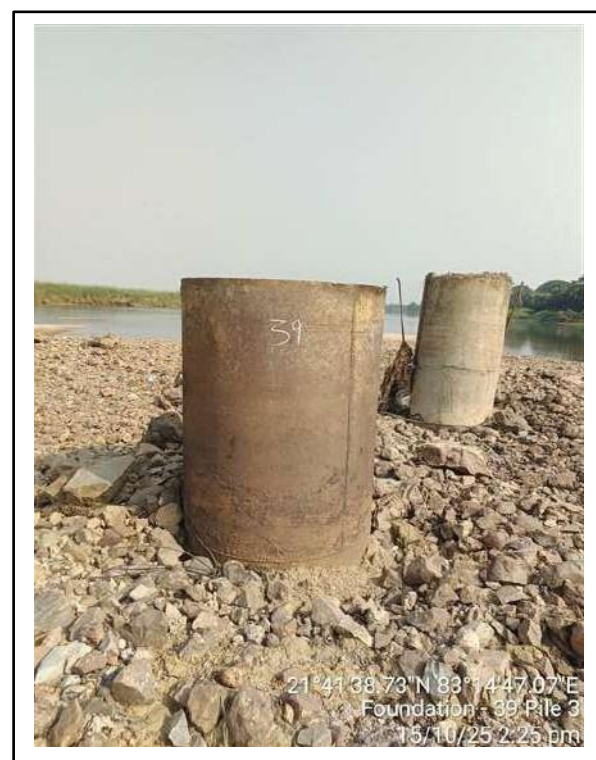
Picture-1: Piles foundation – 39 view



Picture-2: Cracks on pile concrete.



Picture-3: Cracks on pile concrete.



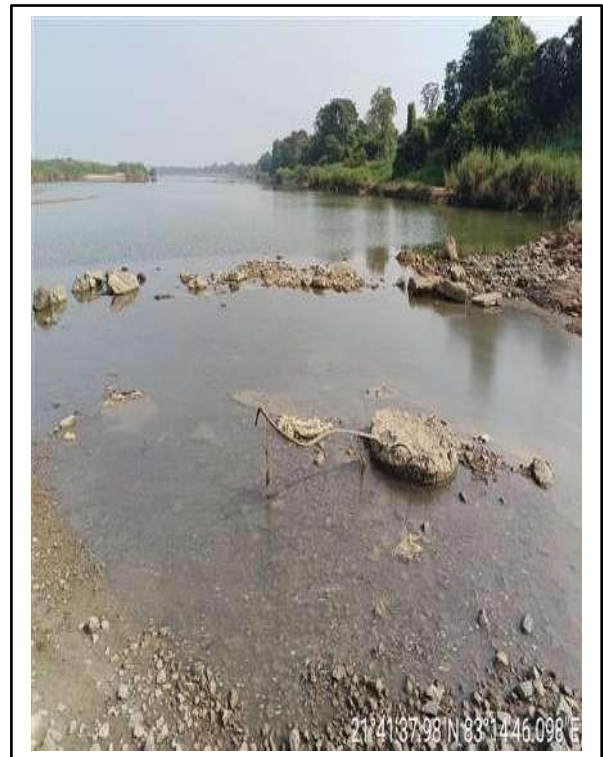
Picture-4: Steel liner for pile

## **4.31 PILE FOUNDATION – 40**

### **4.31.1 OBSERVATIONS**

1. Pier – 40 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed

#### **4.31.2 PHOTOGRAPHS:**



**Picture-1 & 2: Piles foundation – 40 view.**

## **4.32 PILE FOUNDATION – 41**

### **4.32.1 OBSERVATIONS**

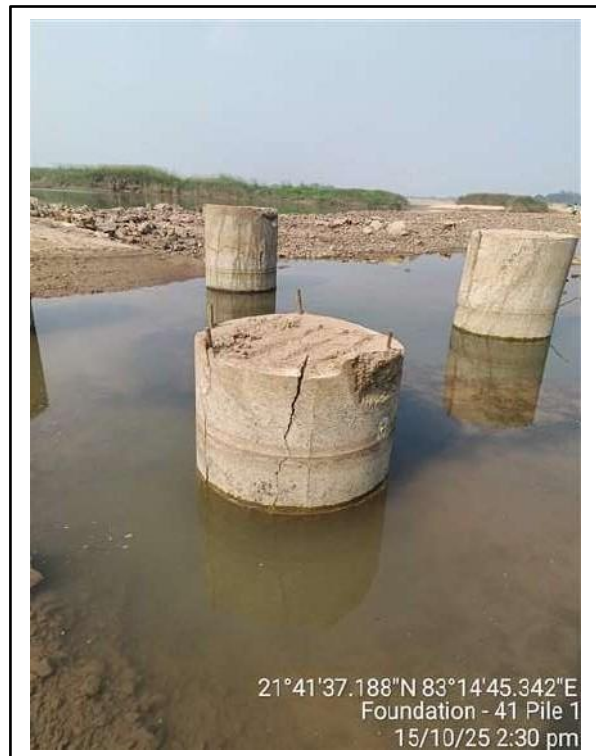
1. Pier – 41 is not constructed and its pile foundation is partially executed up to pile level only.
2. Total 4 Nos piles are observed in this pile foundation and no other structural members are not constructed.
3. Cracks on all pile concrete above the ground level



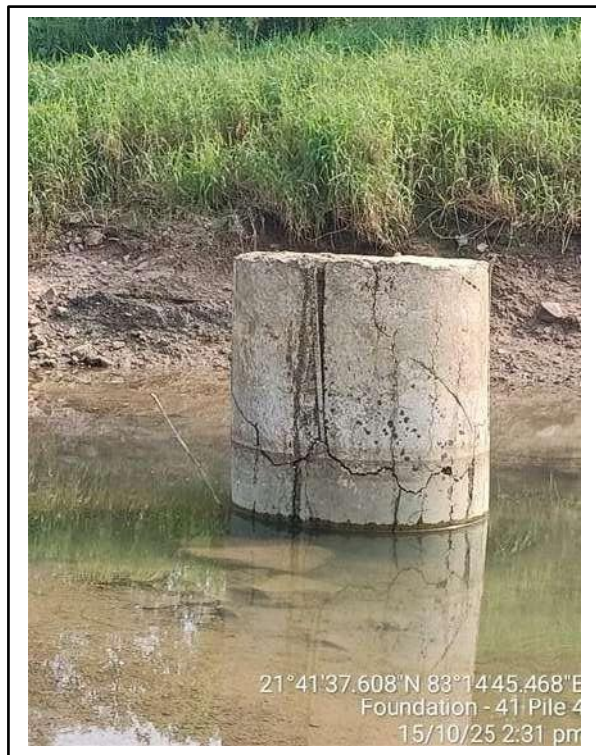
#### 4.32.2 PHOTOGRAPHS:



Picture-1: Piles foundation – 41 view



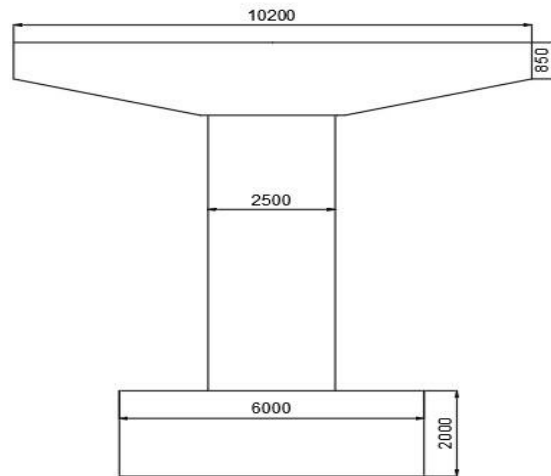
Picture-2: Cracks on pile concrete.



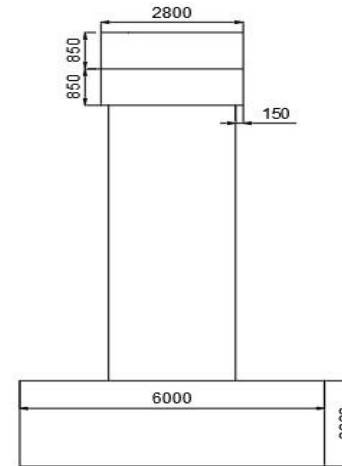
Picture-3 & 4: Cracks on pile concrete.

## 4.33 PIER – 42

### 4.33.1 LAYOUT



PIER- 42 FRONT VIEW



PIER- 42 SIDE VIEW

PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
PIER- 42 ELEVATION

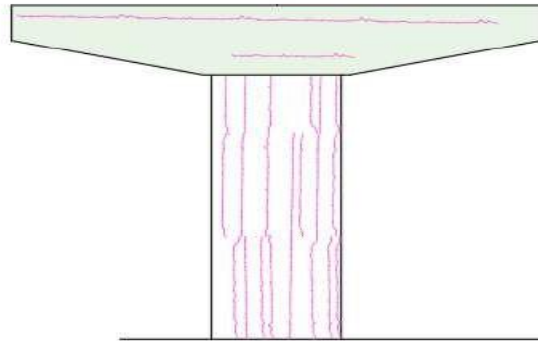
CONSULTANT:



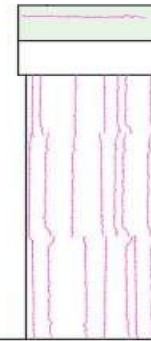
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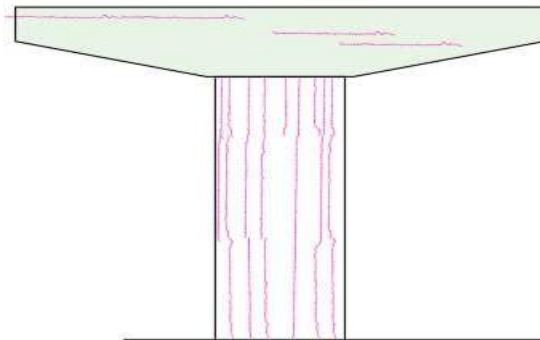
### 4.33.2 DISTRESS PLOTTING



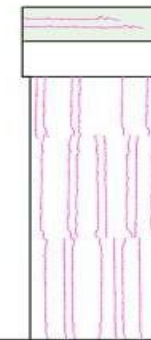
PIER-42 AT NORTH FACE



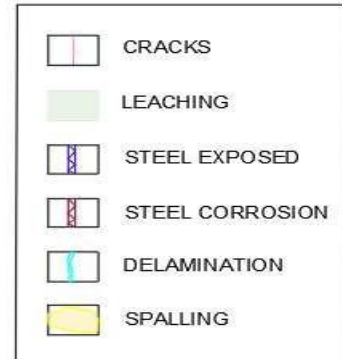
PIER- 42 AT EAST FACE



PIER-42 AT P-43 FACE



PIER- 42 AT WEST FACE



PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
DISTRESS MAPPING ON PIER-42

CONSULTANT:



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### 4.33.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier – 42</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.



#### 4.33.4 PHOTOGRAPHS:



Picture-1: Pier – 42 view



Picture-2: Cracks on pier surface.



Picture-3: Cracks on pier surface.



Picture-4: Minor cracks & leaching on pier cap



### 4.33.5 TEST RESULTS

#### REBOUND HAMMER TEST RESULTS

S. No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pier 42 at 1mt level in south face	0 <sup>0</sup>	38	44	42	40	40	The surface strength of concrete is in Good to Very Good condition as per IS 516 (Part5/Sec1):2020
			38	40	36			
			42	36	42			
2	On Pier 42 at 1mt level in North face	0 <sup>0</sup>	36	38	42	40	40	
			44	36	42			
			40	46	40			
3	On Pier 42 at 2mt level in south face	0 <sup>0</sup>	42	50	46	41	42	
			42	38	38			
			38	32	46			
4	On Pier 42 at 2mt level in North face	0 <sup>0</sup>	40	36	36	41	42	
			42	50	44			
			40	42	40			
5	On Pier 42 cap on North face at LHS	0 <sup>0</sup>	38	38	36	35	32	
			36	34	32			
			34	36	34			
6	On Pier 42 cap on North face at centre	0 <sup>0</sup>	40	38	36	36	33	
			40	34	34			
			34	36	36			
7	On Pier 42 cap on North face at RHS	0 <sup>0</sup>	38	44	48	42	44	
			42	44	40			
			40	42	38			
8	On Pier 42 cap on South face at LHS	0 <sup>0</sup>	48	42	40	41	42	
			42	40	38			
			38	40	40			
9	On Pier 42 cap on South face at centre	0 <sup>0</sup>	40	38	40	38	37	
			34	38	38			
			36	44	38			
10	On Pier 42 cap on South face at RHS	0 <sup>0</sup>	36	40	38	38	37	
			34	42	46			
			40	34	34			

#### ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pier 42	D	2500	609.9	4.10	4.10	Good	The UPV result are in Doubtful to
2			2500	640.6	3.90	3.90	Good	

3			2500	681.3	3.67	3.67	Doubtful	Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
4	On Pier 42 cap	ID	150	42.1	3.56	3.30	Doubtful	
			300	99.1	3.03			
5		ID	150	35.2	4.26	4.10	Good	
			300	76.3	3.93			
6		ID	150	35.7	4.20	3.87	Good	
			300	84.6	3.55			
7		ID	150	37.7	3.98	3.61	Doubtful	
			300	92.8	3.23			
8		ID	150	35.2	4.26	4.31	Good	
			300	68.7	4.37			
9		ID	150	30.1	4.98	4.14	Good	
			300	90.8	3.30			

### CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 42 at 2mts level in the direction of main reinforcement	88	83	As per Design
		84		
		82		
		78		

### HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 42	138	107	86	63	52	85	10%	The level of corrosion is in 10% at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		129	112	82	60	63			
		120	83	67	52	55			

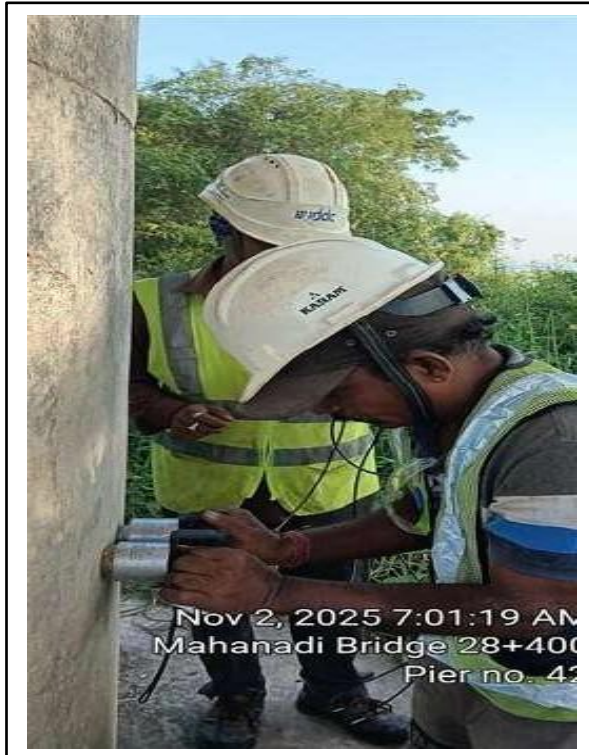
### CRACK WIDTH

S.NO	LOCATION	CRACK WIDTH IN MM
1	Pier -42	Pier 0.1 to 0.8
2		Pier Cap 0.1 to 0.4

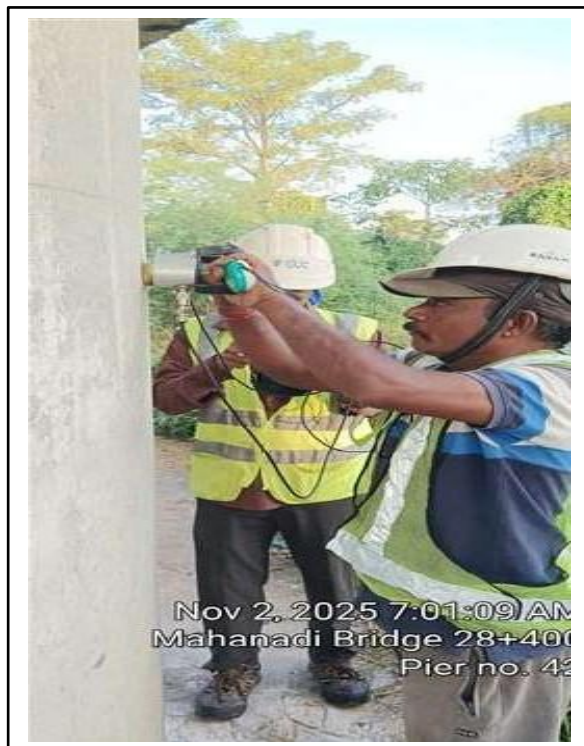
### CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -42	15.66

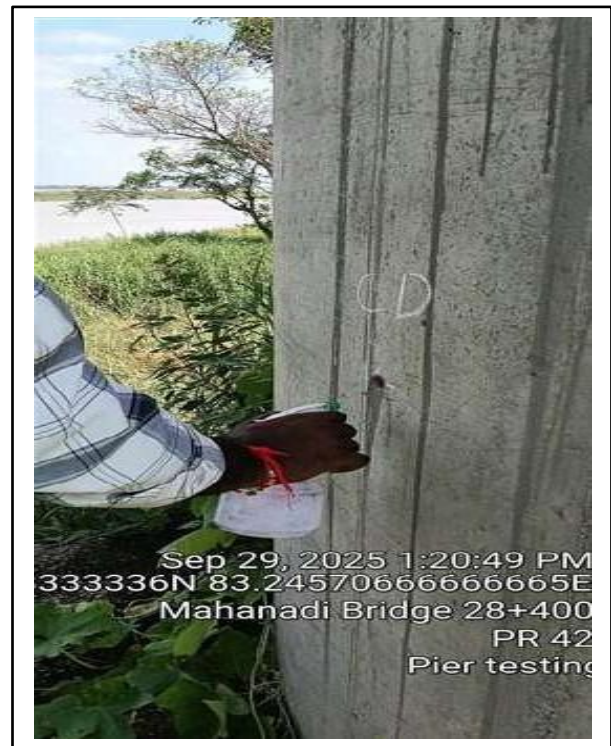
#### 4.33.6 PHOTOGRAPHS:



Conducting UPV tests



Conducting RHT tests



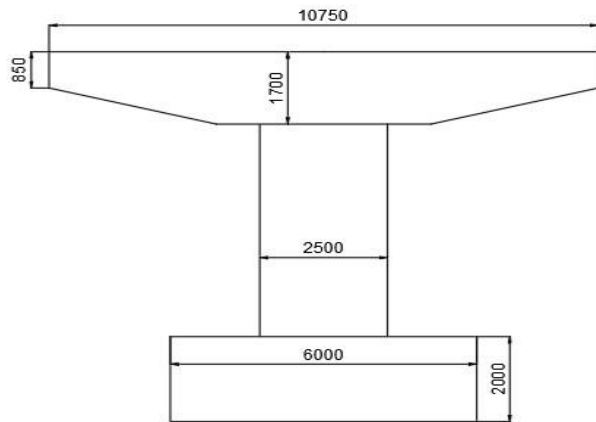
Conducting CD tests

## **SUMMARY OF TEST RESULTS**

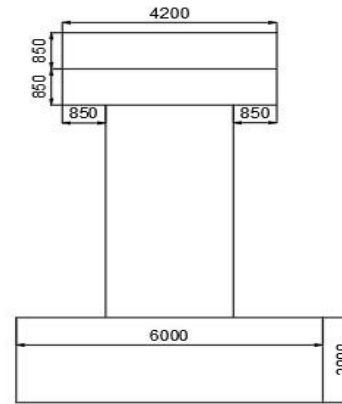
1. Rebound hammer test results revealed that quality of concrete is Good to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. As per concrete cover meter, Concrete cover results are ranging from 83 as per design.
4. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of 10%.
5. Crack width was in the range for pier 0.1mm to 0.8mm and pier cap 0.1mm to 0.4mm.
6. The Core Compressive test results are carried out on pier-42 is of 15.66 N/mm<sup>2</sup>

## 4.34 PIER - 43

### 4.34.1 LAYOUT



PIER- 43 FRONT VIEW



PIER- 43 SIDE VIEW

PROJECT:

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:

PIER-43 ELEVATION

CONSULTANT:



**IDDC Engineers Pvt. Ltd**

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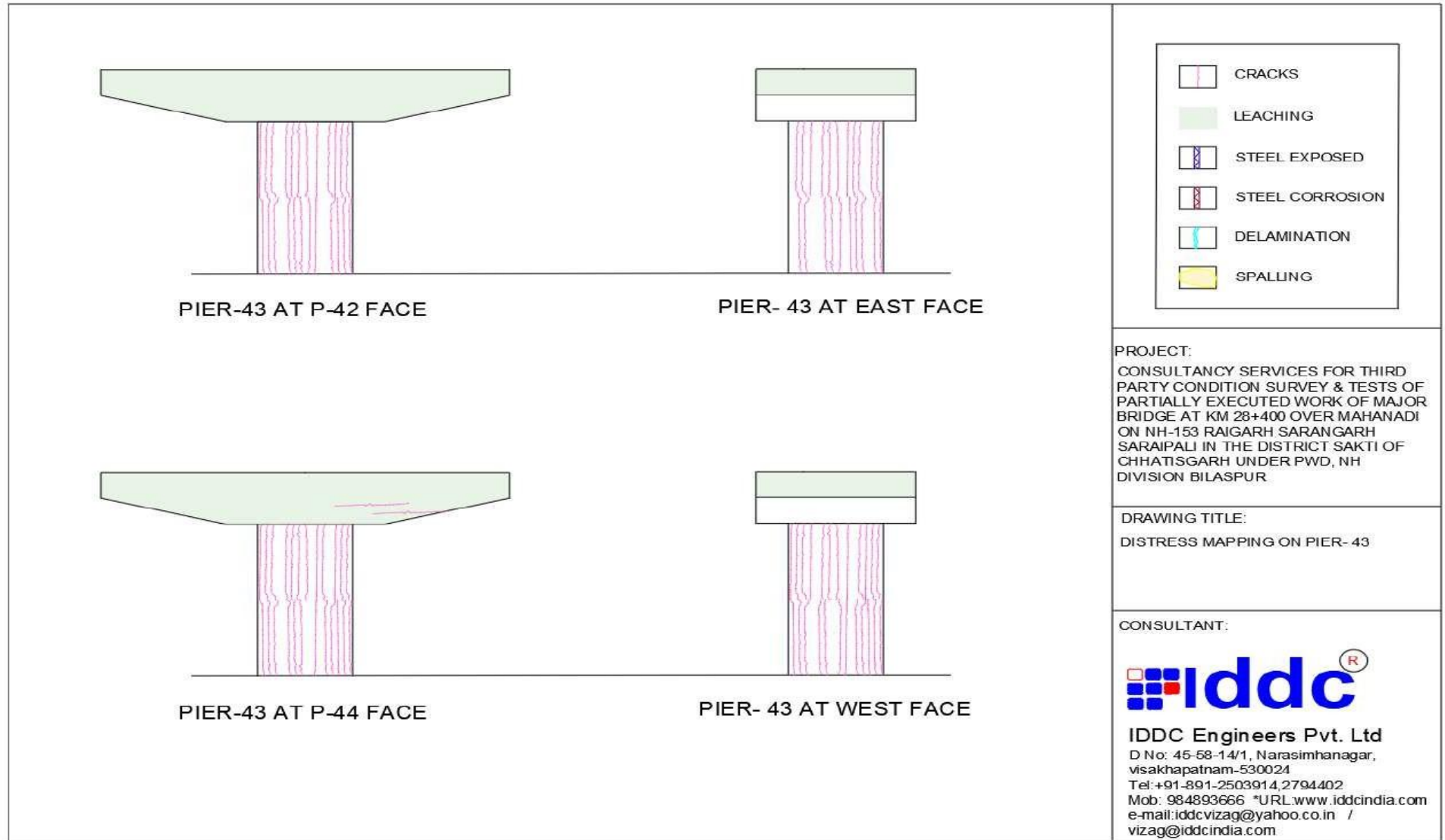
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## 4.34.2 DISTRESS PLOTTING



### 4.34.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier - 43</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.

#### 4.34.4 PHOTOGRAPHS:



Picture-1: Pier - 43 view



Picture-2: Cracks on pier surface.



Picture-3: Honeycombs on pier cap bottom face.



Picture-4: Leaching & minor cracks on cap

## 4.34.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pier 43 at 1mt level in south face	0 <sup>0</sup>	42	38	40	40	40	The surface strength of concrete is in Good to Very Good condition as per IS 516 (Part5/Sec1):2020
			34	46	42			
			38	40	44			
2	On Pier 43 at 1mt level in North face	0 <sup>0</sup>	38	36	36	39	39	
			38	40	40			
			42	38	40			
3	On Pier 43 at 2mt level in south face	0 <sup>0</sup>	44	40	40	39	39	
			40	38	38			
			38	36	40			
4	On Pier 43 at 2mt level in North face	0 <sup>0</sup>	40	44	40	43	46	
			48	46	40			
			42	40	48			
5	On Pier 43 cap on North face at LHS	0 <sup>0</sup>	48	42	42	42	44	
			44	40	40			
			38	40	44			
6	On Pier 43 cap on North face at centre	0 <sup>0</sup>	34	32	32	36	33	
			38	38	36			
			36	38	36			
7	On Pier 43 cap on North face at RHS	0 <sup>0</sup>	48	42	40	44	48	
			42	48	48			
			42	42	40			
8	On Pier 43 cap on South face at LHS	0 <sup>0</sup>	46	40	48	41	42	
			40	40	40			
			42	38	38			
9	On Pier 43 cap on South face at centre	0 <sup>0</sup>	40	50	44	43	46	
			46	46	44			
			38	40	40			
10	On Pier 43 cap on South face at RHS	0 <sup>0</sup>	46	40	42	41	42	
			38	46	40			
			38	38	44			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pier 43	D	2500	635.2	3.94	3.94	Good	The UPV result are in Doubtful to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
2			2500	653.3	3.83	3.83	Good	
3			2500	647.8	3.86	3.86	Good	
4			2500	632.8	3.95	3.95	Good	
5	On Pier 43 cap	ID	150	37.4	4.01	3.65	Doubtful	
			300	91.2	3.29			
6		ID	150	32.1	4.67	4.02	Good	
			300	89.2	3.36			
7		ID	150	37.4	4.01	4.13	Good	
			300	70.5	4.26			
8		ID	150	32.2	4.66	4.41	Good	
			300	72	4.17			
9		ID	150	32.4	4.63	4.59	Excellent	
			300	65.9	4.55			
10		ID	150	35.5	4.23	4.30	Good	
			300	68.5	4.38			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On pier 43	15	5	Dark pink	The results indicate concrete is Carbonated up to a depth of 5mm to 15mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On pier 43 cap	25	15	Light pink	
3		20	10	Dark pink	



## CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 43 at 1mts level in the direction of main reinforcement	69	77	As per Design
		75		
		77		
		85		
2	On Pier - 43 at 2mts level in the direction of main reinforcement	66	75	
		73		
		77		
		85		

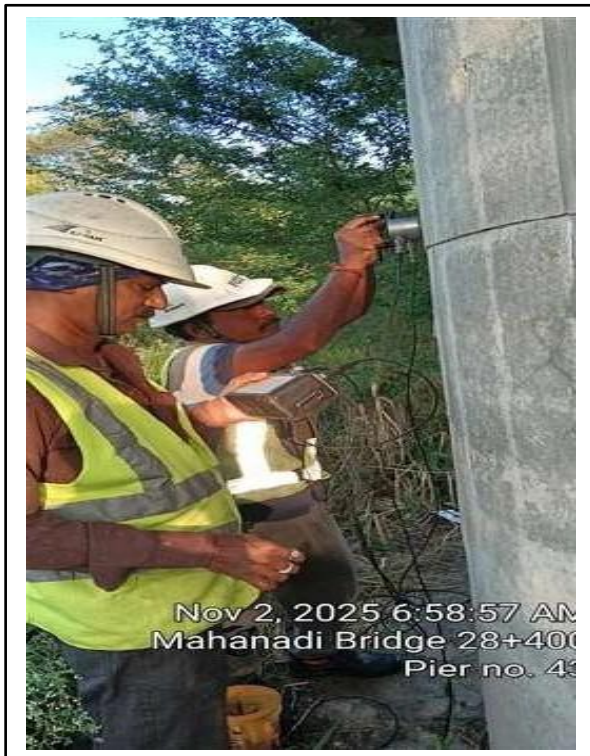
## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 43	121	96	87	63	72	136	10%	The level of corrosion is in 10% at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		246	183	117	84	91			
		225	176	246	121	106			

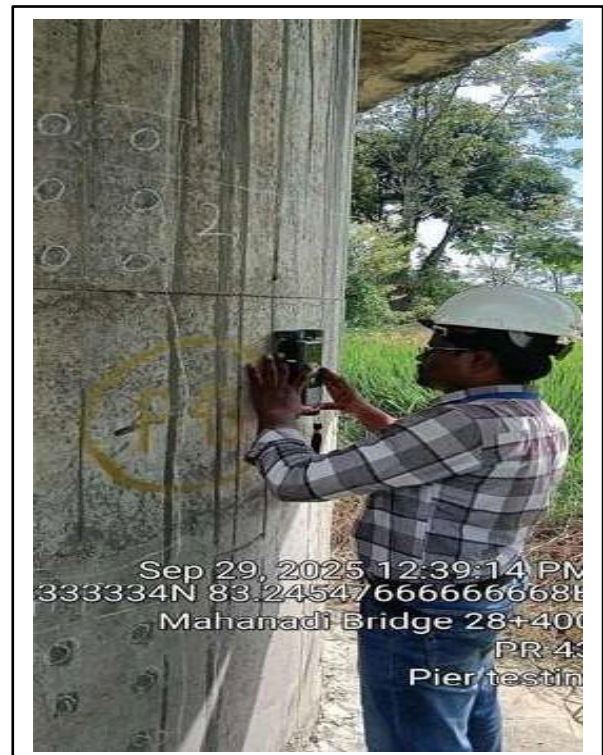
## CRACK WIDTH

S.NO	LOCATION		CRACK WIDTH IN MM
1	Pier -43	Pier	0.1 to 1.5
2		Pier Cap	0.1 to 0.5

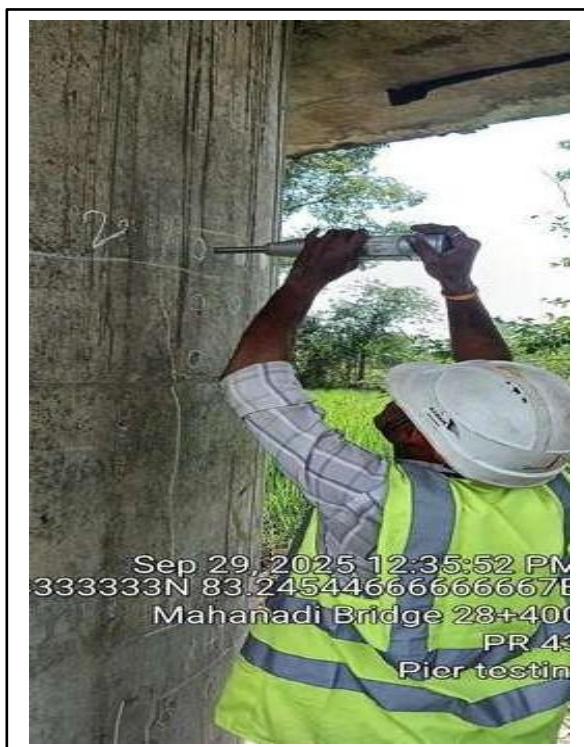
#### 4.34.6 TESTING PHOTOGRAPHS:



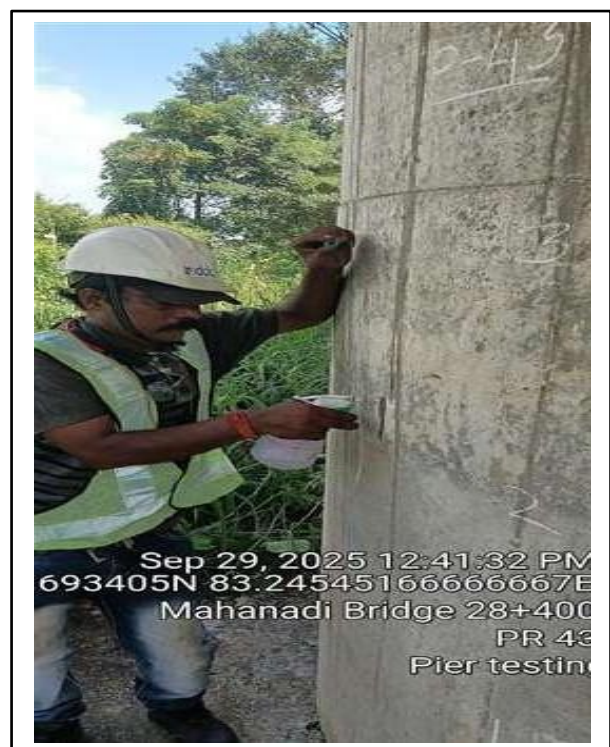
Conducting UPV tests



Conducting Concrete cover meter tests



Conducting RHT tests



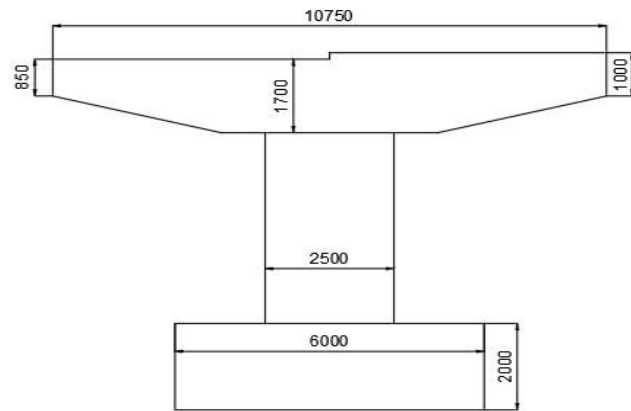
Conducting CD tests

## **SUMMARY OF TEST RESULTS**

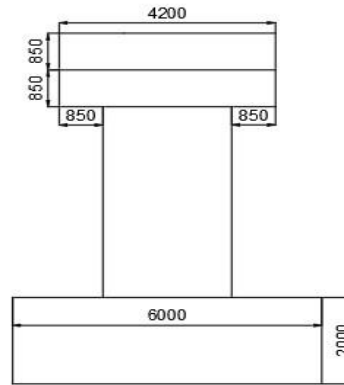
1. Rebound hammer test results revealed that quality of concrete is Good to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Excellent " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 5mm to 15mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 75 to 77 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of 10%.
6. Crack width was in the range for pier 0.1 mm to 1.5 mm and pier cap 0.1mm to 0.5mm.

## 4.35 PIER - 44

### 4.35.1 LAYOUT



PIER- 44 FRONT VIEW



PIER- 44 SIDE VIEW

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

FOUNDATION AND PIER- 44 PLAN & ELEVATION

**CONSULTANT:**



**IDDC Engineers Pvt. Ltd**

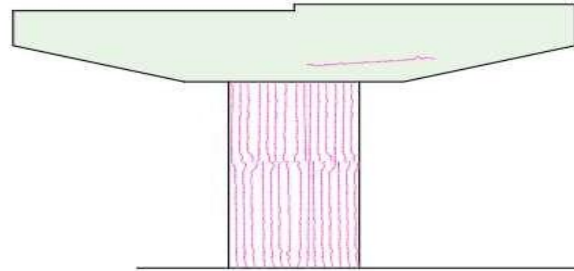
D No: 45-58-14/1, Narasimhanagar, visakhapatnam-530024

Tel: +91-891-2503914, 2794402

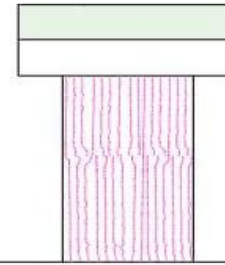
Mob: 984893666 \*URL: [www.iddcindia.com](http://www.iddcindia.com)

e-mail: [iddcvizag@yahoo.co.in](mailto:iddcvizag@yahoo.co.in) / [vizag@iddcindia.com](mailto:vizag@iddcindia.com)

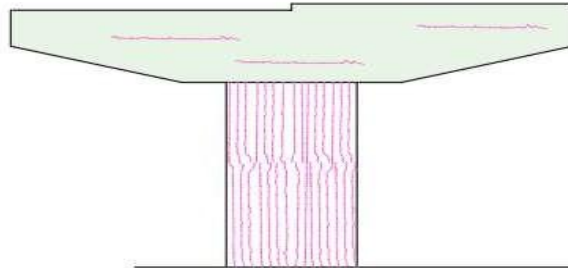
## 4.35.2 DISTRESS PLOTTING



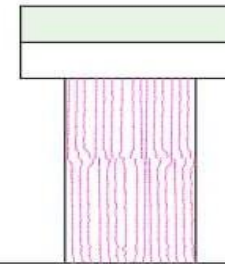
PIER-44 AT P-43 FACE



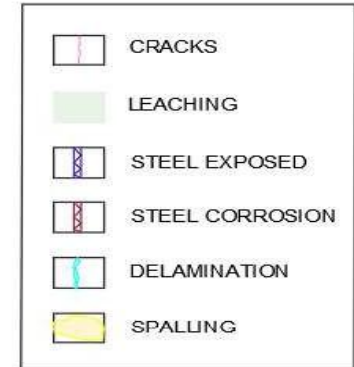
PIER- 44 AT EAST FACE



PIER-44 AT P-45 FACE



PIER- 44 AT WEST FACE



PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
DISTRESS MAPPING ON PIER-44

CONSULTANT:



**IDDC Engineers Pvt. Ltd**  
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### 4.35.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
<b>Pier - 44</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.

#### 4.35.4 PHOTOGRAPHS:



Picture-1: Pier - 44 view



Picture-2: Cracks on pier surface.



Picture-3: Cracks on pier surface.



Picture-4: Leaching & minor cracks on cap.

## 4.35.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Compressive Strength N/mm <sup>2</sup>	Remarks
1	On Pier 44 at 1mt level in south face	0 <sup>0</sup>	46	46	48	43	46	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			44	40	46			
			44	38	38			
2	On Pier 44 at 1mt level in North face	0 <sup>0</sup>	46	46	34	42	44	
			44	44	44			
			38	40	38			
3	On Pier 44 at 2mt level in south face	0 <sup>0</sup>	42	42	44	41	42	
			40	34	42			
			42	36	44			
4	On Pier 44 at 2mt level in North face	0 <sup>0</sup>	44	44	38	42	44	
			38	38	44			
			42	48	40			
5	On Pier 44 cap on North face at LHS	0 <sup>0</sup>	34	36	34	34	30	
			30	32	38			
			34	36	30			
6	On Pier 44 cap on North face at centre	0 <sup>0</sup>	38	32	36	39	39	
			38	40	34			
			42	48	44			
7	On Pier 44 cap on North face at RHS	0 <sup>0</sup>	42	44	46	44	48	
			40	48	46			
			38	38	50			
8	On Pier 44 cap on South face at LHS	0 <sup>0</sup>	30	32	30	30	23	
			28	28	28			
			30	32	28			
9	On Pier 44 cap on South face at centre	0 <sup>0</sup>	44	46	42	42	44	
			44	42	40			
			40	38	38			
10	On Pier 44 cap on South face at RHS	0 <sup>0</sup>	40	46	44	43	46	
			38	50	42			
			48	40	40			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S. No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pier 44	D	2500	653.4	3.83	3.83	Good	The UPV result are in Doubtful to Excellent as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
2			2500	657.4	3.80	3.80	Good	
3			2500	617.7	4.05	4.05	Good	
4			2500	665.4	3.76	3.76	Good	
5	On Pier 44 cap	ID	150	37.6	3.99	4.02	Good	
			300	74.2	4.04			
6		ID	150	35.1	4.27	4.08	Good	
			300	77.2	3.89			
7		ID	150	37.2	4.03	3.93	Good	
			300	78.4	3.83			
8		ID	150	42.1	3.56	3.31	Doubtful	
			300	98.1	3.06			
9		ID	150	42.2	3.55	3.85	Good	
			300	72.3	4.15			
10		ID	150	30.5	4.92	4.59	Excellent	
			300	70.3	4.27			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On pier 44	20	10	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On pier 44 cap	25	10	Light pink	
3		20	10	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 44 at 1mts level in the direction of main reinforcement	73	78	As per Design
		76		
		84		
		78		
2	On Pier - 44 in the direction of stirrups reinforcement	52	55	
		57		
		57		
		55		
3	On Pier cap- 44 at South face	62	59	
		58		
		55		
		60		

## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 44	114	83	69	63	51	88	10%	The level of corrosion is in 10% at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		144	126	111	92	82			
		121	100	76	51	32			

## CRACK WIDTH

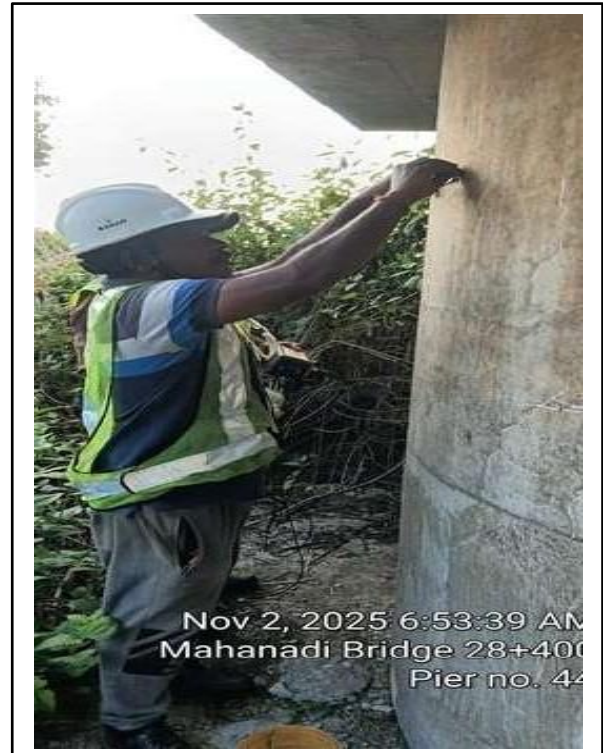
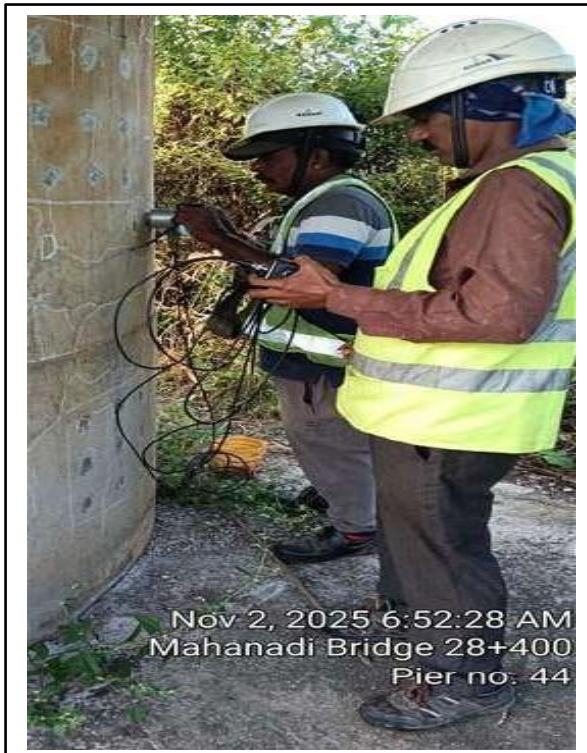
S.NO	LOCATION		CRACK WIDTH IN MM
1	Pier -44	Pier	0.2 to 1.5
2		Pier Cap	0.1 to 0.4

## CORE COMPRESSIVE STRENGTH TEST RESULTS:

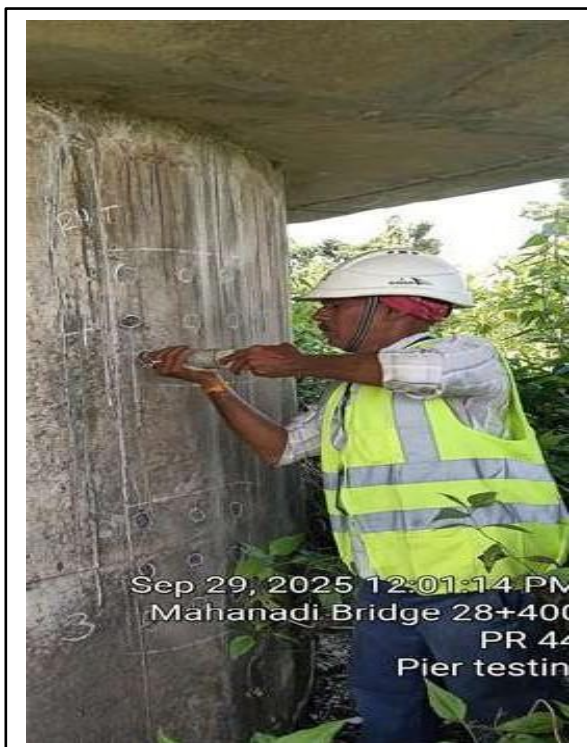
S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -44	18.97



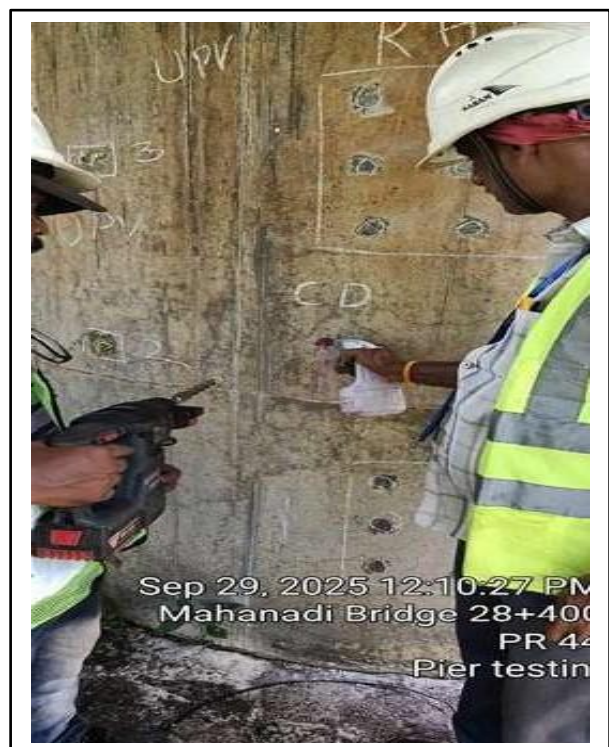
#### 4.35.6 TESTING PHOTOGRAPHS:



Conducting UPV tests



Conducting RHT tests



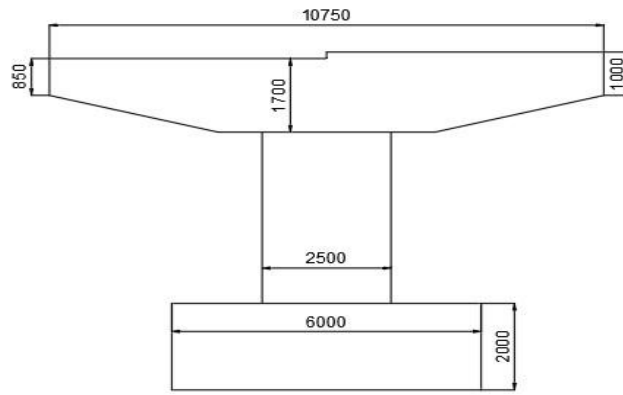
Conducting CD tests

## **SUMMARY OF TEST RESULTS**

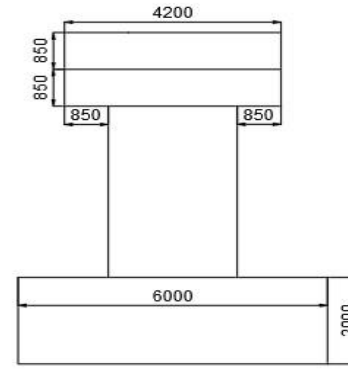
1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Excellent " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 55 to 59 to 78 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of 10%.
6. Crack width was in the range pier 0.2mm to 1.5mm and pier cap 0.1mm to 0.4mm.
7. The Core Compressive test results are carried out on pier-44 is of 18.97 N/mm<sup>2</sup>

## 4.36 PIER – 45

### 4.36.1 LAYOUT



PIER- 45 FRONT VIEW



PIER- 45 SIDE VIEW

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

FOUNDATION AND PIER- 45 PLAN & ELEVATION

**CONSULTANT:**



**IDDC Engineers Pvt. Ltd**

D No: 45-58-14/1, Narasimhanagar,

visakhapatnam-530024

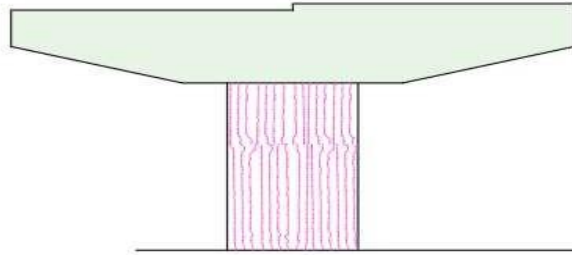
Tel: +91-891-2503914, 2794402

Mob: 984893666 \*URL: [www.iddcindia.com](http://www.iddcindia.com)

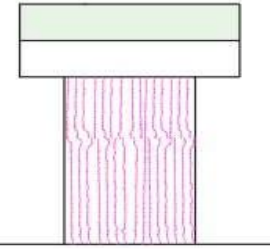
e-mail: [iddcvizag@yahoo.co.in](mailto:iddcvizag@yahoo.co.in) /

[vizag@iddcindia.com](mailto:vizag@iddcindia.com)

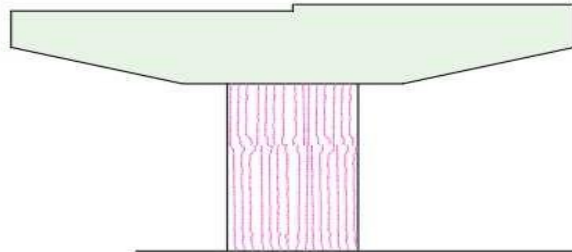
## 4.36.2 DISTRESS PLOTTING



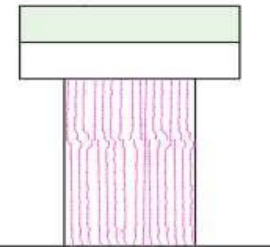
PIER-45 AT P-44 FACE



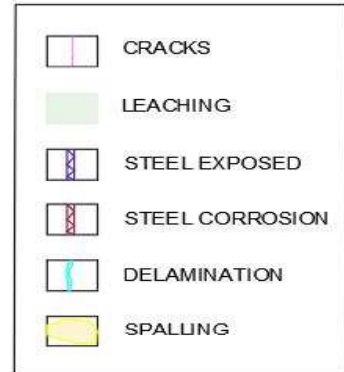
PIER- 45 AT EAST FACE



PIER-45 AT P-46 FACE



PIER- 45 AT WEST FACE



**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

DISTRESS MAPPING ON PIER-45

**CONSULTANT:**



**IDDC Engineers Pvt. Ltd**

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e-mail: iddcvizag@yahoo.co.in /  
vizag@iddcindia.com

### 4.36.3 OBSERVATION SHEET

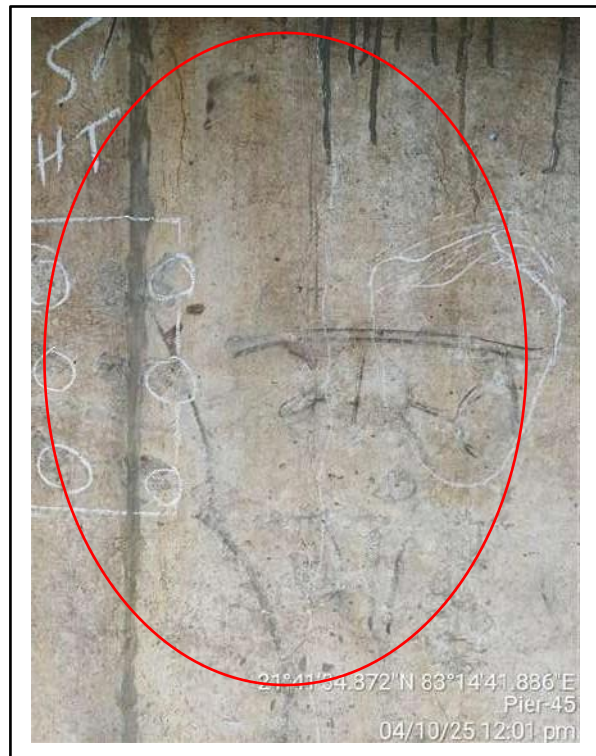
Element Name	Observation	Location of Distress
<b>Pier - 45</b>		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.



#### 4.36.4 PHOTOGRAPHS:



Picture-1: Pier - 45 view



Picture-2: Cracks on pier surface.



Picture-3: Cracks on pier surface.



Picture-4: Leaching & minor cracks on cap

## 4.36.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pier 45 at 1mt level in south face	0 <sup>0</sup>	38	36	38	37	35	The surface strength of concrete is in Fair to Very Good condition as per IS 516 (Part5/Sec1):2020
			38	38	34			
			38	34	36			
2	On Pier 45 at 1mt level in North face	0 <sup>0</sup>	40	48	40	44	48	
			46	50	44			
			40	44	40			
3	On Pier 45 at 2mt level in south face	0 <sup>0</sup>	40	34	38	38	37	
			40	38	40			
			38	34	36			
4	On Pier 45 at 2mt level in North face	0 <sup>0</sup>	46	44	46	45	50	
			50	42	44			
			46	40	46			
5	On Pier 45 cap on North face at LHS	0 <sup>0</sup>	38	40	40	37	35	
			38	36	34			
			36	34	36			
6	On Pier 45 cap on North face at centre	0 <sup>0</sup>	42	38	36	38	37	
			38	36	38			
			36	36	40			
7	On Pier 45 cap on North face at RHS	0 <sup>0</sup>	30	30	32	32	27	
			28	28	38			
			38	32	30			
8	On Pier 45 cap on South face at LHS	0 <sup>0</sup>	34	36	36	34	30	
			36	32	34			
			36	34	32			
9	On Pier 45 cap on South face at centre	0 <sup>0</sup>	38	44	38	36	33	
			32	30	36			
			36	36	30			
10	On Pier 45 cap on South face at RHS	0 <sup>0</sup>	40	38	42	38	37	
			40	40	40			
			38	34	30			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pier 45	D	2500	626.2	3.99	3.99	Good	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
2			2500	646.3	3.87	3.87	Good	
3			2500	652.7	3.83	3.83	Good	
4			2500	680	3.68	3.68	Doubtful	
5	On Pier 45 cap	ID	150	44.5	3.37	3.16	Doubtful	
			300	101.6	2.95			
6		ID	150	545.3	0.28	1.61	Doubtful	
			300	101.6	2.95			
7		ID	150	41.4	3.62	3.18	Doubtful	
			300	109.8	2.73			
8		ID	150	37.4	4.01	3.69	Doubtful	
			300	89.1	3.37			
9		ID	150	64.3	2.33	2.36	Doubtful	
			300	125.6	2.39			
10		ID	150	61.9	2.42	2.60	Doubtful	
			300	108.1	2.78			

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On pier 45	20	10	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm to 15mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On pier 45 cap	25	15	Dark pink	
3		25	15	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 45 at 1mts level in the direction of main reinforcement	69	69	As per Design
		76		
		78		
		52		
2	On Pier cap- 45 at bottom face	59	53	
		53		
		52		
		47		

## HALF CELL POTENTIAL TEST RESULTS

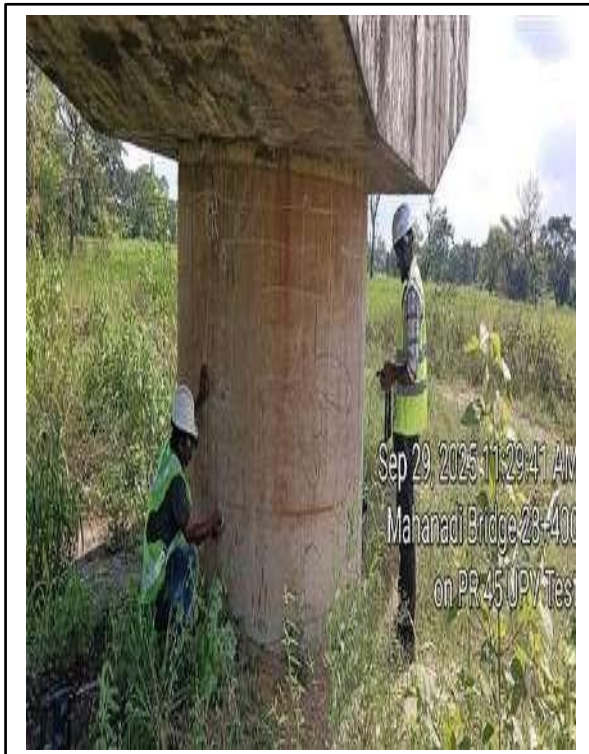
S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 45	89	64	52	46	31	65	10%	The level of corrosion is in 10% at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		107	81	74	68	59			
		83	69	54	51	44			

## CRACK WIDTH

S.NO	LOCATION		CRACK WIDTH IN MM
1	Pier -45	Pier	0.1 to 1.5
2		Pier Cap	0.1 to 0.4



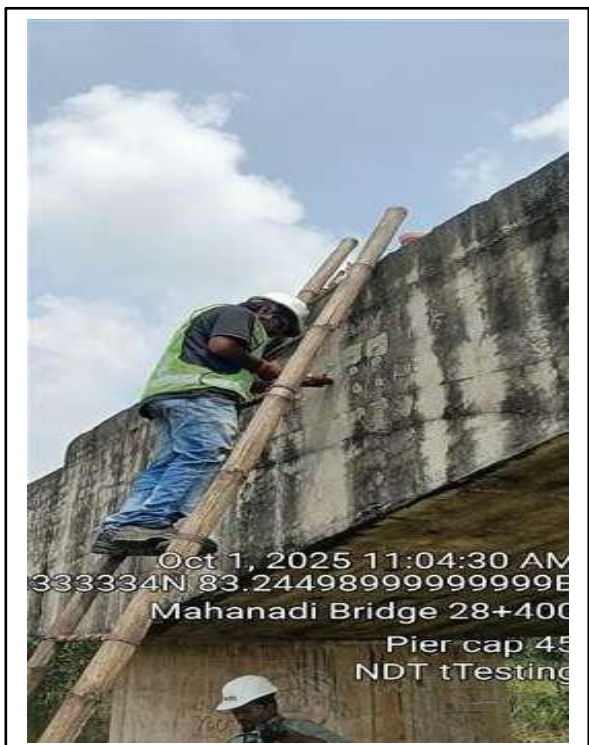
#### 4.36.6 PHOTOGRAPHS:



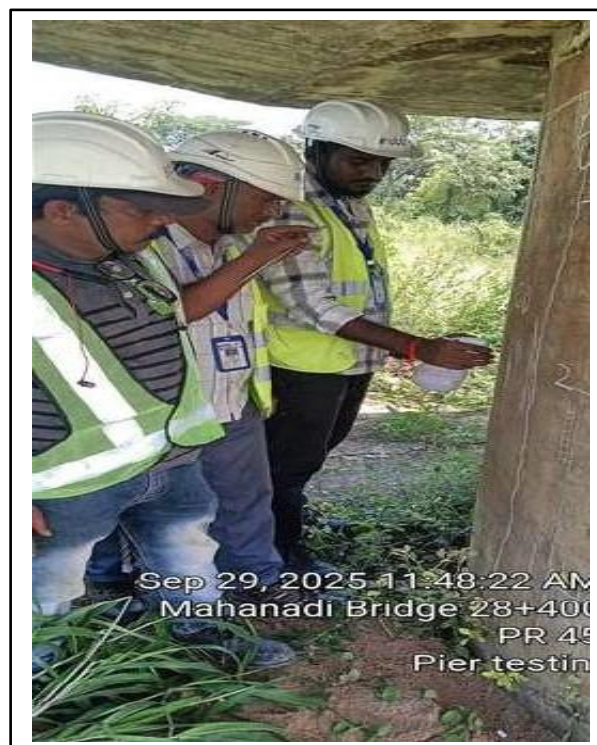
Conducting UPV tests



Conducting Concrete cover meter tests



Conducting RHT tests



Conducting CD tests

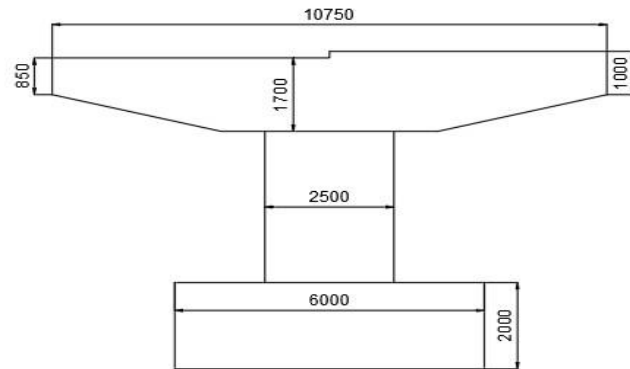


## **SUMMARY OF TEST RESULTS**

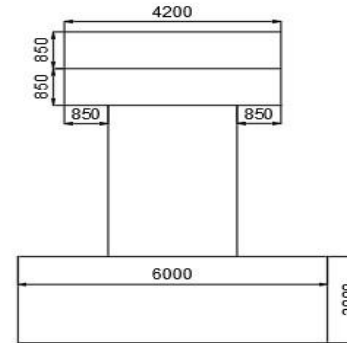
1. Rebound hammer test results revealed that quality of concrete is Fair to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm to 15mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 53 to 69 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of 10%.
6. Crack width was in the range for pier 0.1mm to 1.5mm and pier cap 0.1mm to 0.4mm.

## 4.37 PIER - 46

### 4.37.1 LAYOUT



PIER- 46 FRONT VIEW



PIER- 46 SIDE VIEW

**PROJECT:**

CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

**DRAWING TITLE:**

FOUNDATION AND PIER- 46 PLAN & ELEVATION

**CONSULTANT:**



**IDDC Engineers Pvt. Ltd**

D No: 45-58-14/1, Narasimhanagar,

visakhapatnam-530024

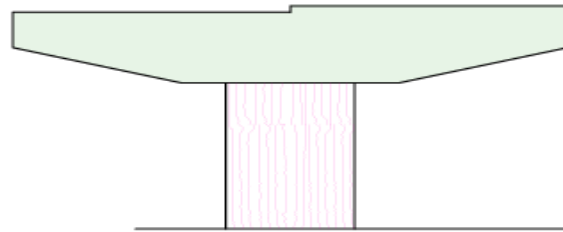
Tel: +91-891-2503914, 2794402

Mob: 984893666 \*URL: [www.iddcindia.com](http://www.iddcindia.com)

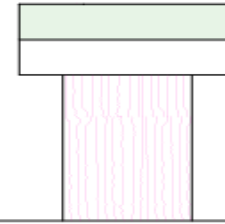
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[vizag@iddcindia.com](mailto:vizag@iddcindia.com)

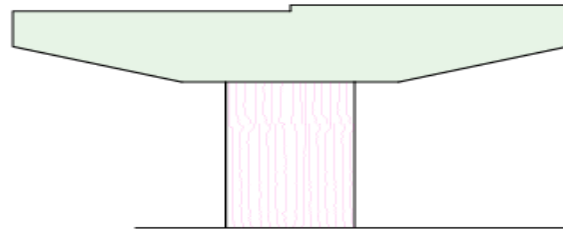
## 4.37.2 DISTRESS PLOTTING



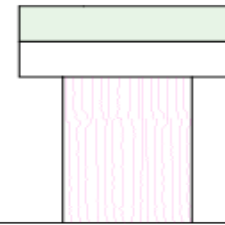
PIER-46 AT P-45 FACE



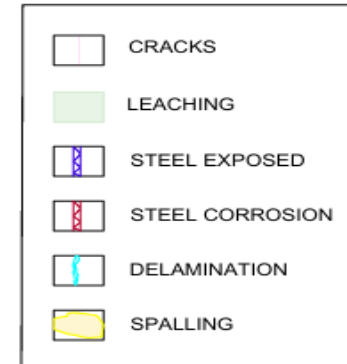
PIER- 46 AT EAST FACE



PIER-46 AT AB-02 FACE



PIER- 46 AT WEST FACE



PROJECT:  
CONSULTANCY SERVICES FOR THIRD PARTY CONDITION SURVEY & TESTS OF PARTIALLY EXECUTED WORK OF MAJOR BRIDGE AT KM 28+400 OVER MAHANADI ON NH-153 RAIGARH SARANGARH SARAIPALI IN THE DISTRICT SAKTI OF CHHATISGARH UNDER PWD, NH DIVISION BILASPUR

DRAWING TITLE:  
DISTRESS MAPPING ON PIER-46

CONSULTANT:



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### 4.37.3 OBSERVATION SHEET

Element Name	Observation	Location of Distress
Pier - 46		
Pier cap	MC	Minor cracks observed on pier cap surface at all faces along the main reinforcement direction.
	L	Leaching observed on pier cap top and all side faces at various locations.
	R	Rust observed on pedestal reinforcement over pier cap.
Pier	C	Vertical cracks observed on pier surface from bottom to top level at various locations.
	MC	Minor discontinues horizontal cracks observed on pier surface at various locations.

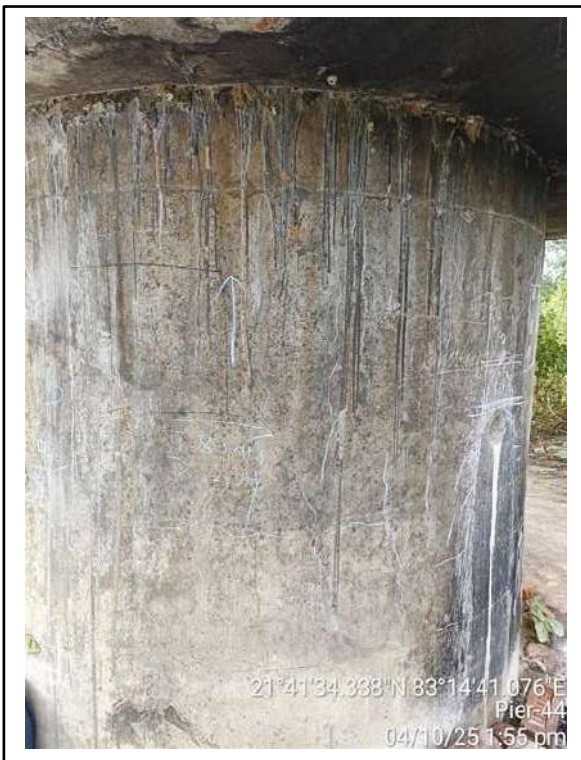
#### 4.37.4 PHOTOGRAPHS:



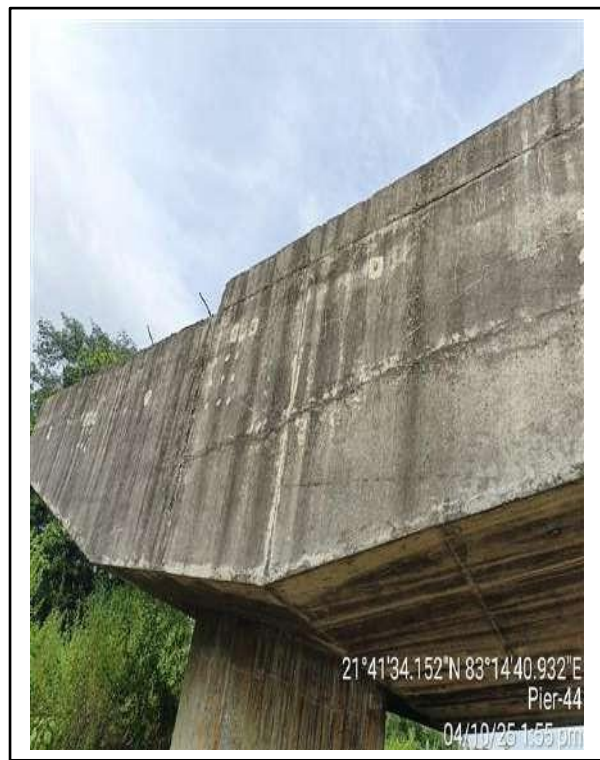
Picture-1: Pier - 46 view



Picture-2: Cracks on pier surface.



Picture-3: Cracks on pier surface.



Picture-4: Leaching & minor cracks on cap



## 4.37.5 TEST RESULTS

### REBOUND HAMMER TEST RESULTS

S.No	Location	Degrees	Rebound Number			Avg. Rebound Number	Surface Strength N/mm <sup>2</sup>	Remarks
1	On Pier 46 at 1mt level in south face	0 <sup>0</sup>	34	36	38	37	35	The surface strength of concrete is in Good condition as per IS 516 (Part5/Sec1):2020
			36	34	36			
			38	40	42			
2	On Pier 46 at 1mt level in North face	0 <sup>0</sup>	44	46	50	41	42	
			36	34	40			
			42	38	40			
3	On Pier 46 at 2mt level in south face	0 <sup>0</sup>	36	40	36	37	35	
			36	34	34			
			38	38	42			
4	On Pier 46 at 2mt level in North face	0 <sup>0</sup>	44	38	38	42	44	
			40	44	50			
			44	36	42			
5	On Pier 46 cap on North face at LHS	0 <sup>0</sup>	36	38	42	38	37	
			40	42	40			
			32	36	36			
6	On Pier 46 cap on North face at centre	0 <sup>0</sup>	40	40	40	36	33	
			36	36	36			
			34	32	34			
7	On Pier 46 cap on North face at RHS	0 <sup>0</sup>	34	40	36	39	39	
			40	44	34			
			46	42	38			
8	On Pier 46 cap on South face at LHS	0 <sup>0</sup>	38	40	44	41	42	
			34	42	44			
			40	46	38			
9	On Pier 46 cap on South face at centre	0 <sup>0</sup>	46	40	34	40	40	
			40	40	34			
			48	42	34			
10	On Pier 46 cap on South face at RHS	0 <sup>0</sup>	30	38	38	39	39	
			40	44	40			
			40	42	42			

## ULTRA SONIC PULSE VELOCITY TEST RESULTS

S.No	Location	Type ID/D	Dist. (mm)	Time (μs)	Velocity (Km/sec)	Avg. Velocity (Km/sec)	Condition	Remarks
1	On Pier 46	D	2500	672.2	3.72	3.72	Doubtful	The UPV result are in Doubtful to Good as per IS 516 (Part 5/ Sec 1) 2018 AMENDMENT NO.1 NOVEMBER 2019.
2			2500	635.2	3.94	3.94	Good	
3			2500	677.4	3.69	3.69	Doubtful	
4			2500	706.2	3.54	3.54	Doubtful	
5	ID	150	35.5	4.23	3.60	Doubtful		
		300	100.8	2.98				
6	ID	150	43.3	3.46	3.18	Doubtful		
		300	103.9	2.89				
7	ID	150	33.7	4.45	3.61	Doubtful		
		300	108.2	2.77				
8	ID	150	36.9	4.07	4.07	Good		
		300	73.5	4.08				
9	ID	150	44.7	3.36	3.64	Doubtful		
		300	76.6	3.92				
10	ID	150	41.8	3.59	3.66	Doubtful		
		300	80.5	3.73				

## CARBONATION DEPTH TEST RESULTS

S. No.	Location	Hole Depth ('D' in mm)	Carbonation Depth ('A' in mm)	Colour Change	Remarks
1	On pier 46 at 1 mt level	30	25	Dark pink	The results indicate concrete is Carbonated up to a depth of 10mm to 25mm from the surface as per IS 516 (Part 5/Sec 3): 2021.
2	On pier 46 cap	25	10	Dark pink	
3		15	10	Dark pink	

## CONCRETE COVER METER TEST RESULTS

S.NO	LOCATION	COVER METER READINGS	AVG READING	REMARKS
1	On Pier - 46 at 1mts level in the direction of main reinforcement	54	59	As per Design
		61		
		64		
		57		
2	On Pier cap- 46 at at bottom face	42	48	
		48		
		51		
		52		

## HALF CELL POTENTIAL TEST RESULTS

S. No	Location	HCP Readings					Avg. HCP Readings	% of HCP	Remarks
1	On Pier - 46	342	296	282	265	287	298	Uncertain	The level of corrosion is to uncertain at tested locations as per IS: 516 (Part 5/Sec 2 2021)
		287	282	271	267	254			
		409	346	314	294	267			

## CRACK WIDTH

S.NO	LOCATION		CRACK WIDTH IN MM
1	Pier -46	Pier	0.3 to 1.5
2		Pier Cap	0.1 to 0.5

## CORE COMPRESSIVE STRENGTH TEST RESULTS:

S. No	Location	Equivalent cube compressive strength in N/mm <sup>2</sup>
1	On Pier -46	11.56

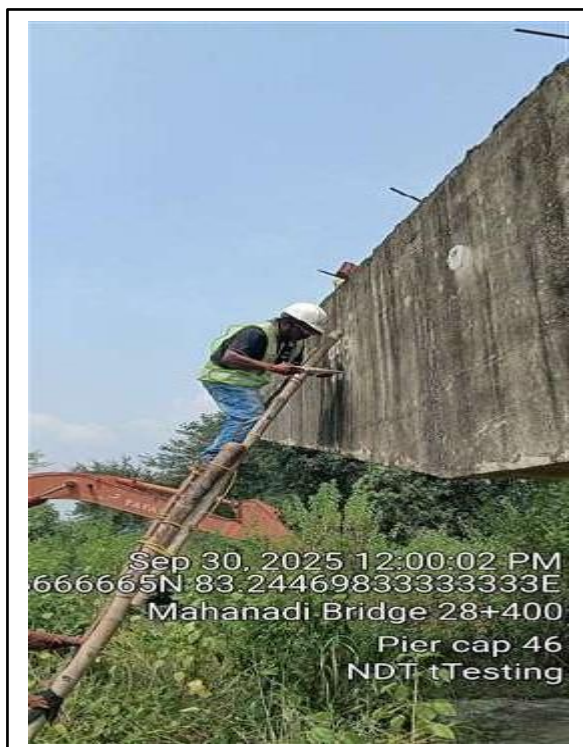
#### 4.37.6 TESTING PHOTOGRAPHS:



Conducting UPV tests



Conducting Concrete cover meter tests



Conducting RHT tests



Conducting Core cutting tests

## **SUMMARY OF TEST RESULTS**

1. Rebound hammer test results revealed that quality of concrete is Good to Very Good among the tested members.
2. Ultrasonic pulse velocity test results indicate that concrete quality is "Doubtful to Good " at the tested locations.
3. The Carbonation depth test results of the structure which indicates the carbonation effect reached up to the core concrete is in the range of 10mm to 25mm at tested locations.
4. As per concrete cover meter, Concrete cover results are ranging from 48 to 59 as per design.
5. The probability levels for steel Corroded against measured Copper/ Copper sulphate half-cell potentials of the existing structure are in the level of Uncertain.
6. Crack width was in the range for pile cap 0.3mm to 1.5mm, pier 0.1mm to 0.5mm and pier cap 0.1mm to 0.4mm.
7. The Core Compressive test results are carried out on pier-46 is of 11.56 N/mm<sup>2</sup>



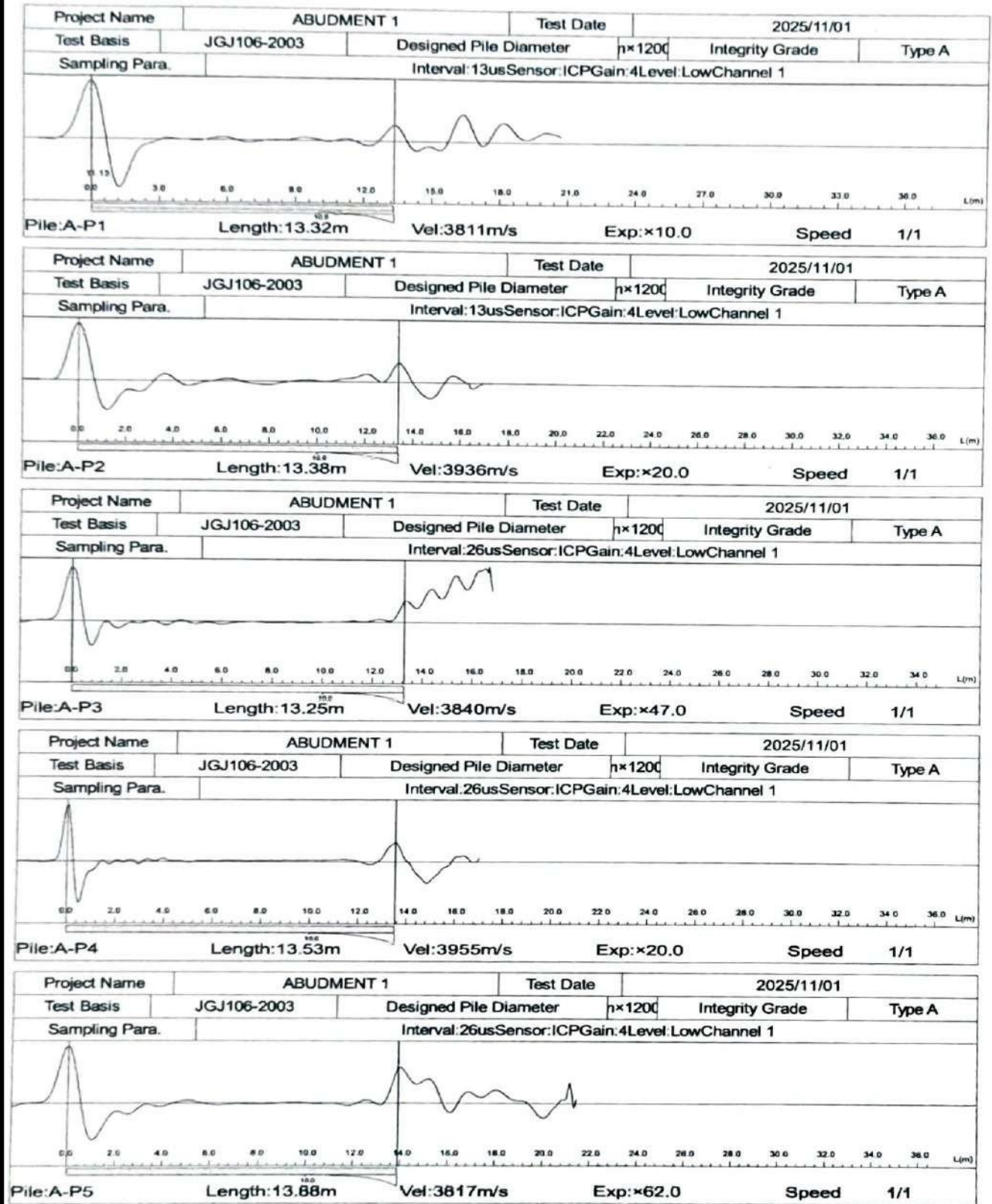
## 5. LOW – STRAIN PILE INTERGITY TEST RESULTS

### TABLER FORM:-

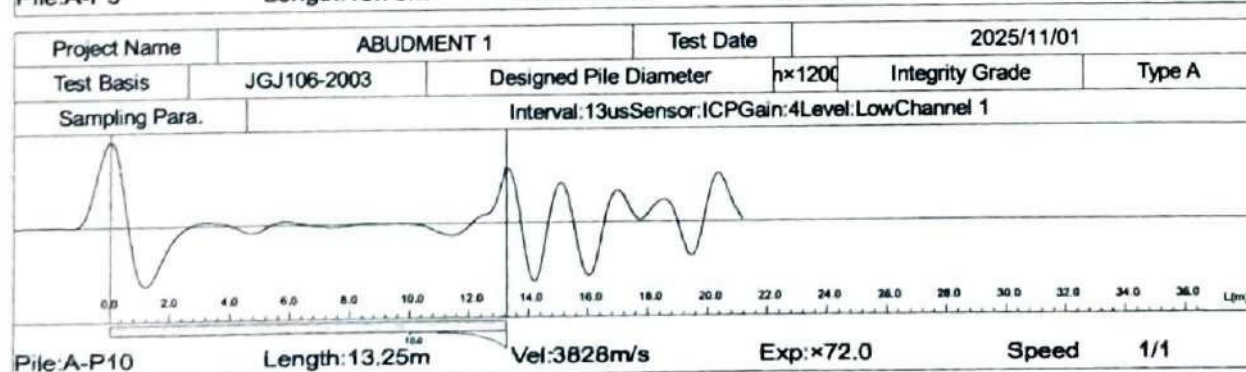
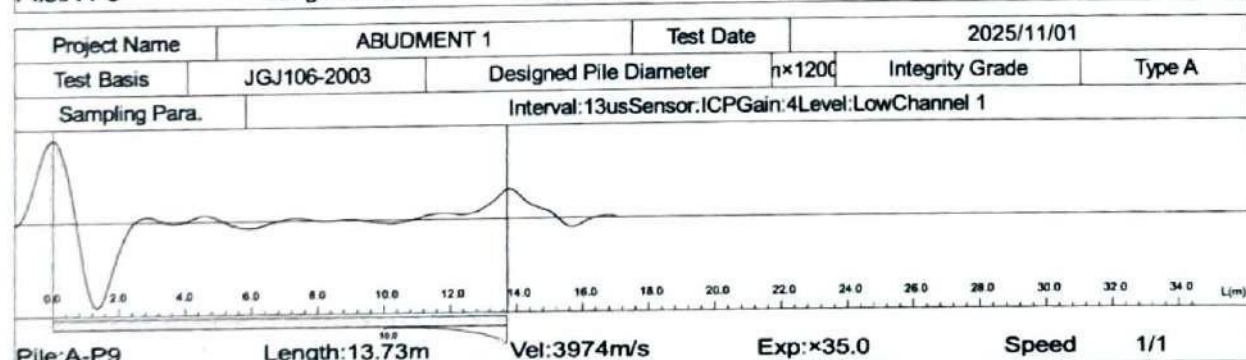
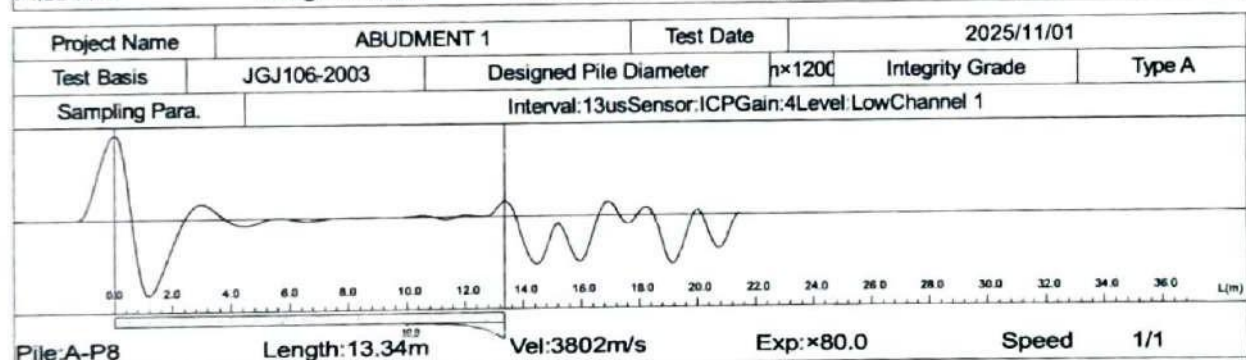
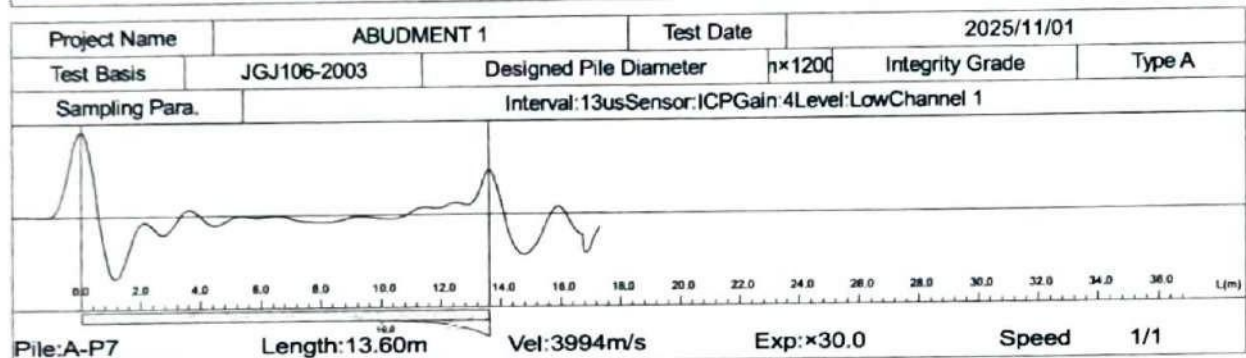
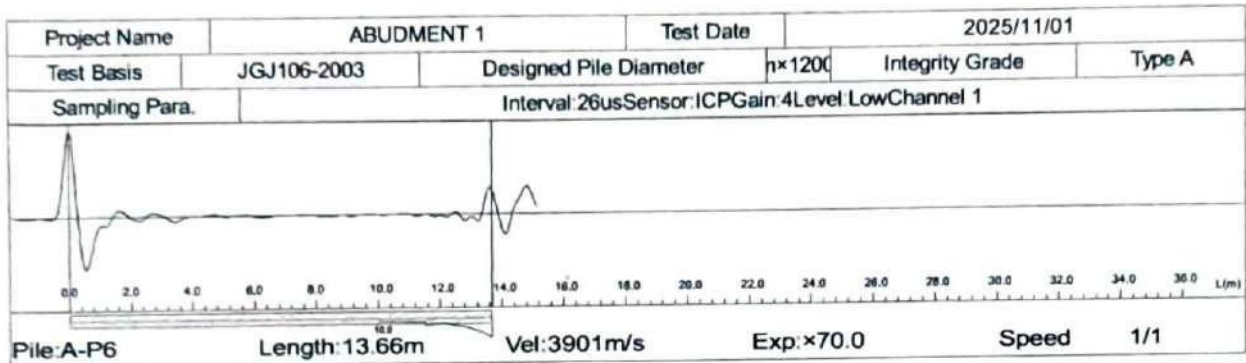
S.NO.	Pile Ref	Length of Pile (m)	Toe Response	Wave speed (m/sec)	Test Result
01.	A1-P01	13.32	Evident	3811	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
02.	A1-P02	13.38	Evident	3936	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
03.	A1-P03	13.25	Evident	3840	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
04.	A1-P04	13.53	Evident	3955	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
05.	A1-P05	13.88	Evident	3817	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
06.	A1-P06	13.66	Evident	3901	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
07.	A1-P07	13.60	Evident	3994	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
08.	A1-P08	13.34	Evident	3802	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
09.	A1-P09	13.73	Evident	3974	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
10.	A1-P10	13.25	Evident	3828	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
11.	A1-P11	13.43	Evident	3956	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
12.	A1-P12	13.65	Evident	3883	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
13.	A1-P13	13.88	Evident	3951	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
14.	A1-P14	13.56	Evident	4012	Pile has fairly cross-sectional area uniform sound concrete with proper integrity

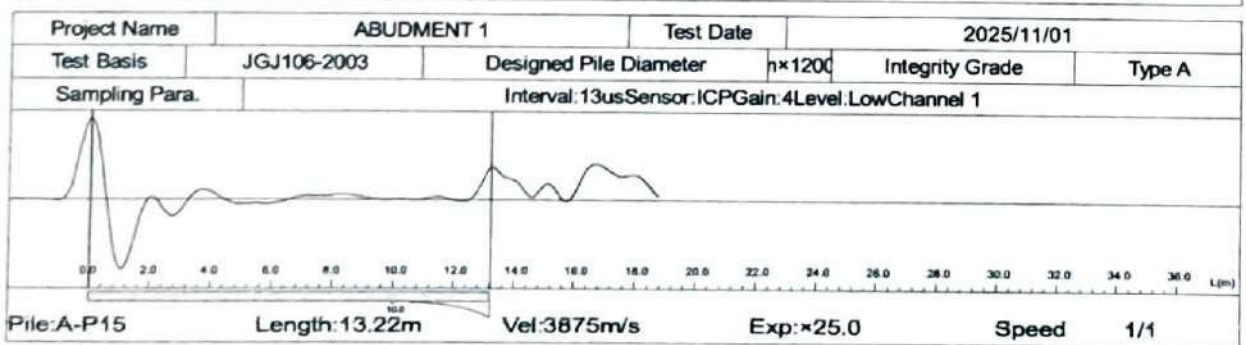
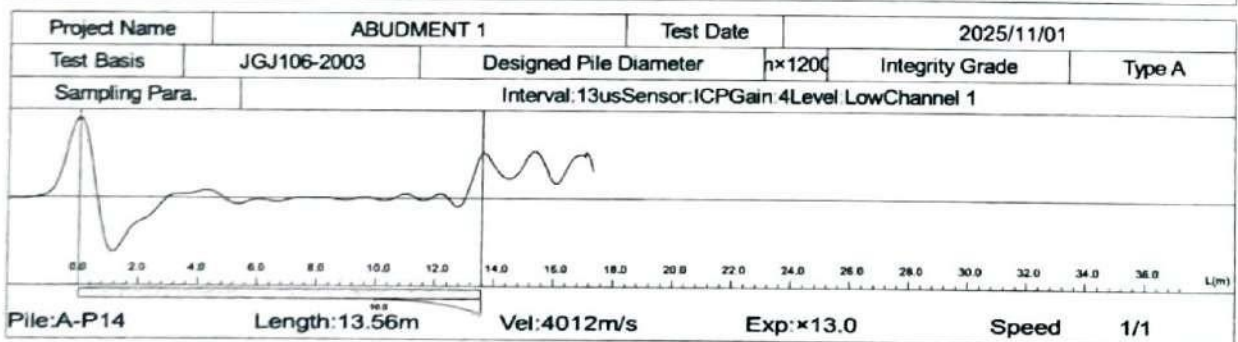
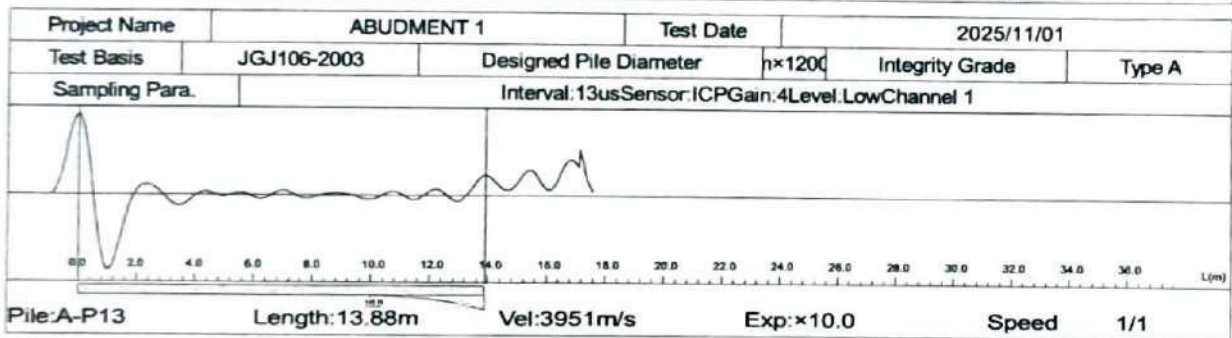
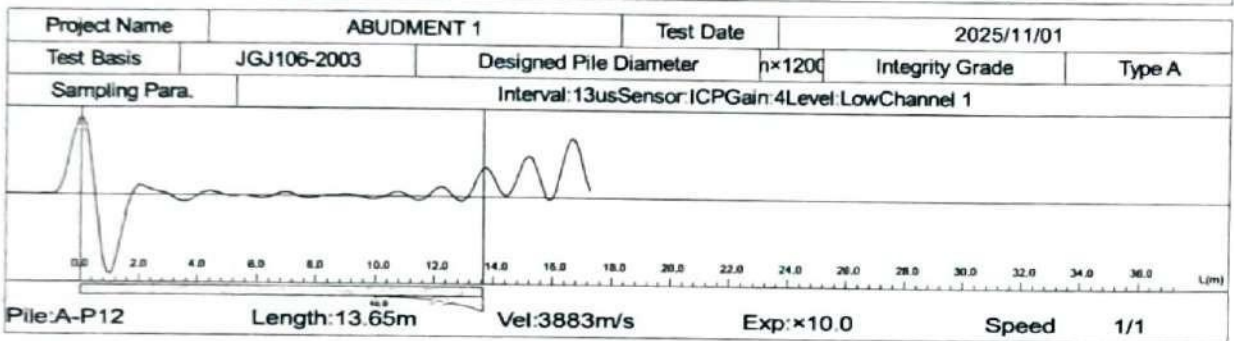
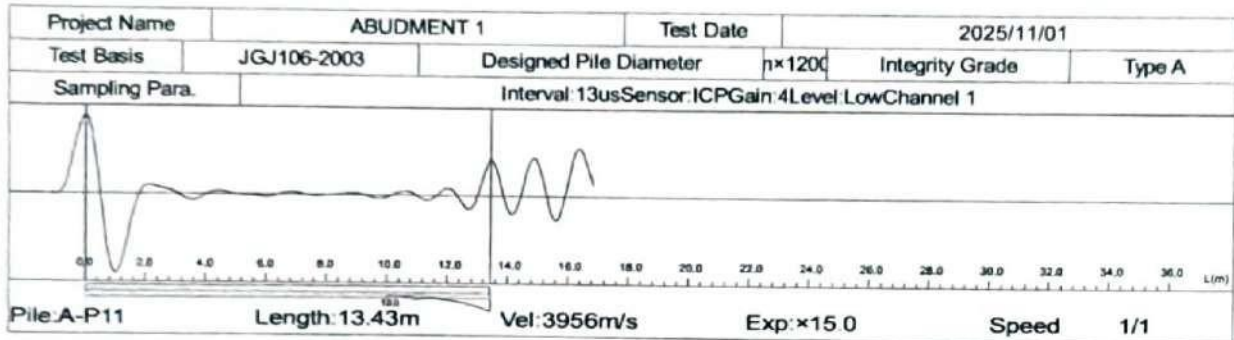
15.	A1-P15	13.22	Evident	3875	Pile has fairly cross-sectional area uniform sound concrete with proper integrity
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### PILE INTERGRITY GRAPHS:-









## **CONCLUSION & REMARKS:-**

### **CONCLUSION:-**

The No. of piles tested is **15** and the conclusion derived from the test conducted at site is mentioned below.

- For the tested Piles concrete quality in relationship with impact wave velocity is varied from 3600m/sec to 4200m/sec.
- Small pile impedance changes, pile toe detected (Pile OK)
- Pile integrity is classified as OK based on low strain records. But its acceptance is depending upon installation records, pile history, site condition and soil status.

Hence shall be decided by the contractors/ consultant and site engineers of the project.

### **REMARKS:-**

- Pile integrity test gives qualitative and geometric evaluation of pile sections.
- This test will give only continuity of concrete in pile.
- If any result deviation in integrity test is found, High Strain Dynamic Load Test is to be carried out on such pile. (Ref: IS 14893).

### **NOTE:**

- (i) The results are based on the items shown by the client and the tests are carried out in the site in the presence of client on pile.
- (ii) Any correction invalidates this report.



## 6. HIGH –STRAIN DYNAMIC LOAD TEST RESULTS

### PILE NO AB1 –P1

**TABLES**  
**TABLE 1 FIELD RESULTS**

Sr. No.	Location	Pile No.	Drop height for Hammer (m)	Total Settlement (mm)	Remarks
1.	ABATMENT-1	P-1	0.50	--	--
2.			1.00	1	Used For Analysis

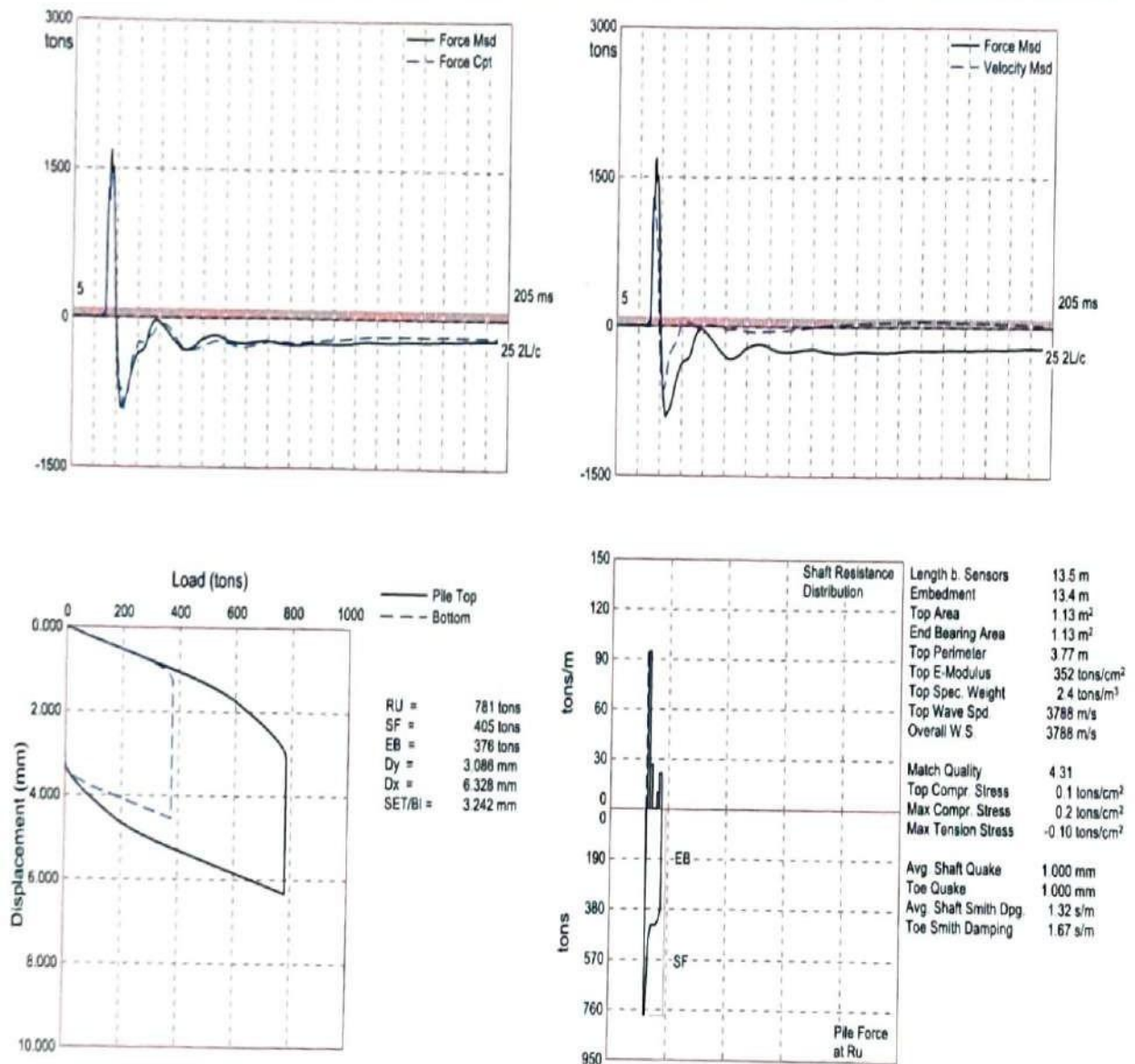
**TABLE 2 PILE DETAILS AND CAPWAP RESULTS**

Pile No.	AB1-P1
Pile Location	ABATMENT-1
Pile Diameter	1200 mm
Pile length below sensor level	13.5 m
Hammer weight	7.5 Tons
Hammer drop height	1.50 m
Design Load	500 tons
Test Load	750 tons

<b><i>CAPWAP Results</i></b>	
<b>Pile No.</b>	<b>AB1-P1</b>
Mobilized Pile Capacity	781.0Tons
Skin Friction	405.0 Tons
End Bearing	376.0 Tons
Net Displacement	3.242 mm
Compressive Stress	0.2Tons/cm <sup>2</sup>
Tensile Stress	-0.10 Tons/cm <sup>2</sup>

R & B - RAIGARH (01-11-25); Pile: ABATMENT P-1, ROUTINE, Blow: 1 (Test: 01-Nov-2025)

CAPWAP(R) 2014-3 



R & B - RAIGARH (01-11-25); Pile: ABATMENT P-1  
ROUTINE; Blow: 1

Test: 01-Nov-202  
CAPWAP (R) 2014-3  
OP: AR

EXTREMA TABLE

File Sgmnt No.	Dist. Below Gages m	max. Force tons	min. Force tons	max. Comp. Stress tons/cm <sup>2</sup>	max. Tens. Stress tons/cm <sup>2</sup>	max. Trnsfd. Energy tons-m	max. Veloc. m/s	max. Displ. mm
1	1.0	1611.3	-1012.5	0.1	-0.09	6.14	1.2	3.177
2	2.1	1674.0	-1081.8	0.1	-0.10	6.12	1.1	3.020
3	3.1	1765.1	-1087.5	0.2	-0.10	6.10	1.0	2.912
4	4.2	1159.4	-650.7	0.1	-0.06	3.75	1.0	2.885
5	5.2	1174.3	-625.7	0.1	-0.06	3.75	1.0	2.862
6	6.2	1048.2	-516.5	0.1	-0.05	3.27	1.0	2.822
7	7.3	1048.2	-540.5	0.1	-0.05	3.27	1.0	2.792
8	8.3	1054.2	-527.1	0.1	-0.05	3.26	1.0	2.851
9	9.3	1050.8	-490.7	0.1	-0.04	3.26	1.0	2.884
10	10.4	1128.9	-458.9	0.1	-0.04	3.26	1.0	2.899
11	11.4	1175.3	-419.4	0.1	-0.04	3.25	1.0	2.895
12	12.5	1040.0	-426.5	0.1	-0.04	3.07	1.2	2.914
13	13.5	956.5	-434.2	0.1	-0.04	2.66	1.1	2.929
Absolute	3.1			0.2			(T =	23.0 ms)
	3.1				-0.10		(T =	28.0 ms)

PILE PROFILE AND PILE MODEL

Depth m	Area m <sup>2</sup>	E-Modulus tons/cm <sup>2</sup>	Spec. Weight tons/m <sup>3</sup>	Perim. m
0.0	1.13	351.5	2.403	3.77
13.5	1.13	351.5	2.403	3.77

Toe Area 1.13 m<sup>2</sup>

Top Segment Length 1.04 m, Top Impedance 1050 tons/m/s

Wave Speed: Pile Top 3787.8, Elastic 3787.8, Overall 3787.8 m/s

Pile Damping 2.00 %, Time Incr 0.274 ms, 2L/c 7.1 ms

Total volume: 15.268 m<sup>3</sup>; Volume ratio considering added impedance: 1.000

R & B - RAIGARH (01-11-25); Pile: ABATMENT P-1  
ROUTINE; Blow: 1

Test: 01-Nov-2025  
CAPWAP(R) 2014-3  
OP: AR

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 781.19; along Shaft 405.19; at Toe 376.00 tons

Soil Sgmt No.	Dist. Below Gages m	Depth Below Grade m	Ru tons	Force in Pile tons	Sum of Ru tons	Unit Resist. (Depth) tons/m	Unit Resist. (Area) tons/m <sup>2</sup>	Smith Damping Factor s/m
				781.2				
1	3.1	3.0	285.00	496.2	285.00	94.52	25.07	1.32
2	5.2	5.1	55.35	440.8	340.35	26.65	7.07	1.32
3	7.3	7.2	0.00	440.8	340.35	0.00	0.00	0.00
4	9.3	9.2	0.00	440.8	340.35	0.00	0.00	0.00
5	11.4	11.3	20.60	420.2	360.95	9.92	2.63	1.32
6	13.5	13.4	44.24	376.0	405.19	21.30	5.65	1.32
Avg. Shaft			67.53			30.24	8.02	1.32
Toe			376.00				332.46	1.67

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.000	1.000
Case Damping Factor		0.51	0.60
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	30	30
Reloading Level	(% of Ru)	100	100
Soil Plug Weight	(tons)		5.997



R & B - RAIGARH (01-11-25); Pile: ABATMENT P-1  
ROUTINE; Blow: 1

Test: 01-Nov-2025  
CAPWAP (R) 2014-3  
OP: AR

	CASE METHOD									
J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	1088	927	767	606	445	284	123	0	0	0
RX	1233	1055	878	700	522	344	167	0	0	0
RU	962	788	615	441	267	94	0	0	0	0

RAU = 0 (tons); RA2 = 197 (tons)

Current CAPWAP Ru = 781 (tons); Corresponding J(RP) = 0.19; J(RX) = 0.25

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS	KEB
m/s	ms	tons	tons	tons	mm	mm	mm	tons-m	tons	tons/mm
1.2	21.66	1257	1440	1793	3.243	3.243	3.242	6.29	1939	376

R & B - RAIGARH (01-11-25); File: ABATMENT P-1  
ROUTINE; Blow: 1

Test: 01-Nov-2025  
CAPWAP (R) 2014-3  
OP: AR

STATIC ANALYSIS

Monotonic D-Toe, E-P R-Toe				
Step No.	Top Load tons	Top Disp. mm	Toe Load tons	Toe Disp. mm
0	0.0	0.000	0.0	0.000
4	25.5	0.068	8.1	0.022
8	51.1	0.136	16.3	0.043
12	76.6	0.203	24.4	0.065
16	102.2	0.271	32.6	0.087
20	127.7	0.339	40.7	0.108
24	153.3	0.407	48.8	0.130
28	178.8	0.474	57.0	0.152
32	204.4	0.542	65.1	0.173
36	229.9	0.610	73.3	0.195
40	255.5	0.678	81.4	0.216
44	281.0	0.745	89.5	0.238
48	306.6	0.813	97.7	0.260
52	332.1	0.881	105.8	0.281
56	357.7	0.949	114.0	0.303
60	383.2	1.017	122.1	0.325
64	408.0	1.084	130.2	0.346
68	431.7	1.150	138.4	0.368
72	454.2	1.215	146.5	0.390
76	475.5	1.280	154.7	0.411
80	495.5	1.343	162.8	0.433
85	518.7	1.420	173.0	0.460
90	540.1	1.496	183.1	0.487
96	563.1	1.585	195.3	0.520
102	583.4	1.672	207.6	0.552
110	604.6	1.782	223.8	0.595
118	624.7	1.891	240.1	0.639
127	646.2	2.013	258.4	0.687
136	667.0	2.132	276.3	0.736
146	688.1	2.257	294.4	0.790
157	708.7	2.386	312.2	0.850
170	729.7	2.527	330.4	0.920
185	749.3	2.675	347.5	1.001
204	767.0	2.838	363.3	1.104
222	776.9	2.968	372.1	1.201
232	779.5	3.031	374.4	1.256
237	780.0	3.060	374.9	1.283
240	780.1	3.077	375.0	1.299
241	781.2	3.086	376.0	1.304
271	781.2	3.248	376.0	1.467
301	781.2	3.411	376.0	1.629
331	781.2	3.573	376.0	1.791

R & B - RAIGARH (01-11-25); Pile: ABATMENT P-1  
ROUTINE; Blow: 1

Test: 01-Nov-2025  
CAPWAP (R) 2014-3  
OP: AR

STATIC ANALYSIS

Monotonic D-Toe, E-P R-Toe

Step No.	Top Load tons	Top Disp. mm	Toe Load tons	Toe Disp. mm
361	781.2	3.735	376.0	1.954
391	781.2	3.898	376.0	2.116
421	781.2	4.060	376.0	2.278
451	781.2	4.223	376.0	2.441
481	781.2	4.385	376.0	2.603
511	781.2	4.547	376.0	2.765
541	781.2	4.710	376.0	2.928
571	781.2	4.872	376.0	3.090
601	781.2	5.034	376.0	3.253
631	781.2	5.197	376.0	3.415
661	781.2	5.359	376.0	3.577
691	781.2	5.521	376.0	3.740
721	781.2	5.684	376.0	3.902
751	781.2	5.846	376.0	4.064
781	781.2	6.008	376.0	4.227
811	781.2	6.171	376.0	4.389
826	781.2	6.252	376.0	4.470
834	781.2	6.295	376.0	4.514
838	781.2	6.317	376.0	4.535
840	781.2	6.328	376.0	4.546
846	755.6	6.260	367.9	4.524
850	730.1	6.192	359.7	4.503
854	704.5	6.124	351.6	4.481
858	679.0	6.057	343.4	4.459
862	653.4	5.989	335.3	4.438
866	627.9	5.921	327.2	4.416
870	602.3	5.853	319.0	4.394
874	576.8	5.786	310.9	4.373
878	551.2	5.718	302.7	4.351
882	525.7	5.650	294.6	4.330
886	500.1	5.582	286.5	4.308
890	474.6	5.515	278.3	4.286
894	449.0	5.447	270.2	4.265
898	423.5	5.379	262.0	4.243
902	398.0	5.311	253.9	4.221
906	373.2	5.244	245.8	4.200
910	349.5	5.178	237.6	4.178
914	327.0	5.112	229.5	4.156
918	305.7	5.048	221.3	4.135
922	285.7	4.985	213.2	4.113
927	262.5	4.907	203.0	4.086
932	241.1	4.831	192.9	4.059

## CONCLUSION:-

High-Strain Dynamic Load test conducted on **Pile No. AB1-P1** with the CAPWAP analysis results showed that the pile has shown the load capacity of **781 Tons**. The pile top settlement at test load for the tested piles was within the permissible limits.

## PILE NO AB1 –P15

### TABLES

**TABLE 1 FIELD RESULTS**

Sr. No.	Location	Pile No.	Drop height for Hammer (m)	Total Settlement (mm)	Remarks
1.	ABATMENT-1	P-15	0.50	--	--
2.			1.00	1	Used For Analysis

**TABLE 2 PILE DETAILS AND CAPWAP RESULTS**

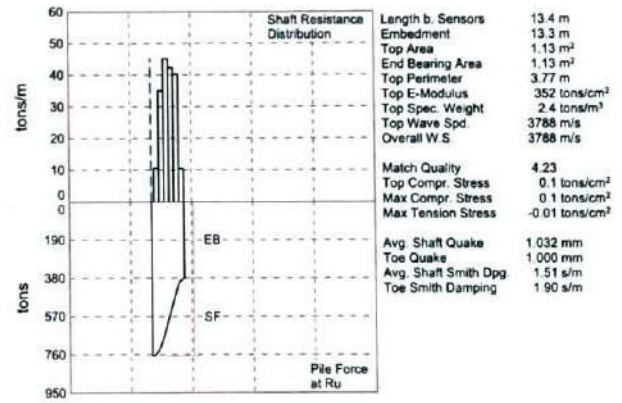
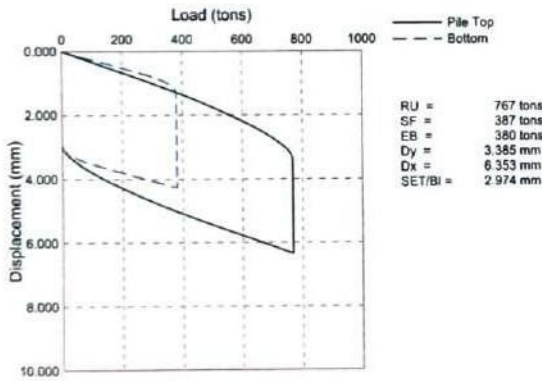
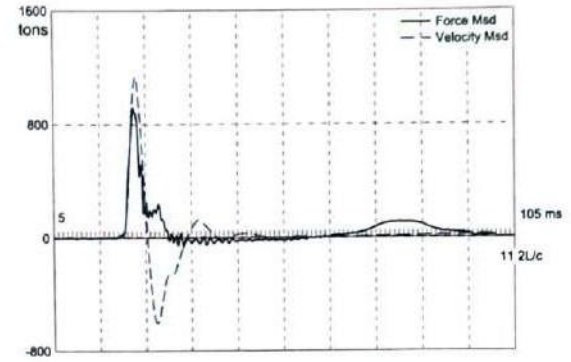
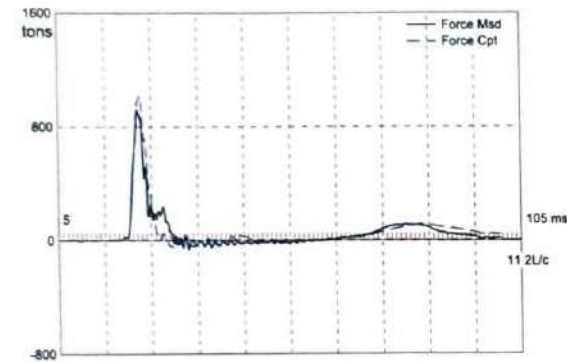
Pile No.	AB1-P15
Pile Location	ABATMENT-1
Pile Diameter	1200 mm
Pile length below sensor level	13.4 m
Hammer weight	7.5 Tons
Hammer drop height	1.50 m
Design Load	500 tons
Test Load	750 tons

<b>CAPWAP Results</b>	
<b>Pile No.</b>	<b>AB1-P15</b>
Mobilized Pile Capacity	767.0Tons
Skin Friction	387.0 Tons
End Bearing	380.0 Tons
Net Displacement	2.974 mm
Compressive Stress	0.1Tons/cm <sup>2</sup>
Tensile Stress	-0.01 Tons/cm <sup>2</sup>



R & B - RAIGARH (01-11-25), Pile: ABATMENT-1 P-15, ROUTINE ; Blow: 1 (Test: 01-Nov-2025)

CAPWAP(R) 2014-3 



R & B - RAIGARH (01-11-25); Pile: ABATMENT-1 P-15  
ROUTINE ; Blow: 1

Test: 01-Nov-2025  
CAPWAP (R) 2014-3  
OP: AR

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force tons	min. Force tons	max. Comp. Stress tons/cm <sup>2</sup>	max. Tens. Stress tons/cm <sup>2</sup>	max. Trnsfd. Energy tons-m	max. Veloc. m/s	max. Displ. mm
1	1.0	1029.9	-81.8	0.1	-0.01	1.98	0.9	2.481
2	2.1	1057.1	-111.4	0.1	-0.01	1.97	0.9	2.389
3	3.1	1087.9	-131.6	0.1	-0.01	1.96	0.9	2.288
4	4.1	1058.9	-139.0	0.1	-0.01	1.82	0.8	2.183
5	5.2	1099.0	-142.2	0.1	-0.01	1.82	0.8	2.074
6	6.2	986.2	-112.3	0.1	-0.01	1.56	0.8	1.974
7	7.2	1024.5	-110.6	0.1	-0.01	1.55	0.7	1.904
8	8.2	877.4	-87.7	0.1	-0.01	1.29	0.7	1.880
9	9.3	916.3	-81.3	0.1	-0.01	1.29	0.7	1.843
10	10.3	787.2	-66.6	0.1	-0.01	1.07	0.6	1.808
13	13.4	646.5	-154.1	0.1	-0.01	0.87	0.7	1.668
Absolute	5.2			0.1			(T =	24.2 ms)
	13.4				-0.01		(T =	30.8 ms)

PILE PROFILE AND PILE MODEL

Depth m	Area m <sup>2</sup>	E-Modulus tons/cm <sup>2</sup>	Spec. Weight tons/m <sup>3</sup>	Perim. m
0.0	1.13	351.5	2.403	3.77
13.4	1.13	351.5	2.403	3.77

Toe Area 1.13 m<sup>2</sup>

Top Segment Length 1.03 m, Top Impedance 1050 tons/m/s

Wave Speed: Pile Top 3787.8, Elastic 3787.8, Overall 3787.8 m/s

Pile Damping 2.00 %, Time Incr 0.272 ms, 2L/c 7.1 ms

Total volume: 15.155 m<sup>3</sup>; Volume ratio considering added impedance: 1.000

R & B - RAIGARH (01-11-25); File: ABATMENT-1 P-15  
ROUTINE ; Blow: 1

Test: 01-Nov-2025  
CAPWAP(R) 2014-3  
OP: AR

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 767.20; along Shaft 387.20; at Toe 380.00 tons

Soil Sgmt No.	Dist. Below Gages m	Depth Below Grade m	Ru tons	Force in Pile tons	Sum of Ru tons	Unit Resist. (Depth) tons/m	Unit Resist. (Area) tons/m <sup>2</sup>	Quake mm
				767.2				
1	3.1	3.0	31.00	736.2	31.00	10.36	2.75	1.000
2	5.2	5.1	72.00	664.2	103.00	34.93	9.26	0.931
3	7.2	7.1	93.00	571.2	196.00	45.11	11.97	1.032
4	9.3	9.2	87.00	484.2	283.00	42.20	11.19	1.107
5	11.3	11.2	83.00	401.2	366.00	40.26	10.68	1.064
6	13.4	13.3	21.20	380.0	387.20	10.28	2.73	0.981
Avg. Shaft			64.53			29.11	7.72	1.032
Toe			380.00				336.00	1.000

Soil Model Parameters/Extensions

		Shaft	Toe
Smith Damping Factor		1.51	1.90
Case Damping Factor		0.56	0.69
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	64	30
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	64	
Soil Plug Weight	(tons)		4.754

R & B - RAIGARH (01-11-25); Pile: ABATMENT-1 P-15  
ROUTINE ; Blow: 1

Test: 01-Nov-2025  
CAPWAP(R) 2014-3  
OP: AR

	CASE METHOD									
J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	1120	1030	940	850	759	669	579	489	398	308
RX	1120	1030	940	850	759	669	587	512	437	368
RU	1683	1649	1616	1582	1548	1514	1480	1446	1412	1378
RAU =	144 (tons);		RA2 =		233 (tons)					

Current CAPWAP Ru = 767 (tons); Corresponding J(RP) = 0.39; J(RX) = 0.39

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS	KEB
m/s	ms	tons	tons	tons	mm	mm	mm	tons-m	tons	tons/mm
1.1	23.13	1156	867	936	3.156	3.156	2.974	1.97	642	380

R & B - RAIGARH (01-11-25); Pile: ABATMENT-1 P-15  
ROUTINE ; Blow: 1

Test: 01-Nov-2025  
CAPWAP(R) 2014-3  
OP: AR

STATIC ANALYSIS

Monotonic D-Toe, E-P R-Toe

Step No.	Top Load tons	Top Disp. mm	Toe Load tons	Toe Disp. mm
0	0.0	0.000	0.0	0.000
2	22.7	0.077	8.4	0.022
4	45.3	0.154	16.8	0.044
6	68.0	0.230	25.3	0.066
8	90.7	0.307	33.7	0.089
10	113.3	0.384	42.1	0.111
12	136.0	0.461	50.5	0.133
14	158.6	0.537	58.9	0.155
16	181.3	0.614	67.3	0.177
18	204.0	0.691	75.8	0.199
20	226.6	0.768	84.2	0.222
22	249.3	0.844	92.6	0.244
24	272.0	0.921	101.0	0.266
26	294.5	0.998	109.4	0.288
28	316.9	1.074	117.8	0.310
30	338.9	1.151	126.3	0.332
32	360.4	1.226	134.7	0.354
34	381.4	1.301	143.1	0.377
36	401.8	1.376	151.5	0.399
38	421.8	1.449	159.9	0.421
40	441.0	1.522	168.3	0.443
43	468.1	1.630	181.0	0.476
46	493.9	1.735	193.6	0.509
49	517.7	1.837	206.2	0.543
52	540.9	1.938	218.9	0.576
55	563.2	2.038	231.5	0.609
58	584.7	2.136	244.1	0.642
61	605.3	2.231	256.7	0.676
64	624.5	2.325	269.4	0.709
68	647.3	2.441	285.2	0.753
72	667.9	2.551	299.7	0.797
77	690.6	2.679	316.2	0.853
82	709.9	2.796	330.7	0.908
89	731.1	2.943	347.8	0.986
98	750.4	3.107	364.1	1.085
108	761.9	3.256	374.9	1.196
114	764.7	3.332	377.6	1.263
117	765.2	3.367	378.0	1.296
118	767.2	3.385	380.0	1.307
133	767.2	3.551	380.0	1.473
148	767.2	3.717	380.0	1.639
163	767.2	3.883	380.0	1.805



R & B - RAIGARH (01-11-25); Pile: ABATMENT-1 P-15  
ROUTINE ; Blow: 1

Test: 01-Nov-2025  
CAPWAP (R) 2014-3  
OP: AR

STATIC ANALYSIS

Monotonic D-Toe, E-P R-Toe

Step No.	Top Load tons	Top Disp. mm	Toe Load tons	Toe Disp. mm
178	767.2	4.050	380.0	1.971
193	767.2	4.216	380.0	2.138
208	767.2	4.382	380.0	2.304
223	767.2	4.548	380.0	2.470
238	767.2	4.714	380.0	2.636
253	767.2	4.880	380.0	2.802
268	767.2	5.046	380.0	2.968
283	767.2	5.213	380.0	3.134
298	767.2	5.379	380.0	3.301
313	767.2	5.545	380.0	3.467
328	767.2	5.711	380.0	3.633
343	767.2	5.877	380.0	3.799
358	767.2	6.043	380.0	3.965
373	767.2	6.209	380.0	4.131
380	767.2	6.287	380.0	4.209
384	767.2	6.331	380.0	4.253
386	767.2	6.353	380.0	4.275
390	744.5	6.277	371.6	4.253
392	721.9	6.200	363.2	4.231
394	699.2	6.123	354.7	4.209
396	676.5	6.046	346.3	4.187
398	653.9	5.969	337.9	4.164
400	631.2	5.893	329.5	4.142
402	608.6	5.816	321.1	4.120
404	585.9	5.739	312.7	4.098
406	563.2	5.662	304.2	4.076
408	540.6	5.586	295.8	4.054
410	517.9	5.509	287.4	4.032
412	495.2	5.432	279.0	4.009
414	472.7	5.355	270.6	3.987
416	450.3	5.279	262.2	3.965
418	428.3	5.203	253.7	3.943
420	406.8	5.127	245.3	3.921
422	385.8	5.052	236.9	3.899
424	365.4	4.978	228.5	3.876
426	345.4	4.904	220.1	3.854
428	326.2	4.831	211.7	3.832
431	299.1	4.724	199.0	3.799
434	273.3	4.619	186.4	3.766
437	249.5	4.516	173.8	3.732
440	226.3	4.415	161.1	3.699
443	204.0	4.315	148.5	3.666

R & B - RAIGARH (01-11-25); Pile: ABATMENT-1 P-15  
ROUTINE ; Blow: 1

Test: 01-Nov-2025  
CAPWAP(R) 2014-3  
OP: AR

STATIC ANALYSIS

Monotonic D-Toe, E-P R-Toe

Step No.	Top Load tons	Top Disp. mm	Toe Load tons	Toe Disp. mm
446	182.5	4.218	135.9	3.633
449	161.9	4.122	123.3	3.600
452	142.7	4.029	110.6	3.566
456	119.9	3.912	94.8	3.522
460	99.3	3.803	80.3	3.478
465	76.6	3.675	63.8	3.422
470	57.3	3.557	49.3	3.367
474	44.4	3.470	39.1	3.323
477	36.1	3.410	32.2	3.289
478	33.6	3.390	30.1	3.278
479	31.1	3.371	28.0	3.267
489	12.4	3.198	11.8	3.157
501	2.7	3.033	2.6	3.024

## **CONCLUSION:-**

*High-Strain Dynamic Load test conducted on **Pile No. AB1-P15** with the CAPWAP analysis results showed that the pile has shown the load capacity of **767Tons**. The pile top settlement at test load for the tested piles was within the permissible limits.*

## 7. UNDER WATER INSPECTION REPORT

### INTRODUCTION:

Underwater pile inspection is a critical process in assessing the structural integrity and safety of marine and offshore structures such as bridges, piers, jetties, and oil platforms. Piles serve as foundational elements, transferring loads from the superstructure to the bed. Due to their constant exposure to harsh underwater environments, they are susceptible to deterioration caused by corrosion, marine growth, scour, and mechanical damage.



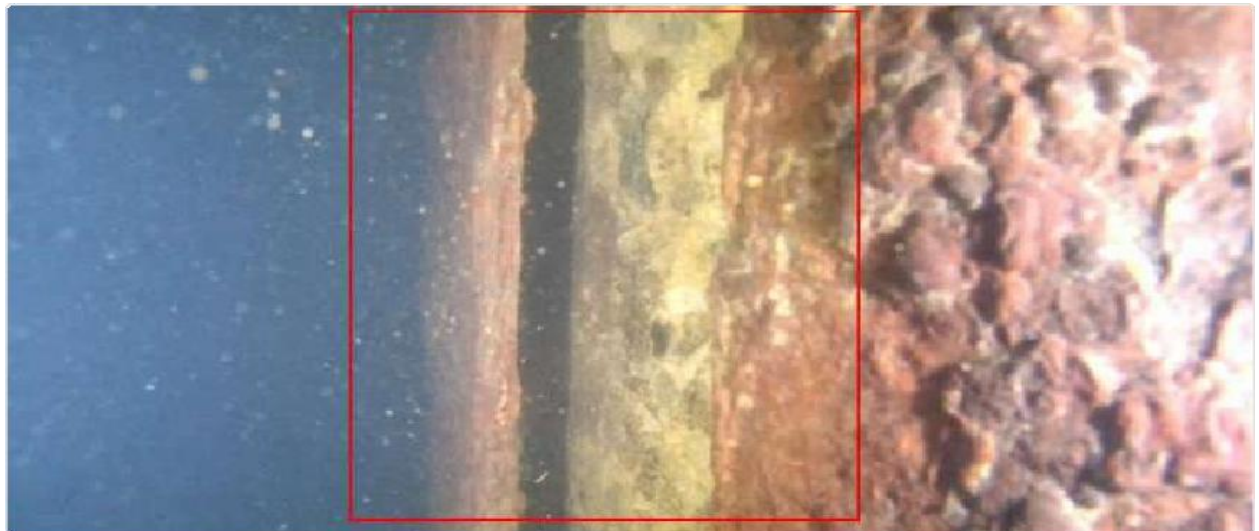
### BRIDGE OVERVIEW

**OBSERVATIONS:**

1. For all piles under the water, the steel liner is observed after 10cm offset from pile cap bottom level.
2. Corrosion observed on complete steel liners at various locations for all piles under the water.
3. Section losses observed on pile liners at various locations inside of the water.
4. Liner openings observed at various locations for piles.
5. Heavy sedimental debris observed near and around the all piles inside of the water.



## 7.1 UNDER WATER INSPECTION PHOTOGRAPHS

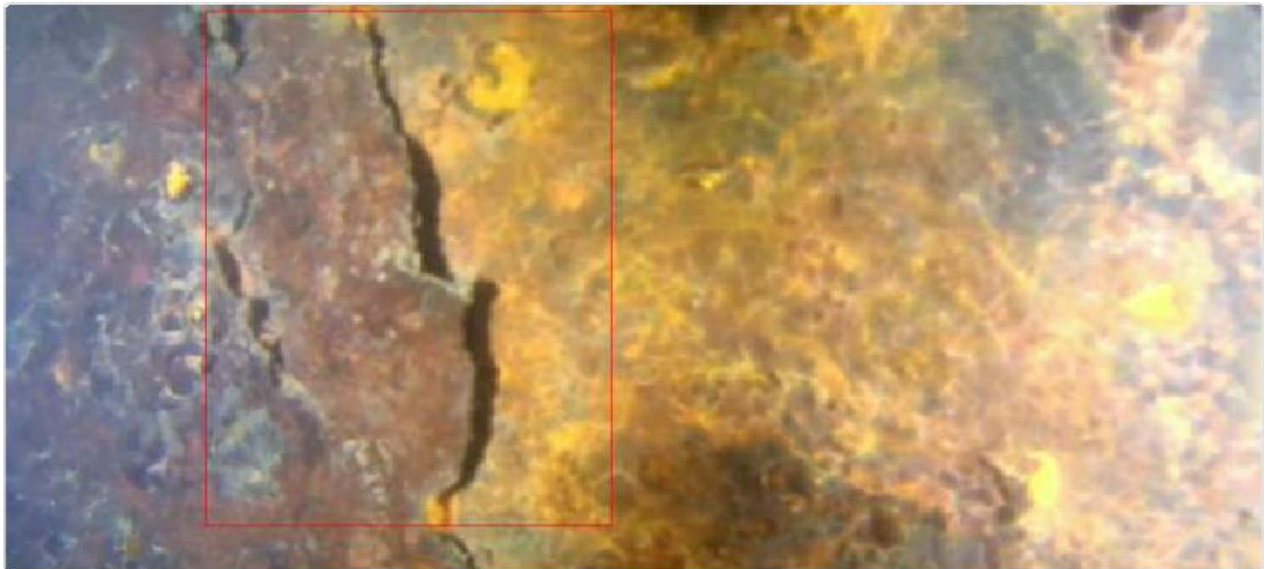


Liner Opening on Piles at various locations



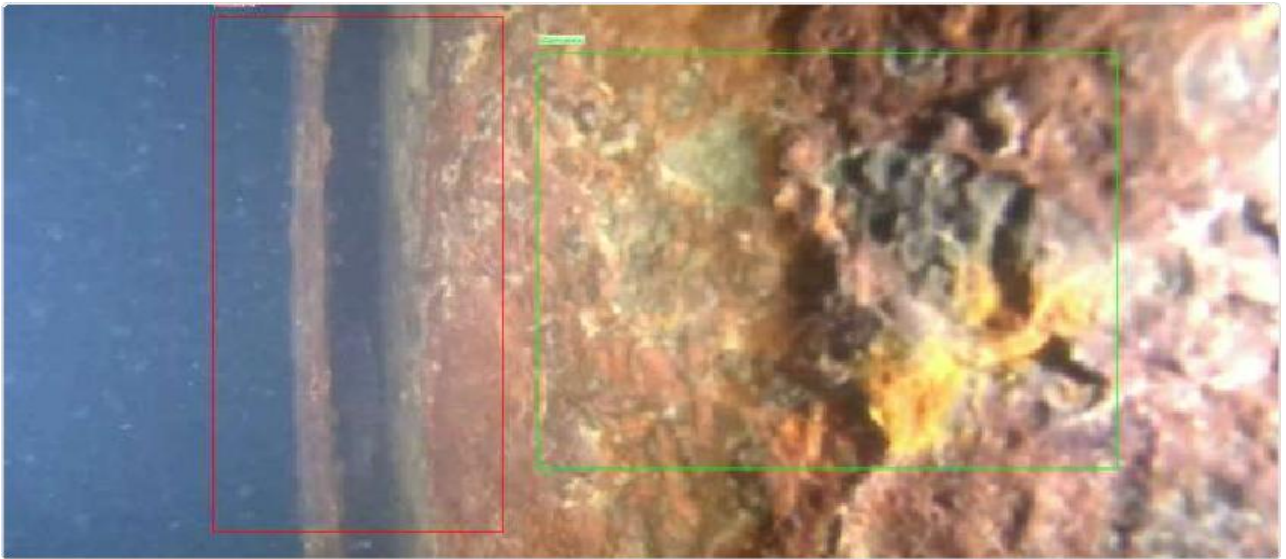
**Corrosion on Liners**









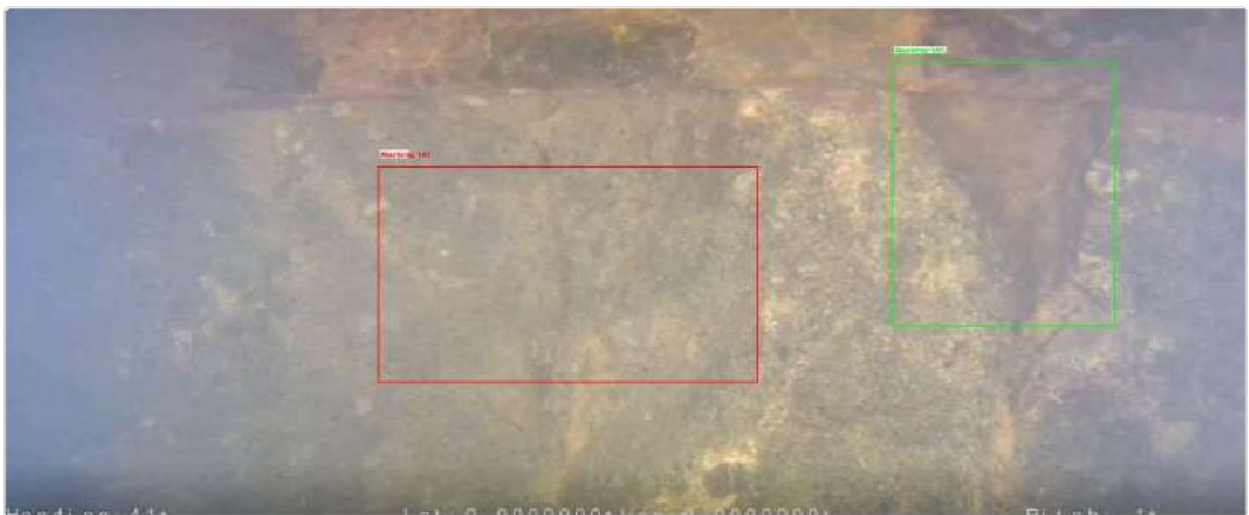


**Corrosion and Section loss observed on Piles at various locations.**





**Debris observed near and around the piles at bottom level.**



**ASSESSMENT:**

1. The combination of open lining, missing sections and active corrosion suggests advanced degradation of the protective layer.
2. Risk of ongoing section loss of the lining, ingress of aggressive agents and potential acceleration of concrete and reinforcement deterioration is high.
3. Directly exposed concrete and corroded lining raise the likelihood of deeper material loss and possible reinforcement corrosion in the long term.
4. Missing or eroded liners and repeated exposure concrete observations indicate significant deterioration of the protective system.

## **8. CONCLUSIONS**

**Based on the study of visual inspection and non-destructive tests results the following distress is noted below**

1. Cracks observed in all piers due to long-term environmental exposure.
2. The vertical discontinues cracks on all piers and minor horizontal cracks on all pier caps & pile caps at various locations are due to uncertain corrosion on exiting reinforcement of the structure.
3. Based on the NDT and core test results, the in-situ compressive strength of the substructure concrete which is significantly lower than the design requirement of M35 grade.
4. Piles liners are corroded and opened in various locations, Section loss and biological growth observed on pile liners as per the underwater inspection and testing.
5. Rehabilitation needs to be done with jacketing for all the Piers shaft - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 42, 43, 44, 45 & 46.
6. Strengthening needs to be done for Pier caps- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 42, 43, 44, 45 & 46 with FRP laminate and surface cracks need to be repaired with polymer modified mortar.
7. Jacketing need to be done for existing Pile caps - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 42, 43, 44, 45 & 46 increase the depth of pile cap at bottom face for reducing the punching shear deficit.
8. Surface cracks are need to be repaired with epoxy grout for Pile caps- 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17, 19 & 20.

## **9. RECOMMENDATIONS**

**1.** The tested core compressive strengths were below M25 which is significantly below the design strength M35. Considering the low strengths, it is recommended to strengthen the existing pier caps, pier shafts and pile caps.

**a) Pier Shaft:** 100mm thick jacketing with M40 grade of micro concrete and additional reinforcement of 20 numbers of 16 mm dia longitudinal bars with stirrups of 12mm dia at 200mm c/c spacing and detailed drawing in annexure-1 in page no 268.

**b) Pier Caps:** FRP Strengthening with 3 numbers of Laminates 100mm wide and 3mm thick as shown in drawing in annexure-1 in page no 268.

Due to presence of surface cracks in majority portion, the existing surface needs to be chip and repair with polymer modified mortar.

**c) Pile Caps:** 300 mm thick Jacketing with M40 grade of micro concrete with 16mm dia bars dowelled into the bottom of existing pile cap to Increase the depth of pile cap for reducing the punching shear deficit.

Cracks on Pile cap surface need to be repaired with Epoxy grout.



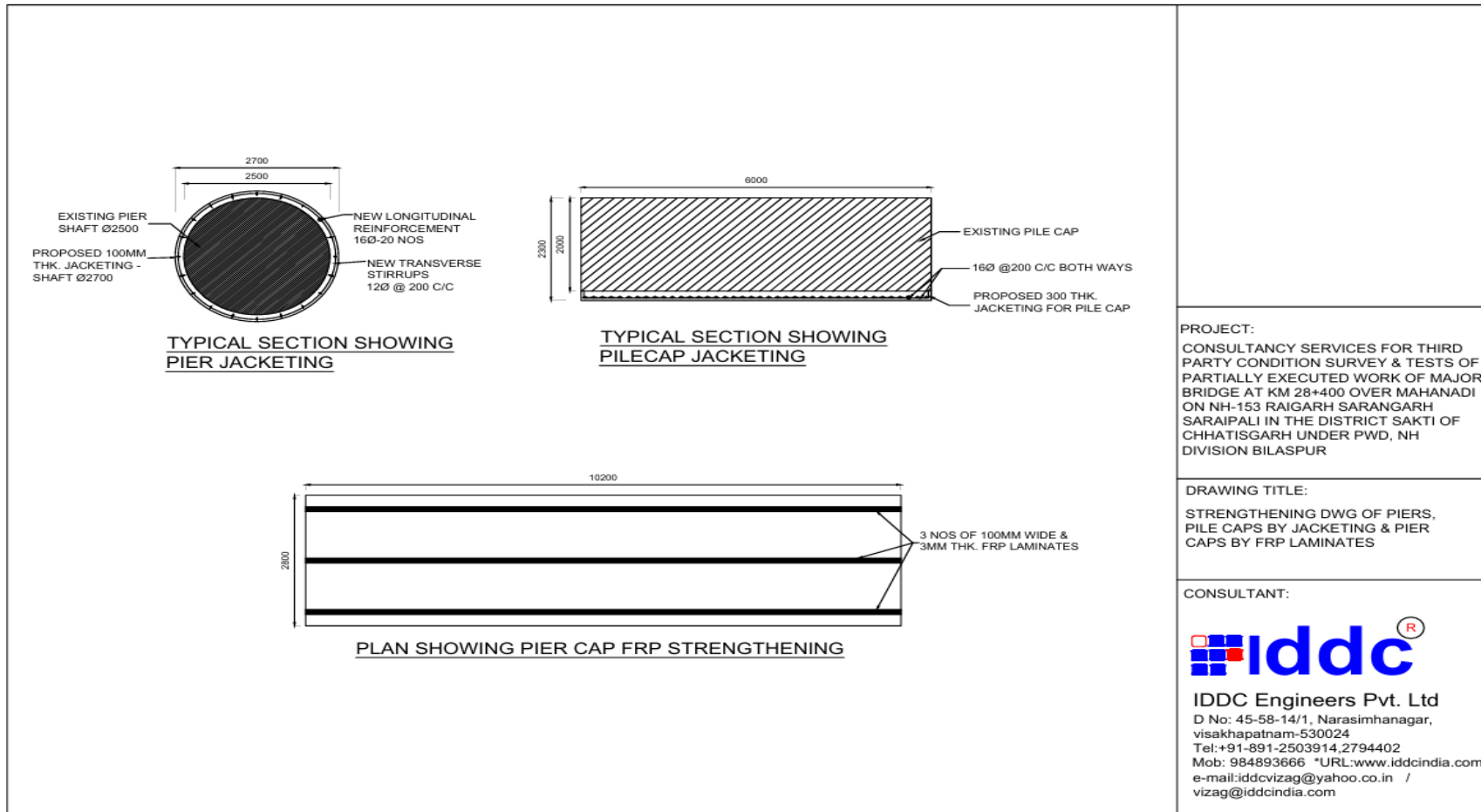
SI.NO	STRUCTURE	Equivalent cube compressive strength in N/mm <sup>2</sup>	REMARKS						REMEDIES
			RHT	UPV	CD	CM	HCP	CW	
1	<b>PIER-1</b>	25.09	GOOD TO VERY GOOD (38 TO 58)	DOUBTFUL TO EXCELLENT (3.75 TO 4.93)	CARBONATED UPTO 10MM	65MM & 77MM	UNCERTAIN	Pier 0.1mm to 1mm & Pier cap 0.1mm to 0.3mm	<b>Rehabilitation with Jacketing for Pier shaft, FRP laminates, PMM for surface cracks on pier cap &amp; Jacketing, epoxy grouting for Pile cap cracks</b>
2	<b>PIER-2</b>	21.44	GOOD TO VERY GOOD (33 TO 56)	DOUBTFUL TO GOOD ( 3.31 TO 4.01)	CARBONATED UPTO 10mm to 20mm	65MM & 79MM	-	Pile cap 0.1mm to 0.3mm, Pier 0.1mm to 0.8mm & Pier cap 0.1mm to 0.3mm	
3	<b>PIER-3</b>	22.77	POOR TO VERY GOOD (19 TO 58)	DOUBTFUL TO EXCELLENT ( 3.08 TO 4.98)	CARBONATED UPTO 6mm to 20mm	62MM & 69MM	10%	Pile cap 0.1mm to 0.5mm, Pier 0.1mm to 1.5mm & Pier cap 0.1mm to 0.3mm	
4	<b>PIER-4</b>	21.8	FAIR TO VERY GOOD (20 TO 60)	DOUBTFUL TO GOOD ( 3.21 TO 4.44)	CARBONATED UPTO 10mm to 20mm	64MM & 73MM	-	Pile cap 0.1mm to 0.5mm, Pier 0.2mm to 1.5mm & Pier cap 0.1mm to 0.4mm	
5	<b>PIER-5</b>	34.03	GOOD TO VERY GOOD (32 TO 56)	DOUBTFUL TO GOOD ( 2.93 TO 4.11)	CARBONATED UPTO 10mm to 15mm	50MM & 65MM	UNCERTAIN	Pile cap 0.1mm to 0.5mm, Pier 0.1mm to 1mm & Pier cap 0.1mm to 0.4mm	

6	<b>PIER-6</b>	23.84	FAIR TO VERY GOOD (27 TO 51)	DOUBTFUL TO EXCELLENT ( 2.50 TO 4.53)	CARBONATED UPTO 10mm to 25mm	42MM & 66MM	-	Pile cap 0.1mm to 0.4mm, Pier 0.1mm to 1mm & Pier cap 0.1mm to 0.3mm	<b>Rehabilitation with Jacketing for Pier shaft, FRP laminates, PMM for surface cracks on pier cap &amp; Jacketing, epoxy grouting for Pile cap cracks</b>
7	<b>PIER-7</b>	25.9	FAIR TO VERY GOOD (28 TO 58)	DOUBTFUL TO GOOD ( 3.17 TO 4.45)	CARBONATED UPTO 5mm to 15mm	54MM & 73MM	-	Pile cap 0.1mm to 0.6mm, Pier 0.1mm to 1.5mm & Pier cap 0.1mm to 0.6mm	
8	<b>PIER-8</b>	16.44	FAIR TO VERY GOOD ( 28 TO 50)	DOUBTFUL TO EXCELLENT ( 2.88 TO 4.48)	CARBONATED UPTO 10mm to 30mm	60MM & 74MM	10%	Pile cap 0.1mm to 0.8mm, Pier 0.1mm to 0.8mm & Pier cap 0.1mm to 0.4mm	
9	<b>PIER-9</b>	42.99	FAIR TO VERY GOOD (23 TO 50)	DOUBTFUL TO EXCELLENT ( 3.49 TO 4.55)	CARBONATED UPTO 5mm to 25mm	65MM & 68MM	-	Pile cap 0.1mm to 0.3mm, Pier 0.1mm to 0.9mm & Pier cap 0.1mm to 0.3mm	
10	<b>PIER-10</b>	12.1	FAIR TO VERY GOOD (27 TO 48)	DOUBTFUL TO GOOD (2.57 TO 4.10)	CARBONATED UPTO 10mm to 15mm	64MM & 80MM	UNCERTAIN	Pile cap 0.1mm to 0.3mm, Pier 0.1mm to 0.6mm & Pier cap 0.1mm to 0.5mm	

11	<b>PIER-11</b>	18.56	FAIR TO VERY GOOD (28 TO 42)	DOUBTFUL TO EXCELLENT ( 3.15 TO 4.91)	CARBONATED UPTO 5mm to 15mm	48MM, 68MM & 70MM	-	Pile cap 0.1mm to 0.3mm, Pier 0.1mm to 1mm & Pier cap 0.1mm to 0.5mm	<b>Rehabilitation with Jacketing for Pier shaft, FRP laminates, PMM for surface cracks on pier cap &amp; Jacketing, epoxy grouting for Pile cap cracks</b>
12	<b>PIER-12</b>	21.41	FAIR TO VERY GOOD (25 TO 44)	DOUBTFUL TO GOOD ( 2.02 TO 4.35)	CARBONATED UPTO 10mm to 20mm	65MM & 68MM	-	Pile cap 0.1mm to 0.3mm, Pier 0.1mm to 0.7mm & Pier cap 0.1mm to 0.3mm	
13	<b>PIER-13</b>	15.03	FAIR TO VERY GOOD (20 TO 48)	GOOD TO EXCELLENT ( 3.78 TO 5.46)	CARBONATED UPTO 5mm to 15mm	63MM & 70MM	UNCERTAIN	Pile cap 0.1mm to 0.3mm, Pier 0.1mm to 0.6mm & Pier cap 0.1mm to 0.5mm	
14	<b>PIER-42</b>	15.66	GOOD TO VERY GOOD (32 TO 44)	DOUBTFUL TO GOOD (3.30 TO 4.31)	CARBONATED UPTO 10mm to 15mm	83MM	10%	Pier 0.1mm to 0.8mm & Pier cap 0.1mm to 0.4mm	<b>Rehabilitation with Jacketing for Pier shaft, FRP laminates, PMM for surface cracks on pier cap &amp; Jacketing for Pile cap</b>
15	<b>PIER-43</b>	12.0	GOOD TO VERY GOOD (33 TO 48)	DOUBTFUL TO EXCELLENT (3.65 TO 4.59)	CARBONATED UPTO 5mm to 15mm	75, 77MM	10%	Pier 0.1mm to 1.5mm & Pier cap 0.1mm to 0.5mm	<b>Rehabilitation with Jacketing for Pier shaft, FRP laminates, PMM for surface cracks on pier cap &amp; Jacketing for Pile cap</b>

16	<b>PIER-44</b>	22.2	FAIR TO VERY GOOD (23 TO 48)	DOUBTFUL TO EXCELLENT (3.31 TO 4.59)	CARBONATED UPTO 10mm	55MM, 59MM & 78MM	10%	Pier 0.2mm to 1.5mm & Pier cap 0.1mm to 0.4mm	<b>Rehabilitation with Jacketing for Pier shaft, FRP laminates, PMM for surface cracks on pier cap &amp; Jacketing for Pile cap</b>
17	<b>PIER-45</b>	26.9	FAIR TO VERY GOOD (28 TO 54)	DOUBTFUL TO GOOD (1.61 TO 3.99)	CARBONATED UPTO 10mm to 15mm	53,69MM	10%	Pier 0.1mm to 1.5mm & Pier cap 0.1mm to 0.4mm	
18	<b>PIER-46</b>	19.8	GOOD (33 TO 44) REPRESENTS ONLY SURFACE STRENGTH	MOST OF THE RESULTS ARE DOUBTFUL (3.18 TO 4.07)	CARBONATED UPTO 10mm to 25mm	48MM & 59MM	UNCERTAIN	Pier 0.3mm to 1.5mm & Pier cap 0.1mm to 0.5mm	
19	<b>Pile Cap-17</b>		GOOD (30 TO 35)	DOUBTFUL TO GOOD (1.68 TO 4.36)	-	64MM	UNCERTAIN	Pile cap 0.1mm to 1.5mm	<b>Jacketing, Epoxy nipple grouting needs to be done for cracks</b>
20	<b>Pile Cap-19</b>	-	FAIR TO VERY GOOD (28 TO 54)	DOUBTFUL TO EXCELLENT (2.77 TO 5.06)	-	77MM	-	Pile cap 0.1mm to 1.5mm	
21	<b>Pile Cap-20</b>	-	GOOD (42 TO 50)	DOUBTFUL TO GOOD (3.07 TO 4.37)	CARBONATED UPTO 10mm	74MM	UNCERTAIN	Pile cap 0.1mm to 1.5mm	

## 10. STRENGTHING DRAWING FOR JACKETING OF PIERS, PILE CAPS & FRP LAMINATES FOR PIER CAPS





## 10. BILL OF QUANTITIES

S.NO	DESCRIPTION	UNITS	QUANTITY	RATE	AMOUNT	REFERENCE
1	<b>Structural Supporting System</b>					
	Scaffolding and support system for repair works					
2	<b>M40 Grade of Micro Concrete for Jacketing</b>	CUM	312	70000.00	21840000	
	Supply, mixing and placing in position the Micro Concrete or equivalent product approved by the Engineer-In-Charge, as per the manufacturer's specifications, mixed 6.4 mm size clean coarse aggregate percentage by weight, including mixing in approved mixing machine, pumping of micro concrete under pressure using approved Pneumatic pumps or manually so as to ensure that the concrete laid for encasement in dense, properly compacted, free from honey combs etc, completed all as directed & approved by the Engineer-in-charge, including the skilled applicators. Product: Fosroc - RENDROC RG65					
3	<b>Additional Reinforcement for repair, rehabilitation work</b>	KG	25719	120	3086280	
	Supply and Providing additional reinforcement bars of grade Fe 500 for column jacketing, as main reinforcement to the specified length as per the drawing. Drilling 12mm dia holes up to a depth of 75mm maximum and fixing 8mm dia L shaped anchor rods as shear connectors at every 300mm c/c on the surfaces of the column. Clean the same using water and make sure that there are no fine particles present in the hole. Fill the drilled and cleaned hole to a minimum depth of 1/3rd of the hole with the Lokfix E77. Make sure that the resin has reached till the end of the hole. At this stage push the shear connector gently in to the hole and finish the excess resin which comes out of the hole and allow the shear connectors not to be disturbed for minimum 20 minutes - complete. Tie the prefixed shear connectors to the additional rebar to act monolithically with the existing ones and core concrete. Provide 8mm dia stirrups in the form of ring shaped bars. Tie them properly so that it has a tight contact with the main bars. The rate shall include the cost of all the material supply, operations, tools etc., complete.					
4	<b>Shuttering for Piers &amp; Pile Caps</b>	SQM	1222	500	611000	
	Supplying and providing shuttering at all heights & depths (1mts below the ground level), with approved steel sheets or any other non- flammable material including centering, strutting, propping to the required levels and sizes, de shuttering after completion of required duration as mentioned in IS-456, 2000/latest revision.					

5	<b>Supply and apply a pultruded FRP plate (100mm width x Thickness 3.0mm) for Strengthening of Pier caps through FRP System</b>	RM	557	7000.00	3901800	
	Supply and applied on the prepared surface with proper roller to remove air voids after application with SikaDur-330 or Fosroc or approved product an Epoxy adhesive as per specification suggested by M/S Sika India Pvt Limited or Fosroc or approved product. Product: Sika® CarboDur® S-512 or Fosroc or approved product Product requirements: approved by Fib, technical report, E-modulus: $1.65 \times 10^5$ N/mm <sup>2</sup> ; tensile strength $\geq 2800$ N/mm <sup>2</sup> ; strain at break > 1.69%; temperature resistant > 100°C. Width = 100mm and 3.0 mm thick Along with supply and apply a solvent-free, Epoxy based, thixotropic, structural two-part adhesive for plate bonding. Product: Sikadur®-30 LP (IN). Compressive Strength >90 N/mm <sup>2</sup> (7 days) according to ASTM C579; Shear Strength >10 N/mm <sup>2</sup> (7 days at 250C) according to FIP 5.15; Bond Strength $\geq 2.5$ N/mm <sup>2</sup> according to EN1542. Supply, application, surface preparation shall be followed as per manufacture data sheet and instructions. Scope of work shall be including supply of materials, application, manpower, machinery, tools, consumables etc., complete as per the direction of engineer –in charge.					
6	<b>Epoxy based nipple grouting</b>	KGS	1534	3300	5062200	
	<p>A) Drilling and fixing nozzle in RC members: Drilling 10 mm dia., upto 300mm deep holes in structural members horizontally and vertically in staggered Supply, providing and fixing nozzles in cracks in RCC structural members. Drilling 10 mm dia., up to 150mm deep holes @ 20 cm Centre-to-Centre distance based on the crack pattern and as instructed by Engineer-In-Charge. Clean the holes by air blower prior to fixing nozzles and insert 8 mm dia. copper nozzles in holes with the help of approved product, rate shall include supply of material, manpower, machinery, tools, surface preparation, application, etc., completed as per the direction &amp; approved product by Engineer-in-charge.</p> <p>B) Epoxy based grout: Supply, providing and execution of Epoxy injection grouting, the surface to be treated must be structurally sound, free from standing water, oil, grease, surface contaminants. Dirt, dust and other foreign materials must be removed. Concrete which is fully contaminated with oil / grease must be removed to the depth of sound &amp; un-contaminated concrete. Impregnation shall be applied with a paint brush or roller until complete saturation of the substrate is achieved. Cracks are sealed by filling / pouring approved product mixed and directly from the mixing vessel. Crack mouth should be opened and sealed. As soon as injection Epoxy grout out of the next injection port, the first one is sealed and injection process is continued from next port. For horizontal crack, injection should start from any of the ends &amp; to be continued &amp; completed till the last port is used. For vertical crack, injection should start from the lowest port &amp; continued upwards. After completion of the injection process, the injection ports as well as the sealing materials between the ports shall be removed. The width of cracks to be injected shall be up to 3 mm, if the crack width found more then same shall bring to the notice of Engineer-In-charge before treating. Rate shall include supply of material, manpower, machinery, tools, surface preparation, application, etc., completed as per the direction &amp; approved product by Engineer-in-charge. (Rates shall including sealing of cracks).</p>					

7	<b>Polymer Modified Mortar</b>	SQM	1182	2400.00	2836800	
	Supply, provide and applying a pre-batched one component Polymer Modified Mortar (PMM) for repair of spalling and damaged unsound concrete in RCC structural members, columns and column-wall junction etc., rate shall include supply of material, manpower, machinery, tools, surface preparation, application, curing etc., completed as per the direction & approved product by Engineer-in-charge. <b>SikaTop 125 HS</b>					
8	Miscellaneous (Pile Liner cleaning, replacement of liner, removal of debris etc.			L.S	5000000	
	<b>Total</b>				<b>4,23,38,080.00</b>	<b>Rs</b>

## 11. MEASUREMENT SHEET

Description	Nos.	Length	Breadth	Height	Quantity	Unit
Item no.1: Support system, Providing scaffolding for the structure.						
As per site condition						
Item No. 2 – M40 Grade of Micro concrete for Jacketing						
2.1. For Piers - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 & 42[100MM THK.]	14	$V = \pi (R^2 - r^2)h, = \pi (1.35^2 - 1.25^2) \times 6.5 = 5.30$			74.20	
2.2 For Pier-Piers-43, 44, 45 & 46	4	$V = \pi (R^2 - r^2)h, = \pi (1.35^2 - 1.25^2) \times 3.3 = 2.69$			10.76	
2.3 For Pile Caps-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17, 19, 20, 42, 43, 44, 45 & 46.	21	Jacketing Quantity = Volume of the jacketing portion - Volume of exisitng piles = (6*6*0.3)- (0.785*1.2*1.2*0.3*4)= =9.44			198.24	
Total					283.20	
Adding 10 % extra					28.32	
Total					311.52	CUM
Say					312	CUM
Item No. 3 – Additional Reinforcement for Piers jacketing						
Referring to Structural Observation sheet						
3.1. For Piers - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 & 42: 3.1.1. Main bars @ 16mm dia from Pier bottom level to top level @6.5mts height.						
	14	20	7		3077.20	
3.1.2. Stirrups @ 12mm dia at 200 mm c/c	Number of bars = Height of the pier/spacing = 6.436/0.2 = 32 Nos					
	14	32	8.8		3500.85	
3.1.3. Shear connectors in jacketing for Pier surfaces in zig-zag manner @ 10mm dia at 300mm c/c	Number of Shear connectors = (Circumference of the pier/spacing) * (Height of the pier/spacing) = (8.3/0.45) * (6.436/0.4) = 295 Nos					
	14	295	0.5		1272.04	

<b>3.2. For Piers - 43, 44, 45 &amp; 46:</b>					
3.2.1. Main bars @ 16mm dia from Pier bottom level to top level @3.3 mts height.					
	4	20	4		502.40
3.2.2. Stirrups @ 12mm dia at 200 mm c/c	Number of bars = Height of the pier/spacing = 3.3/0.2 = 16.5 Nos				
	4	17	8.8		531.38
3.2.3. Shear connectors in jacketing for Pier surfaces in zig-zag manner @ 10mm dia at 300mm c/c	Number of Shear connectors = (Circumference of the pier/spacing) * (Height of the pier/spacing) = (8.3/0.45) * (3.3/0.4) = 152.1 Nos				
	4	152	0.5		187.26
<b>3.3. For For Pile Caps-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17, 19 &amp; 20, 42, 43, 44, 45 &amp; 46 3.5.1.</b>					
Main bars @ 16mm dia at 200mm spacing at Pier cap bottom along length & width.	(1+6/0.2)+(1+6/0.2) = 62 bars				62
	21	62	7		14308.98
<b>Total</b>				23380.11	
Adding 10 % extra				2338.01	
<b>Total</b>				<b>25718.13</b>	<b>KGS</b>
<b>Say</b>				<b>25719</b>	<b>KGS</b>
<b>Item No. 4 – Shuttering for Piers</b>					
Referring to Structural Observation sheet					
4.1. For Piers - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 & 42 up to 6.436mts height.	14	8.478	6.5	771.50	
4.2. For Piers 43, 44, 45 & 46 up to 3.3mts height.	4	8.478	3.3	111.9096	



4.2. For <b>Pile Caps-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17, 19, 20, 42, 43, 44, 45 &amp; 46</b>	21	36	0.3	226.8	
<b>Total</b>				1110.2	<b>SQM</b>
Adding 10 % extra				111.02	
<b>Say</b>				<b>1222</b>	<b>SQM</b>
<b>Item No.5 CARBODOUR LAMINATES-(SIKA CARBODOUR LAMINATES S1014)</b>					
5.1 100mm wide and 3mm Thick laminates for <b>PIER CAPS 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 &amp; 42</b> at top face @ 3 strips per each pier cap.	14	10.2*3=30.6 meters		428.4	
5.2 100mm wide and 3mm Thick laminates for <b>PIER CAPS 43, 44, 45 &amp; 46</b> at top face @ 3 strips per each pier cap.	4	10.75*3=32.25 meters		129	
<b>Total</b>				<b>558</b>	<b>RM</b>
<b>Item No. 6 – Crack Grouting for Pile caps 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17, 19 &amp; 20</b>					
A) Nipple for grouting (at 300 mm spacing for the Pile Cap 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17, 19 & 20) total Running Cracks length = 460 meters	460			1533.333	
Considering 100% Crack length					
<b>Say</b>				<b>1534</b>	<b>NOS</b>
<b>B) Epoxy based Grout</b>					
Considering 1 Kg per Nipple				<b>1534</b>	<b>KG</b>

<b>Item No. 7 – Polymer Modified Mortar</b>					
Complete Surface area of the <b>Pier caps 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 &amp; 42</b>	14	Surface Area (Front, Back, Side & Bottom Faces)			770
Adding 10 % extra					77.00
					847.00
Complete Surface area of the <b>Pier caps 43, 44, 45 &amp; 46</b>	4	Surface Area (Front, Back, Side & Bottom Faces)			304
Adding 10 % extra					30.40
					334.40
<b>Total</b>					1181.40
<b>Say</b>					<b>1182</b>
					<b>SQM</b>

## **12. NABL LAB REPORTS**

CLIENT:  
PWD - CG

CONSULTANT  
IEPL



## VAX CONSULTANTS PVT.LTD.

(MATERIAL TESTING LABORATORY)

D.No: 50-118-J, Ground Floor, Plot No: 95, North Extension Layout Seethammadhara,  
Visakhapatnam-530013, Andhra Pradesh

TEST REPORT NO:  
VAX/LAB/02/Core

Date:  
11.11.2025

Page No.:  
01 of 03

Name of Customer: M/s. IDDC Engineers Pvt. Ltd., Visakhapatnam,

Name of the Project : Third Party Condition Survey & Test of Partially Executed Work for Major Bridge at KM 28+400 over Mahanadi on NH-153.

Name of Client: PWD Chattisgarh

### Core Compressive Strength Results Sheet

Test Method: IS 516- Part-4 2018

Test Method: IS 516-Part-4 2018								Date Of Sample				: 05.11.2025		
*Age of Concrete		:- 8 Years						Date Of Testing				: 11.11.2025		
*Concrete Grade		:- M- 35 Grade				Area in mm	6936.26						Core Diameter in mm: 94	
S.No	Sample Location	Length Of Core After Trimming in mm	Weight of Sample in Gms	Load in KN	Compressive Strength in N/mm2	L/D Ratio	Correction Factor	Corrected Compressive Strength in N/mm2	Correction Factor as per IS 516 Part -4 2018 Clause 8.4.1	Corrected Compressive Strength in N/mm2 as per IS 516 Part -4 2018 Clause 8.4.1	Equivalent Cube Compressive Strength in N/mm2	Required Strength According IS 456-2000		
1	PR-8	150.0	1298.2	92.7	13.36	1.60	0.96	12.77	1.03	13.15	16.44	Minimum Average strength 85%, & Individual Sample Strength 75% Grade of Concrete		
2	P-46	150.0	1255.7	65.2	9.40	1.60	0.96	8.98	1.03	9.25	11.56			
3	P-44	140.0	1165.2	108.3	15.61	1.49	0.94	14.74	1.03	15.18	18.97			
4	PR-3	135.0	1102.5	130.8	18.86	1.44	0.94	17.69	1.03	18.22	22.77	Minimum Average strength 85%, & Individual Sample Strength 75% Grade of Concrete		
5	PR-2	150.0	1284.5	120.9	17.43	1.60	0.96	16.66	1.03	17.15	21.44			


Conditions : 1.The results reported relate only to the items tested, endorsement of product is neither inferred nor implied. Any correction invalidates this report 2. This report shall not be reproduced except in full and cannot be used as evidence in the court of law and shall not be used in any advertising media without our written approval. 3. The test report relate to the sample submitted to us and not collected by Vax Consultants Pvt Ltd. 4. Interpretation & opinion of the test results: Not done 5.Statement of conformity to the Decision Rule as per specification or Standard : Not given 6.Head of the Department has Authorized signatory for the Report, Review & Authorization of the results 7.Technical Manager has Authorized & record maintained for the verification of the test method, analysis of the results & if any statement of the conformity or opinions & interpretations before releasing the Test Report. 8. \*Declared by the Customer.



For VAX CONSULTANTS PVT LTD.  
Authorized Signatory  
Name: P.Praveen  
Designation: H.O.L

CLIENT:  
PWD - CG

CONSULTANT  
IEPL

 <b>VAX CONSULTANTS PVT.LTD.</b> (MATERIAL TESTING LABORATORY) D.No: 50-118-1, Ground Floor, Plot No: 95, North Extension Layout Seethammadhara, Visakhapatnam-530013, Andhra Pradesh												
TEST REPORT NO: VAX/LAB/02/Core				Date: 11.11.2025					Page No.: 03 of 03			
Name of Customer: M/s. IDDC Engineers Pvt. Ltd., Visakhapatnam,												
Name of the Project : Third Party Condition Survey & Test of Partially Executed Work for Major Bridge at KM 28+400 over Mahanadi on NH-153.												
Name of Client: PWD Chattisgarh												
<b>Core Compressive Strength Results Sheet</b>												
Test Method: IS 516- Part-4 2018												
*Age of Concrete								Date Of Sample		: 05.11.2025		
: ~ 8 Years								Date Of Testing		: 11.11.2025		
*Concrete Grade				: M- 35 Grade		Area in mm		6936.26		Core Diameter in mm: 94		
S.No	Sample Location	Length Of Core After Trimming in mm	Weight of Sample in Gms	Load in KN	Compressive Strength in N/mm2	L/D Ratio	Correction Factor	Corrected Compressive Strength in N/mm2	Correction Factor as per IS 516 Part -4 2018 Clause 8.4.1	Corrected Compressive Strength in N/mm2 as per IS 516 Part -4 2018 Clause 8.4.1	Equivalent Cube Compressive Strength in N/mm2	Required Strength According IS 456-2000
11	PR-1	155.0	1288.1	140.6	20.27	1.65	0.96	19.49	1.03	20.07	25.09	Minimum Average strength 85%, & Individual Sample Strength 75% Grade of Concrete
12	PR-6	150.0	1245.5	134.4	19.38	1.60	0.96	18.51	1.03	19.07	23.84	
13	PR-12	150.0	1234.5	120.7	17.40	1.60	0.96	16.63	1.03	17.13	21.41	
14	PR-13	205.0	1532.2	79.4	11.45	2.18	1.02	11.67	1.03	12.03	15.03	
<p>Conditions : 1.The results reported relate only to the items tested, endorsement of product is neither inferred nor implied. Any correction invalidates this report 2. This report shall not be reproduced except in full and cannot be used as evidence in the court of law and shall not be used in any advertising media without our written approval. 3. The test report relate to the sample submitted to us and not collected by Vax Consultants Pvt Ltd.</p> <p>4. Interpretation &amp; opinion of the test results: Not done 5.Statement of conformity to the Decision Rule as per specification or Standard : Not given.6.Head of the Department has Authorized signatory for the Report, Review &amp; Authorization of the results 7.Technical Manager has authorized &amp; record maintained for the verification of the test method, analysis of the results &amp; if any statement of the conformity or opinions &amp; interpretations before releasing the Test Report. 8. "Declared by the Customer.</p>												

**For VAX CONSULTANTS PVT LTD.**  
**Authorized Signatory**  
**Name: P.Praveen**  
**Designation: H.O.L**







## VAX CONSULTANTS PVT.LTD.

(MATERIAL TESTING LABORATORY)

D.No: 50-118-1, Ground Floor, Plot No: 93, North Extension Layout Seethammadhara,  
Visakhapatnam-530013, Andhra Pradesh

TEST REPORT NO:  
VAX/LAB/02/Core

Date:  
11.11.2025

Page No.:  
02 of 03

Name of Customer: M/s. IDDC Engineers Pvt. Ltd., Visakhapatnam,

Name of the Project : Third Party Condition Survey & Test of Partially Executed Work for Major Bridge at KM 28+400 over Mahanadi on NH-153.

Name of Client: PWD Chattisgarh

### Core Compressive Strength Results Sheet

Test Method: IS 516- Part-4 2018

*Age of Concrete								:- 8 Years		Date Of Sample				: 05.11.2025				
*Concrete Grade								:- M- 35 Grade			Area in mm	6936.26	Date Of Testing			: 11.11.2025		
													Core Diameter in mm:				94	
S.No	Sample Location	Length Of Core After Trimming in mm	Weight of Sample in Gms	Load in KN	Compressive Strength in N/mm2	L/D Ratio	Correction Factor	Corrected Compressive Strength in N/mm2	Correction Factor as per IS 516 Part -4 2018 Clause 8.4.1	Corrected Compressive Strength in N/mm2 as per IS 516 Part -4 2018 Clause 8.4.1	Equivalent Cube Compressive Strength in N/mm2	Required Strength According IS 456-2000						
6	PR-42	140.0	1186.6	89.4	12.89	1.49	0.94	12.16	1.03	12.53	15.66	Minimum Average strength 85%, & Individual Sample Strength 75% Grade of Concrete						
7	PR-4	130.0	1065.2	126	18.17	1.38	0.93	16.93	1.03	17.44	21.80							
8	PR-11	135.0	1104.5	106.6	15.37	1.44	0.94	14.42	1.03	14.85	18.56							
9	PR-5	125.0	1035.3	197.9	28.53	1.33	0.93	26.43	1.03	27.22	34.03	Minimum Average strength 85%, & Individual Sample Strength 75% Grade of Concrete						
10	PR-9	150.0	1254.5	242.4	34.95	1.60	0.96	33.39	1.03	34.39	42.99							

Conditions : 1.The results reported relate only to the items tested, endorsement of product is neither inferred nor implied. Any correction invalidates this report 2. This report shall not be reproduced except in full and cannot be used as evidence in the court of law and shall not be used in any advertising media without our written approval. 3. The test report relate to the sample submitted to us and not collected by Vax Consultants Pvt Ltd.  
4. Interpretation & opinion of the test results: Not done 5.Statement of conformity to the Decision Rule as per specification or Standard : Not given. Head of the Department has Authorized signatory for the Report, Review & Authorization of the results 7.Technical Manager has authorized & record maintained for the verification of the test method, analysis of the results & If any statement of the conformity or opinions & interpretations before releasing the Test Report. 8. \*Declared by the Customer.

For VAX CONSULTANTS PVT LTD.

Authorized Signatory

Name: P.Praveen

Designation: H.O.L







An ISO 9001 : 2015 Certified Company

# AMRUTHA

## ENGINEERING LABORATORIES PVT. LTD.

"Specialists in Construction Material Testing"



TC-9430

अमृता इंजीनियरिंग लेबोरेटरीज प्राइवेट लिमिटेड

NABL ACCREDITED LABORATORY AS PER ISO / IEC 17025 : 2017

CIN No. U74999AP2020PTC114919

### TEST REPORT

#### RAPID CHLORIDE ION PENETRATION TEST OF HARDENED CONCRETE

Report Number	: 1512251106185	Issue Date	: 15.11.2025
Test Order Number	: 2025112428	ULR No	: TC943025000004513F
Test Order Date	: 07.11.2025	Page No.	: 1 of 2

Project /Work*	: Not Specified
Client Details	: M/s IDDC ENGINEERS PVT.LTD. D. No : 45-58-14/1, 2 <sup>nd</sup> floor, Narasimhanagar, Visakhapatnam, Andhra Pradesh.
Customer Reference	: Letter No: Nil, Dated 07.11.2025
Contractor Details	: M/s IDDC ENGINEERS PVT.LTD.
Source of Sample	: Sample submitted by Customer
Condition of Sample	: Satisfactory
Material Received On	: 07.11.2025
No. of Samples Tested	: 12(Twelve)
Identification of Sample*	: Concrete Cores
Test Method	: ASTM C1202-17a
Period of Testing	: 07.11.2025 to 15.11.2025
Discipline - Group	: Mechanical – Building Materials

#### RAPID CHLORIDE ION PENETRATION TEST: ASTM C1202-17a

S. No	Identification of Sample – CORE ID*	Dimensions of specimen (mm)		Date of test	Charge passed (coulombs)
		Dia	Length		
1	Sample at PIER 1	100	50	11.11.2025	2958
2	Sample at PIER 2	100	50	11.11.2025	1761
3	Sample at PIER 3	100	50	11.11.2025	1627
4	Sample at PIER 5	100	50	12.11.2025	1327
5	Sample at PIER 6	100	50	12.11.2025	300
6	Sample at PIER 7	100	50	12.11.2025	2904
7	Sample at PILE CAP 8	100	50	13.11.2025	1655
8	Sample at PIER 9	100	50	13.11.2025	206

\*As furnished by the Customer

This Report is subjected to terms and conditions mentioned overleaf

Office Address : B-Block, Plot No. 63, 64, Autonagar, Visakhapatnam-530 012

**Branch Office :**  
Plot No. 22, Industrial Area,  
Yerrabalem, Mangalagiri,  
Gunturu District - 522503, A.P.  
Website : [www.aelanalytical.com](http://www.aelanalytical.com)

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Mail Id : [info@aelanalytical.com](mailto:info@aelanalytical.com)  
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**S. SATYANARAYANA**  
Quality Manager  
Amrutha Engineering Laboratories Pvt. Ltd.





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NABL ACCREDITED LABORATORY AS PER ISO / IEC 17025 : 2017



TC-9430

CIN No. U74999AP2020PTC114919

Report Number	: 1512251106185	Issue Date	: 15.11.2025
Test Order Number	: 2025112428	ULR No	: TC943025000004513F
Test Order Date	: 07.11.2025	Page No.	: 2 of 2

S. No	Identification of Sample – CORE ID*	Dimensions of specimen (mm)		Date of test	Charge passed (coulombs)
		Dia	Length		
9	Sample at PIER 11	100	50	13.11.2025	852
10	Sample at PIER 12	100	50	14.11.2025	419
11	Sample at PIER 13	100	50	14.11.2025	527
12	Sample at PIER 44	100	50	14.11.2025	1418

\*As furnished by the Customer

Requirements as per ASTM C1202-17a: Chloride Ion Penetrability is

- High – if >4000
- Moderate – if 2000-4000
- Low – if 1000-2000
- Very Low – If 100 – 1000
- Negligible- if <100

Note: 1) The results relate only to the items tested.  
2) Report shall not be reproduced, except in full, without the written approval of the lab.  
3) Any correction invalidates the report.

For AMRUTHA ENGINEERING LABORATORIES PVT. LTD

Reviewed and Authorized By

**S. SATYANARAYANA**  
Quality Manager  
Amrutha Engineering Laboratories Pvt. Ltd.

Form No: AEL/FORM/29  
Issue No: 01, Issue Date: 21.09.2020  
Amendment No: 00, Amend. Date: --

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\*\*\*End of Report\*\*\*

Office Address : B-Block, Plot No. 63, 64, Autonagar, Visakhapatnam-530 012

#### Branch Office :

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NABL ACCREDITED LABORATORY AS PER ISO / IEC 17025 : 2017

CIN No. U74999AP2020PTC114919

### TEST REPORT

#### CHEMICAL ANALYSIS OF HARDENED CONCRETE

Report Number	: 1512251106184	Issue Date	: 15.11.2025
Test Order Number	: 2025112428		
Test Order Date	: 07.11.2025	Page No.	: 1 of 2

Project /Work*	: Not Specified
Client Details	: M/s IDDC ENGINEERS PVT.LTD. D. No : 45-58-14/1, 2 <sup>nd</sup> floor, Narasimhanagar, Visakhapatnam, Andhra Pradesh.
Customer Reference	: Letter No: Nil, Dated 07.11.2025
Contractor Details	: M/s IDDC ENGINEERS PVT.LTD.
Source of Sample	: Sample submitted by Customer
Condition of Sample	: Satisfactory
Material Received On	: 07.11.2025
No. of Samples Tested	: 18 (Eighteen)
Identification of Sample*	: HARDENED CONCRETE SAMPLES
Period of Testing	: 07.11.2025 to 15.11.2025
Discipline - Group	: Chemical – Building Material

S.NO	Identification of Sample*	pH	Sulphates as SO <sub>3</sub> (%)
1	Sample -1: PIER 1	12.06	0.52
2	Sample -2: PIER 2	12.03	0.69
3	Sample -3: PIER 3	12.02	0.57
4	Sample -4: PIER 5	12.06	0.48
5	Sample -5: Pile Cap	11.76	0.42
TEST METHOD		IS 3025(Part 11):2022	IS 4032:1985 (RA 2019)

\*As furnished by the Customer

This Report is subjected to terms and conditions mentioned overleaf

S. SATYANARAYANA  
Quality Manager  
Amrutha Engineering Laboratories Pvt. Ltd.

Office Address : B-Block, Plot No. 63, 64, Autonagar, Visakhapatnam-530 012

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CIN No. U74999AP2020PTC114919

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NABL ACCREDITED LABORATORY AS PER ISO / IEC 17025 : 2017

Report Number : 1512251106184  
Test Order Number : 2025112428  
Test Order Date : 07.11.2025

Issue Date : 15.11.2025  
Page No. : 2 of 2

S.NO	Identification of Sample*	pH	Sulphates as SO <sub>3</sub> (%)
6	Sample -6: PIER 7	9.63	0.56
7	Sample -7: Pile Cap 9	11.56	0.62
8	Sample -8: PIER 09	11.89	0.49
9	Sample -9: Pile Cap 13	11.87	0.55
10	Sample -10: Pile Cap 20	12.26	0.67
11	Sample -11: PIER 42	11.80	0.72
12	Sample -12: Pile Cap 43	12.05	0.62
13	Sample -13: PIER 44	11.56	0.68
14	Sample -14: PIER 45	12.24	0.55
15	Sample -15: PIER 46	11.86	0.48
TEST METHOD		IS 3025(Part 11):2022	IS 4032:1985 (RA 2019)

- Note: 1) The results relate only to the items tested.  
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For AMRUTHA ENGINEERING LABORATORIES PVT. LTD

Form No: AEL/FORM/39  
Issue No: 01, Issue Date: 01.04.2021  
Amendment No: 00, Amen. Date: --

Reviewed and Authorized By  
S. SATYANARAYANA  
Quality Manager  
Amrutha Engineering Laboratories Pvt. Ltd.

This Report is subjected to terms and conditions mentioned overleaf  
\*\*\*End of Report\*\*\*

Office Address : B-Block, Plot No. 63, 64, Autonagar, Visakhapatnam-530 012

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**NABL ACCREDITED LABORATORY AS PER ISO / IEC 17025 : 2017**

CIN No. U74999AP2020PTC114919

### TEST REPORT

#### CHEMICAL ANALYSIS OF HARDENED CONCRETE

Report Number	: 1512251106183	Issue Date	: 15.11.2025
Test Order Number	: 2025112428	ULR No	: TC943025000004512F
Test Order Date	: 07.11.2025	Page No.	: 1 of 2

Project /Work*	: Not Specified
Client Details	: M/s IDDC ENGINEERS PVT.LTD. D. No : 45-58-14/1, 2 <sup>nd</sup> floor, Narasimhanagar, Visakhapatnam, Andhra Pradesh.
Customer Reference	: Letter No: Nil, Dated 07.11.2025
Contractor Details	: M/s IDDC ENGINEERS PVT.LTD.
Source of Sample	: Sample submitted by Customer
Condition of Sample	: Satisfactory
Material Received On	: 07.11.2025
No. of Samples Tested	: 18 (Eighteen)
Identification of Sample*	: <b>HARDENED CONCRETE SAMPLES</b>
Period of Testing	: 07.11.2025 to 15.11.2025
Discipline - Group	: Chemical – Building Material

#### Water Soluble Chlorides as Cl - IS 14959 (Part-2): 2001(RA 2021)

S.NO	Identification of Sample*	UNITS	RESULTS
1	Sample -1: PIER 1	%	0.020
2	Sample -2: PIER 2	%	0.024
3	Sample -3: PIER 3	%	0.016
4	Sample -4: PIER 5	%	0.012
5	Sample -5: Pile Cap	%	0.012
6	Sample -6: PIER 7	%	0.016

\*As furnished by the Customer

This Report is subjected to terms and conditions mentioned overleaf

**S. SATYANARAYANA**  
Quality Manager  
Amrutha Engineering Laboratories Pvt. Ltd.

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**NABL ACCREDITED LABORATORY AS PER ISO / IEC 17025 : 2017**

CIN No. U74999AP2020PTC114919

Report Number	: 1512251106183	Issue Date	: 15.11.2025
Test Order Number	: 2025112428	ULR No	: TC943025000004512F
Test Order Date	: 07.11.2025	Page No.	: 2 of 2

S.NO	Identification of Sample*	UNITS	RESULTS
7	Sample -7: Pile Cap 9	%	0.033
8	Sample -8: PIER 09	%	0.029
9	Sample -9: Pile Cap 13	%	0.024
10	Sample -10: Pile Cap 20	%	0.063
11	Sample -11: PIER 42	%	0.018
12	Sample -12: Pile Cap 43	%	0.055
13	Sample -13: PIER 44	%	0.042
14	Sample -14: PIER 45	%	0.027
15	Sample -15: PIER 46	%	0.029

\*As furnished by the Customer

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For AMRUTHA ENGINEERING LABORATORIES PVT. LTD

Reviewed and Authorized By

Form No: AEL/FORM/39  
Issue No: 01, Issue Date: 01.04.2021  
Amendment No: 00, Amen. Date: --

This Report is subjected to terms and conditions mentioned overleaf

\*\*\*End of Report\*\*\*

**S. SATYANARAYANA**  
Quality Manager  
Amrutha Engineering Laboratories Pvt. Ltd.

**Office Address : B-Block, Plot No. 63, 64, Autonagar, Visakhapatnam-530 012**

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TC-9039

**TEST REPORT**

SAMTL/F/TR-01

Name & customer address : <b>IDDC Engineers Pvt.Ltd.</b> D.No: 45-58-14/1, 2nd floor, Narasimhanagar, VSP-530024 Ph: 9848493666		ULR No	: TC903925000000147F
		Job Code No	: SAMTL/Steel/147/2025
		Reference No	: -NA-
		Issue date	: 11.11.2025
		Date of Registration	: 07.11.2025
Sample particulars	: <b>TMT Steel bar, Fe-500D grade φ32mm,CK brand</b>	Date of Commencement of test	: 10.11.2025
Quantity	: 3No's (1mt length)	Date of Completion of Testing	: 10.11.2025
Test Required	: Mass/Meter, 0.2% proof stress, Tensile strength & Elongation	Sample Condition at receiving	: Found Okay
Environmental Conditions (Temp.):	28.7°C	Sample Tested	: As Received
		Sample Packing	: Packed with binded wire
		Page No	: 01 of 03
<b>Name of Work</b>	: "Consultancy services for Third Party Condition Survey & Tests of partially executed work of Major Bridge at Km 28+400 over Mahandi on NH-153 Raigarh Sarangarh saraipali in the District Sakti of Chhattisgarh under the PWD, NH Division Bilaspur.		
<b>Ref</b>	: NIT/Bid No.78/CE/NH/TC/44-59/2025, dated 19.07.2025		

**TEST RESULTS**

Sl.No	Description of test	Test Method	Test Results	Required specifications as per IS:1786-2008 (Fe-550D Grade)
1	Mass per Meter, Kg/m	IS1786:2008 (RA 2018)	6.28	6.31(-4%)
2	0.2% Proof Stress (YS) (N/Sq.mm)	IS 1608: Part-1 : 2022	518	Min 500 N/Sq.mm
3	Ultimate Tensile Strength (TS) (N/Sq.mm)		637	Min 565 N/Sq.mm
4	Elongation(%)		19.52	Min 16.0 %

## Conditions:

- 1.Interpretation of the results is Nil,Deviation from the test Method and conditions is Nil
- 2.Test samples not drawn by us, unless otherwise mentioned.
- 3.Samples will not be returned, balance samples will be returned on customer request only
- 4.Results are applicable only to the submitted samples
- 5.Full or part of the Test report shall not be used for any personnel or publicity purpose without written consent by the LABORATORY

For SATYA ASSOCIATES  
AUTHORISED SIGNATORY

  
 Quality Manager  
( B SATYANARAYANA )



TC-9039

**TEST REPORT**

SAMTL/F/TR-01

Name & customer address : <b>IDDC Engineers Pvt.Ltd.</b> D.No: 45-58-14/1, 2nd floor, Narasimhanagar, VSP-530024 Ph: 9848493666		ULR No	: TC903925000000147F
		Job Code No	: SAMTL/Steel/147/2025
		Reference No	: -NA-
		Issue date	: 11.11.2025
		Date of Registration	: 07.11.2025
Sample particulars	: TMT Steel bar, Fe-500D grade φ25mm,CK brand	Date of Commencement of test	: 10.11.2025
Quantity	: 3No's (1mt length)	Date of Completion of Testing	: 10.11.2025
Test Required	: Mass/Meter, 0.2% proof stress, Tensile strength & Elongation	Sample Condition at receiving	: Found Okay
		Sample Tested	: As Received
		Sample Packing	: Packed with binded wire
Environmental Conditions (Temp.): 28.2°C		Page No	: 02 of 03
Name of Work	: "Consultancy services for Third Party Condition Survey & Tests of partially executed work of Major Bridge at Km 28+400 over Mahandi on NH-153 Raigarh Sarangarh saraipali in the District Sakti of Chhattisgarh under the PWD, NH Division Bilaspur.		
Ref	: NIT/Bid No.78/CE/NH/TC/44-59/2025, dated 19.07.2025		

**TEST RESULTS**

Sl.No	Description of test	Test Method	Test Results	Required specifications as per IS:1786-2008 (Fe-550D Grade)
1	Mass per Meter, Kg/m	IS1786:2008 (RA 2018)	3.846	3.85(-4%)
2	0.2% Proof Stress (YS) (N/Sq.mm)	IS 1608: Part-1 : 2022	559	Min 500 N/Sq.mm
3	Ultimate Tensile Strength (TS) (N/Sq.mm)		717	Min 565 N/Sq.mm
4	Elongation(%)		23.12	Min 16.0 %

**Conditions:**

- 1.Interpretation of the results is Nil ,Deviation from the test Method and conditions is Nil
- 2.Test samples not drawn by us, unless otherwise mentioned.
- 3.Samples will not be returned, balance samples will be returned on customer request only
- 4.Results are applicable only to the submitted samples
- 5.Full or part of the Test report shall not be used for any personnel or publicity purpose without written consent by the LABORATORY

For SATYA ASSOCIATES  
AUTHORISED SIGNATORY

  
Quality Manager  
( B SATYANARAYANA)





TC-9039



Consulting Eng. Services | Govt. Approved Valuers | Material Testing Laboratory

## TEST REPORT

SAMTL/F/TR-01

Name & address of customer : <b>IDDC Engineers Pvt.Ltd.</b> D.No: 45-58-14/1, 2nd floor, Narasimhanagar, VSP-530024 Ph: 9848493666		ULR No	: TC903925000000147F
		Job Code No	: SAMTL/Steel/147/2025
		Reference	: -NA-
		Issue date	: 11.11.2025
Sample particulars	: <b>TMT Steel bar</b>	Date of Registration	: 07.11.2025
Quantity	: 02 No's	Date of Commencement of test	: 10.11.2025
Test Required	: Chemical Properties of Reinforcement Steel bar	Date of Completion of Testing	: 10.11.2025
Test Method	: IS 8811 : 1998 (RA 2018)	Sample Condition at receiving	: Found Okay
		Sample Tested	: As Received
		Page No	03 of 03
Environmental Conditions : Temperature(°C)= 21.2, Humidity(%)= 50			
Name of Work	: "Consultancy services for Third Party Condition Survey & Tests of partially executed work of Major Bridge at Km 28+400 over Mahandi on NH-153 Raigarh Sarangarh saraipali in the District Sakti of Chhattisgarh under the PWD, NH Division Bilaspur.		
Ref	: NIT/Bid No.78/CE/NH/TC/44-59/2025, dated 19.07.2025		

## TEST RESULTS

Sl.No	Identification of sample	Grade	DIA (mm)	Test Parameters		
				C (%)	S (%)	P(%)
1	CK brand	Fe 500 D	25	0.232	0.034	0.032
2	CK brand	Fe 500 D	32	0.236	0.038	0.035

\*As Furnished by the custmore

REQUIREMENTS As Per IS 1786 : 2008 (Ra 2018)	Test Parameters			
	Carbon (C) Maximum %	Sulphur (S) Maximum %	Phosphorous(P) Maximum %	Sulphur and Phosphorous %
For Fe 500 D	0.25	0.040	0.040	0.075

Remarks : Steel- 25mm, 32mm, dia.sample parameters **satisfy** the requirements of Fe-500 D as per IS 1786:2008 (RA 2018).

Conditions:

- 1.Interpretation of the results is Nil ,Deviation from the test Method and conditions is Nil
- 2.Test samples not drawn by us, unless otherwise mentioned.
- 3.Samples will not be returned, balance samples will be returned on customer request only
- 4.Results are applicable only to the submitted samples
- 5.Full or part of the Test report shall not be used for any personnel or publicity purpose without written consent by the LABORATORY

For SATYA ASSOCIATES  
AUTHORISED SIGNATORY

Quality Manager  
( B SATYANARAYANA)

\*\*\*END OF THE REPORT\*\*\*



**END OF THE REPORT**