

E.I.H. TELE INFRA PVT LTD

**GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED
CONSTRUCTION OF RAILWAY FLY OVER
4 LANE BRIDGE NO -248
KASGANJ (U.P.)**

URN NO-	HSL251103:32	DATE OF SAMPLING:	03-11.2025
TYPE OF SAMPLE:	SOIL SAMPLE	DATE OF REPORT ISSUE:	17-11.2025
DISTRICT:	KASGANJ	BLOCK:	KASGANJ
SITE NAME:	SHOOT MILROB(248)	LCATION	A01 and A02
LOCATION MARK:	LATITUDE: 27.805058	LONGITUDE: 78.659681	

SUBMITTED TO:



**UP State Bridge
Corporation Ltd**

**UP STATE BRIDGE CORPORATION LIMITED
ALIGARH**

ACKNOWLEDGEMENT

WE ARE GRATEFUL TO **M/S. U.P STATE BRIDGE CORPORATION LIMITED.** FOR PROVIDING US THE OPPORTUNITY TO CARRY OUT THESE SOIL INVESTIGATION FOR DETERMINATION OF SAFE BEARING PRESSURE ON **PROPOSED CONSTRUCTION OF ROAD OVER BRIDGE AT DISTRICT- KASGANJ IN UTTAR PRADESH.**

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INTRODUCTION

M/s. U.P STATE BRIDGE CORPORATION LIMITED. has proposal for the construction of **ROAD OVER BRIDGE at District- Kasganj in Uttar Pradesh region.** For the purpose of construction it is required to have the soil investigation data to identify the geology of the soil and to identify the type of proposed foundation based on the reports. The work of geotechnical investigation for the above said project was entrusted to **M/s. E.I.H. TELEINFRA PVT LTD. (AN ISO 9001:2015 Certified), Aligarh, Uttar Pradesh.**

Report has been prepared and lab testing is conducted to M/S. H S LABS PVT LTD, PLOT NO. 576, LONI ROAD, MOHAN NAGAR, GHAZIABAD - 201005, UTTAR PRADESH, (ISO & NABL Accredited Laboratory ISO/IEC17025:2017, TC-8865).

The report presented herein deals with the analysis of field and laboratory test results, type and depth of foundation and recommendations based on the type of soil and its safe bearing capacity of soil.

2.0 OBJECTIVES OF INVESTIGATION

The purpose and objectives of investigation was to obtain the sub surface conditions at the site so as to evaluate the soil parameter which are required for evaluating the safe bearing capacity of soil for the design and suitability of the foundation for the proposed structure. The knowledge of general geotechnical subsoil characteristics, compressibility and information about ground water table is an essential requirement for the geotechnical engineer, which would assist the designer to design the foundation system.

3.0 SCOPE OF WORK

The detailed scope of work of geotechnical investigation for the project was limited to the following:

Mobilization of equipment and personnel to the project site, setting up the equipment and carrying out the field investigation and demobilization of the same after completion of fieldwork.

- Drilling of bore hole (BH-1 & BH-02) 150mm diameter of boring at specified location mentioned. As per the work order it was requested to go with the manual boring up to a depth of 30.0m bore or $N > 100$ achieved, whichever occurs earlier.
- Conducting standard penetration test at regular depth intervals of 1.50m or at every change of strata whichever illustrates earlier and collect samples for further testing.
- Collection of the undisturbed soil samples at every change of the strata.
- Recording the depth of ground water table (If observed).

Conducting all necessary and relevant laboratory tests on representative soil sample limited to following:

- Natural moisture content
- Grain Size analysis (Sieve)
- Liquid and Plastic limits
- Specific gravity
- Bulk and Dry density
- Direct shear / Tri-axial shear test

Laboratory testing for evaluating SBC as per latest IS codes.

Submission of soil testing report which includes interpretation of test results and suggesting recommendations for net safe bearing capacity of soil.

4. GEOLOGY AND SEISMICLOGY OF THE AREA

The state of Uttar Pradesh comprises an area of about 2,43,286 Km² and form some of the largest states in the country. It extends from latitude 23°05'15"N to 30°05'05"N and longitude 77°05'36"E to 84°03'10"E and is characterized by rock formations ranging in age from the Archean (the bundelkhand granitic gneisses) to the recent (the Ganga alluvium).

In Uttar Pradesh, the Ganga plain which dominates the landscape and nearly covers three fourth of the geographical area of the State, lies between the rocky Himalayan belt in the north and the southern hilly tract comprised of mainly Pre-Cambrian rocks. Flexing of the Indian lithosphere, in response to the compressive forces due to collision and thrust fold loading produced the Ganga Plain fore land

basin. It is filled with recent alluvial sediments which is at places more than 1,000 m. thick and is an amalgam of sand, silt, clay in varying proportions.

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The southern hilly tract is roughly parallel to the Ganga-Yamuna lineament. The tract is underlain by granitic complex in Bundelkhand region and in Sonbhadra. It is overlain by rocks Mahakoshal (Bijawar) and Vindhyan super group. The younger rock comprise of coal bearing Gondwana in south Sonbhadra and basaltic rocks in southern part of Lalitpur. The granitic complex is considered to be potential for the search of metallic minerals like copper, lead, zinc, molybdenum, gold, nickel, Uranium and Platinum group of elements. The overlying sediments of Mahakoshal (Bijawar) and associated Iron Formation show a potential for the search of copper, uranium, and gold in Lalitpur and alusite, sillimanite, gold, calcite, marble and clay in sonbhadra.

The lower Vindhyan sediments of Sonbhadra contain deposits of cement grade limestone, flux grade dolomite, building stone and is also potential for the search of placer gold and other metals. While the Upper Vindhyan sand stones are suitable for making decorative slab / tiles or ballast. Deposits of silica sand bauxite are available in Allahabad and Chitrakoot districts while coal deposits occur in the Gondwana rocks in south western corner of Sonbhadra.

The Geological Map of UP and Uttarakhand are given below:



SEISMIC TECHNOLOGY OF UTTAR PRADESH & UTTARAKHAND:

Most of the state of Uttar Pradesh lies in the Gangetic Plain. This is a fore-deep, a down warp of the Himalayan foreland, of variable depth, converted into flat plains by long-vigorous sedimentation. This is known as geosyncline and the Gangetic Plain is the Indo-Gangetic Geosyncline.

This has shown considerable amounts of flexure and dislocation at the northern end and is bounded on the north by the Himalayan Frontal Thrust. The floor of the Gangetic trough (if seen without all the sediments) is not an even plain, but shows corrugated and equalized sand buried ridges (shelf faults). Beneath Uttar Pradesh, run the Delhi-Haridwar Ridge (DHR), trending NNE-SSW along New Delhi to the Gharwal region.

The Delhi-Muzaffarnagar Ridge (DMR), which trends east to west, running from New Delhi to Kathgodam, The last ridge is the Faizabad ridge (FR), which runs in a curved manner, first east to west from Allahabad to Kanpur and then starts to bend towards the north-east towards Lucknow and carries on in this direction towards the Himalayas in Nepal.

The depression that forms between the DMR and the FR, forms the West Uttar Pradesh shelf in the west and the Sharda Depression in the east. The region to the south of the FR, forms the East Uttar Pradesh shelf.

There are several faults in the region, among them the Moradabad Fault which trends NE-SW and the Bhairwan Fault in the vicinity of Allahabad. Apart from these there are east-west running tear faults in the region that control the courses of the main rivers.

Earthquakes have occurred in mostly all parts of Uttar Pradesh. Major earthquakes in the neighbouring states of New Delhi, Uttarakhand, Bihar and from across the Indo-Nepal border have also shaken many parts of Uttar Pradesh. However, it must be stated that proximity to faults does not necessarily translate into a higher hazard as compared to areas located further away, as damage from earthquakes depends on numerous factors such as sub surface geology as well as adherence to the building codes.

The districts of Saharanpur, Muzaffarnagar, Bijnor, Moradabad, Meerut, Etah, Hardoi, Sitapur, Agra, Mainpuri, Farukhabad, Unnao, Lucknow, Bara Banki, RaeBareilly, Sultanpur, Faizabad, Azamgarh, Ballia, Pratapgarh, Jaunpur, Ghazipur, Varanasi and Mirzapur lie in Zone IV. The districts of Etawah, Kanpur, Jalaun, Jhansi, Harimpur, Banda, Fatehpur, Allahabad and Lalitpur lie in Zone III. Since the earthquake data base in India is still incomplete, especially with regards to earthquakes prior to the historical period (before 1800 A.D.), these zones offer a rough guide of the earthquake hazard in any particular region and need to be regularly updated.

SIGNIFICANT EARTHQUAKES IN UTTAR PRADESH & UTTARAKHAND:

The following list briefly outlines known earthquakes in this region. General locations are provided for historical events for which "generalized" epicentral co-ordinates are available. Some events which were significant for other reasons are also included.

This list will be updated whenever newer information is available. Please note that Magnitude and Intensity are NOT THE SAME. All events are within the state or union territory covered on this page unless stated otherwise.

15 July 1720 - New Delhi, Delhi, M 7.6 (GSHAP Catalog) 28.66N, 77.25E

The last major earthquake in the New Delhi region. Heavy damage in the city.

1 September 1803- Northern Gharwal region (Possibly Chamoli district), M> 7

Epicentral location unknown

This earthquake is believed to be one of the strongest earthquakes in this region. Between 200 -300 were killed in this shock and several villages were buried by landslides and rock falls. The Badrinath temple located ~40 km north of Chamoli was severely damaged. Tremors were felt as far away as Kolkata. Liquefaction was reported at Mathura.

28 August 1916 - Western Nepal, Mw 7.1 (SSA), Ms 7.3 (SSA), 7.5 (TS),

06:29:30UTC, 30.00N, 81.00E

This major earthquake was centred near Mount Api. It caused damage to some masonry buildings at Dharchula, India.

7 October 1920- NW of Sasaram, Rohtas District (Bihar-U.P. Border region), 5.5 (KISS)

23.00N, 83.80E

6 November 1925- RaeBareilly - Sultanpur District border, 6.0 (TS)

19:20:45UTC, 26.50N, 81.50E

15th January 1934- India – Nepal Border Region, Mw8.0

14:21IST/08:43 UTC, 26.50N, 86.50E

Among the deadliest earthquakes in Indian history. Close to 10, 500 were killed in Bihar. Damage occurred in eastern Uttar Pradesh, at Allahabad, Lucknow, Varanasi and many other places.

8 November 1952- Indo-Nepal Border region (Bahraich - Gonda Districts), 6.0 (TS)

10:41:54UTC, 27.90N, 82.20E

29 August 1953 -Indo-Nepal Border region (Bahraich – Gonda Districts), 6.0 (TS)

01:58:25UTC, 27.90N, 82.20E

4 September 1954- West of Pokhara, Central Nepal, 6.75 (TS)

06:45:14UTC, 28.30N, 83.80E

10 October 1956- Bulandshahr District (Uttar Pradesh), 6.2(IMD)

15:31:36UTC, 28.20N, 77.70E

One of the most powerful earthquakes in Uttar Pradesh struck the districts of western

Uttar Pradesh at 21:01 IST on October 10th, 1956. The massive shock was centred near Jehangirpur, in Bulandshahr District. No fatalities were reported. The shock was also strongly felt at Delhi, where there was some minor damage.

27 August 1960 -Gurgaon-Faridabad Districts (Haryana), 6.0 (TS)

15:58:59.20UTC, 28.20N, 77.40E

Damage from this earthquake extended into New Delhi where at least 50 people were injured. Structural damage was reported in Karol Bagh and cracks in houses in R.K.Puram.

24 December 1961- Indo – Nepal Border region (Pilibhit, Nainital, Kheri Districts),

6.0 (TS)

07:13:30UTC, 28.80N, 81.50E

1 June 1965 - West of Gorakhpur, (Gorakhpur-Basti Districts), 5.7 (TS)

07:52:30UTC, 27.00N, 83.00E

15 September 1966- South of Moradabad, (Moradabad-Rampur Districts), 5.8 (TS)

02:15:33.80UTC, 28.70N, 78.90E

29 July 1980 - Western Nepal, Mw6.8 (HRV)

14:58:40UTC, 29.60N, 81.09E

Between 150 -200 persons were killed and hundreds injured. Extensive damage in several towns in western Nepal. The quake also caused damage in Pithoragarh area, nearly 50 kilometres away from the epicentre. 13 persons were killed here and 40 were injured. The quake was felt as far away as Kathmandu and New Delhi.

21 October 1991- Near Piliang (Uttarkashi District), Mw 6.8 (NEIC)

21:23:14UTC /02:53:14IST, 30.78N, 78.77E

Between 750 to 2000 people killed in the Gharwal region. It was also felt very strongly in Uttar Pradesh, Chandigarh, Delhi, Haryana and Punjab. Some minor damage was reported in Chandigarh and New Delhi.

29th March 1999- Near Gopeshwar (Chamoli District), Mw 6.5 (HRV)

19:05:11UTC, 30.492N, 79.288E

115 people killed in the Gharwal region. The quake was felt very strongly in Uttar Pradesh, Chandigarh, Delhi and Haryana. In Haryana, one person was killed in the city of Ambala and 2 at Nakodar in the neighbouring state of Punjab. Minor damage to buildings in New Delhi, most significantly in Patparganj. Minor damage also reported from Chandigarh.

18 October 2007- Gautambudhnagar, Uttar Pradesh, M3.6

05:54:41UTC, 28.300 N, 77.600 E

A mild earthquake struck the district of Gautambudh nagar in western Uttar Pradesh, India, on 18 October 2007 at 11:24AM local time. It had a magnitude of $M=3.6$ and caused minor damage in the epi-central region.

4 HYDROGEOLOGY OF UTTAR PRADESH

Diverse Setup: The State Of U.P., predominantly covered with Gangetic alluvium, is characterized by varied hydrogeology formations, ranging in geological age from Archean to Recent that have resulted from diversified geological, climatological and topographic setups. These formations, along with space-time variable annual water cycle, govern ground water repositories in respective river basins of the state. The major portion of the state is covered by Ganga basin, comprising Yamuna, Ramganga, Gomti, Ghaghra, Gandak and Son sub basins, including rocky terrain of Bundelkhand. The mountain chain of the Himalayas in the north with high run off plays an important role in passive recharging of the vast Ganga basin.

Due to diverse hydrogeological and geomorphological setups, spatial and temporal distribution of ground water availability are non-uniform and range from plenty in alluvial plain to scarce in Bundelkhand.

The state can be broadly divided into four major hydrogeological units, characterized by different ground water conditions, namely-

- Terai zone
- Central Ganga Alluvial Plain
- Marginal Alluvial Plain
- Southern Peninsular zone
- The small part of Bijnor and Saharanpur districts fall in 'Bhabhar Zone', which extends south of mountainous range of Himalayas. The alluvial formations comprise Multi-aquifer system, explored down to 600-700 m., promises excessive and productive ground water resources.

The peninsular shield comprises discontinuous aquifers of limited potential in weathered and fissured sediments.

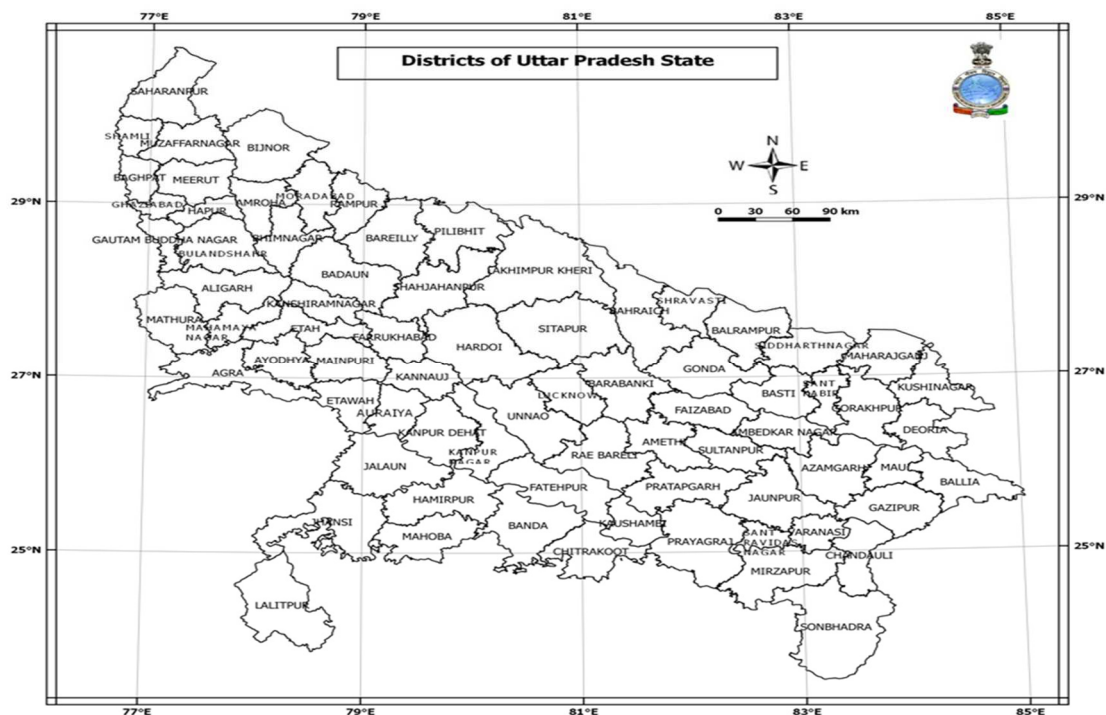
The ground water yield potential in the state by geographic region is briefly outlined below:-

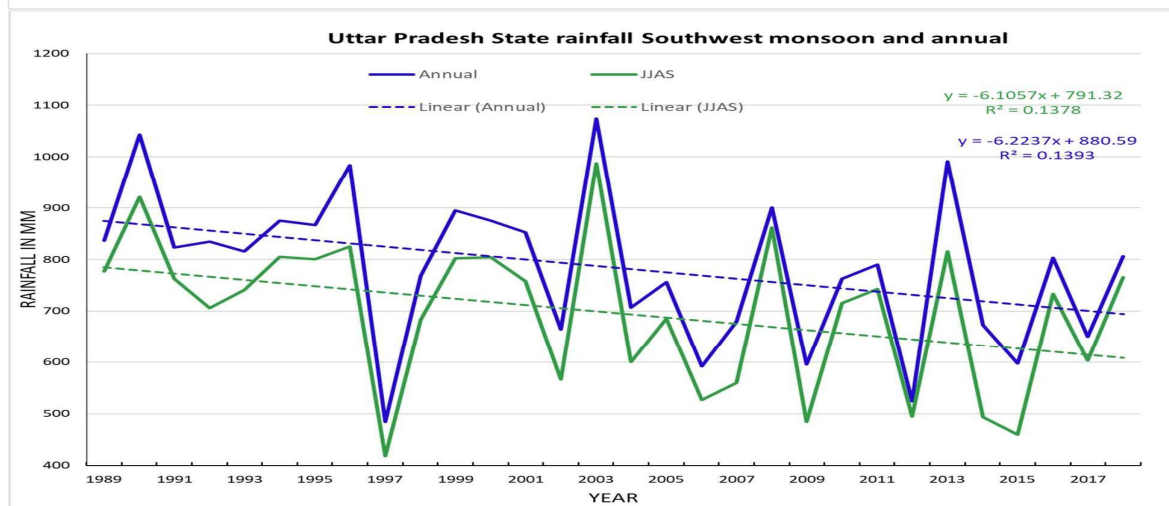
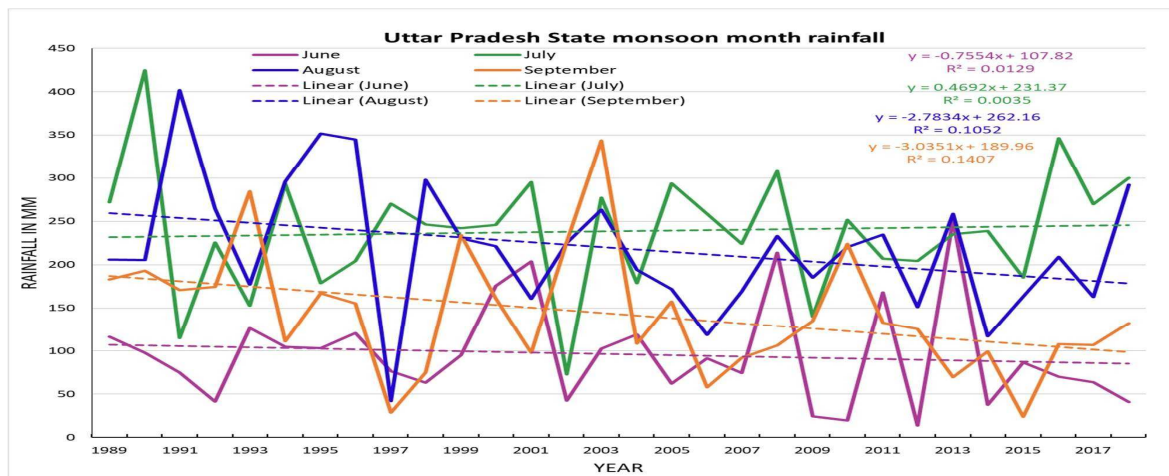
- (i) **Bhabhar Zone :** Fringing the foot hills, the aquifer are inter granular deposits capable of yielding moderate discharge through tube wells to a depth of 250 m. Ground water table is deep, the maximum being in the range of 80 to 90 meter below land surface. (Formations: Boulder and pebbles)

- (ii) **Tarai zone :** The plain in front of Bhabhar belt has capacity to produce a yield potential by tube wells of the order of 20-40 lps between depth of 150-300m (Formations : Alluvium, Fine Sediments)
- (iii) **Central Ganga Plain:** The aquifers within 100 m, depth produce discharge of 10-20 lps, and those beyond 300 m and upto 450 m are multi layered aquifers with higher yield of 40 lps and above. This unit comprises larger portion of the state. (Formations: Alluvium)
- (iv) **Marginal Alluvial Plain:** This zone provide moderate yield by tube well to a depth of 100-150 m, underlain by hard rock basement. (Formation: Alluvium)
- (v) **Bundelkhand Region:** The area characterized by varied geomorphic features / land forms, is having relatively low ground water yield potential, hence scarcity of ground water prevails in Bundelkhand.
(Formation: Pre-Cambrian rocks, Vindhyan Sediments and Colluvium)

OBSERVED RAINFALL VARIABILITY AND CHANGES OVER UTTAR PRADESH STATE-

MetMonograph No. :ESSO/IMD/HS/Rainfall Variability/27(2020)/51



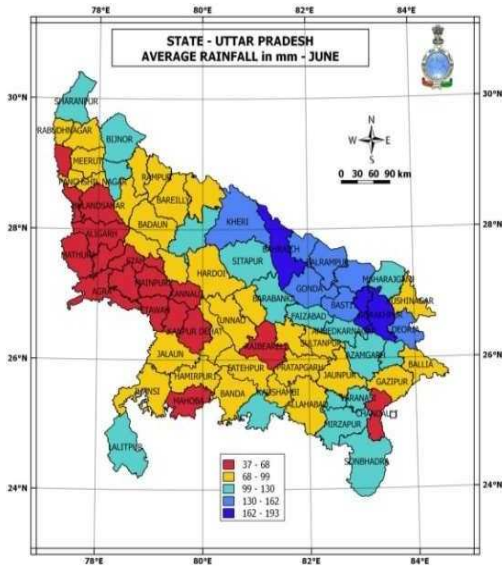


1. DISTRICT RAINFALL MEAN, VARIABILITY AND TREND

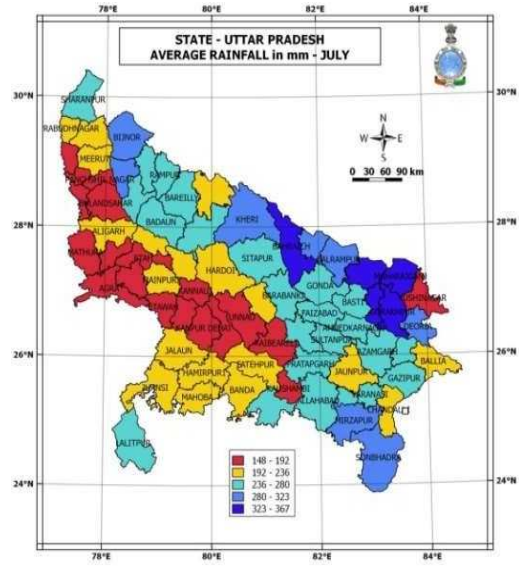
DISTRICT	JUNE		JUL Y		AUGUST		SEPTEMBER		MONSOON		ANNUAL	
	MEAN	CV	MEAN	CV	MEAN	CV	MEAN	CV	MEAN	CV	MEAN	CV
AGRA	48.8	115	171.7	138	169.1	58	101.3	81	490.8	68	548.5	80
ALIGARH	51.6	382	198.6	53	188.1	61	108.5	82	546.8	62	623.5	73
ALLAHABAD	93.7	96	243.8	44	223.2	40	158.7	64	719.4	32	800.1	63
AMBEDKARN GR	125.5	183	254.4	138	224.2	148	175.7	138	779.7	93	873.5	94
AURAIYA	51.2	86	148.1	152	147.2	60	102.5	99	449.0	69	493.7	97
AZAMGARH	103.4	207	259.6	111	233.2	46	174.0	140	770.2	69	854.1	83
BAGHPAT	63.6	437	152.3	203	165.0	142	107.4	275	488.2	117	579.8	120

BAHRAICH	165.9	63	332.6	36	284.0	39	176.1	49	958.5	18	1101.4	18
BALLIA	97.8	215	210.5	52	176.7	41	129.6	64	614.7	58	694.2	70
BALRAMPUR	159.9	68	301.8	91	277.7	57	141.1	69	880.5	49	994.7	75
BANDA	90.9	234	220.2	117	253.2	41	154.4	83	718.7	67	800.3	63
BARABANKI	108.2	72	243.0	43	210.0	55	151.9	53	713.1	27	807.5	23
BAREILLY	99.0	218	270.0	48	255.8	56	161.1	147	786.0	51	879.4	47
BASTI	131.7	232	255.4	106	225.1	50	156.0	151	768.2	77	871.3	96
BIJNOR	127.7	179	298.8	94	281.3	49	176.5	74	884.3	61	1023.8	66
BUDAUN	86.0	240	242.9	101	215.6	56	137.6	171	682.1	66	764.9	90
BULANDSHAH R	42.3	91	172.0	140	147.4	64	94.5	84	456.1	66	512.9	80
CHANDAULI	63.8	721	216.0	235	196.1	252	110.1	418	586.1	132	636.9	131
KANSHIRAM NAGAR	69.5	297	204.7	119	226.1	60	140.4	109	640.7	75	712.8	97
DEORIA	142.1	72	289.5	60	225.9	42	155.5	73	813.0	41	932.4	39
ETAH	65.9	91	178.2	130	167.1	55	112.7	92	524.0	61	587.5	97
ETAWAH	40.8	474	170.4	58	167.3	65	107.7	92	486.2	71	535.1	95
FAIZABAD	122.7	244	249.2	103	233.3	47	158.8	143	763.9	74	845.4	69
FARRUKHABA D	82.6	251	215.0	109	198.2	50	147.4	107	643.2	74	716.1	81
FATEHPUR	81.8	107	196.9	127	204.3	53	124.0	81	607.0	58	673.8	70
FIROZABAD	47.8	563	186.0	134	180.5	66	91.9	242	506.2	99	583.4	120

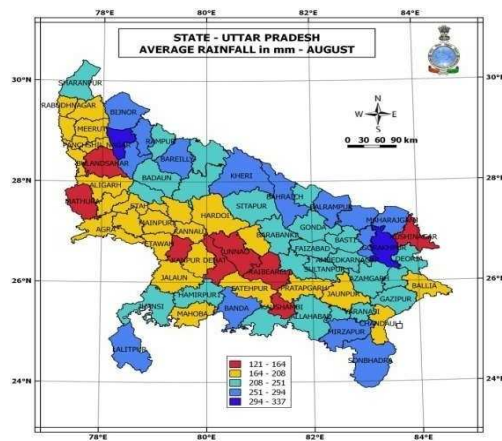
G.BUDHNAGAR	55.3	571	176.0	158	206.5	191	139.6	258	577.2	107	652.4	123
GAZIABAD	69.1	96	190.7	143	196.3	97	124.7	104	580.8	71	656.7	107
GHAZIPUR	96.1	299	244.3	107	216.9	37	160.5	64	717.7	75	793.4	80
GONDA	147.4	73	259.2	102	230.7	106	146.7	152	784.0	64	886.2	71
GORAKHPUR	192.7	137	367.2	58	337.4	55	220.2	123	1117.5	48	1245.3	45
HAMIRPUR	85.1	104	234.6	45	237.2	41	151.2	80	708.1	32	781.4	28
HARDOI	77.2	266	213.7	40	176.9	58	129.7	74	597.5	60	674.7	55
MAHAMAYA NAGAR	46.2	421	189.8	138	168.0	73	101.5	218	505.5	103	562.8	141
JALAUN	69.7	92	199.8	48	192.1	47	134.3	87	595.9	32	664.0	82
JAUNPUR	72.2	385	206.9	127	202.4	71	150.8	71	632.3	88	703.2	102
JHANSI	82.4	110	227.5	41	226.3	44	135.3	108	671.5	32	742.6	52
J.PHULENAGAR	107.3	400	286.4	178	301.1	132	140.2	261	835.1	102	960.4	106
KANNAUJ	53.4	627	183.1	237	164.9	202	119.2	345	520.5	137	594.0	151



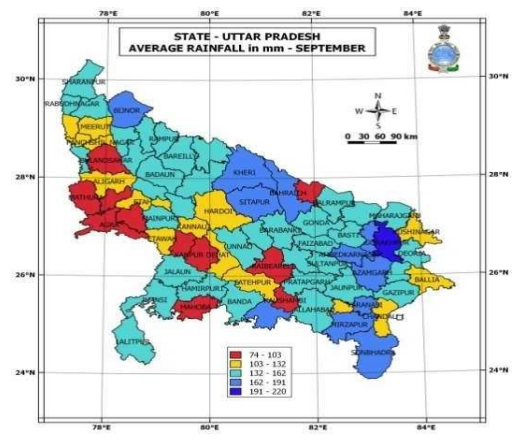
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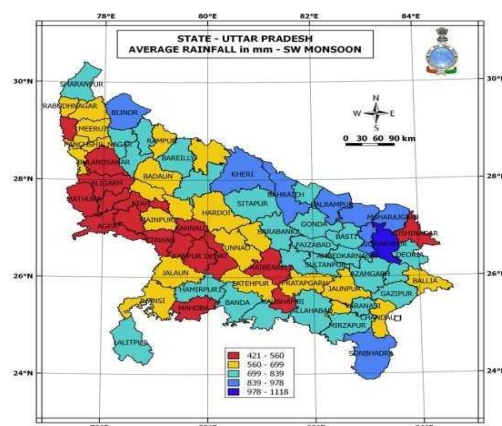
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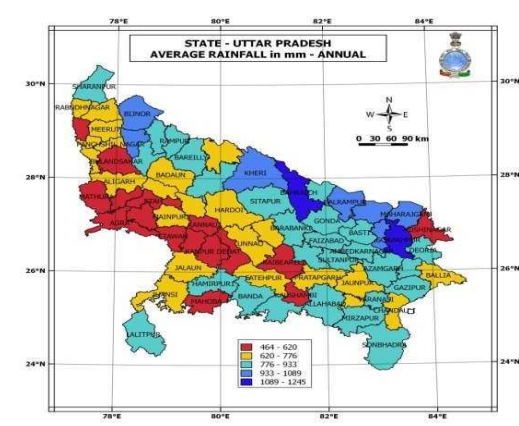
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d

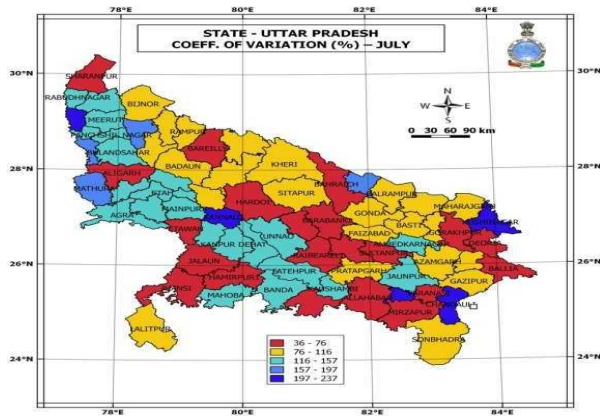


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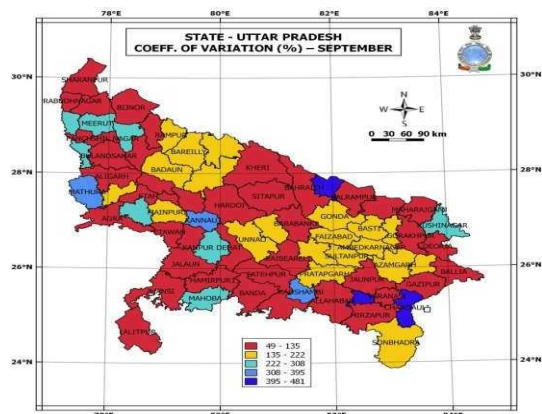
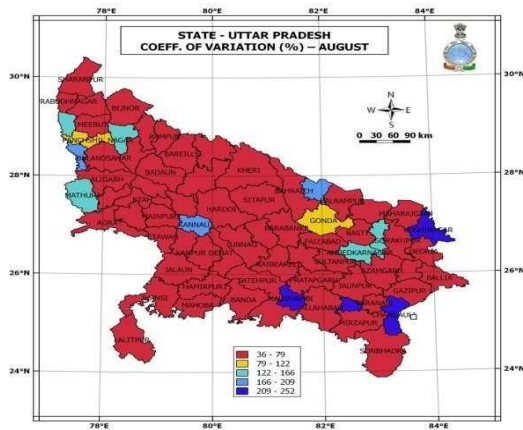


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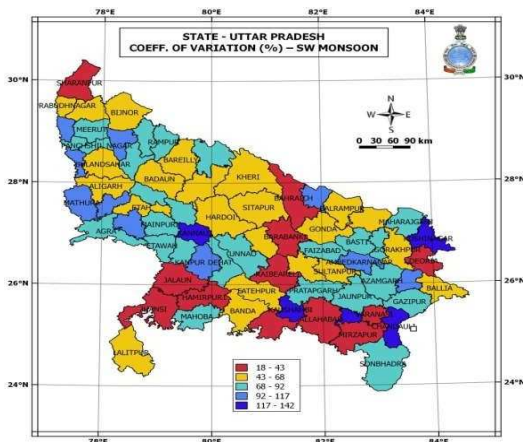
Fig.4 Mean rainfall pattern over districts of Uttar Pradesh for (a) June, (b) July (c) August, (d) September, (e) South west monsoon season and (f) Annual



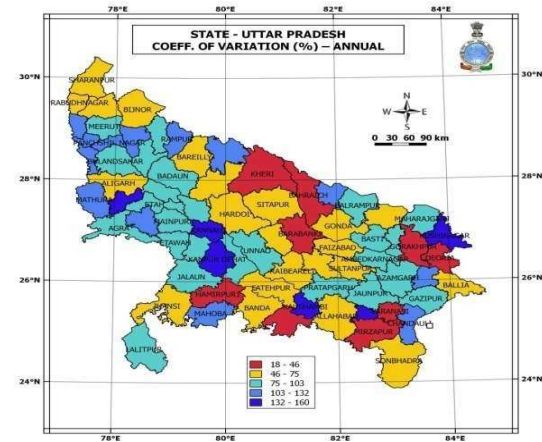
(a)



(c)



(d)



(e)

GROUND WATER

Based on our measurement in the completed bore hole, water table is encountered at the time of our exploration in the borehole as per mentioned below:

S.No.	Borehole No.	Borehole No.	Water Table
01	01	02	Encountered at 9.0m & 9.60m depth

However, Fluctuation may takes place due to surface evaporation rates and variation in seasonal rainfall.

5. FOUNDATION ANALYSIS AND RECOMMENDATIONS (DEEP FOUNDATION):

Pile foundations consist of piles that are dug into soil till a layer of stable soil is reached. Pile foundations transfer load to the bearing ground with the greater bearing capacity. Pile foundations are useful in regions with unstable upper soil that may erode, or for large structures. Pile foundations are often required to resist lateral loading. Lateral loads come from a variety of sources including wind, earthquakes, waves, and ship impacts.

- a) Precast Driven Piles
- b) Driven Cast-in-Situ Piles
- c) Bored cast-in-situ piles

Design parameter for pile:

Material	: RCC
Type	: Cast-in-situ bored pile @ Borehole Loc 02
Diameter	: 1.20 metre
Length	: 30.0 meter
Cut off length	: 2.30 meter

Design parameter of soils:

Coefficient of earth pressure K_a	= 1.00
Max. Depth for overburden	= 15 x Dia.
Factor of safety (FS)	= 2.50
Critical Depth of water table	= 9.00 meter

Notations and symbols:

Q_{uc} = Ultimate load carrying capacity of pile in compression (kN)

Q_{ut} = Ultimate load carrying capacity of pile in Uplift (kN)

Q_{ac} = Net allowable load capacity of the pile in compression (kN)

Q_{at} = Net allowable load capacity of the pile in Uplift (kN)

Q_b = Ultimate bearing capacity in End Bearing resistance (kN)

Q_f = Ultimate bearing capacity in stem friction (kN)

Q_c = Ultimate bearing capacity in cohesion (kN)

Q_w = Gross weight of pile (kN)

FS = Factor of safety

$Q_{uc} = Q_b + Q_f + Q_c$

$Q_{ut} = Q_w + Q_f + Q_c$

$Q_{ac} = Q_{uc}/FS$

$Q_{at} = Q_{ut}/FS$

Calculations have been made for cast-in-situ bored RCC piles as per IS 2911 (part-1, section -2)-2010.

6. SITE OBSERVATIONS AND FIELD TESTS -

Based on our investigation in field and laboratory, it is revealed that the soil strata observed in the borehole at site is as:

Borehole Observation: The strata is comprises with Silty sand (SM) followed by Silty fine sand (SP-SM). Underneath the strata is comprises with Fine sand (SP) and Poorly graded sand with clay upto 30.0m depth.

A detailed lab results data sheet is attached as annexure in this report separately for the borehole.

Disturbed samples were collected from the split spoon sampler after conducting SPT. The samples are preserved in transparent polythene bags. UDS were collected by driving 75 mm diameter thin walled tubes using a 63.5 kg hammer in accordance with IS: 2132. The tubes are sealed with wax at both ends to minimize loss of moisture. All samples were transported to our laboratory for further examination and testing.

7.0 FOUNDATION RECOMMENDATIONS:-

File Load Capacity:

Bored cast in-situ RCC Piles may be provided for the foundation of the proposed foot over bridge structure: Load capacities of pile of diameter 1200 mm with a cut-off = 2.30m and length 30.0 meter have been listed in the table below. A sample calculation sheet is enclosed separately.

RECOMMENDATIONS

PILE FOUNDATION (Cutoff Level- 2.30m)

Depth of Foundation (m)	Dia of Pile Foundation (m)	Bearing Capacity (t)	
		Compression (t)	Uplift (t)
30.0	1.20	557.0	242.0

The Pile Capacity should preferably be confirmed by Initial Load tests as per IS:2911(Part-4)-1985. The settlement of pile should be obtained at working load from load-test results.

Lateral capacity of free head and fixed head is attached in this report.

NOTE:

On the basis of the field and laboratory tests and analysis the following recommendations are made:

1. Water table is encountered at 9.0m depth in the boreholes at the time of soil exploration. Which may vary based on seasonal variation.
2. Based on the liquefaction assessment, the site may found safe and not liquefiable.
3. All loose soils / debris / human waste / chemical waste material should be removed and the exposed foundation bearing surface should be compacted properly using rammers/rollers.
4. The surface should then be protected from to construction activities so that the foundations may bear on the natural undisturbed ground.
5. Suitable surface drains along with plain cement concrete (PCC) apron around the pile be provided to prevent any ingress of water in the sub-soil.

The recommendation are based on the field investigation data results and the laboratory tests results of the samples collected from the test locations and our experience in this regards. If the actual sub-soil conditions during excavation for the foundations differ from that has been reported, a reference should be made to us for suggestions. Further, the recommendations are based on the assumptions as mentioned in the report and the designer of the structure should take into consideration all the factors required as per codes. The recommendations should be taken as guidelines for the designer.



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8.0 References:-

LIST OF IS:CODES FOR GEOTECHNICAL WORKS			
1	FIELD INVESTIGATION		
	1	IS:1498-1970	Classification and identification of soils for general engineering purposes
	2	IS:1892-1979	Code of practice for subsurface investigations for foundations
	3	IS:2131-1981	Method of standard penetration tests for Soils
	4	IS:2132-1986	Code of practice for thin walled tube sampling of soils
	5	IS 6934 – 1973	Method of determination of water level in a borehole
2	LABORATORY TESTS		
	1	IS: 2720-1983 (part-1)	Method of test for soil-preparation of dry soil sample for various tests
	2	IS: 2720-1980 (part-2)	Method of test for soil-determination of water content
	3	IS: 2720-1980 (part-3)- section-1	Method of test for soil-determination of specific gravity of fine grained soil
	4	IS: 2720-1980 (part-3)- section-2	Method of test for soil-determination of specific gravity of coarse grained soil
	5	IS: 2720-1985 (part-4)	Method of test for soil-grain size analysis
	6	IS: 2720-1985 (part-5)	Method of test for soil-determination of liquid limits and plastic limits
	7	IS: 2720-1986 (part-15)	Method of test for soil-determination of consolidation properties
	8	IS: 2720-1986 (Part 11, 12 &13)	Method of test for soil-determination of Shear strength of soil
	9	IS: 2720-1986 (Part 40)	Method of test for soil-determination of Free swell index of soil
	10	IS: 1893-2006 (Part-1)	Criteria for earthquake resistance design of structures

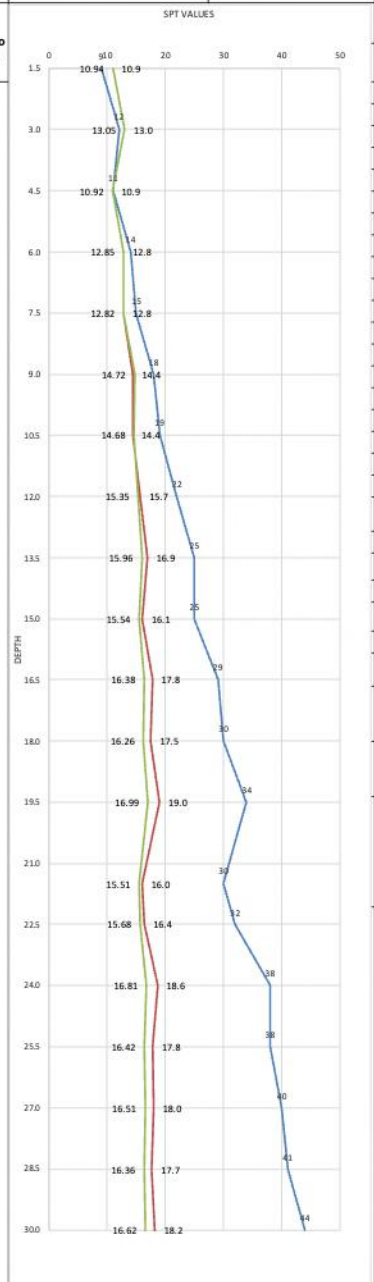
*****ATTACHEMENTS*****



BORE LOG CHART

PROJECT NAME:- SOIL INVESTIGATION WORKS FOR THE PROPOSED ROAD OVER BRIDGE (248) AT DISTRICT- KASGANJ, UTTAR PRADESH.

Borehole No:- 01		U.L.R. NO	0				WATER LEVEL=	Encountered at 9.0m depth
DEPTH IN METER		DEPTH FOR SPT	SPT (OBSERVED)	AVREGE 'N' SPT VALUE	N' CORRECTED SPT (Overburden)	AVREGE 'N' CORRECTED SPT	CORRECTED DUE TO DILATANCY (N'')	AVREGE Corrected due to Dilatancy (N'')
0.00 - 0.50		-						
1.50 - 1.95		SPT	9		10.94		10.94	
3.00 - 3.45		SPT	12		13.05		13.05	
4.50 - 4.95		SPT	11		10.92		10.92	
6.00 - 6.45		SPT	14		12.85		12.85	
7.50 - 7.95		SPT	15		12.82		12.82	
9.00 - 9.45		SPT	18		14.44		14.72	
10.50 - 10.95		SPT	19		14.35		14.68	
12.00 - 12.45		SPT	22		15.71		15.35	
13.50 - 13.95		SPT	25		16.92		15.96	
15.00 - 15.45		SPT	25	27.21	16.09	16.01	15.54	15.23
16.50-16.95		SPT	29		17.76		16.38	
18.00 - 18.45		SPT	30		17.53		16.26	
19.50-19.95		SPT	34		18.98		16.99	
21.00 - 21.45		SPT	30		16.02		15.51	
22.50 - 22.95		SPT	32		16.36		15.68	
24.00 - 24.45		SPT	38		18.62		16.81	
25.50 - 25.95		SPT	38		17.84		16.42	
27.00 - 27.45		SPT	40		18.01		16.51	
28.50 - 28.95		SPT	41		17.72		16.36	
30.00 - 30.45		SPT	44		18.23		16.62	



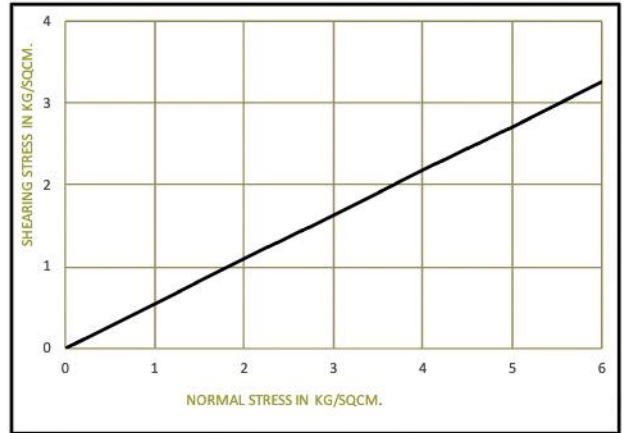


PROJECT NAME:- SOIL INVESTIGATION WORKS FOR THE PROPOSED ROAD OVER BRIDGE (248) AT DISTRICT- KASGANJ, UTTAR PRADESH.

U.L.R. NO	0	DIRECT SHEAR TEST (Failure Envelop Graphs)
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C = 0.00 $\phi = 27$ DEPTH = 1.20-1.50

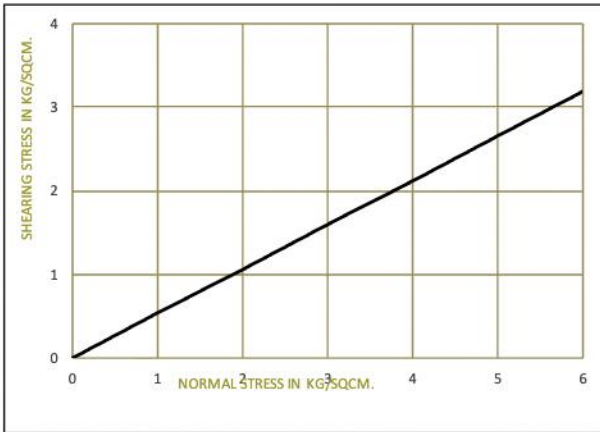
C = 0.00 $\phi = 28.50$ DEPTH = 5.70-6.00



Borehole No:- 01

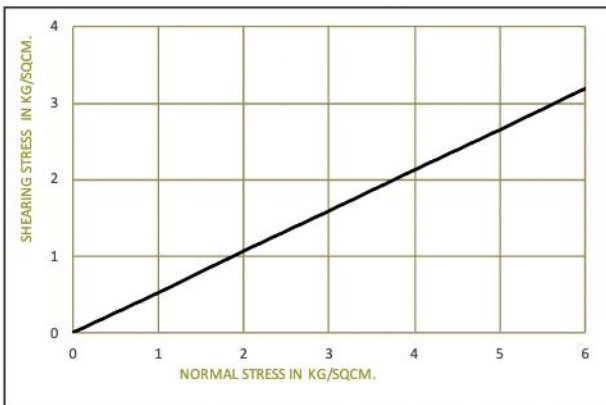
C = 0.00 $\phi = 28.00$ DEPTH = 2.70-3.00

C = 0.00 $\phi = 29.00$ DEPTH = 7.20-7.50



C = 0.00 $\phi = 28.00$ DEPTH = 4.20-4.50

C = 0.00 $\phi = 30.50$ DEPTH = 10.20-10.50



Computation of Liquefaction Potential

PROJECT NAME:- SOIL INVESTIGATION WORKS FOR THE PROPOSED ROB AT DISTRICT- KASGANJ, UTTAR PRADESH.

BOREHOLE No. -01

Design ground acceleration (a_{max}/g) =	0.16	(Zone III)	
Maximum Earthquake Intensity =	7.00		
Atmospheric Pressure (Pa) =	10.11	t/m ²	(76 cm Mercury Pressure)
Correction Factor for Hammer Energy Ratio (C_E) =	0.90		(ER for Rope and Pulley system = 60%, $C_E = ER/60$)
Correction Factor for Borehole Diameter (C_B) =	1.05		(For Bore Hole Dia 200mm : $C_B = 1.15$, For Bore Hole Dia 150mm : $C_B = 1.05$, For Bore Hole Dia 65-115mm : $C_B = 1.00$)
Correction Factor for Standard Sampler (C_S) =	1.00		(For Standard Sampler : $C_S = 1.00$, Sampler without Liners : $C_S = 1.10-1.30$)
Magnitude Scaling Factor (MSF) =	1.19		(EQ Intensity 8.5 : MSF=0.72, EQ Intensity 8.0 : MSF=0.84, EQ Intensity 7.5 : MSF=1.00, EQ Intensity 7.0 : MSF=1.19, EQ Intensity 6.5 : MSF=1.44, EQ Intensity 6.0 : MSF=1.76, EQ Intensity 5.5 : MSF=2.20)
K_{σ} =	1.00		
Water Table used for Calculation =	9.00		

Depth of layer below EGL(m)	Observed/Uncorrected SPT value (N_{60})	γ_{sat} (t/m ³)	γ_{sub} (t/m ³)	Fine Content	Stress Reduction Factor (r_d)	Total Overburden Pressure (t/m ²) (σ_v)	Hydrostatic Pressure (t/m ²) (σ_h)	Effective Overburden Pressure (t/m ²) (σ'_v)	CSR = $0.65^{(1-\sigma'_v/\sigma_v)} (a_{max}/g) * r_d$	Correction Factor for Eff. Overburden pressure (C_{σ})	Correction Factor for Hammer Energy Ratio (C_E)	Correction Factor for Borehole Diameter (C_B)	Correction Factor for Rod Length (C_L)	Correction Factor for Standard Sampler (C_S)	$(N_1)_{60} = N_{60} * C_{\sigma} * C_E * C_B * C_L * C_S$	α	β	$(N_1)_{60CS} = \alpha + \beta * (N_1)_{60}$	$CRR_{M=7.5} = CRR_{M=7.5} * MSF * K_{\sigma}$	$CRR = CRR_{M=7.5} * MSF * K_{\sigma}$	FOS = CRR / CSR	Conclusion
1.50	9	1.65	0.65	39.0	0.99	2.48	-	2.48	0.10	1.70	0.90	1.05	0.75	1.00	11	5.00	1.20	18	0.19	0.23	2.22	Above WT, NL
3.00	12	1.65	0.65	39.5	0.98	4.95	-	4.95	0.10	1.43	0.90	1.05	0.80	1.00	13	5.00	1.20	21	0.22	0.26	2.61	Above WT, NL
4.50	11	1.68	0.68	37.0	0.97	7.47	-	7.47	0.10	1.16	0.90	1.05	0.85	1.00	10	5.00	1.20	17	0.18	0.22	2.19	Above WT, NL
6.00	14	1.73	0.73	32.6	0.95	10.07	-	10.07	0.10	1.00	0.90	1.05	0.95	1.00	13	4.86	1.18	20	0.21	0.25	2.54	Above WT, NL
7.50	15	1.76	0.76	32.7	0.94	12.71	-	12.71	0.10	0.89	0.90	1.05	0.95	1.00	12	4.87	1.18	19	0.20	0.24	2.47	Above WT, NL
9.00	18	1.77	0.77	29.8	0.93	15.36	0.00	15.36	0.10	0.81	0.90	1.05	0.95	1.00	13	4.69	1.15	20	0.21	0.25	2.62	Non Liquefiable
10.50	19	1.81	0.81	25.0	0.89	18.08	1.50	16.58	0.10	0.78	0.90	1.05	1.00	1.00	14	4.29	1.12	20	0.21	0.26	2.52	Non Liquefiable
12.00	22	1.84	0.84	24.5	0.85	20.84	3.00	17.84	0.10	0.75	0.90	1.05	1.00	1.00	16	4.24	1.11	22	0.24	0.28	2.72	Non Liquefiable
13.50	25	1.85	0.85	20.8	0.81	23.61	4.50	19.11	0.10	0.73	0.90	1.05	1.00	1.00	17	3.75	1.08	22	0.25	0.29	2.82	Non Liquefiable
15.00	25	1.85	0.85	18.5	0.77	26.39	6.00	20.39	0.10	0.70	0.90	1.05	1.00	1.00	17	3.34	1.07	21	0.23	0.27	2.63	Non Liquefiable
16.50	29	1.88	0.88	16.0	0.73	29.21	7.50	21.71	0.10	0.68	0.90	1.05	1.00	1.00	19	2.77	1.05	22	0.25	0.30	2.89	Non Liquefiable
18.00	30	1.89	0.89	11.5	0.69	32.04	9.00	23.04	0.10	0.66	0.90	1.05	1.00	1.00	19	1.38	1.03	21	0.22	0.27	2.66	Non Liquefiable
19.50	34	1.88	0.88	12.2	0.65	34.86	10.50	24.36	0.10	0.64	0.90	1.05	1.00	1.00	21	1.62	1.03	23	0.26	0.31	3.14	Non Liquefiable
21.00	30	1.89	0.89	6.0	0.61	37.70	12.00	25.70	0.09	0.63	0.90	1.05	1.00	1.00	18	0.03	1.00	18	0.19	0.23	2.42	Non Liquefiable
22.50	32	1.92	0.92	11.7	0.57	40.58	13.50	27.08	0.09	0.61	0.90	1.05	1.00	1.00	18	1.45	1.03	20	0.22	0.26	2.95	Non Liquefiable
24.00	38	1.93	0.93	12.0	0.55	43.47	15.00	28.47	0.09	0.60	0.90	1.05	1.00	1.00	21	1.55	1.03	24	0.27	0.32	3.63	Non Liquefiable
25.50	38	1.94	0.94	12.8	0.54	46.38	16.50	29.88	0.09	0.58	0.90	1.05	1.00	1.00	21	1.82	1.04	23	0.26	0.31	3.61	Non Liquefiable
27.00	40	1.94	0.94	8.0	0.53	49.29	18.00	31.29	0.09	0.57	0.90	1.05	1.00	1.00	21	0.30	1.01	22	0.24	0.29	3.34	Non Liquefiable
28.50	41	1.99	0.99	6.6	0.52	52.28	19.50	32.78	0.09	0.56	0.90	1.05	1.00	1.00	22	0.07	1.01	22	0.24	0.28	3.31	Non Liquefiable
30.00	44	1.99	0.99	6.8	0.50	55.26	21.00	34.26	0.08	0.54	0.90	1.05	1.00	1.00	23	0.10	1.01	23	0.25	0.30	3.61	Non Liquefiable

Important Notes : Criteria For Non - Liquefiable and Liquefiable Soils

In case of non - cohesive soil:

- 1: Sandy Soil above design WT, if unsaturated, are not susceptible to liquefaction
- 2: Saturated sandy soils having $(N_1)_{60} \geq 30$ are considered to be Non-Liquefiable. (As per Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soil)

In case of cohesive soil:

- 1: Percent fines < 15%, Liquid Limit <= 35% and Natural moisture content >= 0.90LL are susceptible to liquefaction
- 2: Based on percent fines content, liquid limit and natural moisture content of the cohesive layers not satisfying condition 1 above, the clayey soil is non - liquefiable
- 3: Therefore, although the clay soil is calculated and shown as liquefiable, they are not susceptible to liquefaction but may exhibit strain softening behaviour similar to that of liquefied soil. As such, the given clay soil need not to be considered as liquefiable for any analytical purpose.

PILE CAPACITY FOR BORED CAST INSITU PILE

PROJECT NAME:- SOIL INVESTIGATION WORKS FOR THE PROPOSED ROAD OVER BRIDGE AT KASGANJ, DISTRICT- KASGANJ, UTTAR PRADESH.

1) Design Approach

IS: 2911 (Part 1/ Sec 2):2010

BOREHOLE LOCATION- 01

Ultimate Capacity of Pile

Where, Q_{ult} : $Q_b + Q_s - W_p$
 Q_b : Ultimate End Bearing
 Q_s : Ultimate Skin Resistance
 W_p : Self weight of Pile

Safe Capacity of Pile

Where, Q_{safe} : Q_{ult} / FoS
 FoS : Factor of Safety
 Skin friction, Q_{sf} : $KPtan\delta A_s + \alpha CA_s$
 K : Coefficient of earth pressure
 P : Effective overburden pressure
 δ : Angle of wall friction between pile and soil
 A_s : Surface area of pile shaft
 α : Adhesion factor
 C : Average cohesion throughout the length of the pile

End bearing resistance

In Non-Cohesive soils, $Q_b = A_p \times P_d \times N_c$

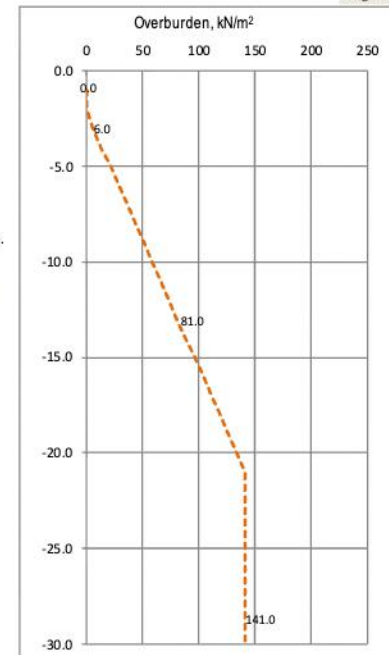
A_p : Cross sectional area of the pile toe
 Y : Effective unit weight of soil at pile toe
 P_d : Effective overburden pressure at pile toe

In Cohesive soils, $Q_b = A_p \times C_p \times N_c$

A_p : Cross sectional area of the pile toe
 C_p : Avg. Cohesion at the pile tip
 N_c : Bearing capacity factor usually taken as 9

2) Pile Information

Pile Type : Bored Pile
 Min conc cube strength, f_{cu} : 35.0 MPa
 Nominal dia : 1.20 m Water Table: 9.0 m
 Working load of Pile : T
 Pile Cut-off level : -2.30 m
 Pile Founding level : -30.0 m
 Pile Embedment length : 27.7 m
 Pile Density : 24.0 kN/m³
 Factor of Safety : 2.5 comp 3.0 for uplift
 15 times the dia. of pile : -20.3 m Effective overburden pressure at pile tip. For piles longer than 15-20 times the diameter of pile diameter, effective overburden pressure at the pile tip should correspond to pile length equal to 15-20 x dia of pile.



3) Pile Calculation

Layer No	Soil type	Reduced Level, m		Layer th. m	SPT N	Design Soil Parameters				Co-eff			Pile area		eff o/b Pres.		Pile capacities in Compression							Uplift Capacity		
		From	To			c	φ	δ	γ _{Sub}	α	K _i	N _q	A _p	A _s	P ₀	P ₀₁	Q _{cz}	ΣQ _{cz}	Q _b	W _p	Q _{ult}	Q _{safe}	Q _{up,ut}	Q _{up,ate}		
		kN/m ²	deg.			deg.	kN/m ³				m ²	m ²	kN/m ²	kN/m ²	kN	kN	kN	kN	kN	kN	T	T	T	T		
1	SILTY SAND-1	0.0	-1.0	0.0	9	S	0	27.0	27	6.0	0.5	1.0	13.20	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	SILTY SAND-1	-1.0	-2.0	0.0	9	S	0	27.0	27	6.0	0.5	1.0	13.20	1.13	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	SILTY SAND-1	-2.0	-3.0	1.0	12	S	0	28.0	28	6.0	0.5	1.0	14.90	1.13	3.77	6.0	3.0	6.0	6.0	6.0	101.1	27.1	8.0	3.2	3.3	1.1
1	SILTY SAND-1	-3.0	-4.0	1.0	12	S	0	28.0	28	7.5	0.5	1.0	14.90	1.13	3.77	13.5	9.8	19.5	25.6	227.5	54.3	19.9	8.0	8.0	2.7	
1	SILTY SAND-1	-4.0	-5.0	1.0	11	S	0	28.5	29	7.5	0.5	1.0	14.90	1.13	3.77	21.0	17.3	35.3	60.9	353.9	81.4	33.3	13.3	14.2	4.7	
1	SILTY SAND-1	-5.0	-6.0	1.0	11	S	0	28.5	29	7.5	0.5	1.0	14.90	1.13	3.77	28.5	24.8	50.7	111.5	573.7	108.6	57.7	23.1	22.0	7.3	
1	SILTY SAND-1	-6.0	-7.0	1.0	14	S	0	29.0	29	7.5	0.5	1.0	17.80	1.13	3.77	36.0	32.3	67.4	178.9	724.7	135.7	76.8	30.7	31.5	10.5	
2	SILTY FINE SAND-2	-7.0	-8.0	1.0	14	S	0	29.0	29	7.5	0.5	1.0	17.80	1.13	3.77	43.5	39.8	83.1	262.0	993.8	162.9	109.3	43.7	42.5	14.2	
2	SILTY FINE SAND-2	-8.0	-9.0	1.0	15	S	0	30.0	30	7.5	0.5	1.0	20.20	1.13	3.77	51.0	47.3	102.8	364.8	1165.1	190.0	134.0	53.6	55.5	18.5	
2	SILTY FINE SAND-2	-9.0	-10.0	1.0	10	S	0	30.0	30	7.5	0.5	1.0	20.20	1.13	3.77	58.5	54.8	119.2	484.0	1336.5	217.1	160.3	64.1	70.1	23.4	
2	SILTY FINE SAND-2	-10.0	-11.0	1.0	19	S	0	30.5	31	7.5	0.5	1.0	20.20	1.13	3.77	66.0	62.3	138.2	622.2	1784.0	244.3	216.2	86.5	86.7	28.9	
2	SILTY FINE SAND-2	-11.0	-12.0	1.0	19	S	0	32.0	32	7.5	0.5	1.0	23.90	1.13	3.77	73.5	69.8	164.3	786.5	1986.7	271.4	250.2	100.1	105.8	35.3	
2	SILTY FINE SAND-2	-12.0	-13.0	1.0	22	S	0	32.0	32	7.5	0.5	1.0	23.90	1.13	3.77	81.0	77.3	182.0	968.5	2189.5	298.6	285.9	114.4	126.7	42.2	
2	SILTY FINE SAND-2	-13.0	-14.0	1.0	22	S	0	32.0	32	7.5	0.5	1.0	23.90	1.13	3.77	88.5	84.8	199.6	1168.2	2392.2	325.7	323.5	129.4	149.4	49.8	
2	SILTY FINE SAND-2	-14.0	-15.0	1.0	25	S	0	32.0	32	7.5	0.5	1.0	23.90	1.13	3.77	96.0	92.3	217.3	1385.5	2594.9	352.9	362.8	145.1	173.8	57.9	
2	SILTY FINE SAND-2	-15.0	-16.0	1.0	25	S	0	32.0	32	7.5	0.5	1.0	23.90	1.13	3.77	103.5	99.8	235.0	1620.5	2797.6	380.0	403.8	161.5	200.0	66.7	
3	FINE SAND-3	-16.0	-17.0	1.0	29	S	0	32.5	33	7.5	0.5	1.0	23.90	1.13	3.77	111.0	107.3	257.6	1878.0	3000.4	407.2	447.1	178.8	228.5	76.2	
3	FINE SAND-3	-17.0	-18.0	1.0	30	S	0	32.5	33	7.5	0.5	1.0	23.90	1.13	3.77	118.5	114.8	275.6	2153.6	3203.1	434.3	492.2	196.9	258.8	86.3	
3	FINE SAND-3	-18.0	-19.0	1.0	34	S	0	32.5	33	7.5	0.5	1.0	23.90	1.13	3.77	126.0	122.3	293.6	2447.2	5685.9	461.4	767.2	306.9	290.9	97.0	
3	FINE SAND-3	-19.0	-20.0	1.0	34	S	0	34.0	34	7.5	0.5	1.0	39.90	1.13	3.77	133.5	129.8	329.9	2777.2	6024.3	488.6	831.3	332.5	326.6	108.9	
4	POORLY GRADED SAND-4	-20.0	-21.0	1.0	30	S	0	34.0	34	7.5	0.5	1.0	39.90	1.13	3.77	141.0	137.3	349.0	3126.2	6362.7	515.7	897.3	358.9	364.2	121.4	
4	POORLY GRADED SAND-4	-21.0	-22.0	1.0	30	S	0	34.0	34	7.5	0.5	1.0	39.90	1.13	3.77	141.0	141.0	358.5	3484.7	6362.7	542.9	930.5	372.2	402.8	134.3	
4	POORLY GRADED SAND-4	-22.0	-23.0	1.0	32	S	0	34.0	34	7.5	0.5	1.0	39.90	1.13	3.77	141.0	141.0	358.5	3843.3	7893.6	570.0	1116.7	446.7	441.3	147.1	
4	POORLY GRADED SAND-4	-23.0	-24.0	1.0	32	S	0	35.0	35	7.5	0.5	1.0	49.50	1.13	3.77	141.0	141.0	372.2	4215.5	7893.6	597.2	1151.2	460.5	481.3	160.4	
4	POORLY GRADED SAND-4	-24.0	-25.0	1.0	38	S	0	35.0	35	7.5	0.5	1.0	49.50	1.13	3.77	141.0	141.0	372.2	4587.7	7893.6	624.3	1185.7	474.3	521.2	173.7	
4	POORLY GRADED SAND-4	-25.0	-26.0	1.0	38	S	0	35.0	35	7.5	0.5	1.0	49.50	1.13	3.77	141.0	141.0	372.2	4959.9	8180.7	651.4	1248.9	499.6	561.1	187.0	
4	POORLY GRADED SAND-4	-26.0	-27.0	1.0	38	S	0	36.0	36	7.5	0.5	1.0	51.30	1.13	3.77	141.0	141.0	386.2	5346.1	8180.7	678.6	1284.8	513.9	602.5	200.8	
4	POORLY GRADED SAND-4	-27.0	-28.0	1.0	40	S	0	36.0	36	7.5	0.5	1.0	51.30	1.13	3.77	141.0	141.0	386.2	5732.3	8180.7	705.7	1320.7	528.3	643.8	214.6	
4	POORLY GRADED SAND-4	-28.0	-29.0	1.0	41	S	0	36.0	36	7.5	0.5	1.0	51.30	1.13	3.77	141.0	141.0	386.2	6118.5	8180.7	732.9	1356.6	542.7	685.1	228.4	
4	POORLY GRADED SAND-4	-29.0	-30.0	1.0	41	S	0	36.0	36	7.5	0.5	1.0	51.30	1.13	3.77	141.0	141.0	386.2	6504.7	8180.7	760.0	1392.5	557.0	726.5	242.2	

LATERAL LOAD CARRYING CAPACITY OF PILES

Analysis in accordance with IS 2911 - Part I(2) - 2010

PROJECT NAME:- SOIL INVESTIGATION WORKS FOR THE PROPOSED ROAD OVER BRIDGE AT KASGANJ, DISTRICT- KASGANJ, UTTAR PRADESH.

BOREHOLE LOC-01

Ref:

IS 2911 (Part 1/ Sec 2):2010

Grade of concrete (fck)	=	M 35	
Concrete Elastic Modulus, E, $5000(fck)^{1/2}$	=	29580398.92 kPa	
Size of the pile	=	1200 mm	
Moment of Inertia of pile	=	0.1018 m ⁴	
Type of soil	=	Silty sand, Silty fine sand	
SPT N value	=	15	SPT N [15] for BH-01
Modulus of Sub grade reaction for granular soils (n_h)	=	2120 kN/m ³	Table 3, Annexure C,
Stiffness factor, T = $(EI/n_h)^{1/5}$	=	4.27 m	Clause C-2.3.1
Min. length of pile as long pile	=	18.0 m	
Free length of pile above ground(L_1)	=	0.0 m	
For free head pile in sands, L_1/T	=	1.9	Figure 4, Annexure C
Fixed Length L_f	=	8.114 m	
Allowable deflection	=	5.0 mm	
Lateral capacity of free head pile (Q_h) =	=	$3YEI / (L_1 + L_f)^3$	Clause C-4.2
	=	85 kN	
	=	8.5 T	

LATERAL LOAD CARRYING CAPACITY OF PILES

Analysis in accordance with IS 2911 - Part I(2) - 2010

PROJECT NAME:- SOIL INVESTIGATION WORKS FOR THE PROPOSED ROAD OVER BRIDGE AT KASGANJ, DISTRICT- KASGANJ, UTTAR PRADESH.
BOREHOLE LOC-01

Ref:

IS 2911 (Part 1/ Sec 2):2010

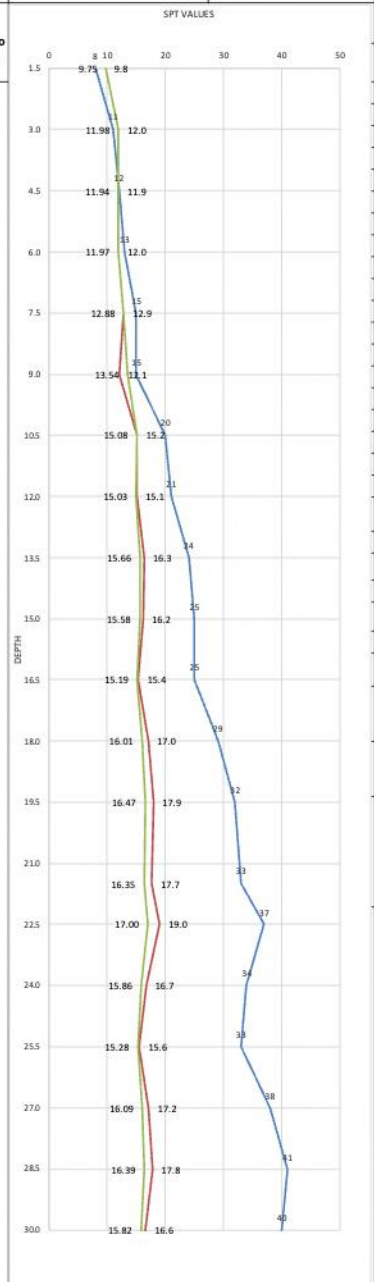
Grade of concrete (fck)	=	M 35	
Concrete Elastic Modulus, E, 5000(fck) ^{1/2}	=	29580398.92 kPa	
Size of the pile	=	1200 mm	
Moment of inertia of pile	=	0.1018 m ⁴	
Type of soil	=	Silty sand, Silty fine sand	
SPT N value	=	15	SPT N [15] for BH-1
Modulus of Sub grade reaction for granular soils (n _h)	=	2120 kN/m ³	Table 3, Annexure C,
Stiffness factor , T = (EI/n _h) ^{1/5}	=	4.27 m	Clause C-2.3.1
Min. length of pile as long pile	=	18.0 m	
Free length of pile above ground(L ₁)	=	0.0 m	
For fixed head pile in sands, L _f /T	=	2.2	Figure 4, Annexure C
Fixed Length L _f	=	9.4 m	
Allowable deflection	=	5.0 mm	
Lateral capacity of fixed head pile (Q _h) =	=	12YEI / (L ₁ +L _f) ³	Clause C-4.2
	=	218 kN	
	=	21.8 T	



BORE LOG CHART

PROJECT NAME:- SOIL INVESTIGATION WORKS FOR THE PROPOSED ROAD OVER BRIDGE (248) AT DISTRICT- KASGANJ, UTTAR PRADESH.

Borehole No:- 02		U.L.R. NO	0				WATER LEVEL=	Encountered at 9.60m depth
DEPTH IN METER		DEPTH FOR SPT	SPT (OBSERVED)	AVREGE 'N' SPT VALUE	N' CORRECTED SPT (Overburden)	AVREGE 'N' CORRECTED SPT	CORRECTED DUE TO DILATANCY (N')	AVREGE Corrected due to Dilatancy (N')
0.00 - 0.50		-						
1.50 - 1.95		SPT	8		9.75		9.75	
3.00 - 3.45		SPT	11		11.98		11.98	
4.50 - 4.95		SPT	12		11.94		11.94	
6.00 - 6.45		SPT	13		11.97		11.97	
7.50 - 7.95		SPT	15		12.88		12.88	
9.00 - 9.45		SPT	15		12.08		13.54	
10.50 - 10.95		SPT	20		15.17		15.08	
12.00 - 12.45		SPT	21		15.06		15.03	
13.50 - 13.95		SPT	24		16.32		15.66	
15.00 - 15.45		SPT	25	26.21	16.15	15.50	15.58	14.95
16.50-16.95		SPT	25		15.38		15.19	
18.00 - 18.45		SPT	29		17.02		16.01	
19.50-19.95		SPT	32		17.94		16.47	
21.00 - 21.45		SPT	33		17.69		16.35	
22.50 - 22.95		SPT	37		19.00		17.00	
24.00 - 24.45		SPT	34		16.72		15.86	
25.50 - 25.95		SPT	33		15.55		15.28	
27.00 - 27.45		SPT	38		17.17		16.09	
28.50 - 28.95		SPT	41		17.77		16.39	
30.00 - 30.45		SPT	40		16.64		15.82	





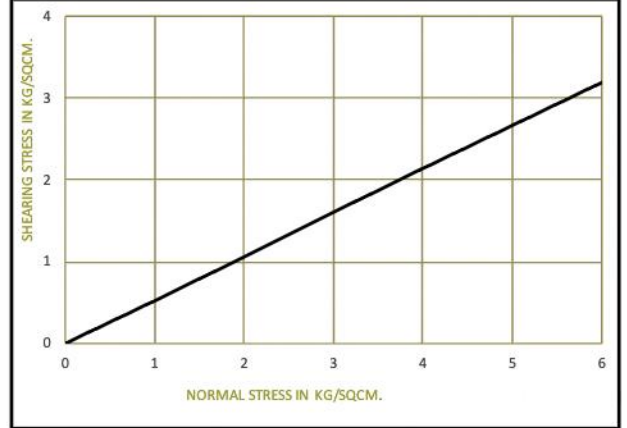
PROJECT NAME:- SOIL INVESTIGATION WORKS FOR THE PROPOSED ROAD OVER BRIDGE (248) AT DISTRICT- KASGANJ, UTTAR PRADESH.

U.L.R. NO	0	DIRECT SHEAR TEST (Failure Envelop Graphs)
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C = 0.00 $\phi = 27$ DEPTH = 1.20-1.50

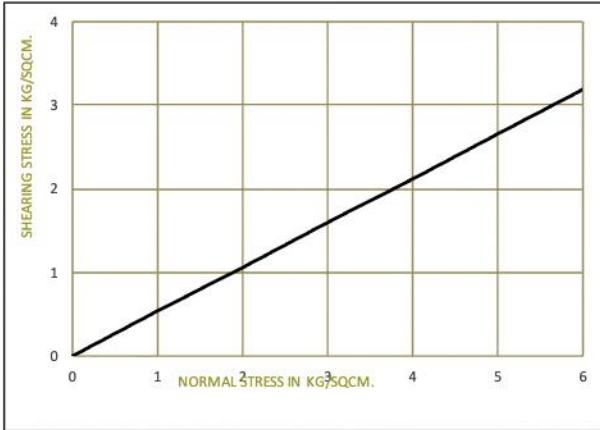


C = 0.00 $\phi = 28.00$ DEPTH = 5.70-6.00



Borehole No:- 02

C = 0.00 $\phi = 28.00$ DEPTH = 2.70-3.00



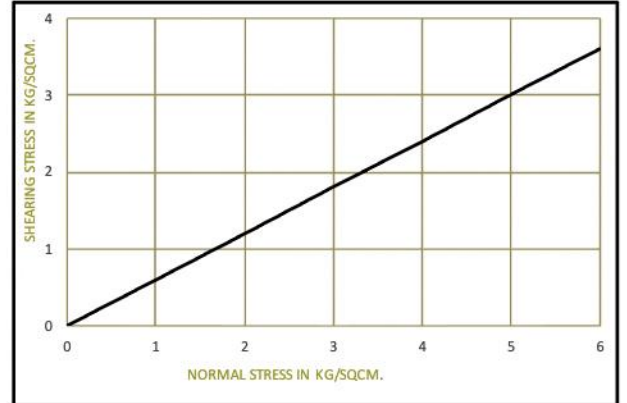
C = 0.00 $\phi = 29.00$ DEPTH = 7.20-7.50



C = 0.00 $\phi = 28.00$ DEPTH = 4.20-4.50



C = 0.00 $\phi = 31.00$ DEPTH = 10.20-10.50

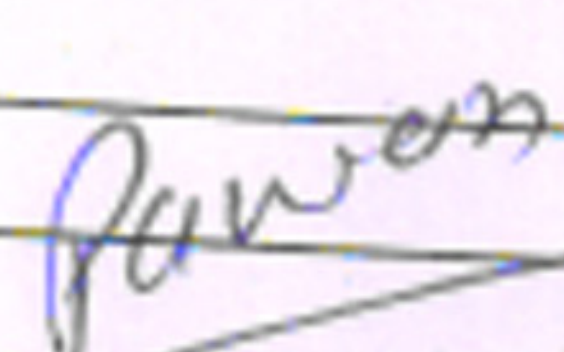


BORELOG CHART

E.I.H. TELE INFRA PVT LTD

An ISO 9001:2015 Certified
SOIL TESTING, CONSTRUCTION MATERIAL TESTING LAB (ROAD & BUILDING) & STRUCTURE CONSULTANT

Gali no-02 kuldeep vihar Allgarh
U.P.
9917071400, 9388012356

PROJECT NAME		ROB(248) Karkajanj					GROUND WATER LEVEL		9.00m	
BOREHOLE NO.	01	GROUND SURFACE LEVEL				DIAMETER OF BORING		100 mm		
LOCATION		TYPE OF BORING		CO-ORDINATES		DATE OF START		1-11-25		
STRUCTURE		CASING TYPE AND DIAMETER USED		ARTESIAN LEVEL IF ANY		DATE OF COMPLETION				
SAMPLE TYPE	DEPTH	VISUAL DESCRIPTION OF STRATA	SAMPLE REFERENCE CODE	N1	N2	N3	N= (N2+N3)	REMARK/COLOUR		
0 -	0.50	Silty sand								
1.50	1.85	"		2	3	6	9			
2.00	3.45	"		6	6	6	12			
4.50	4.95	"		5	5	6	11			
6.00	6.45	"		6	6	8	14			
7.50	7.95	sand		7	6	9	15			
9.00	9.45	"		8	9	9	18			
10.50	10.95	Silty sand		9	8	11	19			
12.00	12.45	"		10	10	12	22			
12.50	13.95	"		12	11	14	25			
15.00	15.45	sand		12	13	12	25			
16.50	16.95	"		15	13	16	29			
18.00	18.45	"		15	15	15	30			
19.50	19.45	"		13	14	20	34			
21.00	21.45	Silty clay		10	13	17	30			
22.50	22.95	"		15	16	16	32			
24.00	24.95	"		16	15	23	38			
25.50	25.95	"		16	16	22	38			
27.00	27.45	"		20	20	20	40			
28.50	28.95	sand		20	21	20	41			
30.00	30.45	"		21	20	24	44			
NAME (FIELD INCHARGE)							NAME (CLIENT)			
SIGNATURE (FIELD INCHARGE)							SIGNATURE (CLIENT)			
CONTACT NO.							CONTACT NO.			

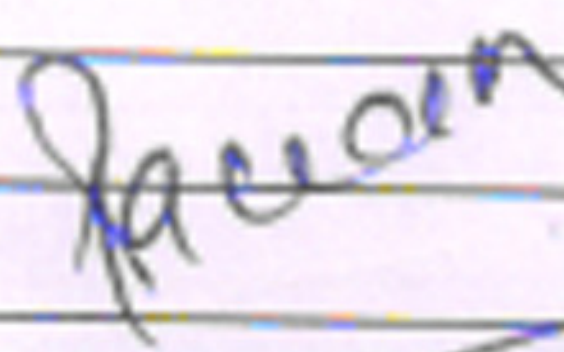
BORELOG CHART

E.I.H. TELE INFRA PVT LTD

An ISO 9001:2015 Certified

SOIL TESTING, CONSTRUCTION MATERIAL TESTING LAB (ROAD & BUILDING) & STRUCTURAL CONSULTANT

Gali no-02 kulddeep vihar Aligarh
U.P.
9917071400, 9368012356

PROJECT NAME		ROB(248) Karkojari					GROUND WATER LEVEL		9.60m
BOREHOLE NO.	02	GROUND SURFACE LEVEL			CO-ORDINATES		DIAMETER OF BORING		150 mm
LOCATION		TYPE OF BORING			DATE OF START		2-11-25		
STRUCTURE		CASING TYPE AND DIAMETER USED			ARTESIAN LEVEL IF ANY		DATE OF COMPLETION		
SAMPLE TYPE	DEPTH	VISUAL DESCRIPTION OF STRATA	SAMPLE REFERENCE CODE	N1	N2	N3	N= (N2+N3)	REMARK/COLOUR	
0-	0.50	silty sand							
1.50	1.85	;		4	4	4	8		
3.00	3.45	;		4	5	6	11		
4.50	4.95	;		6	6	6	12		
6.00	6.45	;		5	6	7	13		
7.50	7.95	;		7	6	9	15		
9.00	9.45	;		8	7	8	15		
10.50	10.95	;		8	10	10	20		
12.00	12.45	;		10	9	12	21		
12.50	13.95	;		12	12	12	24		
15.00	15.45	sand		11	12	13	25		
16.50	16.95	;		10	12	13	25		
18.00	18.45	;		14	14	15	29		
19.50	19.45	;		15	14	18	32		
21.00	21.45	;		15	15	18	33		
22.50	22.95	silty clay		13	14	23	37		
24.00	24.95	;		15	15	19	34		
25.50	25.95	;		14	13	20	33		
27.00	27.45	;		15	18	20	38		
28.50	28.95	silty sand		20	20	21	41		
30.00	30.45	;		20	20	20	40		
NAME (FIELD INCHARGE)					NAME (CLIENT)				
SIGNATURE (FIELD INCHARGE)					SIGNATURE (CLIENT)				
CONTACT NO.					CONTACT NO.				



Latitude: 27.805105
Longitude: 78.659689
Elevation: 191.0±2.47 m
Accuracy: 161.9 m
Time: 11-03-2025
Note: Kanpur Fatak
Amapur Road
Dist: Kasganj Bor 1

Powered by NoteCam



Latitude: 27.804453
Longitude: 78.6596
Elevation: 189.19±24.9 m
Accuracy: 4.244 m
Time: 11-01-2025
Note: Kanpur Fatak
Amapur Road
Dist: Kasganj Bor 2

Powered by NoteCam



Latitude: 27.804442
Longitude: 78.659603
Elevation: 189.19±23.4 m
Accuracy: 5.913 m
Time: 11-01-2025
Note: Kanpur Fatak
Amapur Road
Dist: Kasganj Bor 2

Powered by NoteCam



Latitude: 27.804409
Longitude: 78.65954
Elevation: 189.2±9.61 m
Accuracy: 5.84 m
Time: 11-01-2025
Note: Kanpur Fatak
Amapur Road
Dist: Kasganj Bor 2

Powered by NoteCam



Latitude: 27.804407
Longitude: 78.659627
Elevation: 189.244.83 m
Accuracy: 1.67.4 m
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Note: Kanpur Fatak
Amapur Road
Distt Kasganj Bor 2

Powered by NoteCam



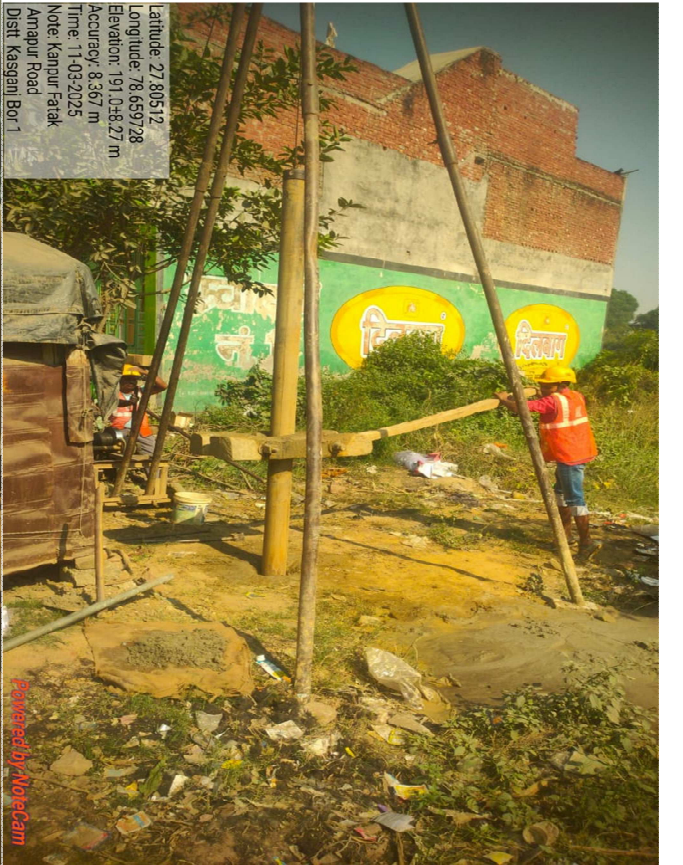
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Longitude: 78.659615
Elevation: 189.245.97 m
Accuracy: 5.99 m
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Note: Kanpur Fatak
Amapur Road
Distt Kasganj Bor 2

Powered by NoteCam



Latitude: 27.805303
Longitude: 78.65971
Elevation: 191.042.21 m
Accuracy: 15.46 m
Time: 11-03-2025
Note: Kanpur Fatak
Amapur Road
Distt Kasganj Bor 1

Powered by NoteCam



Latitude: 27.80512
Longitude: 78.659728
Elevation: 191.048.27 m
Accuracy: 8.67 m
Time: 11-03-2025
Note: Kanpur Fatak
Amapur Road
Distt Kasganj Bor 1

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