ANNEXURE - I





ANNEXURE - II

GEOTECHNICAL INVESTIGATION REPORT

PROJECT : GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF MULTI LEVEL CAR PARKING AT OLD JAIL COMPLEX, NEHRU STREET, PUDUCHERRY.

PROJECT NO : AAL.1627/NEHRU STREET/PDY/2020-21.

- CLIENT : THE CHIEF EXECUTIVE OFFICER, PSCDL, PUDUCHERRY.
- REFERENCE : WORK ORDER NO: 1040/PSCDL/MLCP/2020/513 DATE: 11.08.2020

EXPLORATION DATE : 13.08.2020 - 15.08.2020.

DATE OF REPORT : 29.08.2020.

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Date: 29.08.2020

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NAME OF WORK: GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF MULTI LEVEL CAR PARKING AT OLD JAIL COMPLEX, NEHRU STREET, PUDUCHERRY.

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1. INTRODUCTION

A Geotechnical investigation for the above said work was undertaken as per the authorization given by **THE CHIEF EXECUTIVE OFFICER**, **PSCDL**, Puducherry.

FLOW CHART

Date: 29.08.2020

Date: 29.08.2020

2. SCOPE OF WORK

- 2.1 This geotechnical investigation has been carried out to ascertain the safe bearing capacity and to decide upon suitable foundation system for the proposed structure. It was instructed to make two number of bore holes. The BH -1 was driven upto 20.0 m depth BH-2 & BH-3 was driven upto 10.0m depth and terminated as per the clients instruction.
- 2.2 The allowable safe bearing capacity of the soil is calculated based on the field geotechnical investigation, soil properties, GWT and subsequent laboratory experiments.

3. FIELD INVESTIGATION

3.1 GENERAL

Mobilizations of equipment, skilled and unskilled labours are arranged at site. The various factors for the number and position of boreholes and spacing of boreholes are based on the extent of the site, nature and type of structure. Depth of borehole is concluded based on condition of soil, penetration capacity of soil, shear failure and hard strata condition. Standard Penetration Test (SPT) is conducted at various depths. The disturbed soil sample is collected from the site and transported for examination to Ashhirwaad Analytical Laboratory. The field investigation is being monitored by experienced civil engineers/ Geotechnical/ Structural Engineer.

3.2 STANDARD PENETRATION TEST (IS: 2131 - 1981)

EQUIPMENT PREPARATION

3.2.1 DRILLING EQUIPMENT

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The equipment used shall provide a clean borehole 100 to 150 mm in diameter, for insertion of the sampler ensure that the penetration test is performed on undisturbed soil and shall permit driving of the split spoon sampler to obtain penetration record and sample in accordance with procedure.

3.2.2 DRIVE WEIGHT ASSEMBLY

The drive weight assembly shall consist of driving head and a 63.5 kg weight with 75cm free fall. It is ensured that the energy of the falling weight is not reduced by friction between the drive weight and the guides. The rods to which the sampler is attached for driving should be straight, tightly coupled and straight in alignment. For driving the casting, a hammer heavier than 63.5 kg may be used.

3.2.3 CLEANING THE BOREHOLE

In case wash boring is adopted for cleaning the borehole, side discharge bits are permissible, but in no case a bottom discharge bit be permitted. In cohesive soils, the borehole may be cleaned with bailer with a flap valve.

3.2.4 OBTAINING THE SAMPLES

Test shall be made at every change in stratum or at intervals of not more than 1.5 m whichever is less. Tests may be made at lesser or greater intervals if specified or considered necessary.

The sampler shall be lowered to the bottom of the borehole. The following information shall be noted and recorded.

- (a) Depth of bottom of borehole below ground level.
- (b) Penetration of the sampler into the soil under the combined weight of sampler and rods

- (c) Water level in the borehole or casting
- (d) Depth of bottom of casting below ground level.

Labels shall be fixed to the jar or notation shall be written on the covers with the following information:

- a) Origin of sample
- b) Job designation
- c) Boring number
- d) Sample number
- e) Depth of sampling
- f) Penetration record
- g) Length of recovery
- h) Date of sampling

The jars containing samples shall be stored in suitable container for shipment. Samples should not be placed in the sun.

3.3 IS CODE FOR FIELD INVESTIGATION

SL.NO	IS CODE NUMBER	IS CODE NAME	
1	IS : 1498 – 1970	Classification & Identification of soil for general engineering	
	(Reaffirmed 2007)	purpose (First Revision)	
2	IS : 1892 – 1979	Code of practice for sub surface investigation for	
	(Reaffirmed 2002)	foundation (First Revision)	
3	IS : 2131 – 1981	Method of Standard Penetration Test for soil (First	
	(Reaffirmed 2002)	Revision)	
4	IS : 2132 – 1986	Code of practice for thin walled tube sampling of soil	
	(Reaffirmed 2002)	(Second Revision)	
5	IS : 4968 – 1976	Method of sub surface sounding of soil : Static cone	
	(Reaffirmed 2007)	penetration (First Revision)	

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3.4 SITE EXPLORATION

Subsurface exploration should be carried out in preliminary and detailed exploration. Shear strength and compressibility of the soil is determined in the detailed exploration. The method of boring for soil exploration is rotary boring. Rotary boring is effected by cutting action of the soil. The bit is carried at the end of hollow, jointed drill rods which is rotated by the chuck. A mud laden fluid is pumped continuously and fluid returns to surface in angular space. Undisturbed samples are collected at suitable intervals.

3.5 <u>SITE MAP</u>

Bore Hole No	LATITUDE	LONGITUDE
BH-1	11°56′11.24′′N	79°49′42.18′′E
BH-2	11°56′11.24′′N	79°49'42.18''E
BH-3	11°56′12.33″N	79°49′41.79″E

3.6 BOREHOLE DETAILS

Three number of bore holes are driven in the field at various location of the site. As per IS: 1892 - 1979 (Reaffirmed 2002), the various driven depth of the borehole, Ground Water Table and their corresponding identifications are tabulated below

SL.NO	BOREHOLE IDENTIFICATION NUMBER	DRIVEN BOREHOLE DEPTH (m)
1.	BH-1	20.0
2.	BH-2	10.0
3.	BH-3	10.0

BOREHOLE IDENTIFICATION NUMBER	GROUND WATER TABLE (m)
BH-1	1.20
BH-2	1.20
BH-3	1.20

4. GEOTECHNICAL MODELLING AND OBSERVATION:

4.1 GENERAL

Various laboratory test are carried out to assess the soil as per IS code standard and calculations are done. The results of the test are tabulated and interpretation is given.

4.2 LIST OF IS CODE

4.2.1 LABORATORY IS CODE

SL.NO IS CODE NUMBER		IS CODE NAME	
1	IS : 2720 – 1983 (Part – 1)	Methods of test for soil :Preparation of dry soil	
	(Reaffirmed 2006)	sample for various test (Second Revision)	

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E.mail: aageotech@gmail.com, Website: www.ashhirwaadassociates.co.in

Date: 29.08.2020

ASHHIRWAAD ANALYTICAL LABORATORY

(NABL Accredited Laboratory TC - 8619) (A Unit of Ashhirwaad Associates - Regd. No. 18/2000)

(Approved by Government of India) Civil Engineering Consultancy Services

- Geotechnical Investigation ÷ * Structural consultancy ÷ Survey and contouring *
- ٠ Load testing on Piles
- Material testing NDT Services "A Total Solution Provider In Civil Engineering Services"

ISO/IEC 17025:2005

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2	IS 2720 – 1980 (Part – 2) (Reaffirmed 2010)	Methods of test for soil : Determination of water content (Second Revision)
3	IS 2720 – 1980 (Part – 3) (SECTION – 1) (Reaffirmed 2002)	Methods of test for soil : Determination of specific gravity : Fine grained soil (First Revision)
4	IS 2720 – 1980 (Part – 3) (SECTION – 2) (Reaffirmed 2002)	Methods of test for soil : Determination of specific gravity : Fine, Medium, Coarse grained soil (First Revision)
5	IS 2720 – 1985 (Part – 4) (Reaffirmed 2006)	Methods of test for soil : Grain size analysis(Second Revision)
6	IS 2720 – 1985 (Part – 5) (Reaffirmed 2006)	Methods of test for soil : Determination of liquid and plastic limit (Second Revision)
7	IS 2720 – 1985 (Part – 15) (Reaffirmed 2006)	Methods of test for soil : Determination of consolidation properties (First Revision)
8	IS 1809 – 1972 (Reaffirmed 2006)	Methods of test for soil : Glossary of terms & symbols relating to soil engineering (Third Revision)

4.2.2 FOUNDATION IS CODE

SL.NO	IS CODE NUMBER	IS CODE NAME
1	IS : 1080 – 1986 (Reaffirmed 2002)	Code of practice for design and construction of shallow foundation on soil (other than raft, ring and shell) (Second Revision)
2	IS 1904 : 1968 (Reaffirmed 2006)	Code of practice for design and construction of foundation on soil :General requirement (Third Revision)
3	IS 6403 – 1981 (Reaffirmed 2002)	Code of practice for determination of bearing capacity of shallow foundation (First Revision)

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4.2.3 SEISMIC IS CODE

SL.NO	IS CODE NUMBER	IS CODE NAME
1	IS 1893 – 2002 (Reaffirmed	Criteria for Earthquake Resistant design of
	2007)	Structures(Fifth Revision)

4.3 <u>RESULT:</u>

Laboratory tests the following soil profiles for the boreholes as observed is detailed

below:

<u>BH -1</u>

The details of soil stratification are presented in the bore - log and their interpretation is shown below

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<u>BH -2</u>

The details of soil stratification are presented in the bore - log and their interpretation is shown below

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<u>BH -3</u>

The details of soil stratification are presented in the bore - log and their interpretation is shown below

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5. CHEMICAL TEST:

Chemical tests were performed on water samples collected from bore holes for determining pH value and chloride. The results are given in a tabular form below:

Table 5.1 As per IS 3025 (Part 11 & 32), IS 456-2000.

SL.NO	Particulars	Results	Stipulations of IS 456-2000, IS 3025(Part 32) (Water for Construction Purpose)
1.	pH value	7.9	6.5 – 8.5
2.	Chloride	201.17mg/l	500 - 2000 mg/l

It is seen that the values are within the permissible limit (As per IS 456-2000). So no special cement will be required for foundation concrete.

6. **<u>RECOMMENDATIONS</u>**:

The following recommendations are made based on the field investigations SPT values, GWT and subsequent Laboratory Experiments.

6.1 Considering in situ condition of the soil Strata, two types of foundations are suggested for the Proposed Construction Of Multi Level Car Parking at Old jail

Complex, Nehru Street, Pondicherry.

a) Isolated/Combined Footing

or

b) Strip Raft Foundation

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- **Note:** Filled up Earth Formation was seen in the Bore Hole Locations upto a maximum Depth of 2.80m from the NGL. Hence Footing have to be founded over/Medium to Dense Layer available beyond 2.80m.
- **6.2** If **"ISOLATED/COMBINED FOOTING"** is considered, the allowable safe bearing capacities are calculated and tabulated below along with the allowable settlement.

SI. No.	Dava	Depth in	SBC in T/m ²	As per IS:1904-1986	(Reaffirmed 2006)
	Bore Hole No	le No from NGL		Total Arrived Settlement (mm)	Total Arrived Settlement (mm)
1.	BH-1	3.0	13	3.34	50
2.	BH-2 &	3.25	15	4.00	50
3.	BH-3	3.5	17	4.66	50

Table 6.2.1Safe Bearing Capacity Calculation As per IS 6403:1981

6.3. If **"STRIP RAFT FOUNDATION"** is considered, the allowable safe bearing capacities are calculated and tabulated below along with the allowable settlement.

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	Safe Bearing Capacity Calculation As per IS 6403:1981						
si	Bore	Depth in		As per IS:1904-1986 (Reaffirmed 2006)			
	No.	Hole No	meter from NGL	T/m ²	Total Allowable Settlement (mm)	Total Allowable Settlement (mm)	
	1.	BH-1 BH-2 & BH-3	3.0	15	4.11	75	
	2.		3.25	17	4.73	75	
	3.		3.50	19	5.12	75	

Table 6.3.1

*NGL –Natural Ground Level

- 6.3.2 The Decision of selecting the suitable type and depth of foundation rests with the Structural Engineer Concerned.
- 6.3.3 The width of footing should not be less than 1.5m in order to satisfy the stability requirements.
- 6.4 **SAFETY PRECAUTIONS:** Since the **GWT** is located at 1.20m depth, during construction, adequate safety measures should be taken for the safety of adjacent structures by controlled and constant dewatering with sufficient support measures for prevention of the sliding soil mass. The safety of the men, machineries and structure should be ensured.
- 6.5 For the sub structure [RCC] the environmental exposure condition may be considered as 'Severe' and all the precautions as laid by the relevant code of practice for the design of structures may be adopted.

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6.6 The entire recommendations as above are based on three bore holes executed as per the Clients directions at the location shown by the client's representative as per terms of reference. The uniformity or otherwise of the soil delineation and strength profile over the entire site shall be verified during execution. If there are any variations the same shall be reported to us for review and further advice.

S\d-

Er. N.J.L. RAMESH CHIEF CONSULTANT (Geotech& Structures) ASHHIRWAAD ANALYTICAL LABORATORY (NABL Accredited Laboratory-TC-8619)

Place : Puducherry Date : 29.08.2020

Ref: AAL/8194/GT-Report/P.No.1627/Nehru street/Pdy/2020-21 **7.APPENDICES** Date: 29.08.2020

7.1 SAFE BEARING CAPACITY CALCULATIONS:

7.1.1 For Shallow foundation it is as per IS: 1904 – 1995, Code of practice for design and construction of foundations: General requirements (third revision). The recommended safe bearing Capacity of soil for shallow foundation was calculated as per IS: 6403-1981, Code of practice for Determination of Bearing Capacity of Shallow Foundation. The settlement calculations are as per IS: 8009 (Part-I) - 1976, Code of practice for calculation of settlements in foundations, part I Shallow foundation subjected to symmetrical static vertical Loads. All the calculations are carried out based on the SPT value observed from the field.

7.2. SAFE BEARING CAPACITY CALCULATION FORMULAE: 7.2.1 FOR SHALLOW FOUNDATION:

IN CASE OF GENERAL SHEARE FAILURE AS PER IS: 6403: 1981 The Ultimate Net Bearing Capacity $q_d = cN_cs_cd_ci_c + q(N_q -)s_qd_qi_q + cN_cs_cd_ci_c$

 $0 5 B\gamma N_{\gamma} s_{\gamma} d_{\gamma} i_{\gamma} W'$

Safe Load Carrying Capacity

= q_d/F.S

DEPTH FACTOR

 $d_c = 1 + (0.2 D_f / B\sqrt{N\phi})$

$$d_q = d_\gamma = 1$$
 for $\emptyset < 10^\circ$

 d_q = d_γ = 1 + 0.1 D_f / B $\sqrt{N\emptyset}$ for $\emptyset > 10^\circ$

INCLINATION FACTOR

$$i_c = i_q = (1 - \alpha / 90)$$

 $i_v = (1 - \alpha / \emptyset)^2$

SHAPE FACTOR

SI. No.	Shape of Base	sc	 Sq	Sγ
i)	Continuous strip	1.00	1.00	1.00
ii)	Rectangle	1 + 0.2 B/L	1 + 0.2 B/L	1–0.4 B/L
iii)	Square	1.3	1.2	0.8
iv)	Circle	1.3	1.2	0.6

Where,

C	= Cohesion in Kg/cm
D_f	= Depth of foundation in cm
$d_c, d_q, d\gamma$	= Depth factors
i _c , i _q , iγ	= Inclination factors
L	= Length of footing in cm
Ľ	= Effective length of footing in cm
N	= Corrected standard penetration value
Ν _c , Ν _q , Νγ,	= Bearing capacity factors
Nø	$= \tan^2 (\pi/4 + 0/2)$
q	 Effective surcharge at the base level of Foundation
qd	 Net ultimate bearing capacity based on general shear failure
W'	= Correction factor for location of water table
α	 Inclination of the load to the vertical in degrees
Ø	= Angle of shearing resistance of soil in degrees
γ	= Bulk unit weight of foundation soil
F.S	= Factor of safety.

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Fig. 1 – Site Photo Showing the Soil Exploration Work.

Project.No: AAL.1627/2020 *A Total Solution Provider in Civil Engineering*

Name Of The Work : Geotechnical Investigation For The Proposed Construction Of Multi Level Car Parking at Old jail Complex, Nehru Street, Puducherry.

ASHHIRWAAD ANALYTICAL LABORATORY, PUDUCHERRY (NABL Accredited Laboratory - TC-8619)

	τ	JLR : TC86192000	0000260F			BORE LOG - 1/3									ISO/IEC 17025:2005									
Projec	t No:	AAL.1627/Pdy/2020	Date: GWT (m):	13.	08.2020	Location:	Old Jail Com	plex, Pudu	ucherry.				Index	prope	rties (%	b)	Sh stre parar	ear ength neters	G	iradatio	n prope	erties (%	6)	
	Depth	of boring (m) :		20.00		Graphic	Graphical Representation of		onsistency	ire conten) t/m³	(M)	(M¢)	ex(l _P)	ex (lc)	ex(Cs)	Direct	t shear est		Sie	ve analy	/sis		
Depth Below	stratum .	Classification	Thickness of	De San	epth of npling(m)	Stan	dard Penetrat Test Data (N)	ion	cription /cc	ural moistu (%)	Density (y	iquid limit (lastic limit	asticity ind	stency ind	e swell ind	g(cm²)	egrees)	iravel	se sand	um sand	e sand	: & clay	
GL	Soil s	soil	Layer (m)	UDS	DS	N Value	10 20 3	0 40 50	Å	Nat			E	Ä	Consi	Fre	C	Ф (d	G	Coar	Medi	Fine	silt	
					0.5																			
1.0		Fill up earth			1.0				Verv															
		Sand	2.80		1.5	3			Loose	22	1.39		Non -	Plasti	2	Nil	0.033	31º10'	18.06	5.29	65.20	9.69	1.76	
2.0		(SVV) with gravel			2.0																			
		0			2.5	11			Medium															
3.0					3.0																			
					3.5	19			Medium	14	1.59		Non -	Plasti	0	Nil	0.012	30º45'	0.00	1.49	70.15	25.37	2.99	
4.0					4.0																			
		Light Brown Sand	3 40		4.5	35			Dense	20	1.75		Non -	Plasti	b	Nil	0.058	30°32'	0.00	2.41	29.76	65.68	2.14	
5.0		(SW)	0.10		5.0			1 T																
					5.5	33			Dense															
6.0					6.0			T.																
-					6.5	32			Dense	21	1.75		Non -	Plasti	5	Nil	0.052	31º10'	0.00	0.00	13.21	83.57	3.21	
7.0				-	7.0			1																
	1	Black		-	7.5	26			Medium															
8.0		Silty sand	3.50	-	8.0																			
	1	(SM-SW)			8.5	41		\uparrow	Dense															
					9.0																			
9.0	_				9.5	1			1															
10.0		Silty sand (SM-SW)	0.50		10.0	9			Loose	37	1.72		Non -	Plasti	>	Nil	0.015	31º10'	0.00	0.00	30.38	65.82	3.80	

Project No: AAL.1627/2020

Name Of The Work : Geotechnical Investigation For The Proposed Construction Of Multi Level Car Parking at Old jail Complex, Nehru Street, Puducherry.

ASHHIRWAAD ANALYTICAL LABORATORY, PUDUCHERRY (NABL Accredited Laboratory - TC-8619)

	τ	JLR : TC86192000	0000260F						BO	RE LOG	- 1/3											SO/IEC	17025	2005
Project BH, No	No:	AAL.1627/Pdy/2020	Date: GWT (m):	13.	08.2020	Location:	Old Ja	il Complex	α, Pudu	cherry.	t			Index	prope	rties (%	b)	Sh stre parar	ear ngth neters	G	iradatio	n prope	rties (%	6)
D	epth	of boring (m) :	<u> </u>	20.00		Graphic	al Repi	resentatio	n of	onsistency	re conten) t/m³	(Iw	(Mr)	ex(l,)	ex (lc)	ex(Cs)	Direct	t shear est		Sie	ve analy	/sis	
Depth Below	stratum .	Classification	Thickness of	De Sam	epth of pling(m)	Stan	dard Pe Test Da	enetration Ita (N)		cription /cc	ural moistu (%)	Density (_Y	iquid limit (lastic limit	asticity ind	istency ind	e swell ind	kg/cm²)	legrees)	iravel	'se sand	um sand	e sand	t & clay
GL	Soil s	soil	Layer (m)	UDS	DS	N Value	10	20 30 4	0 50	Des	Nat			d	Ë	Cons	Fre	C	ф ф	O	Coal	Medi	Ē	silt
					10.5					Verv														
11.0					11.0	4				Loose														
					11.5					Verv														
12.0		Black			12.0	4				Loose	37	1.52		Slightly	/ Plast	ic	30	0.082	18º10'	0.00	0.00	20.83	58.8	20.83
		(SM-SW)	4.50		12.5					_														
13.0	_	with clay		_	13.0	5				Loose														
					13.5					_														
14.0				-	14.0	5				Loose	39	1.71		Slightly	/ Plast	ic	20	0.094	15°55'	1.58	1.58	30.04	45.45	21.34
					14.5	_				_														
15.0		Black	1.00	-	15.0	9				Loose	42	1.24	72	35	37	0.81	90	0.113	7º17'	0.00	0.00	0.00	1.25	98.75
		Clay (CII)		-	15.5	-				_														
16.0				_	16.0	9				Loose	30	1.38		Slightly	/ Plast	ic	20	0.137	10º15'	0.00	0.00	30.69	37.62	31.68
				-	16.5					_														
17.0	_	Black Sand	0.50	-	17.0	6				Loose														
		(SP) with clay	3.50	-	17.5					_														
18.0	_			-	18.0	12				Medium	26	1.42		Slightly	/ Plast	ic	20	0.095	20º6'	0.00	0.00	49.8	33.47	16.37
40.0					18.5		\vdash		_	04:44														
19.0					19.0	6			_	Stiff							-							
		Black Clav (CH)	1.00		19.5	-	\vdash		_	-													0.00	
20.0					20.0	10				Very Stiff	36	1.21	68	31	37	0.86	100	0.191	7º44'	0.00	0.00	0	2.22	97.78

Project No: AAL.1627/2020

Name Of The Work : Geotechnical Investigation For The Proposed Construction Of Multi Level Car Parking at Old jail Complex, Nehru Street, Puducherry.

ASHHIRWAAD ANALYTICAL LABORATORY, PUDUCHERRY (NABL Accredited Laboratory - TC-8619)

	ULR : TC86192000000261F BORE LOG - 2/3 ISO/IEC 17025:2005																								
Project	No:	AAL.1627/Pdy/2020 2	Date: GWT (m):	15.	08.2020	Location:	Old	Jail C	omp	lex, Pudu	cherry	Ŧ		I	Index	proper	ties (%	b)	Sh stre parar	near ength meters	G	iradatio	n prope	rties (%)
D	epth o	– of boring (m) :		20.00		Graphic	Graphical Representation of		ion of	onsistenci	consistenc ure contei) /) t/m ³		(Jw)	(M¢)	ex(l,)	ex (lc)	ex(Cs)	Direct shear test			Sie	/e analy	sis		
Depth Below	stratum .	Classification	Thickness of	De Sarr	epth of npling(m)	Stan	dard Test	Pene Data	etratio (N)	on	scription /cc	ural moistu (%)	Density (_V	iquid limit (astic limit	asticity ind	istency ind	e swell ind	kg/cm²)	legrees)	àravel	rse sand	ium sand	e sand	t & clay
GL	Soil	soil	Layer (m)	UDS	DS	N Value	10) 20	30	40 50	Ğ	E Z			а	₽	Cons	Fre	с(о) Ф	0	Sa	Medi	Ē	Si.
					0.5						•														
1.0		Fill Up Earth	2 00		1.0																				
		Red sand	2.00		1.5	5					Loose	23	1.71		Non -	Plastic	;	Nil	0.030	28º25'	0.00	1.29	11.59	84.98	2.15
2.0					2.0																				
				-	2.5	11					Medium	15	1.66		Non -	Plastic	;	Nil	0.042	30º45'	0.00	1.37	64.73	32.53	1.37
3.0				-	3.0																				
				-	3.5	16					Medium	14	1.65		Non -	Plastic	;	Nil	0.042	31º10'	0.00	2.16	63.36	31.90	2.59
4.0				-	4.0						-														
				-	4.5	26			<u>\</u>		Medium														
5.0		Light Brown Sand	6.00	-	5.0						Very														
		(SP)		-	5.5	55					Dense	15	1.70		Non -	Plastic	;	Nil	0.045	30º22'	0.00	0.00	40.80	58.28	0.92
6.0				-	6.0						Very														
				-	6.5	50 _(7cm↑)					Dense			-											
7.0				-	7.0						_														
				-	7.5	46					Dense	19	1.84		Non -	Plastic	;	Nil	0.036	31º10'	0.00	0.00	40.80	58.28	0.92
8.0				-	8.0																				
		Diask		-	8.5	19		f			Medium	-						-							
9.0		Silty Sand	2.00		9.0		L	\square			-														
		(SM-SW)			9.5																				
10.0					10.0	12					Medium	14	1.9		Non -	Plastic	;	Nil	0.018	31º32'	0.00	0.00	27.82	70.56	1.61

Project No: AAL.1627/2020

Name Of The Work : Geotechnical Investigation For The Proposed Construction Of Multi Level Car Parking at Old jail Complex, Nehru Street, . Puducherry.

ASHHIRWAAD ANALYTICAL LABORATORY, PUDUCHERRY (NABL Accredited Laboratory - TC-8619)

	ULR : TC86192000000262F						BORE LOG - 3/3											ISO/IEC 17025:2005							
Project BH. No	No:	AAL.1627/2020	Date: GWT (m):	16.	08.2020	Location:	Old Jail	Comp	olex, Pud	ucherry	ų			Index	proper	ties (%	b)	Sh stre parar	near ength meters	G	iradatio	n prope	erties (%	6)	
D	epth o	of boring (m) :		10.00	-	Graphic	al Repres	senta	tion of	onsistenc	ire conten) t/m³	(Jw)	(M)	ex(l,)	ex (lc)	ex(Cs)	Direc te	t shear est		Sie	ve analy	/sis		
Depth Below	stratum	Classification	Thickness of	De Sam	epth of npling(m)	Stan	idard Pen Test Data	etrati (N)	on	scription /c	ural moistu (%)	Density (_V	iquid limit	lastic limit	asticity ind	istency ind	e swell ind	kg/cm²)	legrees)	i ravel	rse sand	um sand	e sand	t & clay	
GL	Soil :	soil	Layer (m)	UDS	DS	N Value	10 20	0 30	40 50	Des	Nat			4	ä	Cons	Ъre	c(р) ф	Ċ	Coal	Medi	Fin	silt	
					0.5																				
1.0		Fill Up Earth			1.0																				
		Sand (SW)	2.80		1.5	6	•			Loose	19	1.59		Non -	Plastic	;	Nil	0.020	30°32'	4.56	1.65	26.75	69.55	2.06	
2.0		with gravel			2.0	_																			
				-	2.5	8				Medium															
3.0				-	3.0	-	$\vdash \downarrow$			_															
					3.5	16				Medium	22	1.73		Non -	Plastic	;	Nil	0.019	31º10'	0.00	0.00	64.06	34.88	1.07	
4.0					4.0					_															
					4.5	26		\rightarrow		Medium															
5.0		Light Brown Sand	4 70		5.0			\square		Very				L											
		(SP)	4.70		5.5	21		+		Dense	21	1.73		Non -	Plastic	;	Nil	0.058	30º32'	0.00	1.09	43.48	52.90	2.54	
6.0	-				6.0	-		/		Very															
					6.5	18	•			Dense															
7.0					7.0	-				_	-						-								
				-	7.5	6	-			Dense	20	1.66		Non -	Plastic	;	Nil	0.066	31º32'	0.00	32.67	42.20	50.46	3.67	
8.0	-				8.0		$ \rightarrow $																		
		Black	2.50		8.5	16				Medium															
9.0		(SM-SW)	2.50		9.0	-	\vdash			-															
					9.5	-												0.00-	00045						
10.0					10.0	13				Medium	9	1.56		Non -	Plastic	>	Nil	0.097	30°45'	0.00	0.00	33.61	64.75	1.64	

Project No: AAL.1627/2020

BH - 1 GRAIN SIZE DISTRIBUTION CURVE

Project. No: AAL.1627/2020 "A Total Solution Provider in Civil Engineering" 27/29

BH - 2 GRAIN SIZE DISTRIBUTION CURVE

Project. No: AAL.1627/2020 "A Total Solution Provider in Civil Engineering" 28/29

BH - 3 GRAIN SIZE DISTRIBUTION CURVE

Project. No: AAL.1627/2020 "A Total Solution Provider in Civil Engineering" 29/29

GEOTECHNICAL INVESTIGATION REPORT

- PROJECT : GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF MULTI LEVEL CAR PARKING AT MARAIMALAI ADIGAL SALAI, PUDUCHERRY
- PROJECT NO : AAL.1638/MARAIMALAI ADIGAL SALAI /PDY/2020-21.
- CLIENT : THE CHIEF EXECUTIVE OFFICER, PSCDL, PUDUCHERRY.
- REFERENCE : WORK ORDER NO: 1040/PSCDL/MLCP/2020/513 DATE: 11.08.2020

EXPLORATION

DATE : 29.08.2020 - 01.09.2020.

DATE OF

REPORT : 10.09.2020

Head Office:"Mayan Vihar" No.182, 2nd Floor, 4th Main Road, Mahaveer Nagar, Karuvadikuppam,
Puducherry-605008 Phone: 0413-2252663 Extn.27 & 31 Cell: 7598491505Branch Office:No. 14/57C, Nerkundram Road, Vadapalani, Chennai – 26. Cell: 9629486505
E.mail: aageotech@gmail.com, Website: www.ashhirwaadassociates.co.in

Date: 10.09.2020

Date: 10.09.2020

NAME OF WORK: GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF

MULTI LEVEL CAR PARKING AT MARAIMALAI ADIGAL SALAI, PUDUCHERRY.

CONTENTS

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SITE & BORE LOG DETAILS

- 4. GEOTECHNICAL MODELLING AND OBSERVATION
- 5. CHEMICAL ANALYSIS
- 6. RECOMMENDATION
- 7. APPENDICES
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- 9. SITE LAYOUT WITH BORE LOG LOCATIONS
- **10. BORE LOG SHEETS**
- **11. DRY SIEVE CHART**

1. INTRODUCTION

A Geotechnical investigation for the above said work was undertaken as per the authorization given by **THE CHIEF EXECUTIVE OFFICER**, **PSCDL**, Puducherry.

FLOW CHART

Date: 10.09.2020

Date: 10.09.2020

2. SCOPE OF WORK

- 2.1 This geotechnical investigation has been carried out to ascertain the safe bearing capacity and to decide upon suitable foundation system for the proposed structure. It was instructed to make two number of bore holes. The BH -1 was driven upto 22.0m & BH-2 was driven upto 10.0m depth and terminated as per the clients instruction.
- 2.2 The allowable safe bearing capacity of the soil is calculated based on the field geotechnical investigation, soil properties, GWT and subsequent laboratory experiments.

3. FIELD INVESTIGATION

3.1 GENERAL

Mobilizations of equipment, skilled and unskilled labours are arranged at site. The various factors for the number and position of boreholes and spacing of boreholes are based on the extent of the site, nature and type of structure. Depth of borehole is concluded based on condition of soil, penetration capacity of soil, shear failure and hard strata condition. Standard Penetration Test (SPT) is conducted at various depths. The disturbed soil sample is collected from the site and transported for examination to Ashhirwaad Analytical Laboratory. The field investigation is being monitored by experienced civil engineers/ Geotechnical/ Structural Engineer.

3.2 STANDARD PENETRATION TEST (IS: 2131 – 1981)

EQUIPMENT PREPARATION

3.2.1 DRILLING EQUIPMENT

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The equipment used shall provide a clean borehole 100 to 150 mm in diameter, for insertion of the sampler ensure that the penetration test is performed on undisturbed soil and shall permit driving of the split spoon sampler to obtain penetration record and sample in accordance with procedure.

3.2.2 DRIVE WEIGHT ASSEMBLY

The drive weight assembly shall consist of driving head and a 63.5 kg weight with 75cm free fall. It is ensured that the energy of the falling weight is not reduced by friction between the drive weight and the guides. The rods to which the sampler is attached for driving should be straight, tightly coupled and straight in alignment. For driving the casting, a hammer heavier than 63.5 kg may be used.

3.2.3 CLEANING THE BOREHOLE

In case wash boring is adopted for cleaning the borehole, side discharge bits are permissible, but in no case a bottom discharge bit be permitted. In cohesive soils, the borehole may be cleaned with bailer with a flap valve.

3.2.4 OBTAINING THE SAMPLES

Test shall be made at every change in stratum or at intervals of not more than 1.5 m whichever is less. Tests may be made at lesser or greater intervals if specified or considered necessary.

The sampler shall be lowered to the bottom of the borehole. The following information shall be noted and recorded.

- (a) Depth of bottom of borehole below ground level.
- (b) Penetration of the sampler into the soil under the combined weight of sampler and rods

Date: 10.09.2020

- (c) Water level in the borehole or casting
- (d) Depth of bottom of casting below ground level.

Labels shall be fixed to the jar or notation shall be written on the covers with the following information:

- a) Origin of sample
- b) Job designation
- c) Boring number
- d) Sample number
- e) Depth of sampling
- f) Penetration record
- g) Length of recovery
- h) Date of sampling

The jars containing samples shall be stored in suitable container for shipment. Samples should not be placed in the sun.

3.3 IS CODE FOR FIELD INVESTIGATION

SL.NO	IS CODE NUMBER	IS CODE NAME
1	IS : 1498 – 1970	Classification & Identification of soil for general engineering
	(Reaffirmed 2007)	purpose (First Revision)
2	IS : 1892 – 1979	Code of practice for sub surface investigation for
	(Reaffirmed 2002)	foundation (First Revision)
3	IS : 2131 – 1981	Method of Standard Penetration Test for soil (First
	(Reaffirmed 2002)	Revision)
4	IS : 2132 – 1986	Code of practice for thin walled tube sampling of soil
	(Reaffirmed 2002)	(Second Revision)
5	IS : 4968 – 1976	Method of sub surface sounding of soil : Static cone
	(Reaffirmed 2007)	penetration (First Revision)

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3.4 SITE EXPLORATION

Subsurface exploration should be carried out in preliminary and detailed exploration. Shear strength and compressibility of the soil is determined in the detailed exploration. The method of boring for soil exploration is rotary boring. Rotary boring is effected by cutting action of the soil. The bit is carried at the end of hollow, jointed drill rods which is rotated by the chuck. A mud laden fluid is pumped continuously and fluid returns to surface in angular space. Undisturbed samples are collected at suitable intervals.

3.5 SITE MAP

Bore Hole No	LATITUDE	LONGITUDE
BH-1	11°55′50.84″N	79°49′21.52″E
BH-2	11°55′51.17″N	79°49'22.79''E

3.6 BOREHOLE DETAILS

Two number of bore holes are driven in the field at various location of the site. As per IS: 1892 - 1979 (Reaffirmed 2002), the various driven depth of the borehole, Ground Water Table and their corresponding identifications are tabulated below

SL.NO	BOREHOLE IDENTIFICATION NUMBER	DRIVEN BOREHOLE DEPTH (m)
1.	BH-1	22.0
2.	BH-2	10.0

BOREHOLE IDENTIFICATION NUMBER	GROUND WATER TABLE (m)
BH-1	2.80
BH-2	2.80

4. GEOTECHNICAL MODELLING AND OBSERVATION:

4.1 GENERAL

Various laboratory test are carried out to assess the soil as per IS code standard and calculations are done. The results of the test are tabulated and interpretation is given.

4.2 LIST OF IS CODE

4.2.1 LABORATORY IS CODE

SL.NO	IS CODE NUMBER	IS CODE NAME
1	IS : 2720 – 1983 (Part – 1) (Reaffirmed 2006)	Methods of test for soil :Preparation of dry soil sample for various test (Second Revision)

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E.mail: aageotech@gmail.com, Website: www.ashhirwaadassociates.co.in

Date: 10.09.2020

ASHHIRWAAD ANALYTICAL LABORATORY

(NABL Accredited Laboratory TC - 8619)

(A Unit of Ashhirwaad Associates - Regd. No. 18/2000) (Approved by Government of India)

Civil Engineering Consultancy Services

Geotechnical Investigation Survey and contouring Material testing

"A Total Solution Provider In Civil Engineering Services"

- Survey and contouring
 Load testing on Piles
- NDT Services
- ISO/IEC 17025:2005

Date: 10.09.2020

Ref: AAL/8210/GT-Report/P.No.1638/Maraimalai Adigal Salai /Pdy/2020-21

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2	IS 2720 – 1980 (Part – 2) (Reaffirmed 2010)	Methods of test for soil : Determination of water content (Second Revision)
3	IS 2720 – 1980 (Part – 3) (SECTION – 1) (Reaffirmed 2002)	Methods of test for soil : Determination of specific gravity : Fine grained soil (First Revision)
4	IS 2720 – 1980 (Part – 3) (SECTION – 2) (Reaffirmed 2002)	Methods of test for soil : Determination of specific gravity : Fine, Medium, Coarse grained soil (First Revision)
5	IS 2720 – 1985 (Part – 4) (Reaffirmed 2006)	Methods of test for soil : Grain size analysis(Second Revision)
6	IS 2720 – 1985 (Part – 5) (Reaffirmed 2006)	Methods of test for soil : Determination of liquid and plastic limit (Second Revision)
7	IS 2720 – 1985 (Part – 15) (Reaffirmed 2006)	Methods of test for soil : Determination of consolidation properties (First Revision)
8	IS 1809 – 1972 (Reaffirmed 2006)	Methods of test for soil : Glossary of terms & symbols relating to soil engineering (Third Revision)

4.2.2 FOUNDATION IS CODE

SL.NO	IS CODE NUMBER	IS CODE NAME
1	IS : 1080 – 1986 (Reaffirmed 2002)	Code of practice for design and construction of shallow foundation on soil (other than raft, ring and shell) (Second Revision)
2	IS 1904 : 1968 (Reaffirmed 2006)	Code of practice for design and construction of foundation on soil :General requirement (Third Revision)
3	IS 6403 – 1981 (Reaffirmed 2002)	Code of practice for determination of bearing capacity of shallow foundation (First Revision)

Date: 10.09.2020

4.2.3 SEISMIC IS CODE

SL.NO	IS CODE NUMBER	IS CODE NAME
1	IS 1893 – 2002 (Reaffirmed	Criteria for Earthquake Resistant design of
	2007)	Structures(Fifth Revision)

4.3 <u>RESULT:</u>

Laboratory tests the following soil profiles for the boreholes as observed is detailed

below:

<u>BH -1</u>

The details of soil stratification are presented in the bore - log and their interpretation is shown below

Date: 10.09.2020

Date: 10.09.2020

<u>BH -2</u>

The details of soil stratification are presented in the bore - log and their interpretation is shown below

Date: 10.09.2020

5. CHEMICAL TEST:

Chemical tests were performed on water samples collected from bore holes for determining pH value and chloride. The results are given in a tabular form below:

Table 5.1
As per IS 3025 (Part 11 & 32), IS 456-2000.

SL.NO	Particulars	Results	Stipulations of IS 456-2000, IS 3025(Part 32) (Water for Construction Purpose)
1.	pH value	7.2	6.5 - 8.5
2.	Chloride (Cl)	136.48 mg/l	500 (for RCC) - 2000 mg/l (for PCC)

It is seen that the values are within the permissible limit (As per IS 456-2000). So no special cement will be required for foundation concrete.

Ref: AAL/8210/GT-Report/P.No.1638/Maraimalai Adigal Salai /Pdy/2020-21 6. <u>RECOMMENDATIONS:</u> Date: 10.09.2020

The following recommendations are made based on the field investigations SPT values, GWT and subsequent Laboratory Experiments.

- 5.1 Considering in situ condition of the soil Strata, two types of foundations are suggested for the Proposed Construction Of Multi Level Car Parking at Maraimalai Adaigal Salai, Puducherry.
 - a) Isolated/Combined Footing orb) Strip Raft Foundation
- **6.2** If **"ISOLATED/COMBINED FOOTING"** is considered, the allowable safe bearing capacities are calculated and tabulated below along with the allowable settlement.

Table 6.2.1.1

cl	Poro	Depth in		As per IS:1904-1986	(Reaffirmed 2006)
51. No.	Hole No	meter from NGL	SBC in T/m ²	Total Arrived Settlement (mm)	Total Arrived Settlement (mm)
1.	BH-1 &	2.75	12	9.84	50
2.	BH-2	3.0	14	12.24	50
			6.2 [3	

Safe Bearing Capacity Calculation As per IS 6403:1981

6.2.1 If "STRIP RAFT FOUNDATION" is considered, the allowable safe bearing capacities

are calculated and tabulated below along with the allowable settlement.

<u>Head Office:</u> "Mayan Vihar" No.182, 2nd Floor, 4th Main Road, Mahaveer Nagar, Karuvadikuppam, Puducherry-605008 Phone: 0413-2252663 Extn.27 & 31 Cell: 7598491505 <u>Branch Office:</u> No. 14/57C, Nerkundram Road, Vadapalani, Chennai – 26. Cell: 9629486505 E.mail: <u>aageotech@gmail.com</u>, Website: www.ashhirwaadassociates.co.in

Date: 10.09.2020

Table 6.2.1.1

Safe Bearing Capacity Calculation As per IS 6403:1981

SI.	Bore	Depth in	SBC in	As per IS:1904-1986	(Reaffirmed 2006)
No.	Hole No	meter from NGL	T/m ²	Total Allowable Settlement (mm)	Total Allowable Settlement (mm)
1.	BH-1 &	2.75	14	9.66	75
2.	BH-2	3.0	16	11.52	75

*NGL –Natural Ground Level

- **6.2.2** The Decision of selecting the suitable type and depth of foundation rests with the Structural Engineer Concerned.
- **6.2.3** The width of footing should not be less than 1.5m in order to satisfy the stability requirements.
- **6.3** <u>SAFETY PRECAUTIONS</u>: Since the GWT is located at 2.8m depth, during construction, adequate safety measures should be taken for the safety of adjacent structures by controlled and constant dewatering with sufficient support measures for prevention of the sliding soil mass. The safety of the men, machineries and structure should be ensured.
- 6.4 For the sub structure [RCC] the environmental exposure condition may be considered as 'Severe' and all the precautions as laid by the relevant code of practice for the design of structures may be adopted.

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6.5 The entire recommendations as above are based on two bore holes executed as per the Clients directions at the location shown by the client's representative as per terms of reference. The uniformity or otherwise of the soil delineation and strength profile over the entire site shall be verified during execution. If there are any variations the same shall be reported to us for review and further advice.

sd/-Er. N.J.L. RAMESH CHIEF CONSULTANT (Geotech& Structures) ASHHIRWAAD ANALYTICAL LABORATORY (NABL Accredited Laboratory-TC-8619)

Place : Puducherry Date : 10.09.2020

7.APPENDICES

7.1 SAFE BEARING CAPACITY CALCULATIONS:

7.1.1 For Shallow foundation it is as per IS: 1904 – 1995, Code of practice for design and construction of foundations: General requirements (third revision). The recommended safe bearing Capacity of soil for shallow foundation was calculated as per IS: 6403-1981, Code of practice for Determination of Bearing Capacity of Shallow Foundation. The settlement calculations are as per IS: 8009 (Part-I) - 1976, Code of practice for calculation of settlements in foundations, part I Shallow foundation subjected to symmetrical static vertical Loads. All the calculations are carried out based on the SPT value observed from the field.

7.2. <u>SAFE BEARING CAPACITY CALCULATION FORMULAE:</u> 7.2.1 FOR SHALLOW FOUNDATION:

<u>IN CASE OF GENERAL SHEARE FAILURE AS PER IS: 6403: 1981</u> The Ultimate Net Bearing Capacity $\mathbf{q}_{d} = cN_{c}s_{c}d_{c}i_{c} + q(N_{q} -)s_{q}d_{q}i_{q} + cN_{c}s_{c}d_{c}i_{c} + q(N_{q} -)s_{q}d_{q}i_{q}$

 $0.5 By N_{y} s_{y} d_{y} i_{y} W'$

Safe Load Carrying Capacity

 $= q_d/F.S$

DEPTH FACTOR

 $d_c = 1 + (0.2 D_f / B\sqrt{N\emptyset})$ $d_q = d_y = 1 \text{ for } \emptyset < 10^\circ$

$$d_{q} = d_{\gamma} = 1 + 0.1 D_{f} / B \sqrt{N\emptyset}$$
 for $\emptyset > 10^{\circ}$

INCLINATION FACTOR

 $i_c = i_q = (1 - \alpha / 90)^2$

$$i_{\nu} = (1 - \alpha / \emptyset)^2$$

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Date: 10.09.2020

SHAPE FACTOR

SI. No.	Shape of Base	sc	 Sq	Sγ
i)	Continuous strip	1.00	1.00	1.00
ii)	Rectangle	1 + 0.2 B/L	1 + 0.2 B/L	1–0.4 B/L
iii)	Square	1.3	1.2	0.8
iv)	Circle	1.3	1.2	0.6

Where,

= Cohesion in Kg/cm
= Depth of foundation in cm
= Depth factors
= Inclination factors
= Length of footing in cm
= Effective length of footing in cm
= Corrected standard penetration value
= Bearing capacity factors
$= \tan^2 (\pi/4 + 0/2)$
 Effective surcharge at the base level of Foundation
 Net ultimate bearing capacity based on general shear failure
= Correction factor for location of water table
= Inclination of the load to the vertical in
degrees
= Angle of shearing resistance of soil in degrees
= Bulk unit weight of foundation soil
= Factor of safety.

Date: 10.09.2020

Date: 10.09.2020

Fig. 1 – Site Photo Showing the Soil Exploration Work.

Name Of The Work : Geotechnical Investigation For The Proposed Construction Of Multi Level Car Parking at Maraimalai Adaigal Salai, Puducherry. • .

ASHHIRWAAD ANALYTICAL LABORATORY, PUDUCHERRY (NABL Accredited Laboratory - TC-8619)

	τ	JLR : TC86192000	0000278F							BO	RE LOG	- 1/2									ISO/IEC 17025:2005						
Project	No:	AAL.1638/Pdy/2020	Date:	29.	08.2020	Location: Maraimalai Adigal Salai					i, Puduche	erry		I	Index	prope	rties (%	6)	Sh stre	ear ength	G	iradatio	n prope	erties (%	6)		
DR. NO	epth	of boring (m) :	GWT (m):	22.00	2.80	Graphic	al Re	prese	entation	of	Insistency	re content) t/m³	(m	(M)	ex(lª)	ex (lc)	ex(Cs)	Direc	t shear est		Siev	ve analy	ysis			
Depth Below	tratum	Classification	Thickness	De	epth of	Stan	dard Fest I	Pene Data (tration N)		ription /cc	ral moistu (%)	bensity (quid limit (astic limit (sticity ind	stency ind	swell inde	g(cm²)	egrees)	avel	se sand	Im sand	sand	& clay		
GL	Soil st	soil	Layer (m)	UDS	DS	N Value	10) 20	30 40	50	Desc	Natu		יח	Ä	Pla	Consis	Free	с (k	∍p)	Ð	Coars	Mediu	Fine	silt		
					0.5																						
1.0		Fill up Earth			1.0																						
		Silty sand	2.50		1.5	7					Loose	19	1.44		Non-I	Plastic	;	Nil	0.025	31º22'	15.35	6.22	46.06	29.46	2.90		
2.0		with brocken bricks			2.0		I																				
					2.5	5					Loose	19	1.57		Non-I	Plastic	;	Nil	0.045	31º10'	0.72	1.81	45.85	48.74	2.89		
3.0					3.0																						
					3.5	8					Loose																
4.0					4.0		Ī																				
					4.5	8					Loose																
5.0					5.0		۲																				
		Light Brown			5.5	15					Medium	23	1.70		Non-I	Plastic	;	Nil	0.030	30°45'	0.00	1.45	72.73	24.73	1.09		
6.0		Sand	6.50		6.0			Ī																			
		(SW)			6.5	16					Medium																
7.0					7.0			Ì																			
					7.5	18					Medium	18	1.76		Non-I	Plastic	;	Nil	0.065	31º22'	1.02	4.41	60.68	32.88	1.02		
8.0				-	8.0						Ven																
				-	8.5	3					Loose											-					
					9.0		İ																				
9.0		Black			9.5		\parallel																				
10.0		Clay (CH)	1.00	*	10.0	1 (30cm)					Very Soft	43	1.19	72	31	41	0.71	90	0.152	4º10'	0.00	0.00	0.00	3.52	96.48		
Project	No: A	AAL.1638/2020	1	ļl		"A Tota	al So	lutior	Provide	r in (Civil Engi	neerin	g"		I	*	Self Pe	enetrati	on	<u> </u>		<u> </u>	I	21	/26		

Name Of The Work : Geotechnical Investigation For The Proposed Construction Of Multi Level Car Parking at Maraimalai Adaigal Salai, . Puducherry.

ASHHIRWAAD ANALYTICAL LABORATORY, PUDUCHERRY (NABL Accredited Laboratory - TC-8619)

	1	ULR : TC86192000	0000278F					BO	RE LOG	- 1/2								Shoor								
Project	No:	AAL.1638/Pdy/2020	Date: GWT (m):	31.	08.2020 2 80	Location:	Location: Maraimalai Adigal Salai							Index	prope	erties (%	b)	Sh stre parar	ear ength neters	Gradation properties (%)						
Dii. No	epth	of boring (m) :		22.00	2.00	Graphic	al Re	epresentation	of	onsistency	Ire content) t/m³	(M)	(W F)	ex(l₀)	ex (lc)	ex(Cs)	Directe	t shear est		Siev	ve anal	ysis			
Depth	atum	Classification	Thickness	De	epth of	Stan	dard	Penetration		iption /a	al moistu (%)	ansity (uid limit (stic limit	ticity ind	ency ind	swell ind	/cm²)	grees)	Ivel	e sand	nsand	sand	k clay		
Below	l sti	or	or	Sam	ipling(m)		lest	Data (N)			atur	ä	Ŀ	Pla	Plas	Isist	Lee:	c(kg	iəp)	õ	ars	diu	ine	sit 8		
GL	Soi	soil	Layer (m)	UDS	DS	N Value	10	0 20 30 40	50		Ż					Š	ш	0			8	Me	Ľ	0)		
		Black Clay (CH)	1.00	_	10.5		\sum				_															
11.0					11.0	13				Medium	23	1.56		Non-	Plastic	2	Nil	0.092	29°55'	0.00	0.00	35.27	64.00	0.73		
		Black Silty sand (SM-	1.00		11.5																					
12.0		SW)			12.0	2				Soft	42	1.05	72	31	41	0.73	100	0.195	4º41'	0.00	0.00	0.00	0.0	100.00		
					12.5																					
13.0				*	13.0	1 _(30cm)	[Very Soft																
					13.5		I																			
14.0				-	14.0	3				Medium																
					14.5		ľ																			
15.0					15.0	5				Stiff	48	1.21	78	35	37	0.73	80	0.122	5º11'	0.00	0.00	0.00	1.25	98.75		
		51.1			15.5		1																			
16.0		Black Clay	7.50		16.0	4				Medium	-						-				-					
		(CH)			16.5		╎┥																			
17.0				-	17.0	4				Medium																
				-	17.5		╎┥																			
18.0					18.0	5				Stiff	-															
1010				-	19.5																					
				-	10.0	_				-	54		75	20	40	0.50	400	0.004	004.02	0.00	0.00	0.00	0.04	07.70		
19.0				-	19.0	4				Medium	51	1.11	75	32	43	0.56	100	0.234	0°10	0.00	0.00	0.00	2.24	97.76		
		Silty sand		4	19.5	-			-	_														<u> </u>		
20.0		(SM-SW)	0.50		20.0	41	Dense	20	1.65		Non-	Plastic	0	Nil	0.064	31º10'	0.00	0.00	0.00 18.57 78.57 2.86							
Project	No:	AAL.1634/2020				"A Tota	"A Total Solution Provider in Civil Engineering" * Self Penetration										22/26									

Name Of The Work : Geotechnical Investigation For The Proposed Construction Of Multi Level Car Parking at Maraimalai Adaigal Salai,.Puducherry.

ASHHIRWAAD ANALYTICAL LABORATORY, PUDUCHERRY (NABL Accredited Laboratory - TC-8619)

	ULR : TC86192000000278F BORE LOG - 1/2																		100/120 11025/2005							
Projec BH. No	t No: :	AAL.1638/Pdy/2020 1	Date: GWT (m):	01.	.09.2020 2.80	Location:	Location: Maraimalai Adigal Salai, F					rry ₩			Index	prope	rties (%	»)	Sh stre parar	ear ength neters	Gradation properties (%)					
	Depth	of boring (m) :		22.00		Graphic	nical Representation of				onsistenc	ure conte) t/m ³	(w)	:(Wr)	tex(l₀)	tex (Ic)	lex(Cs)	Direct te	t shear est		Siev	/e analy	vsis		
Depth Below	stratum	Classification of	Thickness of	De San	epth of npling(m)	Stan	Standard Penetration Test Data (N)					ural moist (%)	Density (iquid limit	lastic limit	asticity inc	istency inc	e swell inc	kg/cm²)	legrees)	àravel	rse sand	ium sand	e sand	t & clay	
GL	Soil	soil	Layer (m)	UDS	DS	N Value	10	0 20	30 40	50	D	Ξ.		1	ш	E	Cons	Ηe	Ŭ	J	0	å	Med	Ë	sil	
21.0		Silty sand (SM-SW)	2.00		20.5	3					Medium	43	1.25	72	35	37	0.78	100	0.211	5º25'	0.00	0.00	0.00	2.56	97.44	
22.0		Clay (CH)	1.00		21.5	4					Medium															
22.0					22.0	4					Wicdiam															

Project No: AAL.1638/2020

"A Total Solution Provider in Civil Engineering"

23/26

Name Of The Work : Geotechnical Investigation For The Proposed Construction Of Multi Level Car Parking at Maraimalai Adigal Salai, Puducherry.

ASHHIRWAAD ANALYTICAL LABORATORY, PUDUCHERRY (NABL Accredited Laboratory - TC-8619)

	τ	ULR : TC861920000000279F BORE LOG - 2/2																		ISO/IEC 17025:2005							
Project	No:	AAL.1638/Pdy/2020	Date: GWT (m):	1.0	9.2020	Location:	ocation: Maraimalai Adigal Sala							I	ndex	prope	rties (%)	Sh stre parar	ear ngth neters	Gradation properties (%)						
Dinitio	Depth of boring (m) : 22.00			2.00	Graphical Representation of					onsistency	re conten) t/m³	(M)	(M¢)	ex(l _e)	ex (lc)	ex(Cs)	Direct	t shear est		Siev	ve analy	/sis				
Depth Below	stratum .	Classification	Thickness of	De Sam	epth of pling(m)	Stand	dard Fest I	Pene Data (tration N)		scription /co	ural moistu (%)	Density (iquid limit (lastic limit	asticity ind	istency ind	e swell ind	kg/cm²)	legrees)	òravel	rse sand	ium sand	e sand	t & clay		
GL	Soil	soil	Layer (m)	UDS	DS	N Value	1(0 20	30 40	50	ă	Nat			а.	E	Cons	Fre	с С	5)	0	Sa	Medi	Ē	Si.		
					0.5																						
1.0		Fill Up Earth			1.0						verv																
		Silty Sand	2.50		1.5	1					Loose	22	1.68		Non-	Plastic		Nil	0.113	29º12'	0.00	0.00	63.40	35.47	1.13		
2.0		with brocken bricks			2.0		\backslash																				
				-	2.5	7					Loose	16	1.52		Non-	Plastic	:	Nil	0.076	31º10'	4.76	8.33	55.56	28.97	2.38		
3.0					3.0																						
					3.5	9					Loose	20	1.61		Non-	Plastic		Nil	0.085	30º45'	1.60	1.60	55.60	39.20	2.00		
4.0					4.0		1																				
					4.5	13		\mathbf{N}			Medium																
5.0					5.0		_																				
		Light Brown			5.5	17					Medium	17	1.56		Non-	Plastic		Nil	0.065	30º22'	0.00	0.00	60.37	37.78	1.85		
6.0		Sand (SW)	6.50		6.0																						
		(011)			6.5	12					Medium	18	1.64		Non-	Plastic		Nil	0.073	31º32'	2.52	16.19	67.27	14.03	0.00		
7.0					7.0																						
					7.5	10					Loose																
8.0	_				8.0			/																			
					8.5	6					Loose	26	1.42		Non -	Plasti	C	Nil	0.058	30°45'	0.00	0.00	37.39	60.00	2.61		
9.0					9.0						-							-									
0.0		Black Clay (CH)	1.00		9.5						very																
10.0		,			10.0	2					Loose	42	1.56	78	35	43	0.84	80	0.201	6º16'	0.00	0.00	0.00	1.56	98.44		

Project No: AAL.1638/2020

"A Total Solution Provider in Civil Engineering"

* Self Penetration

24/26

BH - 1 GRAIN SIZE DISTRIBUTION CURVE

Project. No: AAL.1638/2020 "A Total Solution Provider in Civil Engineering" 25/26

BH - 2 GRAIN SIZE DISTRIBUTION CURVE

Project. No: AAL.1638/2020 "A Total Solution Provider in Civil Engineering" 26/26