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Application of VES Techniques for Building Foundations in Mysuru city

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ABSTRACT

In order to estimate the structural competency of the sub-surface geological features of the Construction site, the application was performed for data attainment using Schlumberger configuration of the resistivity profiling and Vertical Electrical Sounding (VES) around outer ring road of Mysore City. A 1D numerical reversal of discrete DC resistivity was applied to boost the results for better accomplishment of the study objective. For the edifice of geo-electric sections displaying the key geo-electric physiognomies of the geological entities existing in the subsurface region, the data obtained from the VES techniques were used. The interpretation outcomes reveals the geo-electric segments comprise of 3 to 4 layers explicitly: vegetative topsoil, highly weathered silty loam soil, moderately weathered rock and massive hard rock. The stratum thicknesses and resistivities vary from 1.2 - 1.55 m/31 - 132 Ohm-m, 0.2- 3.875m/ 24 - 300 Ohm-m and 2.5 – 12.76 m/ 27.2 – 1000 Ohm-m and 50 – 1840 Ohm-m respectively. Based on geophysical study of the region states, design of shallow substructure for average civil engineering projects in the extremely and moderately weathered layers are the most competent beds and for multistoried structures, the undeformed hard rock zone is formidable.

KEYWORDS: *Schlumberger Configuration, Multistoried Structures, Geo-electric Section, Substructure, VES.*

INTRODUCTION

In Civil structures, foundation investigation is a noteworthy programme. Numerous approaches have been attempted for the efficacy of foundation design assessments. Geophysical techniques have been extensively used for a broad range of engineering and environmental issues, predominantly electrical resistivity techniques (Zohdy, 1975; Baker, 1980; Boyce, 1996; Mousa, 2003; Olorunfemi et al., 2004; Hosny et al., 2005; Alotaibi and Alamri, 2007; Nigm et al., 2008; and Oyedele et al., 2009). Electrical resistivity surveys comes handy during subsurface geological and geotechnical studies due to its low cost, data acquisition in less time and user friendly, hence it is universally used in civil engineering application (Al – Sayed and El – Qady, 2007; Omoyoloye et al., 2008; Adeoti et al., 2008; and Mahmoud et al., 2009). Its application is further assessed in groundwater exploration; unravel of buried structures, artifacts, contamination source and bearing of leachate. The purpose of this study was to explore the subsurface conditions around outer ring road of Mysore city with the objective of determining the competency and stability of the soil before it comes in contact with subsurface structure.

GEOLOGY OF STUDY AREA

The Mysore district of Karnataka state, South India is bounded by North Latitudes 11°44'29.37" – 12°39'11.1" and East Longitudes 75°54'40" – 77°08'0.09" covering an area of 6311 Sq. km. Most of the rock types of Mysore districts belong to the ancient supracrustal rocks, of Sargur group. These rocks have been subjected to 3 cycles of deformation and 2 cycles of metamorphism which is greater than 3B.y of amphibolite facies and 2.5B.y of old upper amphibolite to granulite facies of metamorphism (Figure 1) (Prakash Narasimha et al., 2009).

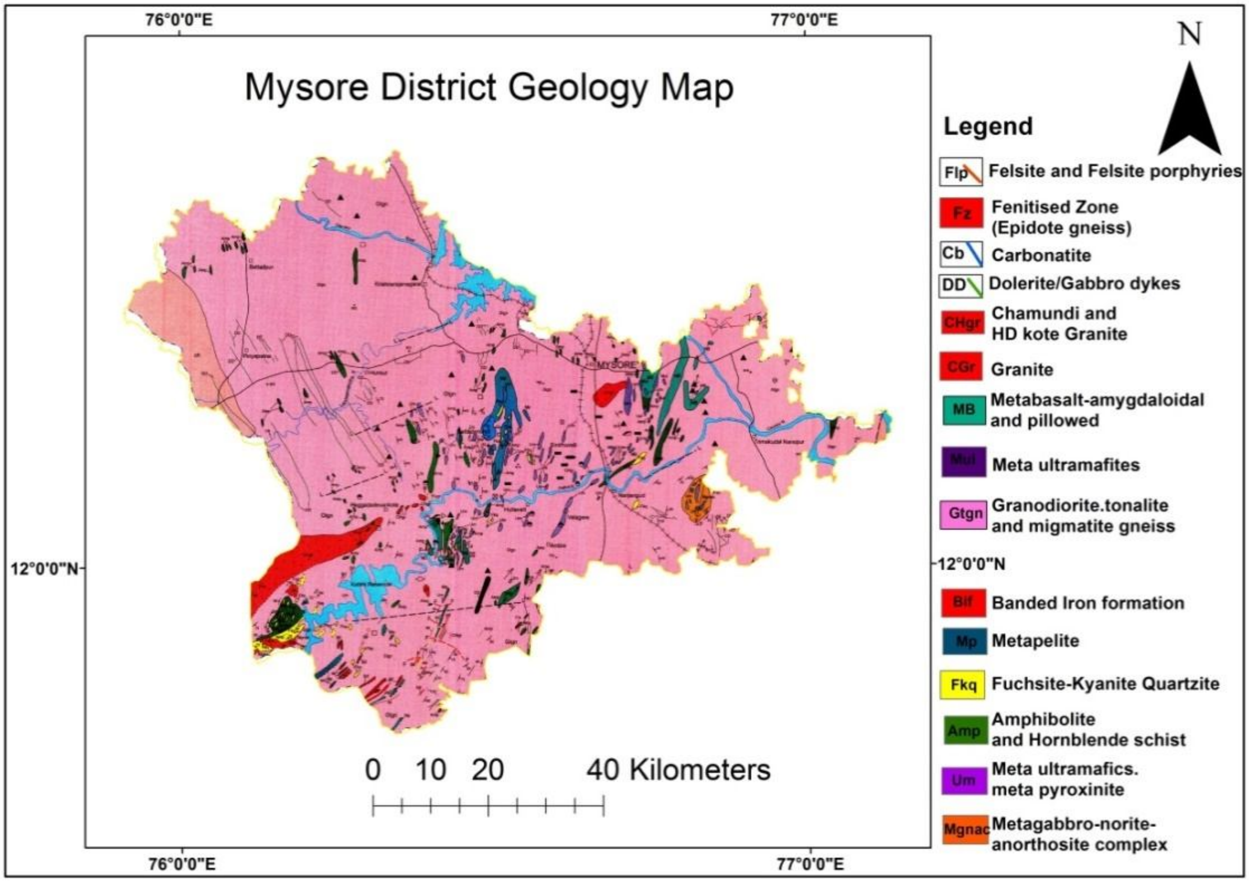


Figure 1: Geology Map of Mysore District [Ref. Data Base 1992, Geological Survey of India]

Soil of study area

Soil plays a vital role in augmenting the groundwater recharge and also shaping the parameters for the betterment of foundation design. The study area consists of Sandy loam, Red sandy loam, Red loam and mixed loam. The depth of soil varies from place to place i.e. from few centimeters to meters. The description of soils of the study area is given below (Figure 2).

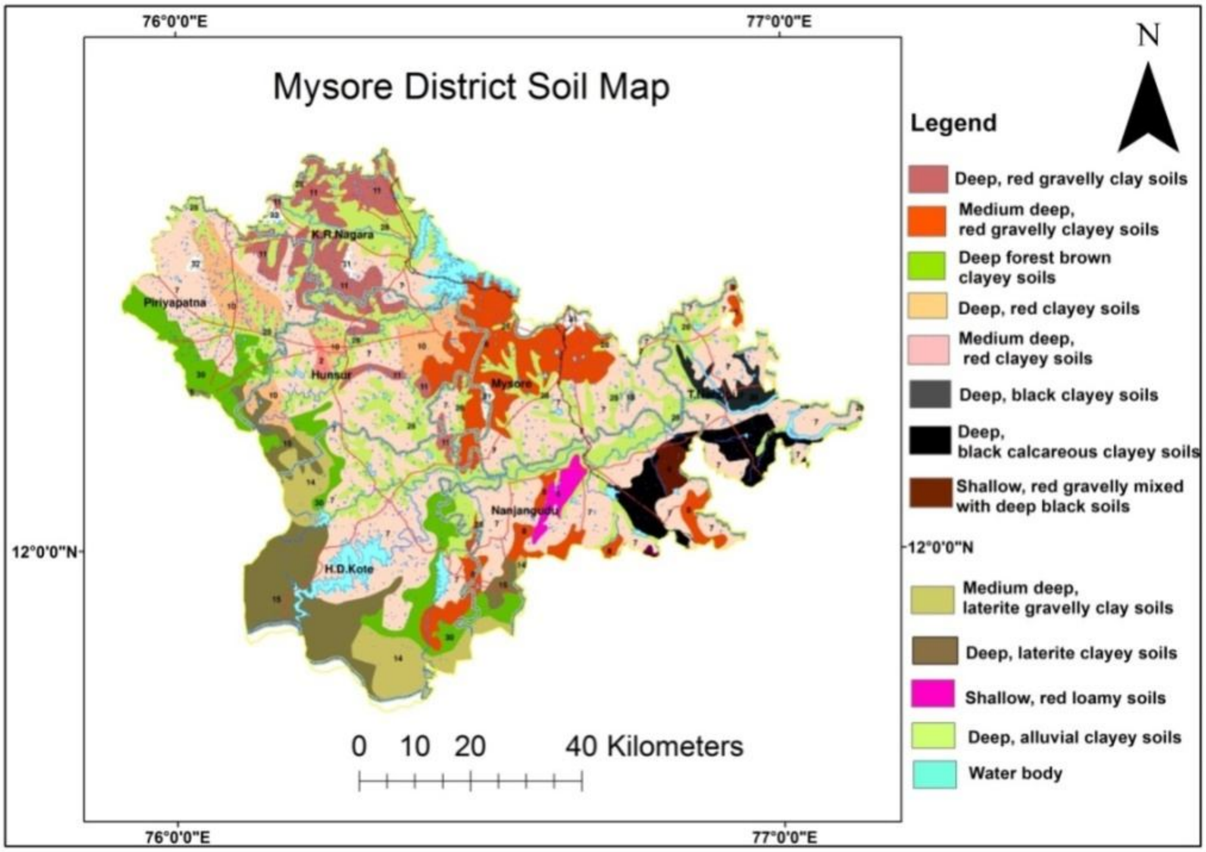


Figure 2: Soil Map of Mysore District [Ref. Shiva Prasad et al. (1998). Soils of Karnataka for optimizing land use NBSS Publ. 47]

MATERIALS AND METHODS

Application of Schlumberger configuration was carried out at 10 numbers of points within the study area (Figure 3). Initial data interpreting phase was achieved via the VES data that were attained with origin software version 2.6 and matches with two-layer master curves and auxiliary curves (Orellana and Mooney, 1966, 1972; Zohdy, 1973). The resistivity data of subsurface stratum functioned as the input for interpretation of subsurface soil and lithology with respect to its thickness, depth and other parameters (Zohdy, 1973, 1975, 1989; Omowumi, Falae Philips, 2014). These results are further used for geotechnical investigation.

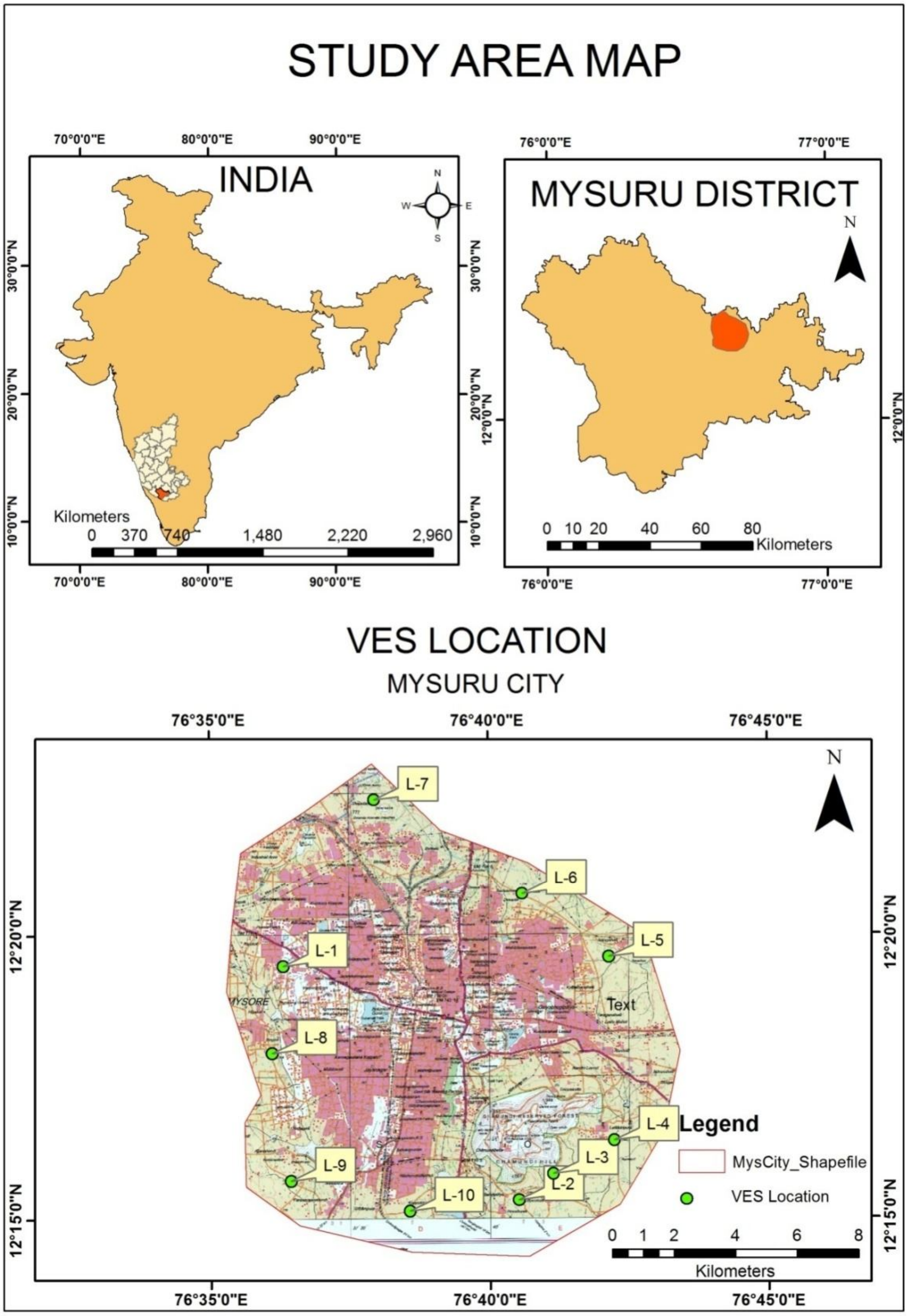


Figure 3: VES locations of study area

RESULTS AND DISCUSSION

The geophysical investigation results were represented as Sounding Curves, Geo-electric sections and Maps. All VES points are interpreted in layer models in Figure 5-14. From the above profiling and VES results (Table 1 & 2) the subsurface soil profile is broadly categorized into 3 types, in first category L1, L3, L5 and L8 locations matches with K and A master curves and consists an average of 3m vegetative hard soil, 3m to 6m highly weathered rocks with silty loam soil, 6m to 10m moderately weathered rock with sandy loam soil and beyond 10m it comprises massive hard rock. The interpretation results show the three geoelectric layers for VES L1 and L3, and the four geoelectric layers for VES L2 and L4 — L10 (Table 3). It is highly favourable for the construction of multistoried civil structures with less engineering treatment providing by mat or raft foundation upto 5 to 6 course. In second category L2, an L4 and L7 location represents K, H and A master curves. It comprises an average of 3m vegetative loamy soil cover, 4m to 10m of highly weathered, fractured and jointed rocks with silty sand soil, below 10m it indicates moderately weathered rocks with sandy soil and hard rock was not encountered. Hence it required engineering treatment by giving pile foundation through hard rock for the construction of earthquake resistant civil structures. Whereas in last case L6, L9 and L10 location represents Q, H and K curves, exhibits an average of 4m vegetative soil cover and below 4m it indicates highly weathered, fractured and jointed rocks with silty sandy soil. No hard rock encountered till 20m depth hence it required strong foundation by providing grouting till hard rock for pile foundation for multistoried civil structures.

Table 1: Electrical resistivity profiling data

Coordinates	Location No	Altitude in meters (MSL)	AB/2 in meters	MN/2 in meters	ρ^a in Ohm meters	Coordinates	Location No	Altitude in meters (MSL)	AB/2 in meters	MN/2 in meters	ρ^a in Ohm meters
N 12°19'27.1" E 76°36' 18.8"	L1A	768	10	2	35.2	N 12°20'43.2" E 76°40' 36.1"	L6A	670	10	2	135.42
			20	2	60				20	2	208
	L1B		10	2	46.39		L6B		10	2	158.81
			20	2	62.4				20	2	156
	L1C		10	2	51.91	N 12°22'23" E 76°37' 57"	L7A	740	10	2	93.69
			20	2	59.65				20	2	168.88
N 12°15'19.2" E 76°40' 31.3"	L2A	720	10	2	125.83		L7B		10	2	73.82
			20	2	168				20	2	129.37
	L2B		10	2	264.25	N 12°17'55" E 76°36' 6.6"	L8A	750	10	2	50.33
			20	2	374.4				20	2	78
	L2C		10	2	219.64		L8B		10	2	47.54
			20	2	374.4				20	2	86.07
N 12°15'46.9" E 76°41' 8.4"	L3A	730	10	2	101.76	N 12°15'40" E 76°36' 26"	L9A	730	10	2	32.72
			20	2	74.29				20	2	32.12
	L3B		10	2	8.09		L9B		10	2	24.43
			20	2	78.49				20	2	31.2
	L3C		10	2	113.89	N 12°15'8" E 76°38' 34"	L10A	730	10	2	68.42
			20	2	159.32				20	2	78
N 12°16'22" E 76°42' 14"	L4A	730	10	2	41.66		L10B		10	2	92.72
			20	2	39				20	2	126.29
	L4B		10	2	33.1	---	---	---	---	---	---
			20	2	34.67	---	---	---	---	---	---
N 12°19'36" E 76°42' 9"	L5A	740	10	2	130.41	---	---	---	---	---	---
			20	2	206.24	---	---	---	---	---	---
	L5B		10	2	100.97	---	---	---	---	---	---
			20	2	202.38	---	---	---	---	---	---

Table 2: Vertical electrical sounding data

Sl No.	Location	Coordinates	AB/2 in meters	MN/2 in meters	ρa in Ohm meters	Sl No.	Location	Coordinates	AB/2 in meters	MN/2 in meters	ρa in Ohm meters
1	L – 1	N 12°19'27.1" E 76°36' 18.8"	1.5	0.5	35.36	31	L – 4	N 12°16'22" E 76°42' 14"	1.5	0.5	37.8
2			2		36.05	32			2		38.09
3			3		39.42	33			3		36.67
4			4.5		43.87	34			4.5		37.59
5			6		46.24	35			6		39.51
6			8		51.06	36			8		49.2
7			10		58.78	37			10		43.24
8			10	2	53.43	38			10	2	49.47
9			15		69.48	39			15		52.11
10			20		88.54	40			20		58.87
11	L – 2	N 12°15'19.2" E 76°40' 31.3"	1.5	0.5	82.1	41	L – 5	N 12°19'36" E 76°42' 9"	1.5	0.5	67
12			2		92.12	42			2		75.73
13			3		112.95	43			3		85.47
14			4.5		131.28	44			4.5		85.41
15			6		141.6	45			6		96.02
16			8		144.22	46			8		118.62
17			10		174.17	47			10		140.25
18			10	2	171.97	48			10	2	132.46
19			15		215.06	49			15		150.23
20			20		245.14	50			20		202.53
21	L – 3	N 12°15'46.9" E 76°41' 8.4"	1.5	0.5	45.94	51	L – 6	N 12°20'43.2" E 76°40' 36.1"	1.5	0.5	108.86
22			2		52.4	52			2		116.96
23			3		64.82	53			3		124.47
24			4.5		83.76	54			4.5		136.39
25			6		96.42	55			6		139.52
26			8		106.98	56			8		129.23
27			10		110.65	57			10		132
28			10	2	109.14	58			10	2	132.13
29			15		116.51	59			15		133.05
30			20		117	60			20		139.58

Sl No.	Location	Coordinates	AB/2 in meters	MN/2 in meters	ρa in Ohm meters	Sl No.	Location	Coordinates	AB/2 in meters	MN/2 in meters	ρa in Ohm meters
61	L – 7	N 12°22'23" E 76°37' 57"	1.5	0.5	82.69	81	L – 9	N 12°15'40" E 76°36' 26"	1.5	0.5	44.1
62			2		87.2	82			2		40.17
63			3		98.29	83			3		33.35
64			4.5		115.51	84			4.5		31.7
65			6		136.58	85			6		33.03
66			8		96.7	86			8		31.63
67			10		111.96	87			10		32.43
68			10	2	93.48	88			10	2	29.94
69			15		126.33	89			15		32
70			20		173.33	90			20		38.32
71	L - 8	N 12°17'55" E 76°36' 6.6"	1.5	0.5	32.81	91	L – 10	N 12°15'8" E 76°38' 34"	1.5	0.5	124.95
72			2		34.26	92			2		103.17
73			3		37.32	93			3		92.58
74			4.5		35.6	94			4.5		91.62
75			6		39.85	95			6		96.63
76			8		40.06	96			8		87.94
77			10		50.56	97			10		76
78			10	2	37.75	98			10	2	80.08
79			15		47.37	99			15		86.85
80			20		78	100			20		83.2

Table 3: Thickness of layers classified using VES techniques.

L1					**L6**				
Layer	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**	**Layer**	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**
1	33.5	1.4	1.4	K and A	1	110	1.55	1.55	K and H
2	50.25	9.8	11.2		2	165	3.875	5.425	
3	1000	∞	∞		3	94.25	3.9	9.325	
--	--	--	--		4	156.25	∞	∞	
L2					**L7**				
Layer	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**	**Layer**	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**
1	72	1.2	1.2	K , H and A	1	78	1.45	1.45	K, H and A
2	25.2	0.72	1.92		2	195	3.625	5.075	
3	180	3.9	5.82		3	42.6	2.9	7.975	
4	387.5	∞	∞		4	1560	∞	∞	
L3					**L8**				
Layer	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**	**Layer**	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**
1	43	1.5	1.5	K and A	1	31	1.35	1.35	K and A
2	215	1.2	2.7		2	62	0.54	1.89	
3	170	∞			3	47.5	9.24	11.13	
--	--	--	--		4	1840	∞	∞	
L4					**L9**				
Layer	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**	**Layer**	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**
1	37	1.4	1.4	K, H and A	1	48	1.2	1.2	Q, H and K
2	46.25	0.658	2.058		2	24	0.9	2.1	
3	32	2.5	4.558		3	27.2	12.76	14.86	
4	72	∞			4	145	∞	∞	
L5					**L10**				
Layer	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**	**Layer**	**Res. (ohm-m)**	**Thickness in meters**	**Depth in meters**	**Master Curve**
1	60	1.3	1.3	K and A	1	132	1.38	1.38	Q, H and K
2	300	2.6	3.9		2	39.6	0.4	1.78	
3	102.5	4.6	8.5		3	111	3.61	5.39	
4	1100	∞	∞		4	50	∞	∞	

All the Profiling (40m interval) and VES were carried out up to a depth of 20m. Profiling was carried out parallel to the strike of the rock formations and sounding perpendicular to the strike of the rock.

Location 1: Vijaynagar 3rd stage, Mysore City (N 12°19'27.1" E 76°36' 18.8").

At the back side of Sapthamathrike temple, Vijaynagar 3rd stage, horizontal profiling is carried out at 3 sub points having 40 meters interval to determine ground resistance. In this area electrical resistivity value ranges from 35.2 'Ωm to 51.91 'Ωm at 10m depth and 59.65 'Ωm to 62.4 'Ωm at 20m depth. Low resistance values 35.2 'Ωm were recorded in western direction and high resistance value 62.4 'Ωm in eastern direction. In engineering constructions high resistance recorded areas are more favourable for foundation (Figure 4a).

The S line method (Figure 4b) adapted to interpret the log – log graph matches with K and A type curves. As indicated by VES values, soil cover up to 8m is seen. The hard weathered rock zone starts from 8m and extends up to 10m with fractured and jointed rocks. 10m onwards presence of massive rock is indicated.

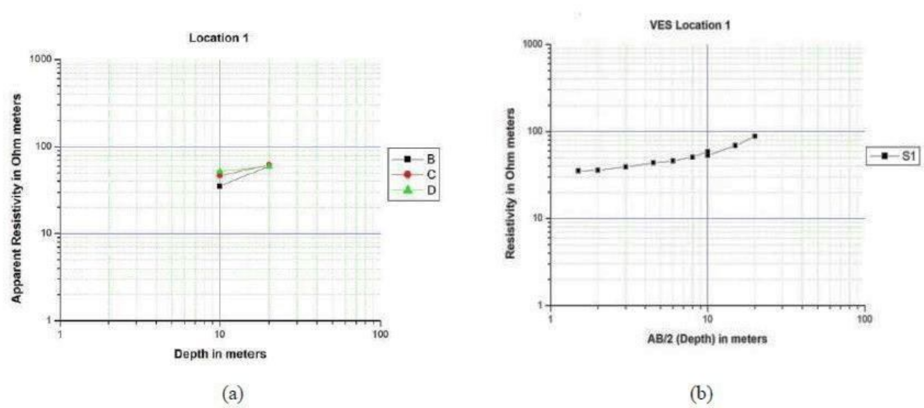
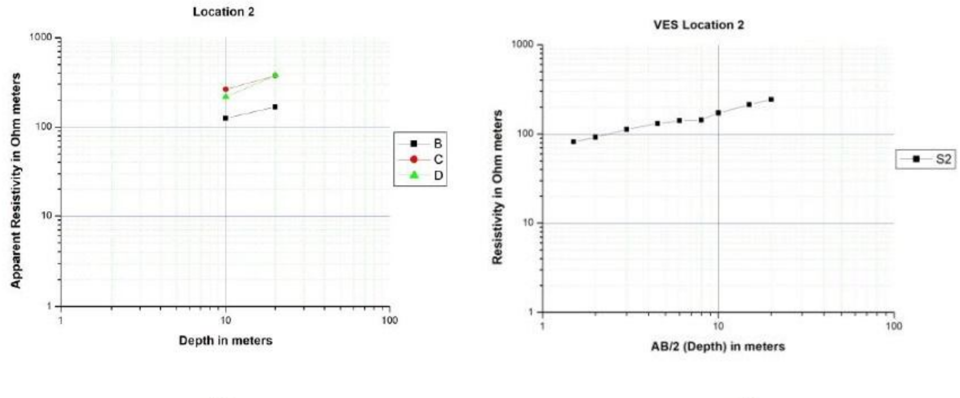


Figure 4a & 4b: Location 1 graphical representation of resistivity profiling and VES data, Vijaynagar 3rd stage, West of Mysore city.

Location 2: South of Chammundi hill, Mysore city (N 12°15'19.2" E 76°40' 31.3").

Towards south of Chammundi hill on right side of ring road (on the way to Devalapura village), horizontal profiling is carried out at 3 sub points having 40 meters interval. In this area electrical resistivity value ranges from 125.83 'Ωm to 219.64 'Ωm at 10m depth and 168 'Ωm to 374.4 'Ωm at 20m depth. Lowest resistance value is 125.83 'Ωm and highest resistance value is 374.4 'Ωm. High resistance values are recorded at shallow depth, due to granitic outcrop. Hence it is highly suitable for construction of multistoried structures consisting 3 course of raft foundation (Figure 5a).

Interpretation of the log – log graph matches with K, H and A type of master curves. As indicated by the VES values 0 to 3 meters indicates silty sandy soil, 3m to 8m shows moderately weathered rocks, fractured and jointed rocks with sandy soil and beyond 8 meters represents massive hard rock (Figure 5b).

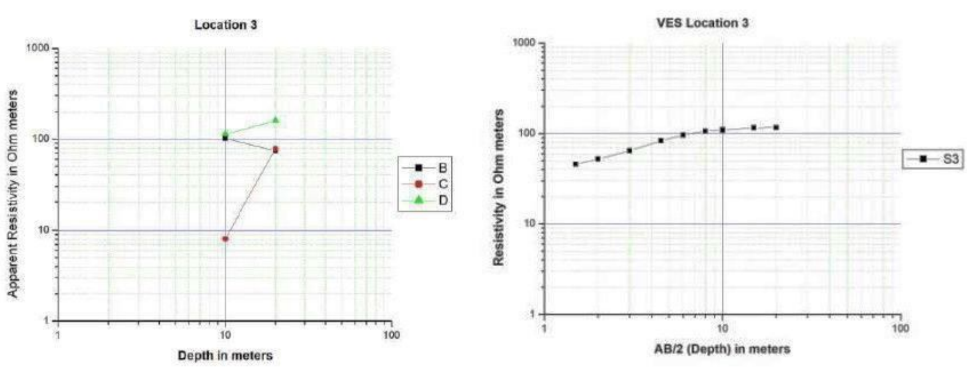


(a) (b)

Figure 5a & 5b: Location 2 graphical representation of resistivity profiling and VES data, South of Chammundi hill, Mysore city.

Location 3: Alanahalli, Mysore city (N 12°15'46.9" E 76°41' 8.4").

Horizontal profiling at Extension of Chamundi hill towards SW direction and North to the left side of outer ring road having 3 sub points at 40 meters interval is carried out. Electrical resistivity value ranges from 101.76 'Ωm to 113.89 'Ωm at 10m depth and 74.29 'Ωm to 159.32 'Ωm at 20m depth. Lowest resistance value is 74.29 'Ωm and the highest resistance value is 159.32 'Ωm. This indicates high resistance at foot hill consists granite rock and low resistance recorded towards the outer ring road due to thick top soil cover and moderately weathered rock. High resistance zones are highly recommended for multistoried structures and low resistance recorded ones, required engineering treatments like 5 to 6 course of raft foundation or pile foundation or column foundation from the basement as an earthquake resistant structure (Figure 6a). Interpreted log – log graph matched with K and A type master curves (Figure 6b). Based on VES values 0 to 2 meters indicate hard soil cover, 2 – 6 meters shows moderately weathered, fractured and jointed rocks with sandy soil type and 6 meters onwards represents hard rock.



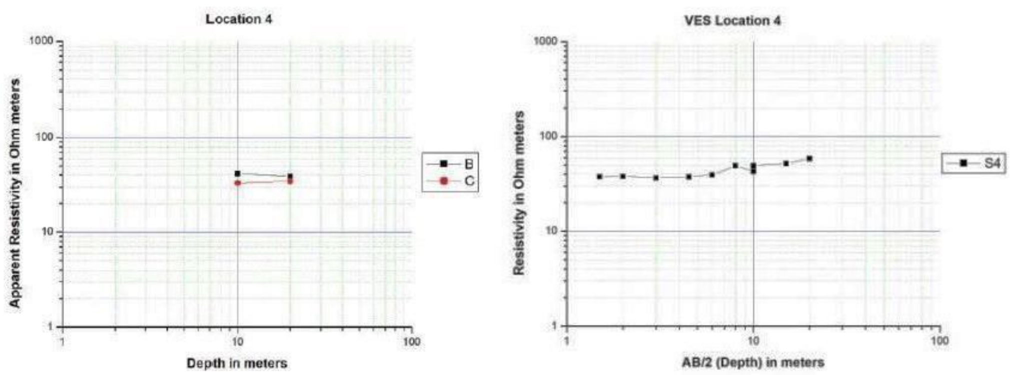
(a) (b)

Figure 6a & 6b: Location 3 graphical representation of resistivity profiling and VES data, Alanahalli, East of Mysore city.

Location 4: IPS Sreenivas Nagar, Mysore city (N 12°16'22" E 76°42' 14").

It is located towards SW direction of Chamundi hill and to the right side of outer ring road (IPS Sreenivas Nagar). Horizontal profiling of 2 sub points at 40 meters interval is carried out. Resistivity value is 33.1 Ωm and 41.66 Ωm at 10m depth, whereas 34.67 Ωm and 39.0 Ωm at 20m depth respectively. Lowest resistance value is 33.1 Ωm and highest resistance value is 41.66 Ωm. This area consists low to moderate resistivity values. Hence foundation requires certain engineering treatment like 5 to 6 course of raft foundation or column foundation etc. (Figure 7a).

VES log – log graph matched with K, H and A type master curves (Figure 7b). Apparent resistivity data up to 6m indicates hard loamy soil, 7m to 15m shows highly weathered, fractured and jointed rocks with sandy silt soil and beyond 15m represents moderately weathered rock.



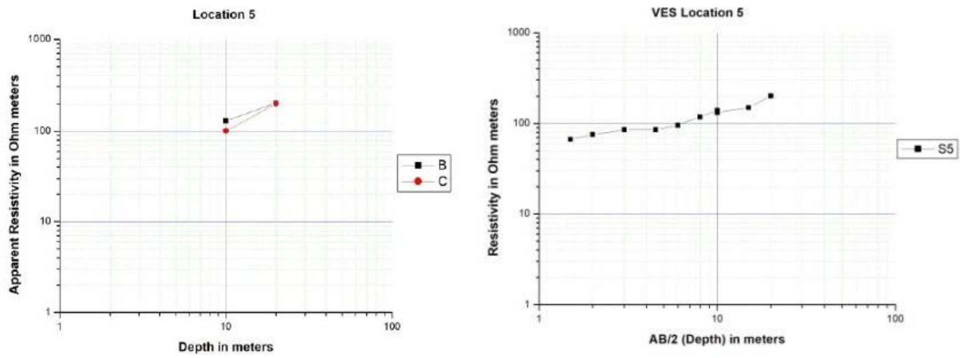
(a) (b)

Figure 7a & 7b: Location 4 graphical representation of resistivity profiling and VES data, IPS Sreenivas Nagar, East of Mysore city.

Location 5: Sathagalli, Mysore city (N 12°19'36" E 76°42' 9").

Survey was carried out at the back side of VTU regional center around 800meters away from ring road, Sathagalli, Mysore city. Horizontal profiling of 2 sub points at 40 meters interval gives resistivity value of 130.41 Ωm and 100.97 Ωm at 10m depth whereas 206.24 Ωm and 202.38 Ωm at 20m depth respectively. Lowest resistance value is 100.97 Ωm and highest resistance value is 206.24 Ωm. This area holds high resistance values due to weathered granites and dolerite dyke formations. Hence it is more favorable for the construction of multistoried structures and requires less engineering treatment (Figure 8a).

Interpretation of the double log graph matches with K and A type master curves (Figure 8b). As shown by the VES values, it indicates hard soil up to 3m; 3m to 8m shows highly weathered, fractured and jointed rocks with sandy soil and 8m to 10m represents moderately weathered rock as sandy soil and 10m onwards massive hard rock is present.



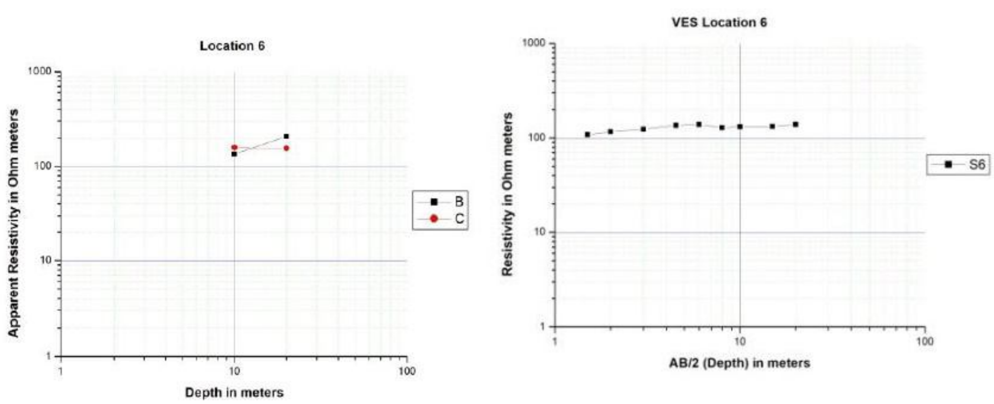
(a) (b)

Figure 8a and 8b: Location 5 graphical representation of resistivity profiling and VES data, Sathagalli, Northeast of Mysore city.

Location 6: Hale Kesare, Mysore city (N 12°20'43.2" E 76°40' 36.1").

Geophysical survey was carried out at the back side of HP gas agency, Hale Kesare around 300meters left side of ring road, where dolerite dyke is running NS direction. Horizontal profiling of 2 sub points at 40 meters interval gives 135.42 'Ωm and 158.81 'Ωm at 10m depth, whereas 208 'Ωm and 156 'Ωm at 20m depth respectively. Lowest resistance value is 135.42 'Ωm and highest resistance value is 208 'Ωm. This area encloses dolerite dykes as an intrusion within the granitic terrain. Hence, high resistance values were recommend for the construction of multistoried structures and requires less engineering treatment (Figure 9a).

Interpretation of the double log graph matches with K and H type master curves (Figure 9b). Graph indicates hard vegetative soil up to 2 meters. Highly weathered, fractured and jointed rocks along with silty sandy soil from 3m to 6m and 6m onwards moderately weathered rock as sandy soil is present.



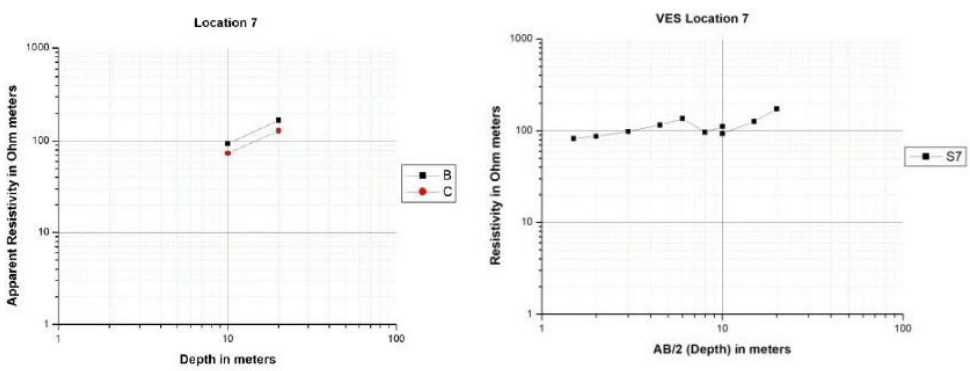
(a) (b)

Figure 9a and 9b: Location 6 graphical representation of resistivity profiling and VES data, Hale Kesare, North of Mysore city.

Location 7: Shyadanahalli, Mysore city (N 12°22'23" E 76°37' 57").

Geophysical prospecting was carried out at Sapthagiri layout, two Kms away from ring road near J.K Tyre & industries, Shyadanahalli. At 40 meters interval horizontal profiling is conducted. This area predominantly consists of felsite rocks having resistivity values of 93.69 'Ωm and 73.82 'Ωm at 10m depth whereas 168.88 'Ωm and 129 'Ωm at 20m depth respectively. Lowest resistance value is 73.82 'Ωm and highest resistance value is 168.88 'Ωm. Hence this point is more suitable for the construction of multistoried structures and required less engineering treatment (Figure 10a).

Double log graph matches with K, H and A type master curves (Figure 10b). Apparent resistivity value indicates hard soil up to 2 meters. 3m to 6m shows highly weathered, fractured and jointed rocks with sandy soil. 7m to 10m represents moderately weathered rock as sandy soil and beyond 10m represents massive hard rock.



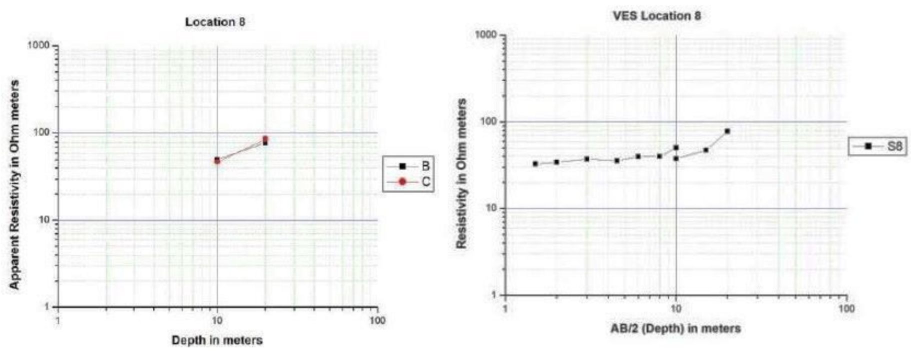
(a) (b)

Figure 10a and 10b: Location 7 graphical representation of resistivity profiling and VES data, Shyadanahalli, west of Mysore city.

Location 8: SBM layout, right side of Bogadi ring road, Mysore city (N 12°17'55" E 76°36' 6.6").

Horizontal profiling was carried out near SBM layout, right side of Bogadi ring road, Mysore city at 40 meters interval (Figure 11a). Electrical resistivity values are 47.54 'Ωm and 50.33 'Ωm at 10m depth, whereas 78 'Ωm and 86.07 'Ωm at 20m depth respectively. Lowest resistance value is 47.54 'Ωm and highest resistance value is 86.07 'Ωm. Due to thick soil profile, it is showing low to moderate resistivity values. Therefore foundation requires certain engineering treatment like 5 to 6 course of raft foundation or column foundation etc.

VES log – log graph matches with K and A type master curves (Figure 11b). Apparent resistivity indicates vegetative top soil up to 3m. From 4m to 10m it shows highly weathered, fractured and jointed rocks with sandy loamy soil. 10m onwards it represents moderately weathered rock as sandy silt soil.



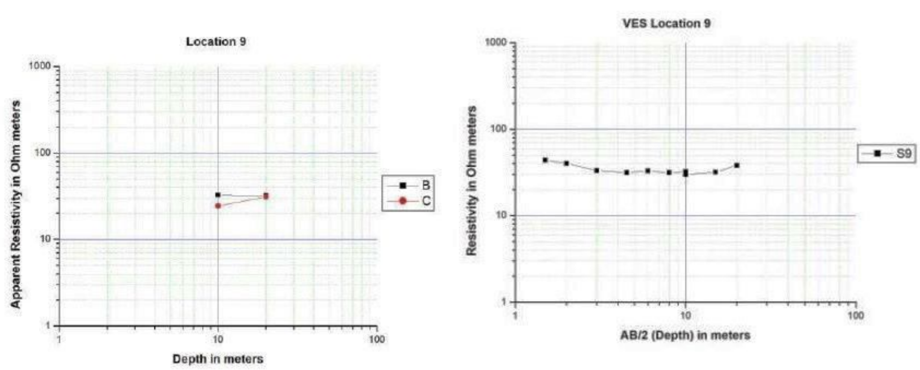
(a) (b)

Fig. 11a and 11b: Location 8 graphical representation of resistivity profiling and VES data, SBM layout, right side of Bogadi ring road, west of Mysore city.

Location 9: Shankaranand Nagar near University layout, Mysore city (N 12°15'40" E 76°36' 26").

At 40 meter interval, electrical resistivity profiling was carried out in Shankaranand Nagar near University layout, towards H.D kote ring road. Resistivity values are 24.43 Ωm and 32.72 Ωm at 10m depth, whereas 32.12 Ωm and 31.2 Ωm at 20m depth. Lowest resistance value is 24.43 Ωm and highest resistance value is 32.12 Ωm. Due to thick soil profile, it is showing low to moderate resistivity values. Therefore foundation requires certain engineering treatment like 5 to 6 course of raft foundation or column foundation etc. (Fig. 12a).

Interpretation of the log – log graph matches with Q, H and K type master curves (Fig. 12b). As indicated by the VES values up to 3 meters show vegetative top soil. From 4m to 10m it shows highly weathered, fractured and jointed rocks with sandy silt soil and beyond 10m it represents moderately weathered rock as sandy soil.



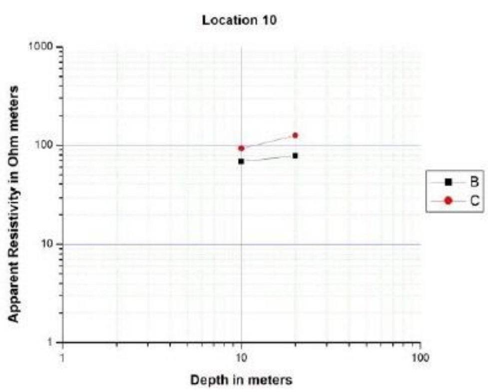
(a) (b)

Figure 12a and 12b: Location 9 graphical representation of resistivity profiling and VES data, Shankaranand Nagar near University layout, South of Mysore city.

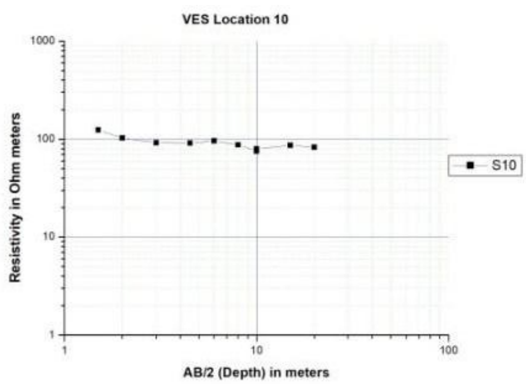
Location 10: Siddlingeshwara badavane, J.P Nagar 4th stage, Mysore city (N 12°15'8" E 76°38' 34").

At 40 meter interval electrical resistivity profiling was carried out in Siddlingeshwara badavane, J.P Nagar 4th stage, Mysore city (Figure 13a). Electrical resistivity values are 68.42 Ώm and 92.72 Ώm at 10m depth, whereas 78 Ώm and 126.29 Ώm at 20m depth respectively. Lowest resistance value is 68.42 Ώm and highest resistance value 126.29 Ώm. Due to thick soil profile and Dolerite dyke intrusion; it is showing low to moderate resistivity values. Therefore foundation requires certain engineering treatment like excavation, concrete filling and 5 to 6 course of mat foundation or pile foundation etc.

VES log – log graph matches with Q, H and K type master curves (Figure 13b). From the apparent resistivity values it indicates vegetative top soil up to 4.5 meters. Beyond 4.5 meters it indicates highly weathered, fractured and jointed rocks with sandy loam soil.



(a)



(b)

Figure 13a and 13b: Location 10 graphical representation of resistivity profiling and VES data, Siddlingeshwara badavane, J.P Nagar 4th stage, South of Mysore city.

Consolidated graph

The graph establishes the existence of 3 to 4 geo electric layers up to a depth of 15m. 15m onwards it indicates massive hard rock (Figure 14a and 14b). The study area mainly consists of granitic and gneissic terrain. Hence it shows high resistance value which is more suitable for the construction of multistoried structures.

GEOELECTRIC AND LITHOLOGICAL CHARACTERISTIC

The obtained VES results were processed to generate two dimensional geo-electric sections. The interpretation outcomes reveals the geo-electric segments comprise of 3 to 4 layers explicitly: vegetative topsoil, highly weathered silty loam soil, moderately weathered rock and massive hard rock. The stratum thicknesses and resistivities vary from 1.2 - 1.55 m/31 - 132 Ohm-m, 0.2- 3.875m/ 24 - 300 Ohm-m and 2.5 – 12.76 m/ 27.2 – 1000 Ohm-m and 50 – 1840 Ohm-m respectively.

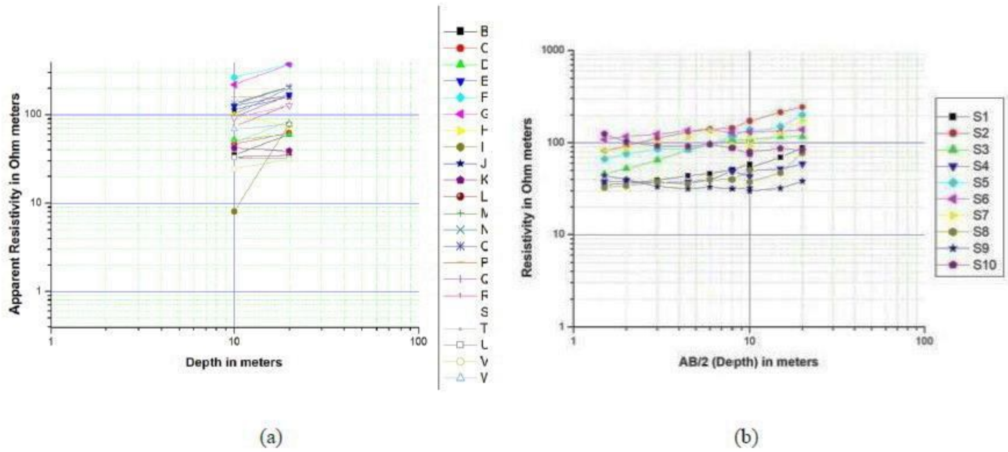


Figure 14a and 14b: Graphical representation of Resistivity Profiling and VES data of all location.

CONCLUSION

The geophysical resistivity method effectively used in defining the various subsurface geological characteristics around outer ring road of Mysore city. From the above results, the subsurface geology of the study area mainly consist of vegetative soil, highly weathered silty loam soil, moderately weathered rock and massive hard rock. Average thickness of the vegetative soil is 2m. The thickness of the highly and moderately weathered rocks generally termed as moderately competent bed varied from 2 – 12 m. Hence these layers are very saturated and insufficient.

Following are the guidelines based on the aforementioned conclusion:

- During construction of a shallow subsurface structure, soil treatment including water draining and ground compaction should prevail.
- RCC Piling is ideal for the corresponding bed structures for the construction of civil projects.
- All other technical design requirements which may be applicable in view of the water-logged condition of the site are necessary to be taken into account.
- Geological, geophysical and geotechnical assessment of the soil samples for wide coverage area enhance the precise delimitation of the stratigraphical strata of the sub-surface part of the earth within the study region.

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