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Evaluation of Soil Quality using Geospatial Technology

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Abstract

Soil is actually happening material that is utilized for the development of structures aside from the surface layers of asphalts. This actually happening soil may not suit the outline necessities of continuous task. Along these lines, soil is to be arranged to meet the necessities and to enhance qualities of the soil, for example, degree, quality, sturdiness, workability, and plasticity and therefore making it more steady. It is required when the dirt accessible for development is not suitable for the planned reason. In present study by the help of GPS, 14 soil samples has been collected at a depth of 1m collected based on point based location at part of Vijayawada, Auto-nagar. Each soil sample index properties were examined like liquid limit, plastic limit, free swell index, optimum moisture content, maximum dry density etc.,. Among the study area Sample 9 has highest natural moisture content of 19%, Sample 4 has highest specific gravity of 2. 61, sample 11 has 36. 1% and optimum moisture content has 24% accordingly. The study area is dived in to three zones among them industrial zone soil has contaminated.

Keywords: soil Quality, GPS, Remote sensing, GIS, Physiochemical.

INTRODUCTION

Soil is the blend of minerals, organic matter, gasses, fluids, and the endless life forms that together bolster life on Earth. Soil is a medium for plant development; it is a methods of water capacity, supply and decontamination; it is a modifier of Earth's air; it is a living space for life forms; all of which, thusly, alter the soil. Soil is thought to

be the "skin of the Earth" and interfaces with its lithosphere, hydrosphere, environment, and biosphere. Soil comprises of a strong stage and in addition a porous stage that holds gasses and water. As needs be, soils are regularly regarded as a three-state system of solids, fluids, and gasses. Soil is the deciding result of the impact of the climate, relief (height, introduction, and slant of territory), living beings, and its guardian materials (unique minerals) collaborating after some time. Soil constantly experiences improvement by method for various physical, synthetic and natural procedures, which incorporate weathering with related disintegration. Most soils have a thickness somewhere around 1 and 2 g/cm3. Little of the dirt of planet Earth is more seasoned than the Pleistocene and none is more established than the Cenozoic, albeit fossilized soils are saved from as far back as the Archean. Soil science has two essential branches of study: edaphology and pedology. Edaphology is worried with the impact of soils on living things. Pedology is centred around the arrangement, portrayal (morphology), and grouping of soils in their common habitat, In designing terms, soil is alluded to as eolith, or free shake material that lies over the 'strong geography'. Soil is normally alluded to as "earth" or "earth"; in fact, the expression "soil" ought to be limited to uprooted soil. As soil assets serve as a premise for nourishment security, the universal group advocates for its practical and capable use through various sorts of Soil Governance. Estimation of soil quality files is required for the de-indication of establishments, holding dividers, and asphalts in civil building applications and for deciding the imperviousness to footing and culturing devices in agrarian applications. These files are additionally crucial in evaluating the dependability of inclines and soil, and can be utilized to interpret the capacity of a dirt to with-stand pushes and strains connected with normally happen ring cases of; expanded pore weight, breaking, swelling, improvement of slickenside, filtering, weathering, undermining, and cyclic stacking and additionally anthropogenic changes to the scene. Shear quality and erosion edge are two critical soil quality lists which have not been given due consideration, especially in a nation overwhelmed by basically feeble and growing soils. Locally, accessible soil data and spatial portrayal have been jogged on farming information. Changing area use and advancement has seen elective uses for this data with evident impediments. Soil builds depend on the current soil physiochemical information and their hypothetical associations with designing quality parameters to bolster and address land use choices and incline soundness issues. The need to evaluate and spatially portray these building bas-ed records for an extensive variety of soils utilizing a snappy and re-subject technique is principal to appropriate arranging and administration.

STUDY AREA

With the 74th amendment of the Constitution of India in 1992, civil commanding voices in the nation have been perceived as a third level of government. The twelfth timetable of the Constitution has set out the capacities imagined to be performed by the city powers one among those capacities is strong waste administration. It is a

required obligation of civil compelling voices in the nation to keep urban areas/towns clean and give a decent personal satisfaction to the nationals. Be that as it may, the administrations gave by the metropolitan powers are obsolete and exceptionally wasteful. Issues of strong waste administration are developing with quick urbanization and change in the way of life of the general population. The circumstance is getting to be basic with the progression of time. The urban populace in India has gone up five times in the most recent six decades. According to 2012 evaluation, 285.35 million individuals live in urban ranges in the nation which represents 27.78% of India's populace.

Existing conditions:

The atmosphere of Vijayawada is tropical in nature with hot summers and direct winters. The months of April to June are the mid year months with the temperature going from at least 27^0C to 45^0C. The temperature amid winter months ranges from 28^0C to 17^0C. The normal dampness ranges from 68% to 80% amid summer season. The yearly precipitation in the locale is around 965mm and is contributed by the south west storms.

Geology:

The locale shapes a piece of Eastern Ghats containing Khondalites, Charnockites, Quartiles and Quartz Veins, Minerals like Khandalites and Charnackites are overwhelmingly found in the district of the Vijayawada, Guntur, Tenali Urban Development Area. Three sorts of soils to be specific, Alluvial, Black, Reger and Red ferruginous are dominatingly found in the zone with ripe alluvial soils in the Krishna delta zone of Vijayawada.

Topography:

The Northern, North-Western and South-Western parts of this locale are secured by a low scope of slopes while the Central, South-Western and South-Eastern parts are secured by rich ripe farming terrains watered by left and right trench frameworks under the Krishna blast developed over the waterway. The noticeable slopes in this area are Kondapalli, Indrakiladri and Mogalrajapuram slopes.

The city is situated on the bank of waterway Krishna of which one stream goes through the city. Likewise 3 channels system frameworks give water to drinking and cultivating to rich ripe horticultural terrains to the algometry range.

Hydrology:

The city has seen a quick development in the course of recent decades with a normal decennial development rate of 43. 15%. Amid the period 1971-81 the net development has been around 57. 57% ascribed to a huge deluge of the country populace to the city. Notwithstanding, amid the previous decade 1981-91, the development has settled with a decadal populace development of 29. 16%.

Demography:
The advancement of the town has generally been restricted to few of the focal wards involving wards 4 to 21 and wards 26 to 35. Then again 15 of the aggregate 50 wards are meagerly populated. There are more than 27500 persons for every square kilometer in created regions and the pattern is towards further union and centralization of these densities. While the wards 1, 2, 49 and 50 show a high rate of development, the focal wards like 15, 16, and 17 displayed a fairly low development rate. Vijayawada city has a thickness of around 12, 000 persons for each square kilometer.

Trade and Commerce:
The city of Vijayawada is generally the principle agrarian business sector place for Krishna bowl. It goes about as a noteworthy business focus to a large group of wholesale and retail exercises managing in shopper merchandise, materials, cars, mechanical items and so forth. It is likewise a noteworthy exchanging, place for prepared Virginia Tobacco, Cotton and Turmeric. The farming things delivered in this some portion of Andhra discovers its business sector in Vijayawada both for neighborhood utilization and fare. Vijayawada is additionally known for its Mango trades, producing crores worth to turnover, yearly.

Industries:
Agro based mechanical action is prevalent around the city. The modern base comprises of dissolvable extraction plants, rice factories, oil and dal plants and so on. There are two Industrial Estates affected by the city. Autonagar Industrial Estate, situated in the Eastern part of the city, close Patamata, covering 340 sections of land, houses mechanical units which are for the most part little and medium in nature. The other domain is situated at around 16 Kms from the city at Kondapalli. The aggregate degree of the domain is 439 sections of land and includes 620 plots. The proposed improvements in this domain are storerooms for significant oil organizations and the area procurement for the same is in advancement.
Different zones where modern exercises are concentrated, is on the outskirts of the city, close Kanuru, with huge units such as dissolvable plants and other agro commercial ventures setting up base in the zone. The vicinity of a Super Thermal Power Station close Vijayawada has a heading on the mechanical improvement of the area. The assorted monetary exercises have expanded quickly in the course of recent decades in different fields showed in the deluge of work power and an ensuing development in population. Table specifies the livelihood and number of commercial ventures in Vijayawada Autonagar region is bifurcated into 3 types of areas which are as follows:

- Open lands area
- Residential area
- Industrial Estate area

OBJECTIVE

To create attribute digital database consisting of selected soil quality parameters derived from the analysis of soil samples collected from predetermined locations in the study area and computation of soil quality index.

METHODOLOGY

By using GPS equipment (object oriented sampling) and noted the location and collected the soil sample at a depth of 0. 5m from the top surface of the location.

The experiments we conducted for collected soil samples are as below

Laboratory Analysis:

Oven dry method:

Can and lid numbers are noted and their weight is noted by weighing machine. Using a spatula, about 15-30 g of moist soil is placed in the can. lid is secured, and weigh record. Temperature of the oven is maintained at 110 ± 5°C. lid is opened, and can is placed in the oven and left over the night. After drying, can is removed carefully from the oven using gloves or tongs and Allowed it to cool to room temperature. dry soil in the can along with lid is weighted For each soil, at least 3 sets of the test is performed

Specific gravity:

Pycnometer is cleaned and weight is noted w1.10 g of soil test is set in pycnometer and weight is noted as w2. The void space of pycnometer is loaded with water noted as w3. Pycnometer is cleaned and brimming with pycnometer is loaded with water and weight is noted as w4. By utilizing the recipe Gs is figured.

Liquid limit:

Take around 150 gm of dry soil passing 425 micron sifter, and blend it with refined water in a porcelain dish to frame a uniform paste. Place a part of the glue in some fluid point of confinement gadget with a spatula, press the dirt down to uproot air pockets, spread it to a greatest profundity of 10 mm, and structure a roughly flat surface. By holding a scoring device opposite to the glass, deliberately slice through the example from back to front, and shape a perfect straight section in the inside by separating into two parts. Turn the wrench handle of the gadget at an unfaltering rate of two cycles for each second. Keep turning until the two parts of the furrow is shut along a separation of 13 mm. Record the quantity of hits to achieve this condition. Take around 15 gm of the dirt from the joined segment of the depression to a dampness can for deciding water content. Exchange the remaining soil from the container into the porcelain dish. Perfect and dry the container and the scoring instrument. Rehash steps 2 to 6, and acquire no less than four arrangements of readings uniformly dispersed out in the scope of 10 to 40 blows

Plastic limit:

Utilize the remaining soil from the porcelain dish. Take around 10 gm of the dirt mass in the hand, shape a ball, and move it between the palm or the fingers and the glass plate utilizing complete movement of the hand forward and switch. Apply just adequate weight to make a dirt string, and keep moving until a string of 3 mm measurement is shaped. Correlation can be made with the metal bar. On the off chance that the measurement turns out to be under 3 mm without splitting, transform the dirt into a ball once more, and re-roll. Rehash this remolding and moving procedure until the string begins simply disintegrating at a width of 3 mm. Accumulate the bits of disintegrated string and put them in a dampness can for deciding water content. Rehash steps 2 to 5 no less than two more times with new specimens of 10 gm each.

Standard Proctor Compaction Test:

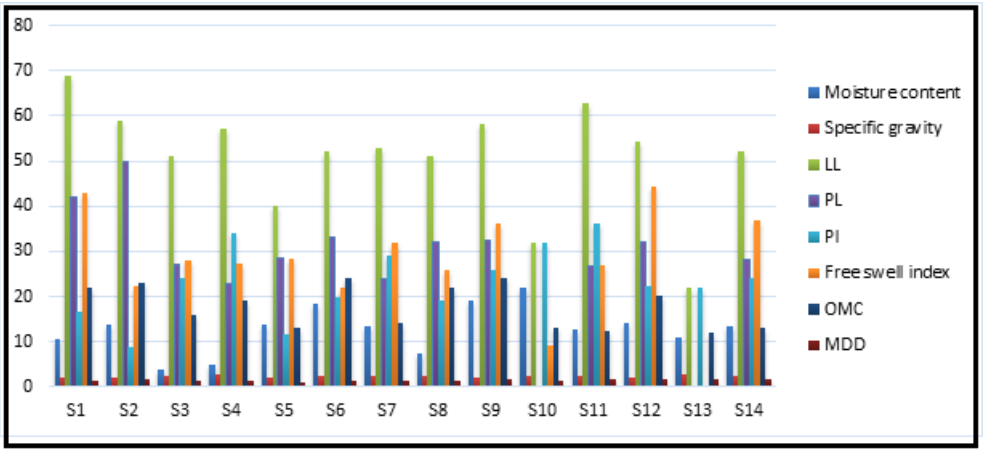
2.5kg of soil test is gone through 4.75 mm sifter in a blending plate. mold with base plate is weighted and oil is connected daintily on the inside surfaces of the mold. Water is added to the dirt its dampness substance is begun from 8% or 10% and after that blended altogether utilizing the trowel until the dirt gets a uniform shading. minimized the clammy soil in three equivalent layers utilizing a rammer of mass 2.6 kg and having free fall of 31 cm. Disseminate the blows equitably, and apply 25 blows in every layer. Turn the neckline in order to evacuate it, trim off the compacted soil flush with the highest point of the mold, and measure the mold with soil and base plate. Extrude the dirt from the mold and gather soil tests from the top, center and base parts for water content determination. Place the dirt back in the plate, include 2% more water based the first soil mass, and re-blend as in step 3. Rehash steps 4 and 5 until a crest estimation of compacted soil mass is come to took after by a couple tests of lesser compacted soil masses

RESULT AND DISCUSSION

Characterization of data (Table-1):

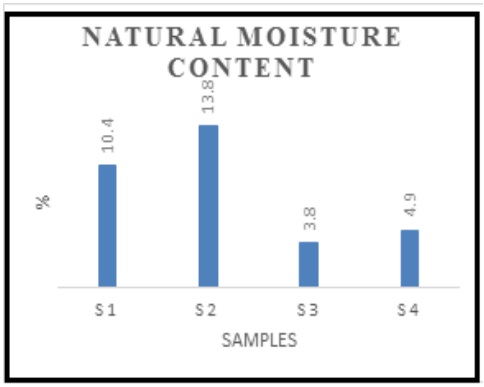
AREA		SAMPLE NUMBER	GPS LOCATION		SOIL TYPE	EXPERIMENTS							
			NORTH	EAST		Moisture content%	Specific gravity	Liquid limit%	Plastic limit%	Plastic index	Free swell Index%	OMC%	MDD g/cc
OPEN LAND		S1	16°499,28"	80°66,692"	Black cotton	10.4	2.12	68.8	42	16.5	43	22	1.5
		S2	16°49,799"	80°66,628"	Black cotton	13.8	2.01	58.8	50	8.8	22.2	23	1.6
		S3	16°49,985"	80°66,978"	Red soil	3.8	2.37	51	27	24	28	16	1.3
		S4	16°49,862"	80°66,714"	Red soil	4.9	2.61	57	23	34	27.3	19	1.5
RESIDENTIAL		S5	16°49,680"	80°67,065"	Red soil	13.6	2.12	40	28.5	11.5	28.3	13	0.9
		S6	16°49,657"	80°66,862"	clay	18.5	2.4	52	33.3	19.7	22	24	1.5
		S7	16°49,719"	80°66,76"	Red soil	13.4	2.52	53	24	29	32	14	1.35
		S8	16°49743"	80°66,536"	clay	7.2	2.4	51	32	19	26	22	1.3
INDUSTRIAL	SHED	S9	16°49318"	80°67,060"	Black cotton	19	2.09	58.3	32.6	25.7	36.3	24	1.8
		S10	16°49236"	80°67,293"	Sandy clay	22	2.25	32	-	32	9	13	1.2
		S11	16°49112"	80°67,302"	Red soil	12.7	2.52	62.8	26.7	36.1	27	12.5	1.7
	ESTATE	S12	16°49901"	80°67,422"	clay	14	1.9	54.3	32.1	22.2	44.4	20.2	1.6
		S13	16°49786"	80°67,284"	Sandy clay	11	2.6	22	-	22	-	12	1.7
		S14	16°49236"	80°67,142	Red soil	13.5	2.5	52	28	24	37	13	1.6

Graphical presentation of Results:



Graph- 1

Open Area:



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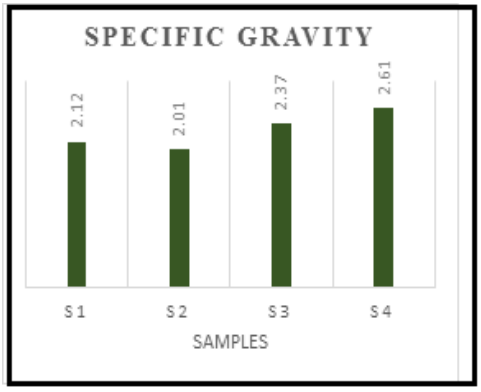

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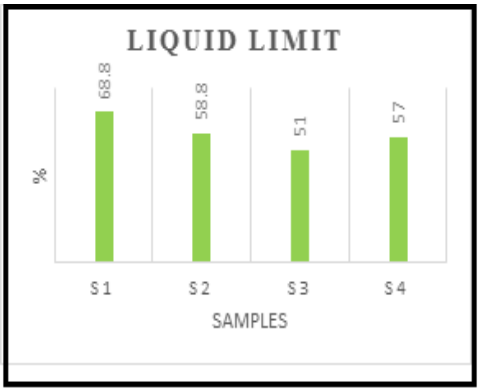
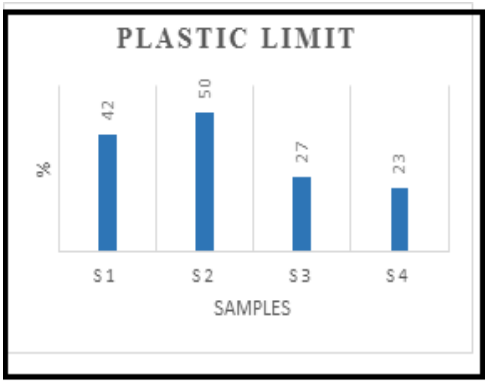
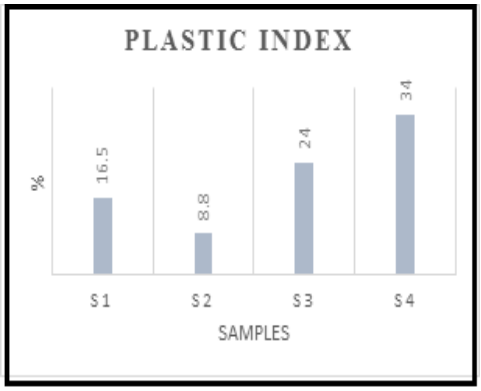


Graph-4



Graph-5



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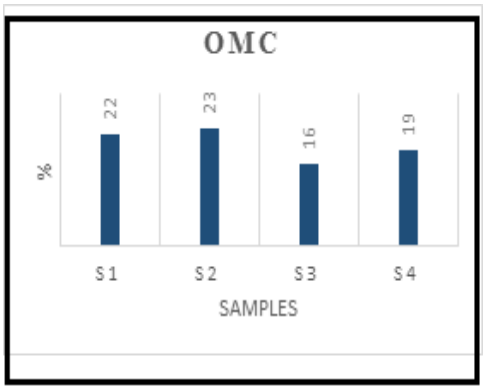
Graph-7



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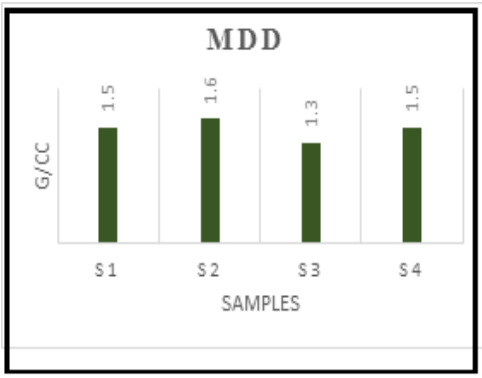
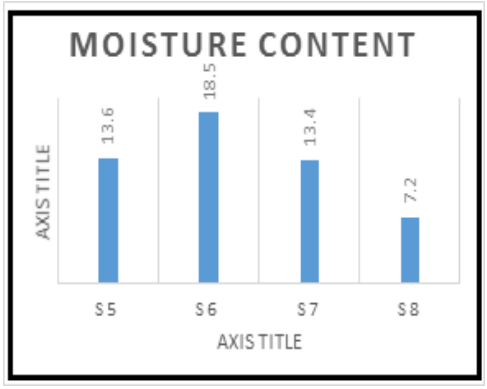


Graph-9

Residential Area:



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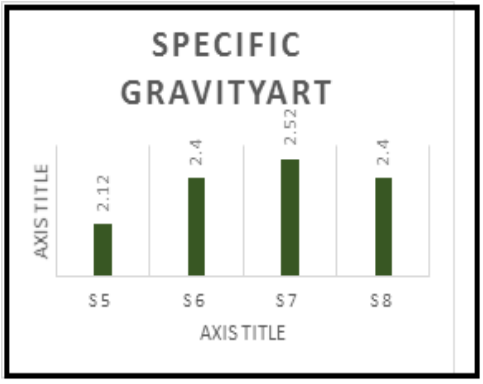
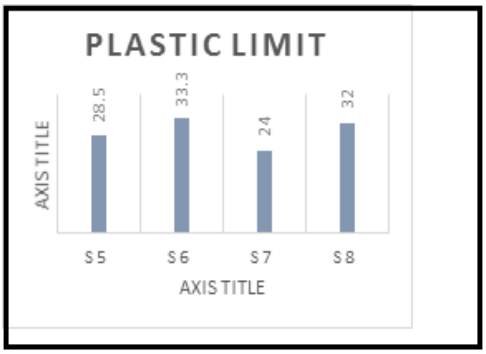


Graph-11

Graph-12



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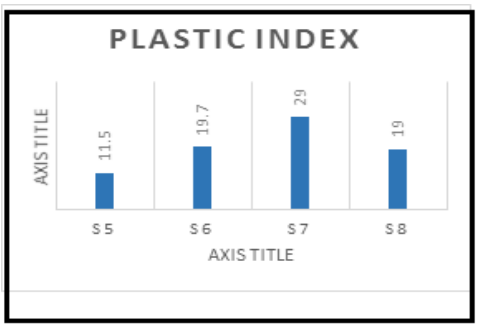

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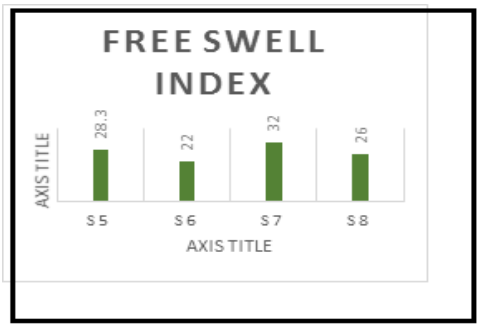

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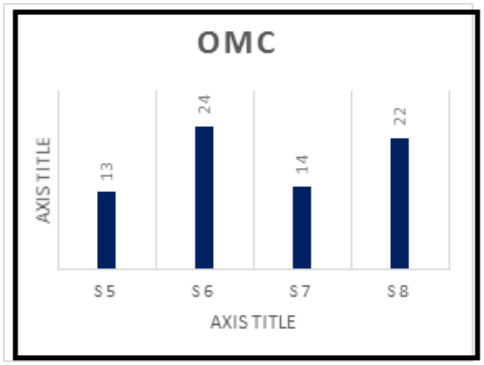

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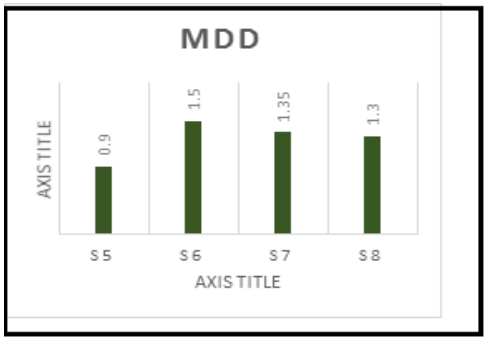
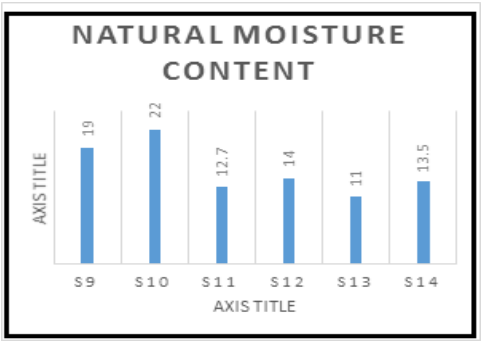


Graph-17

Industrial area:



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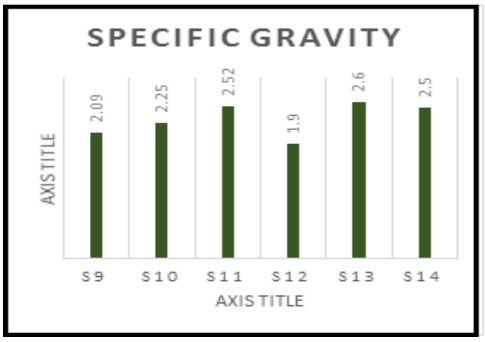

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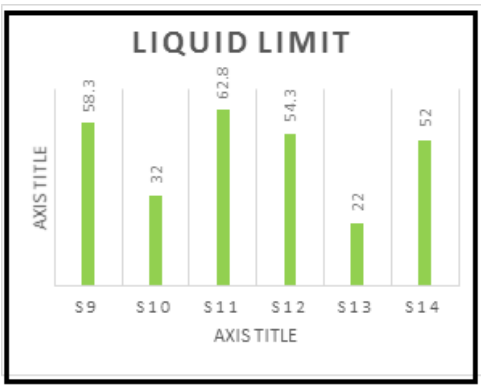

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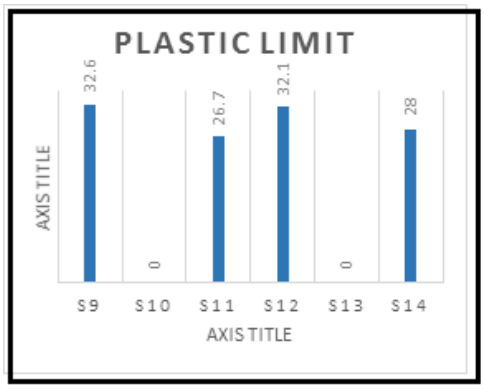

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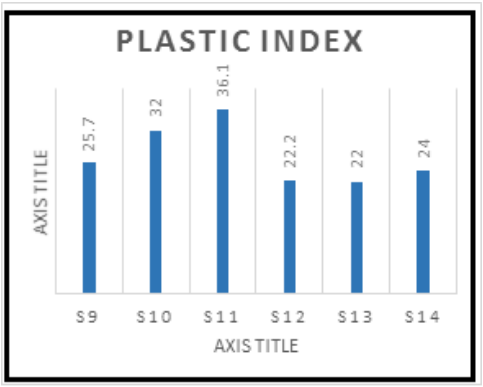

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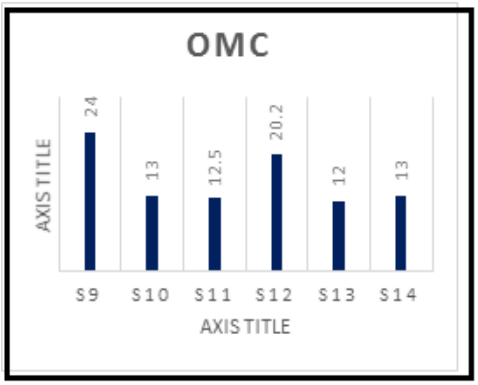
Graph-23



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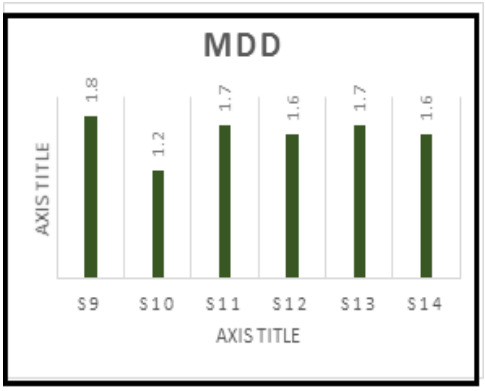

Graph-25

DISCUSSION

In open land area natural moisture content is high in sample 2(13.8%) and low in sample 3 (3.8%), specific gravity is high in sample 4(2.61) and low in sample 2 (2. 01), Liquid limit is high in sample 1 (68.8%) and low in sample 3 (51%), plastic limit is high in sample 2 (50%) and low in sample 4 (23%), plastic index is high in sample 4 (34%) and low in sample 2 (8.8%), Free swell index is high in sample 1 (43%) and low in sample 2 (22.2%), Optimum moisture content is high in sample 2 (23%) and low in sample 3 (16%), Maximum dry density is high in sample 2 (1.6g/cc) and low in sample 3 (1. 3g/cc) and sample 1 and 4 has same Maximum dry density of 1. 5 g/cc.

In residential area natural moisture content is high in sample 6(18.5%) and low in sample 8 (7.2%), specific gravity is high in sample 3(2.52) and low in sample 1 (2.12) and sample 2 and 4 has same specific gravity of 2. 4, Liquid limit is high in sample 3 (53%) and low in sample 1 (40%), plastic limit is high in sample 2 (33.3%) and low in sample 3 (24%), plastic index is high in sample 3 (29%) and low in sample 1 (11.5%), Free swell index is high in sample 2 (22%) and low in sample 3 (22%), Optimum moisture content is high in sample 2 (24%) and low in sample 1 (13%), Maximum dry density is high in sample 2 (1.5g/cc) and low in sample 1 (0.9g/cc).

In industrial area natural moisture content is high in sample 10(22%) and low in sample 13 (11%), specific gravity is high in sample 13 (2.6) and low in sample 12 (1.9), Liquid limit is high in sample 11 (62.8%) and low in sample 13 (22%), plastic limit is high in sample 9 (32.6%) and sample 10 and 13 has no plastic limit, plastic index is high in sample 11 (36.1%) and low in sample 13 (22%), Free swell index is high in sample 12 (44. 4%) and sample 13 has no free swell index, Optimum moisture content is high in sample 9 (24%) and low in sample 13 (12%), Maximum dry density is high in sample 9 (1.8g/cc) and low in sample 10 (1.2g/cc).

Index parameters of the samples are investigated and all the samples are in permissible limits and natural moisture content of the soil is high because samples are collected in the rainy season and The soil in the industrial is contaminated because the waste produced from the factories are disposed in the same area this leads to pollution of the soil and this area is also recommended for structural constructions.

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