STUDY OF THE ENGINEERING PROPERTIES OF SOIL AND TRAFFIC DATA FOR DESIGN OF PARKING FACILITY AT SHOGHI, HIMACHAL PRADESH

Project Report submitted in partial fulfillment of the requirement for the degree of
Bachelor of Technology

in

Civil Engineering

under the Supervision of

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ABSTRACT

From several years Shoghi is in great need of a parking facility and facility for pedestrians to walk upon. Our project ‘Design of parking facility at Shoghi’ is a project that will not only address to these problems but also challenges us to apply our knowledge gained by us in the previous year’s along with gaining of on-site work experience.

In the first chapter of this report we have given a brief introduction about Shoghi, its problems and possible solutions we will be trying to find out.

The second chapter of this report tells us about the importance of parking facilities and various parking statistics. It also tells about different kinds of parking facilities that can be designed and their design considerations.

The third chapter gives us the details of the surveys which were performed by us. We have conducted both photographic and total station survey. Photographic survey has given us the fair idea of the problems faced by pedestrians and from the total station survey we collected data points that helped us to make a layout of the Shoghi-Salana Road and the relative height difference between NH-22 and Shoghi-Salana Road.

The fourth chapter tells us about the type of soil at our survey location. It was important for us to find out the bearing capacity of the soil.

The fifth and the final chapter gives us the procedure of making the layout of the stretch by the use of software’s like AutoCAD, Staad Pro and MS-Excel. The layouts laid the foundation of the designing part of the project.

CHAPTER 1

INTRODUCTION

1. 1 About Shoghi

Shoghi is a small suburb of Shimla, Himachal Pradesh, India. It is about 13 kilometers before Shimla on the Ambala-Shimla national highway (NH-22). The road to the Taradevi temple (hilltop) goes from here which is about 5 km. Shoghi is also famous for bus halts for food as there are many dhabas (local name for food outlets) here. HIMUDA (Himachal Pradesh Urban Development Authority) has also constructed many flats here.

Nestled in the quaint, lush, green hills of Himachal Pradesh just 13 kilometers short of Shimla (The queen of hills), captivating building blocks of pinks and yellows with sloping tin roofs add a touch of natural grandeur to the picturesque surroundings. As you veer off the national highway towards the blocks, you realise you are entering the Housing Board Colony at Shoghi.

The colony was set up in the cozy hamlet of Shoghi in early 2001 by HIMUDA for meeting the housing needs of so many people. Not only accessible, the colony is far from the madding crowd situated on a knoll overlooking hills rising one after another to meet the insurmountable skies from a deep vale just across the road. You can go to Shoghi, and back to nature, without running into traffic jams, a characteristic of Shimla.

But over the years, the colony has lost most of its charm. The metalled road gives way to streets of cobbled stones, as your huffing and panting car wheezes its way up the hillock towards the rising blocks of flats.

Look down the slopes, along the colony streets, and you find the greenery suffocating under the thick layers of rubbish. Carelessly tossed wrappers of potato chips, aluminum foils and empty soda bottles not only narrate the tales of not-so-quiet evenings enjoyed with drinks, but also of sheer disrespect for the nature and inability of the authorities to prevent the littering. The housing board society is now making attempts to clean up the mess, but the dirty picture's end is nowhere in sight. It doesn't take you much time to realise that the colony has been left to fend for itself otherwise also. The concrete road signs, spelling out the location of the blocks, too seem to have crooked under their own weight. Security too is an issue. The colony precincts have not been demarcated; and in the absence of fencing, it's free for all. Water meters are stolen, and the open spaces in the campus have metamorphosised themselves into free public parking lots for the "outsiders".

Shoghi offers a beautiful option for a stay near Shimla with lots of nature activities.

1.2 Problems at Shoghi

The main problem at Shoghi is from housing board colony gate-2 to Shimla bypass for heavy vehicles which is of 1.1 km stretch, within this stretch there is H.P.C.L (Hindustan Petroleum Corporation Limited) Shimla depot, police barrier, primary health center, a Government School, entrance gate towards Hosing Board colony, market place which contains taxi stand, Bus stand, DAV Public School and various kinds of shops and dhabas. For all these places to visit, walking is a prime mode transport for the locals. In this stretch there are ample of space for the people to walk but there are always plenty of vehicles parked on the road forcing people to walk on the carriage way.

Fig 1.1 Traffic jam in the market area

Usually on this road, vehicles travel at an average speed of 50 km/h and people walking along the road risks their life increasing the probability of accidents. Shimla being the hot-spot for tourists and trekkers the vehicle density on NH-22 is increasing day by day leading to the congestion on NH-22 and the authorities at Shimla tried to relieve this congestion by making a bypass at shoghi via Mehli for the heavy vehicles, at that time Shoghi was not that populated and vehicle density was also not that high but now both have drastically increased.

As there is no proper facility to walk and cross the road, it makes unsafe for the people.

CHAPTER-2

PARKING

2.1 Introduction

Parking is one of the major problems that is created by the increasing road traffic. It is an impact of transport development. The availability of less space in urban areas has increased the demand for parking space especially in areas like Central business district. This affects the mode choice also. This has a great economical impact.

Parking lots are paved areas intended for vehicle parking and can vary widely in size, function and design. Parking lots serve businesses, schools, commuters and other functions. The types of vehicles that use a parking lot vary. Some lots have primarily car traffic, but some have buses and trucks that deliver goods or transport people. These heavier vehicles are usually isolated to specific parts of the lot or travel the same path in the lot.

The primary objective of parking lot design is to provide safe, efficient vehicular access to parking stalls that serve businesses, commuter lots and residential facilities. For business and commuter lots, the design must consider the use of pavement by buses, trucks and other heavy vehicles. Unfortunately, all too often, the important functions of the new facility's parking area are overlooked. Not only is the parking area the first part of a building complex seen by the user, it is the gateway through which all customers, employees, visitors and other pass. This first impression is quite important to the overall feeling and atmosphere conveyed by the new facility. When properly designed and constructed, parking areas can be attractive, safe, and above aa, easily and efficiently usable. In addition, they should be designed for low maintenance costs and ease of modification for changes in patterns of use.

Before taking any measures for the betterment of conditions, data regarding availability of parking space, extent of its usage and parking demand is essential. It is also required to estimate the parking fares also. Parking surveys are intended to provide all these information. Since the duration of parking varies with different vehicles, several statistics are used to access the parking need.

2.2 Parking statistics

Parking accumulation: It is defined as the number of vehicles parked at a given instant of time. Normally this is expressed by accumulation curve. Accumulation curve is the graph obtained by plotting the number of bays occupied with respect to time.

Parking volume: Parking volume is the total number of vehicles parked at a given duration of time. This does not account for repetition of vehicles. The actual volume of vehicles entered in the area is recorded.

Parking load : Parking load gives the area under the accumulation curve. It can also be obtained by simply multiplying the number of vehicles occupying the parking area at each time interval with the time interval. It is expressed as vehicle hours.

Average parking duration: It is the ratio of total vehicle hours to the number of vehicles parked.

Parking turnover: It is the ratio of number of vehicles parked in a duration to the number of parking bays available.

Parking index: Parking index is also called occupancy or efficiency. It is defined as the ratio of number of bays occupied in a time duration to the total space available. It gives an aggregate measure of how effectively the parking space is utilized.

2.3 Parking surveys

Parking surveys are conducted to collect the above said parking statistics. The most common parking surveys conducted are in-out survey, fixed period sampling and license plate method of survey.

1. In-out survey: In this survey, the occupancy count in the selected parking lot is taken at the beginning.
Then the number of vehicles that enter the parking lot for a particular time interval is counted. The number of vehicles that leave the parking lot is also

taken. The final occupancy in the parking lot is also taken. Here the labor required is very less. Only one person may be enough. But we wont get any data regarding the time duration for which a particular vehicle used that parking lot. Parking duration and turn over is not obtained. Hence we cannot estimate the parking fare from this survey.

2. Fixed period sampling: This is almost similar to in-out survey. All vehicles are counted at the beginning of the survey. Then after a fixed time interval that may vary between 15 minutes to i hour, the count is again taken. Here there are chances of missing the number of vehicles that were parked for a shortduration.

3. License plate method of survey: This results in the most accurate and realistic data. In this case of survey, every parking stall is monitored at a continuous interval of 15 minutes or so and the license plate number is noted down. This will give the data regarding the duration for which a particular vehicle was using the parking bay. This will help in calculating the fare because fare is estimated based on the duration for which the vehicle was parked. If the time interval is shorter, then there are less chances of missing short-term parkers. But this method is very labor intensive.

2.4 Ill effects of parking

Parking has some ill-effects like congestion, accidents, pollution, obstruction to fire-fighting operations etc.

Congestion: Parking takes considerable street space leading to the lowering of the road capacity. Hence, speed will be reduced, journey time and delay will also subsequently increase. The operational cost of the vehicle increases leading to great economical loss to the community.

Accidents: Careless maneuvering of parking and unparking leads to accidents which are referred to as parking accidents. Common type of parking accidents occur while driving out a car from the parking area, careless opening of the doors of parked cars, and while bringing in the vehicle to the parking lot for parking.

Environmental pollution: They also cause pollution to the environment because stopping and starting of vehicles while parking and unparking results in noise and fumes. They also affect the aesthetic beauty of the buildings because cars parked at every available space creates a feeling that building rises from a plinth of cars.

Obstruction to fire fighting operations: Parked vehicles may obstruct the movement of firefighting vehicles. Sometimes they block access to hydrants and access to buildings.

2.5 Ten Point Program for Parking Reform

1. Reduce or eliminate unnecessary parking requirements.

Requirements for additional parking for new non-residential development in Downtowns and town centers should be eliminated, wherever feasible, based on local conditions and community plans.

2. Share parking.

Ideally, all new non-residential parking in Downtowns and town centers, and around rail transit stations, should be shared parking—spaces that are available for public use, rather than reserved for the tenants and visitors associated with any particular property or set of properties.

3. Promote alternative modes.

Incorporate requirements or incentives for free/discounted transit passes in exchange for parking spaces, carshare incentives, and bicycle parking requirements to promote the use of alternative modes and reduce the need for car ownership.

4. Establish parking maximums in transit-served areas and expand the existing supply of parking only as warranted.

Maximums can prevent over-building; parking codes also can cap the allowable amount of parking, and require additional permits if a developer believes more are required.

5. Adopt additional strategies for parking management.

Some best-practice management strategies are:

- Require developers to unbundle parking costs in residential projects
- Implement parking cashout programs
- Provide transit passes
- Provide parking credits for on-site carsharing service
- Require more bike parking

6. Price on-street and off-street parking.

Charging for parking is the most direct way to both reduce parking demand and ensure that end- users carry more of the cost of providing off-street accommodations. Pricing can be used to ensure availability and turnover of on-street and off-street spaces.

7. Adopt an on-street parking availability target.

The targets can maintain the availability of on-street parking in Downtowns, town centers and transit corridors and prevent spillover parking impacts in surrounding areas. Parking occupancy can be monitored and paired with investment of funds into the local area (see point 10 below).

8. Manage parking to achieve the availability target using pricing or time limits.

Expanding on point #7, cities can manage on-street parking demand to achieve the desired availability target either by implementing pricing or time limits, adjusting rates and/or regulations as necessary to ensure that 1-2 spaces per block are usually available.

9. Prevent spillover parking impacts in surrounding neighborhoods with residential permit parking zones.

Cities can establish residential permit parking zones to prioritize curb space for local residents and/or businesses, in areas where the availability of parking in surrounding areas is seriously impacted by workers, transit riders, shoppers, business vehicles, and/or visitors.

10. Establish parking benefit districts.

Net revenues collected from on-street parking pricing and permit revenues can be dedicated to funding public improvements within designated Parking Benefit Districts, ensuring that revenue is used to benefit the blocks where the money is collected.

2.6 Parking requirements

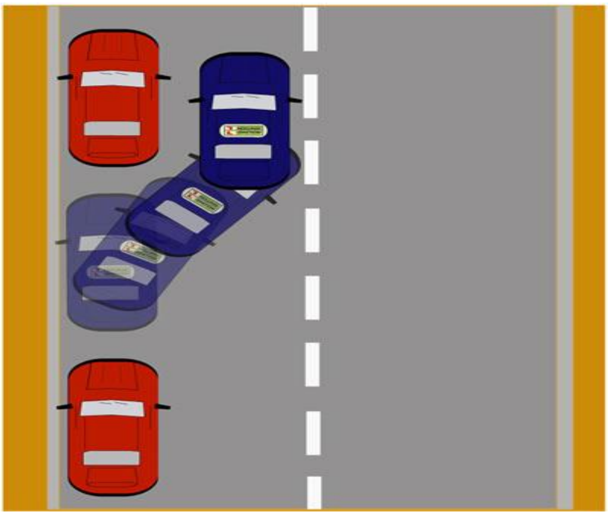
There are some minimum parking requirements for different types of building. For residential plot area less than 300 sq.m require only community parking space. For residential plot area from 500 to 1000 sq.m, minimum one-fourth of the open area should be reserved for parking. Offices may require atleast one space for every 70 sq.m as parking area. One parking space is enough for 10 seats in a restaurant where as theatres and cinema halls need to keep only 1 parking space for 20 seats. Thus, the parking requirements are different for different land use zones.

2.7 On street parking

On street parking means the vehicles are parked on the sides of the street itself. This will be usually controlled by government agencies itself. Common types of on-street parking are as listed below. This classification is based on the angle in which the vehicles are parked with respect to the road alignment. As per IRC the standard dimensions of a car is taken as 5× 2.5 metres and that for a truck is 3.75× 7.5 metres.

Parellel Parking :

The vehicles are parked along the length of the road. Here there is no backward movement involved while parking or unparking the vehicle. Hence, it is the most safest parking from the accident perspective. However, it consumes the maximum curb length and therefore only a minimum number of vehicles can be parked for a given kerb length. This method of parking produces least obstruction to the on-going traffic on the road since least road width is used.



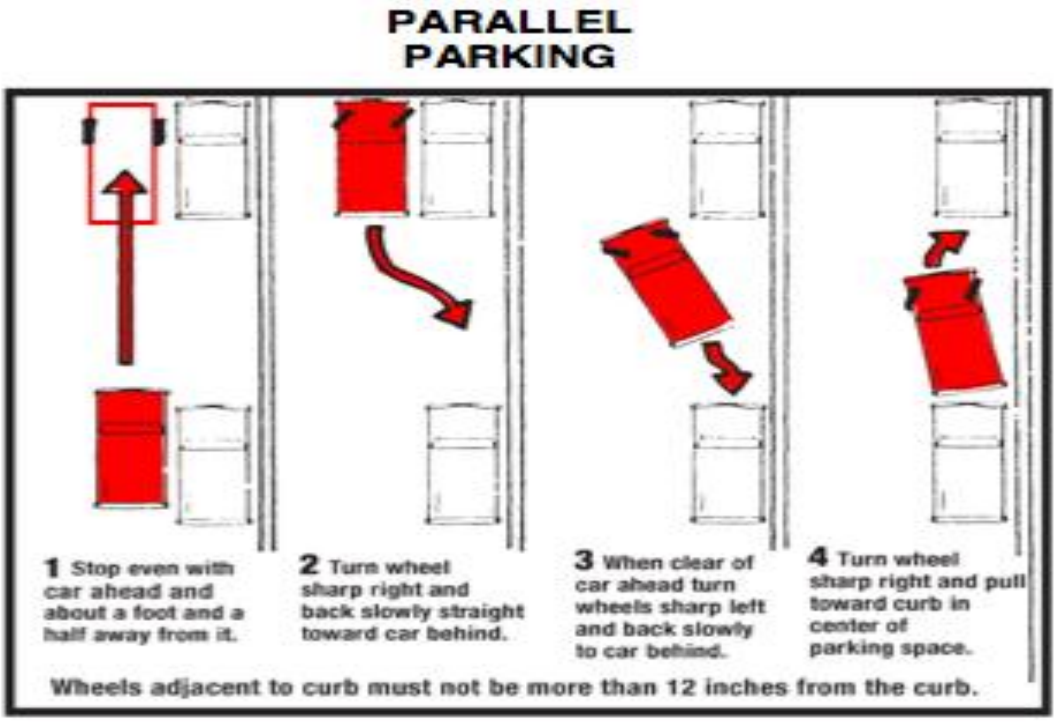


Fig 2.1 parallel parking

30° parking: In thirty degree parking, the vehicles are parked at 30° with respect to the road alignment. In this case, more vehicles can be parked compared to parallel parking. Also there is better maneuver- ability. Delay caused to the traffic is also minimum in this type of parking.

45° parking: As the angle of parking increases, more number of vehicles can be parked. Hence compared to parallel parking and thirty degree parking, more number of vehicles can be accommodated in this type of parking.

60° parking: The vehicles are parked at 60° to the direction of road. More number of vehicles can be accommodated in this parking type.

Right angle or 90°parking: In right angle parking or 90° parking, the vehicles are parked perpendicular to the direction of the road. Although it consumes maximum width kerb length required is very little. In this type of parking, the vehicles need complex maneuvering and this may cause severe accidents. This arrangement causes obstruction to the road traffic particularly if the road width is less. However, it can accommodate maximum number of vehicles for a given kerb length.

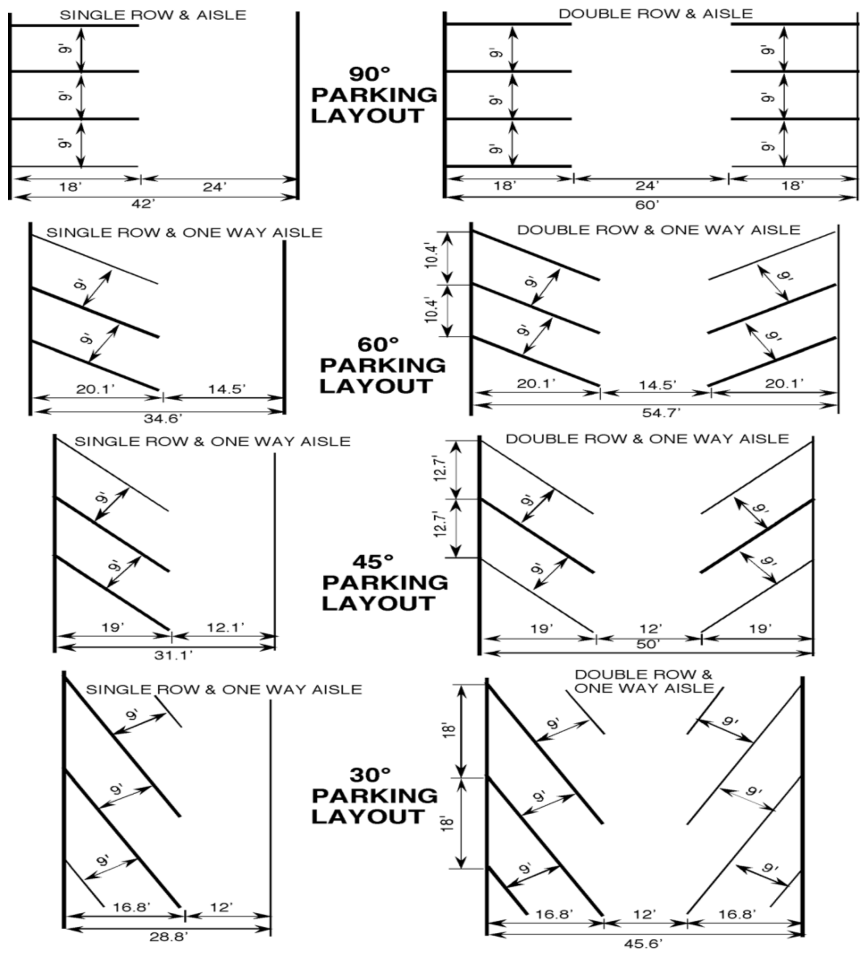


Fig 2.2 90°,60°,45°,30° parking layouts

2.8 Off street parking

In many urban centres, some areas are exclusively allotted for parking which will be at some distance away from the main stream of traffic. Such a parking is referred to as off-street parking. They may be operated by either public agencies or private firms.

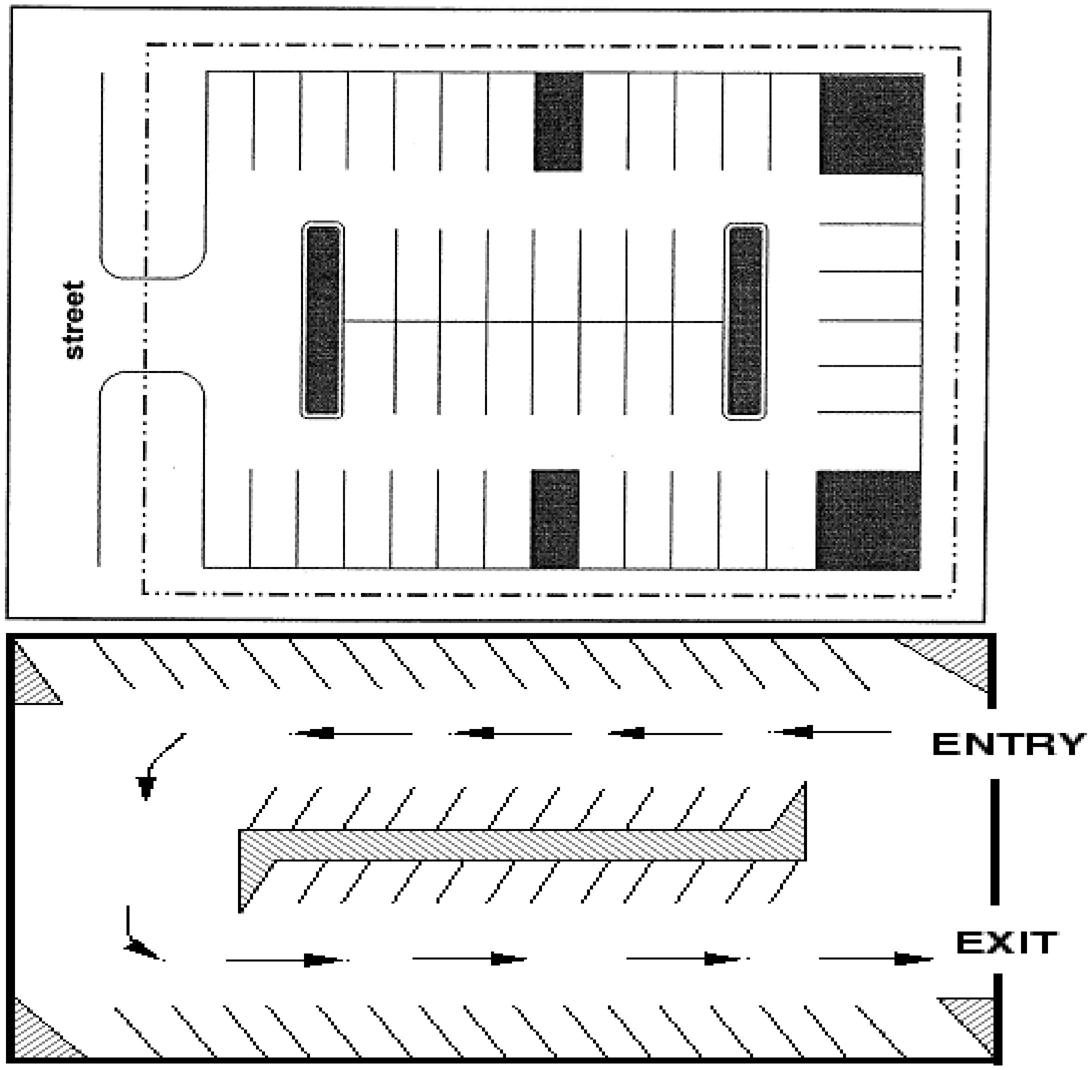


Fig 2.3 Off-street parking

2.9 Design Considerations

Most pavement designs are based on the traffic using the road when the construction is completed. However, with the construction of parking lots, the heaviest traffic using the majority of the parking lot is during the construction phase. Once the parking lot is completed, cars will be in the parking stall areas and trucks or buses will be in identified drive lanes or ring routes. Therefore, the pavement structure must be selected based on the construction traffic and sequence of construction. These pavements are generally built in phases. The first phase is the laying of the aggregate sub-base and asphalt base layers on the prepared subgrade or laying an asphalt base layer directly on the prepared subgrade. Because of the heavy trucks, pavement failures are not unexpected. However, once the construction has been completed, these areas are repaired and the final pavement surface is placed.

Many parking areas are initially under designed, resulting in excessive maintenance problems and a shorter pavement life. The thickness designs given on this page are *minimum* thickness values. Any reduction of these values for base or surface thicknesses may cause severe pavement failure.

Special truck lanes are sometimes required to expedite traffic to loading areas, trash dumpsters, and equipment areas. The design thickness for these lanes or any pavement areas carrying this type traffic should be increased. Drainage problems are also a major cause of parking area pavement failure. Their significance warrants a special section on drainage problems, and it is recommended that section be reviewed prior to selecting a pavement design either from this website or any other source.

General Planning

In developing the parking area plan, several important factors should be considered. The primary consideration should be providing the maximum convenient parking capacity with the best use of available space. General recommendations for required number of parking stalls are given in the table below. The following guidelines should provide optimum use of available parking area:

- **Use rectangular areas.**
- **Make the parking area's long sides parallel.**
- **Use parking stalls along the perimeter.**
- **Use traffic lanes that serve two rows of stalls**

Consideration should be given to the flow of traffic into and out of the area as well as within it. For safety and convenience, pedestrian traffic must also be taken into account when planning. It should be noted that handicapped parking areas must also be provided at a location closest to the facility.

Minimum Requirements

Individual parking stalls should be a minimum of nine feet by nineteen feet (9′ x 19′). However, special sections with slightly smaller stalls may be designated for compact cars to better utilize the area. Two-way traffic lanes have a minimum width of twenty four feet (24′) and perimeter circulation road lanes should be thirty feet (30′). When the parking lot access opening is limited to less than thirty feet (30′) in width a separate entrance and exit should be used.

The minimum entrance radius is six feet six inches (66‘- 6″}. However, eleven feet six inches (11″- 6″) is recommended. The figure below provides a guide for determining the required layout and dimensions of parking lots for both single and overlapping units.

Rear overhang minimums depend on the stall angle. 45° stalls require three feet three inches (3′- 3″), 60° stalls require three feet nine inches (3′ -9″); and 90° stalls require four feet (4′).

Truck Lanes for Loading, Dumpsters, etc.

The pavement for truck lanes used for loading, deliveries, etc., must be increased in thickness to prevent pavement failure due to the weight associated with heavy trucks.

These areas should be constructed with asphalt pavement thicknesses that will support this heavier, pavement loading, typically a minimum of 3” of base asphalt under the surface course and over a 6”-8” aggregate subbase.

For areas where trash truck service waste containers and dumpsters special pads and approaches are required to handle their heavy and special dynamic loading. Often full-depth concrete pads are constructed but this is a costly alternative to a full-depth asphalt pad. However, failure to provide one of these two types of truck lanes/dumpster pads can result in severe pavement failure. A common mistake made at many facilities is constructing pads that are only large enough for the dumpster to sit on. The severe loading and potential to damage the pavement structure comes from the trash trucks not the dumpster. Therefore the pads need to be large enough to accommodate the trash truck when servicing the dumpster.

Future Maintenance Considerations

In time, pavement failures may occur due to settlement or weakening of the soil or aggregate base layers. These will result in localized failures or potholes. To repair these failures, the area impacted should be cut out and the pavement material removed to the subgrade. The subgrade material may need to be removed and replaced or simply recompacted. Finally, the removed pavement material should be replaced with new asphalt concrete or a permanent asphalt patching material.

As asphalt ages, shrinkage cracks will develop. Individual transverse and longitudinal cracks should be sealed with an asphalt based material to reduce the amount of water infiltrating the underlying pavement layers. If the cracking is extensive, then the pavement can be overlaid with a new AC surface or milled and replaced with a new AC surface. Overlaying can be performed on parking lots without curb and gutter. For lots with curb and gutter, milling may be needed to maintain surface drainage. While edge milling can be performed, typically 4 to 6 feet in width at the edge of the pavement, full pavement milling is recommended in order to keep proper cross-slope.

CHAPTER-3

SURVEYING

3.1 Introduction

Surveying is the art of determining the relative position of points on, above or beneath the surface of the earth by means of direct or indirect measurement of distance direction and elevation. It includes the art of establishing points by predetermined angular and linear measurements.

The knowledge of surveying is advantageous in many phases of engineering. The earlier surveys were made in connection with land surveying. Practically every engineering project such as road, water supply and irrigation schemes, railroads and transmission lines, mines, bridges and buildings etc. require surveys. Before plans and estimates are prepared, boundaries should be determined and the topography of the site should be ascertained. After the plans are made, the structure must be staked out in the ground. As the work progresses, lines and grades must be given.

In surveying all measurements of lengths are horizontal, or else are subsequently reduced horizontal distances. The object of a survey is to prepare plan or map so that it may represents the area on a horizontal plane. A plan or map is horizontal projection of an area and shows only horizontal distances of points.

In this project, we have performed two types of survey:-

1. Photographic Survey
2. Total Station Survey

3.2 Photographic Survey

It is the basic kind of survey in which the surveyor visits the area to be surveyed, takes the photograph of the area under consideration to get idea of the topography, surroundings which helps the surveyor to plan his survey camp and helps him to choose the method of surveying. Also, if necessary the surveyor can also talk to the local residents of the area.

Fig 3.1 Vehicles parked on the side of the road

Fig 3.2 Vehicles parked along the road

In our photographic survey we tried to identify the major problems at Shoghi (as shown in figures). While doing the survey we talked to several residents of Shoghi who told us that there is no proper space for pedestrians to walk along the road neither there are any zebra crossing for the people. Also, there is no parking space for the parking of vehicles and thus the drivers park their vehicles along the side of the road causing the pedestrians to walk on the carriage way which may lead to any kind of accident at any point of time.

From the pictures we deduce that:-

1. There is encroachment by the locals.
2. Parking of vehicles is done along the road.
3. Loading and unloading of the goods and people is done by encroaching the areas which are meant for people to walk upon alongside the road.

3.3 Total Station Survey

3.3.1 Total Station

A form of an electronic theodolite combined with an electronic distance measuring device (EDM), the primary function is to measure slope distance, vertical angle, and horizontal angle from a setup point to a foresight point most total stations use a modulated near-infrared light emitting diode which sends a beam from the instrument to a prism. The prism reflects this beam back to the instrument. The portion of the wavelength that leaves the instrument and returns is assessed and calculated. Distance measurements can be related to this measurement.

The accuracy of a total station is dependent on instrument type. Angle Accuracy (Horizontal or Vertical) can range from 2” to 5”. Distance Accuracy can range from: +/- (0.8 + 1 ppm x D) mm to +/- (3 + 3 ppm x D) mm where D = distance measured. Accuracy is highly dependent on leveling the instrument. Thus two leveling bubbles are provided on the instrument and are referred to the circular level and the plate level. Circular level is located on the tribrack while plate level is on horizontal axis of instrument just below scope of the total station. Sensitivity of Circular Level = 10’ / 2mm .Sensitivity of Plate Level = 30” / 2mm.

Although taping and theodolites are used regularly on site – total stations are also used extensively in surveying, civil engineering and construction because they can measure both distances and angles. The appearance of the total station is similar to that of an electronic theodolite, but the difference is that it is combined with a distance measurement component which is fitted into the telescope. Because the instrument combines both angle and distance measurement in the same unit, it is known as an integrated total station which can measure horizontal and vertical angles as well as slope distances.

3.3.2 Advantages of Total Station

1. Relatively quick collection of information.
2. Multiple surveys can be performed at one set-up location.
3. Easy to perform distance and horizontal measurements with simultaneous calculation of project coordinates (Northing, Easting, and Elevations).
4. Layout of construction site quickly and efficiently.
5. Digital design data from CAD programs can be uploaded to data collector.
6. Daily Survey Information can also be quickly downloaded into CAD which eliminates data manipulation time required using conventional survey techniques.

3.3.3 Disadvantages of Total Station

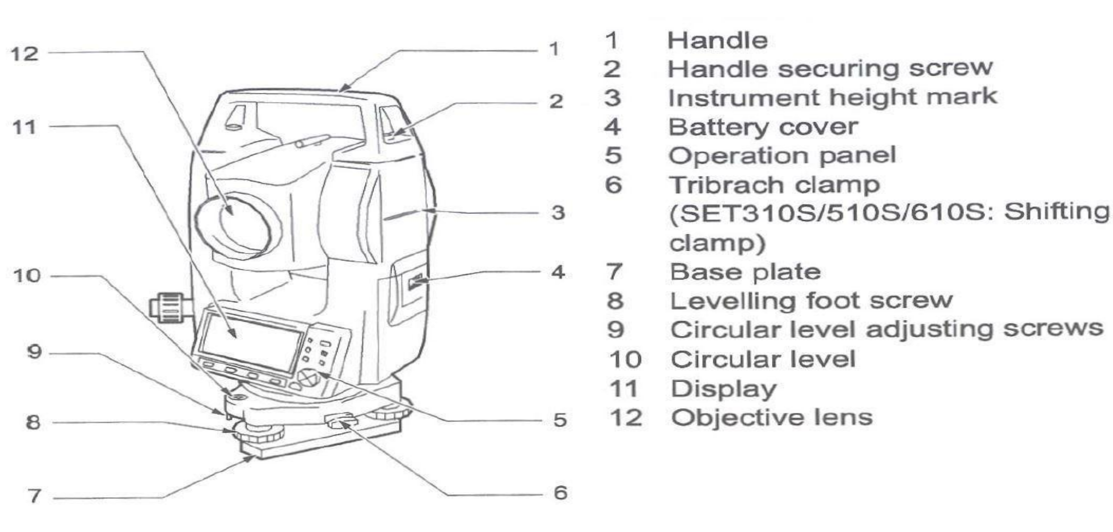
1. Vertical elevation accuracy not as accurate as using conventional survey level and rod technique.
2. Horizontal coordinates are calculated on a rectangular grid system. However, the real world should be based on a spheroid and rectangular coordinates must be transformed to geographic coordinates if projects are large scale.
3. As with any computer-based application "Garbage in equals Garbage out". However, in the case of inaccurate construction surveys "Garbage in equals lawsuits and contractors claims for extras."

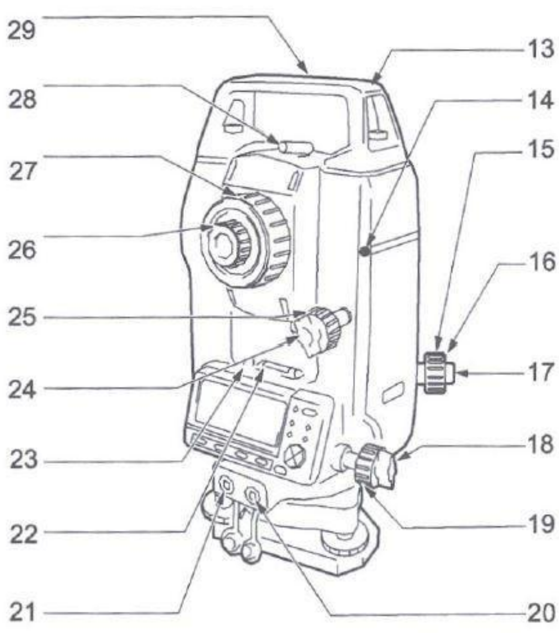
3.3.4 Types of Total Station Surveying

Slope Staking	Areas
Topographic Surveys	Intersections
Construction Project Layout	Point Projections
Leveling	Road (Highway) surveys
Resections	Taping from baseline
Traverse Surveys and adjustments	Building Face surveys

Types of total station surveying

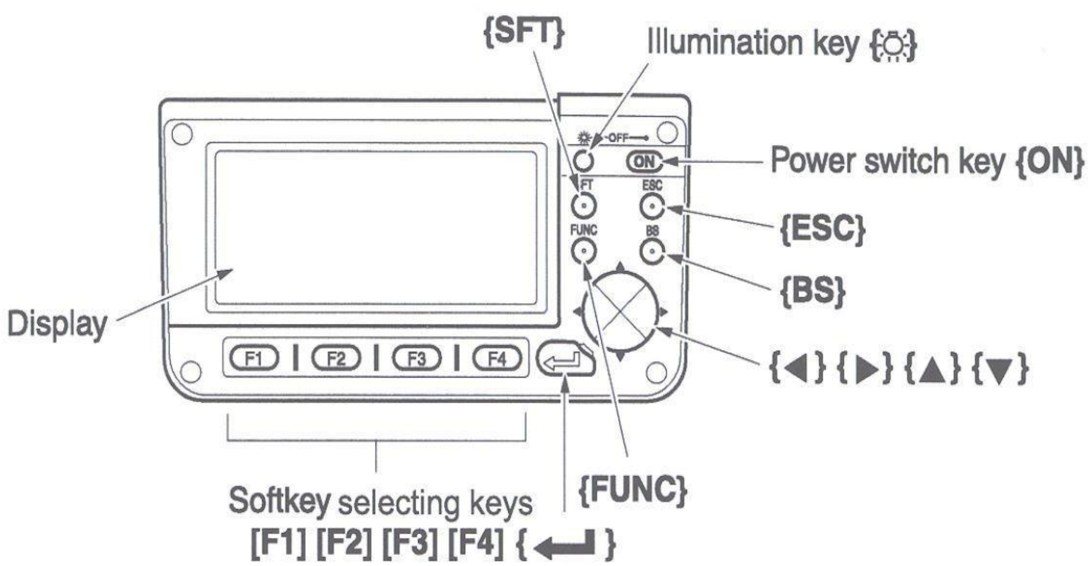
3.3.5 Components of Total Station

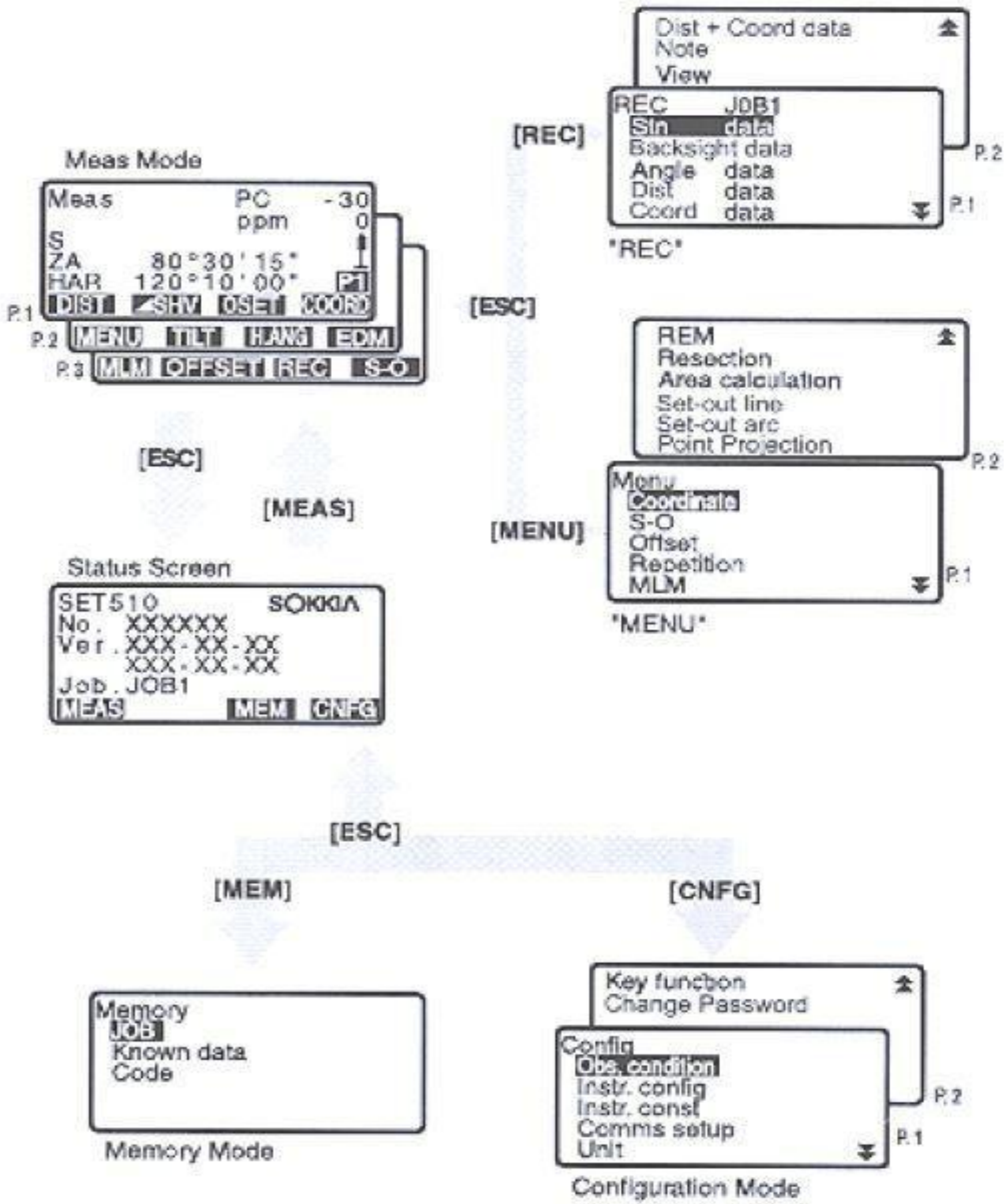




13 Tubular compass slot
14 Beam detector for wireless keyboard (Not included on SET610/610S)
15 Optical plummet focussing ring
16 Optical plummet reticle cover
17 Optical plummet eyepiece
18 Horizontal clamp
19 Horizontal fine motion screw
20 Data input/output connector (Beside the operation panel on SET610/610S)
21 External power source connector (Not included on SET610/610S)
22 Plate level
23 Plate level adjusting screw
24 Vertical clamp
25 Vertical fine motion screw
26 Telescope eyepiece
27 Telescope focussing ring
28 Peep sight
29 Instrument center mark

☞ "5.1 Basic Key Operation"





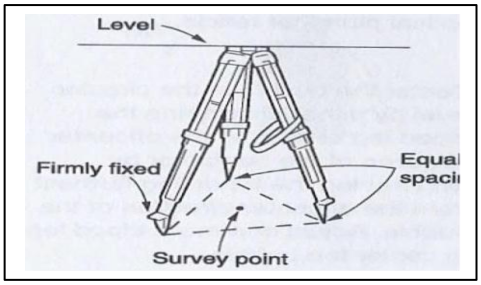
Meas Mode
Meas PC -30
ppm 0
S
ZA 80°30'15"
HAR 120°10'00" P1
P.1 DIST ◢SHV 0SET COORD
P.2 MENU TILT H.ANG EDM
P.3 MLM OFFSET REC S-O
[ESC]
[MEAS]
Status Screen
SET510 SOKKIA
No. XXXXXX
Ver. XXX-XX-XX
XXX-XX-XX
Job. JOB1
MEAS MEM CNFG
[REC]
Dist + Coord data
Note
View
REC JOB1
Stn data
Backsight data
Angle data
Dist data
Coord data
P.2
P.1
"REC"
[ESC]
REM
Resection
Area calculation
Set-out line
Set-out arc
Point Projection
Menu
Coordinate
S-O
Offset
Repetition
MLM
[MENU]
"MENU"
[ESC]
[MEM]
[CNFG]
Memory
JOB
Known data
Code
Memory Mode
Key function
Change Password
Config
Obs. condition
Instr. config
Instr. const
Comms setup
Unit
Configuration Mode

3.3.6 Leveling of Total Station

Leveling the Total station must be accomplished to sufficient accuracy otherwise the instrument will not report results. Before starting leveling the instrument it should be made sure that all the targets can be seen from the station point. After ensuring the leveling process should be started by following steps:-

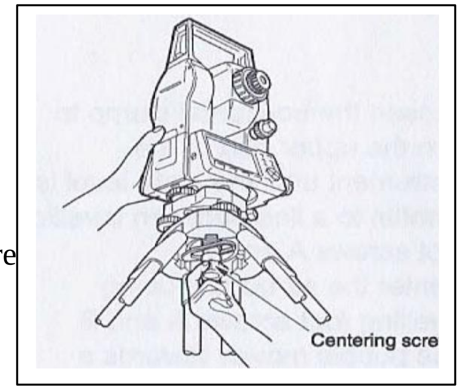
1. Tripod Setup

Tripod legs should be equally spaced. The tripod head should be approximately leveled .also care should be taken that the head should be directly over survey point.



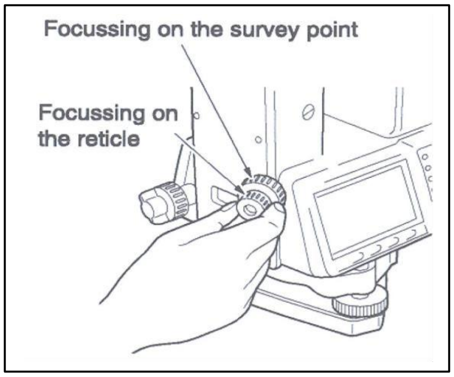
2. Mount Total station on tripod

Place instrument on Tripod .Secure with centering screw bracing the instrument with the other hand. Don't forget to insert the battery in Total station before leveling.



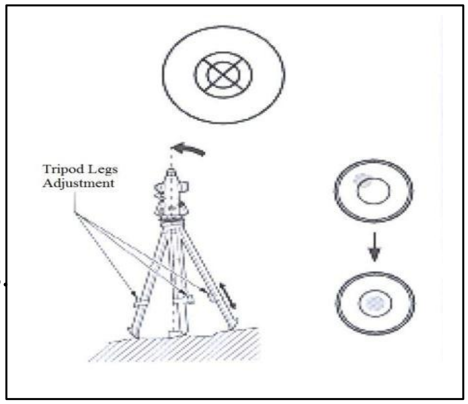
3. Focus on Survey Point

For this, use the optical plummet on the survey point.

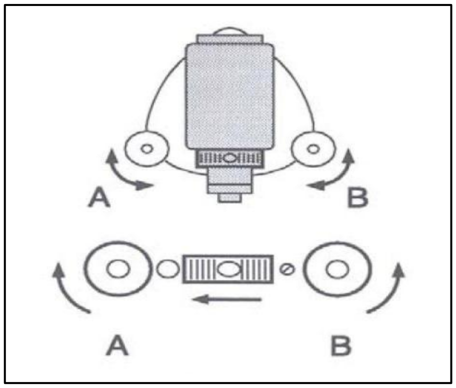


4. Leveling

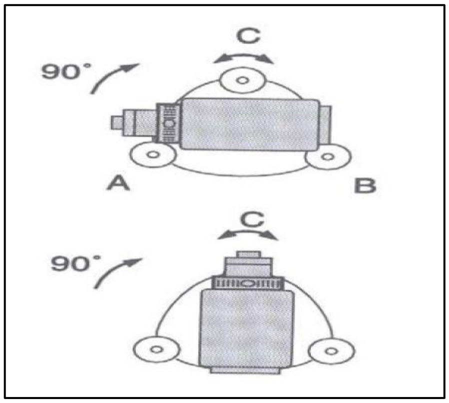
Adjust the leveling foot screws to center the survey point in the optical plummet reticle. Center the bubble in the circular level by adjusting the tripod legs.



Loosen the horizontal clamp and turn instrument until plate level is level to two of the leveling foot screws . Center the bubble using the leveling screws-the bubble moves towards the screw that is turned clockwise.



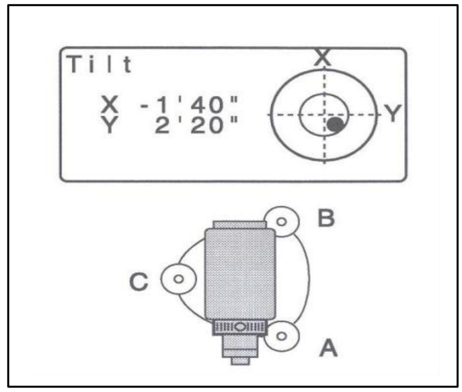
Rotate the instrument 90 degrees and level using the third leveling screw.



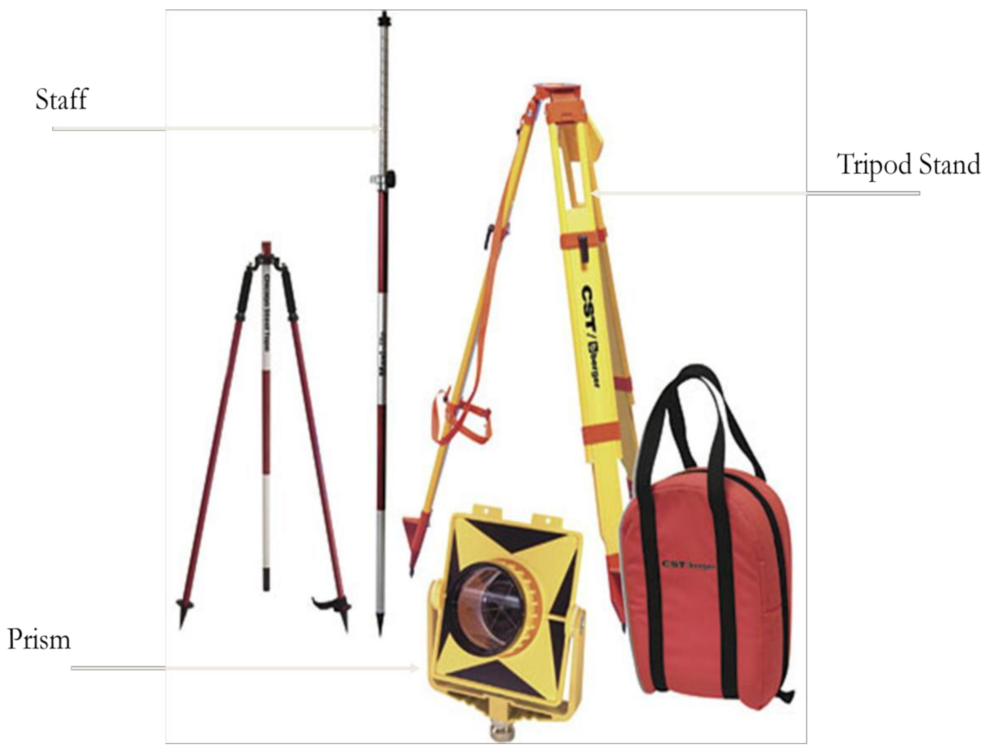
Observe the survey point in the optical plummet and center the point by loosening the centering screw and sliding the entire instrument. After re-tightening the centering screw check to make sure that the plate level bubble is level in several directions.

5. Electronically Verify Leveling

Turn on the instrument by pressing and holding the "ON" button (you should hear an audible beep). The opening screen will be the "MEAS" screen. Select the [TILT] function. Adjust the foot level screws to exactly center the electronic "bubble". Rotate the instrument 90^{o} and repeat.



3.3.7 Accessories of total Station



3.3.8 How Survey was done at Shoghi?

The main aim of doing survey at Shoghi was to prepare a layout of the Shoghi-Salana Road and also to find relative height difference between NH-22 and Shoghi-Salana Road so that we could plan our design parking facility.

Through, total station we measured three Distances as shown in the figure namely D_1, D_2 and D_3.

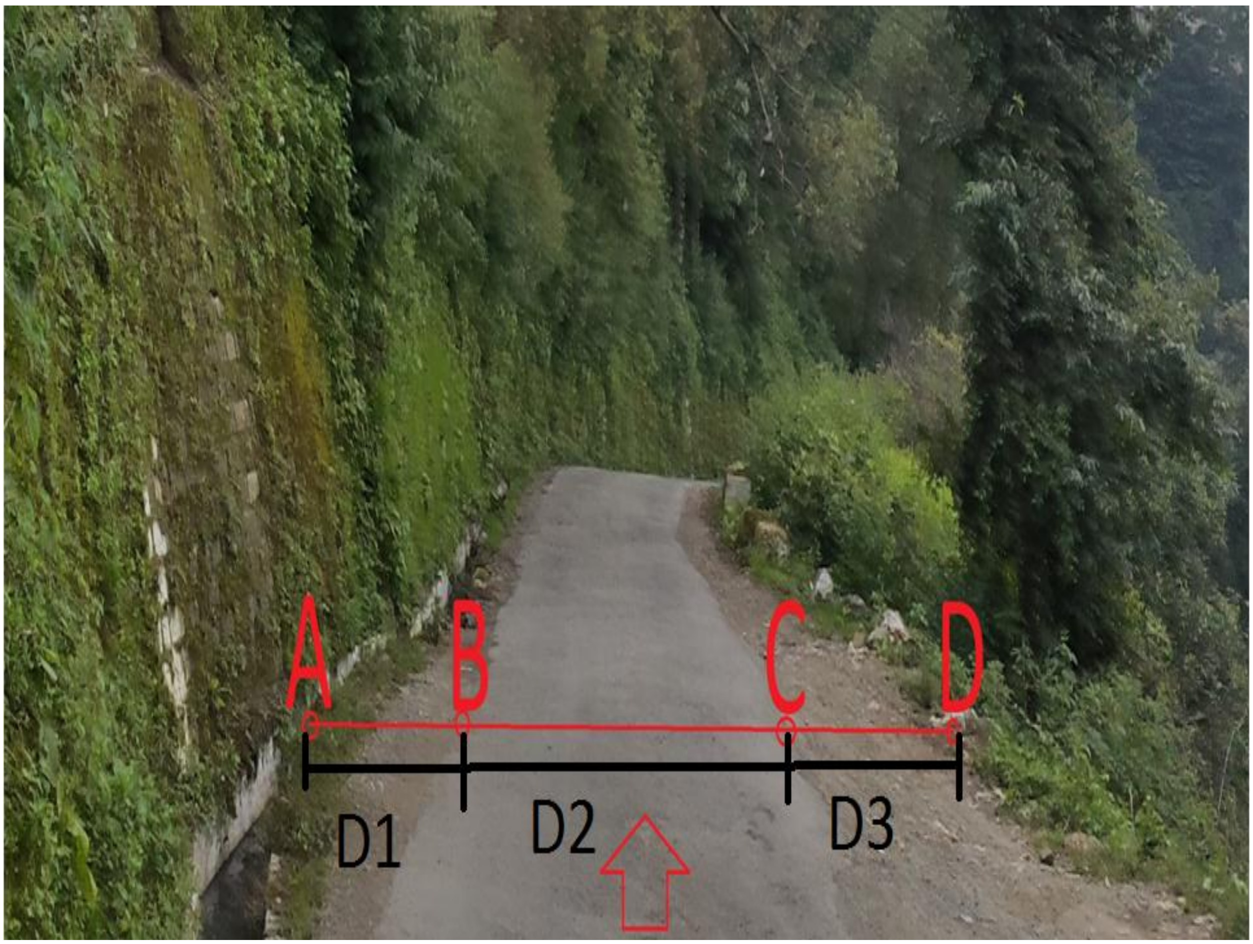


Fig 2.1 The various distances by total station survey

Where,

D_1 - Distance between the left side's outer most point and the left side of the road (black top). D_2 - Width of the carriage way at several cross sections.

D_3 - Distance between the right side's outer most point and the right side of the road (black top).

The Data Sheets of the survey are shown in APPENDIX-A.

CHAPTER-4

SOIL TESTING

4.1 DETERMINING MOISTURE CONTENT OF SOIL

Reference:
IS I 2720 (Part II)-1973 METHODS OP TEST FOR SOILS

PART II DETERMINATION OF WATER CONTENT

Significance:

For many soils, the water content may be an extremely important index used for establishing the relationship between the way a soil behaves and its properties. The consistency of a fine-grained soil largely depends on its water content. The water content is also used in expressing the phase relationships of air, water, and solids in a given volume of soil.

Equipment:

Drying oven, Balance, Moisture can, Gloves, Spatula.

Procedure:

(1) Record the moisture can and lid number. Determine and record the mass of an empty, clean, and dry moisture can with its lid (M_1)

(2) Place the moist soil in the moisture can and secure the lid.
Determine and record the mass of the moisture can (now containing the moist soil) with the lid (M_2).

(3) Remove the lid and place the moisture can (containing the moist soil) in the drying oven that is set at 105 °C. Leave it in the oven overnight.

(4) Remove the moisture can. Carefully but securely, replace the lid on the moisture can using gloves, and allow it to cool to room temperature. Determine and record the mass of the moisture can and lid (containing the dry soil) (M_3).

(5) Empty the moisture can and clean the can and lid.

Observations and Calculations

Specimen number	1	2
Moisture can and lid number	12	15
M_1 = Mass of empty, clean can + lid (grams)	7. 78	7.83
M_2 = Mass of can, lid, and moist soil (grams)	16. 39	13.43
M_3 = Mass of can, lid, and dry soil (grams)	15. 28	12.69
M_S = Mass of soil solids (grams)	7. 5	4.86
M_W = Mass of pore water (grams)	1 . 11	0.74
w = Water content, w%	14.8	15. 2

4.2 DETERMINATION OF DRY DENSITY OF SOIL BY CORE CUTTER METHOD

Reference

IS-2720-Part-29-Determination of dry density of soil in place by the core-cutter method

Apparatus

1. Cylindrical core cutter
2. Steel rammer
3. Steel dolly
4. Balance
5. Steel rule
6. Spade or pickaxe
7. Straight edge
8. Knife

Core cutter, Dolly & Rammer

Procedure

1. Measure the height (h) and internal diameter (d) of the core cutter and apply grease to the inside of the core cutter
2. Weigh the empty core cutter (W_1)
3. Clean and level the place where density is to be determined.
4. Drive the core cutter, with a steel dolly on its top, into the soil to its full depth with the help of a steel rammer.
5. Excavate the soil around the cutter with a crow bar and gently lift the cutter without disturbing the soil in it.
6. Trim the top and bottom surfaces of the sample and clean the outside surface of the cutter.
7. Weigh the core cutter with soil (W_2)
8. Remove the soil from the core cutter, using a sample ejector and take representative soil sample from it to determine the moisture content.

Precautions

1. Core cutter method of determining the field density of soil is only suitable for fine grained soil (Silts and clay). This is because collection of undisturbed soil sample from a coarse grained soil is difficult and hence the field properties, including unit weight, cannot be maintained in a core sample
2. Core cutter should be driven into the ground till the steel dolly penetrates into the ground half way only so as to avoid compaction of the soil in the core.
3. Before lifting the core cutter, soil around the cutter should be removed to minimize the disturbances.

Observations and Calculations

Moisture content determination:

Specimen number	1
Moisture can and lid number	15
M_1 = Mass of empty, clean can + lid (grams)	7.83
M_2 = Mass of can, lid, and moist soil (grams)	13.43
M_3 = Mass of can, lid, and dry soil (grams)	12.69
M_S = Mass of soil solids (grams)	4.86
M_W = Mass of pore water (grams)	0.74
w = Water content, w%	15. 2

$$V = \frac{\pi (3.41)^2 (7.26)}{4} = 66.28 \ cm^3$$

$$\rho_t = \frac{125.20}{66.28} = 1.89 \ \frac{g}{cm^3}$$

$$\rho_d = \frac{1.89}{1 + \frac{15.20}{100}} = 1.64 \frac{g}{cm^3}$$

4.3 To determine the liquid and plastic limits

Reference

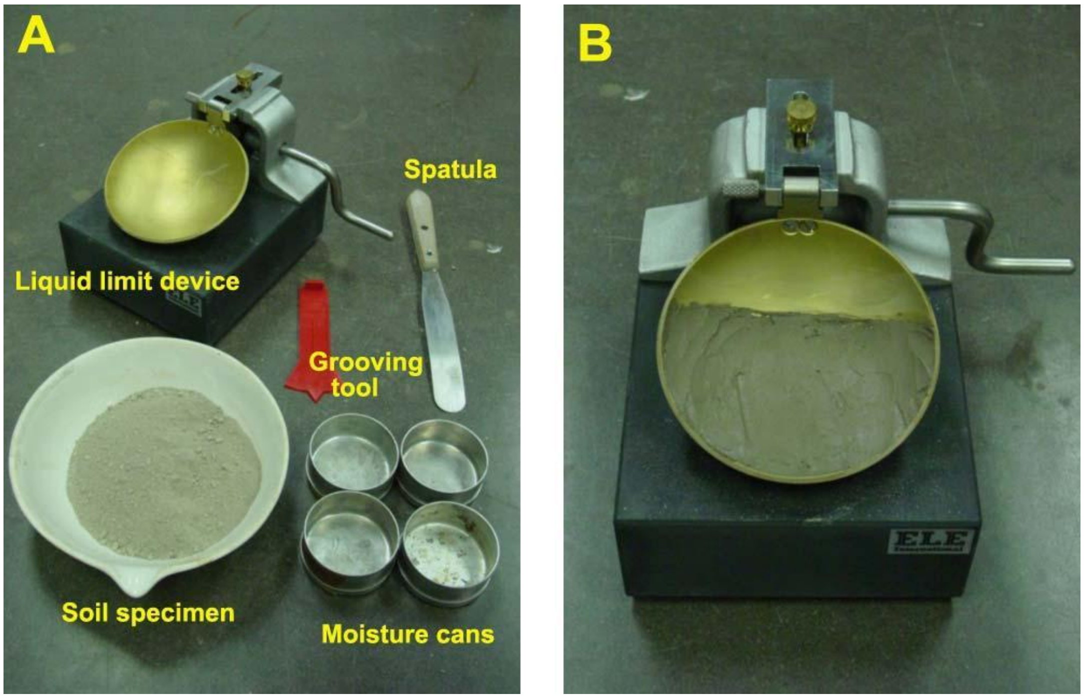
IS-2720-Part-5-Determination of liquid and plastic limit

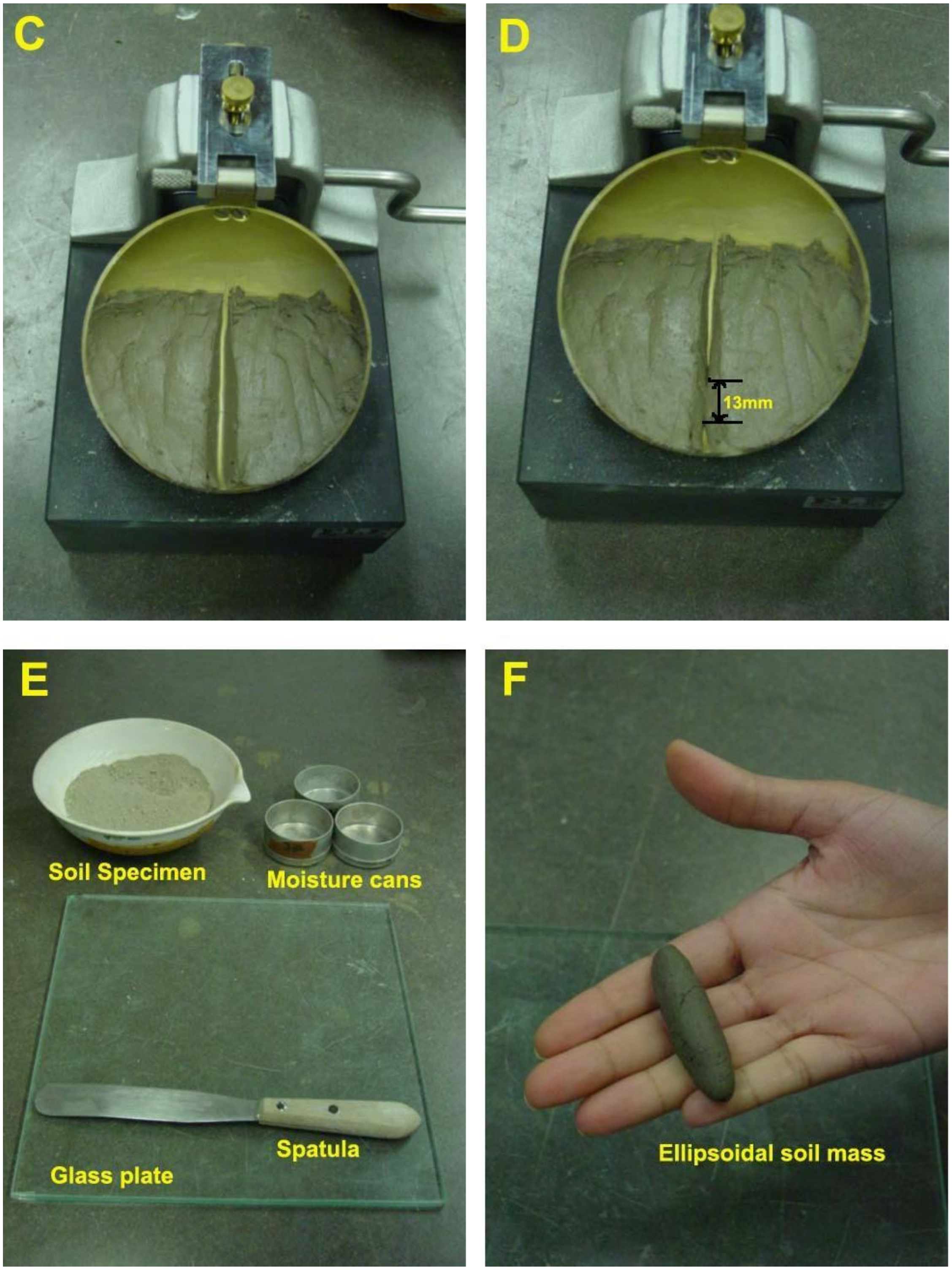
Significance:

The Swedish soil scientist Albert Atterberg originally defined seven “limits of consistency” to classify fine-grained soils, but in current engineering practice only two of the limits, the liquid and plastic limits, are commonly used. (A third limit, called the shrinkage limit, is used occasionally.) The Atterberg limits are based on the moisture content of the soil. The plastic limit is the moisture content that defines where the soil changes from a semi-solid to a plastic (flexible) state. The liquid limit is the moisture content that defines where the soil changes from a plastic to a viscous fluid state. The shrinkage limit is the moisture content that defines where the soil volume will not reduce further if the moisture content is reduced. A wide variety of soil engineering properties have been correlated to the liquid and plastic limits, and these Atterberg limits are also used to classify a fine-grained soil according to the Unified Soil Classification system or AASHTO system.

Equipment:

Liquid limit device, Porcelain (evaporating) dish, Flat grooving tool with gage, Eight moisture cans, Balance, Glass plate, Spatula, Wash bottle filled with distilled water, Drying oven set at 105°C.


A
Spatula
Liquid limit device
Grooving tool
Soil specimen
Moisture cans
B
ELE


C
D
13mm
E
Soil Specimen
Moisture cans
Spatula
Glass plate
F
Ellipsoidal soil mass

Test Procedure:

<u>Liquid Limit</u>:

Take roughly 3/4 of the soil and place it into the porcelain dish. Assume that the soil was previously passed though a No. 40 sieve, air-dried, and then pulverized. Thoroughly mix the soil with a small amount of distilled water until it appears as a smooth uniform paste. Cover the dish with cellophane to prevent moisture from escaping.

Weigh four of the empty moisture cans with their lids, and record the respective weights and can numbers on the data sheet.

Adjust the liquid limit apparatus by checking the height of drop of the cup. The. point on the cup that comes in contact with the base should rise to a height of 10 mm. The block on the end of the grooving tool is 10 mm high and should be used as a gage. Practice using the cup and determine the correct rate to rotate the crank so that the cup drops approximately two times per second.

Place a portion of the previously mixed soil into the cup of the liquid limit apparatus at the point where the cup rests on the base. Squeeze the soil down to eliminate air pockets and spread it into the cup to a depth of about 10 mm at its deepest point. The soil pat should form an approximately horizontal surface (See Photo B).

Use the grooving tool carefully cut a clean straight groove down the center of the cup. The tool should remain perpendicular to the surface of the cup as groove is being made. Use extreme care to prevent sliding the soil relative to the surface of the cup (See Photo C).

Make sure that the base of the apparatus below the cup and the underside of the cup is clean of soil. Turn the crank of the apparatus at a rate of approximately two drops per second and count the number of drops, N, it takes to make the two halves of the soil pat come into contact at the bottom of the groove along a distance of 13 mm (1/2 in.) (See Photo D). If the number of drops exceeds 50, then go directly to step eight and do not record the number of drops, otherwise, record the number of drops on the data sheet.

Take a sample, using the spatula, from edge to edge of the soil pat. The sample should include the soil on both sides of where the groove came into contact. Place the soil into a moisture can cover it. Immediately weigh the moisture can containing the soil, record its mass, remove the lid, and place the can into the oven. Leave the moisture can in the oven for at least 16 hours. Place the soil remaining in the cup into the porcelain dish. Clean and dry the cup on the apparatus and the grooving tool.

Remix the entire soil specimen in the porcelain dish. Add a small amount of distilled water to increase the water content so that the number of drops required to close the groove decrease.

Repeat steps six, seven, and eight for at least two additional trials producing successively lower numbers of drops to close the groove. One of the trials shall be for a closure requiring 25 to 35 drops, one for closure between 20 and 30 drops, and one trial for a closure requiring 15 to 25 drops. Determine the water content from each trial by using the same method used in the first laboratory. Remember to use the same balance for all weighing.

Plastic Limit:

(1) Weigh the remaining empty moisture cans with their lids, and record the respective weights and can numbers on the data sheet.

(2) Take the remaining 1/4 of the original soil sample and add distilled water until the soil is at a consistency where it can be rolled without sticking to the hands.

(3) Form the soil into an ellipsoidal mass (See Photo F). Roll the mass between the palm or the fingers and the glass plate (See Photo G). Use sufficient pressure to roll the mass into a thread of uniform diameter by using about 90 strokes per minute. (A stroke is one complete motion of the hand forward and back to the starting position.) The thread shall be deformed so that its diameter reaches 3.2 mm (1/8 in.), taking no more than two minutes.

(4) When the diameter of the thread reaches the correct diameter, break the thread into several pieces. Knead and reform the pieces into ellipsoidal masses and re-roll them. Continue this alternate rolling, gathering together, kneading and re-rolling until the thread crumbles under the pressure required for rolling and can no longer be rolled into a 3.2 mm diameter thread (See Photo H).

(5) Gather the portions of the crumbled thread together and place the soil into a moisture can, then cover it. If the can does not contain at least 6 grams of soil, add soil to the can from the next trial (See Step 6).

Immediately weigh the moisture can containing the soil, record its mass, remove the lid, and place the can into the oven. Leave the moisture can in the oven for at least 16 hours.

(6) Repeat steps three, four, and five at least two more times. Determine the water content from each trial by using the same method used in the first laboratory. Remember to use the same balance for all weighing.

Analysis:

Liquid Limit:

(1) Calculate the water content of each of the liquid limit moisture cans after they have been in the oven for at least 16 hours.

(2) Plot the number of drops, N, (on the log scale) versus the water content (w). Draw the best-fit straight line through the plotted points and determine the liquid limit (LL) as the water content at 25 drops.

Plastic Limit:

(1) Calculate the water content of each of the plastic limit moisture cans after they have been in the oven for at least 16 hours.

(2) Compute the average of the water contents to determine the plastic limit, PL. Check to see if the difference between the water contents is greater than the acceptable range of two results (2.6 %).

(3) Calculate the plasticity index, PI=LL-PL.
Report the liquid limit, plastic limit, and plasticity index to the nearest whole number, omitting the percent designation.

Observations and Calculations

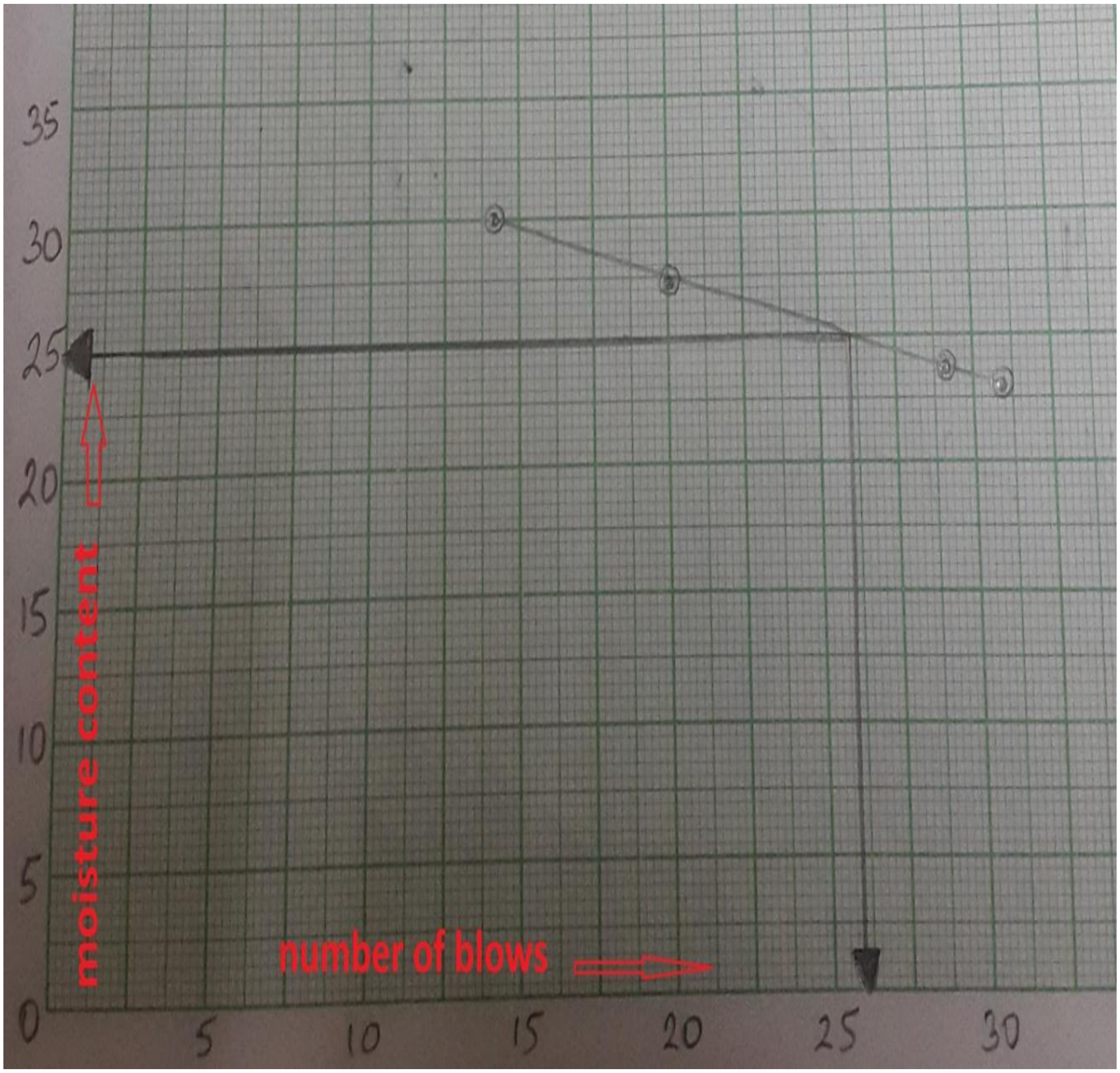
Liquid Limit Determination

Sample no.	1	2	3	4
Moisture can and lid number	11	1	5	4
M_C = Mass of empty, clean can + lid (grams)	22.23	23.31	21.87	22.58
M_{CMS} = Mass of can, lid, and moist soil (grams)	28.56	29.27	25.73	25.22
M_{CDS} = Mass of can, lid, and dry soil (grams)	27.40	28.10	24.90	24.60
M_S = Mass of soil solids (grams)	5.03	4.79	3.03	2.02
M_W = Mass of pore water (grams)	1.16	1.17	0.83	0.62
w = Water content, w%	23.06	24.43	27.39	30.69
No. of drops (N)	31	29	20	14

Plastic Limit Determination

Sample no.	1	2	3
Moisture can and lid number	7	14	13
M_C = Mass of empty, clean can + lid (grams)	7.78	7.83	15.16
M_{CMS} = Mass of can, lid, and moist soil (grams)	16.39	13.43	21.23
M_{CDS} = Mass of can, lid, and dry soil (grams)	15.28	12 .69	20.43
M_S = Mass of soil solids (grams)	7.5	4.86	5.27
M_W = Mass of pore water (grams)	1. 11	0.74	0.8
w = Water content, w%	14.8	15.2	15.1

Plastic Limit (PL)= Average w % $= (14.8 + 15.2 + 15.1)/3 = 15.03$



LIQUID LIMIT CHART

From the above graph, **Liquid Limit=26**

Final Results:

Liquid Limit = 26
Plastic Limit = 15
Plasticity Index =11

CHAPTER-5

MODELLING

5.1 Introduction

In modeling we have used the AUTO CAD software to prepare a layout of the Shoghi-Salana Road and 300m long NH-22 stretch by using the data points which were obtained from the Total Station Survey as discussed in the previous Chapter-2.

Though Auto Cad provides a large number of functions and tools to the users but here to prepare the layout we have used the basic commands such as

1. Drawing Commands: - To draw objects like Line, Poly line, Circle, Hatch etc.
2. Modifying Commands: - To edit the orientation of the objects commands like Copy, Paste, Rotate, Move, Mirror, Trim, Extend and Offset have been used.
3. Other Commands:-

a. LAYERS – These allow the user to assign different line types and colours to named layers. For example, a layer may for red continuous lines, another may be for green hidden lines, and yet another for blue centre lines.

b. UNITS – This command allows the user to set the insertion scale for the drawing and also helps to set the ‘Length’ and ‘Angle’ type and precision.

c. DIMALIGNED

d. DIMLINEAR

e. DCLINEAR

f. DCALIGNED

g. MTEXT

5.2 Procedure

Here, in Auto Cad we have to prepare the layout using the total survey data points. So here we imported these data points to get the layout by following steps:-

Step1:- The lines be drawn. For this to be done we used 'UNITS' and the 'LAYER' commands. On entering the units command a pop window comes on the screen where we set the insertion units to 'Meters' and angle type to 'Surveyor's Units'.

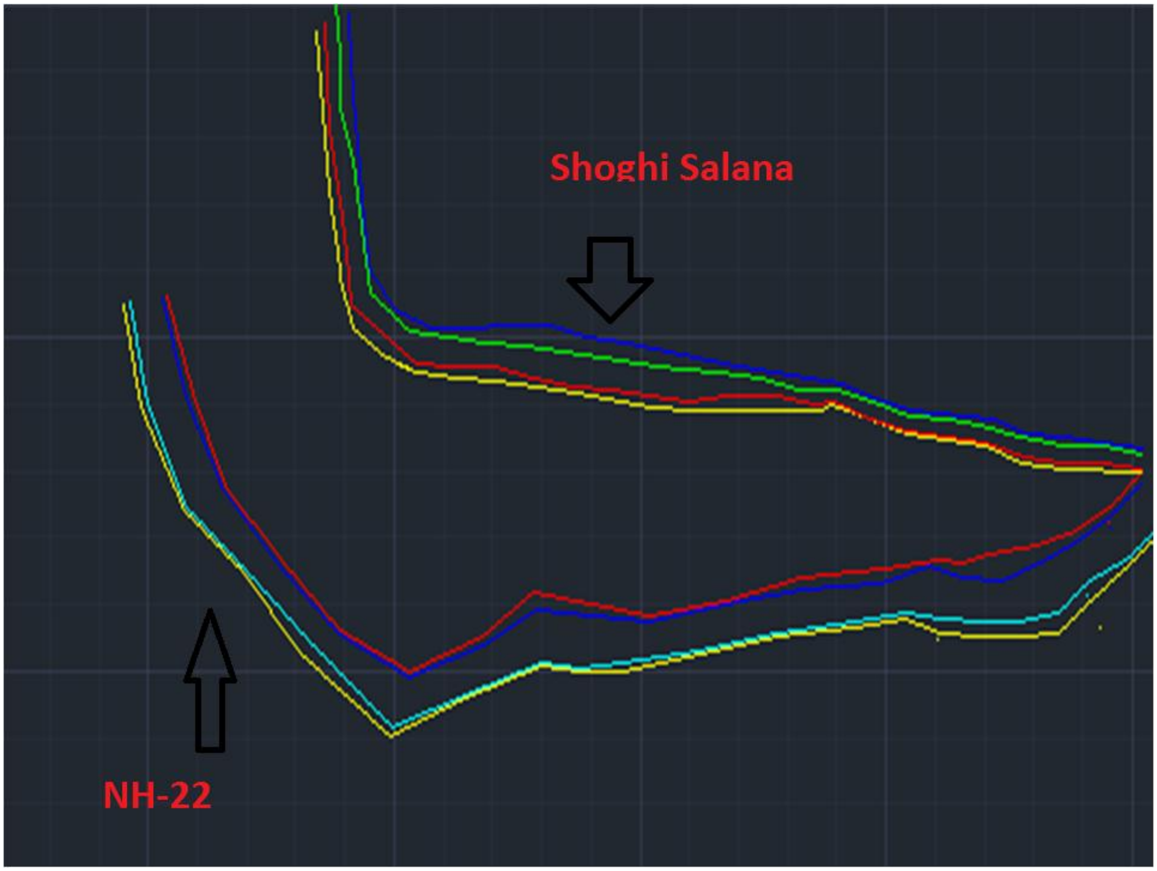
Step2:- Since the drawing conditions are set and the adequate layer is 'on' in Auto CAD. It's time to import. Type the command 'LINE' and then move to the EXCEL SHEET where you have prepared the data points in the required (X, Y) format.

In the EXCEL Sheet select the points that are falling in one line, copy them and then paste them in the command line of Auto CAD. The Auto CAD will join all the points by making a line between two consecutive points.

Here, we achieved the whole layout by joining drawings made in the same fashion upto each change of station of Total Station.

Step3:- After the layout has been made select the different layer to show the cross section lines
and then name them using the 'MTEXT' command.

Step4:- After the layout of the Shoghi-Salana Road was completed we merged it with the layout of the NH22 to get the following model.



Top view of the shoghi-salana roa

REFERENCES:-

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  www.vaasphalt.org

- Guidelines for the design of off-street car parking facilities by Ministry of municipalities and agriculture, Urban Planning Affairs, Kingdon of Bahrain.

- Textbook on “Surveying and Levelling”, Chapter 1, Page 1-3, by N.N.Basak

- Textbook on “Surveying vol.1”, Chapter 1, Page1-5 by Dr. B.C. Punmia, Ashok Kr. Jain and Arun Kr. Jain

- IS I 2720 (Part II)-1973 METHODS OP TEST FOR SOILS ,

  PART II DETERMINATION OF WATER CONTENT

- IS-2720-Part-29-Determination of dry density of soil in place by the core-cutter method

- IS-2720-Part-5-Determination of liquid and plastic limit