The Importance of Survey Camp in Hilly Zone (With Special Reference to Dalhousie) For Graduate Engineering (B.Tech./B.E.) Students: A Case Study

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Abstract— **Survey Camp, Dalhousie was held from 20th July – 6th August, 2009 as part of the academic curriculum at HCTM Kaithal (Affiliated to Kurukshetra University Kurukshetra). The site chosen for the camp was Dalhousie which is set in a valley containing a Zig-Zag and is bounded by a great hilly range. In this camp a batch of 72 students conducted survey operations covering Dalhousie and its adjoining areas using hand-held GPS, Total Station and Geodetic GPS. In addition, the students were introduced to some of the latest surveying techniques like Total Station. The camp was coordinated by Dr. Arvind Dewangan and Er. Manik Goyal a faculty with HCTM Kaithal. As myself one of the students in B.Tech 4th Sem. Of this Survey Camp.**

Index Terms— **Surveying, Mapping, Station, Leveling, Error.**
Sub Area : Surveying
Broad Area : Civil Engineering

MAPPING OF YOUTH HOSTEL:

Students were divided into groups of 7-8 and each group was allotted a Trimble 5600 DR200+ along with the accessories. This task involved mapping of the campsite, including all features at a scale of 1:500. The complexity of terrain required each group to establish controls using two closed traverses with each comprising of 6-7 stations. Free and known station techniques were used for determination of the next station's coordinates. The corrected coordinates of features were imported into ArcGIS where using Northing, Easting, Elevation and ID of points detailed map of the area was made including contours with CI=50cm.

Road Profiling near Forest Officer building using Total Station:

Using the same total station equipment, students were assigned road profiling of a 100 meter long road in which they had to generate data for increasing its width from 3 to 5 meters and also provide suggestions regarding soil removal and filling possibilities after inferring from the longitudinal and transverse profiles. Cross sections were taken every 10 meter along the road where Northing, Easting and Elevation at various points across cross-sections were recorded. Reflectorless method was employed for inaccessible points. As retaining walls and descending steep slopes are major factors in determining methodology for widening the road a number of points were observed on both sides besides normal features like manholes, trees, electric poles etc. The points were imported into ArcView and topographic map of road along with various profiles were prepared.

Computations, Corrections and plotting

For station establishment, two methods were used:
Free station method: Using points whose coordinates were known through Differential GPS.
Known station method: Used when coordinates of station point and reference object were known

Free station method is more accurate as propagation of errors does not take place. After completion of work, traverse is closed and closing error is determined in horizontal and vertical. These errors are then adjusted and corrected coordinates are calculated satisfying the condition that coordinates of a point do not change when returned to the same point after traversing the loop. The corrected coordinates are imported to ArcView for detailed cartography and generation of profiles.

Talking about the past, initially the geometrical and legal description of local lands and county seats, gained importance throughout the early modern period as legal and economic arguments came to rely on accurate descriptions and, increasingly, on measurement and "plotting." By the late seventeenth century, surveying included the mapping of larger political or geographical units. By the eighteenth, military leaders and colonial governors, as well as landed individuals, employed surveyors and cartographers. Techniques and instruments developed throughout the period produced a coherent body of theory and practice used for imperial mapping in the late eighteenth and nineteenth centuries.

The applications of surveying may be explained in following points:

1. To prepare the topographical map which shows hills, rivers, forests, valleys, etc.
2. To prepare the engineering map showing engineering details like higways, railways, canals, dams, reservoirs, etc.
3. To prepare the contour map to determine the best possible route and amount of earthwork required.
4. To prepare the geographical and political map.
5. To prepare archeological map showing the places where ancient relics may have lied.
6. To prepare cadastrial map showing boundries of properties like houses, buildings, fields, colonies, etc.

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Purpose of Surveying in the field of Civil Engineering

To layout our marked positions of proposed structures on the ground. Purpose of Surveying in the field of Civil Engineering

- To determine the relative positions of the existing futures of the ground.
- To layout our marked positions of proposed structures on the ground.
- To determine areas, volumes and other related quantities.
- To prepare a map of a country of detailed out location of cities, towns, villages and major roads.
- To prepare the engineering detailed plans and sections of various sections such as roads, railways, bridges, dams and other structure.
- To prepare a topographical map showing details of hills, valleys and rivers.

Instruments and techniques

The most commonly used instruments in surveying are a tape or chain for determining shorter distances, a level to determine height or elevation differences, and a theodolite, set on a tripod, to measure angles (horizontal and vertical), combined with the process of triangulation. Starting from a position with known location and elevation, the distance and angles to the unknown point are measured.

A more modern instrument is a total station, which is a theodolite with an electronic distance measurement device (EDM). A total station can also be used for leveling when set to the horizontal plane. Since their introduction, total stations have made the technological shift from being optical-mechanical devices to being fully electronic. Modern top-of-the-line total stations no longer require a reflector or prism (used to return the light pulses used for distancing) to return distance measurements, are fully robotic, and can even e-mail point data to the office computer and connect to satellite positioning systems, such as a Global Positioning System. Though real-time kinematic GPS systems have increased the speed of surveying, they are still horizontally accurate to only about 20 mm and vertically accurate to about 30–40 mm.

Surveys based on photographs are especially useful in rugged or inaccessible country and for reconnaissance surveys for construction, mapping, or military purposes. In air photographs, errors resulting from tilt of the airplane or arising from distortion of ground relief may be corrected in part by checking against control points fixed by ground surveys and by taking overlapping photographs and matching and assembling the relatively undistorted central portions into a mosaic. These are usually examined stereoscopically.

Historically, distances were measured using a variety of means, such as with chains having links of a known length, for instance a Gunter's chain, or measuring tapes made of steel or invar. To measure horizontal distances, these chains or tapes were pulled taut according to temperature, to reduce sagging and slack. Additionally, attempts to hold the measuring instrument level would be made. In instances of measuring up a slope, the surveyor might have to "break" (break chain) the measurement- use an increment less than the total length of the chain.

Historically, horizontal angles were measured using a compass, which would provide a magnetic bearing, from which deflections could be measured. This type of instrument was later improved, with more carefully scribed discs providing better angular resolution, as well as through mounting telescopes with reticles for more-precise sighting atop the disc (see theodolite). Additionally, levels and calibrated circles allowing measurement of vertical angles were added, along with verniers for measurement to a fraction of a degree—such as with a turn-of-the-century transit.

The simplest method for measuring height is with an altimeter – basically a barometer – using air pressure as an indication of height. But surveying requires greater precision. A variety of means, such as precise levels (also known as differential leveling), have been developed to do this. With precise leveling, a series of measurements between two points are taken using an instrument and a measuring rod. Differentials in height between the measurements are added and subtracted in a series to derive the net difference in elevation between the two endpoints of the series. With the advent of the Global Positioning System (GPS), elevation can also be derived with sophisticated satellite receivers, but usually with somewhat less accuracy than with traditional precise leveling. However, the accuracies may be similar if the traditional leveling would have to be run over a long distance.

Triangulation is another method of horizontal location made almost obsolete by GPS. With the triangulation method, distances, elevations and directions between objects at great distance from one another can be determined. Since the early days of surveying, this was the primary method of determining accurate positions of objects for topographic maps of large areas. A surveyor first needs to know the horizontal distance between two of the objects. Then the height, distances and angular position of other objects can be derived, as long as they are visible from one of the original objects. High-accuracy transits or theodolites were used for this work, and angles between objects were measured repeatedly for increased accuracy. See also Triangulation in three dimensions.

Turning is a term used when referring to moving the level to take an elevation shot in a different location. When land surveying, there may be trees or other obstructions blocking the view from the level gun to the level rod. In order to "turn" the level gun, one must first take a shot on the rod from the current location and record the elevation. Keeping the level rod in exactly the same location and elevation, one may move the level gun to a different location where the level rod is still visible. Record the new elevation seen from the new location of the level rod and use the difference in elevations to find the new elevation of the level gun. Turning is not only used when there are obstructions in the way, but also when drastically changing elevations. You can turn up or down in elevation but the gun must always be at a higher elevation than the base of the rod. A level rod can usually be raised up to 25 feet high, which enables the gun to be set much higher. However, if the gun is lower than the base of the rod, you will not be able to

take a shot because the rod cannot be lowered beyond the ground elevation.

Levelling

- Levelling is the art of representing relative positions in the vertical plane of different points on the earth's surface.
- It helps in determining the areas that are to be levelled to achieve a certain slope.

Principles of Surveying

All the surveys that are conducted are based on two fundamental principles. They are as follows:

1. Working from whole to part
2. Fixing a point with reference to two fixed points

Working from whole to part

In order to localize errors and prevent their accumulation, a set of control points is always established with great precision first for the whole area to be surveyed.

Later on, details or filled in between these control points to a relatively smaller precision.

This fundamental work principle is known as "Working from whole to part".

Fixing a point with reference to two fixed points

Survey stations are fixed by atleast two measurements, either both linear or angular measurements or linear and angular measurements from two control points.

RESPONSIBILITIES

One of the most important things that a surveyor does is to determine the property boundaries. While this may or may not be a big deal as far as buildings are concerned, but if the project is something such as a road, it can significantly alter the desired route. Land surveyors will often note elevation changes and other physical features that could be important as a project progresses. This can add a considerable amount of time to the work involved, but it can be invaluable to those who need to depend on those measurements when making their designs. Surveyors also transfers the designs from the paper to the actual field. Surveys may be performed to determine the suitability of a site for given project.

Once the surveying is complete, a report is made detailing the findings and sent to the interested parties. In some cases, land surveyors may be asked to explain their findings. In particularly contentious situations, such as a legal dispute involving land, they may even be called on to testify in court. However, such situations are extremely rare.

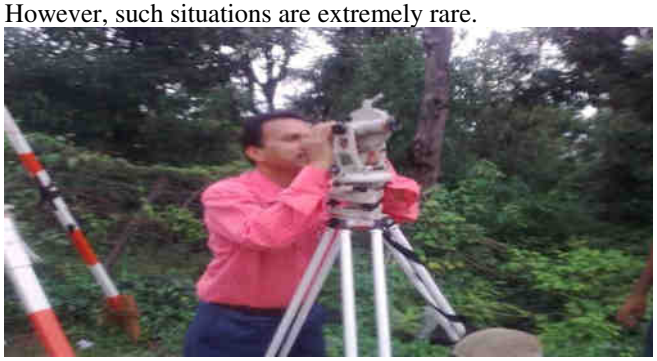

Figure 1: Dr. Arvind Dewangan –Professor in Civil Engineering Department at H.C.T.M. Kaithal concentrate with theodolite in the Dalhousie site on 23-July- 2009 near Station no. 5

In surveying, measurements may be made directly, electronically, by the use of optical instruments, by computations from known lines and angles, or by combination methods. Instruments used for direct linear measurements include the Gunter's chain (known also as the surveyor's chain), which is 66 ft (20 m) long and divided into 100 links; the engineer's chain, 100 ft (30 m) long and also consisting of 100 links; the tape, usually of steel, which has largely superseded chains; and the rod. Tapes and rods made of Invar metal (an alloy of steel and nickel) are used for very precise work because of their low coefficient of thermal expansion. In many situations electronic instruments, such as the geodimeter, which uses light waves, and the tellurometer, which uses microwaves, provide a more convenient and more accurate means of determining distance than do tapes and rods. The height of points in relation to a datum line (usually mean sea level) is measured with a leveling instrument consisting of a telescope fitted with a spirit level and usually mounted on a tripod. It is used in conjunction with a leveling rod placed at the point to be measured and sighted through the telescope.

Methods of Surveying

The practice of measuring angles and distances on the ground and plotting them accurately on map is generally termed as surveying. It is the technique and science used to determine accurate distances and angles between the terrestrial and three dimensional space positions of points. These points are taken from the positions on earth's surface and the method of surveying is used to develop land maps and boundaries for the purpose of land ownership and other governmental purposes. Chains with links of known lengths are one of the ways used to measure the distance in surveying. A compass capable of providing magnetic bearing and from which deflections could be measured is used to measure horizontal angles. Generally surveys are non experimental and descriptive methods related to research. Surveys are scientific research methods and it can be used extensively in library and information science so that attitudes and characteristics of a wide range of subjects can be determined, like quality of user system interfaces & reading habits of library users. There are two basic methods of surveying. They are cross sectional surveys and longitudinal surveys.

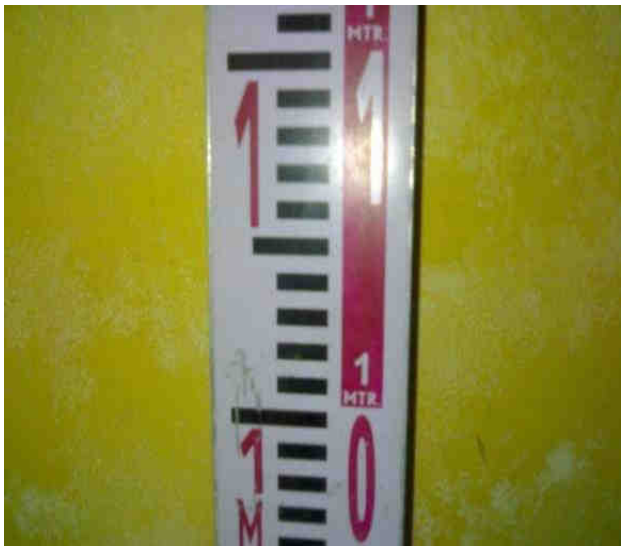

Fig. No.-2

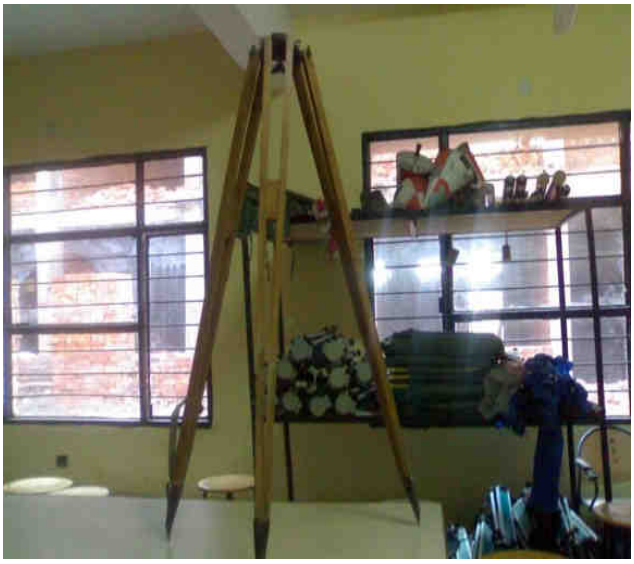

Fig-no.3

LEVELLING

Levelling can be used for checking the accuracy of construction levels for the foundations of houses, large buildings, bridges, etc. An example is shown in Figure 3 below. The surface levels may also be set out and checked using levelling. Levelling is a process of determining the height of one level relative to another. It is used in surveying to establish the elevation of a point relative to a datum, or to establish a point at a given elevation relative to a datum.

Based on the observation points and instrument positions direct leveling is divided into different types as follows:

- Simple leveling.
- Differential leveling.
- Fly leveling.
- Profile leveling.
- Precise leveling.
- Reciprocal leveling.

Cross sectional & longitudinal surveys

To gather information on a population at a single point in time generally cross sectional surveys are used. A cross-sectional survey questionnaire determines the relationship between two factors, for instance the relation between religiousness of parents and views on Internet sifting. Longitudinal surveys can be collected over a period of time. Next step by the researcher may is analyze changes in found in surveying and attempt to describe them. The three main types of longitudinal surveys are trend studies, cohort studies, and panel studies.

Importance of Surveying Methods in Civil Engineering

Creativity and technical knacks are deployed in Civil Engineering in order to make sure that the amenities important for modern life works safely and efficiently. Land Surveying is an important aspect in construction, and this is done with an aim to verify the exactness of the existing records. Information obtained by surveying is used to prepare legal documents like deeds and leases. Planning, designing and establishing the boundaries of properties which include services such as mapping, construction layout services, angle, elevation, area and volume can be done with the help of Surveying. Site examination and selection with the usage of computerized measuring instruments which covers information related to geography and topography are the major methods of surveying. These investigations help to find the best site location. Civil engineering survey works on various regions such as turning out of maps and plans which can help in designing and planning civil engineering structures. This field also includes supervising construction and this helps to ensure the precision of magnitude and tolerances.

Sr. No.	EXPERIMENT LIST FOR SURVEYING
1	TO STUDY THE FUNCTIONS OF VARIOUS PARTS OF THEODOLITE
2	TO CARRY OUT PERMANENT ADJUSTMENTS OF A TRANSIT THEODOLITE
3	TO MEASURE HORIZONTAL AND VERTICAL ANGLES USING A THEODOLITE
4	TO DETERMINE THE CONSTANTS OF AGIVEN TACHEOMETER
5	TO DETERMINE THE HORIZONTAL DISTANCE & ELEVATIONS OF A GIVEN TRAVERSE WITH THE HELP OF A TACHEOMETER
6	TO SET OUT SIMPLE CURVES BY OFFSETS FROM TANGENTS
7	TO SET OUT CURVES BY OFFSETS FROM CHORDS PRODUCED
8	TO SET OUT SIMPLE CURVES BY OFFSETS FROM LONG CHORDS
9	TO SET OUT SIMPLE CURVES BY RANKINE'S METHOD OF TANGENTIAL DEFLECTION ANGLES
10	TO MEASURE THE LENGTH OF BASE LINE IN TRIANGULATION SURVEY

CONCLUSION

The basic aim of the survey camp is to know various works carried out in the industrial field by surveying, which includes determining the topography of particular area with the help of survey work, map study and reconnaissance work. The methods used for surveying are traversing, leveling and contouring. This paper reflect the importance For better understanding to the different types of surveying techniques and methods in the Dalhousie [H.P.]city provide all types of fields in earth surface by which learner can learn all the mojor activities of processes. Being a graduate engineer this place provides various types of location what the survey camp need with fruit full atmosphere around the Youth Hostel at Dalhousie.

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