WHAT IS SURVEYING IN CIVIL ENGINEERING pdf

1: What is Civil Engineering Surveying?

Surveying is an important discipline in civil engineering that is intimately associated with a large number of facilities, including railways, roads, dams, bridges, and residential areas.

Fundamentals Of Surveying written by: Surveying creates the legal geographical boundaries and provides data for computer databases. Surveys are conducted for the preparation of maps, plots, topography, and boundaries to establish ownership of land, and used in the design, planning, and construction of any type of structure and communication networks. Knowledge of geometry, mathematics, and law is applied in the field of surveying. High accuracy optical and electromechanical equipment, including global positioning data obtained from the satellites, is also used for surveying. In prehistoric Egypt, when the boundaries of farms were washed out due to the overflow of the River Nile, the surveyors restored the boundaries by the use of geometry. The perfect north and south direction, and the accurate shape of a square of the pyramid of Giza, confirm the existence of the science of surveying in the period of BC. The corners of the pyramids of Egypt were set by surveyors utilizing surveying tools and fundamental principles of mathematics. The land surveyors existed as a profession during the era of Romans, and they formed the measurement system, for geographical identification of the sub-divisions of the Roman Empire. It is a survey conducted for recording the geological important features of th e area under study. Data is obtained from satellite or aerial photography for several purposes, such as geochemical or geomagnetic topics. It is used to mark the positions and layout of structures, such as buildings and roads for subsequent construction. It is a survey that determines the elevation of different points located on some piece of land, and marks them as contour lines on a plot. It is a survey carried out for the purpose of mapping the coastline for the purposes of navigation or resource management purposes. It is a survey to establish if an object or structure is moving or changing shape. It is conducted by determining the three dimensional positions of particular points, and the measurements are repeated after the passage of some period of time, at the same points. Comparison of the two sets of readings indicates if there is any movement taking place, or a change in shape has occurred. This has been possible because of the rapid advancements in the computer and other technologies. Consequently, reliability and accuracy of the data has increased considerably. Modern total stations are being used for surveying that are fully robotic and efficient. A total station is an electronic instrument used for the measurement of distances and angles from the device to the points being surveyed. By the use of trigonometry, the measured angles and distances are utilized to determine the real location of the points that are being surveyed. It has now become essential that topographical maps be developed with larger scales, including the creation of digital maps for improved planning. There is a requirement to augment our efforts in the measurement and supervision of global changes caused by nature or the human beings.

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2: Civil engineering surveying -

Surveying, the first step of starting a new civil engineering project, is a very important branch of civil engineering. To understand the techniques of surveying a student must carefully study the basics of it.

History[edit] Civil engineering as a discipline[edit] Civil engineering is the application of physical and scientific principles for solving the problems of society, and its history is intricately linked to advances in understanding of physics and mathematics throughout history. Because civil engineering is a wide-ranging profession, including several specialized sub-disciplines, its history is linked to knowledge of structures, materials science, geography, geology, soils , hydrology , environment , mechanics and other fields. Throughout ancient and medieval history most architectural design and construction was carried out by artisans , such as stonemasons and carpenters , rising to the role of master builder. Knowledge was retained in guilds and seldom supplanted by advances. Structures, roads and infrastructure that existed were repetitive, and increases in scale were incremental. Brahmagupta , an Indian mathematician, used arithmetic in the 7th century AD, based on Hindu-Arabic numerals, for excavation volume computations. History of structural engineering Engineering has been an aspect of life since the beginnings of human existence. The earliest practice of civil engineering may have commenced between and BC in ancient Egypt , the Indus Valley Civilization , and Mesopotamia ancient Iraq when humans started to abandon a nomadic existence, creating a need for the construction of shelter. During this time, transportation became increasingly important leading to the development of the wheel and sailing. Leonhard Euler developed the theory explaining the buckling of columns Until modern times there was no clear distinction between civil engineering and architecture, and the term engineer and architect were mainly geographical variations referring to the same occupation, and often used interchangeably. The Romans developed civil structures throughout their empire, including especially aqueducts , insulae , harbors, bridges, dams and roads. The northeast column temple also covers a channel that funnels all the rainwater from the complex some 40 metres ft away to a rejollada, a former cenote. In the 18th century, the term civil engineering was coined to incorporate all things civilian as opposed to military engineering. Though there was evidence of some technical meetings, it was little more than a social society. John Smeaton , the "father of civil engineering" In the Institution of Civil Engineers was founded in London, [10] and in the eminent engineer Thomas Telford became its first president. The institution received a Royal Charter in , formally recognising civil engineering as a profession. Its charter defined civil engineering as: Civil engineer Civil engineers typically possess an academic degree in civil engineering. The length of study is three to five years, and the completed degree is designated as a bachelor of technology , or a bachelor of engineering. The curriculum generally includes classes in physics, mathematics, project management , design and specific topics in civil engineering. After taking basic courses in most sub-disciplines of civil engineering, they move onto specialize in one or more sub-disciplines at advanced levels. After completing a certified degree program, the engineer must satisfy a range of requirements including work experience and exam requirements before being certified. Once certified, the engineer is designated as a professional engineer in the United States, Canada and South Africa , a chartered engineer in most Commonwealth countries , a chartered professional engineer in Australia and New Zealand , or a European engineer in most countries of the European Union. There are international agreements between relevant professional bodies to allow engineers to practice across national borders. The benefits of certification vary depending upon location. For example, in the United States and Canada, "only a licensed professional engineer may prepare, sign and seal, and submit engineering plans and drawings to a public authority for approval, or seal engineering work for public and private clients. In Australia, state licensing of engineers is limited to the state of Queensland. Almost all certifying bodies maintain a code of ethics which all members must abide by. There are a number of sub-disciplines within the broad field of civil engineering. General civil engineers work closely with surveyors and specialized civil engineers to design grading, drainage, pavement , water supply, sewer service, dams, electric and communications supply. General civil engineering is also referred to as site engineering, a branch of civil engineering that primarily focuses on converting a tract of land from one usage to another. Site

engineers spend time visiting project sites, meeting with stakeholders, and preparing construction plans. Civil engineers apply the principles of geotechnical engineering, structural engineering, environmental engineering, transportation engineering and construction engineering to residential, commercial, industrial and public works projects of all sizes and levels of construction.

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3: Civil engineering - Wikipedia

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It would be more difficult to put the pieces of the puzzle together during construction. Without surveyors, none of the aforementioned projects can be constructed correctly. The only way to measure land is to do so via a survey. It is the same measurements and data collected when a homeowner has a survey conducted on their property prior to listing it for sale or before constructing a fence along the property line. There are at least nine different types of surveying projects that surveyors complete within civil engineering. Those nine categories include the following: Used to determine the boundaries of parcels of land. Also referred to as a property survey. Used to determine vertical and horizontal positions for control points. Used to create a map of an area that has both man-made and natural features. Used to explore a site for its infrastructure availability. Used to collect data for the design of various engineering projects. Used to set work for construction to begin on the land. Used to collect data for the design and planning stages of engineering. Used to plan, design, and layout the route of canals, highways, railways, pipelines, and any other infrastructure that is linear. Used to collect data for mining operations. Used to collect longitude and latitude and azimuth when observing astronomical data. Used to establish grades, lines, and points and staking engineering works well after plans have been finalized and the design of the structure has been completed. Do you have questions about the job duties of a surveyor and how it pertains to civil engineering? Contact Cadsourcing in New York at today to speak to an experienced member of the staff.

WHAT IS SURVEYING IN CIVIL ENGINEERING pdf

4: What is Surveying | Definition | Importance - Civil Engineering

The civil engineering industry involves the design and construction of the facilities that shape the world we live in. From roads, railways and bridges to water supply pipes and power stations, this is all civil engineering.

Tacheometric Surveying- Methods, Detail Procedures What is Surveying Definition Importance Surveying, the first step of starting a new civil engineering project, is a very important branch of civil engineering. To understand the techniques of surveying a student must carefully study the basics of it. To start learning surveying one must start with the definition of surveying and its importance. Surveying is the technique of determining the relative position of different features on, above or beneath the surface of the earth by means of direct or indirect measurements and finally representing them on a sheet of paper known as plan or map. According to the American Congress on Surveying and Mapping ACSM , Surveying is the science and art of making all essential measurements to determine the relative position of points or physical and cultural details above, on, or beneath the surface of the Earth, and to depict them in a usable form, or to establish the position of points or details. Surveying also includes the technique of establishing points by predetermined angular and linear measurements. From the plans, sections, and maps prepared by surveying, the area and volume of a particular plot of land can be calculated. A map represents the horizontal projection of the area surveyed and not the actual area. But the vertical distance can be represented more correctly by drawing sections. During a survey, surveyors use various tools to do their job successfully and accurately, such as total stations, GPS receivers, prisms, 3D scanners, radio communicators, digital levels, dumpy level and surveying software etc. To understand the full scope of surveying, you can watch the following youtube video. Importance of Surveying The knowledge of surveying is advantageous in many phases of engineering. Surveying is of vital importance in any engineering project. Some of the basic importance of Surveying is discussed below. The first necessity in surveying is to prepare a plan and a section of an area to be covered by the project. From these prepared maps and sections the best possible alignment, amount of earthwork and other necessary details depending upon the nature of the project can be calculated. The planning and design of all Civil Engineering projects such as railways, highways, tunneling, irrigation , dams, reservoirs, waterworks, sewerage works, airfields, ports, massive buildings, etc. During execution of the project of any magnitude is constructed along the lines and points established by surveying. The measurement of land and the fixation of its boundaries cannot be done without surveying. The economic feasibility of the engineering feasibility of a project cannot be properly ascertained without undertaking a survey work. The execution of hydrographic and oceanographic charting and mapping requires. Surveying is used to prepare a topographic map of a land surface of the earth.

5: Property Surveyor vs. Engineer | www.enganchecubano.com

- Surveying Introduction by civil engineering channel - Surveying is the process of analyzing and recording the characteristics of a land area span to help design a plan or map for construction.

These points are usually on the surface of the Earth, and they are often used to establish land maps and boundaries for ownership or governmental purposes. To accomplish their objective, surveyors use elements of geometry, engineering, trigonometry, mathematics, physics, and law. Furthermore, as alluded to above, a particular type of surveying known as "land surveying" also per ACSM is the detailed study or inspection, as by gathering information through observations, measurements in the field, questionnaires, or research of legal instruments, and data analysis in the support of planning, designing, and establishing of property boundaries. Land surveying can include associated services such as mapping and related data accumulation, construction layout surveys, precision measurements of length, angle, elevation, area, and volume, as well as horizontal and vertical control surveys, and the analysis and utilization of land survey data. Surveying has been an essential element in the development of the human environment since the beginning of recorded history about 5, years ago. It is required in the planning and execution of nearly every form of construction. Its most familiar modern uses are in the fields of transport, building and construction, communications, mapping, and the definition of legal boundaries for land ownership. History of Land Surveying Surveying techniques have existed throughout much of recorded history. In ancient Egypt, when the Nile River overflowed its banks and washed out farm boundaries, boundaries were re-established by a rope stretcher, or surveyor, through the application of simple geometry. The nearly perfect squareness and north-south orientation of the Great Pyramid of Giza, built c. The Egyptian land register BC. A recent reassessment of Stonehenge c. The Groma surveying instrument originated in Mesopotamia early 1st millennium BC. Under the Romans, land surveyors were established as a profession, and they established the basic measurements under which the Roman Empire was divided, such as a tax register of conquered lands AD. The rise of the Caliphate led to extensive surveying throughout the Arab Empire. Arabic surveyors invented a variety of specialized instruments for surveying, including: Instruments for accurate leveling: A wooden board with a plumb line and two hooks, an equilateral triangle with a plumb line and two hooks, and a reed level. A rotating alhidade, used for accurate alignment. A surveying astrolabe, used for alignment, measuring angles, triangulation, finding the width of a river, and the distance between two points separated by an impassable obstruction. Highest in the hierarchy were triangulation networks. These were densified into networks of traverses polygons , into which local mapping surveying measurements, usually with measuring tape, corner prism and the familiar red and white poles, are tied. For example, in the late s, a team from the Ordnance Survey of Great Britain, originally under General William Roy began the Principal Triangulation of Britain using the specially built Ramsden theodolite. Large scale surveys are known as geodetic surveys. Surveying Techniques A standard Brunton Geo compass, still used commonly today by geologists and surveyors for field-based measurements. Example of modern hardware for surveying Field-Map technology: GPS, laser rangefinder and field computer allows surveying as well as cartography creation of map in real-time and field data collection. 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 degreeâ€”such as with a turn-of-the-century transit. The simplest method for measuring height is with an altimeter â€” basically a barometer â€” 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. Surveying Equipment A German engineer surveying during the First World War, As late as the s, the basic tools used in planar surveying were a tape measure 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 with an onship computer and software as well as humans. 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 GPS. 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 30â€”40 mm. Total stations are still used widely, along with other types of surveying instruments. However, GPS systems do not work well in areas with dense tree cover or constructions. One-person robotic-guided total stations allow surveyors to gather precise measurements without extra workers to look through and turn the telescope or record data. A faster but expensive way to measure large areas not details, and no obstacles is with a helicopter, equipped with a laser scanner, combined with a GPS to determine the position and elevation of the helicopter. To increase precision, beacons are placed on the ground about 20 km 12 mi apart. This method reaches precisions between 5â€”40 cm depending on flight height.

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6: Surveying & Leveling Civil Engineering Surveying Lectures & Course Notes

Surveying: Surveying, a means of making relatively large-scale, accurate measurements of the Earth's surfaces. It includes the determination of the measurement data, the reduction and interpretation of the data to usable form, and, conversely, the establishment of relative position and size according to given.

Principles Object of surveying The aim of surveying is to prepare a map to show the relative positions of the objects on the surface of the earth. The map is drawn to some suitable scale. It shows the natural features of a country, such as towns, villages, roads, railways, rivers, etc. Maps also include details of different engineering works, such as roads, railways, irrigation canals, etc. Uses of surveying Surveying may be used for the following various applications: To prepare a topographical map which shows the hills, valleys, rivers, villages, towns, forests, etc. To prepare a cadastral map showing the boundaries of fields, houses and other properties. To prepare an engineering map which shows the details of engineering works such as roads, railways, reservoirs, irrigation canals, etc. To prepare a military map showing the road and railway communications with different parts of a country. Such a map also shows the different strategic points important for the defence of a country. To prepare a contour map to determine the capacity of a reservoir and to find the best possible route for roads, railways, etc. To prepare a geological map showing areas including underground resources. To prepare an archaeological map including places where ancient relics exist. General Principles of surveying The general principles of surveying are: To work from the whole to the part To locate a new station by at least two measurements linear or angular from fixed reference points. According to the first principle, the whole area is first enclosed by main stations i. Controlling stations and main survey lines i. The area is then divided into a number of parts by forming well conditioned triangles. A nearly equilateral triangle is considered to be the best well-conditioned triangle. The main survey lines are measured very accurately with a standard chain. Then the sides of the triangles are measured. The purpose of this process of working is to prevent accumulation of error. During the procedure, if there is any error in the measurement of any side of a triangle, then it will not affect the whole work. The error can always be detected and eliminated. According to the second principle, the new stations should always be fixed by at least two measurements linear or angular from fixed reference points. Linear measurements refer to horizontal distances measured by chain or tape. Angular measurements refer to the magnetic bearing or horizontal angle taken by a prismatic compass or theodolite. In chain surveying, the positions of main stations and directions of main survey lines are fixed by tie lines and check lines. Please follow and like us: Related Post Dumpy Level The dumpy level originally designed by Gravatt, consists of a telescope tube firmly secured in two collars fixed by adjusting screws to the stage carr Types of Surveying Surveying is primarily classified as under: Plane surveying Geodetic Surveying Plane Surveying is that type of surveying in which the mean Levelling Levelling or Leveling is a branch of surveying, the object of which is:

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Surveying or land surveying is the technique, profession, and science of determining the terrestrial or three-dimensional positions of points and the distances and angles between them.

Surveyors and construction workers use laser beams to draw straight lines through the air. The beam itself is not visible in the air except where scattered by dust or haze, but it projects a bright point on a distant object. Surveyors bounce the beamâ€¦ History It is quite probable that surveying had its origin in ancient Egypt. The Great Pyramid of Khufu at Giza was built about bce, feet metres long and feet metres high. Evidence of some form of boundary surveying as early as bce has been found in the fertile valleys and plains of the Tigris, Euphrates, and Nile rivers. Clay tablets of the Sumerians show records of land measurement and plans of cities and nearby agricultural areas. Boundary stones marking land plots have been preserved. There is a representation of land measurement on the wall of a tomb at Thebes bce showing head and rear chainmen measuring a grainfield with what appears to be a rope with knots or marks at uniform intervals. Other persons are shown. Two are of high estate, according to their clothing , probably a land overseer and an inspector of boundary stones. There is some evidence that, in addition to a marked cord, wooden rods were used by the Egyptians for distance measurement. There is no record of any angle-measuring instruments of that time, but there was a level consisting of a vertical wooden A-frame with a plumb bob supported at the peak of the A so that its cord hung past an indicator, or index, on the horizontal bar. The index could be properly placed by standing the device on two supports at approximately the same elevation, marking the position of the cord, reversing the A, and making a similar mark. Halfway between the two marks would be the correct place for the index. Thus, with their simple devices, the ancient Egyptians were able to measure land areas, replace property corners lost when the Nile covered the markers with silt during floods, and build the huge pyramids to exact dimensions. The Greeks used a form of log line for recording the distances run from point to point along the coast while making their slow voyages from the Indus to the Persian Gulf about bce. The magnetic compass was brought to the West by Arab traders in the 12th century ce. The astrolabe was introduced by the Greeks in the 2nd century bce. An instrument for measuring the altitudes of stars, or their angle of elevation above the horizon, took the form of a graduated arc suspended from a hand-held cord. A pivoted pointer that moved over the graduations was pointed at the star. The instrument was not used for nautical surveying for several centuries, remaining a scientific aid only. The Greeks also possibly originated the use of the groma, a device used to establish right angles, but Roman surveyors made it a standard tool. It was made of a horizontal wooden cross pivoted at the middle and supported from above. From the end of each of the four arms hung a plumb bob. By sighting along each pair of plumb bob cords in turn, the right angle could be established. By shifting one of the cords to take up half the error, a perfect right angle would result. About 15 bce the Roman architect and engineer Vitruvius mounted a large wheel of known circumference in a small frame, in much the same fashion as the wheel is mounted on a wheelbarrow; when it was pushed along the ground by hand it automatically dropped a pebble into a container at each revolution, giving a measure of the distance traveled. It was, in effect, the first odometer. The water level consisted of either a trough or a tube turned upward at the ends and filled with water. At each end there was a sight made of crossed horizontal and vertical slits. When these were lined up just above the water level, the sights determined a level line accurate enough to establish the grades of the Roman aqueducts. In laying out their great road system, the Romans are said to have used the plane table. It consists of a drawing board mounted on a tripod or other stable support and of a straightedgeâ€”usually with sights for accurate aim the alidade to the objects to be mappedâ€”along which lines are drawn. It was the first device capable of recording or establishing angles. Later adaptations of the plane table had magnetic compasses attached. Plane tables were in use in Europe in the 16th century, and the principle of graphic triangulation and intersection was practiced by surveyors. In Willebrord Snell , a Dutch mathematician, measured an arc of meridian by instrumental triangulation. In the English mathematician Edmund Gunter developed a surveying chain, which was superseded only by the steel tape beginning in the late 19th century. The study of astronomy resulted in the development of angle-reading devices that were

based on arcs of large radii, making such instruments too large for field use. With the publication of logarithmic tables in , portable angle-measuring instruments came into use. They were called topographic instruments, or theodolites. They included pivoted arms for sighting and could be used for measuring both horizontal and vertical angles. Magnetic compasses may have been included on some. The vernier , an auxiliary scale permitting more accurate readings , the micrometer microscope , telescopic sights , and spirit levels about were all incorporated in theodolites by about Stadia hairs were first applied by James Watt in The development of the circle-dividing engine about , a device for dividing a circle into degrees with great accuracy, brought one of the greatest advances in surveying methods, as it enabled angle measurements to be made with portable instruments far more accurately than had previously been possible. Modern surveying can be said to have begun by the late 18th century. Many improvements and refinements have been incorporated in all the basic surveying instruments. These have resulted in increased accuracy and speed of operations and opened up possibilities for improved methods in the field. In addition to modification of existing instruments, two revolutionary mapping and surveying changes were introduced: Important technological developments starting in the late 20th century include the use of satellites as reference points for geodetic surveys and electronic computers to speed the processing and recording of survey data. Baseline measurements for classical triangulation the basic survey method that consists of accurately measuring a base line and computing other locations by angle measurement are therefore reduced to sea-level length to start computations, and corrections are made for spherical excess in the angular determinations. Primary triangulation is performed under rigid specifications to assure first-order accuracy. Efforts are now under way to extend and tie together existing continental networks by satellite triangulation so as to facilitate the adjustment of all major geodetic surveys into a single world datum and determine the size and shape of the Earth spheroid with much greater accuracy than heretofore obtained. At the same time, current national networks will be strengthened, while the remaining amount of work to be done may be somewhat reduced. Satellite triangulation became operational in the United States in with observations by Rebound A, launched that year, and some prior work using the Echo 1 and Echo 2 passive reflecting satellites. The first satellite specifically designed for geodetic work, Pageos 1, was launched in A first requirement for topographic mapping of a given area is an adequate pattern of horizontal and vertical control points, and an initial step is the assembly of all such existing information. This consists of descriptions of points for which positions in terms of latitude and longitude and elevations above mean sea level have been determined. They are occasionally located at some distance from the immediate project, in which case it is necessary to expand from the existing work. This is usually done on second- or third-order standards, depending upon the length of circuits involved. The accuracy of survey measurements can be improved almost indefinitely but only at increased cost. Accordingly, control surveys are used; these consist of a comparatively few accurate measurements that cover the area of the project and from which short, less accurate measurements are made to the objects to be located. The simplest form of horizontal control is the traverse, which consists of a series of marked stations connected by measured courses and the measured angles between them. When such a series of distances and angles returns to its point of beginning or begins and ends at stations of superior more accurate control, it can be checked and the small errors of measurement adjusted for mathematical consistency. By assuming or measuring a direction of one of the courses and rectangular coordinates of one of the stations, the rectangular coordinates of all the stations can be computed. Triangulation A system of triangles usually affords superior horizontal control. All of the angles and at least one side the base of the triangulation system are measured. Though several arrangements can be used, one of the best is the quadrangle or a chain of quadrangles. Each quadrangle, with its four sides and two diagonals, provides eight angles that are measured. To be geometrically consistent, the angles must satisfy three so-called angle equations and one side equation. Ideally, the quadrangles should be parallelograms. If the system is connected with previously determined stations, the new system must fit the established measurements. Because of gravity anomalies , the geoid is irregular; however, it is very nearly the surface generated by an ellipse rotating on its minor axisâ€”i. Such a figure is called a spheroid. This oblate spheroid has a polar diameter about 27 miles 43 kilometres less than its diameter at the Equator. These lengths are assumed to be the distances, measured on the spheroid, between the

extended lines of gravity down to the spheroid from the ends of the measured lengths on the actual surface of the Earth. The elevations of bench marks are given in terms of their heights above a selected level surface called a datum. In large-level surveys the usual datum is the geoid. The elevation taken as zero for the reference datum is the height of mean sea level determined by a series of observations at various points along the seashore taken continuously for a period of 19 years or more. Because mean sea level is not quite the same as the geoid, probably because of ocean currents, in adjusting the level grid for the United States and Canada all heights determined for mean sea level have been held at zero elevation. To correct these distortions, orthometric corrections must be applied to long lines of levels at high altitudes that have a northâ€”south trend. Trigonometric leveling often is necessary where accurate elevations are not available or when the elevations of inaccessible points must be determined. From two points of known position and elevation, the horizontal position of the unknown point is found by triangulation, and the vertical angles from the known points are measured. The differences in elevation from each of the known points to the unknown point can be computed trigonometrically. The National Ocean Service in recent years has hoped to increase the density of horizontal control to the extent that no location in the United States will be farther than 50 miles 80 kilometres from a primary point, and advances anticipated in analytic phototriangulation suggest that the envisioned density of control may soon suffice insofar as topographic mapping is concerned. Existing densities of control in Britain and much of western Europe are already adequate for mapping and cadastral surveys. Global positioning The techniques used to establish the positions of reference points within an area to be mapped are similar to those used in navigation. In surveying, however, greater accuracy is required, and this is attainable because the observer and the instrument are stationary on the ground instead of in a ship or aircraft that is not only moving but also subject to accelerations, which make it impossible to use a spirit level for accurate measurements of star elevations. The technique of locating oneself by observations of celestial objects is rapidly going out of date. In practicing it, the surveyor uses a theodolite with a spirit level to measure accurately the elevations of the Sun at different times of the day or of several known stars in different directions. For longitude it is necessary also to record the Greenwich Mean Time of each observation. This has been obtained since by using an accurate chronometer that is checked at least once a day against time signals transmitted telegraphically over land lines and submarine cables or broadcast by radio. A more recent procedure for global positioning relies on satellites, whose locations at any instant are known precisely because they are being continuously observed from a series of stations in all parts of the world. The coordinates of these stations were established by very large scale triangulation based on a combination of radar observations of distances and measurements of the directions of special balloons or flashing satellites, obtained by photographing them at known instants of time against the background of the fixed stars. The principal method of using satellites for accurate positioning is based on an application of the Doppler effect. A radio signal is transmitted at a steady frequency by the satellite, but a stationary observer detects a higher frequency as the satellite approaches and a lower one as it recedes. Establishing the framework Most surveying frameworks are erected by measuring the angles and the lengths of the sides of a chain of triangles connecting the points fixed by global positioning. The locations of ground features are then determined in relation to these triangles by less accurate and therefore cheaper methods.

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8: Surveying Lecture Notes PDF - Civil Engineering

Surveying is a very important part of Civil Engineering. It is a basic course for all universities for civil engineers. It is a basic course for all universities for civil engineers. Here in we have gathered some pdf lectures on surveying.

Hardware[edit] Surveying equipment. Clockwise from upper left: Most instruments screw onto a tripod when in use. Tape measures are often used for measurement of smaller distances. The theodolite is an instrument for the measurement of angles. It uses two separate circles, protractors or alidades to measure angles in the horizontal and the vertical plane. A telescope mounted on trunnions is aligned vertically with the target object. The whole upper section rotates for horizontal alignment. The vertical circle measures the angle that the telescope makes against the vertical, known as the zenith angle. The horizontal circle uses an upper and lower plate. When beginning the survey, the surveyor points the instrument in a known direction bearing , and clamps the lower plate in place. The instrument can then rotate to measure the bearing to other objects. If no bearing is known or direct angle measurement is wanted, the instrument can be set to zero during the initial sight. It will then read the angle between the initial object, the theodolite itself, and the item that the telescope aligns with. The gyrotheodolite is a form of theodolite that uses a gyroscope to orient itself in the absence of reference marks. It is used in underground applications. The total station is a development of the theodolite with an electronic distance measurement device EDM. A total station can be used for leveling when set to the horizontal plane. Since their introduction, total stations have shifted from optical-mechanical to fully electronic devices. They are fully robotic, and can even e-mail point data to a remote computer and connect to satellite positioning systems , such as Global Positioning System. Static GPS uses two receivers placed in position for a considerable length of time. The long span of time lets the receiver compare measurements as the satellites orbit. The changes as the satellites orbit also provide the measurement network with well conditioned geometry. RTK surveying uses one static antenna and one roving antenna. The static antenna tracks changes in the satellite positions and atmospheric conditions. The surveyor uses the roving antenna to measure the points needed for the survey. The two antennas use a radio link that allows the static antenna to send corrections to the roving antenna. The roving antenna then applies those corrections to the GPS signals it is receiving to calculate its own position. RTK surveying covers smaller distances than static methods. This is because divergent conditions further away from the base reduce accuracy. Surveying instruments have characteristics that make them suitable for certain uses. Theodolites and levels are often used by constructors rather than surveyors in first world countries. The constructor can perform simple survey tasks using a relatively cheap instrument. Total stations are workhorses for many professional surveyors because they are versatile and reliable in all conditions. The productivity improvements from a GPS on large scale surveys makes them popular for major infrastructure or data gathering projects. One-person robotic-guided total stations allow surveyors to measure without extra workers to aim the telescope or record data. A fast but expensive way to measure large areas is with a helicopter, using a GPS to record the location of the helicopter and a laser scanner to measure the ground. Software[edit] Land surveyors, construction professionals and civil engineers using total station , GPS , 3D scanners and other collector data use Land Surveying Software to increase efficiency, accuracy and productivity. Land Surveying Software is a staple of contemporary land surveying. The factors that can affect the accuracy of their observations are also measured. They then use this data to create vectors, bearings, coordinates, elevations, areas, volumes, plans and maps. Measurements are often split into horizontal and vertical components to simplify calculation. GPS and astronomic measurements also need measurement of a time component. Distance measurement[edit] Example of modern equipment for surveying Field-Map technology: GPS , laser rangefinder and field computer allows surveying as well as cartography creation of map in real-time and field data collection. Before EDM devices, distances were measured using a variety of means. To measure horizontal distances, these chains or tapes were pulled taut to reduce sagging and slack. The distance had to be adjusted for heat expansion. Attempts to hold the measuring instrument level would also be made. When 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. Perambulators , or measuring

wheels, were used to measure longer distances but not to a high level of accuracy. Tacheometry is the science of measuring distances by measuring the angle between two ends of an object with a known size. It was sometimes used before to the invention of EDM where rough ground made chain measurement impractical. Angle measurement[edit] Historically, horizontal angles were measured by using a compass to provide a magnetic bearing or azimuth. Later, more precise scribed discs improved angular resolution. Mounting telescopes with reticles atop the disc allowed more precise sighting see theodolite. Levels and calibrated circles allowed measurement of vertical angles. Verniers allowed measurement to a fraction of a degree, such as with a turn-of-the-century transit. The plane table provided a graphical method of recording and measuring angles, which reduced the amount of mathematics required. In Francis Ronalds invented a reflecting instrument for recording angles graphically by modifying the octant. This is called a close. If the first and last bearings are different, this shows the error in the survey, called the angular misclose. The surveyor can use this information to prove that the work meets the expected standards. When more precise measurements are needed, means like precise levels also known as differential leveling are used. When precise leveling, a series of measurements between two points are taken using an instrument and a measuring rod. Differences in height between the measurements are added and subtracted in a series to get the net difference in elevation between the two endpoints. Usually GPS is somewhat less accurate than traditional precise leveling, but may be similar over long distances. When using an optical level, the endpoint may be out of the effective range of the instrument. There may be obstructions or large changes of elevation between the endpoints. In these situations, extra setups are needed. Turning is a term used when referring to moving the level to take an elevation shot from a different location. To "turn" the level, one must first take a reading and record the elevation of the point the rod is located on. While the rod is being kept in exactly the same location, the level is moved to a new location where the rod is still visible. A reading is taken from the new location of the level and the height difference is used to find the new elevation of the level gun. This is repeated until the series of measurements is completed. The level must be horizontal to get a valid measurement. Because of this, if the horizontal crosshair of the instrument is lower than the base of the rod, the surveyor will not be able to sight the rod and get a reading. The rod can usually be raised up to 25 feet high, allowing the level to be set much higher than the base of the rod. Observations to the sun, moon and stars could all be made using navigational techniques. The point can then be used as a base for further observations. Survey-accurate astronomic positions were difficult to observe and calculate and so tended to be a base off which many other measurements were made. Since the advent of the GPS system, astronomic observations are rare as GPS allows adequate positions to be determined over most of the surface of the earth. Geodetic network A survey using traverse and offset measurements to record the location of the shoreline shown in blue. Black dashed lines are traverse measurements between reference points black circles. The red lines are offsets measured at right angles to the traverse lines. Few survey positions are derived from first principles. Instead, most surveys points are measured relative to previous measured points. This forms a reference or control network where each point can be used by a surveyor to determine their own position when beginning a new survey. The surveyors can set up their instruments on this position and measure to nearby objects. Sometimes a tall, distinctive feature such as a steeple or radio aerial has its position calculated as a reference point that angles can be measured against. It can determine distances, elevations and directions between distant objects. 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, known as the baseline. Then the heights, 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, and angle measurements repeated for increased accuracy. See also Triangulation in three dimensions. Offsetting is an alternate method of determining position of objects, and was often used to measure imprecise features such as riverbanks. The surveyor would mark and measure two known positions on the ground roughly parallel to the feature, and mark out a baseline between them. At regular intervals, a distance was measured at right angles from the first line to the feature.

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