Principles of triangulation survey pdf

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On one side of the triangle and all the angles, you can calculate the other two sides (figure 1-8, page 1-12). Also, if you know the latitude and longitude of one end of the side plus the length and direction of the hand, you can calculate the latitude and longitude of the other end of the side. Figure 1-8. Principles of triangulation (1) The side of the triangle, which is measured, is called the baseline. It should be very carefully measured using a bar, chain or tape, which should be calibrated and periodically checked by the Bureau of Standards. It is not easy to reduce the basic ellipsoid because our knowledge of both geoid and ellipsoid is so limited. Until recently, this was not possible because geoidic heights were not known. Compromise is usually necessary, and the baseline comes down to MSL. This error is small in the very baseline; however, because the baseline determines the scale of the control network, this error can spread throughout the network. Although this source of error may be small, a higher knowledge of undulating geoids can further improve the accuracy of horizontal positioning. With relatively new instruments such as the tsyferometer (a microwave system that uses line-of-sight conditions and is capable of measuring up to 20 to 25 miles) and a geydimeter (a system that uses light as a medium and is capable of measuring up to 2 to 3 miles per day and 15 to 20 miles at night), you can measure distances much faster, but not necessarily with more accuracy than conventional methods. EN0593 1-12 The art of mapping is very old. Ancient Egyptians and Babylonians made maps and plans, fragments of which survived. The Greeks, recognizing the Earth as a sphere, applied astronomical observations to mapping: in fact, in the third century BC Eratosthenes assessed the circumference of the Earth with a certain degree of accuracy, surpassed only in modern times. In the second century AD, the Greek Ptolemy of Egyptian origin was responsible for the production of a set of maps that remained standard reference works for more than a thousand years. In the fourteenth, fifteenth and sixteenth centuries, a series of maps of sailors, known as portolan maps, covering the Mediterranean and neighboring seas, was released. In the sixteenth century, Mercator invented a projection known by its name and is still widely used, especially in navigation maps, for which it is convenient because the compass bearings are displayed as straight lines. Mercator maps also use the latitude and longitude frames that have arisen among the ancient Greeks. The line of separation between ancient and modern mapping can be taken as marked by three great achievements, namely, the triangulation of France, started by Cassini de Touri in 1747 and completed by the French government, the first precise triangulation of the United Kingdom, made by William Roy, and communication by triangulation of the Observatories of Greenwich and Paris, carried out under the auspices of the British Royal Society. Triangulation has become the basis of all modern mapping. It was only with the introduction of the Global Positioning System (GPS) and the use of artificial Earth satellites to establish the position of points on the Earth's surface that a significant alternative to triangulation emerged. Land survey methods are based on five basic principles. First, it is the work from whole to part, which establishes the initial control point structure, which is then broken down into smaller networks with points closer together. The second principle is that once a higher-order network is created, you can operate in less stringent standards in lower orders without affecting the overall accuracy of the work. It makes no sense to work to higher standards, since when you connect later works to earlier ones, the work at a higher order is fixed and therefore the new survey could not be better than a higher control order. The third and related principle is to save money, namely that, since higher accuracy generally costs more money, the surveyor should strive for no higher accuracy than is necessary and sufficient to accomplish the task at hand. The fourth principle is to apply independent data verification where possible - for example, by measuring all three corners of the triangle, even if the third-corner measurement is superfluous. This provides built-in quality control. Finally, in principle, since change occurs over time, mechanisms need to be put in place to ensure that the survey is aware of its further use. This is the last principle that has not been properly considered in most of the world's maps today. The traditional means of establishing control is triangulation, a principle behind which there is a simple trigonometry, namely, that if either two angles and one side length in a triangle are known, or all three lateral lengths are measured, the exact size and shape of the triangle are known. Angle measurements are made using theodolite, while distances that in the past should have been measured very painstakingly with metal tapes are now recorded using electronic distance measuring devices. The fact that the Earth is a spheroid, not a plane surface, means that the direct lines of euclide cannot be measured on its surface. The lines measured in this way do not even arc the true sphere, and this introduces complications in measurements and calculations. This, however, does not detract from the simplicity of the principle, and most modern maps were ultimately based on a series of from one or two baselines of known length and spreads throughout the area covered by the map. This formed the main network of checkpoints, which in turn were used as a basis for defining a number of second-order networks; they, in turn, were used to establish the third order and the fourth order, with local details recorded in relation to the common network. Triangulation using AB as a baseline Distance AB is measured exactly then C, D, E, F, G, H, I, J and K can only be corrected by angular measurements. While triangulation techniques were used to establish horizontal control, altitude measurements were obtained either by measuring vertical angles using theodolite (and correcting observed angles to influence the curvature of the earth and refracting light through the atmosphere) or by alignment. The latter method uses a spirit level and two graded poles to get what can be a very accurate measurement of the height difference between successive points. Thus, starting at points of a known height, levels can be transmitted sequentially until another known point is reached, which can be used to verify that there has not been a gross error. Taking into account the original structure of horizontal checkpoints, additional points can be established either by further triangulation or by trilatation (i.e. measuring the sides rather than the angles of the triangles) or by bypassing. You can also use satellite position capture techniques or photogrammetry techniques. Bypassing is a method often used to take perimeters, or to identify an area for a further more detailed survey, or to construct the course of a road, railway, creek, or other function. The method starts at a known point from which there is a known direction - for example, a point already set by triangulation, from which another known point is visible to provide the necessary orientation. The detour is then done by measuring the angle and linear distance to the next point on the traverse; From there, the bearings can be oriented from the previous point and the further checkpoint set in the future direction. The bypass continues in this way until either it can be closed back to the point at which it started, or preferably to another previously established checkpoint, thus providing the necessary independent verification against any gross error in measurements. Angles are usually measured by theodorite, although a prismatic compass or plane table can be used for elementary surveys. Distances should be measured by a steel band tape, optical distance methods such as a sub-spill strip, or electronic distance measurement. Data either in field notebooks, or electronically for subsequent calculations. Bypass between known points A and B using known C C points D for targeting and fixing E, F, G and H by measuring angles and distances Electronic shooting techniques have become standard in the more developed world. These include measurements using a common station that combines both the angular qualities of traditional theodolite with electronic distance measurement and automatic data recording. The benefits of using such equipment include the speed of surveys compared to traditional methods, which increases productivity; Lower risk of gross measurement errors and lower levels of manipulative skills that are needed to produce much higher levels of accuracy and accuracy. The disadvantages of electronic methods include much higher investments, which are required, and much higher maintenance costs, both of which are the outflow of hard currency for developing countries. In addition, if equipment is disrupted, it may have to be sent to a foreign country for repairs, and any examination may be seriously delayed. Prices for a large number of electronic equipment, especially computers, are still falling, but on the other hand, much of the information technology has a relatively short lifespan before being replaced by more powerful systems that can improve performance. Prices, such as those for Global Positioning System (GPS) receivers, have fallen significantly since their first introduction, making their use economically viable. With the help of GPS it is necessary to see in the sky four satellites, signals from which are picked up by a gps receiver. Signals are marked with pulses at famous times, so the moment at which three signals are received provides information on how far the satellites were at the time - the measurement on the fourth satellite must establish the time difference between the clock in the GPS receiver and the time recorded by the satellite system. The general system allows to determine the relative position of nearby points on the ground within a few centimeters in latitude, longitude and height. Since a good all-round view of the sky is necessary, the technique is not suitable for forests or jungles or in urban centers where there are many high-rise buildings. However, in open rural areas, it is extremely useful and cost-effective for building dense networks of checkpoints. The Global Positioning System (GPS) Receiver with signals from four satellites 15% side overlap 60% Fore and Aft Overlap of the stripes of aerial photography Photogrammetry is another method by which a large number of checkpoints can be installed over a limited area - provided that suitable points on the ground can be seen well in the photos. Positions of some ground points should be determined either by GPS, triangulation or by bypass Measurements the position of other points can be done on aerial photographs and calculations performed in a process known as aerial triangulation to obtain equivalent ground positions of measured points. Appropriate overlapping aerial photography should be available to provide a stereometric cover, meaning each piece of land should appear on at least two adjacent photos, and some points must appear on three consecutive photos in the photo strip. The overlapping and aft-blocking photo cover should be about 60 percent, while the side floor between the lanes should be about 15 percent. With such a block of photography and depending on the scale of the equipment used, the quality of the image of the coordinated points and the skill of the operators, it is possible to measure the relative position of the points on the ground to the limit within a few centimeters. Photogramometry is essentially a mass-produced method that becomes cost-effective only when a fairly large number of points on the ground need to be corrected. Precision, achievable with modern equipment, depends on the cost more than any other factor. An additional advantage that comes from the use of photogramometry is that the methods can be used not only to fix checkpoints, but also to build parts and contour lines. Ground survey methods are less suitable for topographical mapping than for relatively small areas. Trigonometry data, however obtained, relate to positions on the spheroid taken as a survey of datum. The map is usually a flat sheet and it requires a map projection to transmit spheroidal data. There are many types of projections that require changes in angles and distances measured on the Earth's surface. Either the form or the area (or both) of the objects displayed will inevitably be changed to some extent. Different predictions give different results for different parts of the Earth's surface. Some projections have special advantages for specific purposes, and therefore the choice of projection in each case is determined by the part of the Earth's surface to which it should be applied and the purpose for which the map was prepared. The scale of the map, i.e. the number of units of length on the ground represented by one similar unit on the map, is of great practical importance. Libra is best described by ratios (or fractions) in which the first digit (or numerator) refers to one unit of measurement on the map and the second (or denominator) to the equivalent number of the same units on earth. Obviously, the larger the scale of the map, the more details that can be built on it. It is equally obvious that a scale convenient for one purpose may be the most inconvenient for Goal. Thus, a pedestrian can find a map on a scale of 1:10,000 conveniently, but but The scale will be inconvenient for the motorist who will drive outside the map sheet for a few minutes. The scale of the main maps derived from topographical survey data is important because, while it is generally practical and convenient to produce small maps from large-scale maps, omitting the details and adjustments to the position and shape of some objects, it is not virtually impossible to produce large-scale maps from the base map on a smaller scale without further fieldwork. The scale chosen to display the map should depend on the topography and proximity to the occupation of the country and on the objectives to which any maps derived from the original maps must be delivered. In general, the scale chosen should be a scale that would show the details required with the necessary degree of accuracy and clarity and provide enough space to enter into the descriptive question necessary for specific purposes. When the baseline is defined, the base of the map is based on the required projection of three-gonometry and other recorded data. The printed card is then usually washed onto the field to enter the final part, although if it is based on aerial photographs much of this work can be done in the office. The feature of most national cards is the grid. This is a series of lines drawn in parallel and at right angles with the chosen meridian. The purpose of the grid is to ensure that the position of any location on the map is located or described. This is done by singing the squares of the original grid (and their divisions) in a recognized sequence. It should be noted that the only map projection on which the grid coincides with the graticule, that is, the predicted positions of the network of latitude and longitude lines on which the map is based is a simple cylindrical projection. It is never used for topographical maps because of the way it distorts the shape of the earth. In general, the grid and grid match only on selected lines, such as the central meridian in the Cross Mercator, which is the most commonly used mapping projection for topographical mapping. In practice, the grid as a whole never matches the grille. The most convenient scales for topographical maps for public use are those between 1:25,000 and 1:250,000. The common scales are 1:50,000 and 1:100,000 Even the largest of these cards, however, contains many features specified by conventional signs and does not appeal to scale. If you want real precision of topographical details, you need to use a larger scale. The failure to comply with the limitations of standard topographical maps has led to considerable confusion in the past in many countries, especially in the issue of mining concessions. Concessions. principles of triangulation survey pdf

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