



ACBA4002 DIGITAL SURVEYING

Assignment 1

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1. Introduction

Johnson (2014) defined surveying as “a general view; a look at or over; a close examination or inspection to ascertain condition, quantity, quality, etc.; the determination of dimensions and other topical particulars of any part of the earth's surface”. Surveying allows measurements to be more accurate and techniques have also become more accurate with improvements in technology, thereby reducing the risk of human error. The report below outlines the different factors of surveying and discusses the various types of surveying in relation to one of these factors. It will also include a description of the application of digital surveying technologies in surveying listed buildings, whilst describing the tools used and the information collected from the survey.

2. Surveying Classification

The aim of surveying is the preparation of a plan or map illustrating the relative positions of objects on the earth's surface (BEC, 2020). Surveying work consists of planning – carrying out analysis and research for example, the acquisition of data from work in the field and processing this data, representing it through mapping, and finally writing a report. The factors impacting survey classification are identified below, followed by the surveying types for the method chosen.

2.1 Primary Classification

Surveying classifications are based on primary classification, purpose, equipment and method and two principal classifications exist - Geodetic and Plane Surveying. In Geodetic surveying (figure 1), measurements involve a large extent of the earth's surface and so to ensure inconsistencies are eradicated, the curvature of the earth should be taken into account (Clancy, 1991). (Note: the angles of a triangle do not add up to 180° on the surface of a sphere as they do in plane geometry.) In Plane surveying, the curvature of the earth can be disregarded due to the limited extent of the survey. The size of the area that may be deemed to be a flat plane is up to 300 km, depending on the required precision (Clancy, 1991). Illustrated in figure 1, in Geodetic surveying, the mean surface of the earth is seen as a sphere, passing through the points intercepting at the earth's centre, whereas in Plane surveying the mean surface of the earth is seen as a plane and the lines passing through the points are parallel to each other (Chand, 2021). Plane surveying is the most used method.

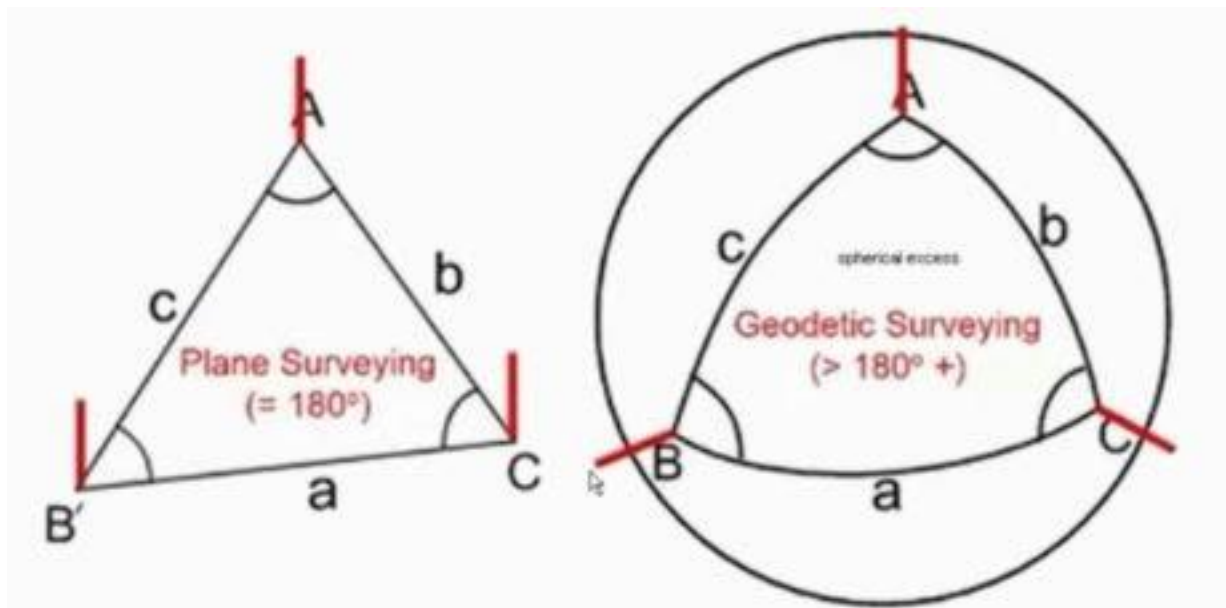


Figure 1: Difference between Plane and Geodetic Surveying. Obtained by (Chand, 2021).

2.2 Purpose

The classification of surveying is also based on purpose and different methods are used for a specific objective, in order to gain a better understanding of the field being studied. Topographical surveys focus on the location of the main natural and man-made characteristics of the earth (including railways and roads, towns and villages, rivers, lakes, valleys and hills) (Dauda, 2021). Cadastral surveys may be undertaken for legal purposes such as deed plans, demonstrating and defining the boundaries of properties and the calculation of area(s) involved and can take place in urban and rural environments. (Clancy, 1991). A hydrographic survey is used to survey bodies of water, from oceans and seas to streams, rivers, lakes and reservoirs. These surveys can for example, measure the flows of a river or stream, chart areas lying beneath water surfaces and map shorelines. They can be used for control of flooding and the development of water supply and resources for example (Dauda, 2021). Photogrammetric Surveys make use of photographs taken from aeroplanes or ground stations but using special cameras, from which measurements are obtained and used in conjunction with ground surveys (figure2).



Figure 2: Aerial photograph example of an area in Sydney, Australia. Obtained (SydneyHeli.au, nd).

2.3 Equipment.

Survey Classification can also be based on the various types of instruments utilised, including both modern and traditional techniques. These techniques include traditional methods such as Compass Survey and Chain Survey, but also more modern approaches such as Remote Sensing and Aerial Photographic Survey. For the more traditional methods such as a Chain Survey, horizontal measurements and angles of an area are taken during fieldwork and is more suitable for surveying small areas of land, The equipment required includes a ranging pole, pegs, arrows and a chain (Mahajan, 2021). A more modern technique such as Remote Sensing, would use equipment such as an airborne laser scanner - the LIDAR (Light Detection and Ranging) being an example. This is mounted on an aircraft and using a GPS and inertial navigation system, uses laser beams to scan extensive areas aground and creates level surveys (Dauda, 2021).

2.4 Method

The Surveying classification based on method is used to collect information. Each method uses the simple principle - that if two points are formed, a third point can be located in relation to these using different methods of measurement. These can be summarised as a Linear measurement or an Angular measurement. The former has only one dimension – length – and a measurement in a straight line would give the shortest distance between any two points. An angular measurement is the measurement of the angle formed when two straight lines meet. I will now discuss surveying classification based on method in more depth.

One surveying method is Triangulation. In order to establish the relative positions and distances of points distributed throughout an area, Triangulation traces and measures a network or series of triangles, in particular “measuring the length of one side of each triangle and deducing its angles and the length of the other two sides by observation from this baseline” (Mudavath, 2018) (figure 3).

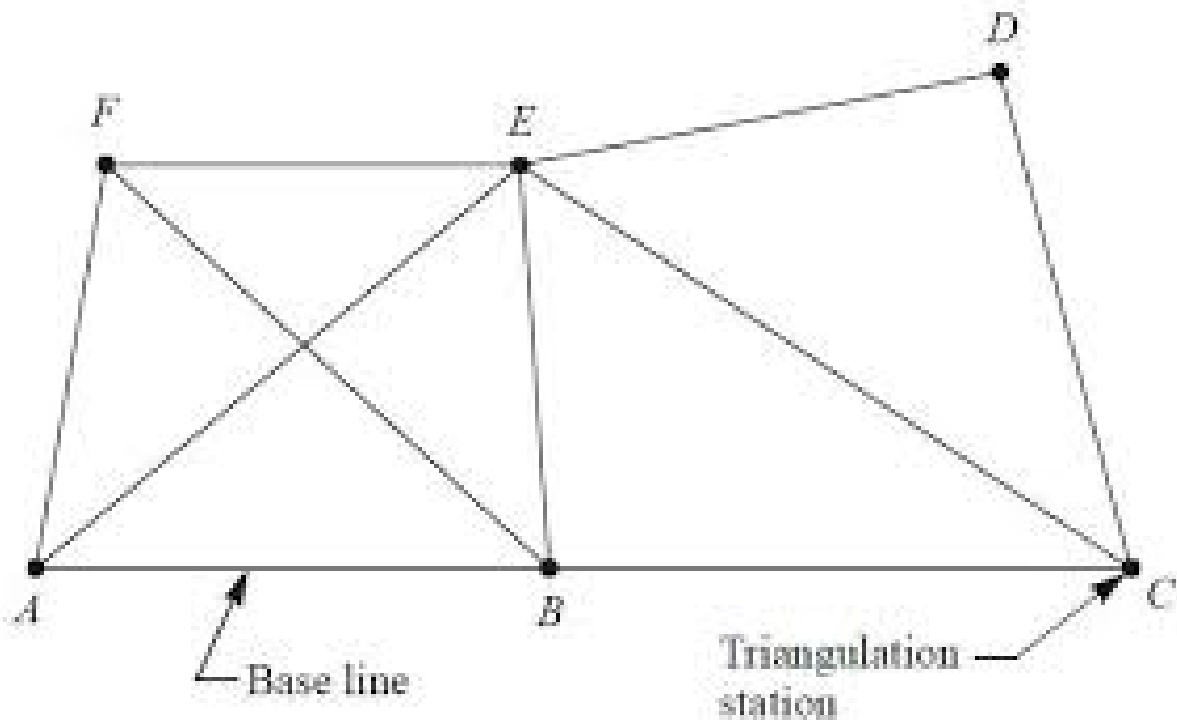


Figure 3: Triangulation method.

Another method is Traversing. Using any direction measuring instrument such as a theodolite or compass, the direction of any survey line can be measured and the length can be gauged using chain or tape, which can be closed or open. (Mudavath, 2018) (figure 4).

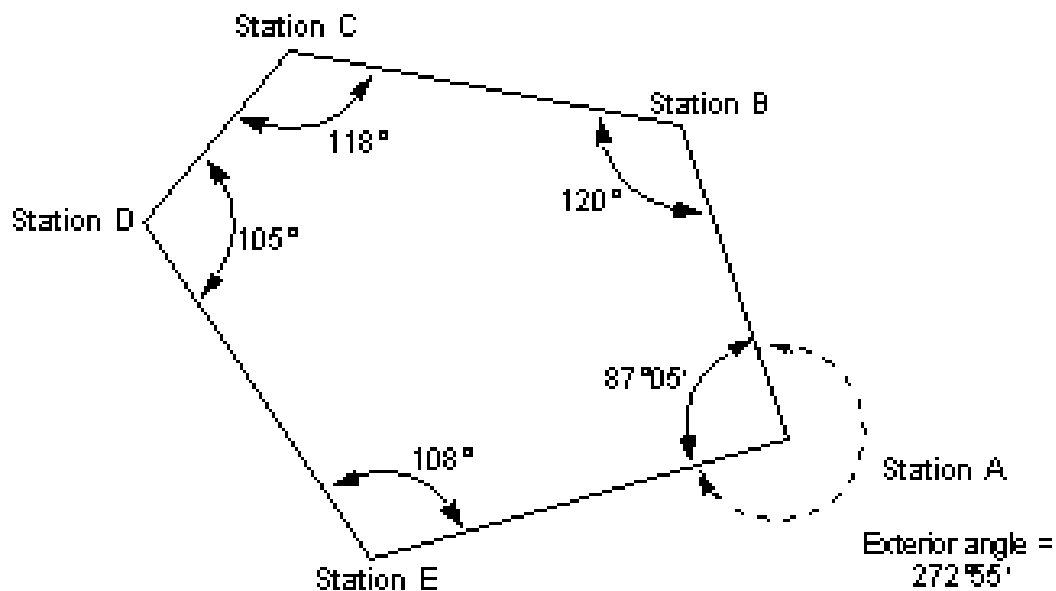


Figure 4: Traversing method.

In Trilateration, the lengths of the sides of a triangle are measured electronically and the angles then computed. A Surveyor can thereby calculate other angles and distances that could not have been measured by constructing a series of triangles adjacent to one another. (Mudavath, 2018) (figure 5).

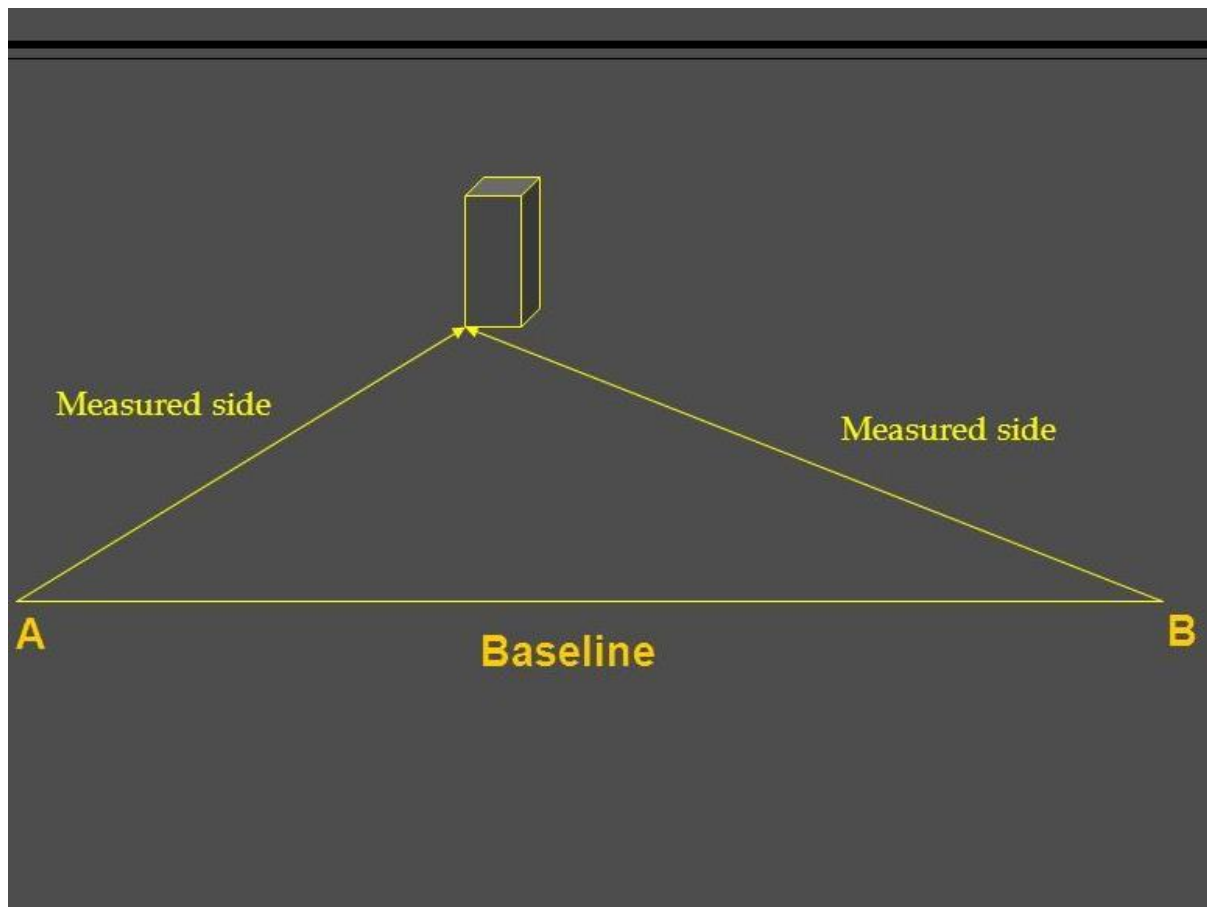


Figure 5: Trilateration method.

3. The application of digital surveying technologies

A listed building survey is undertaken by a Chartered Surveyor on protected properties of architectural or historical significance (Lott, 2018). In this section of the essay, a description of the application of digital surveying technologies in surveying listed buildings will be provided, giving examples of appropriate tools to be used and the information to be collected from the survey.

Many of these buildings are surveyed for different reasons, such as to produce a detailed plan/elevation of the building, to establish the existing conditions and renovations and to fulfil the requirements of building legislation. The surveying team gain a better insight into the building, identifying any defects and the improvements required to ensure that the historical building is structurally sound. 91.7% of buildings in the UK are Grade 2 classification, so they merit every effort to be preserved as they are of “special interest” (Bidwells, 2018). There are 5 parts to the process; the planning including the research, analysis and decision making; Field work concentrating on the acquisition of data, site measurements and observations; Computing which collates the data gathered in the field; Mapping i.e. representation of the data and finally the report, presenting the key findings and data. These are illustrated as follows.

3.1 Planning

The planning stage includes a desktop planning audit, where Planning Authority and historic environmental records are researched, including asbestos register entries and past property deeds (Dauda, 2021). Surveyors then have a good idea of how a building should appear when the inspection commences (Nicholson, 2021). A risk assessment should also be undertaken. In accordance with the HSW Act 1974, the planning phase should establish if applications for listed building consent or planning permission have been submitted. If modifications have not received listed building consent or have not been carried out in accordance with the approved specifications or any conditions, it must be established if these should be made good or removed (Nicholson, 2021).

3.2 Data Acquisition

Various technologies and tools are used to gain measurements of the listed building. One tool is a Disto/Laser which calculates room areas and angled slopes by sending a laser to the object and calculating the distance between them (figure 5). Other pieces of equipment include a thermal camera (figure 6) and a moisture meter (figure 7). The thermal camera detects structural problems, condensation, damp and water leaks and identifies why a property is cold and where energy and therefore money is being wasted, whilst also ensuring building compliance. (Eaton, 2021). A moisture meter measures the amount of water within a wide range of materials, allowing the user to establish if moisture levels are appropriate, or if adjustments are necessary. (Eaton, 2021). There are two main types of moisture meter - pin and pinless – and each is suitable for a specific purpose in measuring moisture content, unique to the user’s needs (Eaton, 2021).



Figure 5: Disto Measuring Device from (Amazon, 2021).

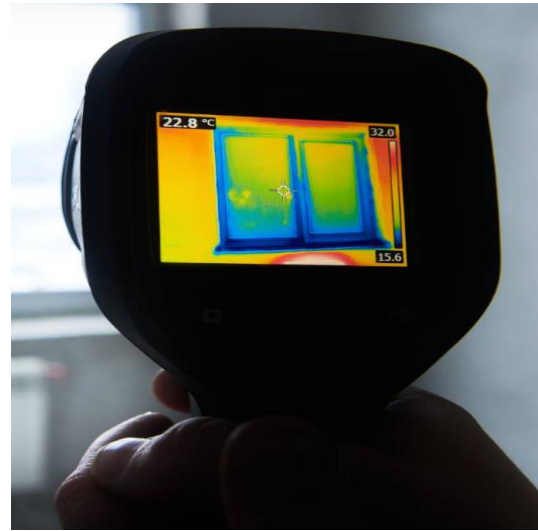


Figure 6: Thermal Camera from (Eaton, 2021).



Figure 7: Moisture meter from (Eaton, 2021).

Additional equipment is also used when access is limited, a Telescopic inspection camera for example. This has a telescopic pole that is self-locking and mounted at the top of featherweight and is ideal for photographing and video-ing roofs, gutters (Dauda, 2021). A Protimeter survey master is used to check wall dampness within the building (Dauda, 2021). A high-quality digital camera will also be utilised to ensure small details are captured for the technical report (Dauda, 2021). Collecting this information correctly is pivotal to ensuring that the correct information is captured, and an appropriate decision can be made in the later stages. These instruments can be observed in figure 8.



Figure 8: Telescopic inspection camera, Protimeter survey master and a high-quality digital camera. Collected from Google images.

3.3 Data Processing and Representation

Once all data from the field has been gathered, it must be analysed, processed and mapped and conclusions drawn. The condition of the elements of the main building are assessed, followed by an assessment of the overall condition of the building and rated as good, fair or poor. Subsequently, an occupancy condition will be undertaken to describe how the building is being used - occupied, partly occupied, vacant, or unknown (Dauda, 2021). Photographs will also have been taken and displayed in the publication. With the results of the field work being collated, the surveyor starts to draw conclusions of the condition of the building which will be summarised in the technical report.

3.4 Report

This is the final stage of the building surveying process, where a technical survey report is constructed, presenting the survey data collected to non-specialist audiences in a format that is easily understood. The report will provide detailed advice about the condition of the building, describe the identifiable risk of potential or hidden defects and make recommendations for any further special inspections (Dauda, 2021).

4. Conclusion

Surveying has played a pivotal role in understanding different principles of the natural and the built environment. As technology continues to advance, and the methods of surveying has continued to develop, the greater our understanding on these principles will be. A development in these methods and technologies has enabled better data acquisition quicker and more effectively. This also has

allowed the surveyor to analyse more data and can develop a stronger insight into what is being surveyed. Thus, promoting a stronger technical report.

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