

A report on the equipment used for conducting surveys and the use of modern digital surveying and listed buildings



Name: Sion Griffiths

Student Number: 2007491

Contents

1.0 Introduction.....	3
1.1 Definition of surveying	3
1.2 What is surveying.....	3
1.3 What is surveying of surveying.....	3
2.0 Different types of surveying equipment.....	4
2.1 Taping.....	4
2.2 Dumpy level.....	4
2.3 Total Station.....	5
2.4 Plumb bob.....	5
3.0 Listed buildings and digital surveying techniques.....	6
3.1 Definition of a listed building.....	6
3.2 Different grades of listed buildings.....	6
4.0 Penrice castle (Mansion)- Planning and survey.....	7
5.0 Mapping, Computing, Report	8
6.0 Summary	9
7.0 References	10

1.0 Introduction

This report will aim to cover what surveying is and what type of equipment maybe used by surveyors on a day to day basis to carry out their work. It will also explain how the equipment is used. It will also aim to explain how digital surveying techniques are used today by using an example of a listed building from the Swansea area and how the survey can create a report.

1.1 Definition of Surveying

The definition of surveying according to Merriam Webster dictionary is “a branch of applied mathematics that is concerned with determining the area of any portion of the earth's surface, the lengths and directions of the bounding lines, and the contour of the surface and with accurately delineating the whole on paper.”(Webster, 2021)

1.2 What is surveying

Surveying is a method of collecting data from a piece of land by taking coordinates or measurements by the use of instruments like total stations and other pieces of equipment like a dumpy level, they do this by measuring distance, height and angle. In simple terms Surveying can be described as a technique and science of accurately finding out the position of points and the distances and angles between them. This data can then be used to create a map of the area which has been surveyed. This data also allows the designers to plot the coordinates of different structures or features to allow the setting out engineer to carry out his work.

1.3 What is the purpose of surveying

There are many uses of surveying in todays modern world and these are used by many professions not just the construction industry. Surveys are used to establish the positions of existing features of the ground such as slopes and heights. The surveyors will mark out positions of the proposed buildings or structures which will allow the architects and engineers to plan the structures and landscapes safely. This will also allow the architects to inform their clients if the land is suitable for the structures planned, if it is on a flood plain and if the ground is as describe in the deeds. As the modern surveying equipment is so accurate not just in surveying the land but also vertical distances it can be used to provide the layout of drainage, pipelines or the road required on the land. By doing this it can be extremely cost effective and ensure you comply with the local building regulations.

2.0 Different types of surveying equipment

2.1 Taping



A tape measure is hand tool that allows people to measure distances and sizes. One of the first known tape measures was in 1829 and was patented by James Chesterman.(Haus of tools, 2019) This was then improved on in 1868 when the first spring loaded tape was used in the USA. A tape measure is usually a metal, plastic or ribbon cloth that has linear measurement markings on it, these markings are typically in metric and or imperial unit measurements. Tapes usually come in sizes ranging from 1 metre to 50 meters. Tapes are used in surveys to measure distances between certain points or to measure sizes of certain structures, features or objects are in the area that is being surveyed.

Image taken from (Educational, 2017)

2.2 Dumpy level



A Dumpy level also known as an Automatic level is an instrument that is used for taking levels of points that are in the same horizontal plane. A dumpy level is a telescope that is usually fixed to a tripod or another form of support, it also has a tribrach plate which is connected the trivet by the use of the levelling screws. Levelling screws allow the surveyor to level the instrument by rotating them and looking at one of the bubble tubes to ensure that the instrument is levelled correctly. The instrument also has a vertical spindle which allows it to rotate 360 degrees. (Anupoju ,2017)

image taken from (Tools, 2022)

The Dumpy level is used in surveying because of its level of accuracy and it's practicality. The instrument is used to find out the level of different points of a

piece of land so the constructors can make the land level before construction or to establish the difference in level between different points. The instrument can

also measure the distance between different locations of the land being surveyed and it can also transfer levels for construction. the dumpy level works of a benchmark which is a known point with a height from mean sea level.(Krishna, 2020)

2.3 Total station



A total station is an optical instrument that is electrical and uses an adjustable telescope to calculate both vertical and horizontal planes and like the Dumpy level it is mounted and screwed to a tripod and levelled using a bubble tube and levelling screws. A total station is a hybrid of a theodolite and a distance meter which makes it perfect for surveying because the two individual instruments are essential for modern surveying. When used along with different types of software such as mapping software it helps create the full surveying package from mapping to measuring. (surveying, 2015)

Image taken from (SCCS, 2015)

A total station is used in surveying for numerous things like measuring the vertical, horizontal and sloping distances this is all done by using the correct keys on the total station or controller that comes with the instrument. It calculates these measurements by firing a laser at a prism that is attached to the 'pogo' or staff that the person is holding, heights of the prism can be keyed in manually so the instrument takes the correct height when it takes the measurement. The instrument is very accurate and it carries out the work very quickly and any manual errors like writing and reading are eliminated. The instrument can calculate coordinates very quickly and accurately.(Mishra, 2017)

2.4 Plumb bob



Image taken from (Equipment, 2012)

A Plumb bob is a surveying tool that consists of a pointed weight that is attached to a piece of string, the weight is

usually made from either brass or steel while the string is typically made from cotton or nylon. (Hubbard, 2020)

The Plumb bob is one of the oldest Tools in surveying first used in Egyptian times and is used to take measurements from a reference point, it works by leaving the weight dangle so it pulls the string to a

straight vertical line which is called the 'Plumb line'. The surveyor or individual using the plum bob would typically set a nail two or three inches from the top of a wall, structure or feature they were trying to check was plumb and then set the Plum bob around the nail then take a measurement at the top and at the bottom and if you had the same measurement then you knew that the wall was plumb. (Hubbard, 2020)

3.0 Listed buildings and digital surveying techniques.

Digital surveying technologies come in many different forms from total stations to laser distometers, and they all aid in today's methods of surveying buildings. Digital surveying techniques are very accurate and fast which has improved the level of survey data that is being collected. This makes the data more reliable.

3.1 Definition of a listed building

According to Collins dictionary a listed building is defined as "a building officially recognized as having special historical or architectural interest and therefore protected from demolition or alteration". (Collins, 2022)

3.2 Different grades of listed buildings

There are 3 grades of listed buildings within the United Kingdom and they are Grade I, Grade II* and Grade II.

Grade I - Buildings are of exceptional interest, only 2.5% of listed buildings are Grade I

Grade II* - Buildings are particularly important buildings of more than special interest; 5.8% of listed buildings are Grade II*

Grade II - Buildings are of special interest; 91.7% of all listed buildings are in this class and it is the most likely grade of listing for a home owner.

(England, 2021)

Buildings get listed because it means that they have special architectural and/ or historic interest. listing a building protects it's historic or architectural design for the future generations so they can look back at the history of how these buildings were designed and in what era they were built. Buildings that were typically built before the year 1700 and are between 1700 and 1850 that are still standing are more than likely to be listed due to their history. (England, 2021)

4.0 Penrice Castle (Mansion) - Planning and Survey

Reasons for a surveys to be conducted.

1. To discover the buildings condition.
2. It is requirement to comply with building legislation.
3. Whether there is or has been substantial alterations.

The surveyor carrying out the survey will conduct research prior to his survey to understand what instruments will be needed to carry out this task it is advisable to use a chartered surveyor who has expertise in the surveying of listed buildings and is accredited by Royal institute of chartered surveyors. as they will be fully versed with the legislation around these buildings.

When the surveyor conducts their survey they will carry out a level 3 survey which entails a visual inspection of the property or structure and it's services such as electrical, water and drainage along with the grounds. (Boast, 2019) After the survey has been carried out the surveyor will report his findings and rate them from good to very poor and if there were any parts of the building or structure that he couldn't survey or access he would then say which parts were inaccessible or not surveyed.

This is a picture of the Penrice Castle (Mansion) that is situated in Penrice, Swansea.



There would have been a number of digital surveying tools used during the survey of this building before it was listed, as they can gain access to areas that could be inaccessible for the surveyor. Some of the equipment that could have been used would be a drone, this would make it easier for the surveyor to assess areas like the roof and gutters without putting themselves in dangerous places.

image taken from (ecastles)

Another type of digital surveying equipment that could've been used would be a thermal imaging camera, this instrument would be used to detect what parts of the listed building are losing heat. Other equipment that could be used would be a protimeter, a protimeter is a very handy tool for surveying listed building as they can measure the amount of dampness in a building and listed building are very old. A laser distomat could be used in areas where the use of a tape maybe unsafe or impractical, they are very accurate.

5.0 Mapping, Computing , Report

Once all the information has been captured and recorded it is vitally important that it is stored securely until it can be made into a report. This is usually done by using digital devices at the time or previously this was done with note pad and pen and then transferred to a more accurate and comprehensive report. There are now computer programs that can assist with the compiling of a report and as long as the data captured on site is in a easily transferrable state this can be done quickly for the client saving time and money. This report should be put together in a way that is understandable to the client. All the key points of the survey should be highlighted so that the client is aware of any detail that may have an affect on the decisions they will now need to make.

6.0 Summary

This report shows and explains different types of surveying equipment and what their purpose is within surveys and highlights their importance within modern day surveying. This report also explains what a listed building is and how they are placed into different grades according to their architecture or history, while also explaining what equipment a surveyor would use to help carry out the survey of the listed building accurately and efficiently. It also briefly explains the process of taking the data gathered from the survey and creating a report for the client.

7.0 References

- Anupoju, S. (2017). *Dumpy Level Surveying - Components, Procedure, Advantages*. [online] The Constructor. Available at: <https://theconstructor.org/surveying/dumpy-level-surveying-components-procedure-advantages/20456/>.
- Boast, A. (2019). *Listed Building Surveys - Building Surveyor and Survey Cost*. [online] SAM Conveyancing. Available at: <https://www.samconveyancing.co.uk/news/house-survey/listed-building-surveys-building-surveyor-and-survey-cost-8757> [Accessed 10 Jan. 2022].
- Collins Dictionary. (2022). *Listed building*. [online] Available at: <https://www.collinsdictionary.com/dictionary/english/listed-building> [Accessed 10 Jan. 2022].
- Delta Educational. (2017). *30m Tape Measure - Delta Educational*. [online] Available at: <https://www.deltaed.co.nz/product/30m-tape-measure/> [Accessed 10 Jan. 2022].
- Haus of Tools. (2019). *The History and Origin of the Tape Measure*. [online] Available at: <https://hausoftools.com/blogs/news/the-history-and-origin-of-the-tape-measure>.
- Herts Tool Co. (2022). *Dumpy Level with Tripod & Staff Hire | Herts & London*. [online] Available at: <https://hertstools.co.uk/product/dumpy-level-with-tripod-and-staff-hire/> [Accessed 10 Jan. 2022].
- Historic England (2015). *Listed Buildings | Historic England*. [online] Historicengland.org.uk. Available at: <https://historicengland.org.uk/listing/what-is-designation/listed-buildings/>.
- Hubbard, B. (2020). *A Complete History of the Plumb Bob and How to Use It*. [online] The Architect's Guide. Available at: <https://www.thearchitectsguide.com/blog/plumb-bob>.
- Jurovichsurveying.com.au. (2015). *What's a Total Station? | Surveying Equipment | Jurovich*. [online] Available at: <https://www.jurovichsurveying.com.au/faq/what-is-a-total-station>.
- Krishna (2020). *Dumpy Level Surveying, About, Components, Advantages & Limitations*. [online] CIVIL READ. Available at: <https://civilread.com/dumpy-level-surveying/>.
- Mishra, G. ed., (2017). *Total Station in Surveying - Operation, Uses and Advantages*. [online] The Constructor. Available at: <https://theconstructor.org/surveying/total-station-operation-uses-advantage/6605/>.

www.ecastles.co.uk. (n.d.). *PENRICE CASTLE*. [online] Available at: <http://www.ecastles.co.uk/penrice.html> [Accessed 10 Jan. 2022].

www.merriam-webster.com. (2021). *Definition of SURVEYING*. [online] Available at: <https://www.merriam-webster.com/dictionary/surveying>.

www.sccssurvey.co.uk. (2015). *Leica TS13 Mid-Range Robotic Total Station - Leica Captivate - Total Stations - Surveying Equipment*. [online] Available at: <https://www.sccssurvey.co.uk/leica-ts13-mid-range-robotic-total-station.html> [Accessed 10 Jan. 2022].

www.xpertsurveyequipment.com. (2012). *Stanley 16 oz. Brass Plumb Bob 47-974*. [online] Available at: <https://www.xpertsurveyequipment.com/stanley-16-oz-brass-plumb-bob-47-974.html> [Accessed 10 Jan. 2022].