

Unit 27: Site Surveying Procedures for Construction and the Built Environment

Unit code: R/601/1291

QCF level: 4

Credit value: 15

- **Aim**

This unit develops an understanding of the principles of site surveying and cartographic detailing of construction works and the skills to use site surveying instruments, alongside an understanding of the software available.

- **Unit abstract**

This unit is designed to develop learners' skills in using modern surveying equipment to carry out a range of typical site surveying procedures in the construction and built environment sector. Learners will undertake setting-out and control of alignment of construction work. This unit develops the understanding and skills required to perform surveying calculations. It is intended that the procedures outlined in the specification are performed using semi-manual methods and learners will also gain an understanding of the software available for site surveying. Learners will develop the skills required to produce cartographic details from survey information using a manual approach, alongside the benefits of computer-aided plotting.

- **Learning outcomes**

On successful completion of this unit a learner will:

- 1 Understand the principles of site surveying
- 2 Be able to use site surveying instruments
- 3 Understand cartographic detailing of construction works
- 4 Understand the software available for site surveying.

Unit content

1 Understand the principles of site surveying

Linear measurement: errors in using steel tapes; adjustments for tension, sag and temperature; change of standard length; semi-permanent adjustments to Electromagnetic Distance Measurement (EDM) instruments (for temperature, pressure, curvature of the Earth)

Levelling: errors in levelling and compensation methods; reciprocal levelling; flying levels; location of Ordnance Bench Mark (OBM); principle and practice of setting up a Temporary Bench Mark (TBM); levelling large areas (grid and radial methods); direct and indirect methods of contouring

Angular measurement: errors and methods for reducing errors; reduction of angular measurement; horizontal and vertical angles; computation of true horizontal length (from slope distance and angle of inclination)

Distinction between open, link and closed traverse: traverse for area control; factors affecting choice of traverse stations; whole circle bearings; distinction between grid, true and magnetic north; coordinate system; Ordnance Survey (OS); grid references; angular closing error and correction; Bowditch correction for misclosure errors

Setting out: principles; control of spread of error (working from the whole to the point); procedure for coordinated setting out; appropriate accuracy; procedures and practices for setting out ground works; upper floors; road construction; drainage and sewerage works; embankments and cuttings

2 Be able to use site surveying instruments

Appropriate instruments: linear measuring instruments eg steel bands, sonic measuring devices, EDM instruments

Levels: optical (automatic and tilting); water level; general construction laser; pipe alignment laser; electronic and optical levels; angular measuring instruments; optical and electronic theodolites; magnetic compasses and compass attachments to theodolites; combined theodolites and EDM devices (total station instruments); vertical alignment instruments eg plumb bob, spirit level, optical plumb, laser alignment

Electronic and laser instruments: electronic reading levels; electronic logging of field data; laser construction levels; laser alignment levels; EDMs; Global Positioning Systems (GPS); digital terrain modelling

3 Understand cartographic detailing of construction works

Raw data and translation for cartographic detail/setting out: levelling; plotting contours by graphic interpolation; plotting of cross-sections from contoured plans; area measurement (manual, mechanical, electronic methods); computation of volumes from spot heights; ground sections and contours; calculations of volumes of cut and fill (straight road with transverse sloping ground)

Angular measurement: correction to measured angles, distances, bearings and coordinates for a closed traverse, manual and electronic plotting of traverse surveys, survey symbols

Setting out: computation of deflection angles; distances for coordinated setting out

4 **Understand the software available for site surveying**

Surveying computer software: software for capturing data in the field; dedicated software for setting out; built-in capabilities of total station instruments; commercial software and programmed spreadsheets to facilitate repetitive surveying calculations; Geographical Information Systems (GIS) and OS digital data

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Understand the principles of site surveying	1.1 describe procedures and instrumentation for transferring control points 1.2 describe procedures for producing large horizontal curves used in road construction 1.3 explain the use of electronic surveying instruments
LO2 Be able to use site surveying instruments	2.1 set up and use appropriate instruments 2.2 record readings to produce contoured plans and traverse surveys 2.3 set out horizontal and vertical controls and small radii horizontal curves 2.4 check the verticality of perpendicular members of construction frames
LO3 Understand cartographic detailing of construction works	3.1 evaluate the benefits of computer software to solve typical surveying problems 3.2 explain the use of information taken from digital mapping databases 3.3 evaluate the use of GPS within construction and civil engineering work
LO4 Understand the software available for site surveying	4.1 explain how to determine contours and ground sections for an area of ground, using raw survey data 4.2 explain how to determine areas and volumes of cut and fill, using survey data 4.3 explain how to correct coordinate points within control traverse networks 4.4 explain how to determine setting out data for coordinated points

Guidance

Links

This unit links with other Edexcel BTEC HN Construction and the Built Environment units, for example:

- Unit 3: Applied Mathematics for Construction and the Built Environment
- Unit 12: Conversion and Adaptation of Buildings
- Unit 28: IT Applications for Construction
- Unit 33: Civil Engineering Technology
- Unit 36: Applied Mathematics for Complex Engineering Problems
- Unit 37: Advanced Civil Engineering.

The content of this unit has been designed and mapped against the current CIC National Occupational Standards and the current NVQs at levels 4 and 5. Completion of the learning outcomes will contribute knowledge, understanding and skills towards the evidence requirements of the NVQs.

- See *Annexe B* for summary of mapping information to NVQs.

This unit has also been mapped to illustrate the links to the NQF units.

- See *Annexe D* for summary of mapping information to NQF units.

Essential requirements

This unit requires learners to use of Personal Protective Equipment (PPE) when undertaking practical activities. Surveying software and spreadsheet programs must be readily available to learners. Manual drawing and computer-aided design (CAD) are an integrated part of this unit. Learner access to ancillary equipment and carpenters' workshops to help with the production of sight rails and other setting out items is strongly recommended.

It is essential that a culture of health and safety is embedded in all the units to ensure that the learners understand the importance and relevance of health and safety issues. Therefore there should be clearly signposted aspects of current legislation and health, safety and welfare implications throughout the delivery and assessment of this unit.