London South Bank University

Faculty of Engineering, Science and the Built Environment

Surveying and Setting Out

EBB/4/40

Faculty of Engineering, Science and the Built Environment

2012/2013

Level 4

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1. MODULE DETAILS

Module Title:	Surveying and Setting Out
Module Level:	4
Module Reference Number:	EBB/4/40
Credit Value:	20
Student Study Hours:	125
Contact Hours:	60
Private Study Hours:	15
Pre-requisite Learning (If applicable):	None
Co-requisite Modules (If applicable):	None
Course(s):	BSc commercial management, FdSc Construction, BSc Construction Management, HNC Construction
Year and Semester	2012/13
Module Coordinator:	Dr A. Bayyati
MC Contact Details (Tel, Email, Room)	02078157338,bayyatia@lasbu.ac.uk,T520
Teaching Team & Contact Details (If applicable):	As above
Subject Area:	Surveying
Summary of Assessment Method:	Course work

2. SHORT DESCRIPTION

This unit will provide an overview of the theory and practice of surveying

The students will be introduced to basic surveying principles and techniques and develop a working knowledge of the use standard techniques and equipment.
The unit provides an explanation of basic principles of surveying, levelling, setting out of building works together with angular measurements, fieldwork and computations associated with levelling, dimensional control and positioning.

3. AIMS OF THE MODULE

To enable the students to have a primary knowledge of site surveying and levelling theory and practice
To enable the student to have a fundamental knowledge and understanding of control and setting out principles and practice

4. LEARNING OUTCOMES

4.1 Knowledge and Understanding

On completion of this unit, the student will be able to:

- Understand the principles of linear surveying, and the process employed by OS.
- Be able to carry out a practical linear(chain) survey, and draw the surveyed area to a suitable scale
- Understand the principles of angular measurements and its uses in calculation of rectangular coordinates using traversing for positioning
- Cary out a traversing exercise for the establishment of control
- Measure and calculate areas and volumes
- Carry out a setting out exercise
- Understands the principles of levelling
- Undertake a levelling exercise to establish levels of given points and carry out field book calculations and checks using standard methods
- Understand how advances in technology(GPS,Lasers etc) have affected surveying practice
- Understand the need for checks and systems in the Quality Assurance process.

4.2 Intellectual Skills

Understand basic surveying processes as applied in construction

4.3 Practical Skills

Use surveying skills to carry out simple site survey, Levelling, Angular measurements, setting out and levelling.

Use and interpret maps, plans& drawings, carry out measurements, undertake surveys, record information, prepare plans and information for others
Interpret and use quantities and qualitative data
Use generic and bespoke ICT software; related technologies ;select and use appropriate computational methods to solve problems.

4.4 Transferable Skills

Managing and developing self
Working and relating to others
Communication
Managing tasks and solving problems
Applying numeracy
Applying technology
Applying design

5. ASSESSMENT OF THE MODULE

The unit is assessed by a practical project weighted as follows:

A. Field Work……30%

Work carried out during the first ten practical's of the semester will be assessed on site. Marks will be awarded to group members participating in the practical.

B. Practical Project……..70%

The project work is weighted as follows:

1. Coursework (A)-Linear Survey 20%
2. Coursework (B)-Levelling 45%
3. Coursework(C)-Angles/Setting Out 35%

The minimum pass mark for the unit (weighted average) is 40%

IMPORTANT NOTE: Attendance and participation are essential to pass unit.

Resit assessment is done through a test.

6. FEEDBACK

Feedback will normally be given to students 15 working days after the submission of an assignment.

7. INTRODUCTION TO STUDYING THE MODULE

7.1 Overview of the Main Content

This unit introduces the students to the basic theory and practice of land surveying, particularly as applied in construction. Concepts of dimensional horizontal and vertical control are taught and supported by practical exercises. The students will develop practical skills in use of basic surveying instrumentation including tapes, levels and applications. They will learn how to take surveying measurements, book, carry out levelling, angular measurements for basic setting out, and necessary computations and check the accuracy using standard methods. The practical aspects of this unit will involve carrying out a linear survey of a given site together with levelling, angular measurement and setting out project.

7.2 Overview of Types of Classes

The contact time will be as follows:

- Lectures: The students will be introduced to basic principles of surveying, levelling and computation of reduced levels, principles of setting out using linear and polar measurements
- Tutorials: The students will carry out surveying computations exercises in levelling, basic survey calculations to consolidate learning of standard surveying methods and techniques
- Fieldwork: The students will undertake a fieldwork project in chain and offset linear triangulation survey, levelling, angular measurements and setting out.

7.3 Importance of Student Self-Managed Learning Time

Students will work in groups to complete all practical, computational and presentation work. It is essential that groups functions as a team to plan and carry out all their work both during and outside the contact hours.

7.4 Employability

This module develops skills in Surveying and setting out process using tapes, levels, theodolites and total stations as applied in construction

8. THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

Week	Week Starting	Topic	Fieldwork	Coursework
1	28 Jan	Introduction to the unit	Reconnaissance/planning and distance measurement	Project brief
2	04 Feb	Principles of linear surveying/triangulation	Establishment of control/triangulation	A
3	11 Feb	Principles of levelling; Measurement and booking	Detail measurements: offsetting	A
4	18 Feb	Principles of levelling; Measurement and booking	Detail measurement/Offsetting Use levels :Levels measurement and booking	A,B
5	25 Feb	Principles of levelling Levelling booking and computations	Use levels :Levels measurement and booking	B
6	04 Mar	Principles of levelling Levelling booking and computations	Levelling practical/Tutorial	B
7	11 Mar	Principles of levelling Levelling booking and computations	Levelling practical/Tutorial: Levelling computations	B
8	18 Mar	Angular measurements and setting out	Levelling measurements Use of Theodolite/Total Stations : measurement of angles and booking	B,C
9	15 April	Angular measurements and setting out	Use of Theodolite/Total stations : measurement of angles/Setting Out	C
10	22 Apr	Angular measurements and setting out	Use of Total station; Measurement of Angles/Setting Out	C
11	29 Apr	Modern Surveying Technology/Construction	Setting Out/Tutorial. Modern Technology Construction uses	C
12	06 May	Modern Surveying Technology	Setting Out Modern Surveying Technology Apllications	All
13	13 May	Review Work **Hand in Survey Project: 14/05/2012**	Review Work	All

9. STUDENT EVALUATION

Overall the students enjoyed the practical work and the learning experience.

10. LEARNING RESOURCES

10.1 Core Materials

Irvine, W, Surveying For Construction 5th Edition McGraw Hill, 2002
Banister, A, et al, Surveying, 7th edition Longman, 2003.

10.2 Optional Materials

Clancy,J, Site Surveying and Levelling 2nd Edition, Edward Arnold, 1991
Banister, A and Baker, R, Solving problems in Surveying, 2nd edition, Longman, 1994
Muskett, J, Site Surveying, BSP professional Books, 1988

Useful internet sites:

www.ordnacesurvey.org.uk
www.rics.org.uk
www.ice.org.uk
www.ices.org.uk
www.leica-geosystems.co.uk
www.sokkia.com
www.pentax.com
www.trimble.com

11. HEALTH,SAFETY AND SECURITY DURING SURVEYING PRACTICALS

Task/Activity steps*	Current management Controls	Additional controls
Measuring distances by taping	Students advised to be extra vigilant when surveying public highways including surveying in the car park roads and the vehicular access areas	All involved in the surveying practical should wear high visibility safety vests
Levelling on public highways including university campus and the car parks	Surveying instruments should be set up in suitable areas well away from obstructing traffic or pedestrians. Surveying points are chosen in suitable safe spots in the surveyed area	All involved in the surveying practical should wear high visibility safety vests
Measurement of Inverse levels-points higher than the collimation height of a level such as bridge levels	Inverse level measurement is only allowed under supervision and the staff holder should wear a hard hat	Students should be briefed on the risk involved plus the use of hard hat is compulsory. Students should also be aware of risk to themselves, others and property in vicinity of the use of fully extended levelling staff. Safe procedure of handling the staff is necessary
Angular measurements using a theodolite are carried out within the car park	Surveying instruments should be setup in suitable areas well away from obstructing traffic or pedestrians.	All involved in the surveying practical should wear high visibility safety vests
Use of Laser Surveying instruments	Students/users should be made aware of the risk	Students/User are instructed not look directly into the laser beam
Use of surveying instruments involves the use of Tripods, Ranging Rods and other equipment	Students are shown to safely handle surveying equipment especially tripods, Ranging Rods etc	Students are given instructions and demonstration on safe transport and use of surveying instruments
SECURITY: Never leave your instruments or your positions unattended at any time. Take these with you as you move around the site.		

12. ASSIGNMENT BRIEF

SURVEYING AND SETTING OUT

Tutor(s):	Dr A. Bayyati		
Issue date:	Week Beginning 28 January 2013	Submission Date	14/5/2013
Unit no(s):	Surveying and Setting Out (EBB/4/40)	**100% Coursework Assessment :Practical Survey work Project**	

You are required to carry out and produce a large scale survey of the suggested development area together with associated calculations using linear surveying, levelling techniques and angular measurements.

This is a group work project in which you are expected to plan, carry out your work, and complete your survey project and presentation as a team. All group members must participate in various aspects of this practical project.

A full diary of work must be kept and submitted with the project showing times, dates, type of work and members of team's work (participation).Attendance therefore is essential in completing this unit successfully.

Resit assessment is carried out through a test.

A. Linear Surveying

Carry out a reconnaissance for the site and produce a sketch supplemented by photographs for the site showing the important features including buildings, boundaries, services nearby, control points etc. Copies of the sketch may used to reference your measured points by labelling and numbering on the sketch in further surveys.

1. **Choose suitable control points to triangulate the site at suitable positions. Avoid selecting positions that result in small angles(less than 20 degrees) and very short distances or the obstruction of flow of traffic / pedestrians.**
2. **Measure all distances (fore and back) between control points and diagonals to fully triangulate the surveyed area using linear survey principles.**
3. **Measure and record all details (boundary, services, lamp posts, fences etc) by offsetting from chain lines (l lines joining control points).**
4. **All measurements should be recorded on appropriate survey sheets using standard methods.**
5. **Produce a fully annotated indexed large scale (choose a suitable scale) drawing on A4/ A3 to all measured details.**
6. **Calculate the area of the development using area formulae.**

B. Levelling

Start your levelling at the nearby OSBM =3.771m above datum

1. **Locate the OSBM on the site. Set up the level in a suitable position, take a reading to the OSBM and record as BS reading.**
2. **Appropriate levelling book (height of collimation) should be used to book all your readings.**
3. **The first reading for any setup of the instrument must be recorded as BS.**
4. **All other reading should be recorded as intermediate sights (IS), except the last reading which should be recorded as FS.**
5. **The levelling processes should continue towards the control points established in advance either in anticlockwise or clockwise direction until all the points are levelled.**
6. **The levelling processes should continue to close back on the TBM. This final reading should be recorded as FS.**

7. **Every student should copy these group work measurements on both Heights of Collimation and the Rise and Fall methods booking sheets.**
8. **Calculate the level of control points using both methods.**
9. **Check the accuracy of your levels and your levelling calculation using standard methods.**
10. **The closing error of your levels should not be more than ± 5√ n mm, where n is the number of instrument setups.**
11. **If the required accuracy is not achieved, the exercise should be repeated.**
12. **For a selected line between two control points measure and calculate levels at 5m interval and produce a longitudinal section showing invert levels of drain with a gradient of 1:150 and a minimum depth below ground level of 1 m.**
13. **Calculate earthwork quantities for (typical trench cross section; width=0.8m) the drain**
14. **Draw a longitudinal section to show the measured ground levels and the calculated invert levels at 5m interval along the profile**

C1 Angular measurements

1. **Measure and record the horizontal angles for the selected control points(control traverse)**
2. **For each control point you need a full round of measurements(FL,FL,FR,FR)**
3. **Record all your measurements using standard methods and format.**
4. **Reduce the round of observation for each point to the average angle for the station on the booking sheets. Add up the measured angles and compare to the theoretical sum of polygon (split into triangles to find this sum).**
5. **The difference between the practical and the theoretical sums is the closing error of the traverse. This should be distributed equally over the measured angles of the traverse (should be small e.g. less than s√n seconds, n is the number of traverse points and s minimum reading of the theodolite)**
6. **Assume that one of your traverse lines as due north.**
7. **Calculate WCB and the coordinates of your traverse points assuming the coordinates of first point are E=500 and N=1000m.**
8. **Draw your traverse to a suitable scale using the calculated coordinates.**

C2 Setting Out

In this exercise the new Leica total stations will be employed to measure/store and process a set of data(at least 10)points using 'AS BUILT' programme. This followed by automatic setting out of these points using the 'LAYOUT' programme. The instrument will display a pair of coordinates and the height of the point (E, N, h).
To carry out the practical you need to follow the procedure below:

1. **Setup you're the total station on the given control station.**
2. **Sight the reference on face left and set the horizontal circle to zero.**
3. **To set out the first point, turn the theodolite clockwise through the given angle; this defines the direction of the point from your theodolite position. In this direction a tape may be used to approximately find the position of the point. Then use the EDM to measure the distance precisely to the prism. The prism should be moved fore and back until the exact given distance is measured in the set direction.**
4. **Identify the feature positioned; corner of a column, corner of a building, centre of a manhole, etc.**
5. **Continue setting out all the given points following the above procedure.**
6. **Record the accuracy of your setting out in terms of Easting, Northing and Height of each point positioned.**
7. **Produce a clear drawing (not to scale) showing the control, reference and all points positioned and features identified.**
8. **Briefly explain the procedure adopted accuracy of techniques used and results achieved.**

Poor participation in this project may result in a Resit through a test

			Academic Comments
Surveying and Setting Out Marking Scheme(EBB/4/40)			
Please Submit this form with your work	**Percentage Mark**	**Awarded Mark**	
Linear Surveying	**20%**		
Area sketch/photographs	3		
Triangulate the area	3		
Measure/book Offsets	3		
Final scaled drawing	5		
Area calculations	3		
Summary methods/comments	3		
Levelling	**45%**		
Measurements/RL of control points	5		
Measurements/RL of services	5		
Measurements/RL of bridge levels	5		
RL calculation using both methods/checks	5		
Measurements/RL of drain	5		
Drain profile levels and drawing	5		
Earthwork calculation	5		
Level checks/two peg test	5		
Summary of methods/comments	5		
Angular measurements	**15%**		
Traverse measurements	3		
Reduced angles	3		
Scaled Traverse Drawing/information	3		
Coordinate calculation	3		
Summary of methods/comments	3		
Setting Out (incl Bibliography & Diary)	**20%**		
Setting Out data and sketch/photos	3		
Scaled drawing of setting out	3		
Accuracy of setting out/checks	3		
Summary of methods/comments	3		
Bibliography(All)	3		
Diary of Work(All)	5		
Total Mark	**100%**		Signature ……..Date……

Group Names	**Number**