LONDON SOUTH BANK UNIVERSITY

unit guide

Surveying

BCE/1/104

Faculty of Engineering Science and the Built Environment

2008/2009

become what you want to be

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1. UNIT DETAILS

Unit Title:	Surveying
Unit Level:	1
Unit Reference Number:	BCE/1/104
Credit Value:	15
Student Study Hours:	52
Contact Hours:	52
Private Study Hours:	30
Pre-requisite Learning (If applicable):	None
Co-requisite Units (If applicable):	None
Course(s):	Civil Engineering Studies(BSc,HNC)
Year and Semester	2008/2009 -1
Unit Coordinator:	Dr A.Bayyati
UC Contact Details (Tel, Email, Room)	02078157338, bayyatia@lsbu.ac.uk, Room T607
Survey Technician-Paul Elsdon	Survey Room E123, elsdonp@lsbu.ac.uk,020 78157139
Teaching Team & Contact Details (If applicable):	Dr Ali Bayyati
Subject Area:	Civil Engineering
Summary of Assessment Method:	Practical/Assignment work/Test

2. SHORT DESCRIPTION

The indicative contents of this unit provides an explanation of principles of surveying ,levelling, setting out works together with angular measurements, fieldwork and computations associated with levelling, angular measurements ,earthwork calculation , dimensional control and positioning.
This unit introduces students to the theory and practice of engineering surveying as applied in civil engineering and construction. Concepts of three dimensional positioning are taught and related to practical surveying exercises. The students will acquire practical skills in the of various surveying instruments including tapes, levels, theodolites and EDMs.The students will also learn about modern advances in surveying technology such as GPS and LASERS and their uses in civil engineering and construction. They will learn how to use standard surveying techniques to measurements, booking, computations and quality assurance. The acquired knowledge will applied to complete a practical survey project .The students will also learn about the design and setting out of horizontal/vertical curves used in highway and railway construction.

3. AIMS OF THE UNIT

To enable the students to have a fundamental knowledge of engineering surveying and practice including basic surveying principles, levelling, angular measurements ,computations and practices for positioning, setting out, levelling, earthwork calculation and curve analysis.

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 Ordnance Survey
- Be able to carry out a practical linear(chain) survey, and draw the surveyed area to a suitable scale
- Understand the principles of angular measurement and its uses in calculation of rectangular coordinates using traversing for positioning control and polar coordinates
- Understand the basic geometry of coordinate transformation
- Carry out a traversing exercise for the establishment of control
- Understands the principles of levelling
- Use levelling to establish a TBM from OSBM

- Undertake a levelling exercise to establish levels of given points and carry out all field book calculations
- Carry out calculations and checks using standard methods
- Understands the principles of setting out and curve calculations
- Understand how advances in technology(GPS, Lasers etc) have affected surveying practice
- Measure and calculate areas and volumes
- Understand the need for checks and systems in the Quality Assurance process

4.2 Intellectual Skills

Understand surveying processes as applied in civil engineering design and construction

4.3 Practical Skills

Use surveying skills to carry out site survey, levelling, angular measurements, establishment of control for engineering/construction projects and setting out

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 UNIT

The unit is assessed by:

1. Site Survey and Levelling (Coursework)	40%
3. Angular Measurements and Setting Out (Coursework)	40%
5. Test	20%
Total Mark	100%

Minimum pass mark for the test 30%
The minimum pass mark for the unit (weighted average of coursework and test) is 40%

6. FEEDBACK

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

7. INTRODUCTION TO STUDYING THE UNIT

7.1 Overview of the Main Content

This unit introduces the students to the basic theory and practice of engineering surveying, particularly as applied in civil engineering and construction. Concepts of dimensional horizontal and vertical control are taught and supported by practical exercises. The students will develop practical skills in use of surveying instrumentation including tapes and levels and theodolites and total stations. They will learn how to take surveying measurements, book, carry out levelling, angular measurements, setting out, and necessary computations including volumetric and curve design and check the accuracy using standard methods. The practical aspects of this unit will involve carrying out survey of

a given site together with levelling, angular measurements for the establishment of positioning control/ setting out.

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 , angular measurements and computation, calculation of reduced levels, principles of setting out using linear and polar measurements and earthwork calculations
- Tutorials: The students will carry out surveying computations exercises in levelling, volumes, bearing and coordinate calculations to consolidate learning of standard surveying methods and techniques
- Fieldwork: The students will undertake a fieldwork project using linear survey, levelling and angular measurements.

7.3 Importance of Student Self-Managed Learning Time

Surveying equipments will be available(under supervision) for students who would like extra practice to consolidate/improve their acquired skills and complete the project work.

7.4 Employability

This unit gives you the opportunity to acquire site surveying knowledge and skills which are an integral part of all civil engineering/construction work

8. THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

Week	Date	Topic	Fieldwork	Coursework
1	22/09/08	Introduction to the unit	Reconnaissance/planning and preparation	Project brief
2	29/9	Principles of linear surveying/triangulation	Establishment of control/triangulation	A
3	06/10	Principles of levelling	Detail measurement(chain and offsets)	A
4	13/10	Principles of levelling	Detail measurement(chain and offsets) and plotting	A
5	20/10	Principles of levelling Levelling booking and computations	Levelling practical	B
6	27/10	Principles of levelling Levelling booking and computations	Levelling practical/Tutorial	B
7	03/11	Principles of levelling Levelling booking and computations	Practical/Tutorial: Levelling computations	B
8	10/11	Earthworks	Area/Volume Calculations/ Tutorial	B
9	17/11	Angular measurement	Practical ;Use of Theodolite	C
10	24/11	C.E Surveying Modern Technology	Control surveys ; Traversing	C,D
11	01/12	Setting Out/Curve Calculations	Control surveys ; Traversing/Tutorial	C,D
12	08/12	Review and completion of Project Work	Setting Out Practical/Tutorial	A,B,C,D
13	5/01/09	Exams	Hand in Project	A,B,C,D
13	12/01/09	Test		A,B,C,D

9. LEARNING RESOURCES

9.1 Core Materials

Irvine, W, Surveying For Construction 5th Edition McGraw Hill, 2002
Uren and Price, Surveying For Engineers. Macmillan, Latest Edition.

9.2 Optional Materials

Banister, A, et al, Surveying, 7th edition Longman, 2003
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 site:
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

NOTES

The following penalties apply for late submission of coursework:

Up to 1 week late…….20% deduction
Up to 2 weeks late……...40% deduction
Over 2 weeks – will only be marked in mitigating circumstance

10. 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.		

11. ASSIGNMENT BRIEF

Surveying

Tutor(s):	Dr A.Bayyati		
Issue date:	22nd September 09	Submission Date	5 January 2009
Unit no(s): BCE/1/104	**Surveying**		

Coursework :Practical Survey 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, 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.

The total mark for the practical project is 80%.
IMPORTANT NOTE: Attendance and participation are essential to pass unit.
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**

C. 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 sx√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 of your traverse using the corrected angles**
8. **Draw your traverse with all reduced measurements for stations**

D. Setting Out

A set of setting out data as polar coordinates (angles and distances) which represent permanent features in the surveyed area will be provided on course. During the practical you will be shown both the control and the reference points. To carry out the practical you need to follow the procedure below:

1. **Set your theodolite (total station) on the given control station.**
2. **Sight the reference station with the theodolite 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. **Produce a clear drawing (not to scale) showing the control, reference and all points positioned and features identified.**
7. **Check your setting out by measuring and calculating distances between selected points.**
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
BCE/1/104 Surveying Marking Scheme			
Please Submit this form with your work	**Percentage Mark**	**Awarded Mark**	
Linear Surveying	**20%**		
Area sketch/photographs	3		
Triangulate the area/Check	3		
Measure/book Offsets	3		
Final scaled drawing	5		
Area calculations	3		
Summary methods/comments	3		
Levelling	**30%**		
Measurements/RL of control points	3		
Measurements/RL of services	3		
Measurements/RL of bridge levels	3		
RL calculation using both methods/checks	3		
Measurements/RL of drain	3		
Drain profile levels and drawing	3		
Earthwork calculation	3		
Level checks/two peg test	3		
Summary of methods/comments	3		
Angular measurements	**30%**		
Traverse measurements	6		
Reduced angles	6		
Adjusted reduced angles	6		
Angular misclosure	6		
Summary of methods/comments	6		
Setting Out	**20%**		
Setting Out data and sketch/photos	4		
Scaled drawing of setting out	4		
Accuracy of setting out/checks	4		
Summary of methods/comments	4		
Bibliography(All)	4		
Total Mark	**100%**		Signature ……..Date……

Group Names	**Number**