

Engineering

Revised curriculum 2023

STUDENT'S BOOK

Building and Structural Surveying

N6



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TVET FIRST



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Building and Structural Surveying N6

This document contains important information about the revised curriculum for Building and Structural Surveying N6 for implementation in January 2023.

Overview of main curriculum changes

- The syllabus for Building and Structural Surveying N6 has been reworked and updated.
- Plotting (old Module 4) has been replaced by Tacheometry (new Module 3). Tacheometry was a topic previously covered in N5.
- Both the learning content and the learning outcomes have been completely reworded, and much more detail has been provided for all sections.
- Topics have been organised more logically.
- Module 1 (Angular measurement) is substantively unchanged although more detail is provided in the learning outcomes.
- Module 2 (Traversing) no longer explicitly covers meridians. Mapping media has been added to the new syllabus.
- Module 3 (Tacheometry) has been moved from N5 to N6.
- Module 4 (Contouring) was covered in Module 3 in the old syllabus. “Methods of contouring of an area by grid and radial line method and tacheometric readings with tache and level” are no longer covered in this module. However, these techniques are covered in Module 3 (Tacheometry). The purpose of contouring is now covered explicitly in the new syllabus. “Measuring areas with a planimeter” is no longer required.
- Module 5 (Setting out) is substantively unchanged although definitions of terminology are now explicitly required.
- Module 6 (Road construction) now requires that the road construction process be explained by students. Plotting cutting and embankment lines from contours is also required.
- The aims of the new syllabus are:
 - to acquire a systematic understanding of practice, theory and methodology in the building and structural surveying field
 - to develop knowledge, and professional and general competencies in:
 - surveying
 - building construction.

Structure and weighting changes

Previous syllabus (1981)

Old curriculum modules (no weighting given)
1. Angular measurement
2. Traversing
3. Contouring
4. Plotting

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Old curriculum modules (no weighting given)

5. Setting out
6. Road construction

New syllabus (2022)

New curriculum modules	Weighting
1. Angular measurement	10
2. Traversing	20
3. Tacheometry	15
4. Contouring	20
5. Setting out	10
6. Road construction	25
Total	100

Detailed curriculum changes

The following table sets out the changes made to the curriculum. All new/changed content has been colour coded in red.

Previous curriculum (1981)	New curriculum (2022)
<p>Module 1: Angular measurement</p> <p>1.1 Temporary adjustments to optical theodolites</p> <p>1.2 Definitions of the terms:</p> <ul style="list-style-type: none"> ● Transit ● Swing ● Face ● Bisection of a target angle ● Angle of direction ● Direction measurement of angles by theodolite <p>1.3 Recording and reduction of angular observations</p> <p>1.4 Measurement of angles of depression and elevation by theodolite</p> <p>1.5 Computing of the true horizontal length from the slope distance and the angle of inclination</p> <p>1.6 Operational errors and errors due to natural causes in measurement of angles</p>	<p>Module 1: Angular measurement</p> <p>1.1 Theodolite</p> <p>1.1.1 Explain the following terms:</p> <ul style="list-style-type: none"> ● Transit ● Swing ● Face ● Bisection of a target angle ● Angle of direction ● Temporary adjustment to theodolite ● Permanent adjustment to theodolite <p>1.1.2 List the fundamental lines of a theodolite and describe the desired relationship between them.</p> <p>1.1.3 Describe operational errors and errors due to natural causes in measurement of angles.</p>

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Previous curriculum (1981)	New curriculum (2022)
	<p>1.2 Measuring horizontal angles</p> <p>1.2.1 Record and reduce horizontal angular observations by calculating mean angles (angular based method).</p> <p>1.2.2 Record and reduce horizontal angular observation by calculating mean direction (angular based method).</p> <p>1.2.3 Calculate join (distance and direction) between two or more known points.</p> <p>1.2.4 Calculate the unknown point using distance and direction references.</p> <p>1.3 Measure vertical angles.</p> <p>1.3.1 Describe the measurement of vertical angles.</p> <p>1.3.2 Record and reduce vertical angles.</p> <p>1.3.3 Compute the true horizontal length from the slope distance and the angle of inclination.</p>
<p>Module 2: Traversing</p> <p>2.1 Definitions of the terms:</p> <ul style="list-style-type: none"> ● Traversing ● Open and closed traverses ● The meridian ● Magnetic meridian ● Grid ● Arbitrary meridian ● Whole circle bearing <p>2.2 Reducing angles from traverse reading</p> <p>2.3 Computing a theodolite traverse, including all adjustments</p> <p>2.4 Plotting by co-ordinates</p> <p>2.5 Computing the area inside a traverse</p> <p>2.6 Plotting of a compass traverse including graphical corrections</p> <p>2.7 Bowditch rule</p>	<p>Module 2: Traversing</p> <p>2.1 Basic concepts</p> <p>2.1.1 Explain basic terminology such as:</p> <ul style="list-style-type: none"> ● traversing ● open traverses ● closed link traverse ● closed loop traverses. <p>2.2 Traverse computation</p> <p>2.2.1 Explain the following types of traverses:</p> <ul style="list-style-type: none"> ● Theodolite traversing ● Compass traversing ● Tacheometric traversing

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Previous curriculum (1981)	New curriculum (2022)
	<p>2.2.2 Calculate open and closed traverse.</p> <p>2.2.3 Calculate the orientation of direction from observed angles (whole circle bearing and quadrant bearing).</p> <p>2.2.4 Compute closed link traverse using the Bowditch rule for corrections.</p> <p>2.2.5 Explain the computation of the theodolite traverse.</p> <p>2.2.6 Compute closed loop traverse using the Bowditch rule for corrections.</p> <p>2.3 Plotting</p> <p>2.3.1 Plot to scale, a traverse survey using co-ordinates.</p> <p>2.3.2 Plot to scale, a compass traverse with corrections done graphically using the Bowditch rule.</p> <p>2.3.3 Explain the following:</p> <ul style="list-style-type: none"> ● Cartridge paper ● Linen ● Tracing film <p>2.4 Areas</p> <p>2.4.1 Compute the area inside a close-loop traverse from coordinates.</p>
	<p>Module 3: Tacheometry</p> <p>3.1 Tacheometric surveying</p> <p>3.1.1 Define the word tacheometry.</p> <p>3.1.2 Explain the purpose of tacheometry surveying.</p> <p>3.1.3 State the advantages of tacheometry surveying.</p> <p>3.1.4 Explain the following instruments used for tacheometric surveying:</p> <ul style="list-style-type: none"> ● Tacheometer ● Stadia rods <p>3.1.5 Explain the principles of tacheometry (for example in isosceles triangle).</p> <p>3.1.6 Explain the following systems of tacheometric measurements.</p> <ul style="list-style-type: none"> ● The stadia system ● The fixed hair method ● Moveable hair method ● The tangential method

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Previous curriculum (1981)	New curriculum (2022)
	<p>3.1.7 Explain the application of tacheometry.</p> <p>3.2 Tacheometry computation</p> <p>3.2.1 Record and reduce tachometric readings with tache and level to determine the reduced level of survey using the tachometry field book.</p> <p>3.2.2 Compute the horizontal distance between survey points using the cosine rule.</p> <p>3.3 Field procedure</p> <p>3.3.1 Explain the six steps procedures that should be followed when carrying out the tachometric surveying</p> <p>3.3.2 Discuss four steps that can be used as guidelines for plotting details surveys.</p> <p>3.4 Errors in tangential tachometry</p> <ul style="list-style-type: none"> • Wrong reading of the staff • Wrong reading of vertical angle • Wrong booking. <p>Explain the systematic errors that results from the following:</p> <ul style="list-style-type: none"> • Non-perpendicularity of the staff • Differential refraction
<p>Module 3: Contouring</p> <p>3.1 Definitions of the terms:</p> <ul style="list-style-type: none"> • Contour line • Vertical interval • Gradient <p>3.2 Methods of contouring of an area by grid and radial line method and tacheometric readings with tache and level</p> <p>3.3 Plotting contours by graph and interpolation</p> <p>3.4 Plotting ground sections from contoured drawings</p> <p>3.5 Computing areas and volumes from contours, spot heights and ground sections</p> <p>3.6 Measuring areas with a planimeter</p>	<p>Module 4: Contouring</p> <p>4.1 Definitions</p> <p>4.1.1 Explain the following:</p> <ul style="list-style-type: none"> • Contouring • Contour line • Vertical interval (contour interval) • Horizontal interval • Gradient

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Previous curriculum (1981)	New curriculum (2022)
	<p>4.2 Purpose of contouring</p> <p>4.2.1 Explain the purpose of contouring and contour mapping.</p> <p>4.2.2 List and explain the factors affecting the selection of contour intervals.</p> <p>4.3 Plotting ground sections from contour drawings</p> <p>4.3.1 Explain the following methods of contouring:</p> <ul style="list-style-type: none"> ● Direct method ● Indirect method <p>4.3.2 Explain how to fix the contour position with the following operations under direct method of levelling:</p> <ul style="list-style-type: none"> ● Levelling ● Surveying of the pegs <p>4.3.3 Explain how to fix the contour position with the following operations under indirect method of levelling:</p> <ul style="list-style-type: none"> ● Setting out a grid ● Levelling ● Interpolating the contours, mathematically and graphically <p>4.3.4 Explain the difference between contour interval and horizontal interval.</p> <p>4.3.5 Explain the characteristics of contour lines.</p> <p>4.4 Volume and area calculations</p> <p>4.4.1 Calculate volume from given spot heights and ground sections.</p> <p>4.4.2 Calculate volume and area from contours.</p> <p>4.5 Use of contour maps</p> <p>4.5.1 Explain the following uses of contour maps:</p> <ul style="list-style-type: none"> ● Vertical sections ● Intersection of surfaces

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Previous curriculum (1981)	New curriculum (2022)
<p>Module 5: Setting out</p> <p>5.1 The procedure for coordinated setting out</p> <p>5.2 The procedure for setting out and levelling of foundations for a steel framed building</p> <p>5.3 Checking verticality of tall buildings using theodolite, optical plumb, and plumb bob</p> <p>5.4 Formwork: horizontal and vertical control.</p>	<p>Module 5: Setting out</p> <p>5.1 Definitions</p> <p>5.1.1 Explain the following:</p> <ul style="list-style-type: none"> ● Horizontal controls ● Vertical control ● Vertical alignment <p>5.2 Setting out procedure</p> <p>5.2.1 Describe the procedure for the following:</p> <ul style="list-style-type: none"> ● Co-ordinated setting out ● Setting out a point by forward intersection ● Setting and levelling of foundations for a steel framed building <p>5.3 Checking verticality</p> <p>5.3.1 Describe how to check verticality of tall buildings using the following surveying instruments:</p> <ul style="list-style-type: none"> ● Theodolite ● Optical plumb ● Plumb bob <p>5.4 Formwork</p> <p>5.4.1 Explain the vertical and horizontal control in surveying.</p>
<p>Module 6: Road construction</p> <p>6.1 Methods of surveying routes for roads excluding aerial survey</p> <p>6.2 Setting out of centre line or offset line</p> <p>6.3 Types of control used for embankments, cuttings and levels</p> <p>6.4 Calculation and setting out of a horizontal circular curve by tangential angle using a theodolite and steel tape</p>	<p>Module 6: Road construction</p> <p>6.1 Road construction setting out</p> <p>6.1.1 Describe the methods of surveying routes for roads excluding aerial surveying.</p> <p>6.1.2 Describe the setting out of centre line or offset line.</p> <p>6.1.3 Explain the road construction process.</p>

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Previous curriculum (1981)	New curriculum (2022)
<p>6.5 Longitudinal and cross-sections.</p> <p>6.6 Volumes of cut and fill on a straight road with traverse sloping ground</p>	<p>6.2 Circular curves</p> <p>6.2.1 Explain the following types of circular curves:</p> <ul style="list-style-type: none"> ● Simple curve ● Compound curve ● Reverse curve <p>6.2.2 Calculate and tabulate the setting out of road curve.</p> <p>6.3 Setting out of a horizontal circular curve</p> <p>6.3.1 State and explain the following methods of setting out small radius curve:</p> <ul style="list-style-type: none"> ● Finding the centre ● Offsets from the tangent ● Offsets from the long chord ● Offsets from the chords produced <p>6.3.2 Explain the procedure of setting out the small radius curve.</p> <p>6.3.3 State and explain the following methods of setting out large radius curve:</p> <ul style="list-style-type: none"> ● Offsets from the chords produced ● Tangential angle <ul style="list-style-type: none"> – Explain the set out of the curve when the tangential angle is known. – Calculate tangential angle using two theodolites. <p>6.4 Cutting and embankment</p> <p>6.4.1 Describe the types of control used for the following:</p> <ul style="list-style-type: none"> ● Embankments ● Cuttings ● Levels <p>6.4.2 Calculate the volume of cut and fill on a straight road with traverse sloping ground.</p>

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Previous curriculum (1981)	New curriculum (2022)
	<p>6.4.3 Determine the reduced level of cutting and embankment controls.</p> <p>6.5 Plotting cutting and embankment lines from contours</p> <p>6.5.1 Plot road width and embankment line to scale.</p> <p>6.5.2 Plot cutting and embankment lines to scale.</p> <p>6.6 Longitudinal and cross- sections</p> <p>6.6.1 Calculate the volume of materials contained in the earthworks using the following rules:</p> <ul style="list-style-type: none"> ● Simpson’s rule ● Trapezoidal rule ● Prismoidal formula ● Frustrum formula
<p>Not covered in new N6 syllabus</p> <p>Module 4: Plotting</p> <p>4.1 Identification of survey symbols</p> <p>4.2 Survey maps: types and scales</p> <p>4.3 Difference between grid, true, and magnetic north</p> <p>4.4 Position by grid references</p> <p>4.5 Standard plotting instruments: flexible curves; railway curves; beam compasses; French curves; stencils; ink pens</p> <p>4.6 Standard plotting materials: cartridge paper; linen; tracing film Plotting of chain, traverse, and building surveys</p>	

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Features and benefits of *TVET First Building and Structural Surveying N6*

TVET First is the ideal textbook to guide Building and Structural Surveying students towards success in their studies. This high-quality Student's Book includes practical advice from a practising building professional. It is packed with features that take students through the complete curriculum and prepare them for examination success. Features of the textbook include the following:

- Accessible language, with clear explanations and definitions of new vocabulary, makes learning easy and enjoyable.
- Our simple, step-by-step approach to problem-solving ensures that students have the skills they need to succeed.
- Varied activities keep learning interesting and consolidate the student's knowledge.
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- Summaries at the end of every module make revision a breeze.
- Summative assessments modelled on exams provide plenty of exam practice, ensuring that students are fully prepared when the time comes.

TVET First authors

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New or amended curriculum content

This Curriculum Guide for TVET lecturers breaks down the changes between the old and new NATED curricula.

All other important updates

The simple, helpful summaries cover all the changes lecturers need to know about:

New or amended Learning Outcomes

Changes to the weightings of modules in the curriculum

Changes to the structure of exams and assessment

Details of content that has been removed or that has moved between levels

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