

**Unit ID: 899**

**Domain            FOUNDATION BUILDING SCIENCE AND  
DRAWING SKILLS**

**Title:                Apply advanced knowledge of building  
science in different contexts**

**Level: 4**

**Credits: 6**

### **Purpose**

This unit standard specifies the competencies required to apply advanced knowledge of building science in different contexts. It includes demonstrate knowledge of uses of building materials, demonstrate basic knowledge of electricity fundamentals, carry out calculations related to static and kinetic friction, apply knowledge of lifting machines, determine moments of forces, determine forces acting on frames, determine shear forces and bending moments and determine shear legs and tripods. This unit standard is intended for people requiring advanced building drawing skills as applied in different contexts.

### **Special Notes**

2. This unit standard gives users exposure to a holistic approach of study and world of work to gain an understanding of the world as a set of related systems, by recognizing that problem solving contexts do not exist in isolation but that they may differ from context to context according to the area of application.
3. This unit standard may be assessed in any context of operation and may be assessed in conjunction with other relevant technical unit standards selected from a particular domain that has a thematic link to this unit standard.
4. Assessment evidence may be collected at any realistic place where logical collection of such evidence can be achieved.
5. The correct use of the suitable technical terminology must be stressed, especially in formulating definitions and principles.
6. Scientific pocket calculators may be used in solving mathematical problems. Basic instruction must be offered in the practical use and operational abilities of the calculator. A comma has to be used for the decimal sign throughout calculations.
7.  $g = 10 \text{ m/s}^2$  should be taken as the value for gravitational acceleration in all applicable calculations.
8. Regulations and legislation relevant to this unit standard include the following:
  - Labour Act, No. 11, 2007.
  - Occupational Health and Safety Regulations No. 18, 1997 and all subsequent amendments.

## **Quality Assurance Requirements**

This unit standard and others within this subfield may be awarded by institutions which meet the accreditation requirements set by the Namibia Qualifications Authority and the Namibia Training Authority and which comply with the national assessment and moderation requirements. Details of specific accreditation requirements and the national assessment arrangements are available from the Namibia Qualifications Authority and the Namibia Training Authority on [www.nta.com.na](http://www.nta.com.na).

## **Elements and Performance Criteria**

### **Element 1: Demonstrate knowledge of uses of building materials.**

#### **Performance Criteria**

- 1.1 Specifications for mixing and testing concrete, cement and mortar are explained.
- 1.2 Simple experiments are carried out to explain concepts using the correct formulas in calculations.
- 1.3 Mixing and testing of concrete is demonstrated by means of experiments.
- 1.4 A simple experiment is demonstrated to illustrate the process of crystallization.
- 1.5 The effects of hard and soft water on pipes and the treatment of hard water are explained.
- 1.6 The use of paint in the building constructions is explained with regard to reasons for painting surfaces, composition, uses and paint materials, preparation of surface, painting techniques and defects on painted surfaces.
- 1.7 The use of plastics in the building constructions is described with regard to composition and uses, sources of plastic, advantages and disadvantages, the difference between thermosetting plastics and thermoplastic.

### **Element 2: Demonstrate basic knowledge of electricity fundamentals.**

#### **Performance Criteria**

- 2.1 Basic principles of electricity generation, distribution and electric circuit operation are explained.
- 2.2 The concept of safe use of electricity is explained with regard to operating electrical power tools, protection devices and earthing of electrical appliances.
- 2.3 Electrical quantities in an electric circuit are determined using applicable formulae and units.
- 2.4 Types, purpose and operation principles of different types of lightings are explained.

- 2.5 Direct and alternating currents are contrasted in terms of their characteristics, and single-phase and three-phase is differentiated by means of graphical examples.

**Element 3: Carry out calculations related to static and kinetic friction.**

**Performance Criteria**

- 3.1 Concepts are applied to static and kinetic frictions are defined and methods are applied to experimentally determine magnitude of forces.
- 3.2 Angle of friction and coefficient of friction are calculated by:  $\tan \theta = \mu = \frac{F\mu}{N}$ .
- 3.3 Angle of repose is calculated and practical applications are stated.
- 3.4 A sketch is used to explain different forces acting on an object and calculations related to frictional forces on horizontal and inclined planes are carried out.

**Element 4: Apply knowledge of lifting machines to determine work done.**

**Range**

Devices and machines may include but are not limited to, block and tackle (single rope pulley), wheel and axle machine, differential wheel and axle, single and double winch, Weston differential pulley system and screw jack.

**Performance Criteria**

- 4.1 The principle of work done is explained using examples of applications and the applicable formula is applied to calculate work done by levers in terms of mechanical advantage, velocity ratio and efficiency.
- 4.2 Devices and machines used for lifting loads and to ease work on a building site are described.
- 4.3 Calculations of lifting different loads by machines and pulley systems are performed to determine velocity/displacement ratio, mechanical advantage, efficiency and magnitude of the load.

**Element 5: Determine moments of forces.**

**Performance Criteria**

- 5.1 Moment of a force is described and the law of moment is reproduced and applied to calculate moment of a force taking in account the conditions for equilibrium.
- 5.2 The reaction of the beams of the supports is calculated under various conditions.

- 5.3 The moment of couple is determined using correct formula.
- 5.4 The position of centroid on various figures is determined.
- 5.5 Calculations related to the position of the centroid are performed using given conditions.

### **Element 6: Determine forces acting on frames.**

#### **Range**

Frames may include but are not limited to structures such as a roof truss, bridge, built wall and angle iron.

#### **Performance Criteria**

- 6.1 The tensile and compressive forces imposed on a frame are explained as applied by Newton's third law of motion.
- 6.2 The principle of identifying the nature of members in a frame is described and applied.
- 6.3 The triangle of forces and the polygon of forces methods are applied separately to determine the magnitude and nature of forces in members in a frame graphically.

### **Element 7: Determine shear forces and bending moments.**

#### **Range**

Examples of space and force diagrams should be drawn to scale and the scale stated.

The bending moment at the beginning and end of the beam is always zero if the beam is in equilibrium.

The unit of bending moments is expressed as kilo Newton metres (kN.m) or Newton meters (Nm).

#### **Performance Criteria**

- 7.1 Terms shear force and bending moment as applied to beams are defined.
- 7.2 Shear forces and bending moments for cantilevers and simply supported beams and the shear force and bending moment diagrams of vertical point loads and uniformly distributed loads are drawn.

### **Element 8: Determine shear legs and tripods.**

#### **Performance Criteria**

- 8.1 The term tripod and shear legs are defined.

8.2 The forces in the legs of a tripod and a shear leg are determined graphically using the parallelogram of forces.

### **Registration Data**

<b>Subfield:</b>	Building Science and Drawing
<b>Date first registered:</b>	18 November 2010
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<b>Body responsible for review:</b>	Namibia Training Authority