higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

CIVIL AND STRUCTURAL STEELWORK DETAILING

(First paper)

NQF LEVEL 4

2 March 2020

This marking guideline consists of 5 pages.

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QUESTION 1: REINFORCED CONCRETE DETAILING AND SPECIFICATIONS

1.1
- All external forces act at the joints of the truss members and nowhere else.
- The truss members are acted upon either by axial tension or axial compression. (2)

1.2 1.2.1 Sum of forces in the Y✓ direction is equal to zero✓

1.2.2 Sum of forces in the X✓ direction is equal to zero✓

1.2.3 Sum of moments✓ about any point is equal to zero✓

(3 × 2) (6)

1.3 1.3.1 Pa

1.3.2 m^2

1.3.3 N

1.3.4 Kg

1.3.5 m/s^2

1.3.6 N.m

(6 × 1) (6)

1.4 $0.405\sigma_c bx = 0.87\sigma_y A_{st}$
$0.405(40)300(187.43) = 0.87(450)A_{st}$

$910.278 = 391.5A_{st}$✓
$A_{st} = 910909.8/391.5$✓
$= 2326.7\ mm^2/m$✓ (3)

1.5 KL/r✓
= 0.7(6000)/78.9✓
= 53.2< 200✓ (3)
[20]

QUESTION 2: REINFORCED CONCRETE DETAILING AND SPECIFICATIONS

2.1 slabs✓ beams✓ columns✓ and footings✓ (4)

2.2 A pile cap forms part of the foundation.✓ It transfers loads from the columns to the piles underneath.✓ (2)

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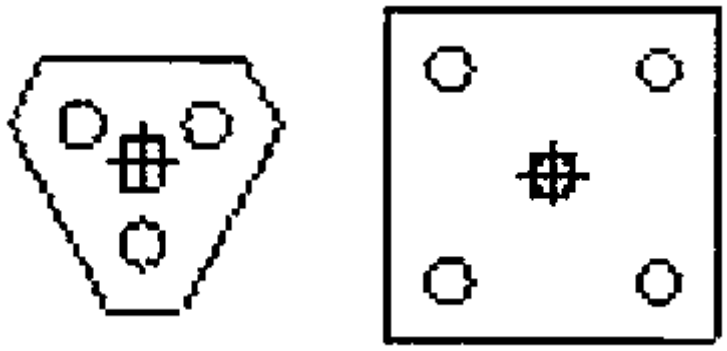
2.3



3 pile 5 pile (6)

2.4
- Longitudinal
- Transverse (2 × 1) (2)

2.5.1 The tread is the length of a single step

2.5.2 The nosing is the length that a step extents past the start of a next step

2.5.3 The waist is the diagonal thickness of the staircase

2.5.4 The slope is the angle of inclination of the staircase

(4 × 1) (4)

2.6 2.6.1 False
2.6.2 True

(2 × 1) (2)
[20]

QUESTION 3: STRUCTURAL STEELWORK DETAILING AND SPECIFICATIONS

3.1 Equalises the forces in horizontal ✓ and vertical directions✓ as well as moments about a point. (2)

3.2 Joint A✓ or joint D✓ (2)

3.3 Forces at member AE:

$F_{AE}X = F_{AE}\,Cos\,30^0 = F_{AE}\,Y = F_{AE}\,Sin\,30^0$ ✓

$\sum F_y = 0$ ✓

$65 + F_{AE}\,Sin30^0 = 0$ ✓
$F_{AE} = -(65/Sin30^0)$
$= -130$ kN ✓

Forces at member AB:

$\sum Fx = 0$✓

$F_{AE}\,Cos\,30^0 + F_{AB} = 0$ ✓
$F_{AB} = -\,F_{AE}\,Cos\,30^0$
$= -(-130\,Cos\,30^0)$ ✓
$= 112{,}58$ kN ✓ (8)

3.4 3.4.1 152 × 152 × 37, $f_y = 300$ MPa
$Cr = \emptyset Afy(1 + \lambda^{2.68})^{-1/1.34}$
$0.9(4.73 \times 10^3)(300)(1 + 1.6^{2.68})^{-1/1.34}$✓
414.024 kN✓

3.4.2 203 × 203 × 71, $f_y = 350$ MPa
$Cr = \emptyset Afy(1 + \lambda^{2.68})^{-1/1.34}$
$0.9(9.09 \times 10^3)(350)(1 + 1.6^{2.68})^{-1/1.34}$✓
928.7 kN✓

(2 × 2) (4)

3.5 3.5.1 With Gusset ✓plates and Angle Cleat✓s

3.5.2 The EAVE is the edge or the overhang of the roof ✓
The SHOE is the bottom –most part of a truss that rests on the walls or columns ✓

(2 × 2) (4)
[20]

QUESTION 4: PROPERTIES OF STRUCTURAL STEELWORK AND REINFORCED CONCRETE

4.1
- Concrete cracks affect the durability of concrete✓.
- It causes the concrete to be much more exposed to the weather. ✓ (2)

4.2 Plastic settlement occurs due to settlement of concrete too soon✓ after it has been placed. This is due to the weight✓ of the mixture that has a tendency to sink.✓ Reinforcement bars could remedy this.✓ (4)

4.3
- Concrete always increases its strength over its lifetime. ✓
- It gains full strength over 28 days. ✓
- 70% of its strength is gained within 7 days and 90% within 14 days. ✓ (3)

4.4 4.4.1 Ease to work with wet concrete (1)

4.4.2 Residue of burnt coal (1)

4.4.3 Prone to catch fire under pressure (1)

4.4.4 Mixture of cement,✓ sand✓ and water✓ (3)
[15]

TOTAL: 75

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