Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 40: Connections – Bolted and Welded Joints)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. The primary mode of failure in a bolted joint due to tension: **(c) Tension failure of the plate**

2. Efficiency of a bolted joint depends on: **(b) The strength of the plate, bolt diameter, and pitch spacing**

3. A fillet weld is designed based on: **(a) The throat thickness of the weld**

4. The strength of a welded joint depends on: **(b) The quality of the weld and its geometry**

5. Shear capacity of a bolt: **(a)** $V = \frac{A_b F_u}{\gamma_m}$

Section B: Problem-Solving Solutions

1. Shear strength of a single M20 bolt in double shear:

$$V = 2 \times \left(\frac{\pi d^2}{4} \right) \times \tau$$

$$= 2 \times \left(\frac{\pi (20)^2}{4} \right) \times 150$$

$$= 2 \times (314.16) \times 150$$

$$= 94.25 \text{ kN}$$

2. Strength of a fillet weld:

$$P = \text{throat thickness} \times \text{weld length} \times \text{shear stress}$$

$$= (0.707 \times 6) \times 200 \times 120$$

$$= 101.8 \text{ kN}$$

3. Shear strength of two M16 bolts in single shear:

$$V = 2 \times \left(\frac{\pi (16)^2}{4} \right) \times 140$$

$$= 2 \times (201.06) \times 140$$

$$= 56.3 \text{ kN}$$

4. Load-carrying capacity of a welded connection:

$$P = (0.707 \times 5) \times 250 \times 110$$

$$= 97.5 \text{ kN}$$

5. Bearing capacity of the joint:

$$P = \text{plate thickness} \times \text{width} \times \text{bearing stress}$$

$$= 12 \times 120 \times 180$$

$$= 259.2 \text{ kN}$$