Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 47: Plastic Analysis and Composite Construction)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. The plastic moment capacity is determined using: **(a) The plastic section modulus**
2. The shape factor is: **(a) The ratio of the plastic moment to the elastic moment**
3. A plastic hinge forms when: **(a) The entire section reaches yield stress**
4. The number of plastic hinges required for collapse in a simply supported beam: **(a) One**
5. Composite construction typically involves: **(a) A combination of steel and concrete**

Section B: Problem-Solving Solutions

1. Plastic moment capacity:

$$M_p = Z_p f_y$$

$$= (600 \times 10^3) \times 250$$

$$= 150 \times 10^6 \text{ N·mm} = 150 \text{ kN·m}$$

2. Plastic section modulus:

$$Z_p = S \times \text{Shape Factor}$$
$$= (500 \times 10^3) \times 1.2$$
$$= 600 \times 10^3 \text{ mm}^3$$

3. Collapse load for simply supported beam:

$$P_c = \frac{8M_p}{L}$$

   Using appropriate values for M_p, collapse load is determined.

4. Moment of inertia of composite beam:

$$I_{\text{eq}} = \frac{bd^3}{12} \times \left(\frac{E_c}{E_s}\right)$$

   Substituting values gives the required moment of inertia.

5. Plastic hinges required for continuous beam collapse:

$$n = \text{Spans} + 1$$
$$= 2 + 1 = 3$$