Civil Engineering Licensure Exam – Mock Exam (Day 45: Shear, Bond, and Development Length)

February 24, 2025

Instructions

- Time Limit: 60 Minutes
- Coverage: Shear, Bond, and Development Length
- Total Questions: 10 (Multiple Choice & Problem-Solving)
- Show complete solutions for problem-solving questions.

Section A: Multiple Choice Questions (MCQs)

Choose the best answer.

1. The shear force in a reinforced concrete beam is primarily resisted by:
   (a) Stirrups
   (b) Longitudinal reinforcement
   (c) The concrete cover
   (d) The neutral axis
2. Bond stress is defined as:
   (a) The shear stress between concrete and reinforcement
   (b) The stress due to compression in a column
   (c) The bending stress in a reinforced beam

(d) The maximum shear stress in a beam

3. The development length of a reinforcing bar is required to:

   (a) Provide sufficient anchorage to prevent bond failure
   (b) Increase the bending capacity of the beam
   (c) Reduce the deflection of the beam
   (d) Strengthen the concrete against cracking

4. The shear stress in a reinforced concrete beam is maximum at:

   (a) The neutral axis
   (b) The extreme fibers of the section
   (c) The centroid
   (d) The midspan of the beam

5. Hooks in reinforcing bars are provided to:

   (a) Increase bond and anchorage
   (b) Reduce the shear stress in the beam
   (c) Provide lateral stability
   (d) Minimize deflection

Section B: Problem-Solving

1. A reinforced concrete beam has a width of 300 mm and an effective depth of 450 mm. If the factored shear force is 120 kN, determine the required shear reinforcement assuming $f'_c = 25$ MPa and $f_y = 415$ MPa.

2. A reinforcing bar has a diameter of 20 mm and is embedded in concrete. Determine the development length if the bond stress is 1.4 MPa and the yield strength is 415 MPa.

3. A simply supported reinforced concrete beam has a span of 5 m and carries a uniformly distributed load of 20 kN/m. Determine the maximum shear force at the support.

4. A reinforced concrete beam has a factored shear force of 80 kN. Determine the required spacing of stirrups using $\tau_v = V_u/bd$, where $f_y = 415$ MPa and the bar diameter is 10 mm.

5. A column reinforcement bar has a required development length of 600 mm. If a standard 90-degree hook is provided, determine the reduced development length assuming a reduction factor of 0.75 for hooked bars.