* 1. General Information
     1. Design Code : IS 456 2000
     2. Unit System : N, mm
  2. Material
     1. : 30.00MPa
     2. : 415MPa
     3. : 415MPa
  3. Section
     1. Section Size : 800 x 1,150mm (R-Section)
     2. Cover : 40.00mm
     3. Compression Bar : Not Considered
     4. Splice Type : 0%
     5. Span : 0.000m



* 1. Moments and Forces
     1. : 250kN·m
     2. : 5,000kN·m
     3. : 500kN
     4. Tu : 0 kN -m
  2. Reinforcement
     1. Top Bar : 4-#10 (
        + Layer 1 : 4 EA (
     2. Bot Bar : 20-#10 (
        + Layer 1 : 11 EA (
        + Layer 2 : 9 EA (
     3. Stirrup : 3-#3@200 (= 213mm²)
     4. Skin Bar : 3-#14 (
  3. Deflection
     1. Support Condition : Case-1 (Pin-Pin)
     2. Span : 1.000m
     3. Factor
        + Total Deflection Factor : Span/350 **[23.2 a]**
        + Total Deflection Factor : Span/250 **[23.2 b ]**
     4. Design Load
        + Dead Load : 5,000kN/m
        + Live Load : 5,000kN/m
        + Sustained Load : 50.00% of Live Load
  4. Seismic Design
     1. IS 13920 DESIGN
  5. Check space of skin bar [26.5.1.3]
     1. Calculate required space of skin bar.
     2. Check space of skin bar

s = 148 < 275 → O.K

* + 1. Calculate required steel Area.
       - Ass=0.001
    2. Calculate required Steel of skin bar.

Ass = 0.003< 0.001 → O.K

* 1. Check Bending Moment Capacity (Positive)
     1. Check space of rebar **[Table 15]**

        + Smin = max(Large Dia, MaxBar Dia) =min(25,14) = 25 mm

s = Smin < S < Smax = 25 < 66.87 < 180mm → O.K

* + 1. Calculate required ratio of reinforcement  **[26.5.1.1]**
    2. Check ratio of tensile reinforcement
       - 0.024
    3. Calculate moment capacity **[ANNEX G 1.1]**
       - ~~ø = 0.8700~~
       - .
    4. Equivalent Moment **[41.3]**
       - Me=Mu x Tu (1+D/b)/1.7
       - Mu =Me
    5. Calculate ratio of moment capacity
  1. Check Bending Moment Capacity (Negative)
     1. Check space of rebar **[Table 15]**

        + Smin = max(Large Dia, MaxBar Dia) =min(25,14) = 25 mm

s = Smin < S < Smax = 25 < 66.87 < 180mm → O.K

* + 1. Calculate required ratio of reinforcement  **[26.5.1.1]**
    2. Check ratio of tensile reinforcement
       - 0.024
    3. Calculate moment capacity **[ANNEX G 1.1]**
       - ~~ø = 0.8700~~
       - .
    4. Equivalent Moment **[41.3]**
       - Me=Mu x Tu (1+D/b)/1.7
       - Mu =Me
    5. Calculate ratio of moment capacity
  1. Check Shear Capacity
     1. Calculate shear strength by concrete
        + d = 1,055mm
        + **[40.4 c, T table 19]**
     2. Calculate required shear strength by shear reinforcement
        + **[26.5.1.6]**
     3. Calculate shear strength by stirrup
        + **[40.4 c]**
     4. Equivalent Shear
        + Ve = Vu + 1.6 Tu /b
     5. Calculate ratio of shear capacity
     6. Calculate spacing limits for reinforcement
  2. Check Deflection
     1. Criteria for deflection
        + Total Deflection : Span/250  **[23.2 b]**
     2. Calculate crack moment of section
        + **[6.2.2]**
        + **[ C-2.1]**
     3. Calculate positive moment
     4. Calculate inertia of moment for positive section **[C-2.1 ]**
        + **[ C-2.1 ]**
     5. Calculate effective inertia of moment
     6. Calculate deflection
        + K = 1.000
     7. Calculate Creep deflection
     8. Calculate Shrinkage deflection
        + Ece =
        + Δi+cp =
        + Δcp = Δi+cp – Δi=D
     9. Calculate Total Deflection deflection

Total deflection = 0.0400mm ( Span/25,027 < Span/250 → O.K )

* 1. Check Crack Width
     1. Criteria for Crack width
        + Exposer Condition : Moderate 0.2 mm
        + em = = 0.00216

wcr = = 0.009

* + 1. check crack width limits

crack width wcr = 0.009 ( 0.009 < 0.002 → O.K )