ALGORITHM: Concurrent Mix Calculator and Beam Load Calculator

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PART A: CONCRETE MIX DESIGN CALCULATOR
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1. INPUT MODULE
   Input Parameters:
     - Grade of concrete (M15, M20, M25, M30, M40, etc.)
     - Type of cement (OPC 33, 43, 53)
     - Maximum aggregate size (10mm, 20mm, 40mm)
     - Degree of workability (slump value)
     - Exposure conditions (mild, moderate, severe)
     - Quality of materials (aggregates, water)

2. TARGET STRENGTH CALCULATION
   Process:
     a. Obtain characteristic strength (fck) from grade
        Example: M25 → fck = 25 N/mm²
     b. Calculate target mean strength (fm):
        fm = fck + 1.65 × s
        where s = standard deviation (depends on quality control)
        - Good control: s = 4 N/mm²
        - Fair control: s = 5 N/mm²
   Output: Target mean strength

3. WATER-CEMENT RATIO SELECTION
   Process:
     a. Calculate W/C ratio from target strength:
        W/C = 0.5 (for approximate calculation)
        Or use empirical formula:
        fck = (fm × Ce × Wa) / (Ce + k × Wa)
        where Ce = cement content, Wa = water content, k = constant
     b. Check durability requirements:
        - Mild exposure: max W/C = 0.55
        - Moderate exposure: max W/C = 0.50
        - Severe exposure: max W/C = 0.45
     c. Select minimum of strength and durability W/C ratio
   Output: Final W/C ratio

4. WATER CONTENT DETERMINATION
   Process:
     a. Select water content based on:
        - Maximum aggregate size
        - Slump value required
     b. Use standard tables (IS 10262):
        For 20mm aggregate:
          - 25-50mm slump: 186 liters
          - 50-100mm slump: 205 liters
   Output: Water content per m³

5. CEMENT CONTENT CALCULATION
   Process:
     a. Calculate cement (C) from W/C ratio:
        C = Water content / (W/C ratio)
     b. Check minimum cement content (durability):
        - Mild exposure: min 300 kg/m³
        - Moderate exposure: min 320 kg/m³
        - Severe exposure: min 340 kg/m³
     c. Use maximum of calculated and minimum values
   Output: Cement content (kg/m³)

6. AGGREGATE PROPORTIONING
   Process:
     a. Calculate total aggregate = 1 m³ - (Cement vol + Water vol)
     b. Determine fine aggregate (FA) to coarse aggregate (CA) ratio:
        - Use grading zone and workability tables
        - Typical ratio: 1:2 (FA:CA)
     c. Calculate individual quantities:
        FA = Total aggregate × (FA ratio / (FA + CA ratio))
        CA = Total aggregate × (CA ratio / (FA + CA ratio))
   Output: Fine aggregate and coarse aggregate quantities

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7. MIX ADJUSTMENT FOR ADMIXTURES
   Process:
     a. If using admixtures (plasticizers, superplasticizers):
        - Reduce water content by 5-30%
        - Maintain W/C ratio
        - Adjust cement accordingly
   Output: Adjusted mix proportions

8. FINAL MIX PROPORTIONS
   Output Format:
     - Cement : Fine Aggregate : Coarse Aggregate (by weight)
     - Example: 1 : 1.5 : 3
     - Quantities per m³:
       * Cement: XXX kg
       * Fine Aggregate: XXX kg
       * Coarse Aggregate: XXX kg
       * Water: XXX liters
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