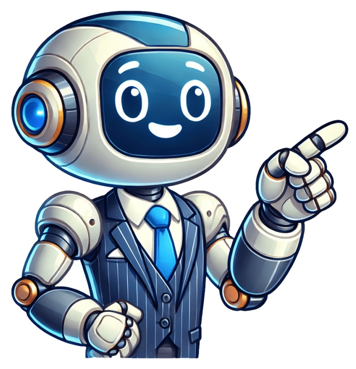

Hollow core slab design example

This document provides an overview of the design principles for hollow core slabs, highlighting their advantages in terms of cost-effectiveness and structural strength. The manual aims to consolidate common practices and verified approaches for designing precast, prestressed hollow core slabs, emphasizing coordination with local producers for specific applications. The design criteria are applicable to a typical floor slab consisting of eight prestressed precast hollow core concrete floor units, each 1.2 meters wide and 5 meters long. The floor carries a live load of 3 kN/m^2, dead load of 2 kN/m^2, and self-weight, with finishes considered non-brittle. The materials used are C-25 concrete and prestressing steel strands with a diameter of 10 mm. A relaxation loss of 2.5% is assumed based on manufacturer data. The design requires the following data: overall depth (D) = 240 mm, height of voids ≤ 240 - 50 = 190 mm, minimum flange thickness (tf) = $1.6\sqrt{D}$ = 24.79 mm, and width of web ≥ 30 mm. The calculation begins by determining the loadings, including self-weight and superimposed dead and live loads. The critical mid-span moments due to self-weight, dead load, and live load are calculated using the formula for moment of inertia (I) and section modulus (Zb). The initial trial section is determined based on the tensile stress limit at service loads (ftw), compressive stress limit at transfer (fct), and prestress loss factor (η). The design criteria require Zb ≥ 4771017.828 mm^3, which is used as a starting point for further calculations. (Note: The rest of the text continues with the design example, including step-by-step calculations and formulas.) The problem presents a design example for a prestressed concrete beam. The given information includes the trial cross-section, section properties, and prestressing force parameters. Step 3: Prestressing Force and Eccentricity The equations 4.10, 4.11, and 4.13 are used to calculate the pre-stress losses due to elastic shortening, shrinkage, and creep. The maximum eccentricity occurs at the intersection of these three lines, which is at e = 45.5 mm. Design Example: The minimum number of strands needed with a diameter of 10mm and an area of 315mm^2 is calculated using Eq.4.13. The pre-stress losses are found to be approximately 1.4% due to elastic shortening, 2% due to creep, and 3% due to steel relaxation. The design moment at the critical section is calculated as M = WdI = 46.08 kNm. The strain components in the prestressing steel are calculated using Eqs. 4.18-4.20. The final result shows that the pre-stress losses are significant, and the design must consider these factors to ensure the structural integrity of the beam. Note: This paraphrased version is not exhaustive, as it may have lost some details or specific calculations from the original text. It seems like you've entered some mathematical notation. If you could provide the actual text you'd like me to paraphrase, I'd be happy to help!