CONTINUOUS COMPOSITE BEAM

ANALYSIS AND DESIGN OF CONTINUOUS COMPOSITE BEAMS AND SLABS

ANALYSIS | DESIGN | DETAILING | X02

Summary

The composite continuous beam design module designs multi-span composite beams. Composite construction methods are becoming more popular globally due to the rapid construction potential and efficient use of materials. The module forms part of the **PROKON** structural analysis and design suit together with the three other composite design modules.

What makes this module special?

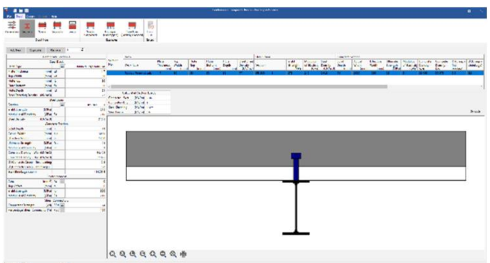
- Design of a section for both sagging and hogging
- Various deck layouts
- Multi-span composite beams
- Different construction methods
- Point loads & moments as well as distributed loads
- Output: elastic & long-term deflections, shear forces and bending moments
- Detailed equations

Detailed Description

A composite beam is usually a combination of a steel I-beam and a concrete slab cast on top. Shear connectors are welded to the top flange of the steel beam to ensure that the composite resistance is possible. Composite construction reduces the construction timeline because the contractors don’t have to wait for concrete beams to reach the required 28-day strength before removing formwork. With good planning, formwork can be completely avoided, which allows for massive savings. The composite continuous beam design module allows you to design a composite section for bending and shear. The module considers the case of sagging as well as hogging moments.

Various deck layouts are possible:

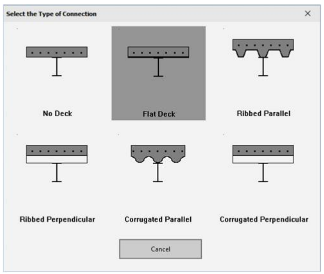
1. No deck
2. Flat deck
3. Ribbed parallel to beam
4. Ribbed perpendicular to beam
5. Corrugated parallel to beam
6. Corrugated perpendicular to beam

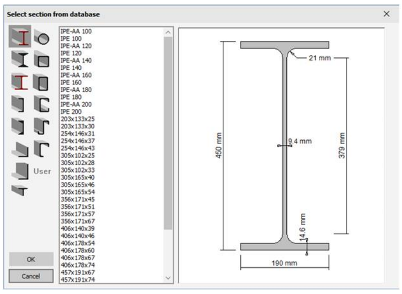


Various spans can be defined, and each span can consist of more than one section. This allows for economical design because you can have a section with reinforcing in the flange to be used in regions of hogging and another without reinforcing in the flange for sagging regions.

Construction loads and construction supports can be entered which will affect the construction phase's analysis and design. When the construction phase is complete and the concrete and steel can achieve composite action, the construction loads and supports are removed, and the beam is re-analysed and designed. This all happens automatically without any additional user input required.

The module reads sections from the **PROKON Section Database** which contains the steel sections used in most countries.





Possible ULS loads include distributed loads, point loads, and point moments at any point along the beam.

The design output includes elastic deflections, long term deflections, shear forces and bending moment envelopes along the length of the beam.

Theory used in this module

The module calculates the sagging and hogging resistance of composite beam sections according to rigid-plastic theory in Section 6 of EN 1994-1-1:2004 (Eurocode 4). It can evaluate both full shear connection and partial shear connection designs using plastic theory.

The module verifies that the section is either a Class 1 or a Class 2 section as required for rigid-plastic theory design. It accounts for longitudinal reinforcement in compression (if present) for sagging resistance with the assumption that such reinforcement is fully anchored.

To calculate the plastic bending resistance of the section, the module determines the plastic neutral axis (PNA) location of the section. It does this by balancing the contributing horizontal forces (based on plastic stresses) in the composite cross-section.

In the shear connection calculations, the module checks headed studs for adherence to the ductility requirements for steel sections with equal flanges. It also checks resistance to vertical shear.