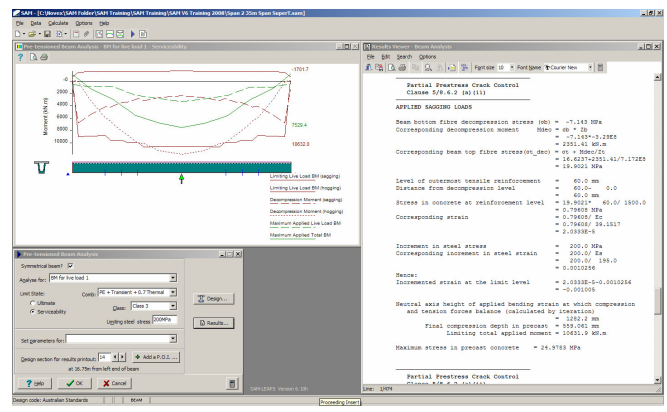
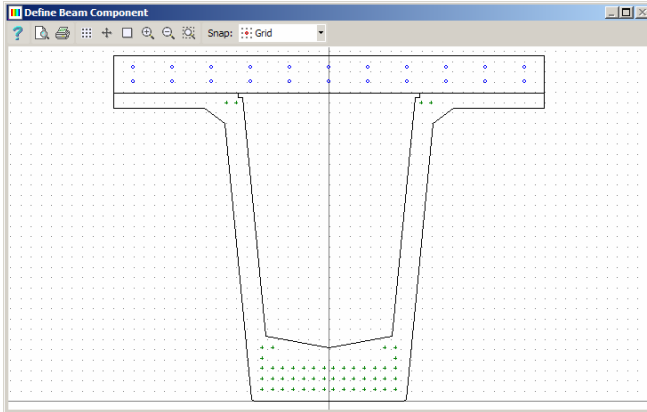


Beam Design Module for Australian Standards: B.03_{AU}



The following module is available in the Australian Standard format for code checking bridge beams B.03_{AU} – Pre-cast pre-tensioned beams to AS5100

The module provides code checking in accordance with AS5100.5. The section properties used in the code checking are calculated from section module S.01. They integrate with the structural analysis modules in order to produce fast iterations on the analysis/design cycle. Detailed hand-calculation style reports are produced wherever possible.

Beams can have multiple cross-sections, multiple stages of construction and multiple material properties. All these variations are accounted for when calculation section properties and, in the case of the integrated analysis, member stiffness.

Beam sections can be defined using standard pre-defined beams (such as “Super-T” beams), or any sections defined using the tools of section module S.01.

There are several benefits to these modules:

- ⇒ The integration with analysis means that one model serves many purposes, and this saves time in defining several different models, saves time in calculating section properties, saves time in transferring results from analysis to code checking, and finally ensures a consistent model.
- ⇒ All the results are displayed graphically, so it is possible to see where design problems occur, and the scale of their magnitude. This makes it easy to make design corrections and check that they have the desired effect.
- ⇒ If the corrections change either the dead weight of the beam or its stiffness, it is simple to re-run the analysis in order to determine the new load effects, and thus re-check the beam with its correct loads. This ensures that the right model is associated with the right loads, and that the design has the correct data throughout.
- ⇒ Wherever possible a mimic of an engineer’s hand calculations are created, in order to allow the user to see why and how results are calculated. This allows the user to check the program, and to develop confidence in using it, as well as conforming to many quality standards that require a hard copy of the design calculations.

Module Specifications B.03_{AU} – Design of pre-tensioned pre-stressed concrete beams

- Graphical Section generator and beam elevation generator for beams comprising:
 - Standard pre-cast concrete beams:
 - Comprehensive libraries Australian (including AS5100 Appendix B shapes, Super-T, Deck Units, Planks etc.), UK, and USA standard beam and girder shape ranges.
 - User defined pre-cast concrete beam shapes.
 - Standard in situ concrete shapes.
 - User defined in situ concrete shapes (e.g. for parapet upstands).
 - Additional steel reinforcement.
- Graphical tendon editor for fast insertion and removal at standard locations, or de-bonding, or deflecting. The editor is accessible directly from calculation screens allowing fast modification and repeat analyses.
- The beam elevation may comprise an unlimited number of different sections specified at different locations along the beam, with varying soffit and/or crown heights.
- Loadings which may be specified are ULS & SLS bending moments, shear forces and axial loads for:
 - Differential temperature secondary moments - positive case.
 - Differential temperature secondary moments - reverse case.
- Shrinkage modified by creep secondary moments.
- Settlement of supports.
- Soil pressure.
- Temperature restraint.
- Beam erection (eg temporary supports).
- Construction stages (up to 3 superimposed stages allowed, stage 1 may be split into 2 longitudinal stages)
- Superimposed dead load.
- Superimposed dead load, non-structural concrete.
- Bending Moments and associated Shear Force for worst hogging and worst sagging load cases (any number of load cases)
- Worst Shear Force and associated Bending Moments (any number of load cases).
- The load effects data may be entered by:
 - Direct entry on screen
 - Reading from ASCII text file
 - Generating from applied trapezoidal beam loads.
 - Direct transfer from Sam analysis module results, if licensed.
- Tendon layouts and debond / deflect details can be automatically optimised using a variety of parameters.
- Calculation to AS5100.5 for ULS and SLS for the following options:
 - Bending Moments at transfer
 - Bending Moments during erection
 - Bending Moments at construction stages
 - Live load Bending Moments and associated Shear Forces
 - Live load Shear Force + associated Bending Moments
 - Longitudinal Shear Force
 - Shrinkage modified by creep, primary stresses.
 - Differential temperature primary stresses.
- Graphical results plot of permissible stresses and actual stresses (or permissible and actual moments (ULS) or permissible and actual shear forces as appropriate)
- Logical selection of loadings during design (eg differential shrinkage/creep included only if adverse).
- The following code clauses are included in the design to AS5100.5:
 - Cl. 2.2 Strength Reduction Factors;
 - Cl. 6.1 to 6.3 Material Properties
 - Cl. 6.4 Prestress Losses
 - Cl. 8.1.3 Design Strength in Bending
 - Cl. 8.1.4 Minimum Strength Requirements
 - Cl. 8.2 Strength of Beams in Shear
 - Cl. 8.4 Longitudinal Shear in Beams
 - Cl. 8.6.2 Crack Control for Flexure in Prestressed Beams (including stress increment checks to Cl 8.6.2 a) (ii))
- Fully detailed hand calculation style output and tabular summaries are produced for all the calculations listed above.