

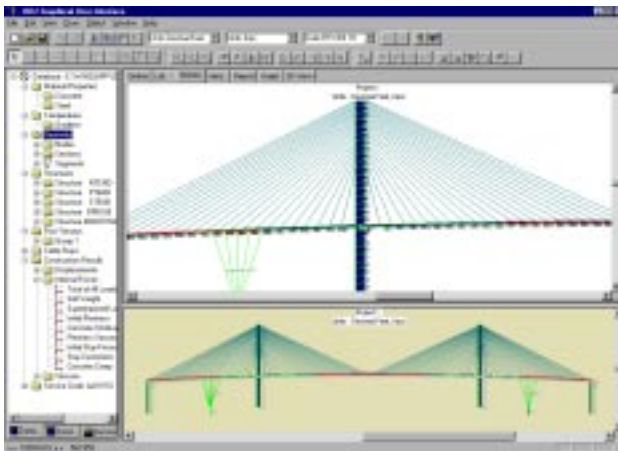
# BRIDGE DESIGNER

STATE OF THE ART BRIDGE SOFTWARE

BD2/BD2GUI

*BRIDGE DESIGNER II is a versatile expert software package, which addresses the various requirements of Pre-stressed Concrete Bridge Analysis and Design.*

*BRIDGE DESIGNER II uses basic matrix structural analysis formulation combined with time-dependent material properties, to carry out a Time Simulation of a structure under construction. During this process, all stress conditions are checked at every construction step and in service.*



## DISPLACEMENT METHOD

The current release includes a standard plane-frame, two-dimensional displacement method. The field of unknowns is the vertical plane (coordinates  $x$  and  $y$ , and rotation  $r$ ). Various stiffness components may be inserted in the global stiffness matrix such as support stiffness and restraint stiffness (boundary conditions).

## SPECIFIC CONCRETE SEGMENTAL BRIDGE DESIGN FEATURES:

- Unlimited number of components (nodes, segments, post-tensioning tendons, spans, construction phases, etc...)
- Time Dependent Material Properties (Concrete Creep, Shrinkage and Steel Relaxation)
- 3D Post-Tensioning Geometry with automatic initial and long term PT losses (Tendon stress, de-stress and grout)
- Non-Linear Cable-Stay Analysis (Stay stress, de-stress, re-stress)
- User defined boundary conditions and Construction Phases
- Time Dependent Stress redistribution
- Service Loads – AASHTO Stress Combinations
- Microstation compatible Graphical Interface

## CONSTRUCTION SIMULATION

The construction of a structure may be simulated in great details. Concrete segments may be poured in-place or pre-cast and assembled, tendons and stays may be stressed or de-stressed, external loads (concentrated or distributed) may be applied at any time anywhere on the structure, moved on various sections or removed. The construction time steps account for the correct concrete age throughout the construction, and proper evaluation of the time-dependent strains

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**Interactive Design Systems' Bridge Designer runs in all flavors of Windows and provides State of the Art Bridge Design Environment.**

The analysis performed by Bridge Designer is a two-dimensional displacement method based on the assumption of linear elasticity and the condition of static equilibrium. Under any loading condition, a structure may be broken down into elementary pieces which behave in accordance with the Theory of Elasticity. In addition in the range of small displacements and assuming that the material remains elastic, this behavior is linear, and the **Principle of Superposition** of the deformations and stresses applies.

## Material Properties:

Defined in the Project Database. Several types of material may be used within one model. Properties are:

- Elasticity Modulus vs. Time
- Creep & Shrinkage Coefficients (FIP-CEB and ACI209)

## Long Term Redistributions

Time dependent effects are evaluated during and after construction. Creep is handled as an internal load-case to simulate the effect of restrained long term strains. Shrinkage is also applied as an internal load, although it is independent of the stress level in the material.

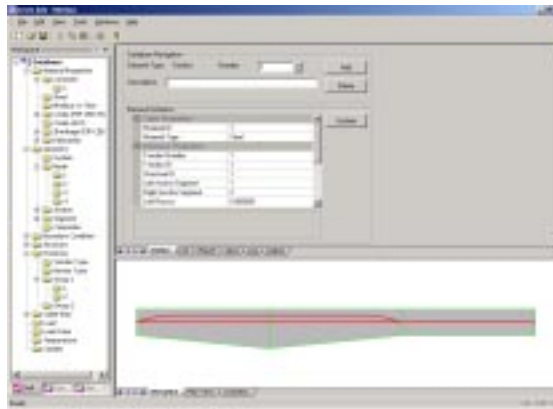
## Post-Tensioning and Cable-Stays

PT tendons are defined mechanically and geometrically through the use of PI points defined in the vertical and horizontal planes. This provides an accurate evaluation of the 3D angle change, and friction losses.

Stay cables are defined in a similar fashion. In addition the system accounts for cable sag and its variation during construction phases.

## ADDITIONAL FEATURES

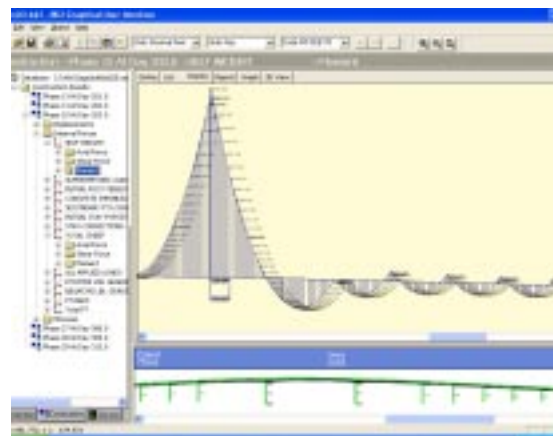
- Linear and non-linear thermal gradients (based on TRB Report 276)
- Substructuring
- Composite Sections
- BD\_Plot Microstation Interface



## Database Interaction:

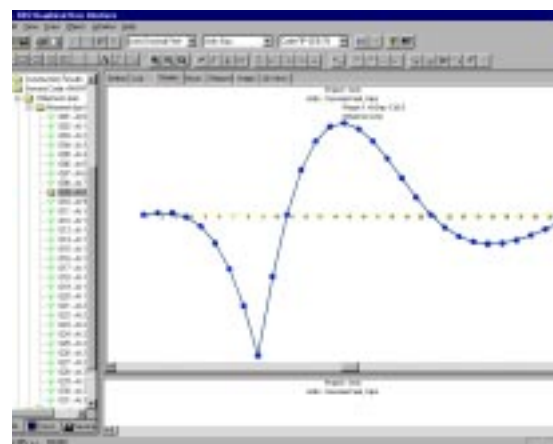
The GUI (Graphical User Interface – BD2GUI):

< Users define the various mechanical and graphical elements via a Windows based User Interface to the RDMS Database.



## Construction Results:

< Displacements, Internal forces and Stresses during construction phases may be viewed interactively in the GUI.



## Influence Lines

< Display of Influence lines in the Service 2000 Module. Axial Force, Moments and Shear Envelopes may be displayed as well.