midas Civil
Integrated Solution System for Bridge and Civil Engineering
01
Unique modelling tools
- Advanced bridge wizard such as Box Culvert, FCM, ILM, FSS, MSS, Grillage, Cable Stayed Bridge Wizard
- Powerful moving load optimizer
- Auto-generation of rail track analysis models

02
Specialized on high-end analysis
- Segmental post-tensioning including prestress losses and camber results
- Cable force tuning in forward stage analysis and suspension bridge analysis with geometric nonlinearity
- Accurate seismic performance reflecting nonlinear properties

03
Practical design features
- Practical modelling features such as SPC, Tendon Template and Transverse Model Wizard
- RC/Steel/PSC/Composite section design as per Eurocodes, AASHTO and other standards
- Bridge load rating for PSC box and composite girder

04
Maximized productivity
- User-friendly GUI with high speed graphic engine
- Presenting input data in Works Tree and manipulating the data by Drag & Drop
- Excel compatible input & output tables
- Automatic generation of analysis and design reports
1. Innovative User Interface

Stretch your imagination & extend your ideas without restrictions. midas Civil will help you achieve the goals.

- Full graphical representation of all shapes
  - Display of line & plane type section shapes
  - Combined analysis results & design display

- Hidden view processing of a user-specified section

- Ease of modelling in Civil
  - Data input via main menu ribbon interface
  - Quick mouse access from context menu
  - Modelling by command input
  - Tabular data entry directly from excel
  - Dynamic interaction between works tree and model window

- Command Line
  - Modelling function similar to autoCAD commands
  - Modelling by one key commands

- Output Window
- Tables

- Task Pane
  - A new concept tool, which enables the user to freely set optimal menu systems
  - A new concept menu system comprising frequently used menus
  - Procedural sequence defined by the user for maximum efficiency
  - Links to corresponding dialogue boxes for ease of checking input data

- Walk Through Mode
  - Model rendering provided in various view points
2. Optimal Solutions for Bridges

Design process for bridges

Reinforced concrete design (beam / column)

- RC design as per Eurocode 2-2, AASHTO LRFD and other codes
- Iterative analyses for calculating optimal sections & rebars
- Column checking for user-defined sections
- Design check for maximum forces with corresponding force components

Optimal solution provided for analysis & design
2. Optimal Solutions for Bridges

Steel design

- Steel combined stress check as per Eurocode 3-2, AASHTO LRFD and other codes
- Stress checks for user-defined sections
- Automatically searches for the optimized steel section with minimal section area (minimal weight) whilst satisfying the design strength checks

Dynamic report generator

- midas Civil enables the user to auto-generate an MS Word report using analysis and design results
- All the input and output data can be plotted (i.e., material properties, section properties, reactions, member forces, displacements, stresses, section verification results, etc.) in a diagram, graph, text or table format
- The report updates itself automatically when changes are made in the model

Section types in database

User-defined irregular sections

Graphical results of stress checks

Reporting dynamic images

Reporting dynamic input/output tables

MS Word report
3. Composite Girder Bridge Design

- Automatic generation of steel composite girder bridge model
  - Straight, curved and skewed bridge
  - 3D bridge model with piers, abutments and cross frames
  - Automatic generation of construction sequence with composite action
  - Easy generation of non-prismatic tapered sections over the entire or partial spans
- Automatic calculation of effective width for composite section
- Cracked section option to ignore concrete deck stiffness in negative flexure region
- 3D Cross frame modeling for accurate design
- Automatic calculation of member forces and stresses separately for steel girder and concrete deck
- Stage-wise stress check during composite construction
- Automated check of composite girder bridges with concrete deck as per Eurocode 4-2 and AASHTO LRFD
  - Steel I-girder, tub and box girder bridges
  - Checks for uniform and hybrid steel girder
  - Composite girder checks for main girders, longitudinal stiffeners, transverse stiffeners and shear connectors
  - Steel code checks for cross frame / bracing
  - Cross section proportion limits, constructability, service limit state, strength limit state, stiffeners and shear connectors
- Bridge load rating for existing bridges as per AASHTO LRFR
  - Standard vehicles, user defined vehicles, legal vehicles and permit vehicles
- Detailed calculation report for analysis, design and rating
- Applicable functions can be changed upon design code

Procedure and main features for steel composite girder bridge design

- Built-in composite section data
- Effective width scale factor
- Reinforcement and longitudinal stiffener data
- Composite section for construction stage to simulate composite action with 1-D element
- Main Girder Check
- Stiffener Check
- Shear Connector Check
- Cross Frame / Bracing Check
- Design Report
3. Composite Girder Bridge Design

Steel & PC Composite Girder bridge wizard

- Fast modelling of steel I, box, tub and PC composite bridges using wizard
- 4 types of model generation
  - All plate model
  - All frame model
  - Deck as plate & girder as frame
  - Deck & web as plate, flanges as frame
- Multi-curve and different skew angle by support positions
- Inclination in bridge deck
- Pier and abutment modelling

- Easy generation of tapered girder
- Definition for transverse deck element spacing by number of division per span or distance
- X bracing, V bracing, inverted V bracing and single beam cross frame
- Dead load before composite and after composite action with quick generation of live load
- Easy generation of tendon using tendon template
- Automatic generation of construction stage considering deck pouring sequence
- Long term effect by applying 3n in elastic modulus after composite action
- Resultant forces at every 10 points per span
3. Composite Girder Bridge Design

Useful features suited for composite girder bridge design

**Resultant forces for 3D FE model**
- Calculation of resultant forces on a selected region in beam, plate and solid elements
- Resultant forces for unstructured meshes
- Table and text format output by load cases / combinations

**Generation of irregular shape composite section**
- Generation of general shape composite section using SPC
- Composite tapered section with general shape is supported
- Construction stage analysis to simulate composite action by parts

SPC (Section Property Calculator)

Before composite action

After composite action

Resultant forces in the table and text format
3. Composite Girder Bridge Design

Steel composite girder check

Automatic steel composite girder check
- Composite girder check as per Eurocode 4-2, AASHTO LRFD and other specifications
- Automatic generation of load combinations
- Constructability, strength, service and fatigue limit state checks
- Main girders, longitudinal stiffeners, transverse stiffeners, shear connectors, braces and cross frames
- Excel format calculation report, spreadsheet format table and design result diagram

Steel composite girder rating

Automatic steel composite girder rating
- Steel composite bridge load rating as per AASHTO LRFR
- Strength, service and fatigue limit state rating
- Design live load, legal load and permit load evaluation
- Adjustment factor resulting from the comparison of measured test behavior with the analytical model
- Member resistances and allowable stresses in accordance with AASHTO LRFD
- Excel format calculation report and spreadsheet format table
3. Composite Girder Bridge Design

Main features for PC composite girder bridge design

- UK and Italy PSC section database for composite sections
- Quick generation for PSC general shape composite section in Section Property Calculator
- Easy and fast generation of strands/tendons using Tendon Template
- Considering longitudinal rebars and tendons in section stiffness calculation
- Construction sequence with time dependent behaviour of concrete
- Automatic calculation of member forces and stresses separately for PC girder and concrete deck
- Stage-wise stress check during composite construction
- Immediate and time-dependent prestress losses by tendons (Graph & Tables)
- PSC composite girder design as per Eurocode 2-2 and AASHTO LRFD
- Detailed calculation report for analysis and design
4. PSC Bridge Design

Integrated solution for practical PSC bridge design
(Longitudinal & transverse direction analysis and strength checks)

Procedure and main features for PSC bridge design

- Construction stage analysis reflecting change in elements, boundary conditions & loadings
- Creep & shrinkage calculation based on codes
- Time dependent steel relaxation (CEB-FIP, Eurocode, Magura & IRC112)
- Irregular sections displayed to true shapes

- 3D/2D tendon placement assignment (lumped representative tendon analysis)
- Strength check to Eurocode, AASHTO LRFD and other codes

- Confinement effect of rebars considered for creep
- Auto-calculation of section properties considering effective width
- Easy generation of non-prismatic tapered sections over the entire or partial spans

- Beam stress check for PSC bridges
- Automatic reaction summary at specific supports through staged launching in ILM bridges
- Compression-only element provided for modelling temporary supports & precasting platform

- Completed state analysis reflecting effective width by construction stages
- Special type of PSC bridge analysis (extradosed bridge)
- Automatic generation of transverse analysis model
- RC design of irregularly shaped columns

Automatic generation of transverse analysis model

- Auto generation of transverse analysis models through global analysis models
- Transverse analysis model generation wizard & auto generation of loading and boundary conditions (transverse tendon assignment)
- Automatic placement of live load for transverse analysis
- Automatic positioning of loadings for plate analysis
- Section check using RC / PSC design function

- Global analysis along the spans
- Transverse analysis
- Strength check
- Integrated solution for PSC bridge design

- Global analysis along the spans
- Transverse model generation
- Partial modification of model data
- RC design
- End of design

- Defining positions for transverse analysis
- Transverse analysis model wizard
- Generation & analysis of a transverse model

- RC Design Result Table
- Text Design Report
- Detail Design Calculation Sheet
4. PSC Bridge Design

Modelling features suited for practical design

- Modelling PSC bridges of irregular sections using Section Property Calculator
- PSC bridge wizards (BCM, ILM, MSS & FSM): user-defined tendons & sections possible

Display and design of irregular sections

Irregular section defined by user using SPC

PSC wizard reflecting design practice

Tendon profile input and real-time display

Auto generation of non-prismatic tapered sections

Auto generation of tapered sections based on bridge spans

Lumped representative tendon analysis

3D tendon profile placement

Automatic calculation of effective width

Schedule-based input of rebars

2D placement of tendons using the representative tendon function
4. PSC Bridge Design

Automatic strength check

- Eurocode 2-2, AASHTO LRFD and other specifications
- Bending strength, shear strength & torsional strength checks
- Transverse rebars check and resistance & factored moment diagrams
- Stress check for completed state by construction stages
- Generation of member forces & stresses by construction stages and maximum & minimum stresses summary
- Excel format calculation report (Crack Control check as per Eurocode)

Various analysis results for practical design

- Separate immediate and time-dependent tension losses by tendons (graphs & tables)
- Generation of tendon weights and coordinates (calculation of tendon quantity)
- Normal / principal / shear / inclined stresses using PSC Stress Diagram command
- Generation of erection cambers
- Summary of reactions at specific supports in ILM bridges

Design parameters for strength check

- Analysis results table
- Analysis results graph
- Bending strength check

PSC bridge-specific stress diagrams

- Maximum normal stress distribution for a PSC bridge
- Principal stress distribution for a PSC bridge
- Tendon loss graph
- Tension losses in tendons
4. PSC Bridge Design

Special type of PSC bridges

- Construction stage analysis reflecting time-dependent material properties and pretensioning forces
- External type pretension loads provided for inducting cable tensioning forces

Construction stage analysis of an extradosed bridge (BCM)

1. Construction stage analysis - tower erection
2. Construction stage analysis - staged construction of girders
3. Construction stage analysis - cable erection
4. Completed state model

Construction stage analysis of an extradosed bridge (FSM)

1. Construction stage analysis - FSM
2. Construction stage analysis - cable erection
3. Construction stage analysis - removal of shoring
4. Analysis results of a completed state model
5. Construction Stage Analysis Control dialogue box

- Compression-only element provided to reflect the effects of temporary bents
- Calculation of section properties of an irregular section using AutoCAD and SPC
- Calculation of normal / principal / inclined stresses using the Beam Stress (PSC) command
4. PSC Bridge Design

Grillage analysis model wizard

- Grillage analysis model wizard automatically converts wide multi-celled PSC box girder sections into a grillage mesh of longitudinal and transverse elements to perform a grillage analysis.
- Both slab based and web based divisions are supported to automatically calculate the section properties such as total area, transverse shear area, torsional moment of inertia, etc for the longitudinal and transverse beam elements.
- The grillage analysis wizard supports tapered bridges with horizontal curvatures, multiple types of spans, user defined bearing conditions, diaphragm and bent definition, auto live load generation, auto-placement of tendon profiles and reinforcement definitions.

Prestressed multi-celled box girder bridges

- Multi-celled box girder bridge grillage model completed with prestressing tendons and boundary conditions.
5. Cable bridge analysis

Optimal solution for cable bridge analysis

- **Initial equilibrium state analysis**
  - Cable nonlinearity considered (equivalent truss, nonlinear truss & catenary cable elements)
  - Calculation of initial pretensions for cable stayed bridges & initial shape analysis for suspension bridges

- **Construction stage analysis reflecting geometric nonlinearity**
  - Finite displacement method (P-delta analysis by construction stages and for completed state)
  - Large displacement method (independent models for backward analysis & forward construction stage)

- **Completed state analysis & tower / girder design**
  - Linearised finite displacement method & linear elastic method
  - Linear buckling analysis / moving load analysis / inelastic dynamic analysis
  - Steel column design of irregular sections

- **Backward construction stage analysis using internal member forces (reflecting large displacement)**

- **Auto calculation of tensions in main cables and coordinates for self-Anchored and earth-Anchored suspension bridges**

- **Detail output for suspension cables (unstressed lengths, sag, etc.) & detail shape analysis**

- **Steel column design of irregular sections**

Initial equilibrium state analysis for cable stayed bridges

- Optimal initial pretensions generated to satisfy desired girder, tower & cable force and displacement constraints

**Generation of optimal cable pretension forces satisfying design constraints**

- Optimum solutions produced by an optimisation theory based on object functions
- Solutions obtained by simultaneous equations if the numbers of constraints and unknowns are equal

**Optimum stressing strategy**

- Ideal dead load force diagram assumed

- Initial equilibrium state analysis results satisfying constraints
5. Cable bridge analysis

Construction stage analysis for cable stayed bridges

Forward staged analysis using the pretensions in the completed state

- Auto calculation of erection pretensions by entering only the pretensions of the completed state & adding Lack of fit force without having to perform backward analysis
- Applicable for both large displacement and small displacement analyses
- Initial equilibrium state analysis reflecting the behaviours of the closure of key segments during erection
- Auto calculation of construction stage pretensions accounting for creep & shrinkage

STEP 01. Calculation of pretensions using Unknown Load Factor

Optimal tensions in cables found satisfying constraints

STEP 02. Forward stage analysis for a cable stayed bridge using the pretensions of the completed state and Lack of fit force

Construction stage analysis results - initial erection

Construction stage analysis results - cantilevers erected

Construction stage analysis results - closure of side spans

Construction stage analysis results - immediately before centre span closure

Construction stage analysis results - final stage

Completed state analysis results - Moment

Forward staged analysis based on application of constraints

- Calculation of cable pretensions by construction stages satisfying the constraints for the completed state
- Auto-iterative function provided to reflect creep & shrinkage
- Superb convergence for calculating unknown load factors using simultaneous equations & object functions

Procedure for a construction stage analysis

1. Set up constraints and unknowns
2. Load Factors found
3. Iteration control

Construction Stage

Unit pretension loads applied

Unknown Load Factor

Assignment of constraints & calculation of unknown load factors for each stage (good convergence)

Construction Stage

Re-analysis of construction stage reflecting influence factors

Check

Analysis of results for each construction stage

End

Construction stage analysis results

Analysis results of the completed state
5. Cable bridge analysis

Construction stage analysis of self anchored suspension bridges

- Accurate analysis with initial member forces to reflect the behaviour of a self anchored suspension bridge subjected to axial forces in girders
- Typical construction methods applicable for self anchored suspension bridges such as hanger insertion and Jack-down construction methods

Construction stage analysis of earth anchored suspension bridges

- Accurate analysis of initial shape performed to satisfy the coordinates of towers and sags

Backward construction stage analysis - large displacement analysis

1. Final Stage
2. Stage 05
3. Stage 04
4. Stage 03
5. Erection bents, main cables & girders installed
6. Removal of superimposed dead load
7. Removal of main span girders
8. Removal of side span girders
9. Removal of main span girders completed
10. Removal of hangers & setback calculation
6. Nonlinear analysis

Seismic & earthquake resistant system and seismic performance
Evaluation for bridges using high-end nonlinear analysis

Nonlinear analysis process in midas Civil

Pushover analysis

- Checking the status of safety limits of a system, which has been considered with dynamic behaviours & load redistribution, after yielding
- Structural inelastic behaviours & resistance capability calculated efficiently
- Capacity spectrum method provided to efficiently evaluate nonlinear seismic response & performance

Process of pushover analysis

- Load control & Displacement control methods
- Gravity load effects considered
- Pushover analysis reflecting P-delta effects
- Various load patterns supported (Mode Shape / Static Load / Uniform Acc.)
- Analysis results checked by pushover steps (hinge status / distribution, displacements, member forces & stresses)

Capacity spectrum method

- Various types of capacity curves supplied
- Demand spectrums supplied for each design standard
- Seismic performance evaluated using Performance Point
6. Nonlinear analysis

Boundary nonlinear analysis

- Structural analysis function including nonlinear link elements (General Link)
- Structural analysis using spring elements having nonlinear properties (Inelastic Hinge Property)
- Various dampers & base isolators (Gap, Hook, Viscoelastic Damper, Hysteretic System, Lead Rubber Bearing Isolator & Friction Pendulum System Isolator)
- Static loads converted into the form of dynamic loads (Time Varying Static Loads)

Analysis capabilities for dampers & base isolators

- Dampers, base isolators & inelastic elements simultaneously considered in nonlinear time history analysis (nonlinear direct integration method)
- Good convergence by Runge-Kutta method (Step Sub-Division Control & Adaptive Stepsize Control)
7. Moving Load Optimiser

Generation of influence lines and surfaces for multiple lanes of traffic to produce the most adverse live load patterns

Moving load analysis pre-processor

- Easy and multiple lane generation techniques along any type of curvilinear path
- Load models and vehicles from Eurocode, AASHTO LRFD, BS and other specifications
- Highway traffic loads, railway traffic loads and footway pedestrian loads can be combined automatically for moving load analysis
- Construction stage analysis and moving load analysis can be done in the same model
- Special vehicles can be made to straddle between two lanes

Moving load analysis post-processor

- Fast generation of analysis results using clever result filtering techniques that saves physical memory and time
- Combined member force checks are possible due to availability of corresponding force components for the max/min force effects. Eg: At maximum bending moment, combined shear + bending result can be seen
- Moving load tracer displays the adverse live load pattern for all vehicle combinations
- Moving loads can be converted into equivalent static loads for detail analysis
8. Soil-Structure Interaction

Automatic modelling of soil-structure interface facilitating the analysis of integral bridges and box culverts

**Integral bridge and culvert wizard**

- Built-in wizard for RC frame/box culvert can model a 3 dimensional plate model of box culverts with all boundary conditions and ground pressure loads
- Auto calculation of soil springs from simple modulus of subgrade reaction input
- Automatic calculation of earth pressure loads considering the submerged condition of soil and the ground water level

**Integral bridge spring supports**

- Nonlinear soil behaviour can be automatically modelled
- Soil structure interaction around the abutment and pile can be simulated by entering basic geotechnical inputs
- Stress distribution along the depth of the abutment can be visualised
- Detail analysis with soil models can be performed using midas GTS
- Dynamic soil structure interaction can be assumed with general links with 6x6 stiffness, mass and damping matrices to represent the foundation impedance of the substructure
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**Option 1. Heat of Hydration Analysis**

**Heat of Hydration Analysis**

midas Civil provides heat of hydration analysis capabilities through heat transfer and heat stress analyses. Heat of hydration analysis by construction stages reflects the change in modulus of elasticity due to maturity, effects of creep/shrinkage, pipe cooling and concrete pour sequence.

- **Analysis Flow**
  - Definition of material properties
  - Definition of boundary conditions
  - Input of analysis condition
  - Heat transfer and heat stress calculations
  - Crack index check

**Definition of heat source of concrete**

Define heat source of concrete to model the amount of heat generated during hydration.

**Definition of material properties of concrete**

Compressible strength of concrete

Tensile strength of concrete

- **Consideration of various parameters for accurate crack index analysis**
  - Adiabatic temperature rise considering maximum adiabatic temperature ($K$) and relative velocity coefficient ($a$)
  - Creep/Shrinkage, compressive strength data base / Heat source function by code
  - Changes in ambient temperature and convective coefficient
  - Various convective coefficient depending on the existence, type and thickness of formwork, curing method, and wind velocity

- **Heat transfer analysis**
  - Definition of heat transfer
  - Definition of ambient temperature
  - Calculate stress using temperature load obtained from heat transfer analysis

**Temperature distribution based on the placement height**

Stage 1

Stage 2

Stage 3

- **Various types of analysis results**
  - Temperature during construction stage
  - Stress during construction stage

- **Various results considering placement sequence**
  - Pipe cooling to reduce cracks
  - Control of temperature for the use of ice plant by defining initial temperature for newly activated elements at a corresponding construction stage
Option 2. Material Nonlinear Analysis

Material Nonlinear Analysis

Material nonlinear analysis is a high-end analysis function to represent nonlinear behaviors of structures after elastic limits.

- Analysis Flow
  - Definition of Nonlinear material model
  - Nonlinear analysis control
  - Nonlinear static analysis of material nonlinearity
  - Evaluation of yielding stress and deformation

- Analysis results

- Various hardening models which define the behaviors from the elastic limits to maximum stress points (Isotropic hardening, Kinematic hardening & Mixed hardening)
- Various failure models frequently encountered in civil engineering practice
- Good convergence for nonlinear analysis using shell elements, which reflect large displacements & large rotations

- Simultaneous analysis of geometric and material nonlinearity

- Material nonlinear properties
  - Ductile material
  - Brittle material

- Load vs displacement
  - Load Step 3

- Von-Misses stress & deformed shape
  - Stress contour & yield status

- Material & geometric nonlinear analysis functions to carry out detail analyses of steel structures consisting of steel box, steel plate & I-beam sections
- View function supported to display plastic zone and identify the status of yielding at integration points
- Animation function provided to examine rather large deformation & stress redistribution in real time
Option 3. **Inelastic Time History Analysis**

**Inelastic Time History Analysis**

For the seismic design and assessment of a structure, midas Civil offers a wide range of hysteresis hinge models such as kinematic hardening, Takeda, slip, etc. in the inelastic time history analysis.

**Analysis Flow**

1. Static analysis and design of members
2. Definition of inelastic hinge properties
3. Define earthquake load
4. Inelastic time history analysis
5. Analyze Inelastic response and behavior
6. Evaluation of Seismic performance and safety

**Evaluation of performance in earthquake**

- Over 50 built-in earthquake acceleration records in DB & import of artificial seismic waves
- Versatile nonlinear analysis results [hinge distribution, max. & min. displacement / velocity / acceleration, time history graphs & simulations]

**Versatile inelastic hysteresis models**

- Inelastic concrete material model
  - Kent & Park / Japan Concrete Standard Specification / Japan Road Bridge Specification / Nagoya Highway Cooperation / Trilinear Concrete / China Concrete Specification(GB50010-02) / Mander Model
- Inelastic steel material model
  - Menegotto-Pinto / Bilinear / Trilinear Steel / Asymmetrical Bilinear / Park / Japan Roadway Specification Model

- Limitation of nonlinear hinge models eliminated, which are based on experience such as pushover analysis, seismic analysis, etc.
- Change in axial forces accurately reflected through fibre models in structures whose axial forces change significantly
- Accurate representations of confinement effects of tie reinforcing steel, crashing and cracking in concrete members and tensile yielding in steel members under nonlinear analysis

**Inelastic hysteresis models**

- Uni-axial hinge model
- Over 20 hinge models including bilinear, tri-linear, Clough, Slip, Multi-linear, Takeda and Kinematic, etc.
- Translational hardening type model / fibre model
- Lumped Type Hinge
- Spring Type Hinge
- Truss Type Hinge
- Distributed Type Hinge
- Multi-axial hinge model

**Option 3. Inelastic Time History Analysis**
Module 1. **FX+ Modeler**

**FX+ Modeler**

midas FX+ Modeler can create complex geometric data for accurate FE modelling. midas FX+ Modeler is capable of modelling any complex configuration encountered in civil structures and industrial facilities. Generated meshes can be produced in various types of data files that are fully compatible with midas Civil.

- **Application Areas**
  - Civil / Geotechnical
  - Automotive / Aerospace
  - Marine / Offshore
  - Consumer Products
  - Research / Education
Module 2. **GSD (General Section Designer)**

**General Section Designer**

- Safety checks for any irregular RC, steel, composite section
- Definition of any irregular cross-section and calculation of section properties
- Mander model to define nonlinear properties to concrete
- Generation of P-M, P-My-Mz, M-M interaction curves as per Eurocode, AASHTO LRFD
- Calculation of section capacity (in flexure) and safety ratio based on member forces
- Generation of moment-curvature curve
- Plot of stress contour for all the cross-sections
  - Uncracked elastic stress
  - Cracked elastic stress

**Workflow**

1. **Step 1**
   - General Section Definition in GSD
   - Export to midas Civil

2. **Step 2**
   - Export General Section & Section Properties from GSD to midas Civil

3. **Step 3**
   - Perform Analysis and Design in midas Civil
   - Import to GSD

4. **Step 4**
   - Import member forces from midas Civil to GSD

5. **Step 5**
   - Section Design in GSD (Interaction Curve, Moment Curvature, Stress Contour)

**Features**

- Concrete non-linear material properties
- Rebar non-linear material properties
- 3D P-M & M-M curve
- Moment curvature curve
- Print out of report
Module 3. Rail Track Analysis

- Rail track analysis wizard
  - Auto-generation of multi-linear type elastic links
  - Generation of additional moving load analysis models with referring to the most critical position

- Modal time history analysis for high speed rail
  - Time step deformation of railway bridge due to dynamic high speed rail loads
  - Shear vs displacement behaviour of Lead Rubber Bearing Isolator due to train loads
  - Acceleration vs time response at mid-span of the bridge under high speed train load

- Fast dynamic analysis approach for nonlinear boundaries
- Easy entry of train loads via Excel sheet input in the dynamic nodal loads table
- Wide variety of graphs and tables displayed in the post processor for time history forces, stresses and displacements under the dynamic effects of high speed rail
- Peak acceleration, displacement checks and bearing behaviours can be obtained for high speed rails
**Module 4. AASHTO Composite Girder Design**

**Steel and PC Composite Girder Design & Rating as per AASHTO LRFD & LRFR**

Composite girder design module enables engineers to perform design check as per latest AASHTO LRFD code and rating as per latest AASHTO LRFR code in 3D models. Engineers will be able to consider erecting sequence of the girders with different deck pours and temporary supports.

Girder bridge wizard automatically generates steel and PC composite girder bridge model with longitudinal reinforcements, tendons, bracings, stiffeners, and loads.

- **Composite girder design process**
  - Cross Section
  - Service Limit State
  - Strength Limit State
  - Transverse Stiffener
  - Constructibility
  - Fatigue Limit State
  - Shear Connector
  - Longitudinal Stiffener

- **Bridge load rating**
  - Design Load Rating
    - Performance of existing bridges
    - Bridge plan data block
  - Legal Load Rating
    - Single safe load capacity
    - Bridge posting determination
  - Permit Load Rating
    - Applied to bridges having sufficient capacity
    - Overweight permit determination

- **Three modeling methods for composite action**
  - METHOD 1
    - Sequential Analysis + Accurate Time Dependent Material
    - Long-term Modular Ratio of 3n
  - METHOD 2
    - Composite Action without Sequential Analysis
  - METHOD 3
    - Pre-Composite Section

- **Girder bridge wizard**
Project Applications

Segmental Concrete Bridges

US17 Wilmington Bypass (North Carolina, USA)
I-95/I-295 Lee Roy Selmon Flyovers (Florida, USA)
Galena Creek Bridge (Nevada, USA)

Jalan Travers Bansar (Kuala Lumpur, Malaysia)
The bridge over the Adige river (Verona, Italy)
Basarab viaduct (Bucharest, Romania)

La Jabalina Bridge (Durango, Mexico)
Tarango Bridge (Mexico City, Mexico)
Intersección Elevada Av. Suba x Av. Boyacá (Cali, Colombia)

*Bridge Awards of Excellence* (American Segmental Bridge Institute)
Project Applications

Cable Stayed Bridges

- **Russky Island Bridge** (Vladivostok, Russia)
- **Stonecutters Bridge** (Hong Kong, China)
- **New Wear Bridge** (Sunderland, UK)

Suspension Bridges

- **Ironton-Russell Bridge** (Between Ironton and Russell, USA)
- **Talavera Bridge** (Castile-La Mancha, Spain)
- **Korabelny Farvater Bridge** (Saint-Petersburg, Russia)

- **Thuan Phuoc Bridge** (Da Nang, Vietnam)
- **Young Jong Bridge** (Incheon, South Korea)
- **Kum Ga Bridge** (Chungju, South Korea)

Bridging Your Innovations to Realities
About MIDAS IT

“MIDAS IT is taking flight with endless passion and devotion to provide technological solutions worldwide”

MIDAS Information Technology Co., Ltd. develops and supplies mechanical / civil / structural / geotechnical engineering software and provides professional engineering consulting and e-Biz total solutions. The company began its operation since 1989, and currently employs 600 developers and engineers with extensive experience. MIDAS IT also has corporate offices in US, UK, China, Japan, India and Russia. There are also global network partners in over 35 countries supplying our engineering technology. MIDAS IT has grown into a world class company.
Introduction to MIDAS Family Programs

“MIDAS Family Programs are advanced CAE (Computer Aided Engineering) solutions that have been and are being developed using the latest technology”
a total of over 30,000 licences used worldwide in over 150 countries

Largest CAE Software Developer in Civil Engineering