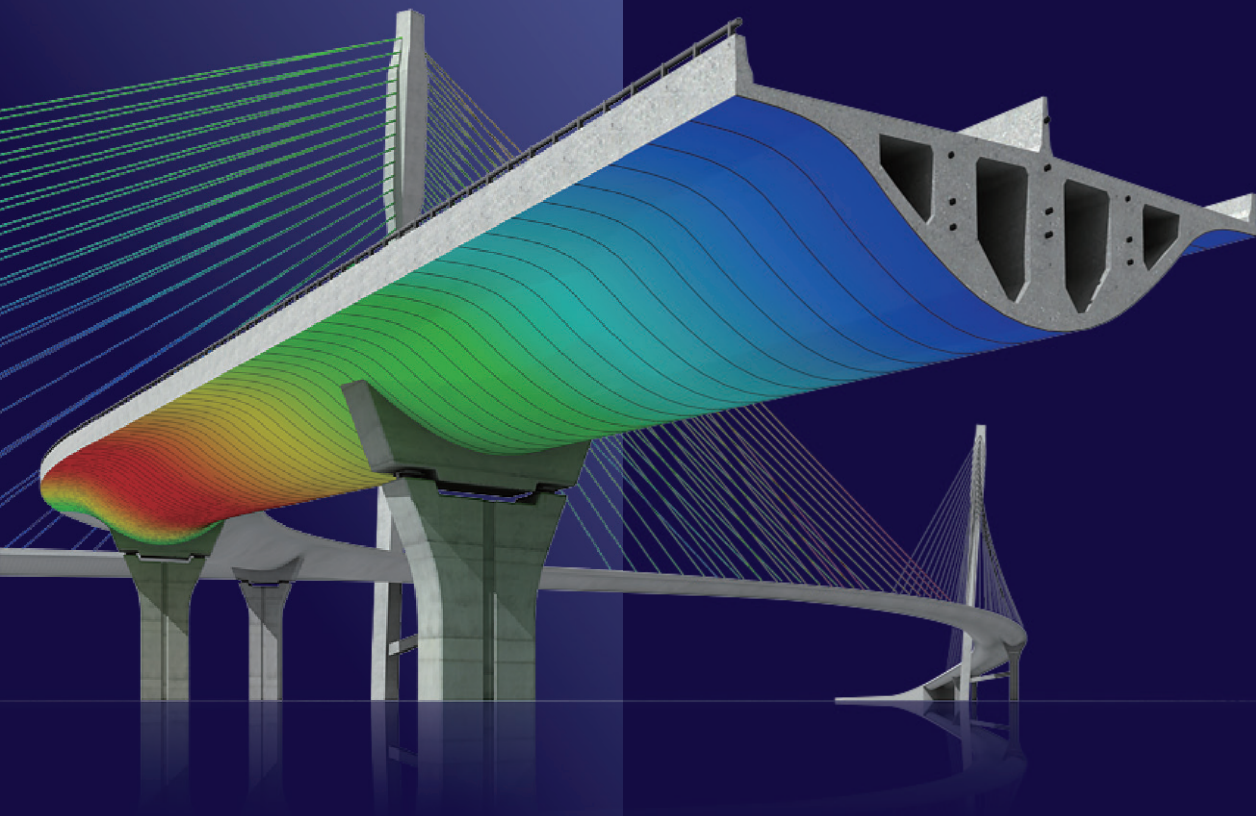


# midas Civil を活用した 解析事例

—  
建設分野における  
Civilの適用実績-海外編



Global Leader in Providing Engineering Solutions &amp; Services

## MIDAS ITは世界の技術者を支援します



世界 構造解析分野市場占有率1位(midas Gen/iGen)

韓国 建築分野/土木分野/地盤分野CAEソフト占有率1位

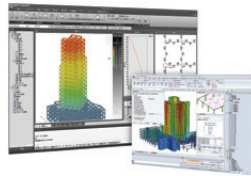
中国 土木/地盤構造解析分野市場占有率1位 (midas Civil, midas GTS)

建設業界 **No.1** 現地法人 **9**  
 海外代理店 **35** 使用国 **110**

## MIDAS Family Programs

## 建築

Building Engineering



## midas iGen

任意形状建造物の  
汎用構造解析  
及び許容応力度計算

## midas eGen

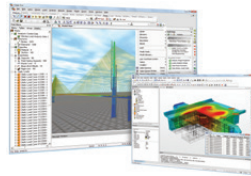
任意形状建物の  
一貫構造計算  
CAD基盤モデリング

## midas Drawing

建築構造図面の  
自動生成プログラム

## 土木

Bridge Engineering



## midas Civil

土木分野の  
汎用構造解析および  
最適設計システム

## midas FEA

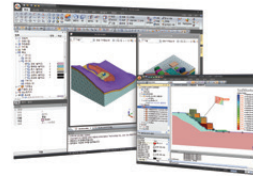
建設分野の非線形解析  
および詳細解析システム

## midas CIM ※開発中

3D情報モデルを活用した  
土木建造物のモデリング/  
図面生成/施工管理  
ソリューション

## 地盤

Geotechnical Engineering



## GTS NX

2/3次元地盤汎用解析  
プログラム

## SoilWorks

2次元専用地盤汎用解析  
プログラム

## SoilWorks for FLIP

液状化解析プログラム  
FLIP用のプリ・ポスト

## SoilWorks for LIQCA

液状化解析プログラム  
LIQCA用のプリ・ポスト

## midas GeoXD

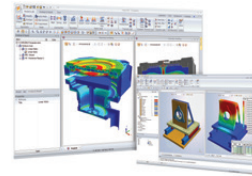
土留め設計図面生成  
プログラム

## SOLIFLUK PE

河川堤防の液状化  
対策設計ソリューション

## 機械

Mechanical Engineering



## midas NFX

機械分野の  
汎用構造解析システム

## midas NFX CFD

流動解析システム

## MIDAS/CIVIL Project Applications



For utmost accuracy &amp; Productivity,

MIDAS provides the best solution in Structural Engineering.

We Analyze and Design the Future.



The Most Intelligent Design &amp; Analysis System

## CONVENTIONAL BRIDGE WIZARD

SLAB RAHMEN CULVERT SUBWAY STATION



Rahmen Bridge



Slab Bridge



Subway



Steel Box Bridge



PSC Beam Bridge

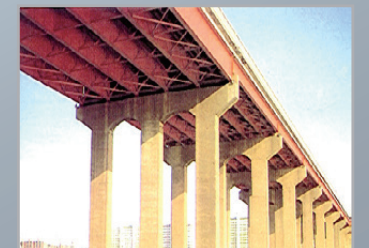


Plate Girder Bridge

RC Slab Bridge, RC Rahmen/Box Culvert, Subway Station Wizard

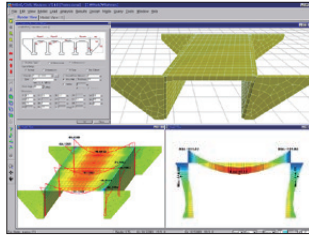
Static Analysis, Moving Load Analysis, Influence Line/Surface Analysis

2D - Beam &amp; Column Design/Checking

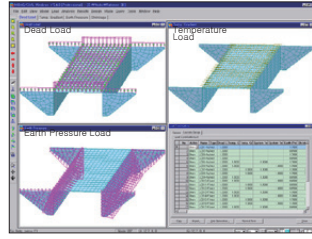


## RC RAHMEN WIZARD

Conventional Bridge



Results of static analysis of a skewed Rahmen Bridge



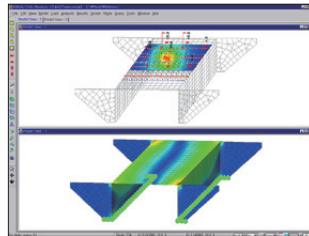
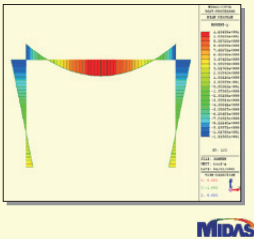
Verification of inputting load in a skewed Rahmen Bridge

### Design scope

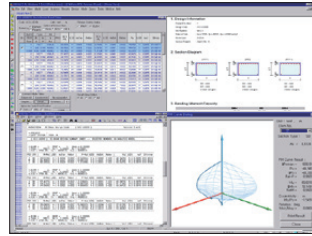
RC Rahmen Wizard  
Static Analysis  
Influence Surface Analysis  
Moving Load Analysis  
Beam & column Design

### Profile of Model

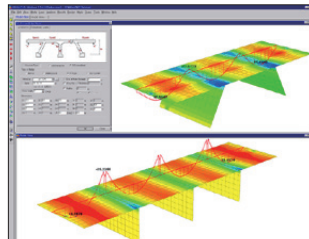
Node : 884  
Element : 832  
Element Type : Beam, Plate



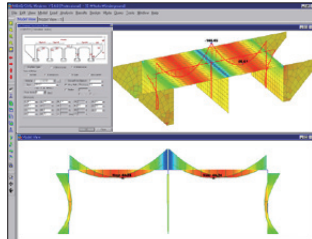
Results of a moving load analysis and settlement analysis of a skewed Rahmen bridge



Beam & Column Design of a RC Rahmen Bridge



A cutting plane of  $\pi$  type Rahmen Bridge



Results of static analysis of a 2 span Rahmen Bridge

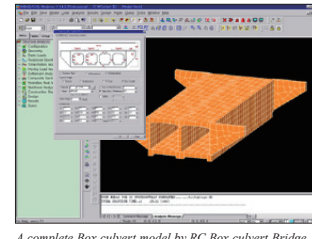
### MIDAS/CIVIL PROJECT

#### Conventional Br.

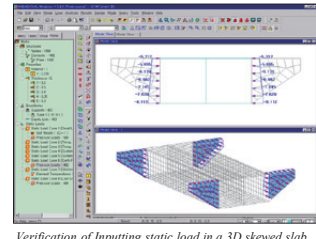
PSC BOX  
FCM  
ILM  
MSS  
EXTRADOSED  
CABLE-STAYED  
SUSPENSION  
STEEL BRIDGE  
HEAT OF HYDRATION  
TUNNEL  
SUBWAY  
SEWAGE TREATMENT

## RC CULVERT WIZARD

Conventional Bridge



A complete Box culvert model by RC Box culvert Bridge Wizard.



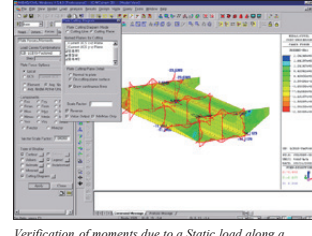
Verification of Inputting static load in a 3D skewed slab Bridge

### Design scope

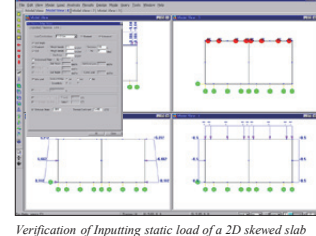
RC Box/Culvert Wizard  
Static Analysis  
Beam & column Design

### Profile of Model

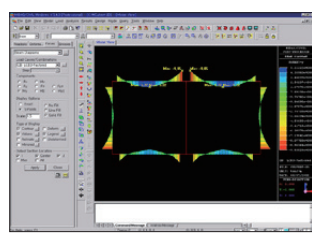
Node : 1926  
Element : 1482  
Element Type : Beam, Plate



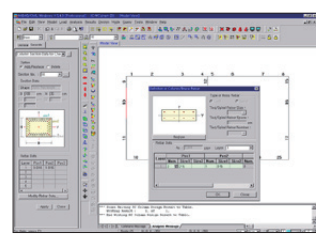
Verification of moments due to a Static load along a Cutting Line of the slab bridge



Verification of Inputting static load of a 2D skewed slab Bridge



Results of static analysis of a 2 cell box culvert



Beam & Column Design of a 2 cell box culvert

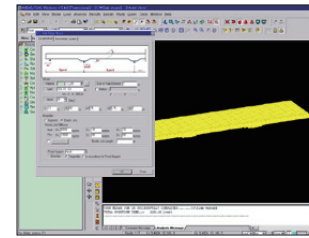
### MIDAS/CIVIL PROJECT

#### Conventional Br.

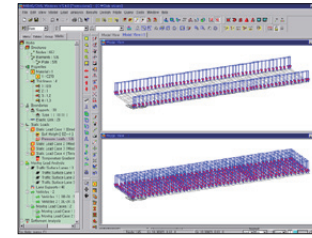
PSC BOX  
FCM  
ILM  
MSS  
EXTRADOSED  
CABLE-STAYED  
SUSPENSION  
STEEL BRIDGE  
HEAT OF HYDRATION  
TUNNEL  
SUBWAY  
SEWAGE TREATMENT

## RC SLAB WIZARD

Conventional Bridge



A complete RC slab Bridge model by RC Slab Bridge Wizard.



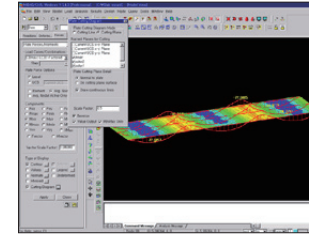
Verification of Inputting static load in a skewed slab Bridge

### Design scope

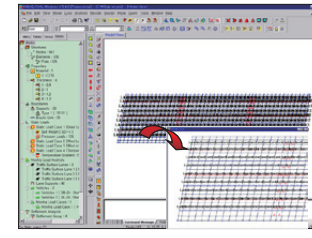
RC Slab Wizard  
Static Analysis  
Influence Surface Analysis  
Moving Load Analysis

### Profile of Model

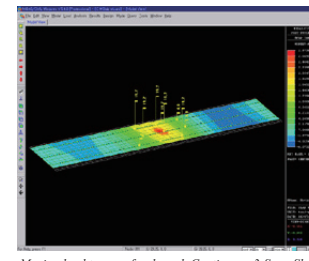
Node : 657  
Element : 576  
Element Type : Plate



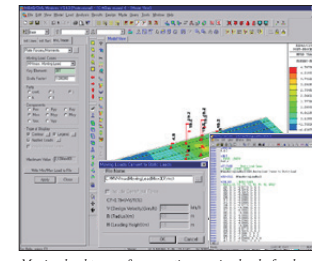
Verification of moments due to a moving load along a Cutting Line of the slab bridge



Verification of Inputting moving Load in a skewed slab Bridge



Moving load tracer of a skewed, Continuous 3-Span Slab Bridge due to a moving load



Moving load tracer & converting moving load of a skewed, Continuous 3-Span Slab Bridge due to a moving load

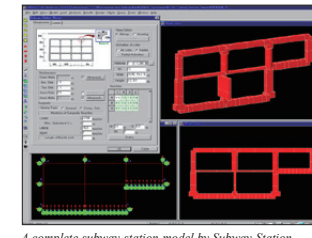
### MIDAS/CIVIL PROJECT

#### Conventional Br.

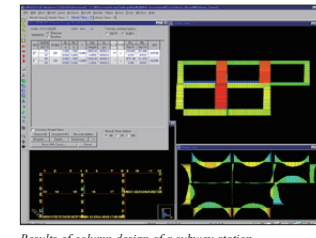
PSC BOX  
FCM  
ILM  
MSS  
EXTRADOSED  
CABLE-STAYED  
SUSPENSION  
STEEL BRIDGE  
HEAT OF HYDRATION  
TUNNEL  
SUBWAY  
SEWAGE TREATMENT

## SUBWAY STATION WIZARD

Conventional Bridge



A complete subway station model by Subway Station Wizard.



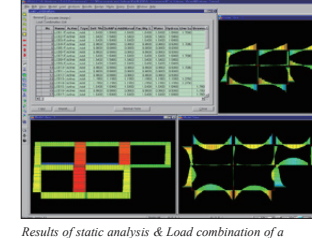
Results of column design of a subway station

### Design scope

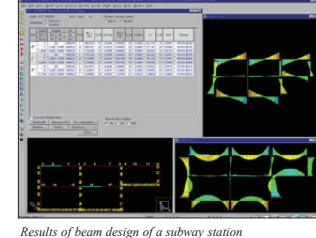
Subway Station Wizard  
Static Analysis  
Beam & column Design

### Profile of Model

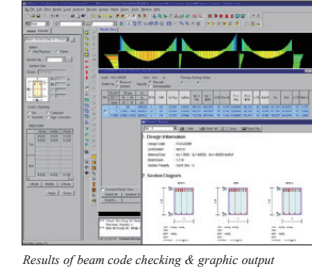
Node : 114  
Element : 74  
Element Type : Beam



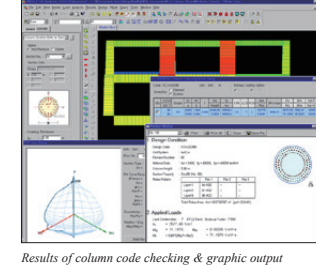
Results of static analysis & Load combination of a subway station



Results of beam design of a subway station



Results of beam code checking & graphic output



Results of column code checking & graphic output

### MIDAS/CIVIL PROJECT


#### Conventional Br.

PSC BOX  
FCM  
ILM  
MSS  
EXTRADOSED  
CABLE-STAYED  
SUSPENSION  
STEEL BRIDGE  
HEAT OF HYDRATION  
TUNNEL  
SUBWAY  
SEWAGE TREATMENT



# STEEL BOX BRIDGE

Conventional Bridge

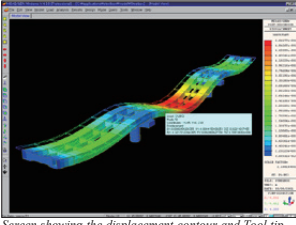


Design scope

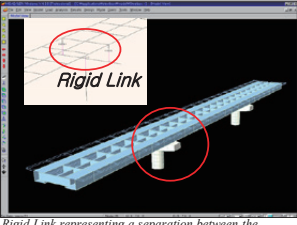
- Static Analysis
- Moving Load Analysis
- Response Spectrum Analysis

Profile of Model

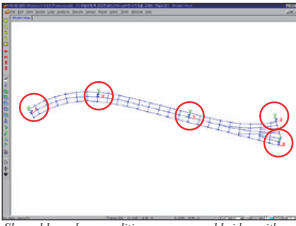
Node : 101  
Element : 144  
Element Type : Beam, Plate, Solid



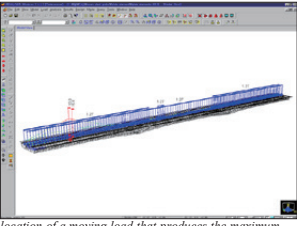
Screen showing the displacement contour and Tool tip, which provides detail analysis results of a steel box girder bridge



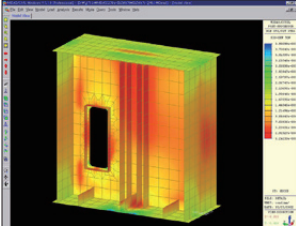
Rigid Link representing a separation between the bridge box girder and support pier



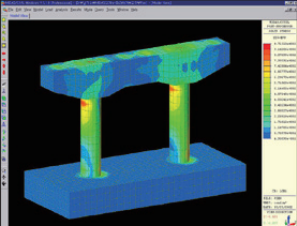
Skewed boundary conditions on a curved bridge with a lane expansion



Location of a moving load that produces the maximum member forces in a composite structural steel bridge



Von Mises stress Contour of a diaphragm at a steel box girder bridge support



Von Mises stress Contour of a pier at a steel box girder bridge

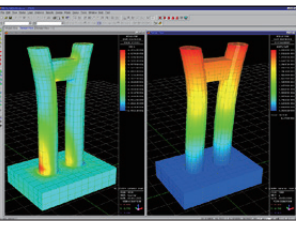
MIDAS/CIVIL PROJECT

Conventional Br.

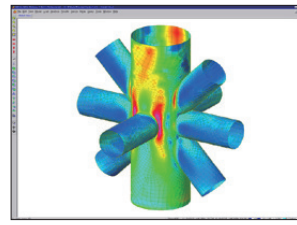
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

# AUTO MESH GENERATOR for DETAIL ANALYSIS

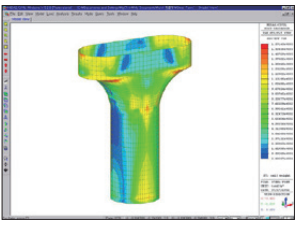
MIDAS/MESH Applications



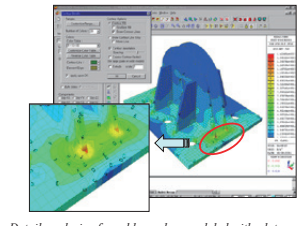
Deformation and principal stress contours from a response spectrum analysis of a highway bridge pier



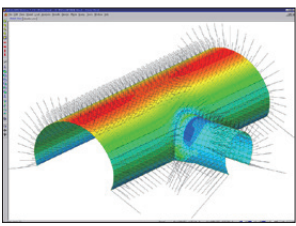
Automatic mesh generation of elements by assembling basic features followed by intersection calculations



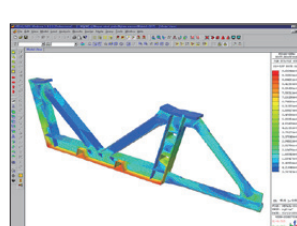
Von Mises stress Contour of a pier steel form using automatic mesh generation of elements



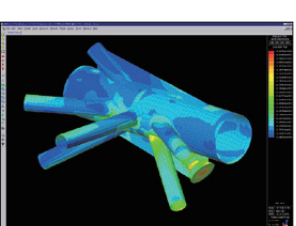
Detail analysis of a cable anchor modeled with plate elements. The stress contour shows the stresses at the top and bottom of the plate elements simultaneously.



Analysis results of a main/access tunnel joint model, created by the mesh generator using selective basic features



Von Mises stress Contour of a cross bracing at a structural steel box girder bridge support



Connection of branch and main pipes in cable anchorage

Design scope

Detail analysis of pier, cross bracing diaphragm, tunnel, cable anchorage, etc.

Static Analysis  
Moving Load Analysis  
Response Spectrum Analysis  
Buckling Analysis

Profile of Model

Node : 1362  
Element : 2092  
Element Type : Plate, Solid


MIDAS/CIVIL PROJECT

Conventional Br.

- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

# PSC BEAM BRIDGE

Conventional Bridge

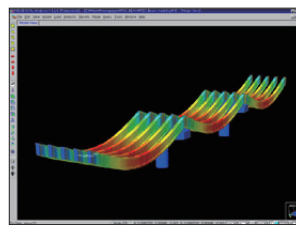


Design scope

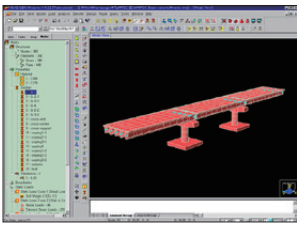
- Static Analysis
- Moving Load Analysis
- Response Spectrum Analysis

Profile of Model

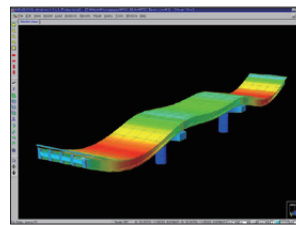
Node : 373  
Element : 294  
Element Type : Beam, Plate



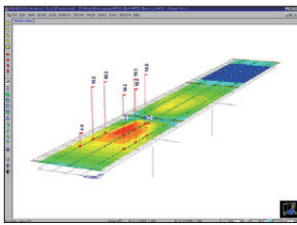
Results of a displacement analysis of a 3-span PSC beam bridge before composite



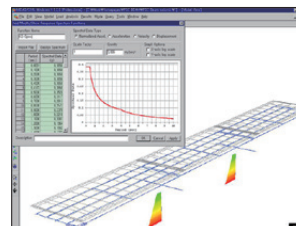
Change of precast sectional properties of selected members by Drag & Drop in Works Tree



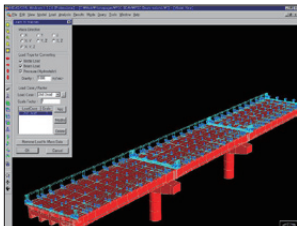
Results of a displacement analysis of a 3-span PSC beam bridge after composite



Location of a moving load that produces the maximum member forces in a slab Bridge



Response spectrum analysis of a 3-span PSC beam bridge



Converting to loads to masses for Dynamic analysis of PSC beam Bridge

MIDAS/CIVIL PROJECT

Conventional Br.

- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

# PSC BOX Bridge

FCM

ILM

MSS


EXTRADOSED

Free Cantilever Method


Incremental Launching Method

Movable Scaffolding System


Extradosed Bridge




Free Cantilever Method




Incremental Launching Method




Free Cantilever Method



Movable Scaffolding System



Precast Segment Method



Extradosed Bridge

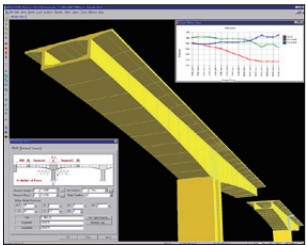
Time dependent material properties are defined to reflect the variation of modulus of elasticity relative to concrete maturity and the long-term deflection effects due to creep and shrinkage. MIDAS/CIVIL provides **Standardized PSC Box Sections** for Post-tensioned Box Girder Bridges for easy application in practical modelling. Analysis accounts for pre-stressing effects considering Pre-/Post-tension and Internal/External placing methods. **FCM, ILM and MSS Bridge models** and construction stages are generated after having entered only cross sections, tendon placement and bridge information.



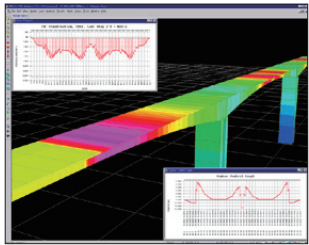
FCM  
Free Cantilever Method



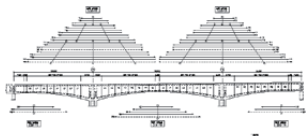
Naro Island - Lyunlyook Br.



Real Time Display of element generation and loading process in an FCM Bridge in Render View



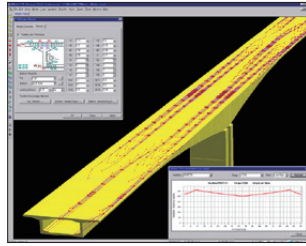
Graphs showing Bridge Girder Stress & Camber Control



FCM Bridge Tendon Profile



Elevated overpass, Pusan



A complete FCM bridge model and tendon profile simply created by FCM Bridge Wizard.

**Design scope**  
FCM Wizard  
Static Analysis  
Construction Stage Analysis  
Moving Load Analysis

**Profile of Model**  
Node : 80  
Element : 75  
Element Type : Beam



MIDAS/CIVIL  
PROJECT

CONVENTIONAL Br.

PSC BOX

FCM

ILM

MSS

EXTRADOSED

CABLE-STAYED

SUSPENSION

STEEL BRIDGE

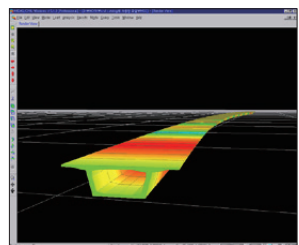
HEAT OF HYDRATION

TUNNEL

SUBWAY

SEWAGE TREATMENT

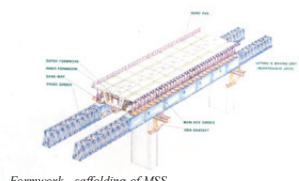
MSS  
Movable Scaffolding System



Results of construction stage analysis of an MSS Bridge



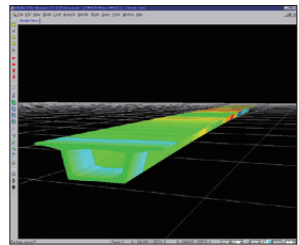
MSS Staging view of Jeokmoon Br.



Formwork - scaffolding of MSS



Construction view of Sangchon Br. using MSS



Results of construction stage analysis of an MSS Bridge



A construction stage view of MSS

**Design scope**  
MSS Wizard  
Static Analysis  
Construction Stage Analysis  
Moving Load Analysis

**Profile of Model**  
Node : 119  
Element : 118  
Element Type : Beam



MIDAS/CIVIL  
PROJECT

CONVENTIONAL Br.

PSC BOX

FCM

ILM

MSS

EXTRADOSED

CABLE-STAYED

SUSPENSION

STEEL BRIDGE

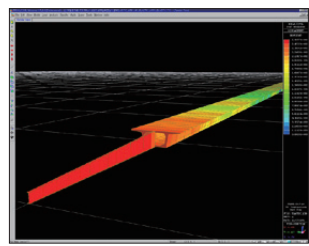
HEAT OF HYDRATION

TUNNEL

SUBWAY

SEWAGE TREATMENT

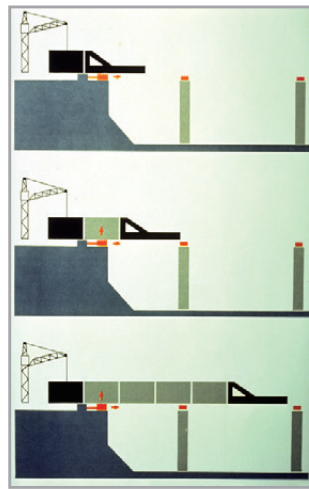
ILM  
Incremental Launching Method



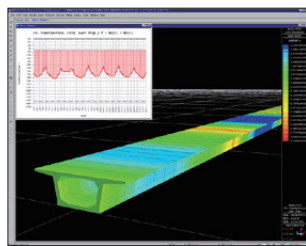
Results of construction stage analysis of an ILM Bridge



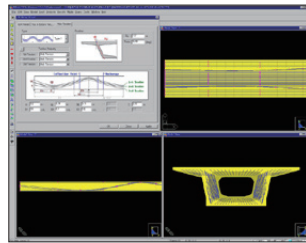
Construction view of Jungryung Br.



Launching schematic of an ILM Bridge



ILM Bridge Girder Stress Diagram



Placement wizard for ILM Bridge

**Design scope**  
ILM Wizard  
Static Analysis  
Construction Stage Analysis  
Moving Load Analysis

**Profile of Model**  
Node : 322  
Element : 154  
Element Type : Beam



MIDAS/CIVIL  
PROJECT

CONVENTIONAL Br.

PSC BOX

FCM

ILM

MSS

EXTRADOSED

CABLE-STAYED

SUSPENSION

STEEL BRIDGE

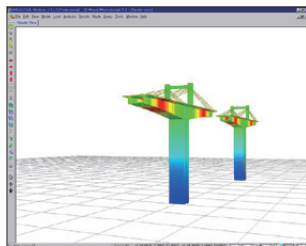
HEAT OF HYDRATION

TUNNEL

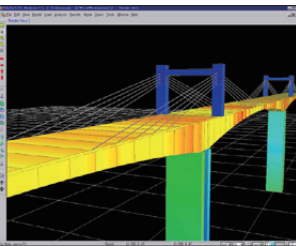
SUBWAY

SEWAGE TREATMENT

EXTRADOSED  
Extradosed PSC Bridge



Results of construction stage analysis of an Extradosed PSC Bridge



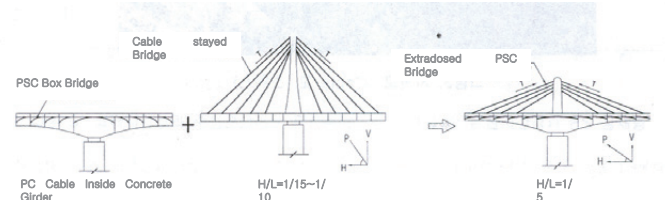
Analysis results of a completed Extradosed PSC Bridge



Ganter Bridge, Swiss, 1980 (174m)



Sunniberg Bridge, Swiss, 1998 (140m)



Overview of Extradosed PSC Bridge structure

**Design scope**  
Static Analysis  
Construction Stage Analysis  
Moving Load Analysis  
Unknown Load Factor

**Profile of Model**  
Node : 80  
Element : 75  
Element Type : Beam



MIDAS/CIVIL  
PROJECT

CONVENTIONAL Br.

PSC BOX

FCM

ILM

MSS

EXTRADOSED

CABLE-STAYED

SUSPENSION

STEEL BRIDGE

HEAT OF HYDRATION

TUNNEL

SUBWAY

SEWAGE TREATMENT



# CABLE-SYAYED BRIDGE



Stonecutter Bridge, Hong Kong, China



Seohae Grand Bridge, Asan bay, Korea, 1997 (470m)



Pont de Normandie, Le Havre, France, 1995 (856m)



YoungHeung Grand Bridge, Incheon, Korea, 2001 (240m)



Ting Kau Bridge, Hong Kong, China, 1997 (475m)

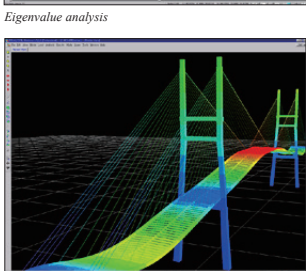
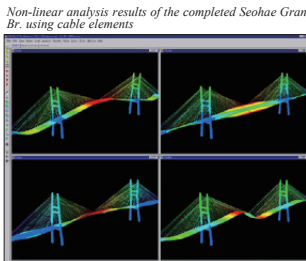
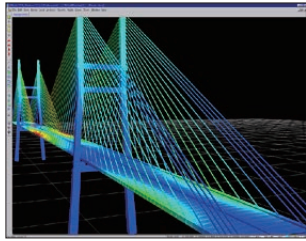


Kap Shui Mun Bridge, Hong Kong, China, 1997 (430m)

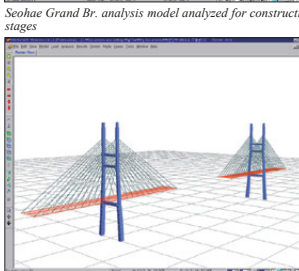
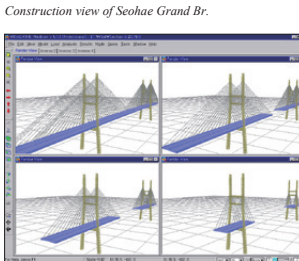
MIDAS/CIVIL provides the **Wizard** to create a completed model of a Cable Stayed Bridge very fast. Initial pre-stressing forces are calculated through **Optimization** for initial equilibrium state analysis. It also provides the **Construction stage** function, which enables us to reflect Creation/Deletion of elements, change in boundary conditions and loading changes that may occur in various stages of construction.

## SEOHAE GRAND Br.

Cable Stayed Br.



Eigenvalue analysis of Seohae Grand Br. reflecting Initial Force for Geometric Stiffness



Rendering view of Seohae Grand Br. analysis model analyzed for construction stages

**Design scope**  
Static Analysis  
Construction Stage Analysis  
Moving Load Analysis  
Unknown Load Factor  
Eigenvalue Analysis

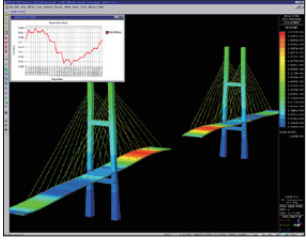
**Profile of Model**  
Node : 850  
Element : 1421  
Element Type : Beam, Cable

### MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE STAYED**
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

## SAMCHEONPO GRAND Br.

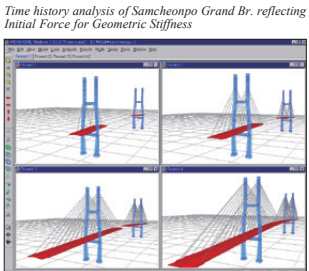
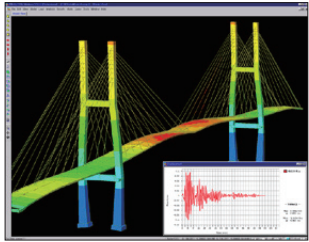
Cable Stayed Br.



Construction stage analysis model of Samcheonpo Grand Br.

**Design scope**  
Static Analysis  
Construction Stage Analysis  
Moving Load Analysis  
Unknown Load Factor  
Eigenvalue Analysis

**Profile of Model**  
Node : 759  
Element : 1086  
Element Type : Beam, Cable



Construction stage analysis model of Samcheonpo Grand Br.



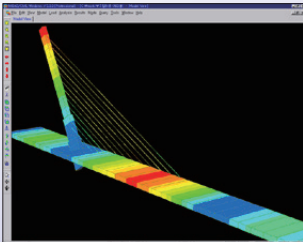
Construction view of Samcheonpo Grand Br.

### MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE STAYED**
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

## KUMDANG Br.

Cable Stayed Br.



Results of initial cable pre-stressing forces obtained by the Unknown Load Factor function



Kumdang Bridge, Kwangyang, Korea (160m)

**Design scope**  
Static Analysis  
Construction Stage Analysis  
Moving Load Analysis  
Unknown Load Factor

**Project profile**  
Node : 51  
Element : 62  
Element Type : Beam, Cable

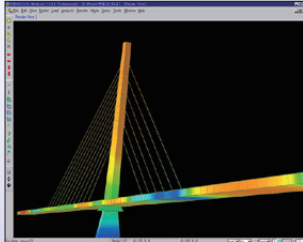


### MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE STAYED**
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

## 2nd SUNGSAN GRAND Br.

Cable Stayed Br.



Linear & Non-linear analyses using Truss & Cable elements



2nd Sungsan Grand Bridge, Seoul, Korea (225m)

**Design scope**  
Static Analysis  
Construction Stage Analysis  
Moving Load Analysis  
Unknown Load Factor

**Project profile**  
Node : 107  
Element : 123  
Element Type : Beam, Cable



### MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE STAYED**
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

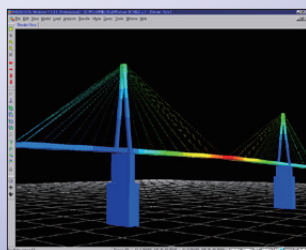


# DOLSAN GRAND Br.

Cable Stayed Br.



Dolsan Grand Bridge, Yeosu, Korea, 1984 (280m)



Eigenvalue analysis of Dolsan Br. reflecting Initial Force for Geometric Stiffness

### Design scope

Static Analysis  
Moving Load Analysis  
Unknown Load Factor

### Project profile

Node : 141  
Element : 116  
Element Type : Beam, Cable



## MIDAS/CIVIL PROJECT

CONVENTIONAL Br.

PSC BOX

FCM

ILM

MSS

EXTRADOSED

**CABLE STAYED**

SUSPENSION

STEEL BRIDGE

HEAT OF HYDRATION

TUNNEL

SUBWAY

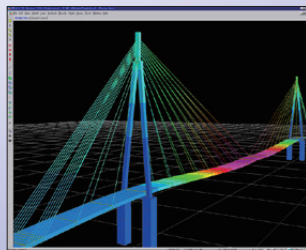
SEWAGE TREATMENT

# JINDO GRAND Br.

Cable Stayed Br.



Jindo Grand Bridge, Jindo, Korea, 1984 (344m)



Non-linear analysis results of the completed Jindo Grand Br. using cable elements

### Design scope

Static Analysis  
Moving Load Analysis  
Unknown Load Factor

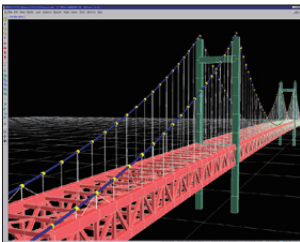
### Project profile

Node : 237  
Element : 304  
Element Type : Beam, Cable



# KWANGAN GRAND Br.

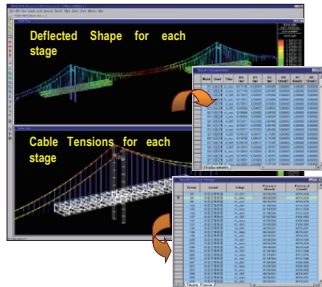
Suspension Br.



Analysis model of the completed Kwangan Grand Br. using Suspension Bridge Wizard



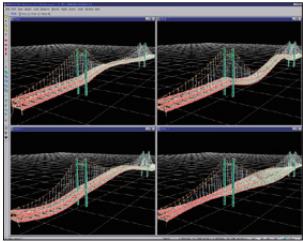
Perspective model view of Kwangan Grand Br.



Display of a deflected shape and tension forces, which are also tabulated, subsequent to carrying out inverse construction stage analysis



Construction view of Kwangan Grand Br.



Mode Shapes resulting from eigenvalue analysis of Kwangan Br.



Pylon & catwalk of Kwangan Grand Br.



Display of Inverse Construction Stage Analysis models reflecting members, boundary conditions and loadings pertaining to each stage

### Design scope

3D full model created using cable and beam elements for Kwangan Grand Br.

### Profile of Model

Node : 2018  
Element : 3176  
Element Type : Beam, Cable



# YOUNGJONG GRAND Br.

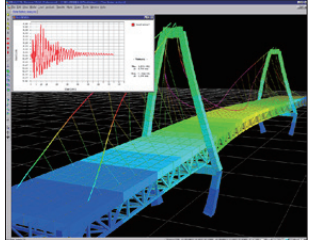
Suspension Br.



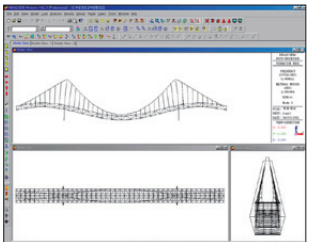
Perspective model view of Youngjong Grand Br.



Construction view of Youngjong Grand Br.



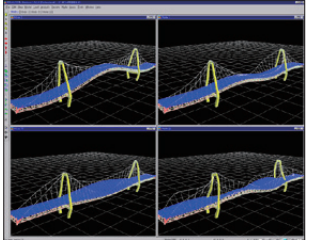
Time History Analysis of Youngjong Grand Br.



Eigenvalue analysis result showing the 1st vertical mode



Youngjong Grand Br.



Mode Shapes resulting from eigenvalue analysis of Youngjong Grand Br.

### Design scope

A structural analysis model of the existing Youngjong Bridge was created for the purpose of maintenance management during its life cycle. Cable and Beam elements were used for the superstructure. Elastic Links and Rigid Links were used to represent the boundary conditions. The entire structural model was tuned to represent the true behavior of the bridge, reflecting the displacements and natural frequencies measured from a series of load tests.

### Profile of Model

Node : 1362  
Element : 2092  
Element Type : Beam, Cable



## MIDAS/CIVIL PROJECT

CONVENTIONAL Br.

PSC BOX

FCM

ILM

MSS

EXTRADOSED

CABLE-STAYED

**SUSPENSION**

STEEL BRIDGE

HEAT OF HYDRATION

TUNNEL

SUBWAY

SEWAGE TREATMENT

# SUSPENSION BRIDGE



Great Belt Bridge, Halskov-Sprogø, Denmark, 1998 (1991m)



Severn, Bristol, UK, 1996 (988m)



Tacoma Narrows Bridge, Washington, USA, 1950 (853m)



Golden Gate Bridge, San Francisco, USA, 1937 (1280m)



San Francisco-Oakland Bay, San Francisco, USA, 1936 (704m)



Kurushima Kaikyo Bridge, Nishiseto, Japan, 1999 (1030m)

Unlike conventional structures, a special analysis approach is required for Suspension Bridges, which are composed of flexible cables. *Suspension Bridge Wizard* in MIDAS/CIVIL automatically calculates the cable coordinates and tensions of the completed structure. Also, using 3D Elastic suspension line element and Equivalent truss element can consider non-linear characteristics of the cables. It supports *Geometric non-linear analysis* as well as *Construction stage analysis*.

## MIDAS/CIVIL PROJECT

CONVENTIONAL Br.

PSC BOX

FCM

ILM

MSS

EXTRADOSED

CABLE-STAYED

**SUSPENSION**

STEEL BRIDGE

HEAT OF HYDRATION

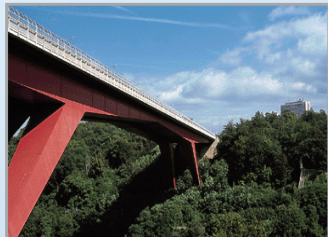
TUNNEL

SUBWAY

SEWAGE TREATMENT



# STEEL BRIDGE



Grand duchess charlotte Bridge



Iron Bridge, UK, 1779 (30m)



Sscott key Bridge, Francis



Mornas bow-string bridge, Francis



Sungsan Grand Bridge, Seoul, Korea



Kwangan Grand Bridge, Pusan, Korea

Static Analysis, Free Vibration Analysis, Response Spectrum Analysis  
Time History Analysis (Transient Dynamic, Periodic Dynamic)  
Buckling Analysis (Critical buckling load factors, Buckling modes), P-Delta Analysis

# CHUNGDAM GRAND Br.

Steel  $\pi$  Type FRAME Br.

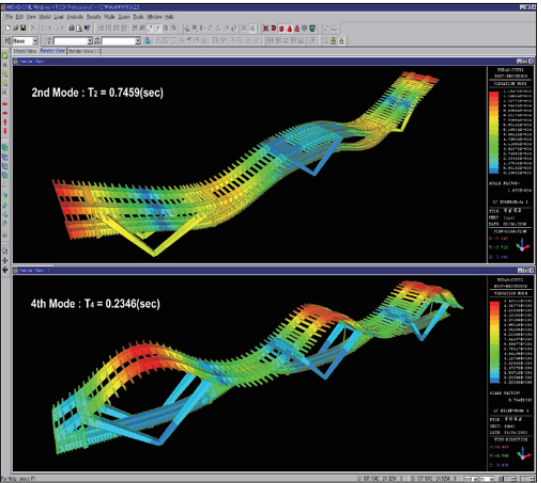


## Design scope

Natural Periods of Vibration (Modal)  
Analysis of Chungdam Br. for  
Seismic Design, 1st & 2nd Modes in  
Vertical Direction (2nd Mode :  
T2=0.7459 sec, 4th Mode :  
T4=0.2346 sec)

## Profile of Model

Node : 850  
Element : 1197  
Element Type : Beam



Eigenvalue Analysis of Chungdam Grand Bridge



Aerial view of north ramps of Chungdam Grand Bridge

## MIDAS/CIVIL PROJECT

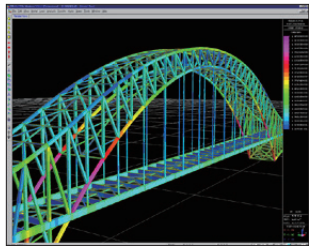
- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE**
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

# BANGHWA GRAND Br.

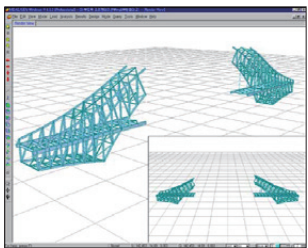
Steel Arch Br.



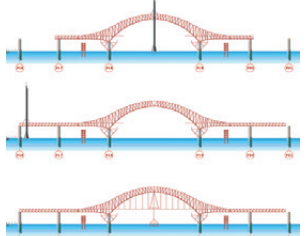
Construction stage of Banghwa Grand Br.



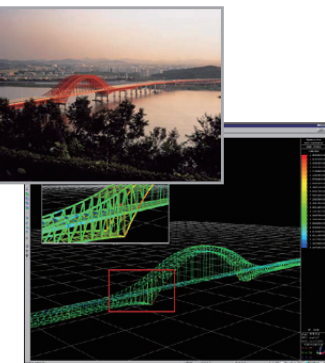
Contour of combined stresses of beam elements in Banghwa Bridge



Construction stage Analysis model of Banghwa Grand Br.



Overview of erection sequence



Display of Combined Beam Stresses of Banghwa Br. subjected to Live and Earthquake Loads

## Design scope

3D Model of Banghwa Grand Bridge  
spanning over Han river using the  
modeling functions such as create  
Node, Mirror, Intersect Node,  
Parabolic Curve, etc.

## Profile of Model

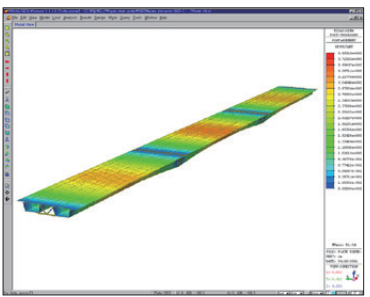
Node : 713  
Element : 2076  
Element Type : Beam

## MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE**
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

# ORTHOTROPIC STEEL DECK Br.

Steel Bridge



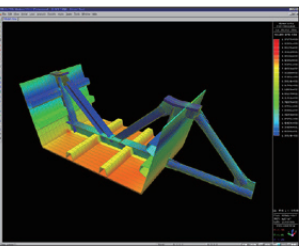
190m long structural steel composite bridges consisted of 60, 70 & 60m long segments

## Design scope

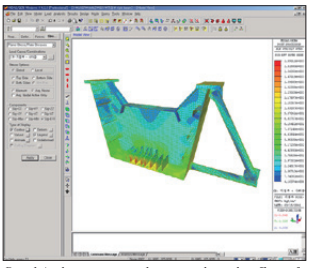
An open shape, 190m long  
structural steel composite bridges  
consisted of 60, 70 & 60m long  
segments. A full model was created  
for the entire structure using plate  
elements. Detail Analysis was  
carried out to evaluate the effects of  
concentrated reaction forces on the  
diaphragm, which was open at the  
top. Pipe shaped bracing, U-shaped  
ribs and reinforcements at the  
support points were fully reflected in  
the model.

## Profile of Model

Node : 34269  
Element : 33732  
Element Type : Plate



Pipe shaped bracing, U-shaped ribs and reinforcements at the support points were fully reflected in the model.



Detail Analysis was carried out to evaluate the effects of concentrated reaction forces on the diaphragm, which was open at the top.

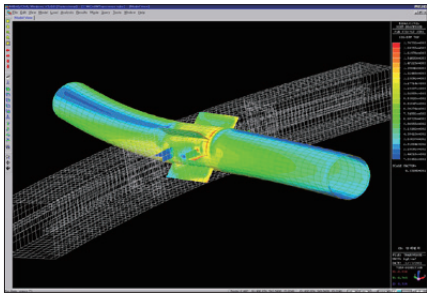
## MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE**
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT



## GULPO Br.

Steel Arch Br.



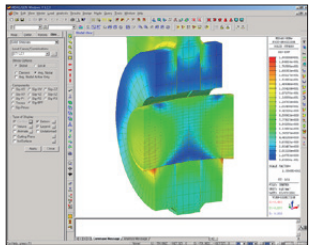
Detail Analysis Model of Transverse Tube connection to an Arch Rib. Beam elements were used at the boundaries of the detail model. Relevant displacements at the boundaries were obtained from the analysis of the entire model, which were then applied to the detail model as specified (forced) displacements.

### Design scope

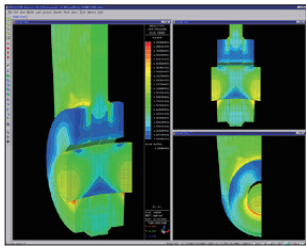
3D Solid Elements were implemented to represent a Lug-Pin connection part of a Cable Hanger of an Arch Bridge. Compression-Only Members and Gap Elements were used to resolve the contact Problem at Pin and Lug.

### Profile of Model

Node : 5814  
Element : 5912  
Element Type : Plate, Solid



Results of a detail analysis at the Lug/Pin part



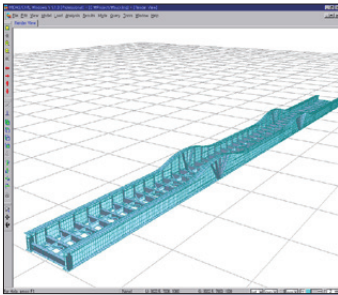
3D Solid Elements were implemented to represent a Lug-Pin connection part of a Cable Hanger of an Arch Bridge

### MIDAS/CIVIL PROJECT

CONVENTIONAL Br.  
PSC BOX  
FCM  
ILM  
MSS  
EXTRADOSED  
CABLE-STAYED  
SUSPENSION  
**STEEL BRIDGE**  
HEAT OF HYDRATION  
TUNNEL  
SUBWAY  
SEWAGE TREATMENT

## JECHON-DODAM RAILWAY Br.

Steel Plate Girder Br.



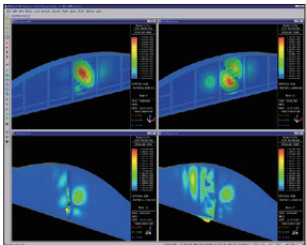
Analysis model of Local Buckling Analysis of plate girder bridge

### Design scope

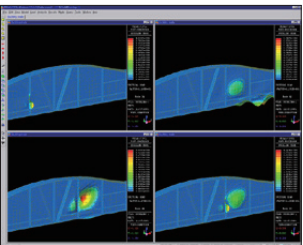
Local Buckling Analysis of plate girder bridge

### Profile of Model

Node : 1645  
Element : 1584  
Element Type : Beam, Plate



Local Buckling Analysis before reinforcement



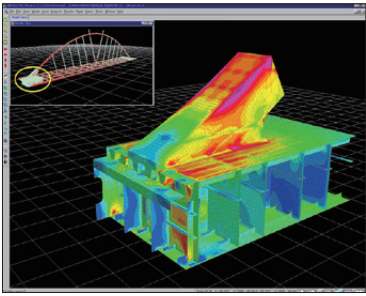
Local Buckling Analysis after reinforcement

### MIDAS/CIVIL PROJECT

CONVENTIONAL Br.  
PSC BOX  
FCM  
ILM  
MSS  
EXTRADOSED  
CABLE-STAYED  
SUSPENSION  
**STEEL BRIDGE**  
HEAT OF HYDRATION  
TUNNEL  
SUBWAY  
SEWAGE TREATMENT

## UCHON 1st Br.

Steel Arch Br.



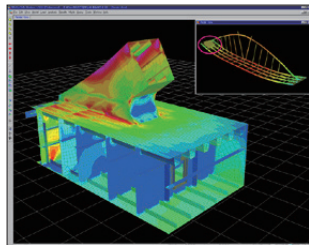
Detail analysis of connection of an arch rib

### Design scope

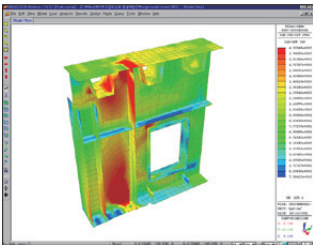
Detail analysis of a connection in an arch rib  
Detail Connection Analysis

### Profile of Model

Node : 45654  
Element : 46098  
Element Type : Beam, Plate



Detail analysis of connection of an arch rib



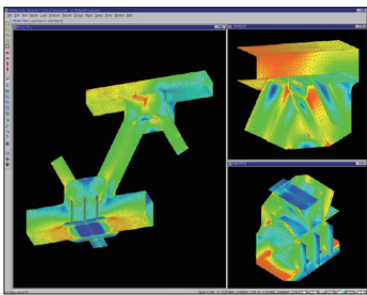
Detail analysis of connection of an arch rib

### MIDAS/CIVIL PROJECT

CONVENTIONAL Br.  
PSC BOX  
FCM  
ILM  
MSS  
EXTRADOSED  
CABLE-STAYED  
SUSPENSION  
**STEEL BRIDGE**  
HEAT OF HYDRATION  
TUNNEL  
SUBWAY  
SEWAGE TREATMENT

## JECHON-DODAM RAILWAY Br.

Steel Truss Br.



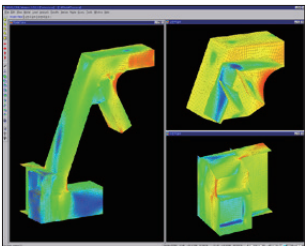
Detail Analysis of a connection of a pony truss bridge

### Design scope

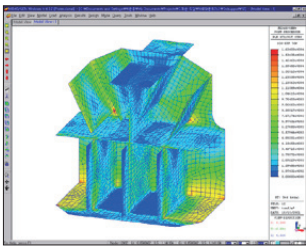
Detail analysis of a connection of a pony truss bridge  
Detail Connection Analysis

### Profile of Model

Node : 20384  
Element : 20416  
Element Type : Beam, Plate



Detail Analysis of a connection of a pony truss bridge



Detail Analysis of a connection of a pony truss bridge

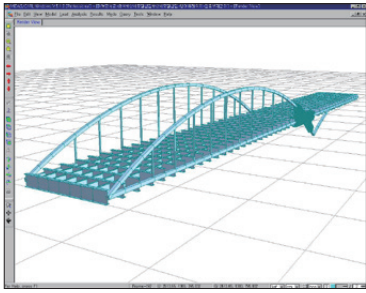
### MIDAS/CIVIL PROJECT

CONVENTIONAL Br.  
PSC BOX  
FCM  
ILM  
MSS  
EXTRADOSED  
CABLE-STAYED  
SUSPENSION  
**STEEL BRIDGE**  
HEAT OF HYDRATION  
TUNNEL  
SUBWAY  
SEWAGE TREATMENT



# JECHON-DODAM RAILWAY Br.

Steel Arch Br.



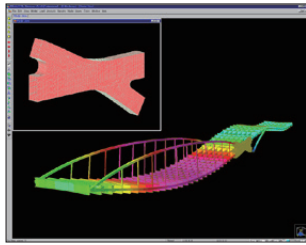
Analysis model of an arch Bridge

## Design scope

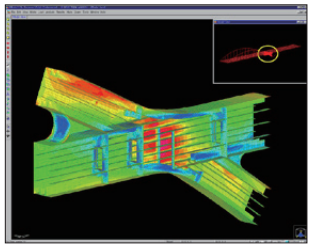
Detail analysis of a connection of an arch rib  
Detail Connection Analysis

## Profile of Model

Node : 24268  
Element : 24520  
Element Type : Beam, Plate



Detail analysis of connection of arch ribs



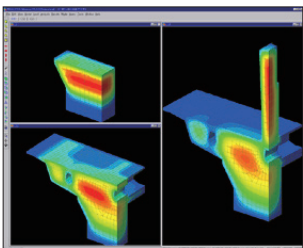
Detail analysis of connection of an arch rib

## MIDAS/CIVIL PROJECT

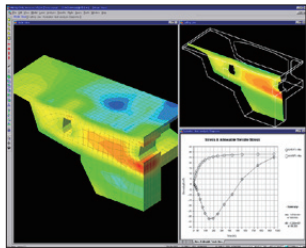
- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE**
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

# HEAT OF HYDRATION

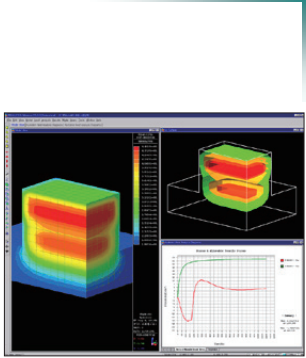
Pier Abutment Breakwater Pylon



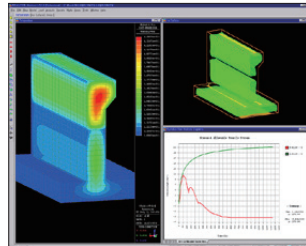
Structural model of Extradosed PSC Box at a pier cap for Heat of Hydration analysis, divided by a concrete pour sequence



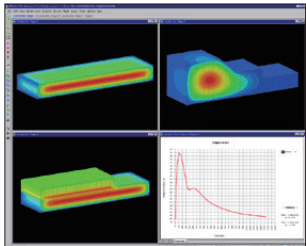
Results of Heat of Hydration analysis for PSC Box at a pier cap reflecting construction stages (Stress distribution)



Results of Heat of Hydration analysis for Mat Foundation Reflecting construction stages (Stress distribution)



Results of Heat of Hydration analysis for Abutment reflecting construction stages (Stress distribution)



Results of Heat of Hydration analysis for Breakwater in Cheju Harbor reflecting construction stages (Stress distribution)

## Design scope

Heat of Hydration Analysis by construction stages reflects the changes of Modulus of Elasticity due to maturity, effects of Creep, Shrinkage and Pipe Cooling and the Con-crete pour sequence.

## Profile of Model

Node : 4495  
Element : 3141  
Element Type : Solid

## MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYD.**
- TUNNEL
- SUBWAY
- SEWAGE TREATMENT

## HEAT OF HYDRATION TUNNEL SUBWAY SEWAGE TREATMENT



SUBWAY



TUNNEL



SEWAGE TREATMENT



HARBOR



DAM



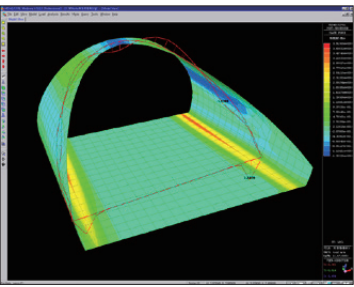
PLANT

- Heat of Hydration for Mass Conc.: PSC Box Br., Abutment, Pier, Breakwater
- Underground Structures: Tunnel, Subway, Municipal service facilities

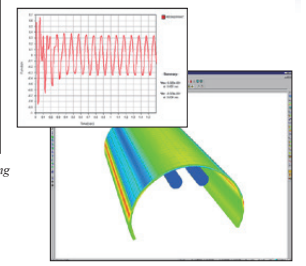
- Plant Structures: Tank, Pressure vessel, Transmission tower, Power plant
- Public facilities: Airport, Dam, Harbor

# TUNNEL

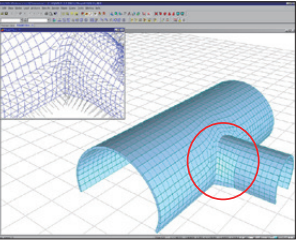
Tunnel lining



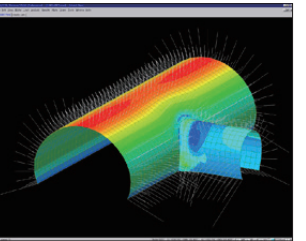
Detail Analysis of a Tunnel Exit modeled with plate elements presenting a Stress Distribution Diagram through a Cutting Plane.



Result of a time history analysis of a tunnel lining subjected to Jet Fan vibrations



Main tunnel lining attached to an emergency access. Modeled by auto-generation showing equivalent soil springs



Analysis results of a main/access tunnel joint model, created by the mesh generator using selective basic features

## Design scope

Detail Analysis of a Tunnel Exit modeled with plate elements  
Main tunnel lining attached to an emergency access

## Profile of Model

Node : 4092  
Element : 1274  
Element Type : Plate, Compression-only

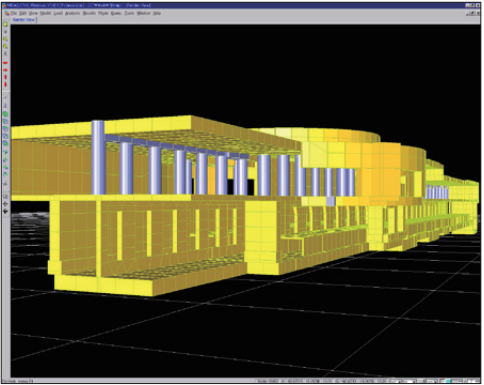
## MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL**
- SUBWAY
- SEWAGE TREATMENT



# SUBWAY I

Subway Station



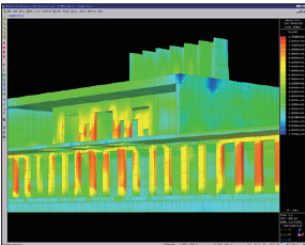
Complete analysis model of a subway station structure using beam and plate elements

## Design scope

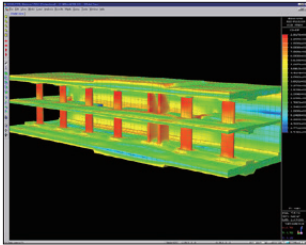
Complete analysis model of a subway station structure using beam and plate elements.

## Profile of Model

Node : 12597  
Element : 12978  
Element Type : Beam, Plate



Structural Analysis Result of a Subway ventilation opening structure fully modeled with plate elements



Structural Analysis Result of a Subway station fully modeled with plate elements

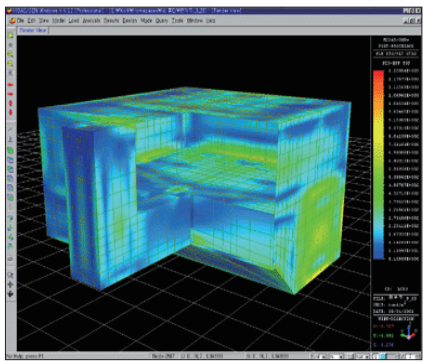


## MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY**
- SEWAGE TREATMENT

# SEWAGE TREATMENT CONTAINMENT

Plant Structure



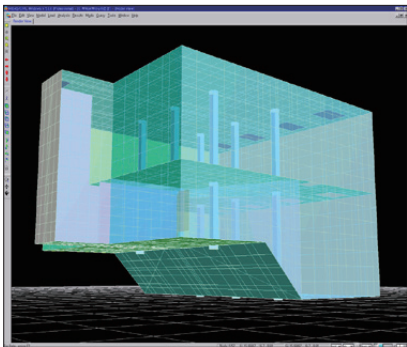
Structural Analysis Result of a Sewage Treatment Containment structure, fully modeled with plate elements.

## Design scope

Structural Analysis Result of a Sewage Treatment Containment structure fully modeled with plate elements.  
Compression-only Members were used to reflect the foundation boundary conditions.  
Lateral soil and water pressures were applied to the structure.

## Profile of Model

Node : 3080  
Element : 3176  
Element Type : Plate,  
Compression-only



A see-through effect of a sewage treatment structure wall by blending effect

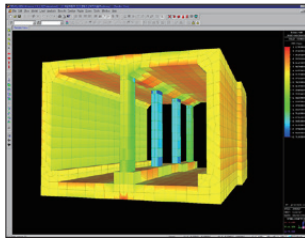
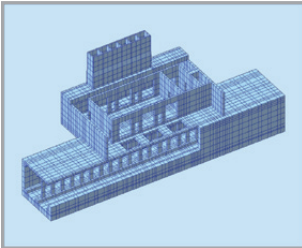


## MIDAS/CIVIL PROJECT

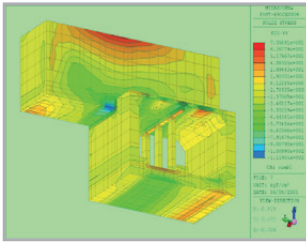
- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY
- SEWAGE TREAT.**

# SUBWAY II

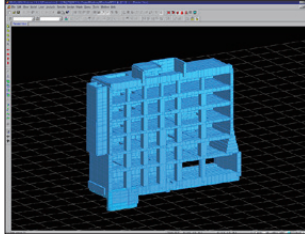
Subway Station



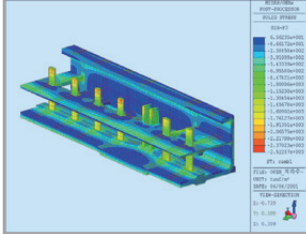
Maximum Principal Stress distribution of a main section



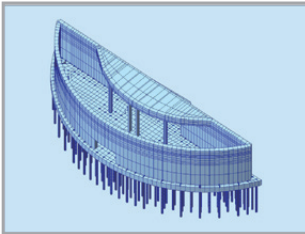
Subway tunnel - ventilation junction



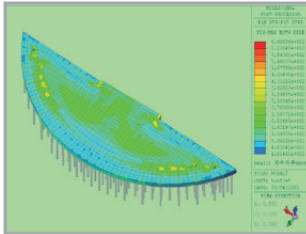
Half model of Dokbaewee Stn.



Subway Stn. At open area



Analysis model of a subway entrance



Stress distribution of a subway entrance



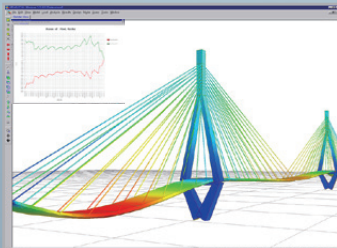
## MIDAS/CIVIL PROJECT

- CONVENTIONAL Br.
- PSC BOX
- FCM
- ILM
- MSS
- EXTRADOSED
- CABLE-STAYED
- SUSPENSION
- STEEL BRIDGE
- HEAT OF HYDRATION
- TUNNEL
- SUBWAY**
- SEWAGE TREATMENT

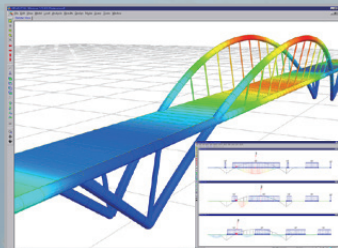
# YOSU-GOHEUNG BRIDGE DESIGN COMPETITION



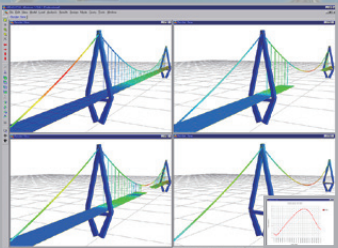
Perspective model view of yosu-goheung bridge



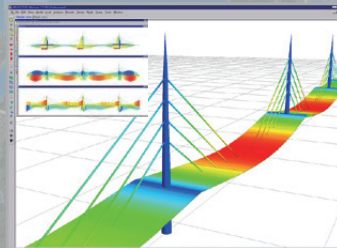
BR-1 Cable stayed bridge



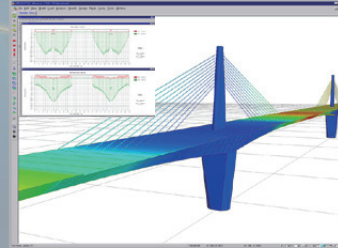
BR-2 Steel pipe arch bridge



BR-3 Suspension bridge



BR-4 Cable stayed bridge



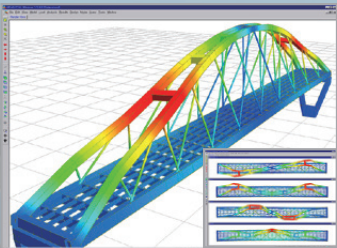
BR-5 Extradosed bridge

Static Analysis, Dynamic Analysis, Geometric Nonlinear Analysis, Free Vibration Analysis, Response Spectrum Analysis, Time History Analysis (Transient Dynamic, Periodic Dynamic), Moving Load Analysis, Construction Sequence Analysis, Suspension/Cable-Stayed Bridge Analysis

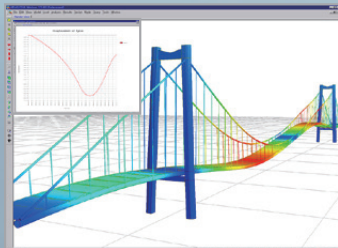




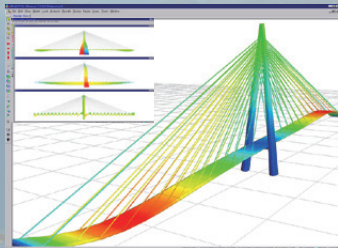
# YOSU-GOHEUNG BRIDGE DESIGN COMPETITION



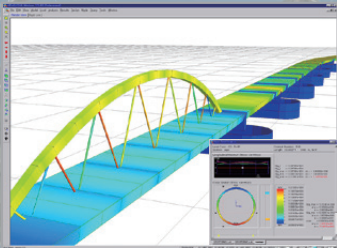
BR-6 Nielsen arch bridge



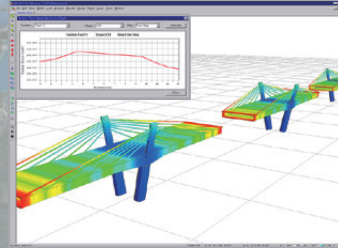
BR-7 Suspension bridge



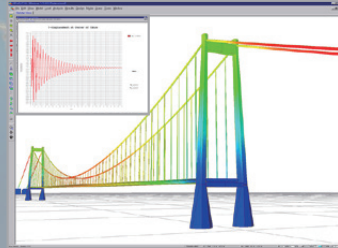
BR-8 Cable stayed bridge



BR-9 Floating bridge



BR-10 Extradosed bridge

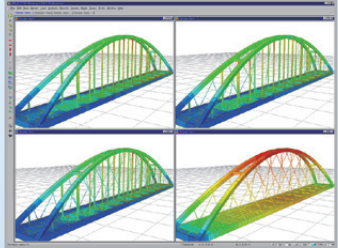


BR-11 Suspension bridge

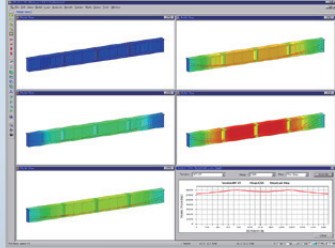
Static Analysis, Dynamic Analysis, Geometric Nonlinear Analysis, Free Vibration Analysis, Response Spectrum Analysis, Time History Analysis (Transient Dynamic, Periodic Dynamic), Moving Load Analysis, Construction Sequence Analysis, Suspension/Cable-Stayed Bridge Analysis



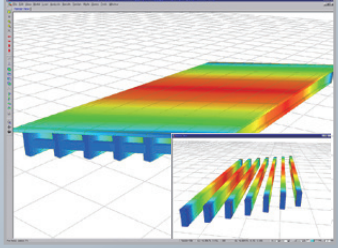
# THE LATEST PROJECT APPLICATIONS



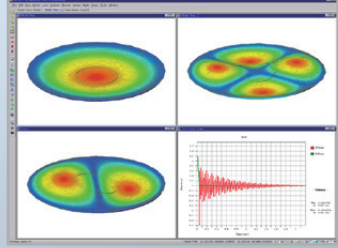
Namdo grand bridge / Freyssinet Korea



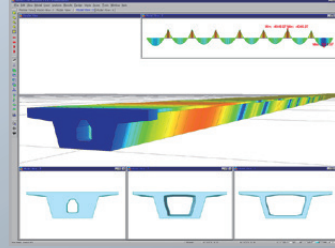
Railway PSC beam bridge / BMS Engineering



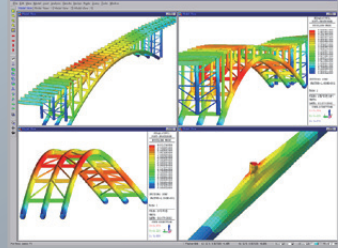
Osun 2nd bridge / Deahan Construction Eng.



Manhole cover time history analysis / Hanbo Ind.



MSS PSC box bridge / Manyoung Engineering

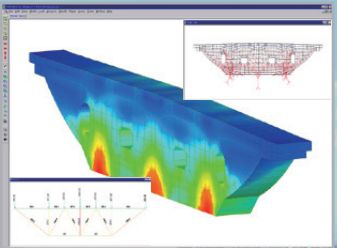


Yangsan-dongmyeoun T/K project / Seoyoung Eng.

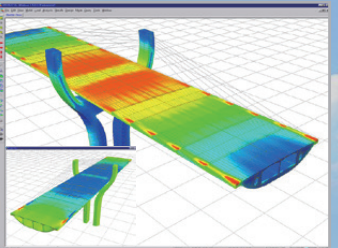
Static Analysis, Dynamic Analysis, Geometric Nonlinear Analysis, Buckling Analysis, Moving Load Analysis, Hydration Heat Analysis, Response Spectrum Analysis, Time History Analysis, Construction Sequence Analysis, PSC Box Girder Bridge Analysis, Suspension/Cable-Stayed Bridge Analysis



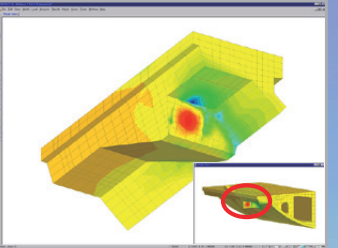
# YONGDU-KEUMGA BRIDGE DESIGN PROJECT



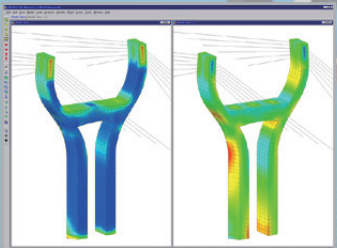
Diaphragm - strut tie model



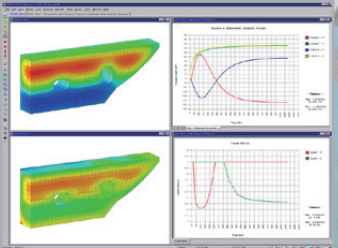
Girder - detail analysis



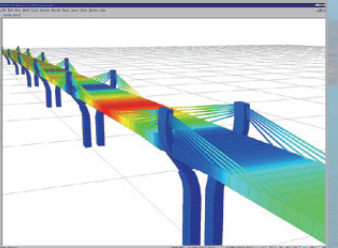
Cable anchorage - detail analysis



Pylon - detail analysis



Pier - hydration heat analysis



Extradosed bridge - construction stage analysis

Static Analysis, Dynamic Analysis, Free Vibration Analysis, Hydration Heat Analysis, Response Spectrum Analysis, Time History Analysis (Transient Dynamic, Periodic Dynamic), Moving Load Analysis, Construction Sequence Analysis, PSC Box Girder Bridge Analysis





# midas Civil

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Change is Chance



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TEL 03-5817-0787 | FAX 03-5817-0784 | e-mail [civil.support@midasit.com](mailto:civil.support@midasit.com) | <http://jp.midasuser.com/civil>

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