FORUM8®

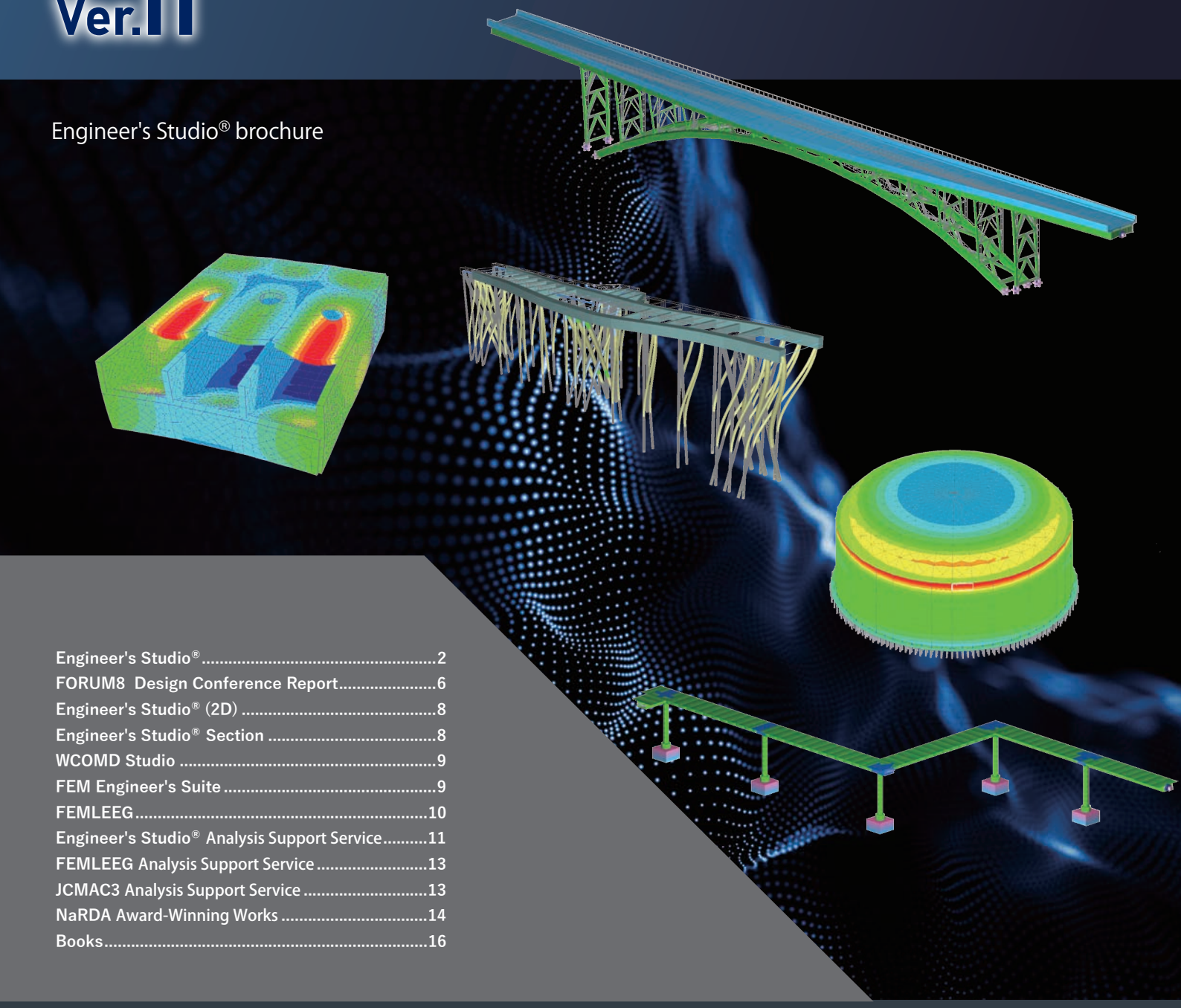
Three-Dimensional Plate Dynamic Nonlinear Analysis

Engineer's Studio®

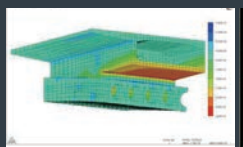
FEM

Ver.11

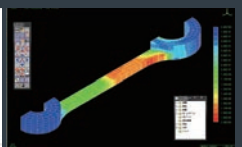
Engineer's Studio® brochure



FEMLEEG Ver.12



Stress verification of arch crown bridge

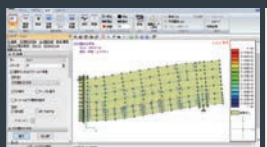


FEMOS output result (Gradation chart)

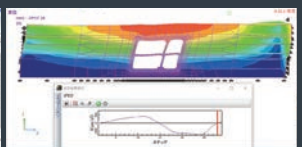
3D Solid and Thermal FEM Analysis

Mesh data creation for analysis, Simultaneous creation of elements and geometry under different conditions of loads, constraints and properties. Complementary operation with Engineer's Studio® for a wide range of analyses.

WCOMD Studio



Condition of displacement and cracking



integrated analysis of ground and structure

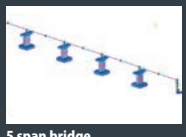
Dynamic Non-linear Analytical Program for 2D RC Structures

Various analyses for cracks can be carried out using high-precision constitutive laws to assess the safety of structures and study damage levels.

Analysis Support Service

●Engineer's Studio® (JPN/ENG/CHN/KOR)
●FEMLEEG ●Architecture ●JCMAC3

Water distribution ponds (flat plate and fibre composite model)



5 span bridge

Three-Dimensional Plate Dynamic Nonlinear Analysis Software

Engineer's Studio® Ver.11

Ultimate USD21,000
Ultimate (not including the Maekawa model) USD14,000
Ultimate (not including the cable element) USD16,000
Advanced USD10,000
Lite USD5,200
Base USD3,500

Windows 10/11
Electronic delivery
IFC 3D PDF

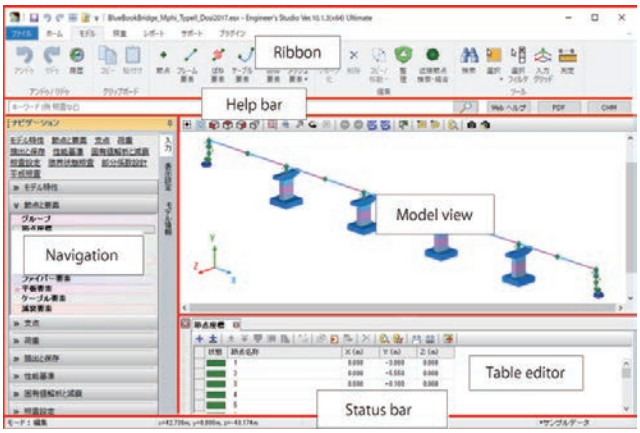
FEM analysis program, supporting the Maekawa Model, the world's best concrete analysis theory, and has been developed in-house for everything from pre-processing to the calculation engine and post-processing. Supporting a wide range of structural analyses, including Mindlin plates and large deformation analysis.

Features

- General-purpose analysis software that can analyze the behavior of various structures, including civil engineering and architectural structures.
- 3D fiber elements and the plate elements based on the Reissner-Mindlin theory and also static / dynamic analysis are available, considering material nonlinearity and geometric nonlinearity(Large Displacement) simultaneously.
- The support of the 64bit version has realized the input and analysis of large models consuming a lot of memory.and report output.

Interface

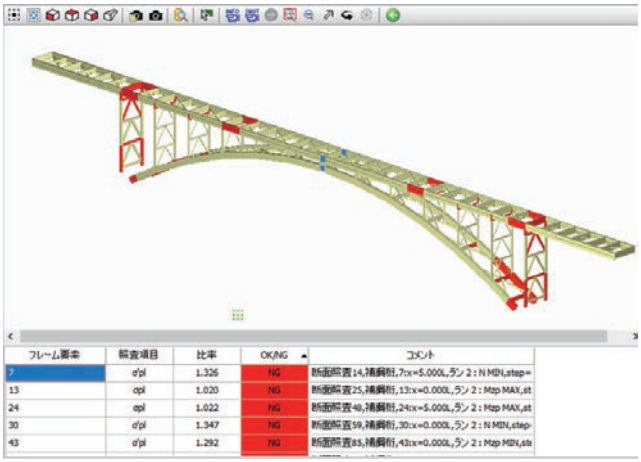
- Graphical and intuitive operation
- Tree-format input and bulk input functions in the table editor



Main screen

Cross section verification (beam element)

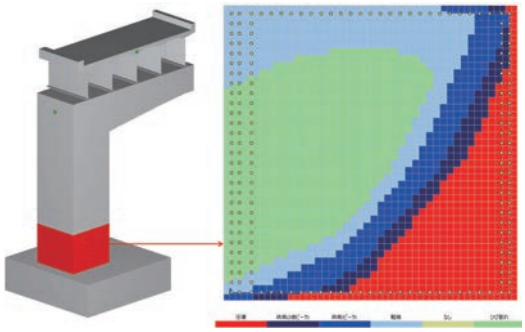
- Supports calculation of section force and moment stress vrf. / strength vrf. / curvature vrf. and limit state design
- Compatible with the partial factor method (Specification for Highway Bridges, 2017), which checks the safety factor by considering both external force and resistance force.



NG materials displayed in red

Nonlinear beam element

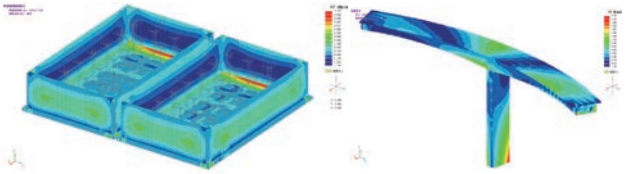
- Nonlinear beam elements can be selected from fiber elements/M-φ elements.
- Supports M-φ elements considering varying axial force.
- Fiber elements allow for biaxial bending.



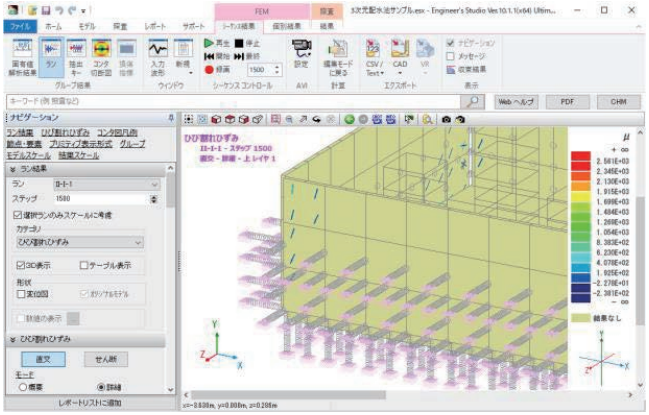
Damage display of fiber elements

Plate element

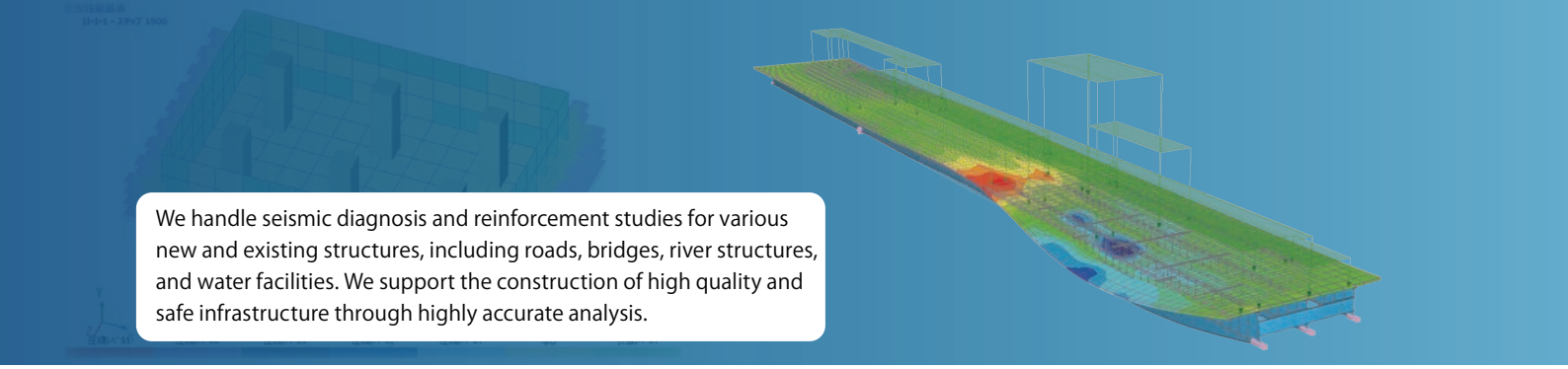
- Flat plate elements can be selected from triangular primary/secondary elements and quadrilateral primary/secondary elements.
- It can have laminated structures that consist of layers which direct to the thickness way and define each setting for different type of materials between each layers or linear/non/linearity.
- Reinforcement concrete non linear constitutive equation is adopted as concrete constitutive equation applied to the plate elements, which was developed by the concrete lab. in the University of Tokyo. RC element in UC-win/WCOMD has expanded to thickness way to multi-layer and has made it possible to analyze non-linear behavior not only of in-plane deformation but also of out-of-plane.



Contour figure of analysis result of plate element



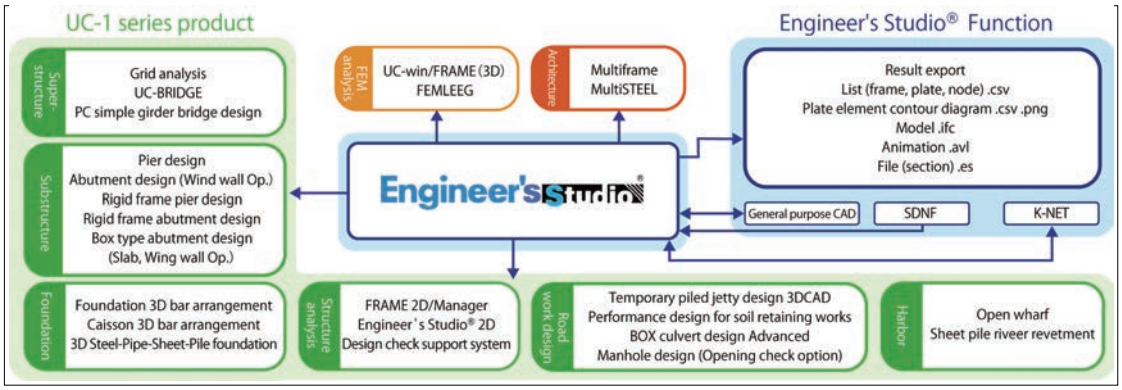
Calculate crack width by the reinforcement concrete nonlinear constitutive equation

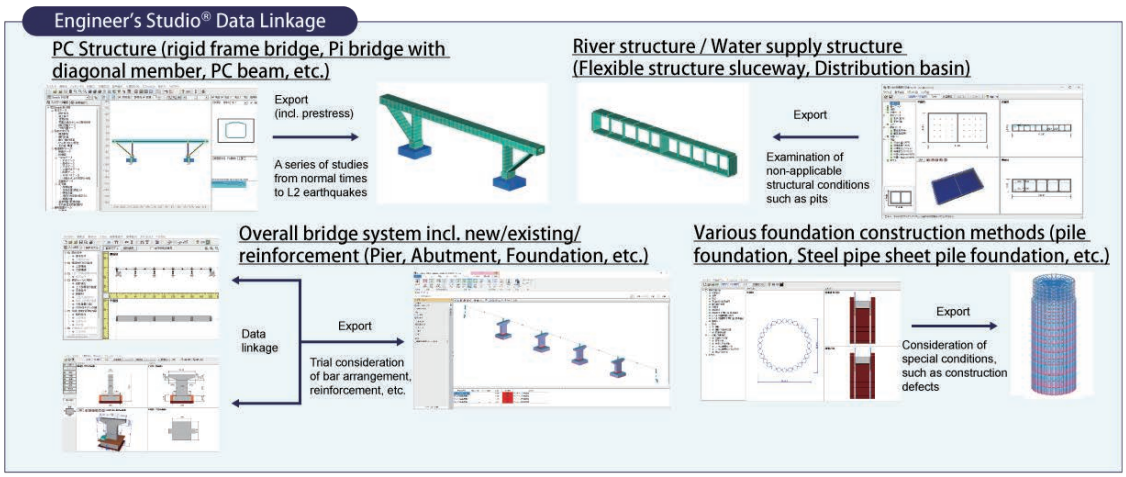


We handle seismic diagnosis and reinforcement studies for various new and existing structures, including roads, bridges, river structures, and water facilities. We support the construction of high quality and safe infrastructure through highly accurate analysis.

Product Linkage

- Can be linked with various external data and design software
- By importing data from UC-1 design software such as pier design and seismic intensity calculation, verification using dynamic nonlinear analysis is possible in a short time.





Product Configuration

Option	Overview	Price	Ultimate	Advanced	Lite
Engineer's Studio® Base	Basic product (required for all analyses)	USD3,500	○	○	○
ES-Eigen Analysis option	Allows eigenvalue analysis (required for dynamic analysis)	USD200	○	○	–
ES-Dynamic Analysis Option	Allows time history response analysis (dynamic analysis)	USD200	○	○	–
ES-MPhi Element Option	M-φ elements of material nonlinear properties can be used.	USD700	○	○	–
ES-Nonlinear Spring Option	Nonlinear spring characteristics such as bilinear/trilinear can be used.	USD700	○	○	–
ES-Fibre Element Option	Fiber elements of material nonlinear properties can be used.	USD200	○	○	–
ES-Geometrical Nonlinear Option	Allows geometrical nonlinear analysis (large deformation analysis)	USD200	○	○	–
ES-Plate Element Option	Elastic plate elements can be used.	USD1,100	○	○	○
ES-Maekawa Concrete Model Option	Nonlinear properties of RC plate elements can be used (Plate Element OP required)	USD6,500	○	–	–
ES-Beam Model Live Load Option	Allows influence line analysis of beam model live load	USD200	○	○	○
ES-Japan Civil Codes Section Design (Old Std.)	Allows stress/strength check mainly based on the Spec for Highway Bridges before 2017.	USD900	○	○	○
ES-Strain Check for Steel Member OP	Allows strain checking of steel members for fiber elements	USD300	○	○	–
ES-Bridge Residual Displacement OP	Residual displacement/plasticity ratio/displacement of bridge piers can be checked based on old road guidelines	USD300	○	○	–
ES-Cable Element Option	Cable elements resisting tension only can be used.	USD4,400	○	–	–
ES-Partial Factors Method Option	Allows verification by the partial factor method.	USD1,400	○	–	–
ES-Varying Axial Force Option	M-φ/M-θ spring elements that take into account changes in axial force can be used.	USD1,000	–	–	–

Lite:Mainly linear static analysis using beam elements and plate elements is possible, and for beam elements it is also possible to perform cross-sectional verification based on old road and bridge specifications.
Advanced:This product includes options required for performing nonlinear dynamic analysis. Partial Factors Method Option and Varying Axial Force Option are required separately.
Ultimate:A product with all functions available, and products excluding the Maekawa Concrete Model OP and Cable Element OP can be selected depending on the application.

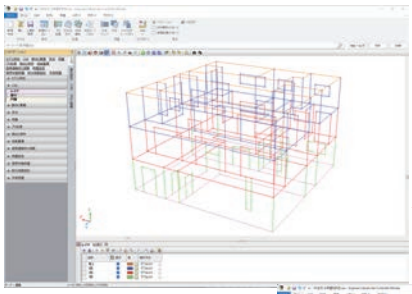
Ver.11 Revised Contents Released on August 1st, 2023

New functions in Ver.11 NEW!

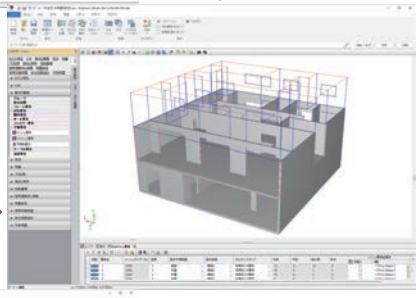
1. Remeshing function of flat elements

[Model creation using the remeshing function of flat elements]

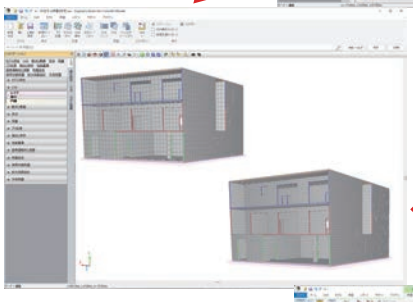
- You can change the mesh size of flat plate elements as many times as you like.
- Easily perform editing operations such as adding/deleting plate elements, changing shapes, and verifying appropriate mesh sizes.



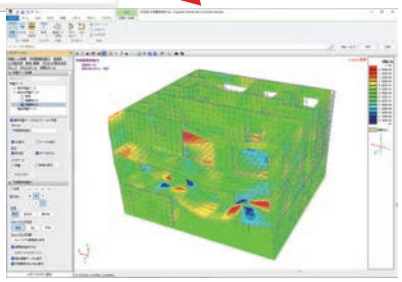
Step1
Create the outlines of structure using layers



Step2
Select the outline and create remesh element



Step3
Set mesh size using the remesh function

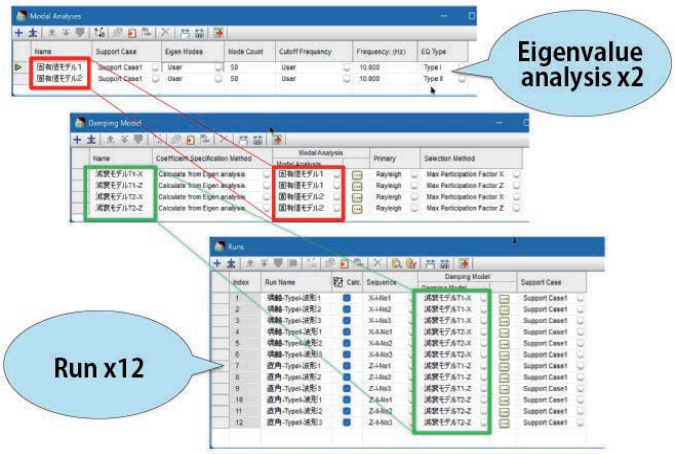


Step4
Set the load and run the analysis

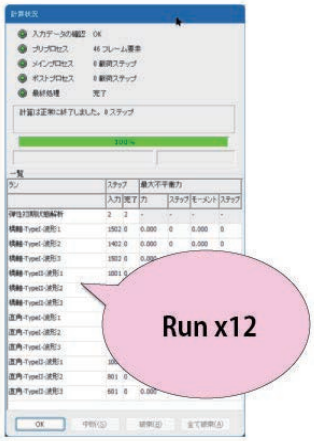
2. Rationalization of eigenvalue analysis and viscous damping

[The number of eigenvalue analysis has been reduced by rationalization]

- Dynamic analysis of road bridges calculates a total of 12 runs, as there are Type I and Type II Level 2 earthquake motions, three seismic waveforms for each ground type, and perpendicular and parallel directions to the bridge axis. In this version, analyses under the same conditions can be performed at the same time to reduce the calculation time.



Old version...



New version...

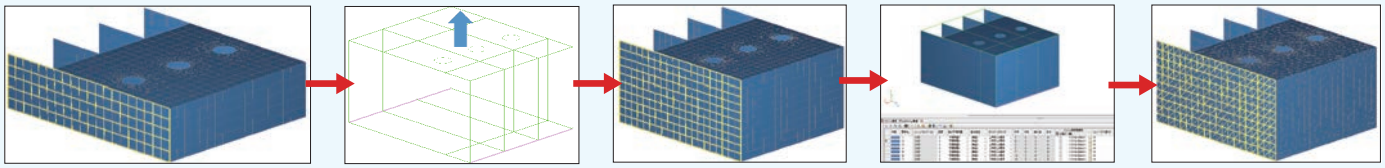
Example of using remesh function

Change structures/analysis models

In some cases, it may be necessary to change the analysis model created due to structural changes for new structures or reinforcement thickening changes for existing structures. Previously, it was necessary to delete the existing mesh and recreate the model, but the remesh function allows changes to be made in a short time and improves work efficiency, especially when running many tests.

Verify accuracy and validity based on differences in mesh

Changing mesh elements took time because it required rebuilding the model, but the remesh function allows to compare the difference between triangular and quadrilateral elements and between primary and secondary elements. It is possible to quickly verify the validity of your choice.



1. Initial model (quadrilateral)
2. Modify line to change structure height
3. Remesh and regenerate the model
4. Change mesh type of line segment to triangular element
5. Remesh and regenerate the model

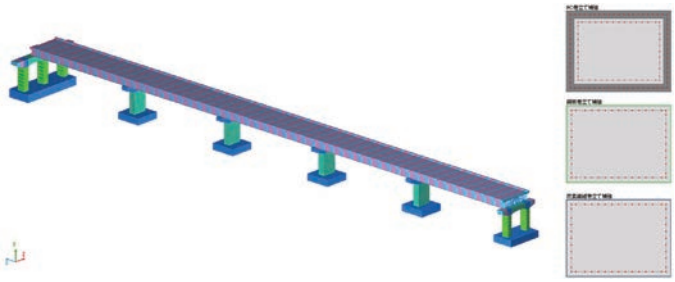
Analysis Example

Can be used for structural analysis in various fields, including roads, bridges, foundations, river structures, water facilities, ports, and architectural structures.

Seismic diagnosis and reinforcement study of existing RC bridges

- Corresponds to complex structures such as loop bridges and curved bridges
- Compatible with various reinforcement methods such as cross-sectional reinforcement of RC/steel plate/fiber wrapping and support replacement.

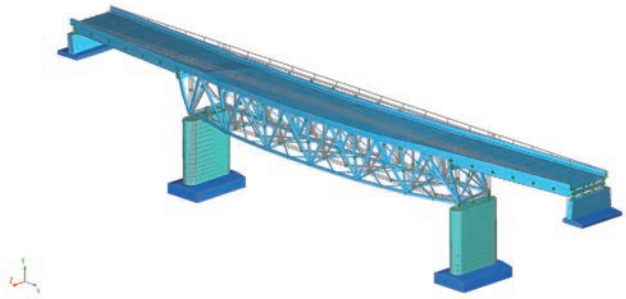
Loop bridge



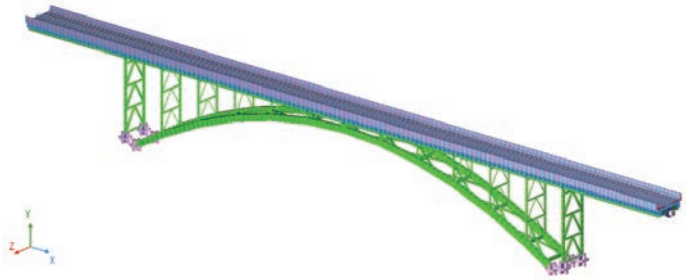
Cross-sectional reinforcement of existing RC bridge

Seismic diagnosis and reinforcement study of steel bridges

- Compatible with various types of steel bridges including truss and arch bridges.
- Various types of reinforcement are possible, including seismic isolation/damping devices and plate reinforcement.



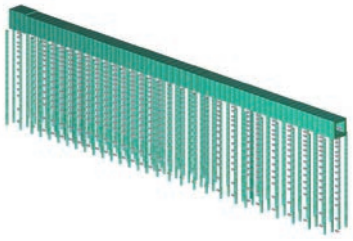
Steel truss bridge



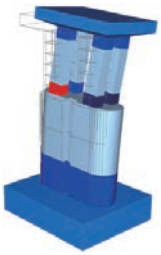
Steel arch bridge

River structure

- Supports various river structures such as water gates, sluices, weirs, special levee, and drainage pump stations.
- A wide range of analyses from normal time study to L2 seismic horizontal capacity method, and L2 dynamic analysis.



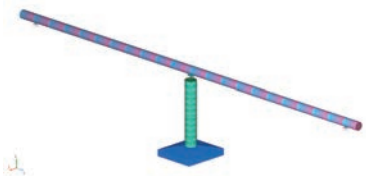
Flexible structure sluiceway (pile foundation)



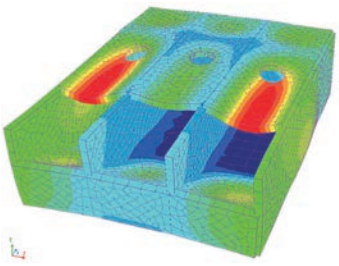
Water gate

Water and sewage facilities/structures

- Create anything from 2D flat models to 3D solid models.
- Water tightness can be checked using the Maekawa model.

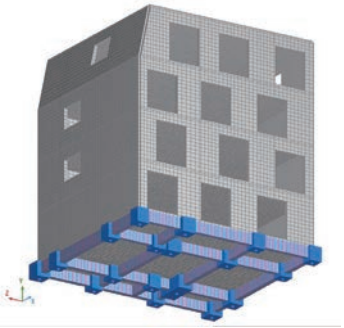


Water pipe bridge

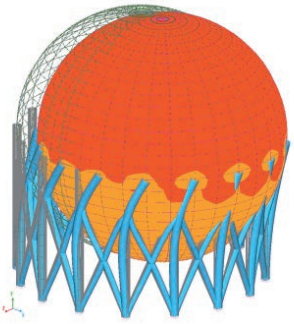


Distribution basin

Building structures/special structures/others



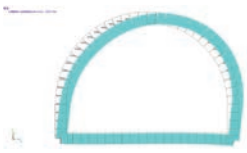
Housing



Gas holder

Steel tower

Steel-Pipe-Sheet-Pile foundation



Tunnel

Pedestrian bridge

FORUM8 Design Conference Report on Special Lecture

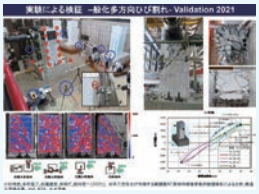
On Design Festival Day3, FORUM8 invites specialists of seismic, disaster mitigation, information construction, etc. as lecturer.

The 16th (2022) Design Conference IM&VR i-Construction Session

"Numerical analysis of collapse process for RC structures and environmental impact -Collapse Process, Gravelization, and High-Temperature History of Fire-"

Prof. Koichi Maekawa, College of Urban Sciences, Yokohama National University

Graveling concrete is a factor that greatly reduces its durability, but if it has a high binding force, graveling improves its strength, and for concrete that has been subjected to high temperature history, its residual performance increases. He explained that it is "Engineering" that controls this well, and the importance of 3D thinking and 3D analysis. even though there are things not visible in the world of statistics or the digital world respectively, overlapping the two allows what can be seen to be deepened.

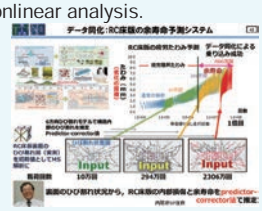


The 11th (2017) Design Conference IM&VR i-Construction Session

"Data assimilation of performance verification of new structures and inspection data of existing structures"

Prof. Koichi Maekawa, Concrete Lab., Department of Civil Engineering, Graduate School of Engineering, the University of Tokyo

As inspection data of existing structures increased rapidly, their effective use was required. Regarding some structural problems that made nonlinear analysis unable to treat, he talked about his attempt of data simulation for uniting inspection information and numerical analysis (data assimilation). To solve constrains that had emerged through an actual project, he introduced an approach using AI. Based on their results, he also explained possibility of its utilization in maintenance by mutual complement of advantages and disadvantages of each of inspection data and nonlinear analysis.



The 10th (2016) Design Conference Seismic, Geotechnical and Water Works Sessions

"Transition of bridge technology - Aiming for a strong and long-lasting bridge -"

Prof. Hiroshi Mutsuyoshi, Graduate School of Science and Engineering / Director of International Institute for Resilient Society, Saitama University

First, he explained the definition of external cable structure (external prestressing) and the difference from internal cables, and their character istics based on the results of experiments and analyses etc. Furthermore, he expounded the requirements for providing the bridges newly constructed or renewed in the future with high urability from the following points of view: 1) Structural rationality, 2) Multilayer protection, and 3) Easy inspection. Finally, he mentioned the process of modification of new Specifica tions for Highway Bridges, as well as the related points in the current modification.

The 8th (2015) Design Conference Design and Analysis Session

"Repair example for long-lasting structure"

Mr. Tadayoshi Ishibashi, Chairman of JR East Consultants Company / Advisor of East Japan Railway Company / Visiting professor of Waseda University

Focusing on an upcoming problem about the delamination of concrete fragments, he explained its cause and measures including damages caused by alkali-aggregate reaction, salt damage, and frost damage and various repair methods. In his opinion, the data cooperation from design to maintenance is important for long-last ing structure, since design and construction standards should be changed early by using maintenance trouble data.

The 7th (2013) Design Conference Design and Analysis Session

"Concrete Engineering and Water -Short/Long term Performance Evaluation-"

Prof. Koichi Maekawa, Department of Civil Engineering, Graduate School of Engineering, the University of Tokyo

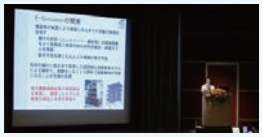
The structure of concrete is subject to the influence of behavior of water. he summarized the difference in the influence that water has on concrete according to a broad scale, gave an overview of the multiscale analysis used their based on the link between water and concrete structure, and mentioned points to note in analyzing behavior of the micro world. regarding the fatigue life analysis of the existing reinforced concrete floor slab and its maintenance, he explained the system for estimating the remaining life of the concrete bridge deck slab based on the non-linear fatigue response analysis.

The 6th (2012) Design Conference Civil Engineering and Analysis Session

"Developing a technology for reducing the damage potentially inflicted by a disaster by an experiment of fracturing life size structure using E-Defence"

Hyogo Earthquake Engineering Research Center Mr. Tomohiro Sasaki

After mentioning "3-D Full-Scale Earthquake Testing Facility (E-Defense)", he summarized seismic technology study using E-Defense shaking table. With respect to the clarification of the fracture process of the structure and earthquake-resistant evaluation, he explained validity of the base-isolation structure in a base isolation technology assessment experiment. With respect to the development of structure fracture simulation technology aiming to construct of a numeric shaking table and integration, he introduced an overview about development of E-Simulator and an analysis case of reproduction using it, and the future study including experimental works on isolation system of next generation.



The 5th（2011） Design Conference Civil Engineering and Analysis Session

Current status and future outlook for civil engineering structures as seen from damage caused by the Great East Japan Earthquake

Graduate School of Civil Engineering,
Tokyo Institute of Technology
Prof. Kazuhiko Kawashima

He analyzed the differences in ground motion and tsunami height and damage from the Great East Japan Earthquake compared to past earthquakes, including the Southern Hyogo Prefecture Earthquake. He explained that damage to bridges by earthquake is more severe before the application of the Earthquake Capacity Act, especially when seismic reinforcement is insufficient, and that the Specifications for Highway Bridges and seismic standards published in 1990, which are based on the horizontal load bearing capacity method contribute to reducing bridge damage. There is a possibility that a major earthquake could occur and damage elevated bridges in urban areas. Seismic standards need to be reviewed on an ongoing basis.

The 4th（2010） Design Conference Civil Engineering and Analysis Session

"The Latest and State-of-the-art Technologies of Civil Engineering and the Future Outlook: design criteria, a large-scale model experiment for structural elements, and a verification example using E-Defense"

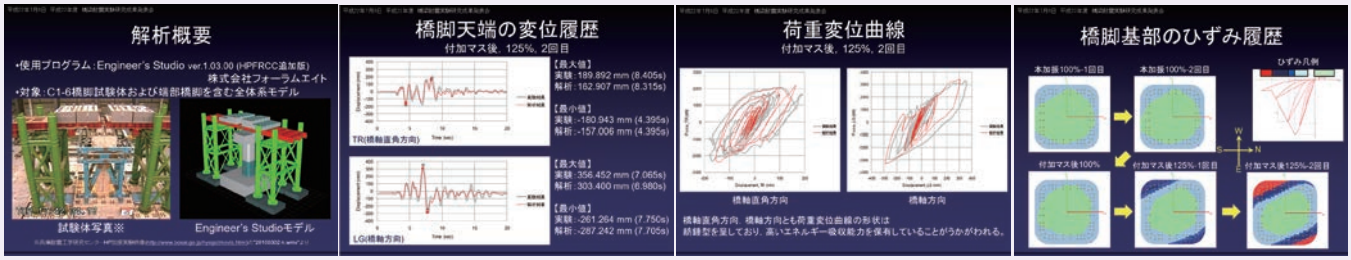
Director, earthquake-resistant technology department,
structural project division, Chodai Co. Ltd.
Mr. Masaaki Yabe

First, he talked about the reason why the allowable values (design criteria) for earthquake-resistant design to secure quake-proof performance, then realization of performance design and criteria setting. Next, he explained about the full-scale model experience for verification of design criteria through experiments using E-Defense (piers, foundations, supports, etc.). Lastly, he mentioned expectation towards experiments with E-Defense.

Won several analysis competitions

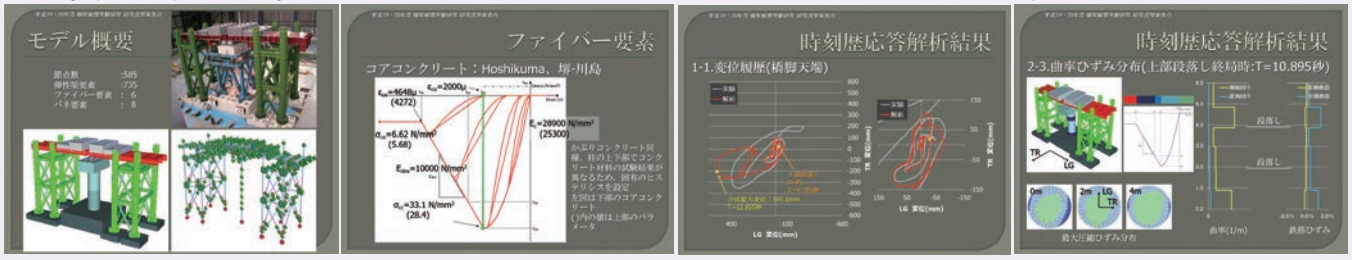
FORUM8 won the destruction analysis contest (2010)

On July 8, 2010, a combined team formed by Forum8 employee and Tokyo City University professor, Hiromichi Yoshikawa, were commended as champion of "Destruction analysis and blind analysis contest for seismic resistance experiment on full size bridge made of nature mortar" at the ceremony presenting the results of the 2010 seismic resistance experiment /research on bridge pier, hosted by National Institute for Earth Science and Disaster Prevention in Japan (Independent company). Dynamic nonlinear analysis "Engineer's Studio®"developed by FORUM8 is used for analysis software.



Winner of the pre-analysis contest in the fiber model category (2009)

On the theme of seismic experiment/research on bridge piers using a full size three dimensional shaking destruction experiment facility (called E-Defense) referred to as "To what extent bridge piers can resist earthquakes?", FORUM8 won the pre-analysis contest in the fiber model category at the ceremony presenting the results for the C1-2 Experiment Pre-analysis Contest for "The 2007/2008 Seismic Resistance Experiment/Research on bridge piers", sponsored by the National Research Institute for Earth Science and Disaster Prevention in Japan, on 5 March 2009.



Engineer's Studio® Awards and Certificates

Awards of excellent new technology and products for small and medium enterprise, Excellent award for software section
May 11, 2011 Prof. Koichi Maekawa (Univ. of Tokyo) also won the award
"Special collaboration prize among government, industry and academia".

FORUM8 won the Risk Management Design Award March 15, 2013 (RiMDA Risk Management Design Award)

Certified as "Technical Information Contributing to Earthquake Disaster Reconstruction and Recovery" by NETIS
"3D plate dynamic nonlinear analysis Engineer's Studio®" "Flood analysis simulation" "Road damage information system"

Engineer's Studio® in-plane Ver.3

Windows 10/11

A 2D linear elastic frame/truss structural analysis product

Engineers Studio® In-plane is a two-dimensional linear elastic analysis program with a user interface similar to Engineer's Studio®. Cross-sectional verification such as stress and proof strength checks can be performed after the frame calculation.

Program Features

- 2D in-plane analysis program for material and geometrical linear
- Frame calculation can be performed after entering the section shape and auto calculating section constant.
- Supported section shapes: rectangle, oval, circle, I beam, T beam, W T beam, super structure, super structure circular hole
- Element: Euler beam element, truss element (when both ends are pin), beam element on elastic floor, spring element, rigid element. Combination of beam element and truss element
- Supports: Node supports, multiple node support cases, multiple spring boundary support cases
- Load: Translational load/moment load on nodes, forced displacement, member distributed load, member concentrated load, basic load case, combined load case, extracted load case

Function comparison with UC-1 FRAME (in-plane)

- Creation of continuous beam elements and positioning of nodes (element resizing), frame elements, spring elements, and rigid body elements
- Calculation of maximum / minimum bending moment for each group, calculation of section force for each structural part
- Supporting points can be changed in the selected state. Loads will be kept even when the element is re-divided.
- Spring elements can be connected to the main node of rigid element.
- Analyze structures where multiple members are connected from the ends of rigid elements.
- Moment loads can be input to supported beam elements.
- Internal force like prestress can be input to beam elements supported by distributed springs
- Section check (Specifications for Highway Bridges, Concrete specification published by Japan Society of Civil Engineers)

Options

Beam Model Live Load Option

- Extract the results with the most severe cross-sectional force and displacement using influence line analysis
- For entrained loads, it is possible to set reciprocating or to not apply uniformly distributed load p2.

Japan Civil Codes Section Design (Old standard)

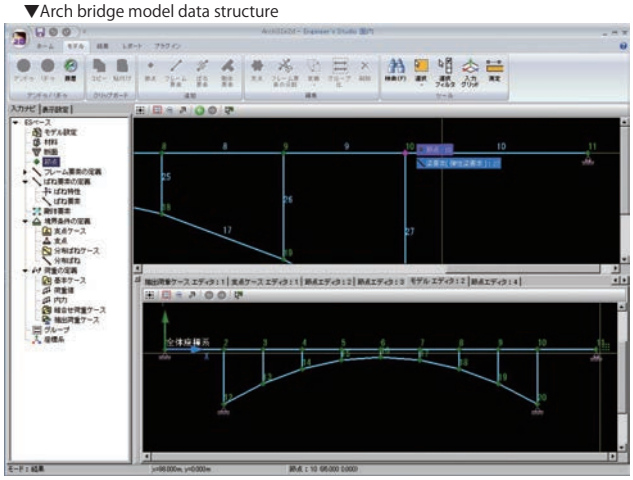
- Following verifications to RC section compliant with specifications for highway bridges are available; allowable moment stress vrf, moment strength vrf, average shear stress vrf, shear strength vrf, minimum amount of reinforcing bar vrf.
- Verification of ultimate/use/fatigue limits, durability, safety against cross-sectional and fatigue fracture, usability

Partial Factors Method Option

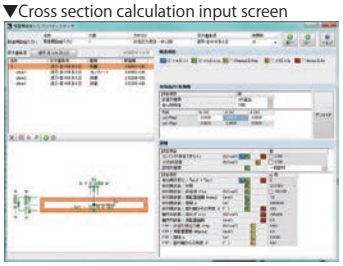
- Verification using the partial factors method applied in the 2017 Specifications for Highway Bridge.

Program / Option	Price
Engineer's Studio® in-plane Ver.3	USD2,320
Beam Model Live Load Option	USD200
Partial Factors Method Option	USD1,430
Japan Civil Codes Section Design (Old standard)	USD1,001

▼Arch bridge model data structure

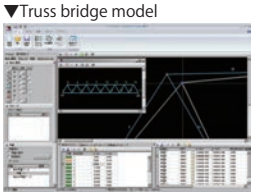


▼Cross section calculation input screen

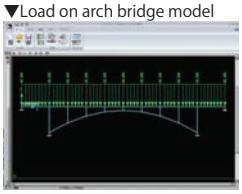


▼Rigid frame bridge model displacement + section force

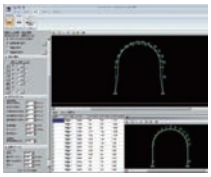
▼Truss bridge model



▼Load on arch bridge model



▼Tunnel model



Engineer's Studio® Section Ver.3

A solitary program for section calculation derived from Engineer's Studio®

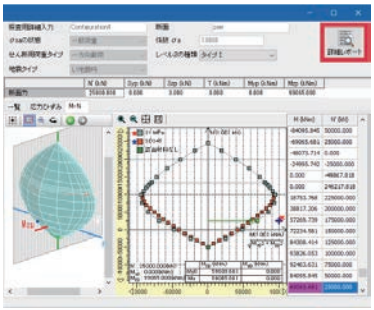
Windows 10/11

Engineer's Studio® Section allows users to verify sections by giving specification contents and section forces to freely selected section shape. Settings can be imported from / exported to Engineer's Studio®.

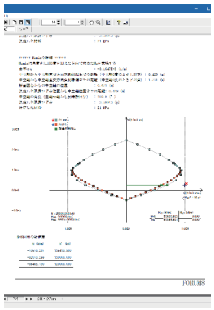
- Material: Concrete, reinforcement bars, PC steel (stranded wire, steel bar), steel plate, carbon fiber sheet, aramid fiber sheet, elastic material (Young modulus can be entered arbitrarily), non-structural material (material considering only weight per unit volume)
- M-φ characteristics (for curvature verification): skeleton, bilinear (symmetric, asymmetric), trilinear (symmetric, asymmetric), tetra linear (symmetric, asymmetric)
- Check items: Bending stress, shear stress, bending strength, shear strength, bending strength of steel pier, bond unit stress, minimum reinforcement, curvature checks, Limit State checks, Partial Factor Design

Program Price USD2,800

▼M-N interaction figure and "report" button



▼Report output



Ver.2 Revised Contents

Released on October 25th, 2021

❶64bit support

❷Support for report output of 2D graphs in M-N interaction diagrams on the simple verification results screen.

❸Support for decimal places in dimension values in section thumbnails.

WCOMD Studio

Dynamic Non-linear Analytical Program for 2D RC Structures

Windows 10/11

Forum8 has produced analytical program WCOMD, developed by the Concrete Materials & Structures Laboratory at the University of Tokyo, for 2D non-linear dynamic analysis/static analysis of reinforced concrete. WCOMD uses high-precision constitutive properties based on the results achieved through numerous experiments and theoretical verifications on concrete. These properties are highly regarded internationally, as well as in Japan, and provide accurate 2D non-linear dynamic/static analysis of various reinforced concrete structures with cracks. The safety and damage level of structures can be evaluated from analytical results so that more rational and appropriate reinforced concrete structures can be designed.

Program Price
USD12,000

Program overview

- Solver: RC non-linear constitutive law developed by the Concrete Lab., Univ. of Tokyo
- Input and result display function in Engineer's Studio® is used for the pre post processing
- Pre-processing: Auto-mesh inside complex outline shapes
- Post-processing: Diagram of displacement, displacement contour, stress contour, crack. Visualization of displacement diagrams and crack using animation.
- Functions to output result data in text file format (CSV file) and to output reports
- Analysis objects: Non-linear static and dynamic analysis of RC structures
- Dynamic analysis considering nonlinearity of ground (Osaki model) and nonlinearity of RC structure simultaneously
- The strain based design concepts as specified in the Japan Standard Specifications for Concrete Structures 2012, Design. This involves calculating and checking the deviatoric strain and normalized cumulative strain energy and using these as damage indicators.
- Mesh generation function: Create plate elements with mouse operation

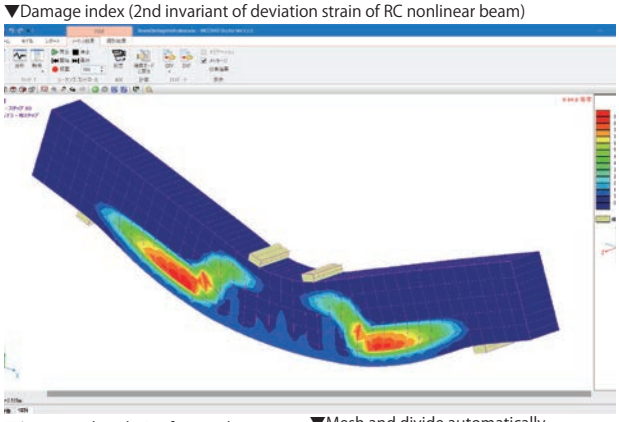
Analysis contents

- Non-linear dynamic analysis: Performs non-linear time history response analysis. Vertical acceleration as well as horizontal acceleration can be simultaneously applied as seismic acceleration
- Static analysis : Analyzes weight and conditions where incrementally forced displacement and incremental load are given
- Analyze all loading conditions

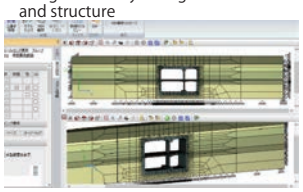
Analysis result

- For all elements and nodes, cracking condition, average stress result, yield results, response displacement, response speed, response acceleration, reaction force, and section force are verified at each calculation step
- Occurrences of cracking, displacement conditions, stress conditions, and so on can be viewed as an animated representation at each step
- Damage level can also be evaluated based on the size of distortions.
- Advanced mode: Designers can change the distortion for determination
- Loading conditions are shown in static analysis results, and input waveforms are displayed in dynamic analysis

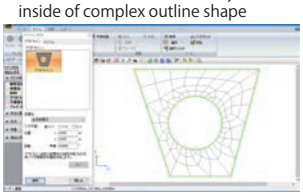
▼Damage index (2nd invariant of deviation strain of RC nonlinear beam)



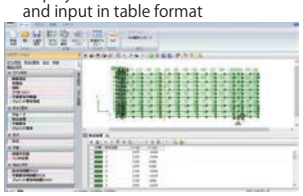
▼Integrated analysis of ground and structure



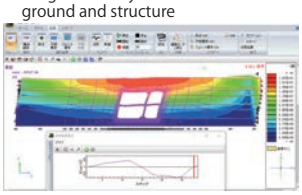
▼Mesh and divide automatically inside of complex outline shape



▼Display node / element names and input in table format



▼Integrated analysis result of ground and structure



Windows 10/11

Electronic delivery | SXF3.1
Calculation CAD | 3D PDF
3D bar arrangement | IFC

FEM Engineer's Suite

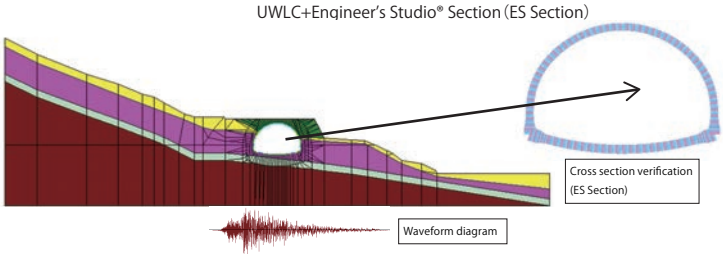
Bundle of each FEM analysis series product. Cloud support, enhanced CIM functions

As the "FEM Engineer Suite," we offer a set version that can handle a wide range of FEM analyzes for structural analysis and ground analysis.
All programs support the ability to save and read input data files in the cloud from the first version.

Application example

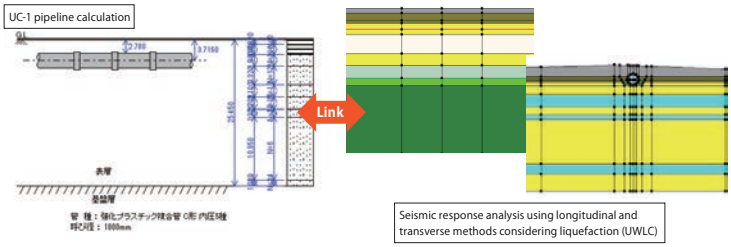
• Cross-sectional verification of tunnel taking into account the seismic response characteristics of the ground

UWLC+Engineer's Studio® Section (ES Section)



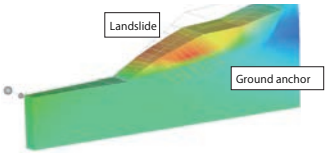
• Seismic analysis of pipelines in liquefied ground

UWLC+UC-1 pipeline calculation (separately sold product)



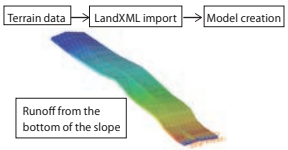
• 3D deformation analysis of slopes using ground anchors

GeoFEAS VGFlow
elastoplastic soil analysis function



• Seepage flow analysis on natural slopes during heavy rains

GeoFEAS VGFlow seepage analysis,
3D slope stability analysis



FEM analysis suite product structure

Advanced Suite	Price
Engineer's Studio® Advanced	~~Normal price:USD15,500~~
Engineer's Studio® Section	S USD10,500
Geo Engineer's Studio (Lite)	F USD12,600

Senior Suite	Price
Engineer's Studio® Ultimate	~~Normal price:USD50,940~~
FEMLEEG Advanced	S USD26,400
VGFlow2D	F USD29,800
GeoFEAS2D	S : Subscription license
UWLC	F : Floating license

FEMLEEG Ver.12

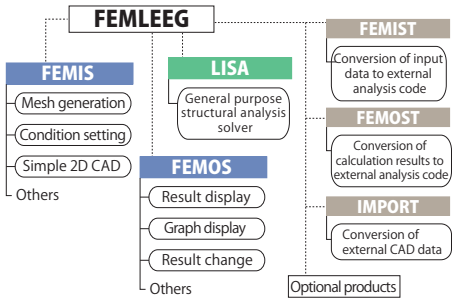
Comprehensive Finite Element Analysis system

Windows 10/11

FEMLEEG, a full-fledged domestic CAE system, can perform from model creation to analysis evaluation. The basic configuration is FEMIS (preprocessor), FEMOS (postprocessor), LISA (solver), translator (external interface), and LApack (option).

Program	Price
Advanced	USD13,500
Standard	USD10,500
Lite	USD5,000
LAPack Option	USD3,000

Basic configuration of FEMLEEG



Product	Module		LISA restrictions	Nodal limit
	FEMIS, FEMOS LISA, IMPORT	FEMIST FEMOST		
Advanced	○	○	No	No
Standard	○	×	Yes※	No
Lite	○	×	Yes※	Yes (10,000pts)

* No Tension analysis, CAP analysis, and construction analysis cannot be used.
No Tension analysis: A function that automatically releases when a contact spring installed on the surface between different types of structures has a tension.
CAP analysis: A function that divides the model conveniently, meshes both parts independently, and then recombines and analyzes
Construction analysis: A function to perform the structural analysis at each stage of a structure that has several stages of construction process

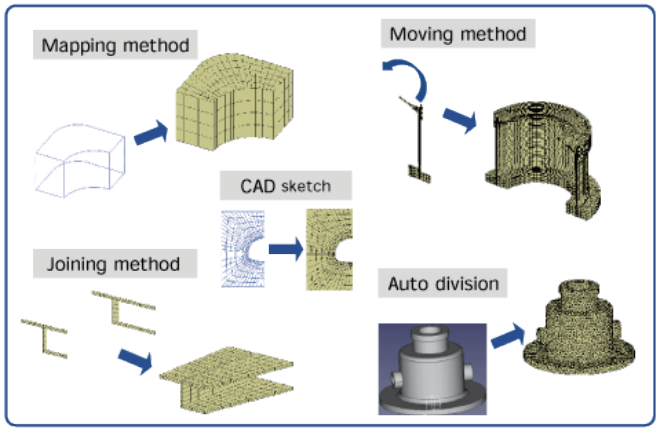
Corresponding element

- 1D: Truss, embedded rebar, beam, spring, link
- 2D: Plane stress, plane strain, axis, plate shell, laminate
- 3D: Solid

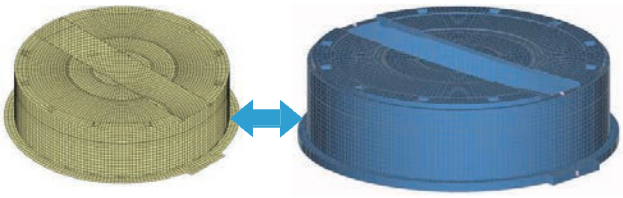
FEMIS (preprocessor)

- Mesh generator with excellent operability
- The product allows users to create mesh data for analysis, set loads, restraints, physical properties, etc., create both of element and shape, and mesh like CAD.

▼Mesh generation

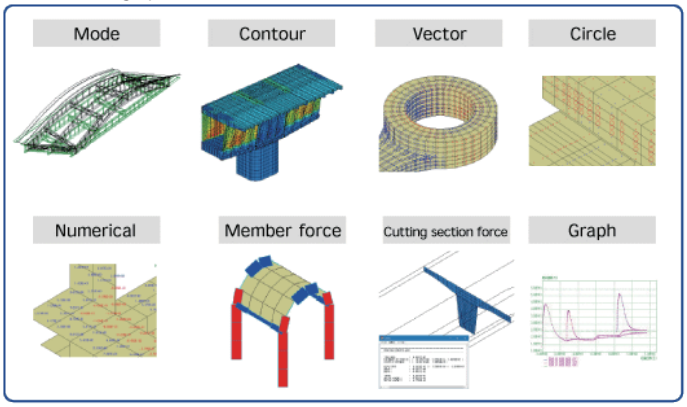


- Import/export from/to Engineer's Studio®



FEMOS (postprocessor)

- Result evaluations and output results are displayed in contour, vector, numerical, graph, etc.



LISA (solver)

- General-purpose structural analysis system, static analysis, eigenvalue analysis, thermal analysis, etc
- Having the excellent operability, running smoothly, and corresponding to tens of thousands of mesh models
- Analysis type: Linear static elastic analysis, natural vibration analysis (including free body analysis function), response spectrum analysis (maximum response analysis), time history response analysis, buckling analysis, steady / unsteady / heat transfer and thermal stress linked analysis, NO TENSION analysis, CAP analysis, radiation analysis, construction analysis, large deformation analysis

Translator (external interface)

- Data exchange between FEMLEEG and external software. FEMIS converts created data into other solver data and converts analysis results into a FEMOS input file
- Convert CAD data (wire frame) to FEMIS input file

LApack (optional)

- Optional product for loading support "LoadHelper" and analysis result overlay "AddCase"

Ver.12 Revised Contents

Released on April 10th, 2023

Common ❶ Changed from 1 construction stage = 1 file to setting all construction stages in 1 file, now supports batch analysis execution

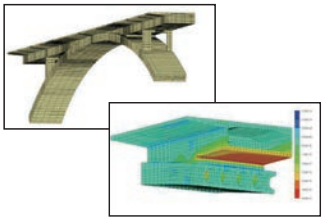
FEMIS ❶ Added the following functions to Movement generation - Shape correction of parallel movement
- Supports projection plane specification
- Added coordinate system specification to coordinate value specification
- Movement source shape can be specified other than side and block surface.

❷ Specification of projection plane for copying/moving mesh data and CAD data

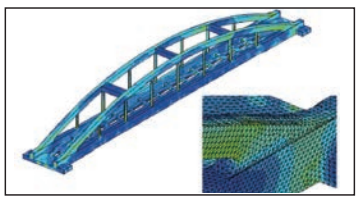
FEMOS ❶ Added the ability to tag nodes/element groups and to reference the tags in the result drawing commands output.

❷ Stage appearance animation

▼Stress check near arch crown joint



▼Analysis of RC langer girder

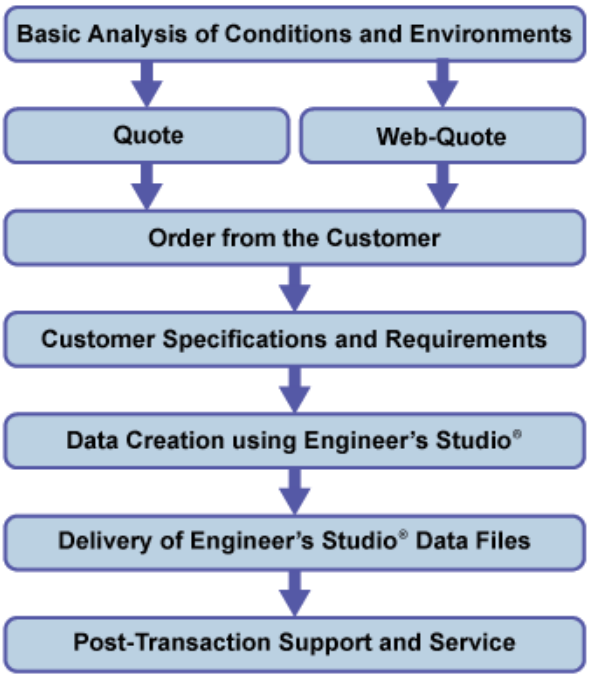


Engineer's Studio® Analysis Support Service

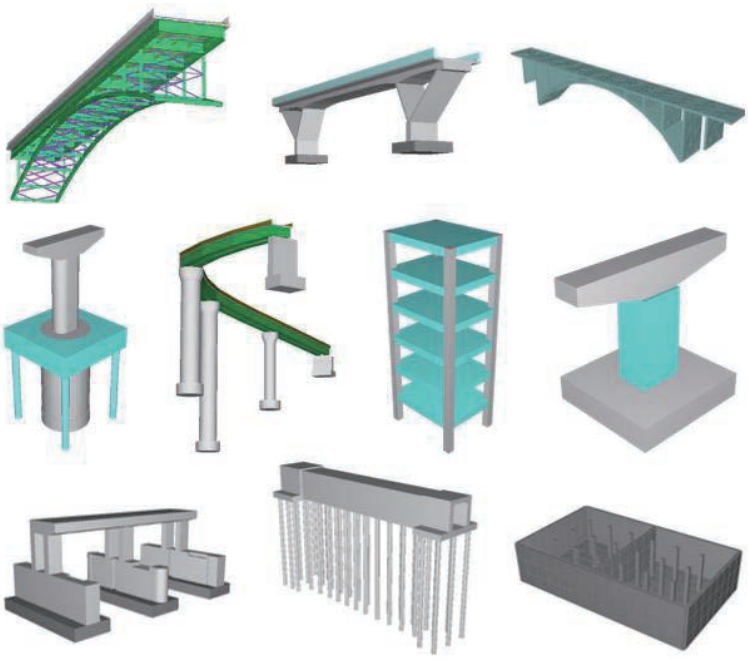
3D laminated plate, distributed crack model input data support service

In addition to selling products, we provide "Engineer's Studio® Analysis Support Service". The service helps users create an initial model designed by dynamic verification method in line with the "Japan Specifications for Highway Bridges, Seismic design" (2012, 2017). This is a technical service that supports users who design not only bridges but also various structures in static, dynamic, linear and nonlinear states. We have registered as a consultant (steel structure and concrete / soil quality and foundation) to improve the service quality.

▼Flow of Analysis Support Service



▼Supports various structures



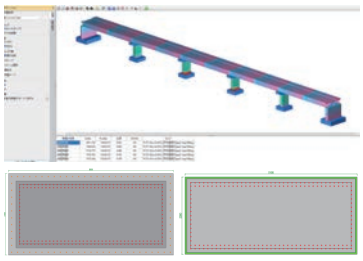
Bridge

Existing bridge (current + reinforcement)

Dynamic nonlinear L2 seismic analysis based on Specifications of highway bridges. Pillars modeled using M-φ elements. The current situation and reinforcement (3 trials)

Node=82 Element=55 M-φ element=32 Spring element=24
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation (incl. 3 trials)

Analysis support service fee USD11,560

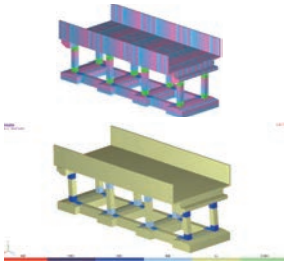


Railway viaduct

Dynamic nonlinear L2 seismic analysis based on railway standards. Multi-column model using fiber elements and add vibrations in 3 directions simultaneously.

Node=104 Element=104 Fiber element=16
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee USD9,699

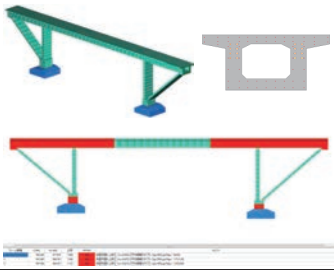


Pi type bridge with diagonal member

Dynamic nonlinear L2 seismic analysis based on Specifications of highway bridges. The plastic hinge is modeled with M-θ rotation springs, and M-φ elements are used for other models.

Node=105 Element=105 M-φ element=105
Node/element data: CAD data and valid prestress
Spring data: Provided Contents: Input data creation

Analysis support service fee USD10,147

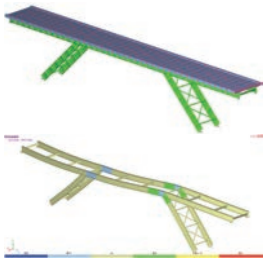


Batter-post steel rigid frame bridge

Dynamic nonlinear L2 seismic analysis based on Specifications of highway bridges. Modeled the main structure with fiber elements and the slab anchor with spring elements.

Node=262 Element=172 Fiber element=112
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee USD15,133

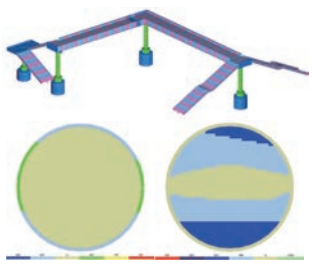


Pedestrian bridge

Dynamic nonlinear L2 seismic analysis based on Specifications of highway bridges. Columns are modeled using fiber elements because the inspection is mainly performed on columns.

Node=92 Element=64 Fiber element=28
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee USD8,399

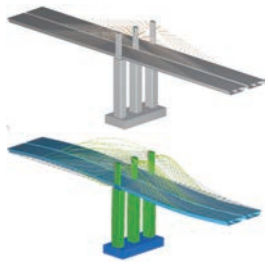


Extradosed bridge (cable structure)

Dynamic nonlinear L2 seismic analysis based on Specifications of highway bridges. Modeled the substructure and main tower with fiber elements and the diagonal members with cable elements.

Node=133 Element=133 Fiber element=61 Cable element=44
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee USD14,996



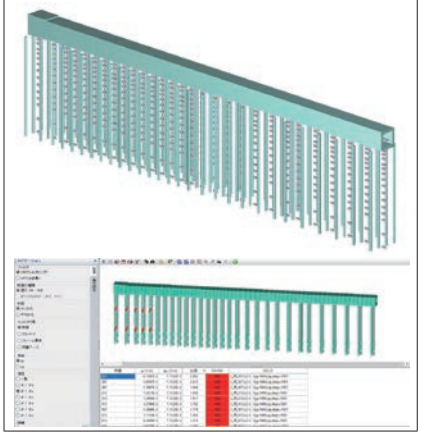
River structure

Sluice gate vertical direction

Static nonlinear L2 seismic analysis based on river seismic guideline. The box and pile models with M-φ, ground model with spring elements. The ground analysis result is loaded.

Node=122 Element=122 M-φ element=122 Spring element=20
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee	USD11,173

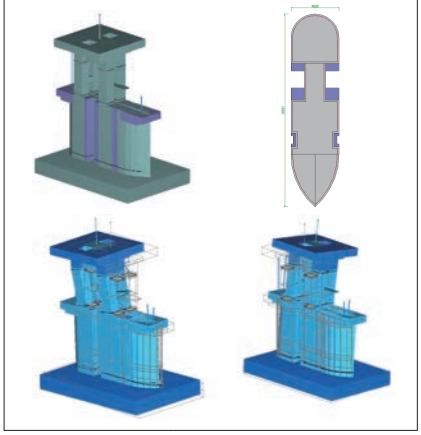


Water gate / Weir

Static nonlinear L2 seismic analysis based on river seismic guideline. Model plastic hinge with an M-θ rotation spring and perform pushover analysis

Node=37 Element=37 Spring element=10
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee	USD7,056

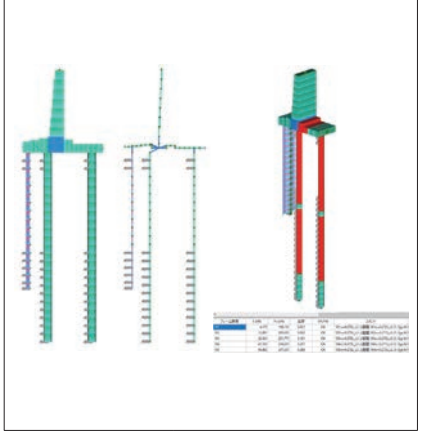


Riverbank (special levee)

Static nonlinear L2 seismic analysis based on river seismic guideline. Vertical walls and steel sheet piles are modeled with M-φ elements, and ground springs are modeled with nonlinear spring elements.

Node=97 Element=75 M-φ element=27 Spring element=36
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee	USD8,267



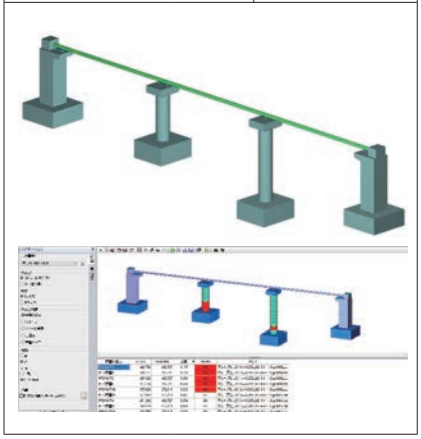
Water facility

Water pipe bridge

Dynamic nonlinear L2 seismic analysis based on water supply guidelines. Model columns using M-φ elements. Acceleration results from 1D response ground analysis is loaded.

Node=80 Element=80 M-φ element=26
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee	USD7,862

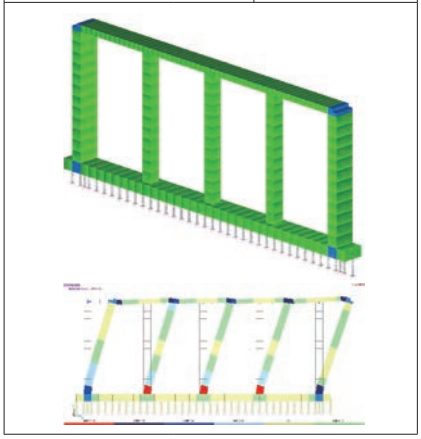


Distributing reservoir (2D)

2D static nonlinear L2 seismic analysis based on water supply guidelines. The members are modeled using fiber elements and pushover analysis is performed.

Node=33 Element=53 Fiber element=32 Spring element=9
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee	USD8,071

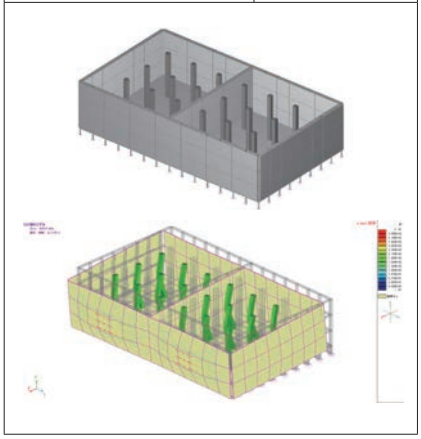


Distributing reservoir (3D)

3D static nonlinear L2 seismic analysis based on water supply guidelines. Model the columns with fiber elements, and the top, bottom, and side walls with nonlinear flat plate elements.

Node=250 Element=250 Fiber element=46 Plate element=154
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee	USD16,201



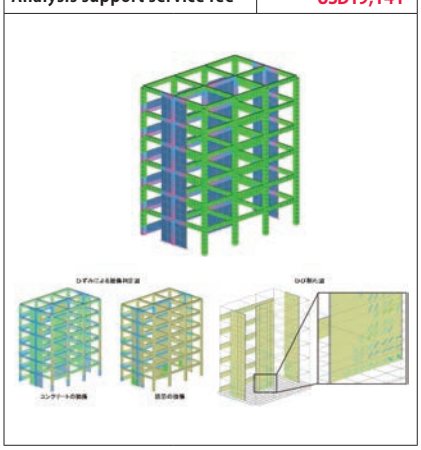
Others

Building structure

Dynamic nonlinear analysis of a 6-story building based on building standards. Beams and columns are modeled with fiber elements, and shear walls are modeled with nonlinear flat plate elements.

Node=265 Element=366 Fiber element=245 Plate element=106
Node/element data does not exist. Data is created from design drawing / design calculation report
Spring data: Provided Contents: Input data creation

Analysis support service fee	USD19,141

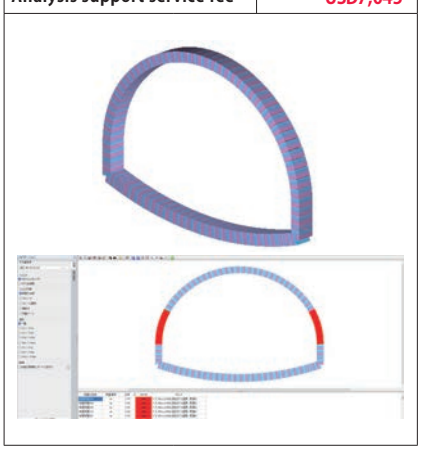


Tunnel

Static linear analysis of normal time, earthquakes, and during construction based on tunnel standard specifications. The ground is modeled with a support spring, and cross-sectional test is carried out.

Node=39 Element=39 Spring element=19
Node/element data: CAD data
Spring data: Provided Contents: Input data creation

Analysis support service fee	USD7,045

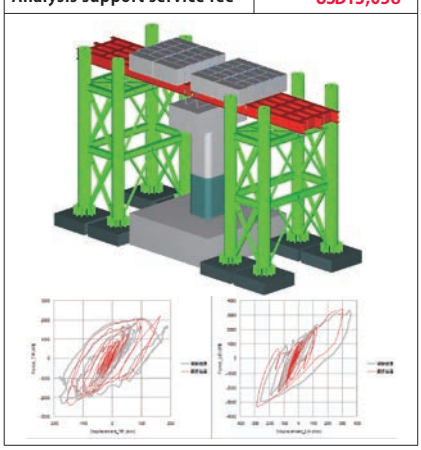


Experimental test (competition model)

Dynamic nonlinear analysis submitted for a competition. Model the columns with fiber elements, run 3 tests, and organize analysis results.

Node=251 Element=155 Fiber element=14
Node/element data does not exist. Data is created from design drawing / design calculation report Spring data: No
Contents: Input data creation + Organization of the analysis results

Analysis support service fee	USD13,058



FEMLEEG Analysis Support Service

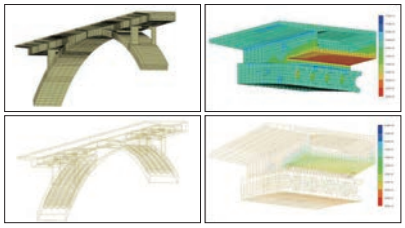
Supports model input and analysis of the comprehensive finite element analysis system FEMLEEG

In addition to selling FEMLEEG software products, FORUM8 technical support staff and development staff provide various analysis support services to assist your model creation and analysis work.

Stress check near arch crown joint

Nodes=68,000 Models=1 Analysis cases=7

Analysis support service fee USD14,674



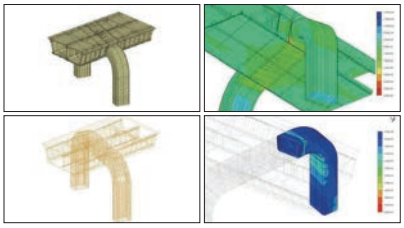
Creates a half-section model by using symmetry conditions

Max principal stress distribution diagram / vector diagram

Stress verification of superstructure and steel pier

Nodes=75,000 Models=1 Analysis cases=5

Analysis support service fee USD16,583



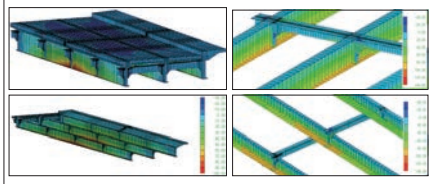
Corrugated web bridge / concrete filled steel pier

Max principal stress of concrete / von Mises stress distribution map of steel pier

Local stress verification of plate girder bridges

Nodes=65,000 Models=1 Analysis cases=3

Analysis support service fee USD13,184



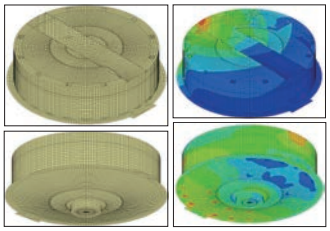
Loading at the max live load position of steel plate girder bridge

Main girder max principal stress distribution diagram

Stress check of circular tank

Nodes=25,000 Models=1 Analysis cases=7

Analysis support service fee USD9,486



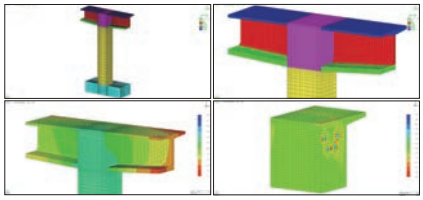
The entire circular tank is modeled, including the projection.

Max principal stress distribution/deformation diagram

Stress analysis of PC box girder pier capital

Nodes=40,000 Models=1 Analysis cases=4

Analysis support service fee USD10,679



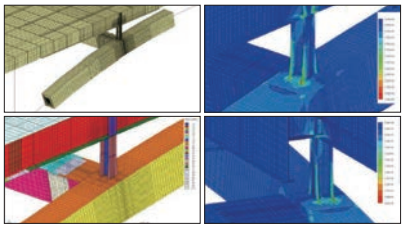
1/2 of the pier capital 2BL is modeled with solid

Capital max principal stress distribution/deformation diagram

Stress check of steel arch bridge trusses and arch members

Nodes=50,000 Models=1 Analysis cases=1

Analysis support service fee USD13,722



H-type plate thickness color map. Main girder, slab, truss, and arch are shell element.

von Mises stress distribution map

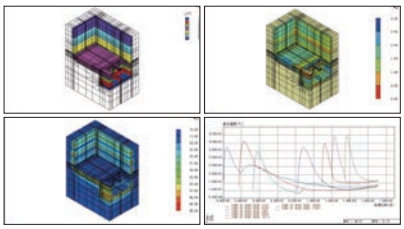
JCMAC3 analysis support service

FORUM8 will respond to diverse needs with well-managed services by taking advantage of being the developer of JCMAC3 pre-post. This is a three dimensional thermal stress analysis program developed by the JCI Committee on Computer Code Development for Crack Control in Massive Concrete. This program helps the comprehensive analysis of stress, deformation, and the probability and width of cracks due to the initial strain in concrete. FEMLEEG's FEMIS/FEMOS is used as the pre/post processor. (Sold only on an annual rental basis from the JCI.

Pump room in water purification plant (1/4 scale model)

Nodes=17,908 Placing lifts=7 Stages=14
Leveled concrete is modeled with non-heating elements.

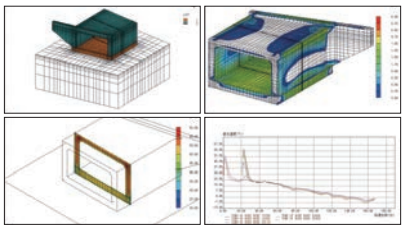
Analysis support service fee USD14,972



Box culvert with bevel

Nodes=39,539 Placing lifts=2 Stages=6 Cast the bottom plate in 1 time, and the side walls and top plate in 1 time.

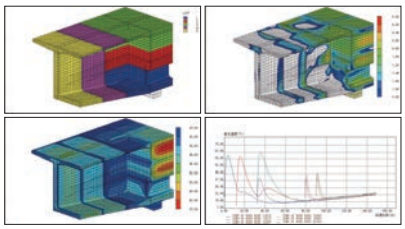
Analysis support service fee USD15,688



Capital + Overhang 2BL (1/4 model)

Nodes=22,217 Placing lifts=5 Stages=20 After placing the nodal capital in 3 parts, the overhang is placed 1 by 1 block.

Analysis support service fee USD9,246

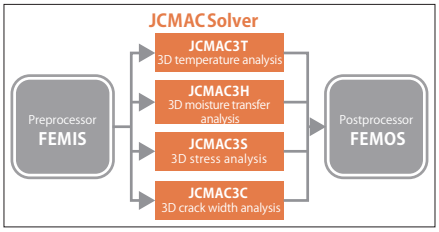


Pier (1/2 model)

Nodes=42,398 Placing lifts=7 Stages=13
Pile steel pipes and filled concrete are modeled as non-heat generating elements.

Analysis support service fee USD7,158

▼JCMAC3 product overview



NaRDA
National Resilience Design Award

National Resilience Design Award

"National Resilience Design Award" is the place to provide information and to improve skills by assembling concrete cases and results which is helping to strengthen the national land. Various brilliant works for strengthening of national land in the field of structural analysis (civil engineering and construction), ground and water engineering, and disaster prevention will be introduced.

The 9th NaRDA Award Winning Works (2020)

Grand Prix

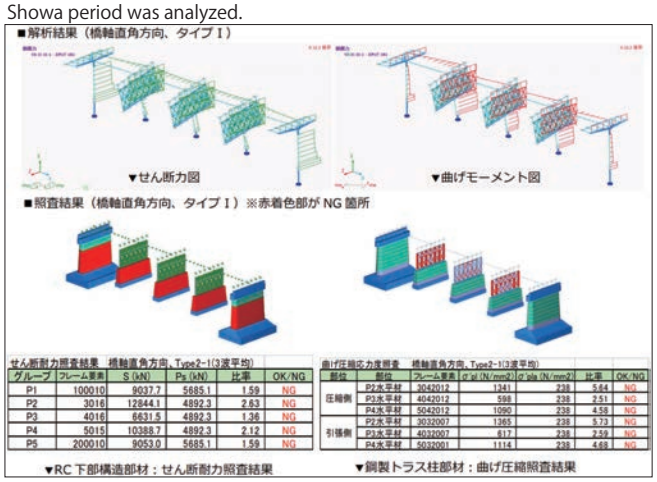
Level 2 Earthquake Dynamic Nonlinear Analysis of Existing Overpass with Composite Piers

-Verify a bridge constructed in the early Showa period under the latest seismic loads-

KRAY Inc.

Program Engineer's Studio®

80-year-old complex structure with RC and steel truss constructed in the early Showa period was analyzed.



This bridge is a 4-span continuous steel plate girder overpass constructed in the early Showa period. The central three piers are of RC structures in the lower part, and the upper part is a composite structure with steel truss legs consisting of seven lattice columns connected with trusses to form a single plate. It has passed over 80 years since its construction, and a dynamic nonlinear analysis was conducted at the level 2 earthquake to verify the seismic performance of the bridge under the latest seismic loading. The superstructure and steel truss legs were modeled as elastic beam elements, and the substructure as a nonlinear beam element (M-φ element), with plastic hinge springs at the column bases. As a result of the verification, the shear capacity of the RC members and the bending and compressive stress of the steel truss legs exceeded the allowable values, which were confirmed as basic data for future reinforcement studies.

Excellent Award

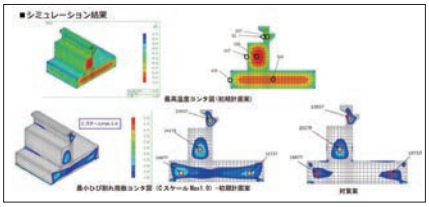
Preliminary Study of Thermal Cracking Before Construction of New Bridge Abutments

-Analysis and countermeasure based on the crack control guideline for mass concrete-

Hagihara Giken Co., Ltd.

Program JCMAC3 (First time)

Since the cracking was expected to occur during construction from the design stage, the current situation and countermeasures were considered using thermal stress analysis simulation.



Nomination Award

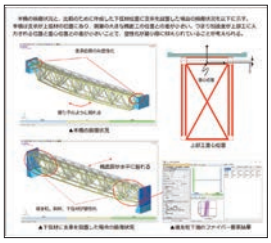
Seismic Performance Verification of a Simple Steel Truss Bridge Built in the 1950s

-The wisdom of our forefathers that can be realized when a major earthquake occurs-

FUJI Consultants Co.,Ltd.

Program Engineer's Studio®

Analysis to check the soundness of a 60-year-old simple steel truss deck bridge



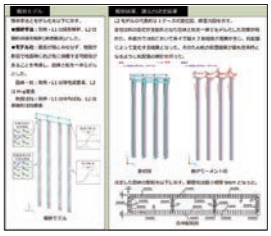
Seismic Performance Verification of River Bridges with Box Structures

-Static nonlinear analysis of box and piles as a whole-

Kitacon Corporation

Program Engineer's Studio®

For structures that do not apply to conventional culverts in the culvert design guidelines, performed an analysis as an integrated structure and implemented seismic design .



The 8th NaRDA Award Winning Works (2020)

Grand Prix

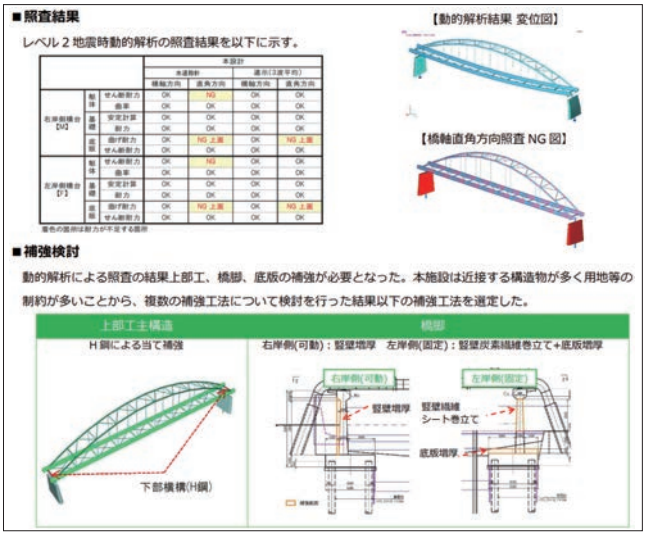
Seismic Study of Existing Steel Pipe Arch Water Pipe Bridge

-Check damages of steel arch members and verify nonlinear seismic performance of legs-

NIX Co., Ltd.

Program Engineer's Studio®

Water infrastructure continues to deteriorate, resulting in the collapse of water pipe bridges. This work performed seismic assessments of existing structures, examined reinforcement methods for NG members, and selected construction methods.



Excellent Award

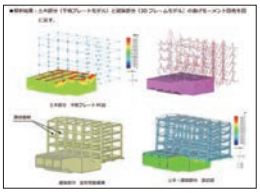
United Seismic Performance Verification of Civil Engineering Facility and Architectural Facility

-Reproduce behaviors during earthquakes using dynamic analysis-

F-tech Inc.

Program Engineer's Studio®

Analyzed underground civil engineering facilities and above-ground construction facilities together and considered optimal countermeasures across standards.



Bridge Pier Reinforcement Award

Honorable Judge Award Prof. Masaru Morita, Prof. Emeritus, Shibaura Institute of Technology

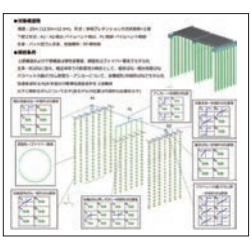
Level 2 Seismic Performance Verification for Pile-Bent Piers

-Study of seismic performance of the entire bridge by dynamic nonlinear analysis-

SANKYO ENGINEERING Co., Ltd.

Program Engineer's Studio®

Analyzed the entire bridge system for pile-bent piers and considered more rational reinforcement measures.



Nomination Award

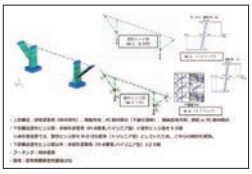
Level 2 Seismic Study of π-Shaped Rigid-Frame Bridge with PC Diagonal Members

-Reevaluate the design based on the old standard by the current standard-

ORBIT Co.,LTD.

Program Engineer's Studio®

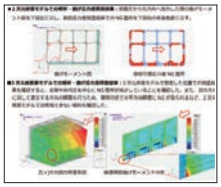
Due to the revision of the standards, PC Pi type bridges with diagonal members designed using the old standards were re-examined based on the 2017 standards.



The 7th NaRDA Award Winning Works (2020)

Grand Prix — Nihon Suiko Consultant Co.,Ltd

Comparison of seismic test result by using 2D and 3D model of existing water tank
—Validity of analysis and verification in different models—

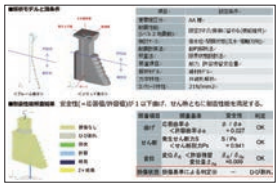


Program Engineer's Studio®

Proposed a 3D analysis and it verified the difference in results from the 2D model and the validity of the modeling through analysis.

Excellent Award — Naigai Engineering Co., Ltd.

Seismic performance test using observed seismic motion
—Seismic performance test for headworks and comparison of damage—



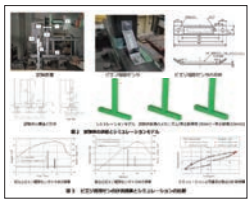
Program Engineer's Studio®

Evaluated seismic performance through analysis using observed seismic motion, and compared to and verified actual damage conditions and field survey results.

The 6th NaRDA Award Winning Works (2019)

Grand Prix — Akita Prefectural University Faculty of Systems Science and Technology

Development of simple measurement technology for steel structures
—Constructing a convenient soundness monitoring system for structures using piezo limit sensors—



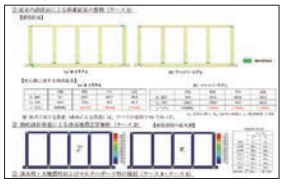
Program Engineer's Studio®

Displacement and load prediction using analysis simulation for a steel structure health monitoring system

Water Supply Resilience Award — Knowledge Fusion Co., Ltd.

Honorable Judge Award — Prof. Masaru Morita, Vice-president of Shibaura Institute of Technology; Prof. of Urban Environmental Eng. Lab.,Civil Eng. Dept., Shibaura Institute of Technology

Disaster countermeasures for water supply facilities considering multi-hazards
—Approach to streamlined design by sophistication of analysis model and verification index—



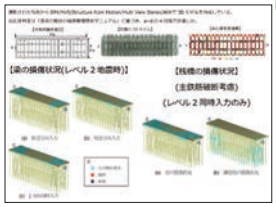
Program Engineer's Studio®、WCOMD Studio

Performed structural analysis assuming that several natural disasters occur at the same time and consider rational disaster countermeasure indicators.

The 5th NaRDA Award Winning Works (2018)

Grand Prix — Institute of Technology, PENTA-OCEAN CONSTRUCTION CO., LTD.

Applying the residual strength evaluation method using degradation level check to jetties
—Proposal of a new strength evaluation method using a loading experiment and general regular check results—



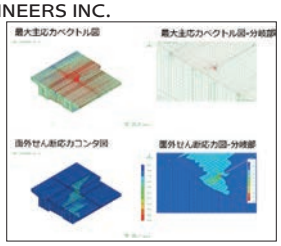
Program Engineer's Studio®

Considered a method to easily evaluate the remaining strength by reflecting the results of deterioration study in an analytical model.

Full 3D Design Award — KATAHIRA & ENGINEERS INC.

Honorable Judge Award — Prof. Hiromichi Yoshikawa (Chief of the judging committee) Prof. Emeritus, Tokyo City University

Stress analysis on the branch point of steel deck box girder bridge
—Stereoscopic FEM model analysis by using plate and shell—



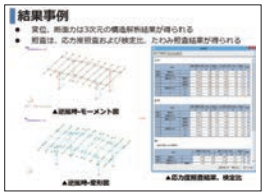
Program FEMLEEG (First time)

Stress concentration were concerned for the special structure, and if it was damaged, it would take a considerable amount of time to recover. So local stress analysis was used to resolve problems in advance.

The 4th NaRDA Award Winning Works (2017)

Grand Prix — Next Energy & Resources Co., Ltd.

Design of solar cell support structure
—Detail design by 3D skeleton structure analysis—



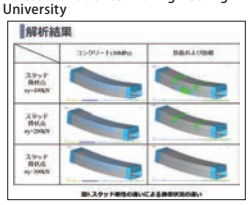
Program Engineer's Studio®

Dedicated design software developed with the goal of reducing design time and improving work efficiency using the features of Engineer's Studio®.

Integrated Design Award — Japan Association of Diaphragm Wall

Honorable Judge Award — Prof. Akihiko Wakai, Professor of Science and Engineering Department, Gunma University

Strength test analysis by steel diaphragm wall method-II
—Consider an evaluation way of bending strength and rigidity by analysis numeric experiment—



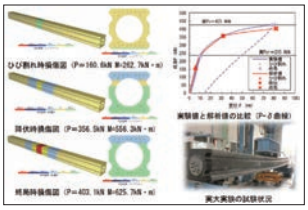
Program Engineer's Studio®

Verify the impact of structural members on the overall structure and determine appropriate specimen specifications before testing

The 3rd NaRDA Award Winning Works (2016)

Grand Prix — Nippon Concrete Industries Co., Ltd.

High seismic retrofitting of freestanding retaining wall by using PC-Wall and reasonable performance verification type seismic design method
—Actual-size experiment and verification by using high performance FEM fiber model—

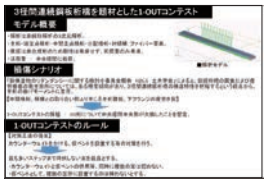


Program Engineer's Studio®

The performance test type seismic design method for in-house developed products was verified through experiments and analysis and also used as a design and sales tool.

Excellent Award — Association of road and bridge structure, MLIT. Central Regional Development Bureau

Utilize Engineer's Studio® for personnel training
-For understanding of structure features of triple span steel plate girder bridge-



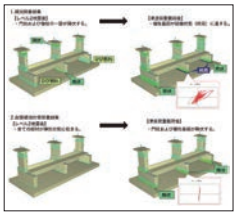
Program Engineer's Studio®

To ensure a timely response to future bridge accidents, an analysis competition was held to optimize emergency measures and will be used for human resources development.

The 2nd NaRDA Award Winning Works (2015)

Grand Prix — RATECH Co., Ltd.

Seismic performance verification considering the level 2 earthquake and tsunami load
—Series of analysis of earthquake and tsunami against coastal sluice gate—



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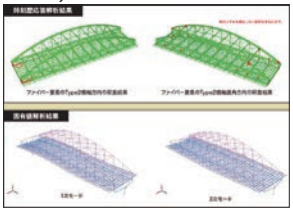
Taking into consideration the effects of tsunamis following a major earthquake, the current condition of the existing floodgates was reviewed and reinforcement measures were considered.

Seismic Resilience Design Award — Doboku Giken

Honorable Judge Award — Prof. Hiromichi Yoshikawa (Chief of the judging committee) Professor Emeritus, Tokyo City University

Verification of current state of steel langer truss bridge constructed in 1953 by complex nonlinear analysis
—Toward economic and logical selection of best repair and reinforcement method—



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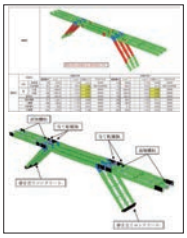
By applying complex nonlinearity to a Langar bridge that exhibited complex behavior, the optimal repair/reinforcement was selected.

The 1st NaRDA Award Winning Works (2014)

Grand Prix — Tonichi Sekkei Consultant

Seismic verification and review of reinforcement by using Specifications for Highway Bridges for the steel strutted beam rigid frame bridge constructed for 40 years ago
—Application of optimum construction method among seismic isolation dampers, buckling-restrained brace, etc. from the viewpoint of effectiveness and economy—



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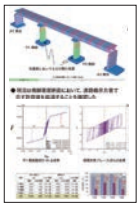
Optimal construction methods such as seismic isolation and damping devices and reinforcement plates for steel strutted beam rigid frame bridges were considered.

Excellent Award — Yokogawa Sumikin Bridge Corp.

Study on the effect of buckling-restrained brace against transverse seismic motion
—A suggestion for the reinforcement using damping damper for girder bridge—



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The placement and installation effects of reinforcement methods were considered.

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Published in 2013

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Editor Hiromichi Yoshikawa
(Prof. Emeritus of Tokyo City University)

Author: Harumi Yashiro/Seiichiro Fukusima/Hideto Omine

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[Learning through VR series]

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Published in 2018

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Published in 2015

Author: Tatsuoki Inagaki President of Pave & Road How-To Way Technology Association (Paroway Tec)

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Small talk about FEM

I.Math essay II.Miscellany essay

Author Yoshiaki Harada (FEM Advisor, FORUM8)

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