BIM for Bridges: OpenBridge Designer

Comprehensive Modeling and Design from Planning to Construction

Steve Willoughby
Senior Engineering Consultant

Bentley
Advancing Infrastructure

Everything Is About 3D Digital Project Delivery

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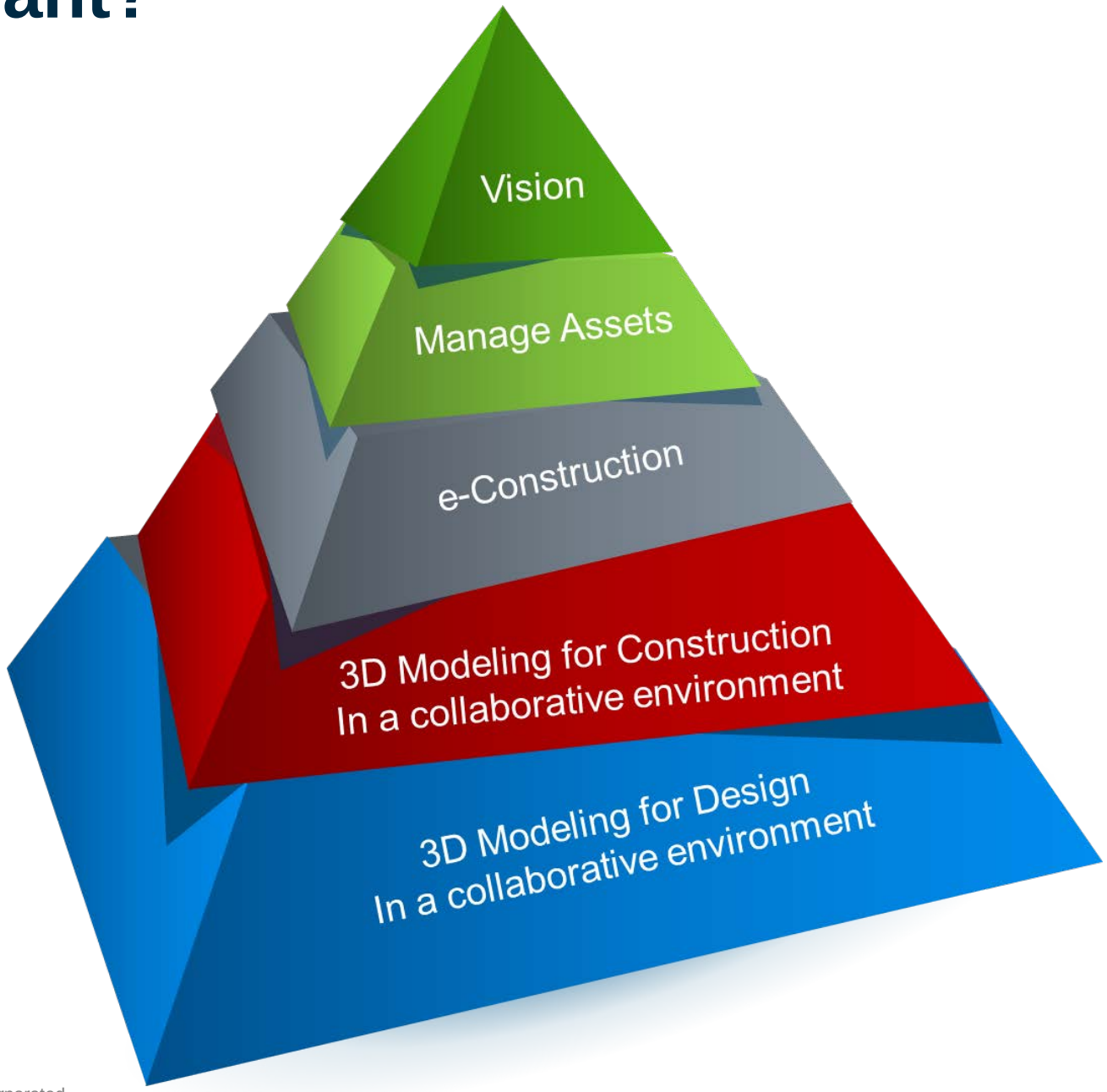
What do We Want?



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Software: One Piece of the Puzzle

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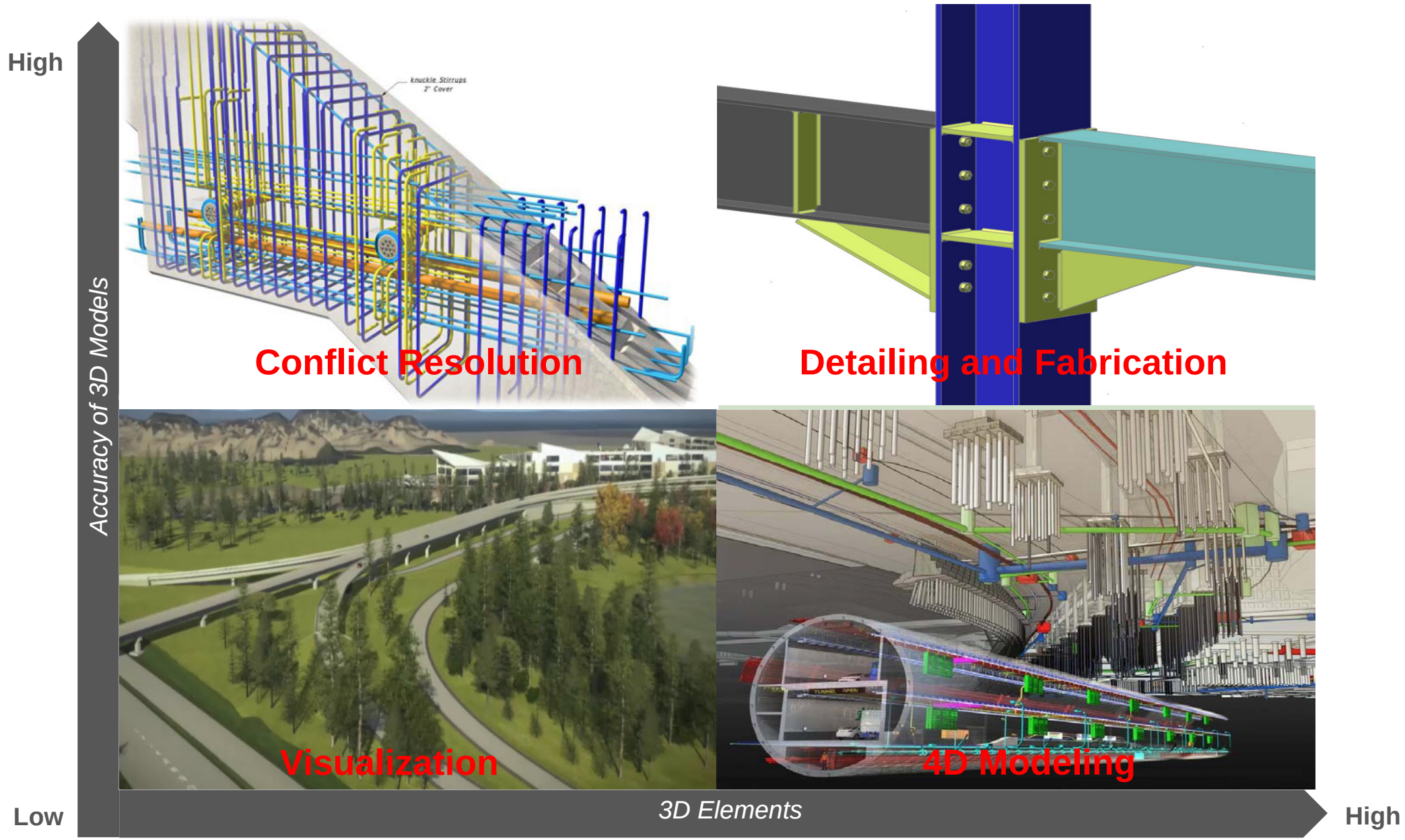
Level of Development of 3D Models



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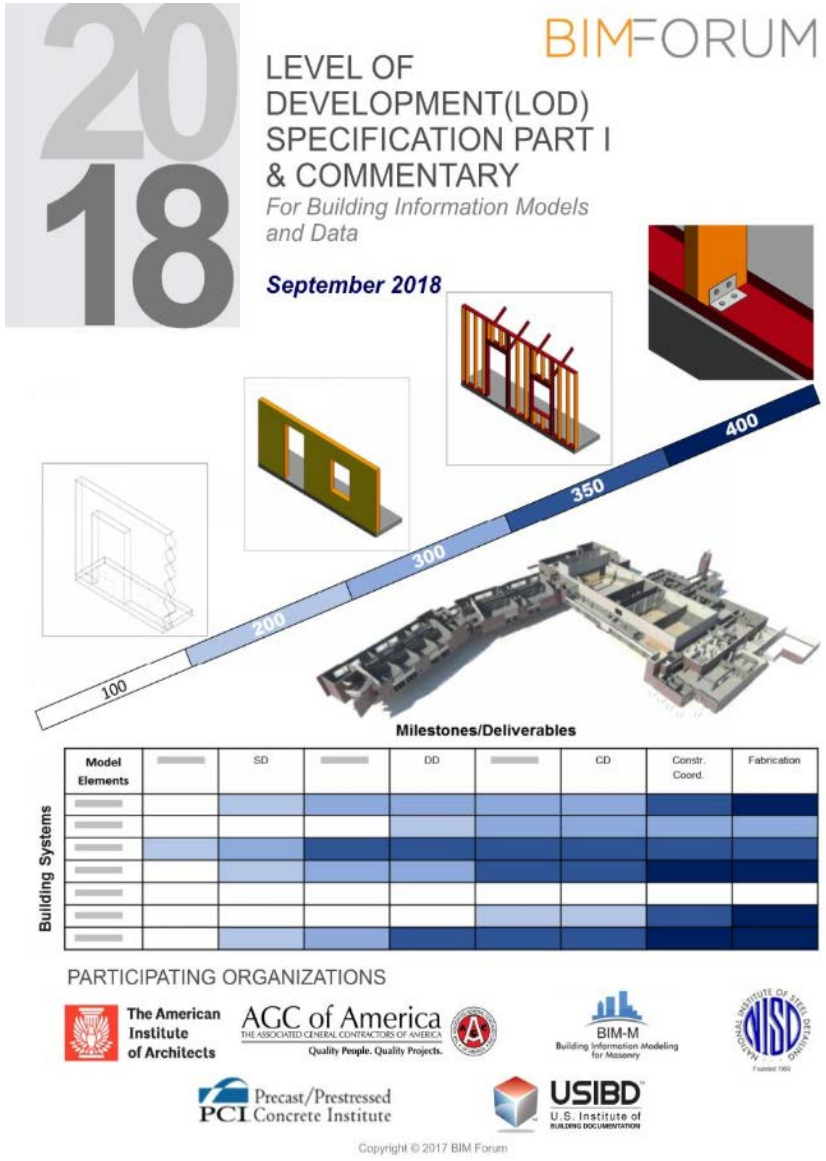
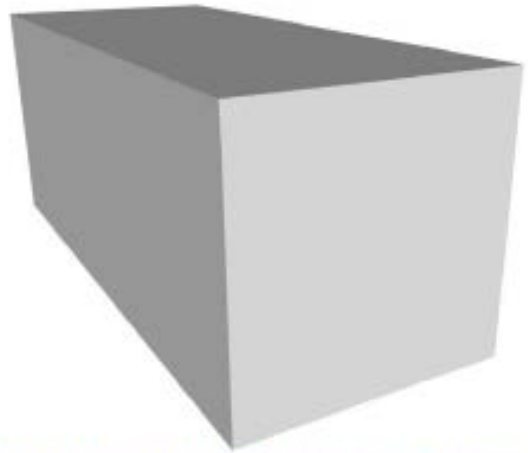
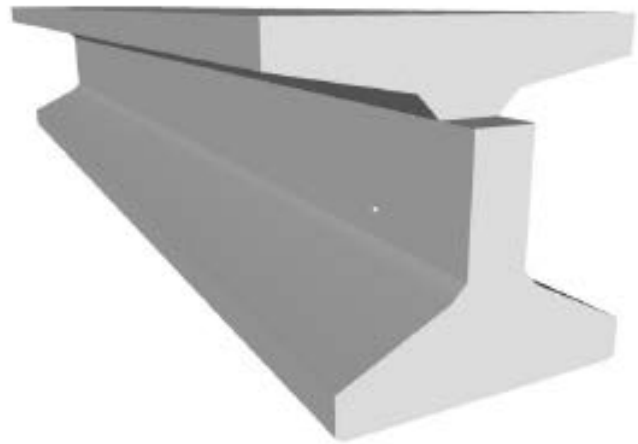
Level of Development of 3D Models





LOD 200 Highway Bridges Precast Structural I Girder (Concrete)



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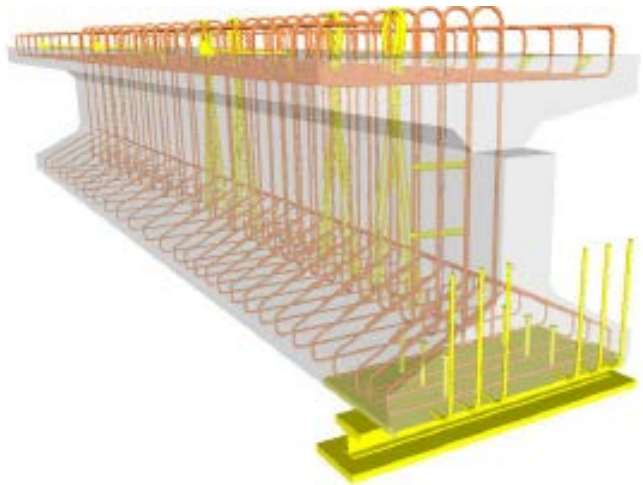

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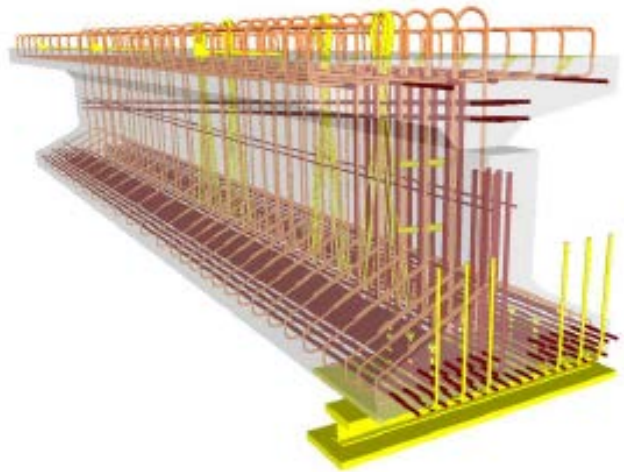

LOD 400 Highway Bridges Precast Structural I Girder (Concrete)

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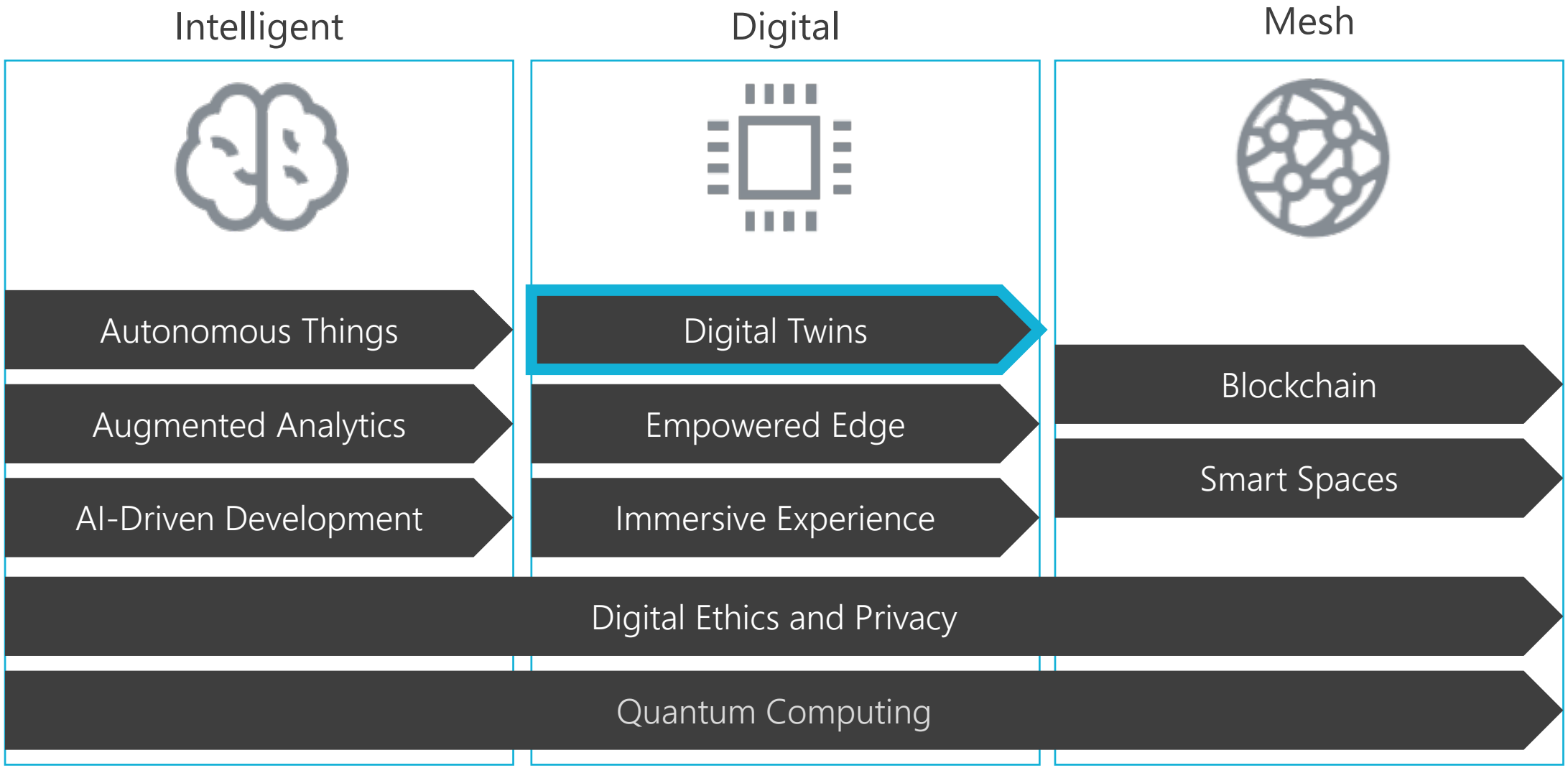
Top 10 Strategic Technology Trends for 2019



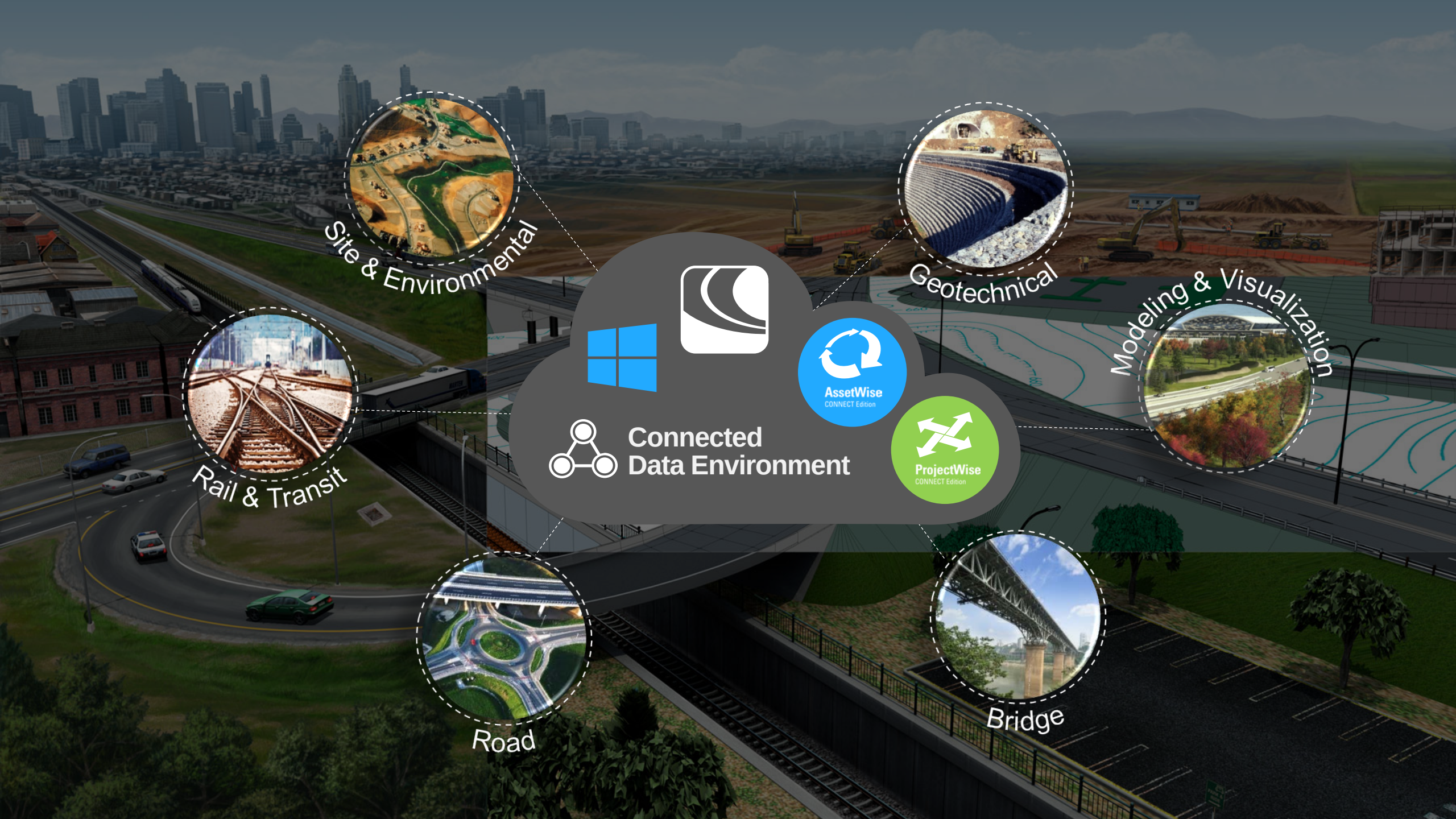
ID:374252

Source: Gartner (October 2018)

A ***digital twin*** is a **digital representation** of a physical asset, process or system, **as well as the engineering information** that allows us to understand and model its performance.

Typically, a ***digital twin*** can be **continuously synchronized** from multiple sources, including sensors and continuous surveying, to represent its near real-time status, working condition or position.

A ***digital twin*** enables users to **visualize** the asset, check status, **perform analysis** and generate insights in order to **predict** and **optimize** asset performance.

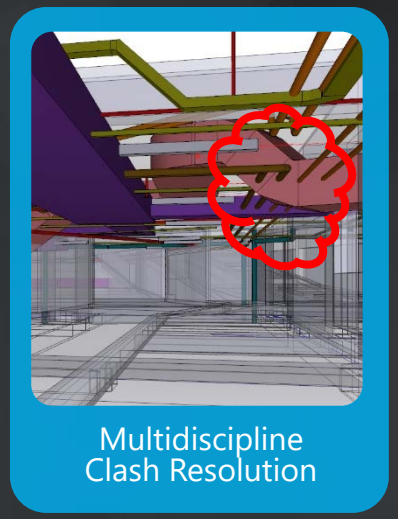

Site & Environmental
Geotechnical
Modeling & Visualization
Rail & Transit
Road
Bridge
Connected
Data Environment
AssetWise
CONNECT Edition
ProjectWise
CONNECT Edition

Design Engineering

Infrastructure Solutions


MicroStation
OpenBuilding
Bentley Substation
OpenPlant
STAAD
RAM
ContextCapture
gINT
OpenSite
OpenRoads
OpenRail
OpenBridge
CONNECT Edition

Comprehensive Modeling Environment



Multidiscipline
Clash Resolution

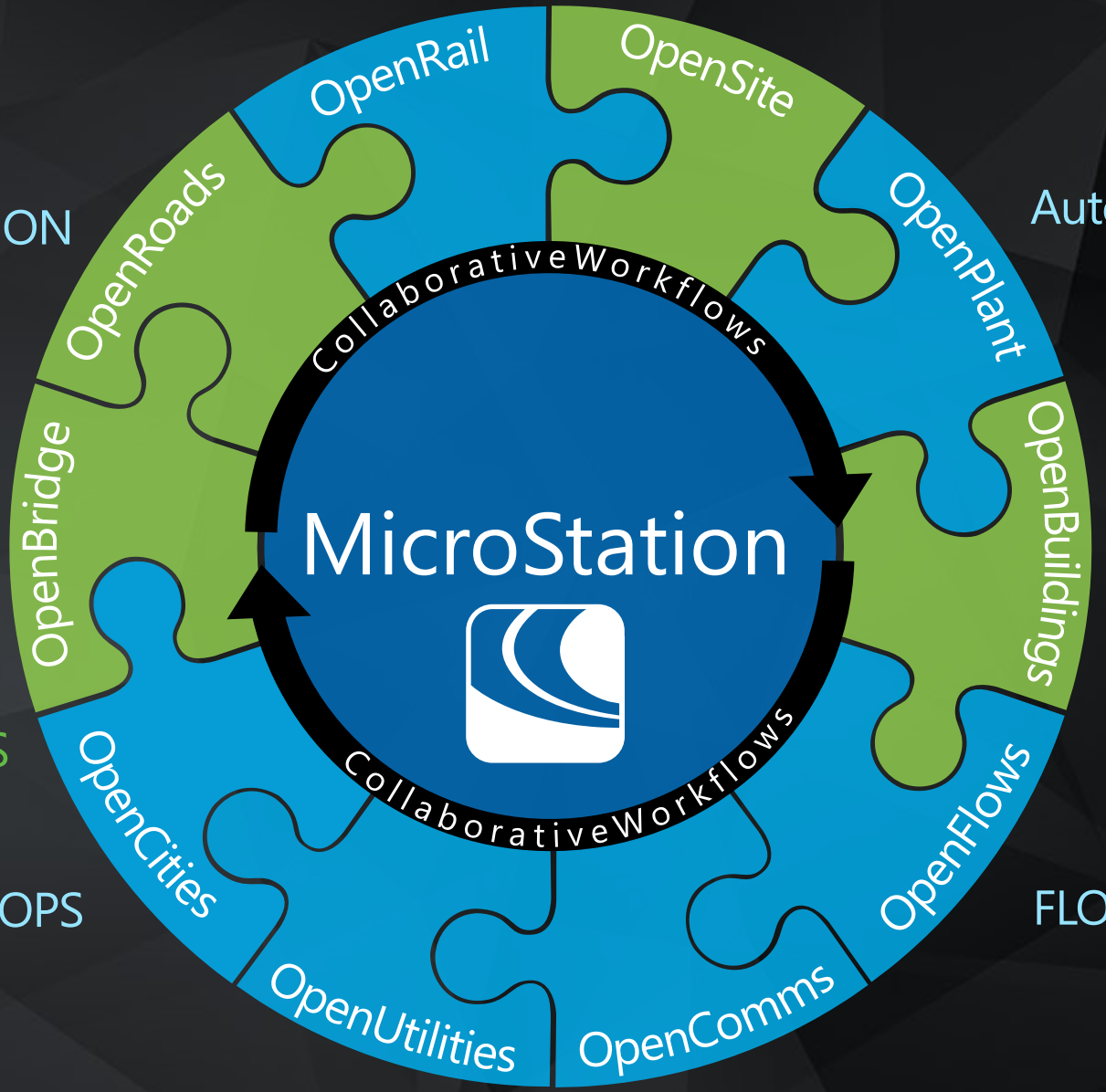
LEGION

LEAP

RM

PLAXIS

SITEOPS

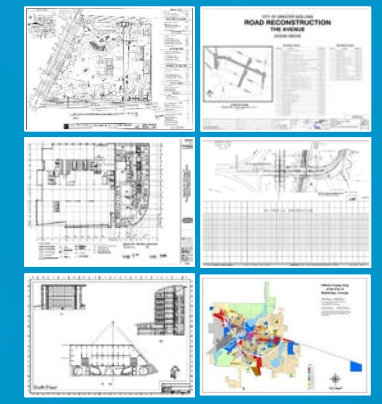


AutoPIPE

RAM

STAAD

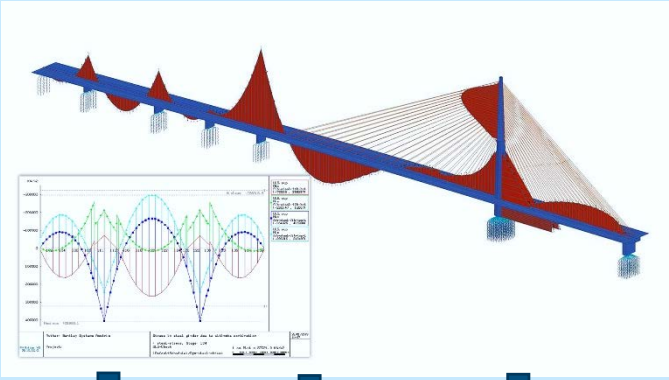
FLOOD



Multidiscipline
Documentation Center

Current Disconnected Bridge Workflow

Analytical Modeling & Design



Report

Report

Analytical Model

Manual Process

Design Documentation

2D Plans production
Manual Quantities
Manual detailing

2D drawings

2D detailing

Quantities Reports

Manual Process

Construction & Asset Management

- Construction
- Inspection
- Load Rating
- Routing & Permitting

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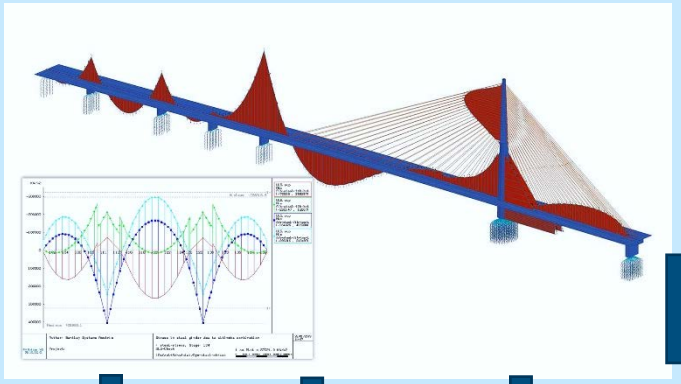
OpenBridge Designer Interoperable Workflow

Analytical Modeling & Design



Report

Report

Analytical Model

Automatic Process

3D Physical Modeling

Design Documentation

2D Plans production
Parametric Quantities
Parametric Detailing

2D drawings

2D detailing

3D detailing

Quantity Reports

3D PDF

Automatic Process

Construction & Asset Management

- Construction
- Inspection
- Load Rating
- Routing & Permitting

OpenBridge Designer

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OpenBridge Designer *Connect Edition*

Perform bridge analysis and design
Interoperate with bridge analytic tools for Concrete and Steel bridges

Develop 2D drawings and design reports
Dynamic views, clash detection, deck elevations, beam seat elevations, input echo report

Prepare quantities and cost estimates
Bid preparation, pay item lists

Develop steel and concrete details
Connection details, barmarks, lists, and schedules via ProStructures

Create intelligent 3D MicroStation-based BIM models

In just
ONE Model
with
OpenBridge Designer

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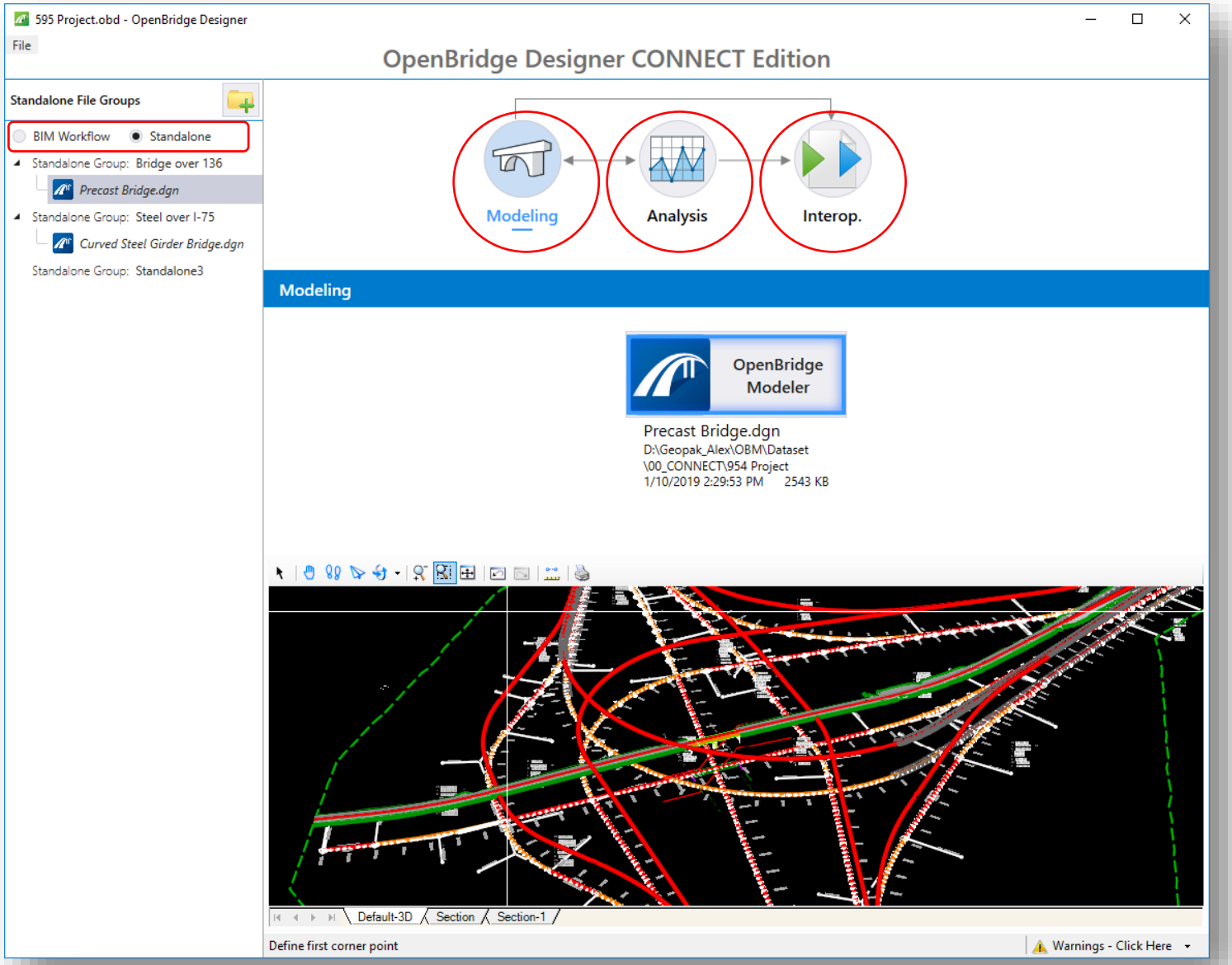
OpenBridge Designer Connect Edition



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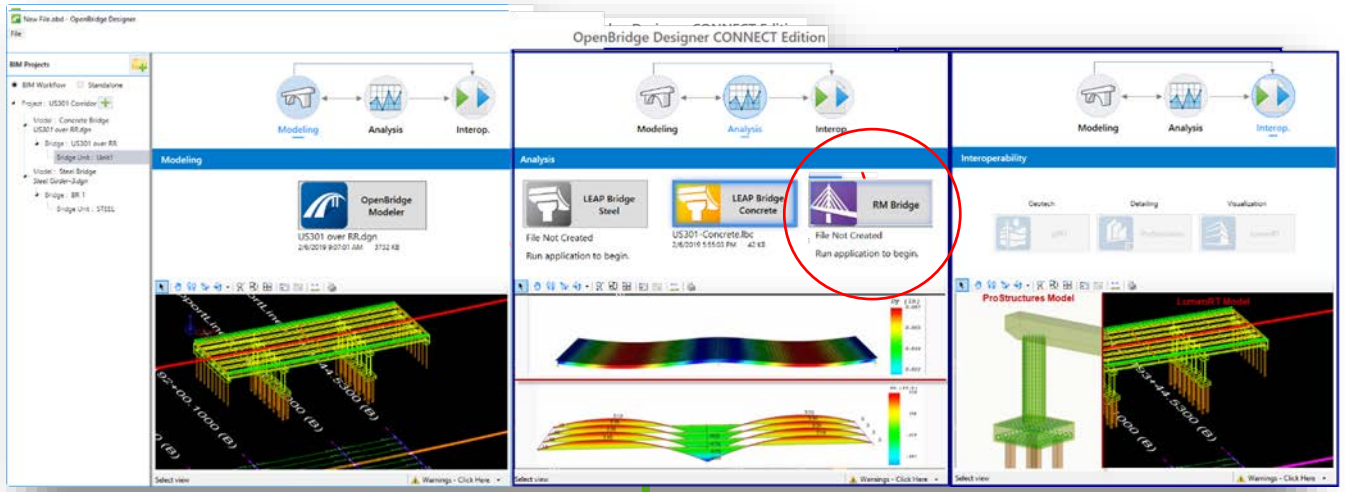
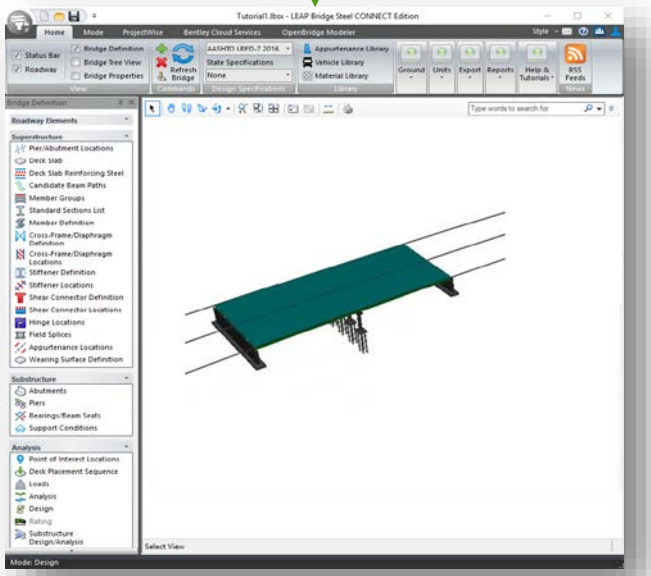
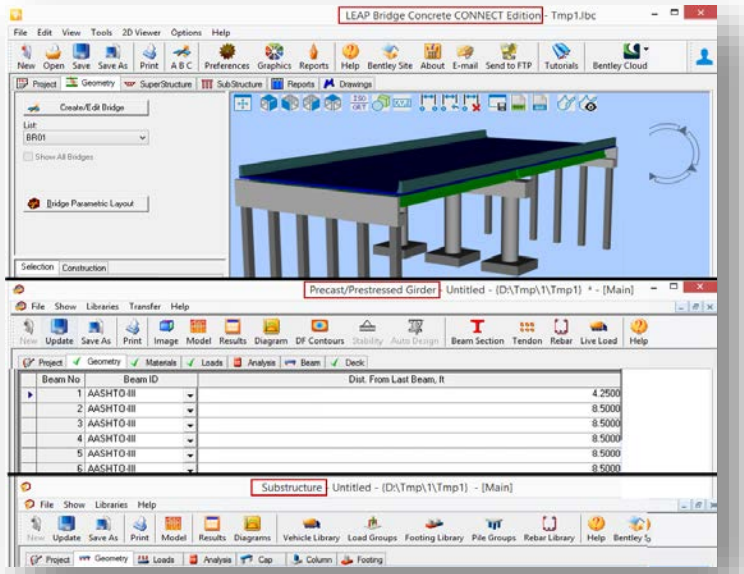
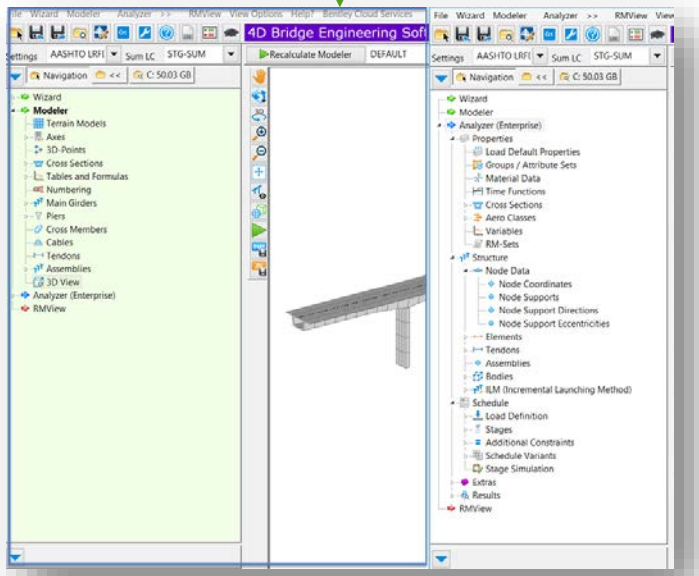
OpenBridge Designer Connect Edition









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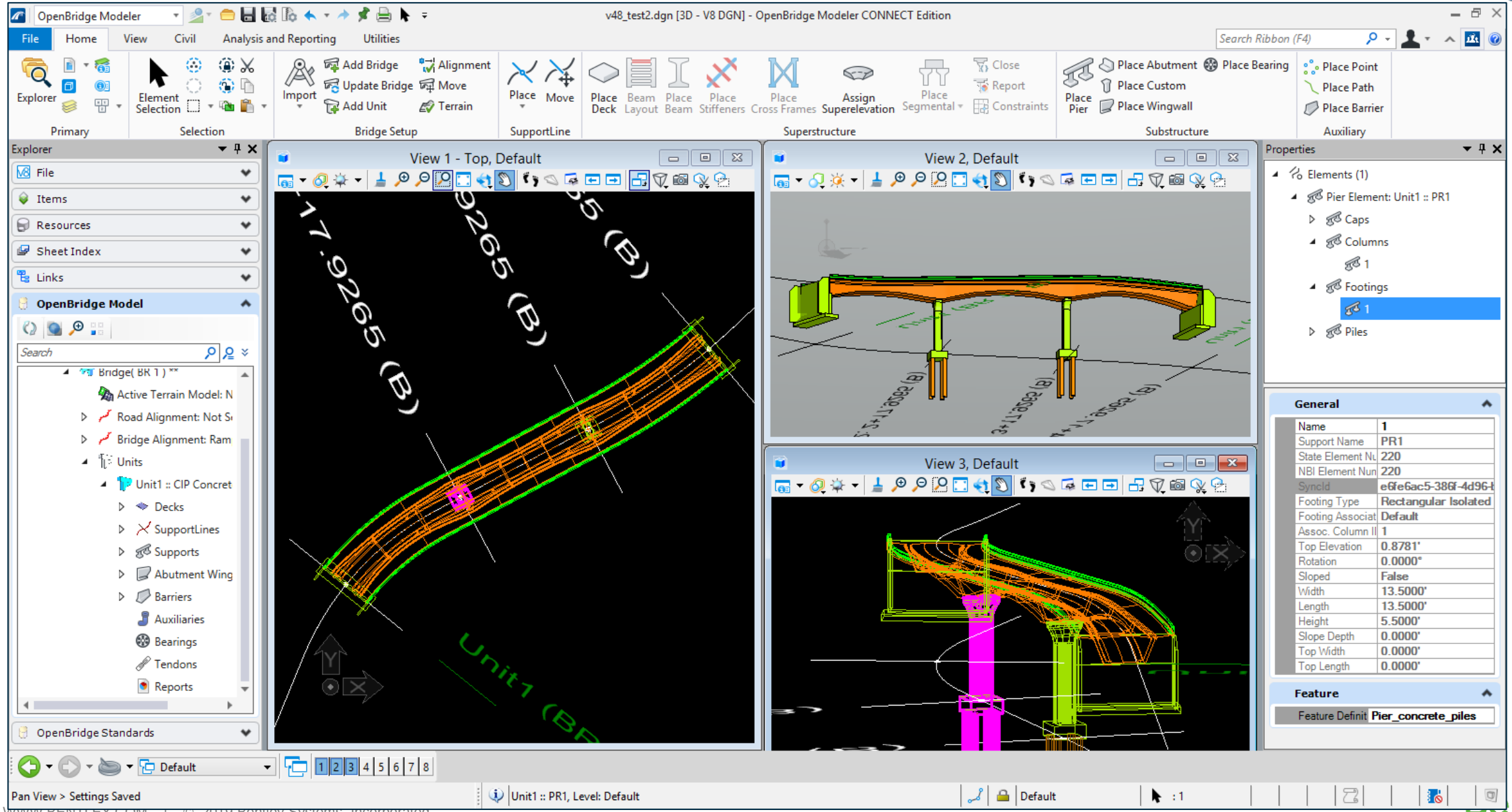
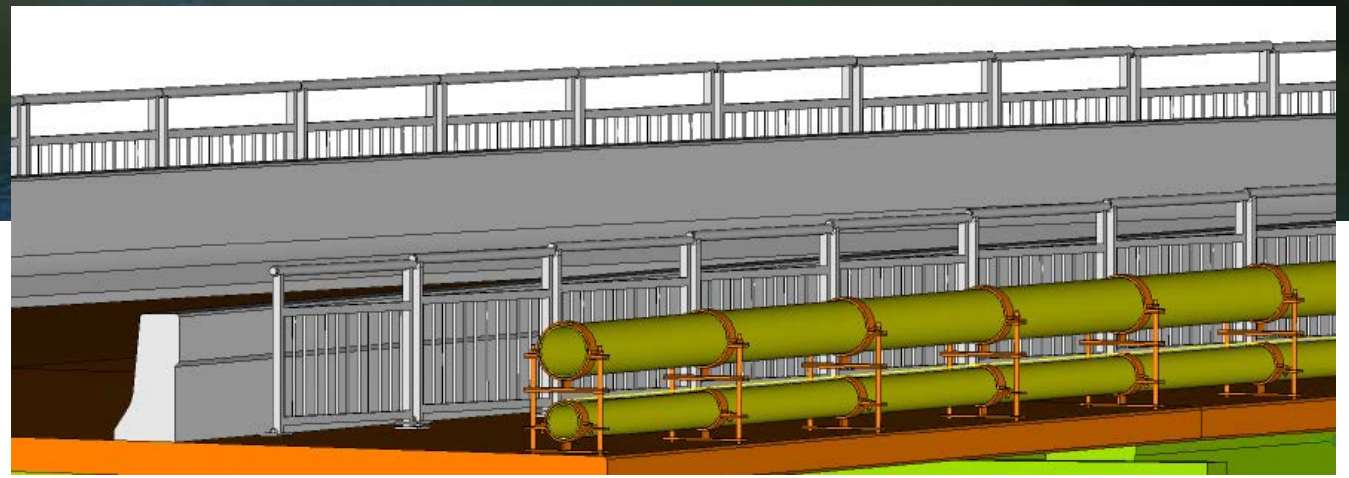
OpenBridge Designer *Connect Edition*



OpenBridge Designer



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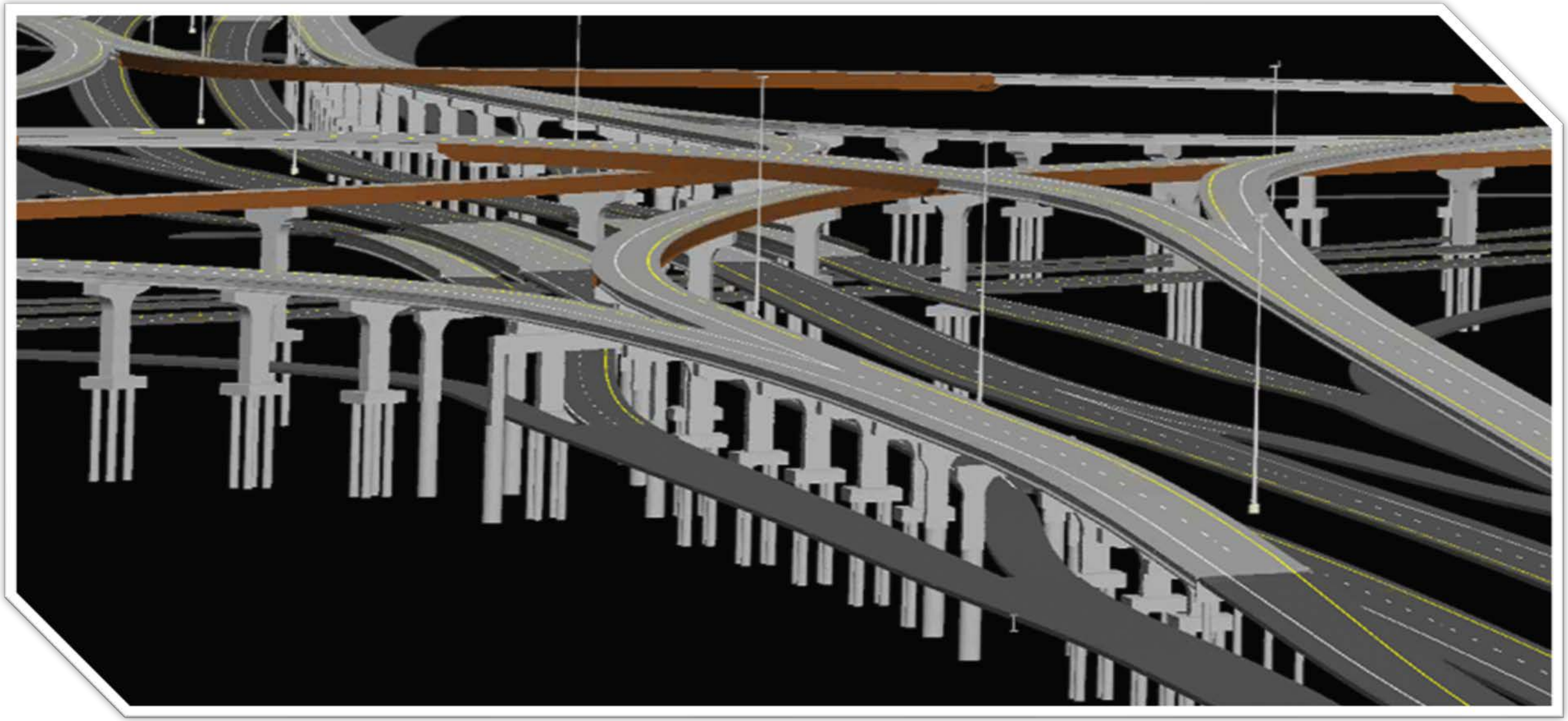
OpenBridge Designer



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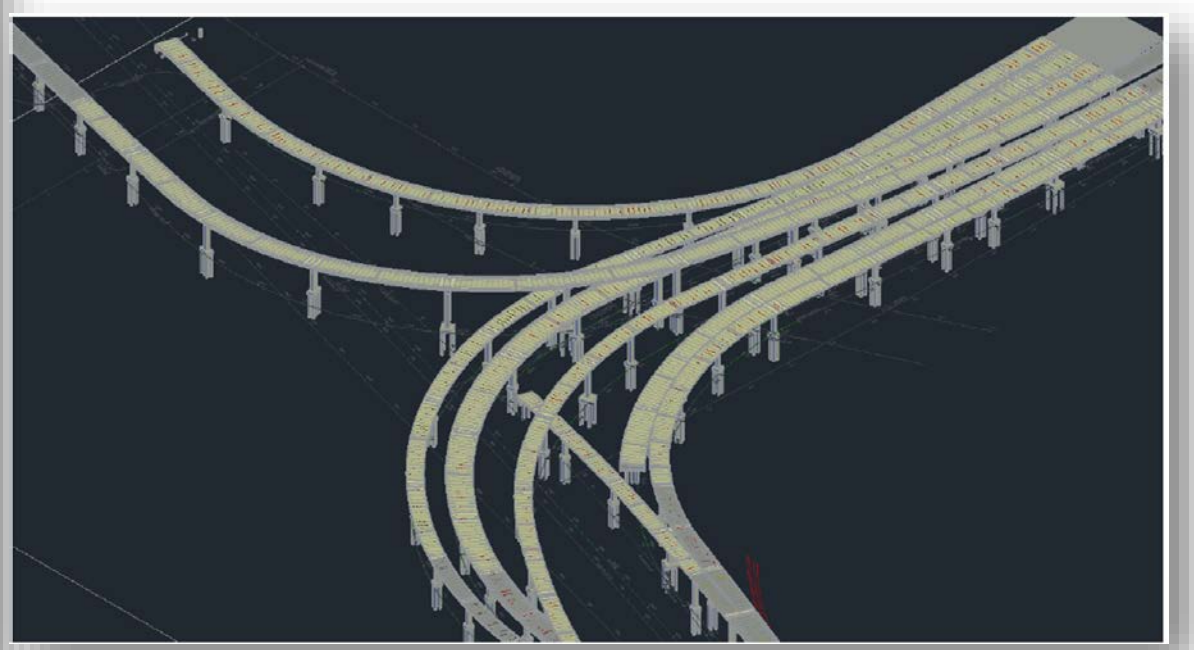
OpenBridge Designer



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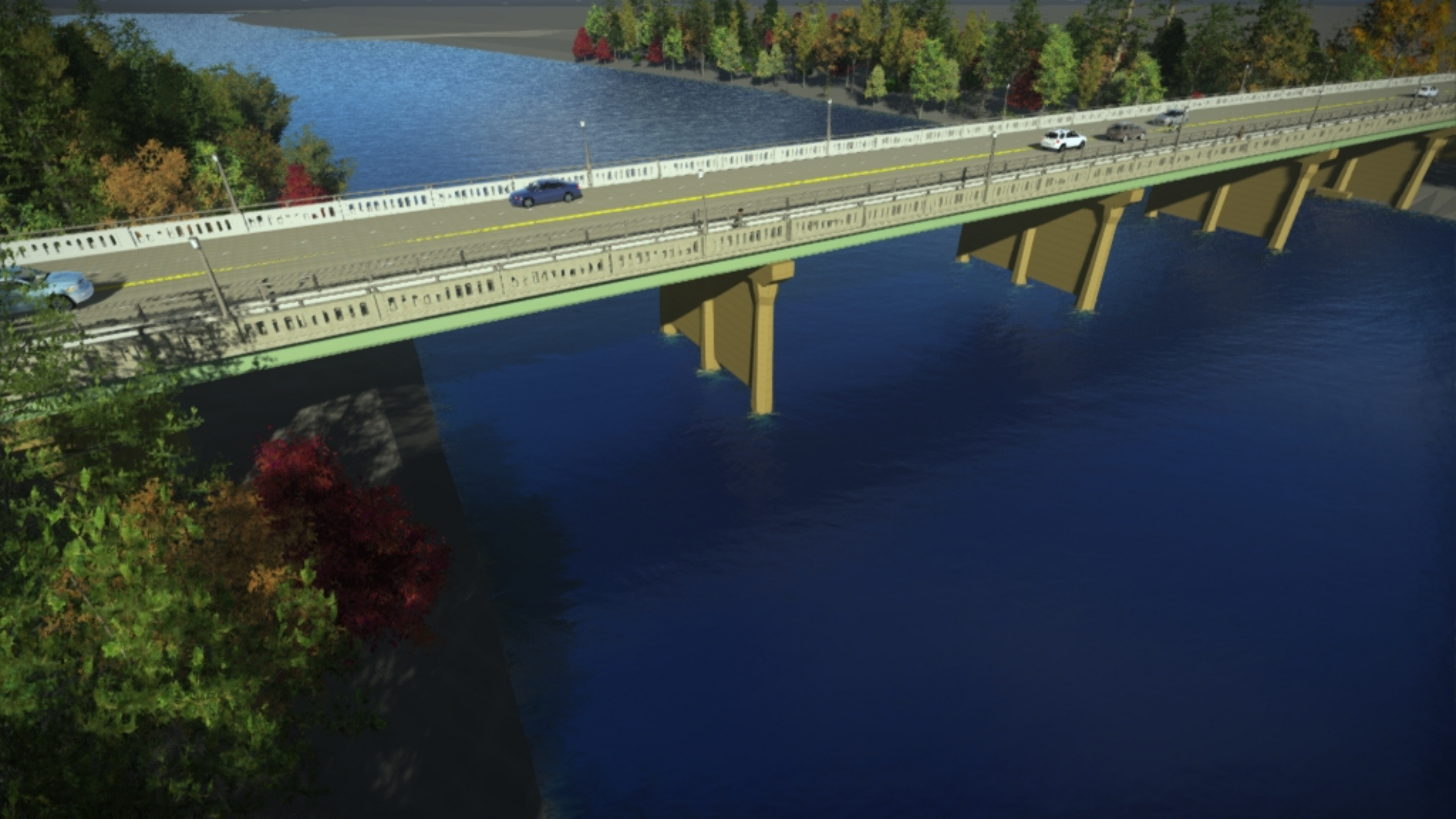
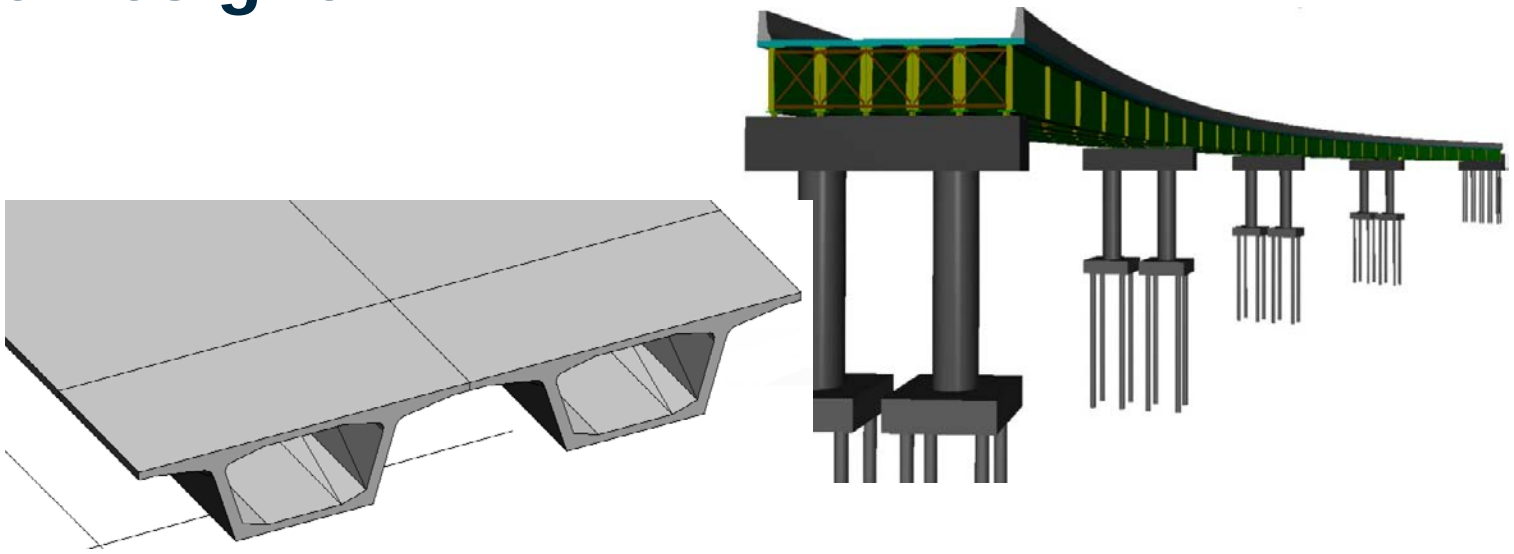
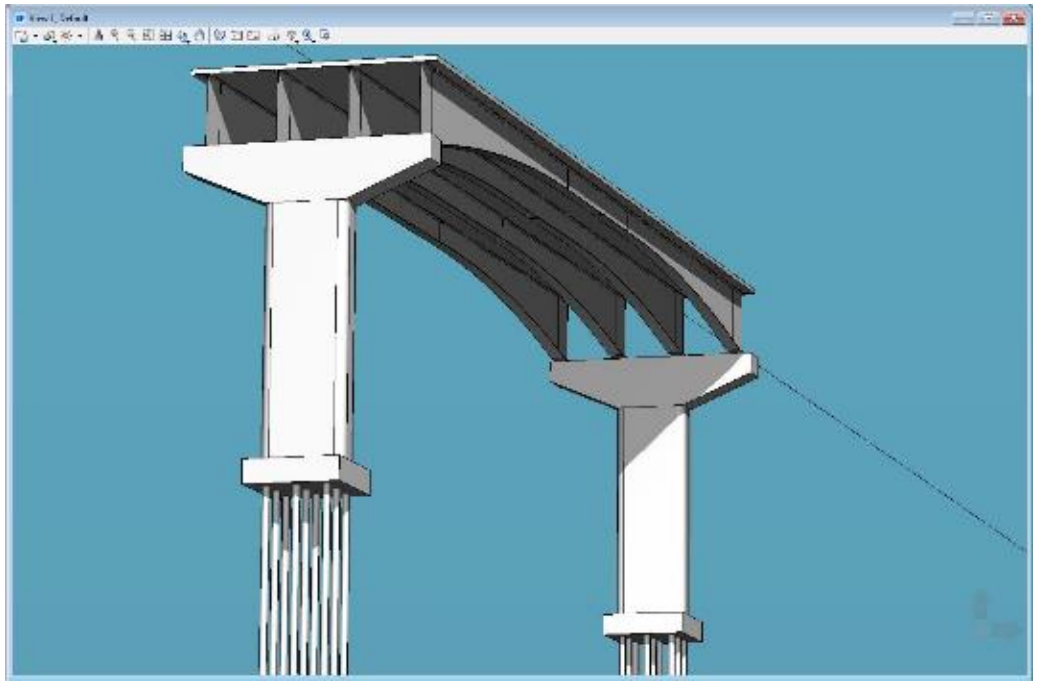


Bridge Types in OpenBridge Designer

- Pre-tensioned Concrete
  - Girder
  - Slab
- Steel girder + concrete slab bridges
  - Rolled Shapes
  - Built-up
- Segmental bridges
  - Span-by-span
  - Balanced cantilever
- Cast-in-Place Concrete Boxes and Slabs





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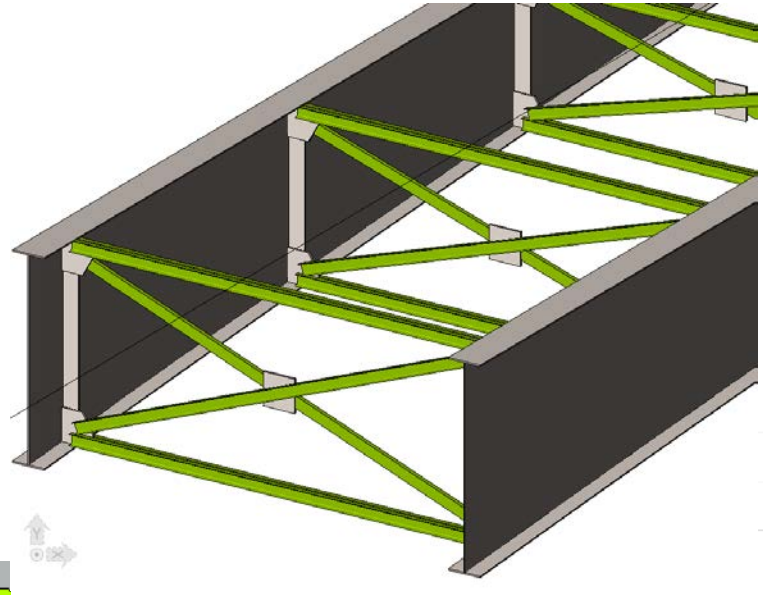
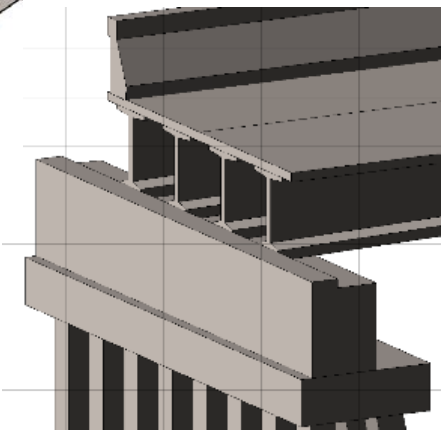
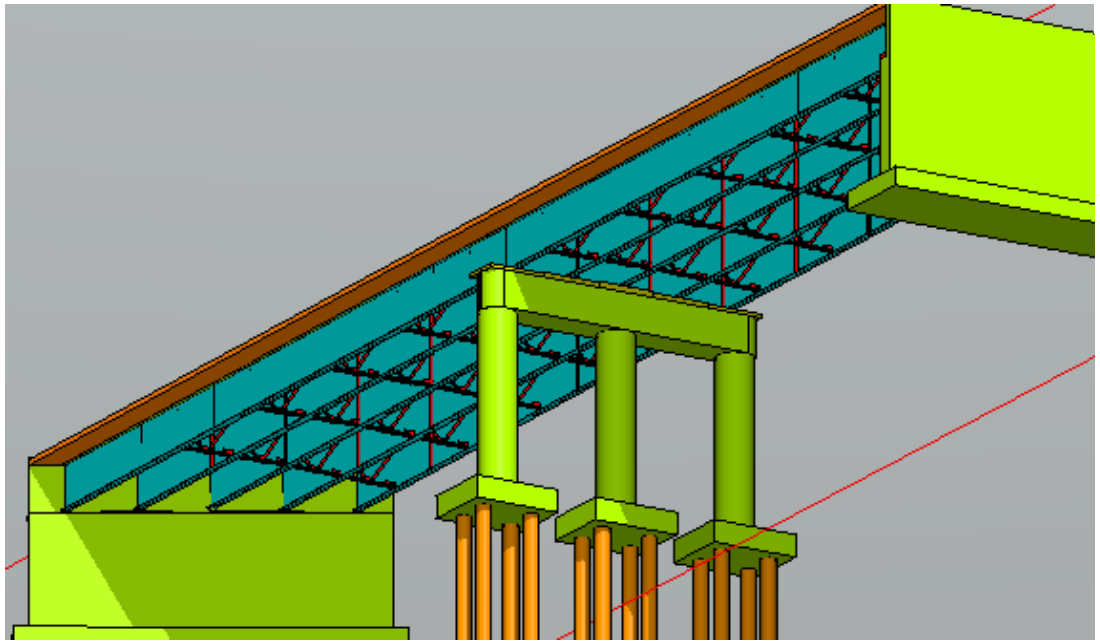
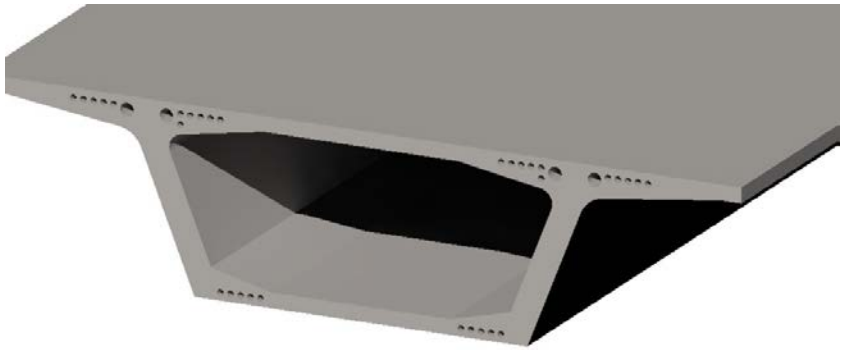
Superstructure Modeling

- 3D parametric bridge modeling
- Super and substructure modeling toolset
- Physical bridge modeling
  - using OBD native geometry tools









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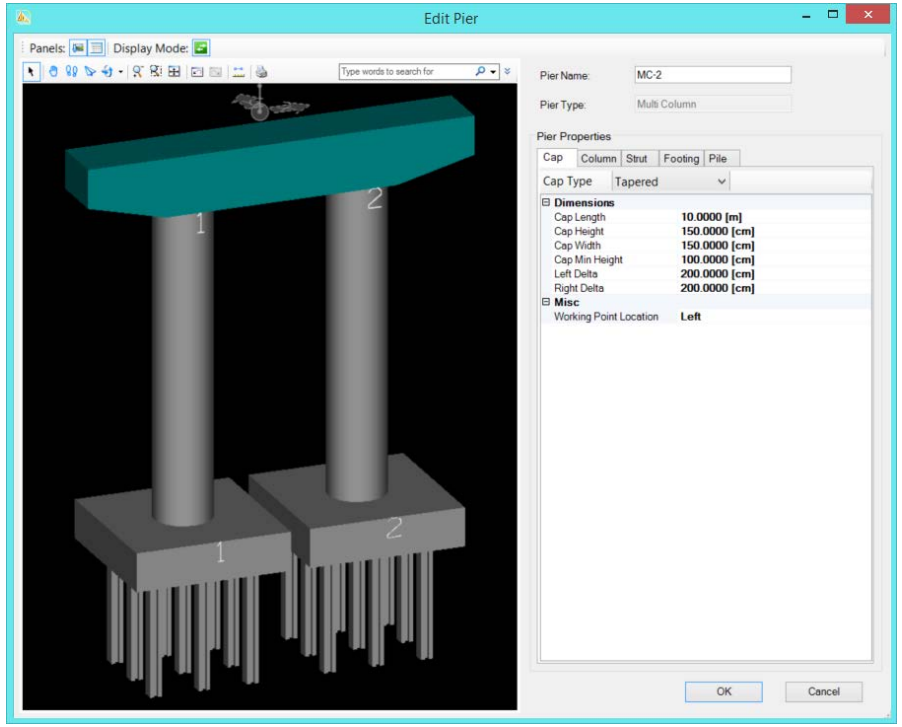
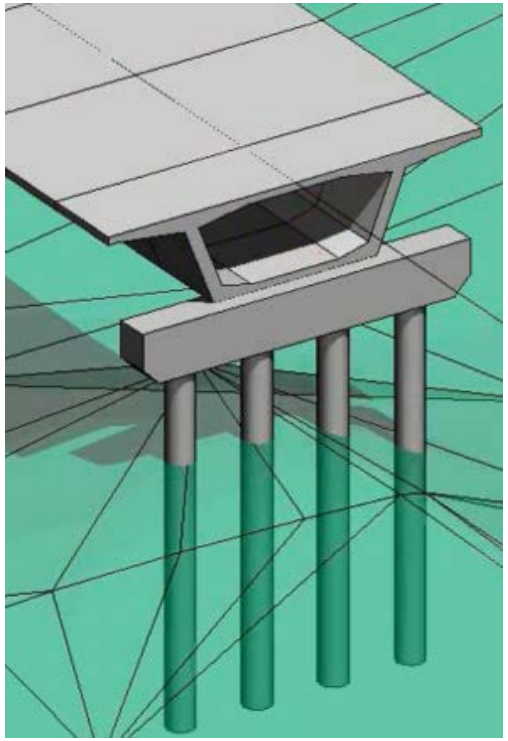
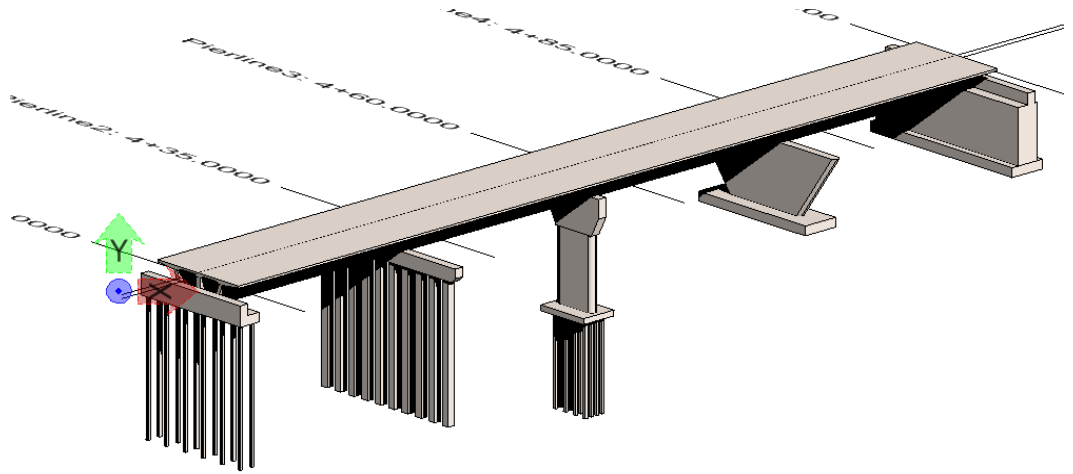
Substructure Modeling

- Abutments
  - Stem wall
  - Pile cap
  - User defined
- Piers
  - Wall piers
  - Multi-column piers
  - Hammer head piers
  - Pile bents
  - User defined







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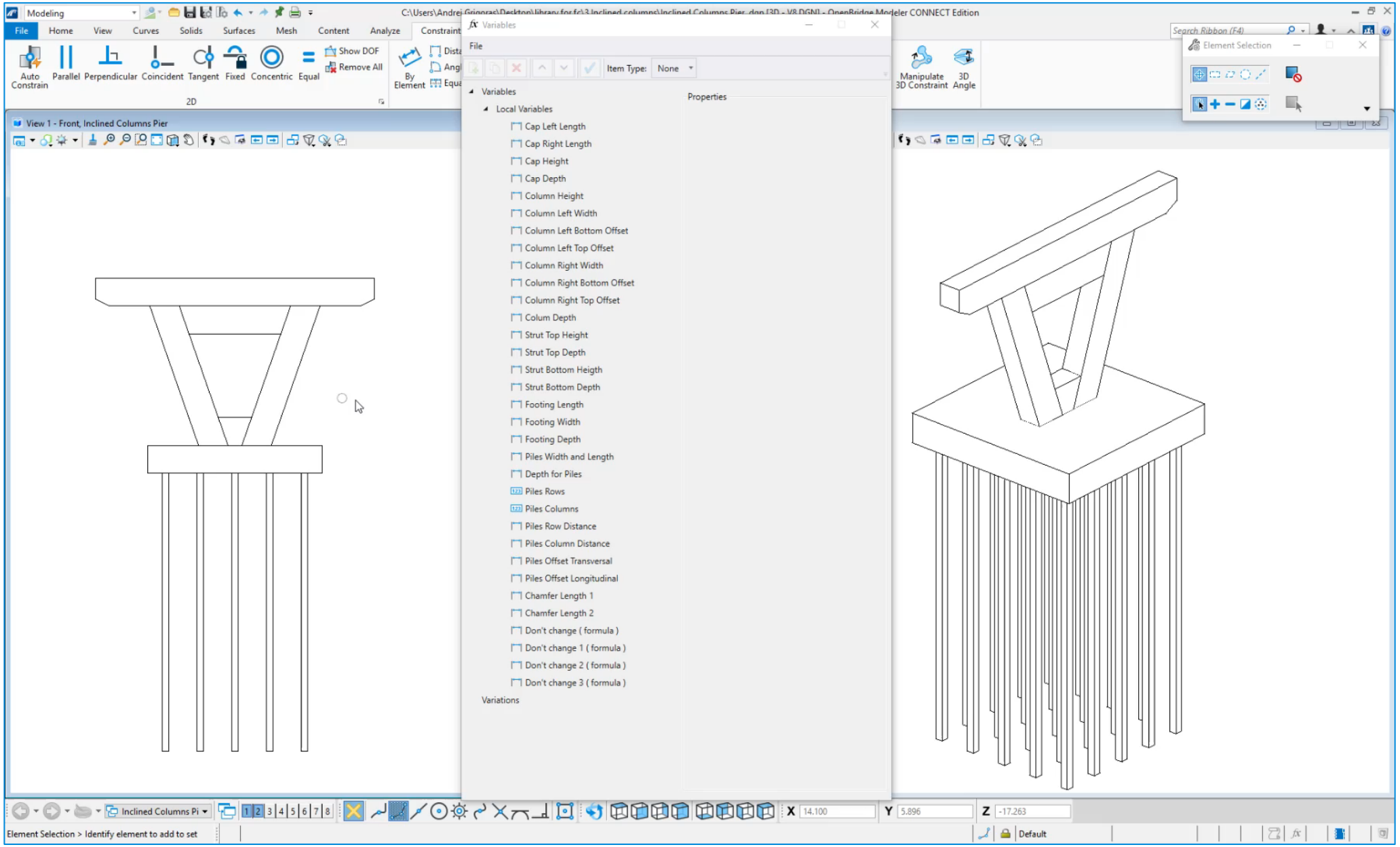
Substructure Modeling



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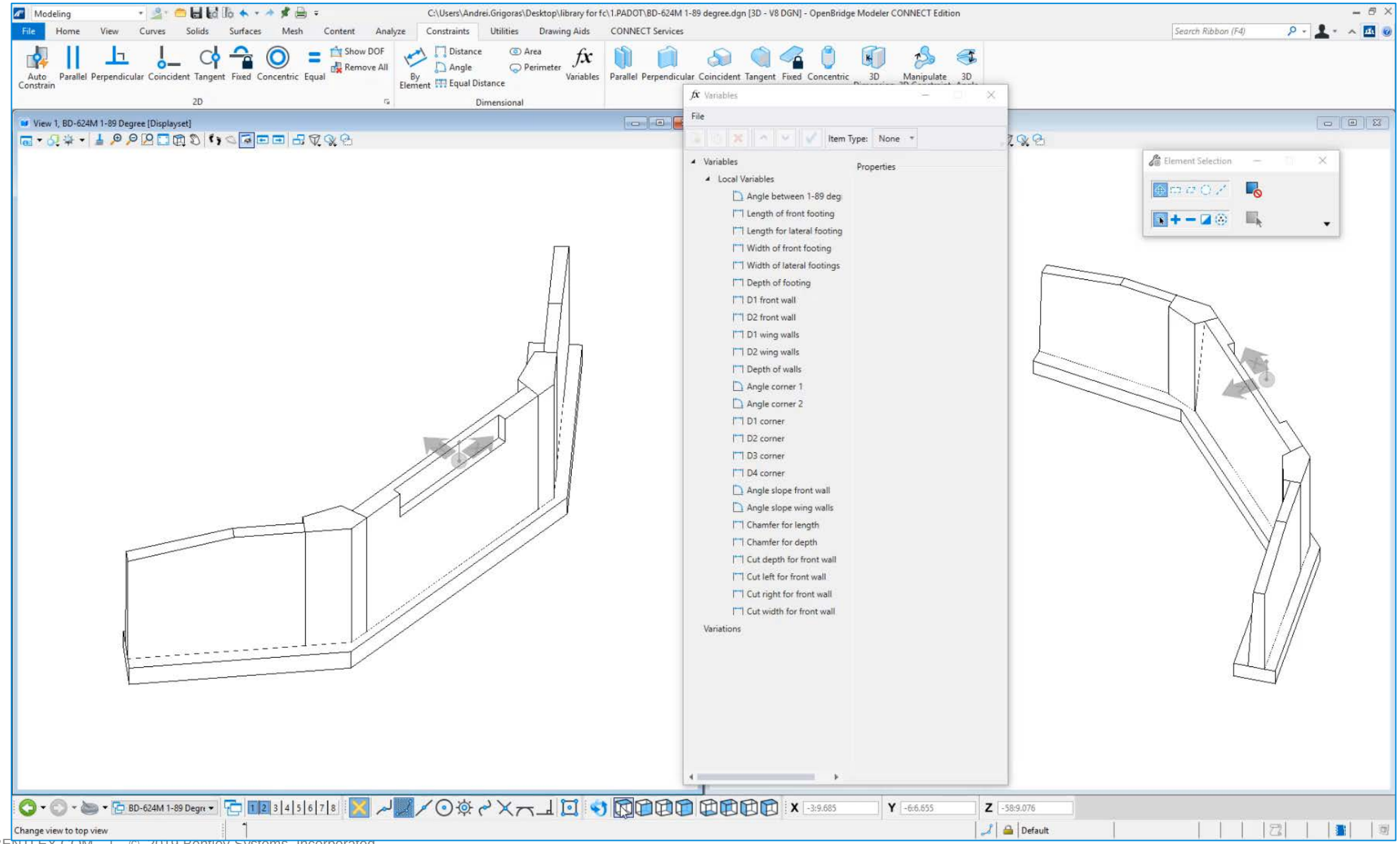
Substructure Modeling



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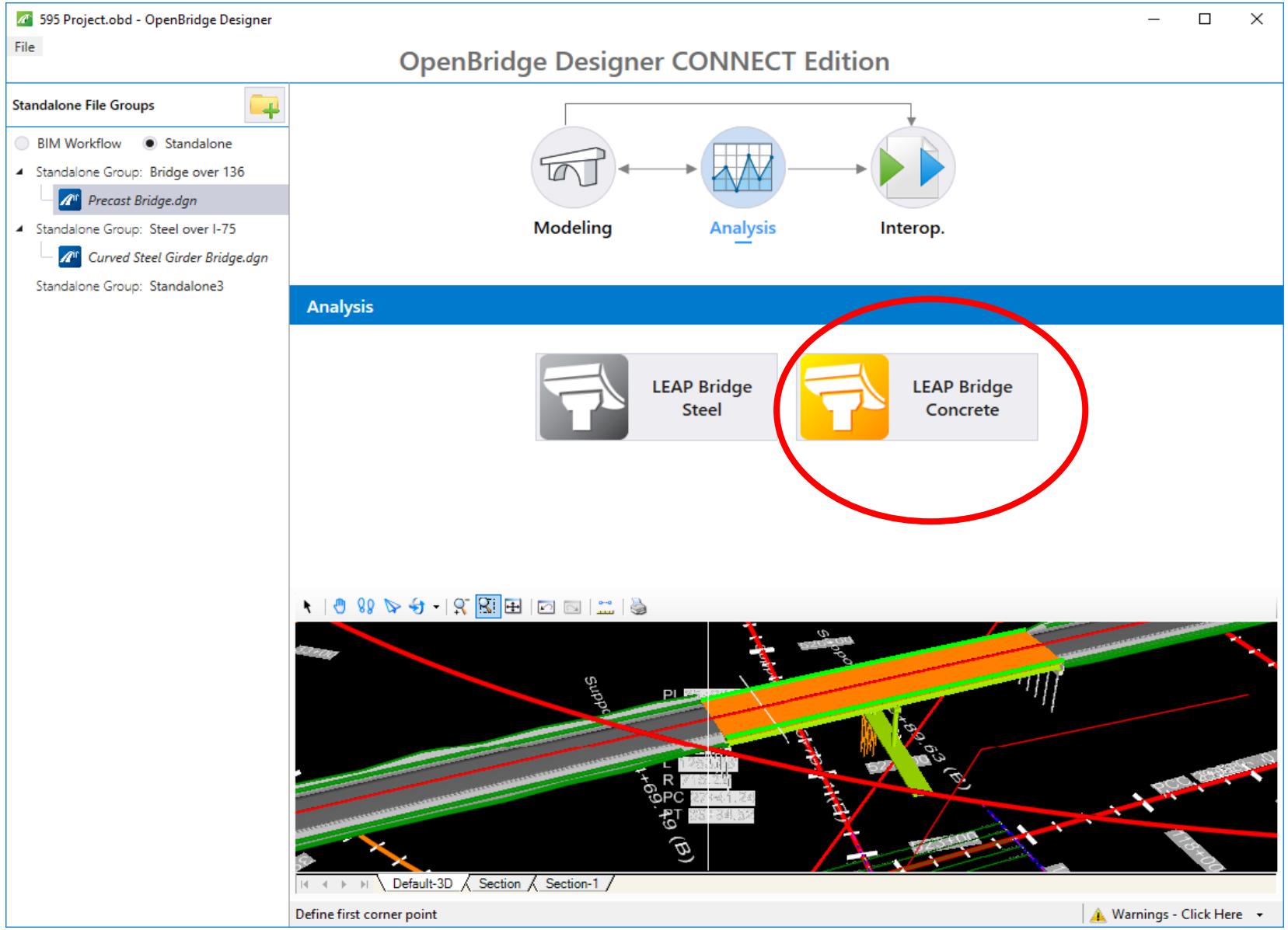
OpenBridge Designer Analytics Connection

- Direct links for Physical to Analytical model
- Bi-directional connectivity



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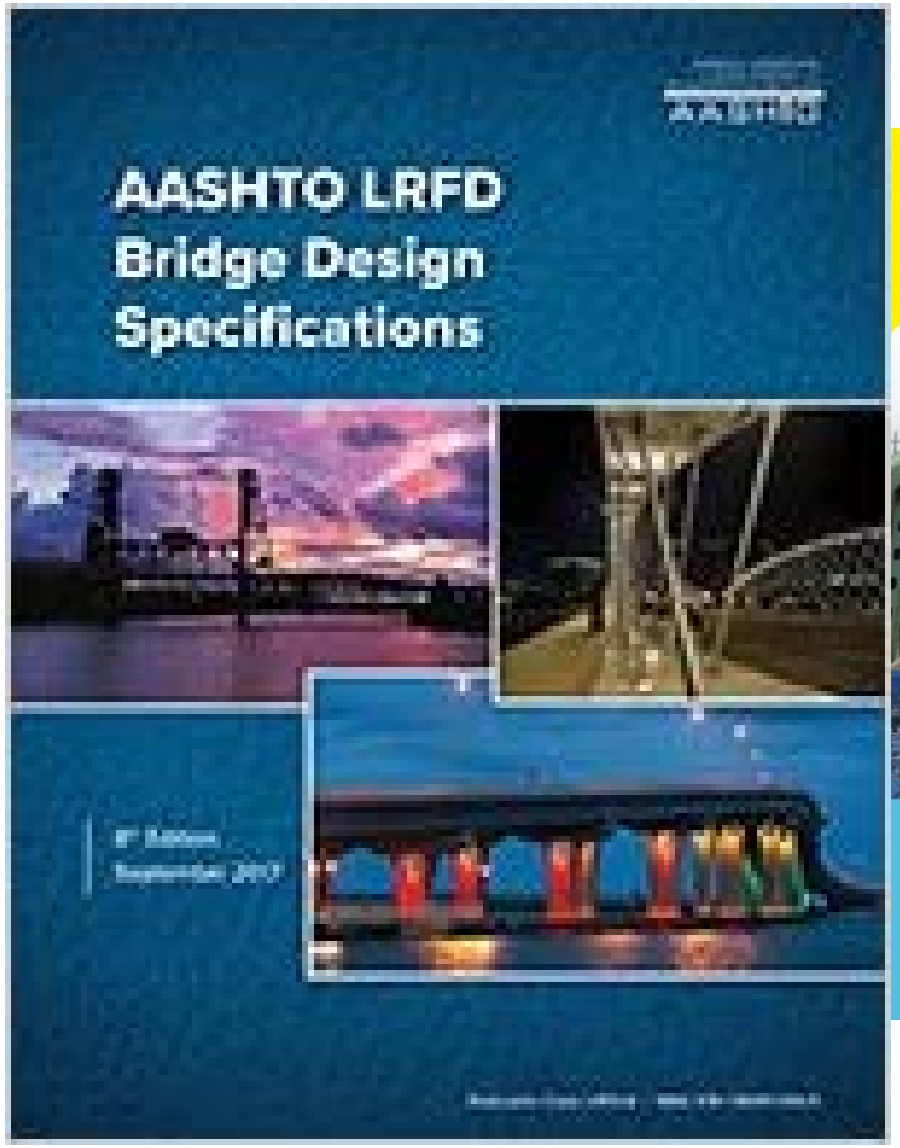
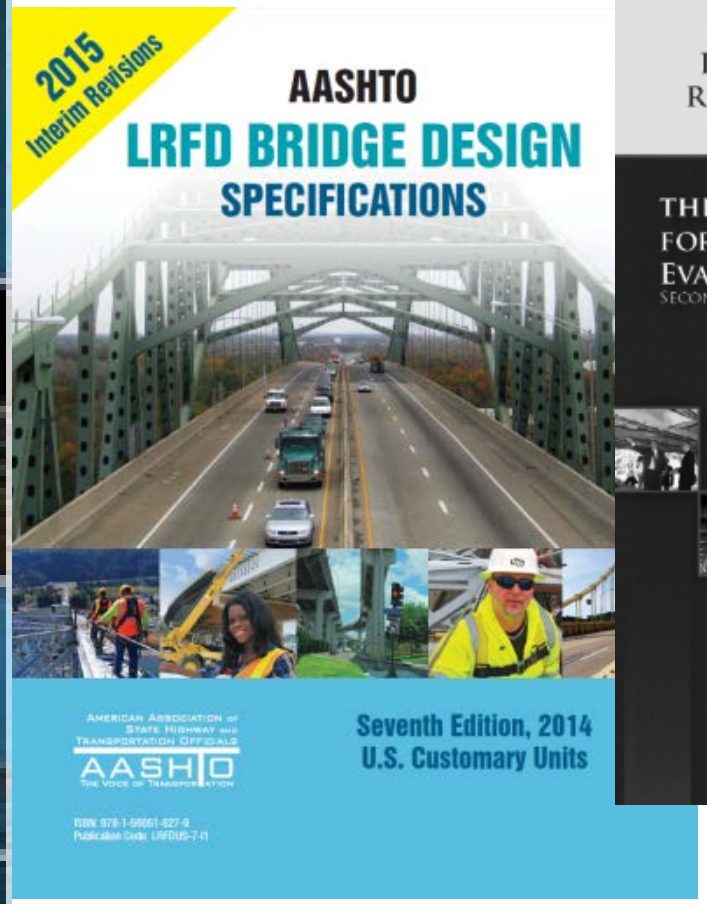
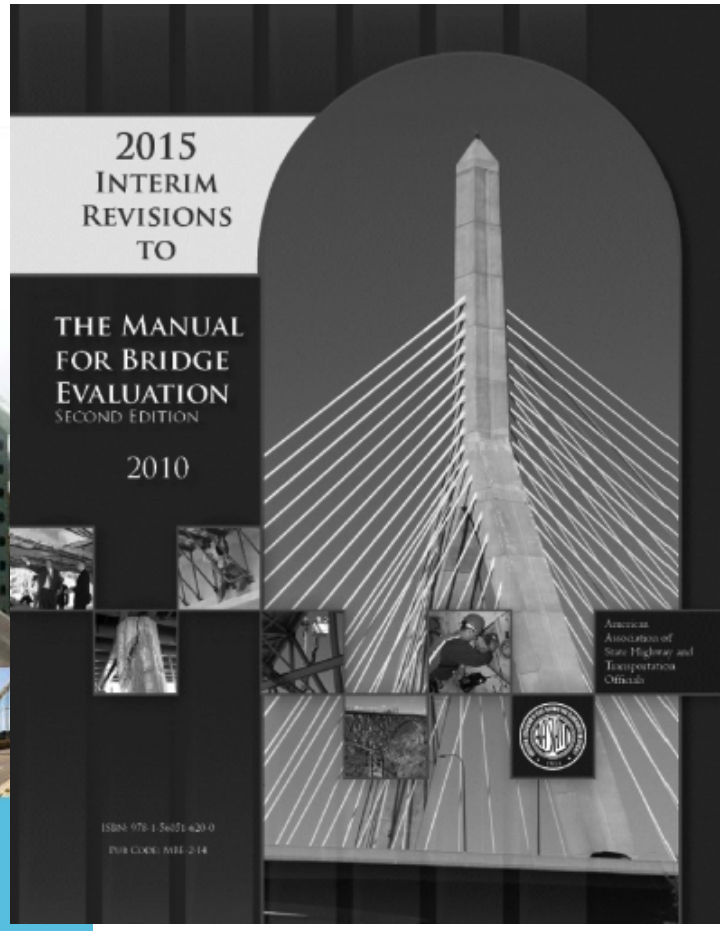
AASHTO LRFD 8th Edition







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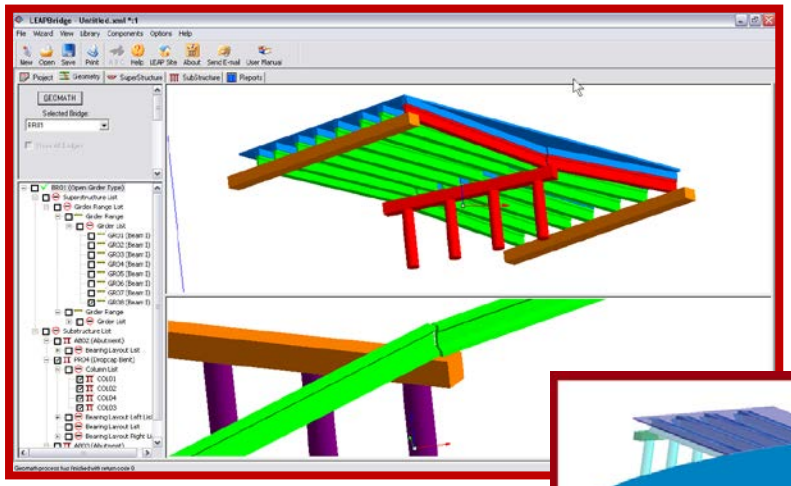
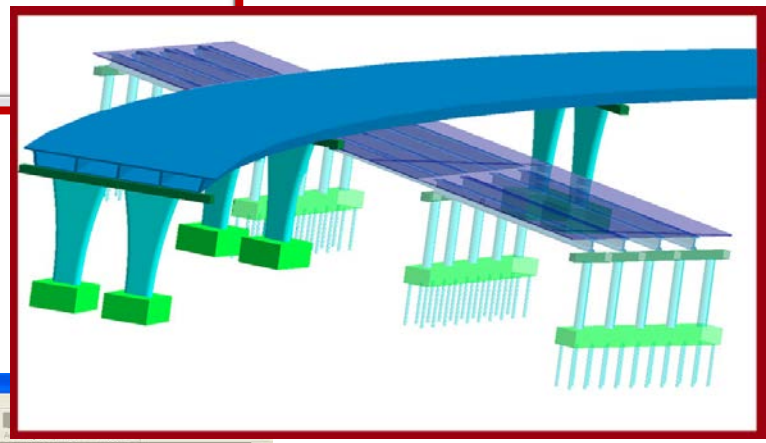
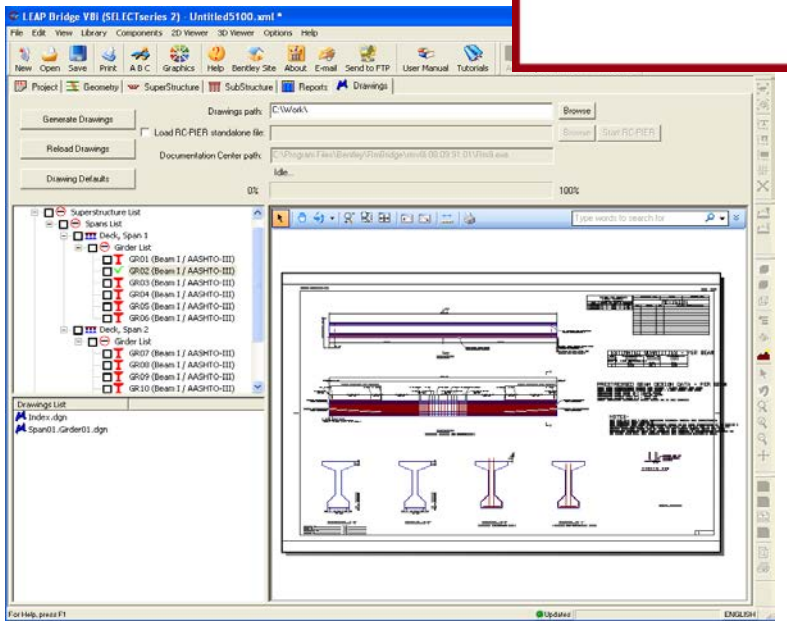
LEAP Bridge Concrete

- Create 3D Bridge Model
- Design and analyze concrete bridges
- Design and analyze superstructures
- Design and analyze substructures
- Visualize bridge designs
- Analyze and rate traffic loading
- Design and analyze spliced girder bridges
- Generate bridge project deliverables
- Coordinate multi-discipline bridge teams







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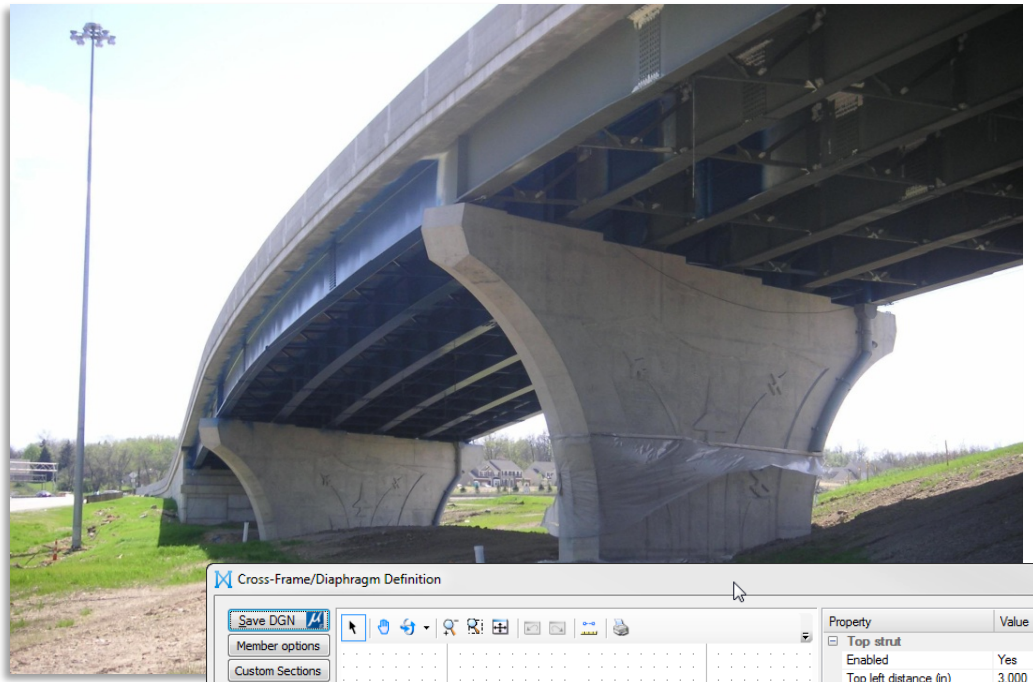
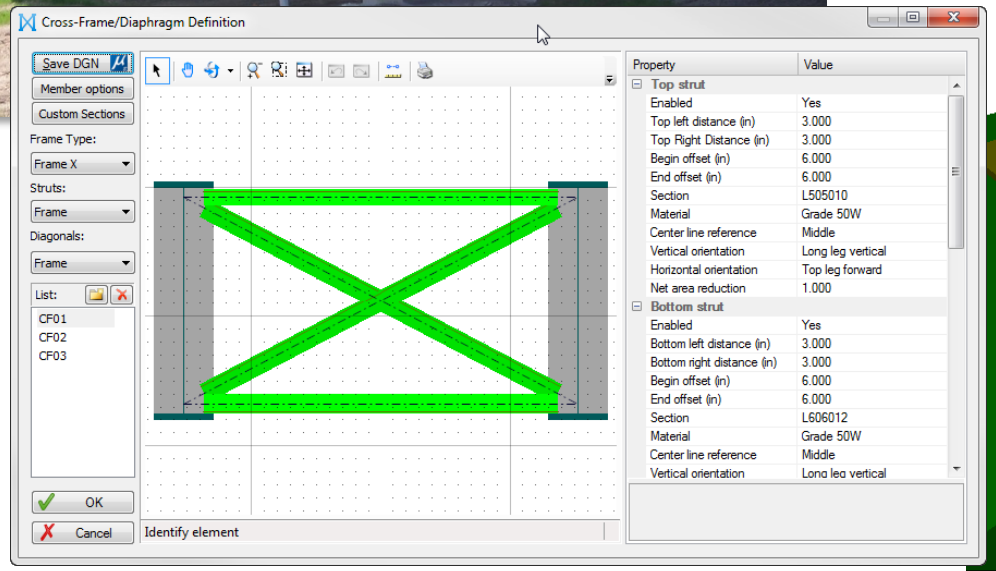
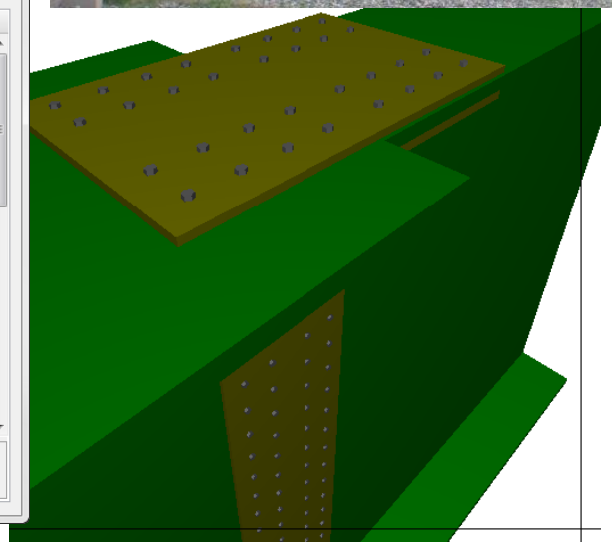
LEAP Bridge Steel

Modeling, design, analysis, and load-rating system for steel bridges







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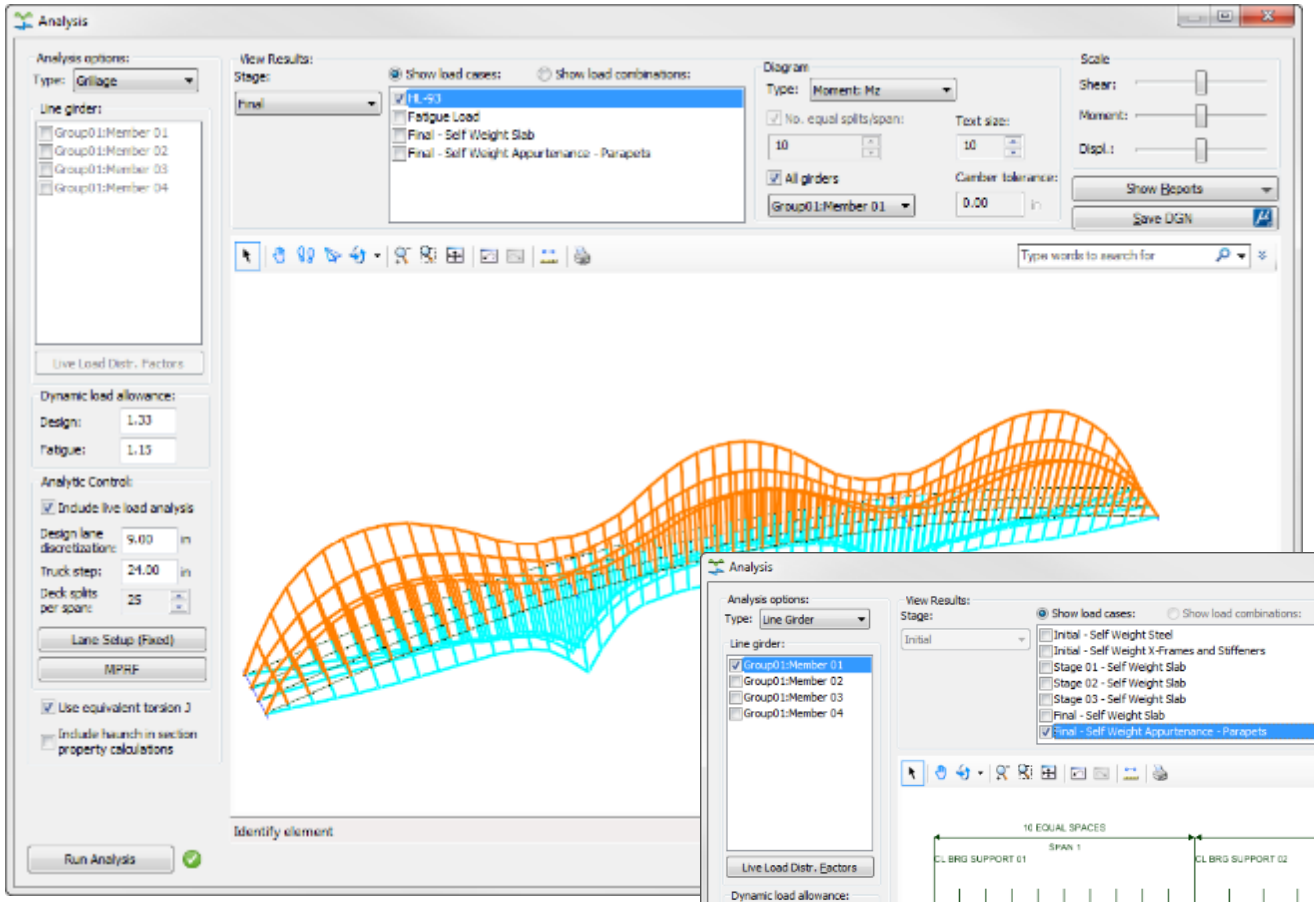
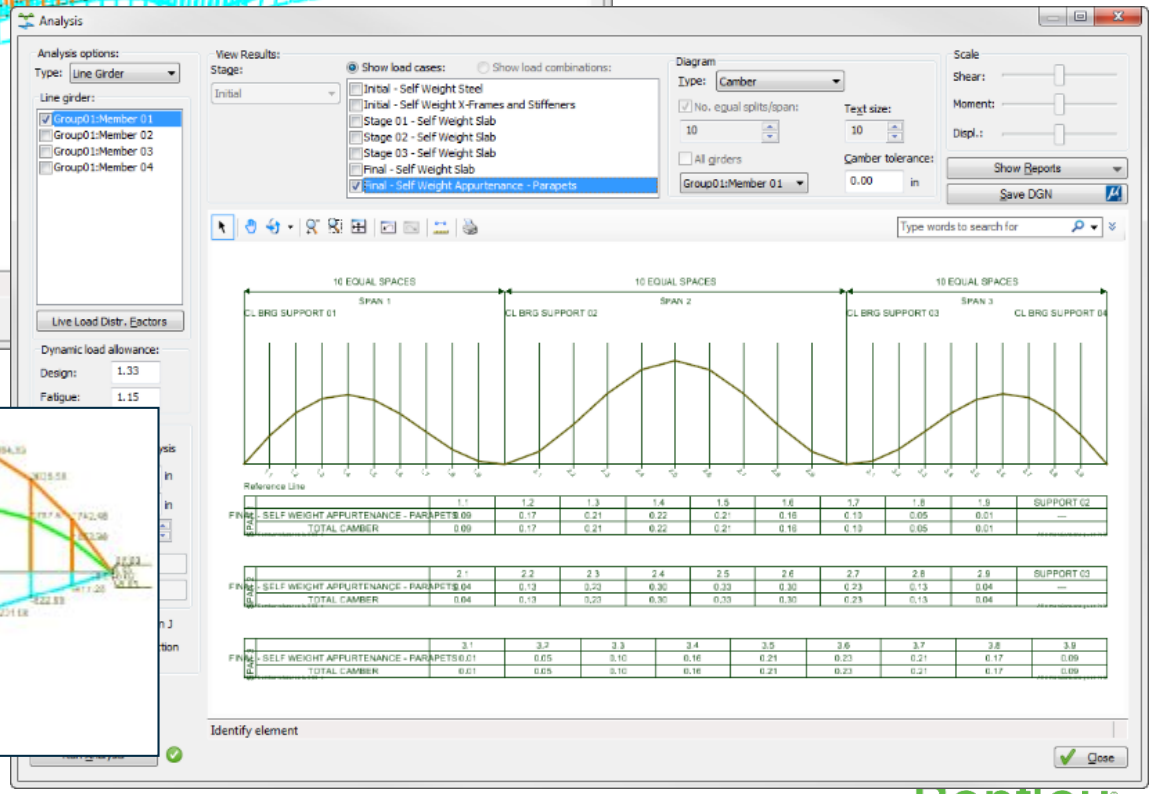
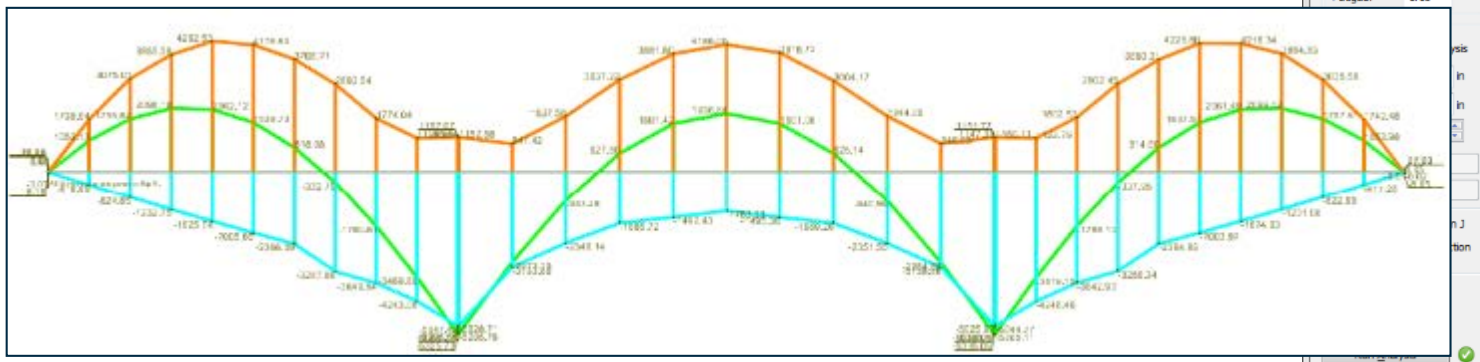
Steel Analysis

- Line girder, grillage and 3D finite element for I-girders
- 3D finite element for tub-girders







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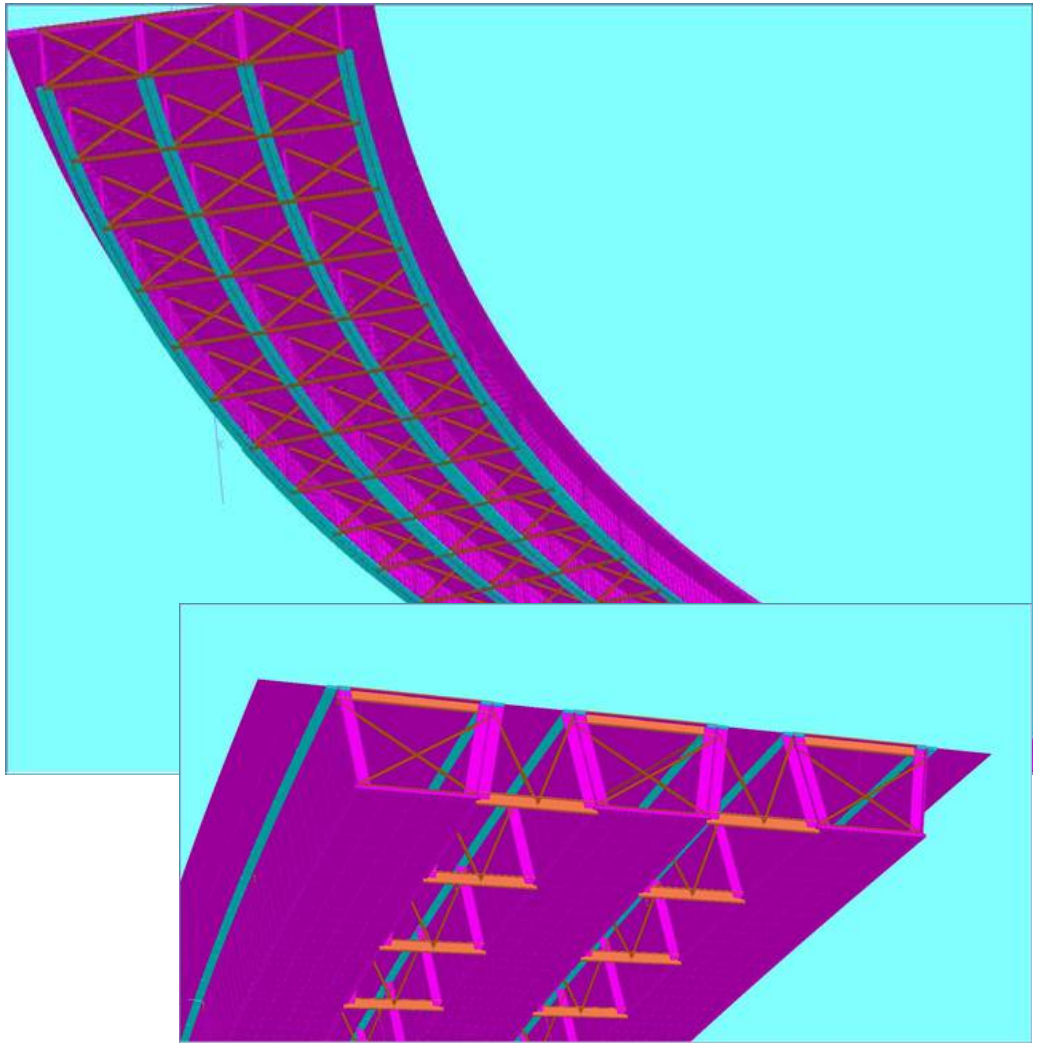
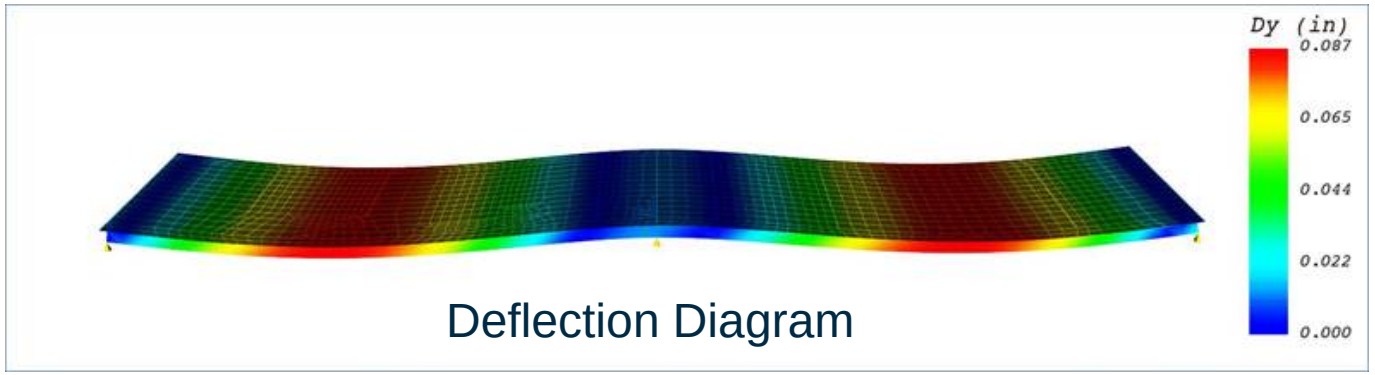
3D Finite Element Analysis

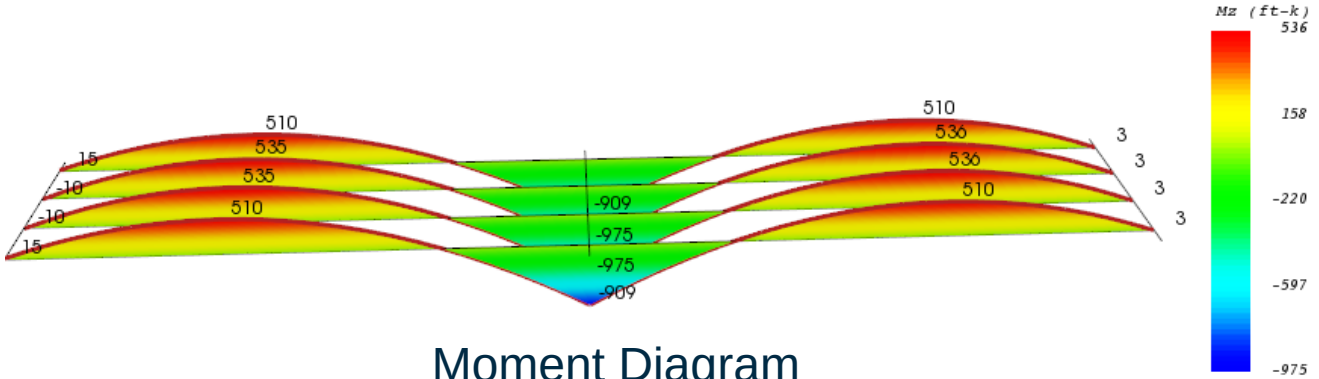
- Analytical Model



- Analysis Results



Deflection Diagram



Moment Diagram

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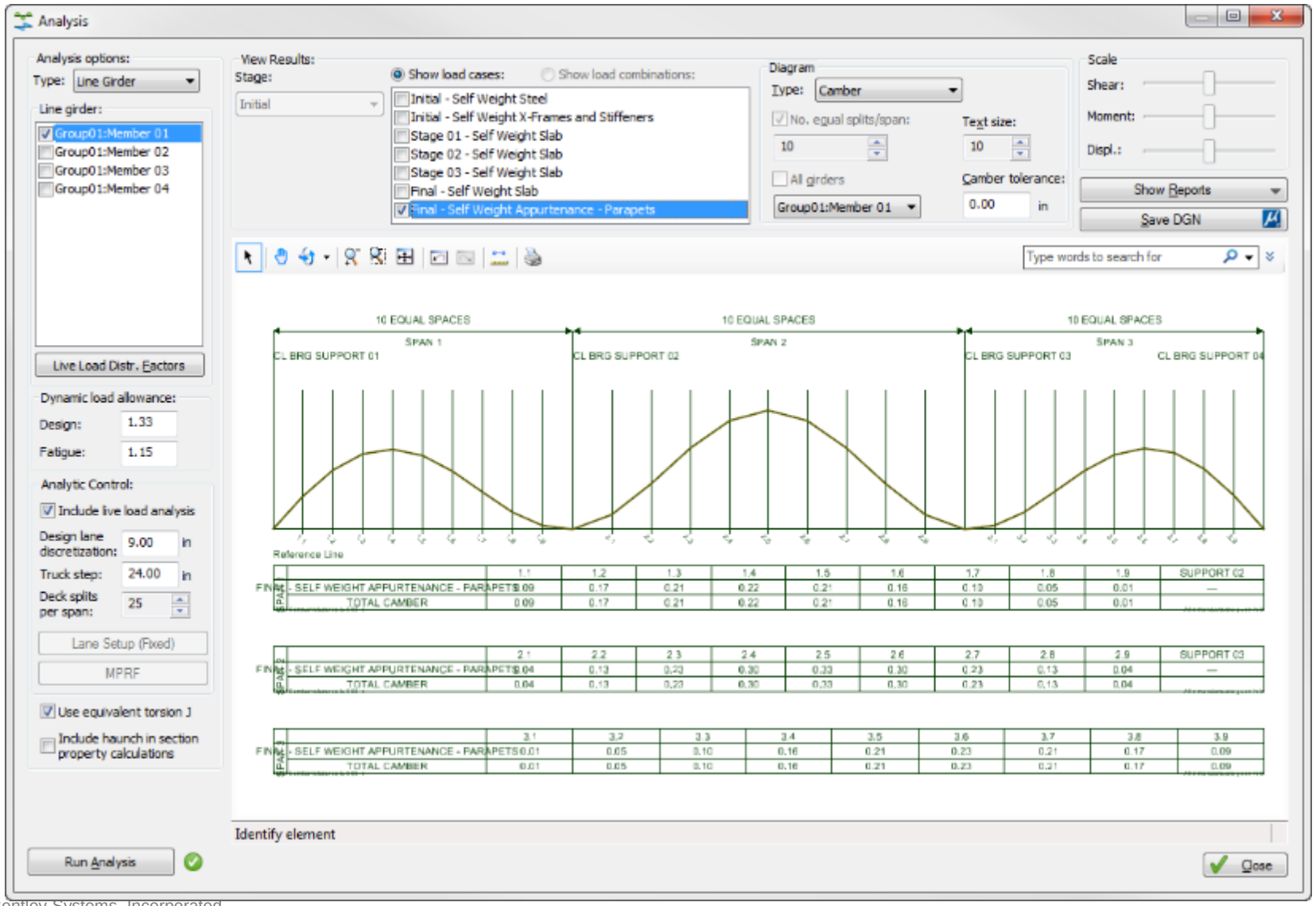
Camber Diagrams

- Generation of camber diagrams and the ability to export to a DGN file



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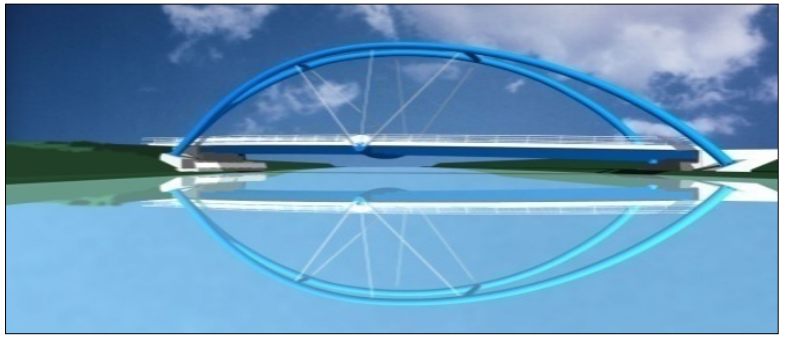
RM Bridge

- **All types of bridges**
  - Reinforced and pre-stressed concrete
  - Steel, concrete and composite
  - Cable-stayed bridges
  - Suspension bridges
  - Arch
  - Truss
- **Any erection method**
  - Span-by-span
  - Advanced shoring
  - Incremental launching
  - Balanced cantilever
  - Pre-cast segmental
- **International codes**



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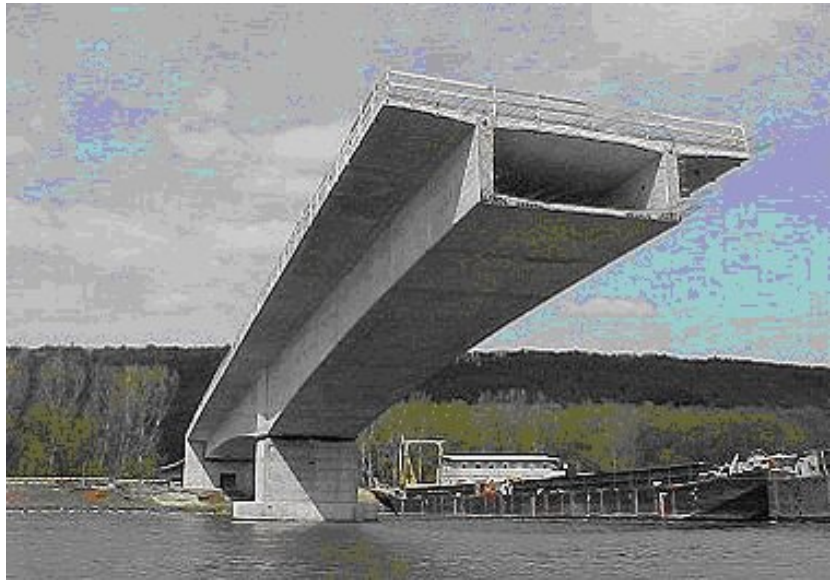
Complex Bridges

- Quickly create/update complex bridges using simple parameters
- Typical, pier, closure segments
- Flexible support for complex section variations
- Report segment weight, volume and surface area
- Full 3D model generated
- Send/Receive to RM Bridge for analysis and design



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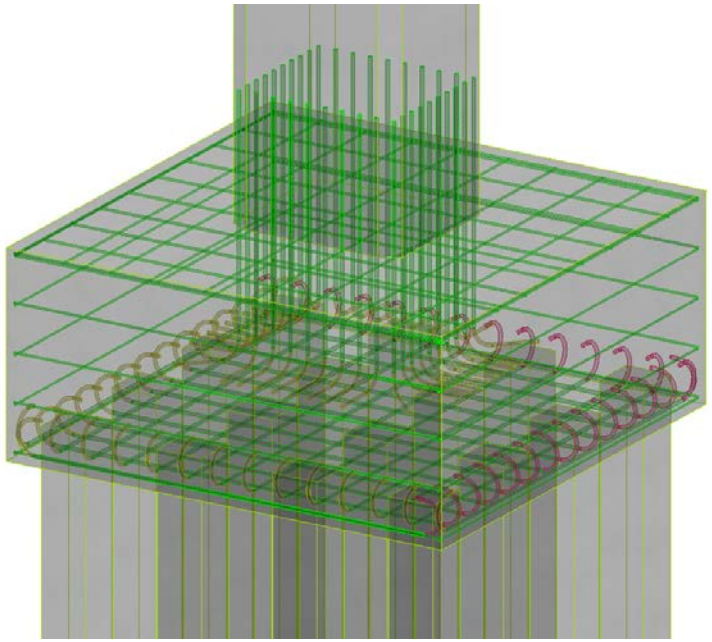
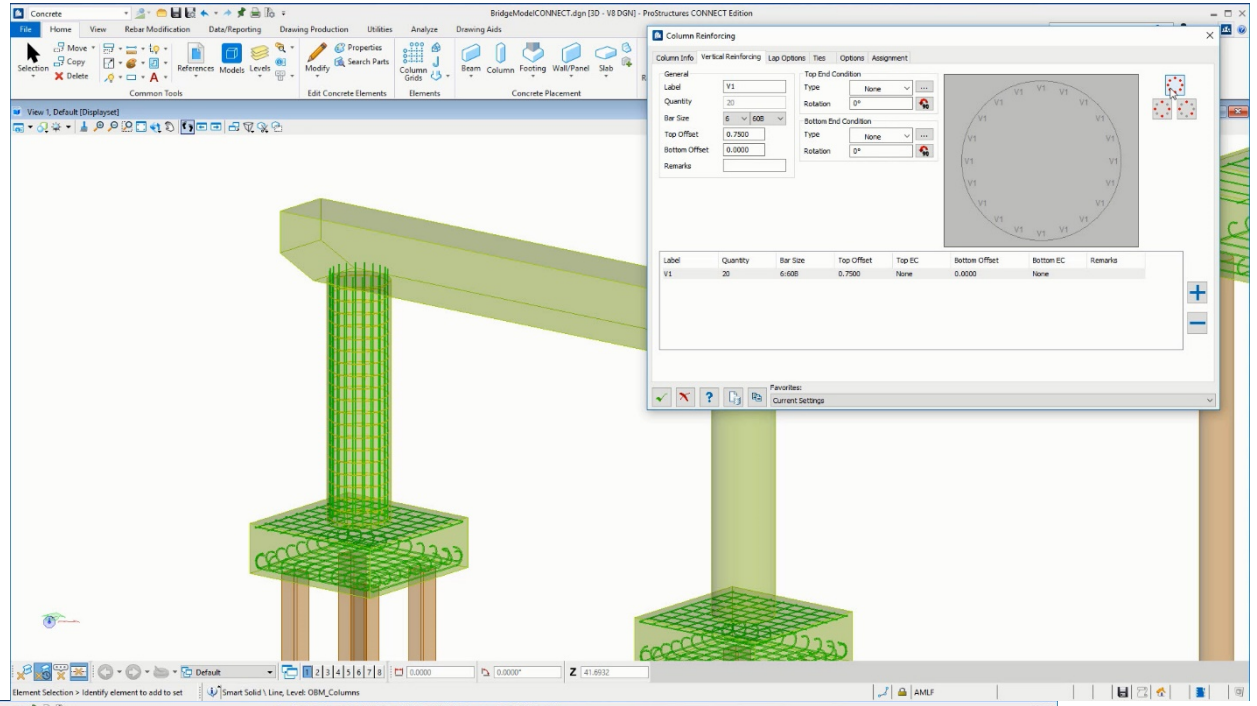
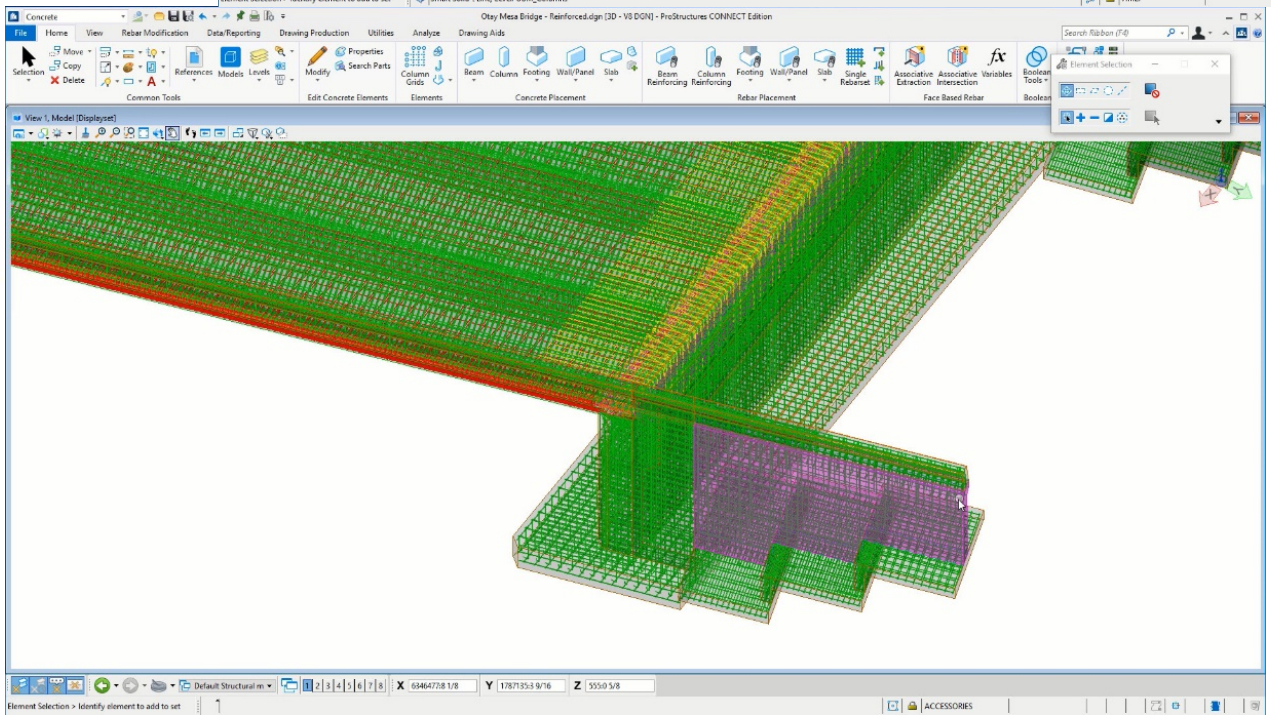
Integration with ProStructures

- Concrete objects are automatically recognized in ProStructures
- Reinforcing using ProConcrete tools and Dynamic Views to Label & Detail







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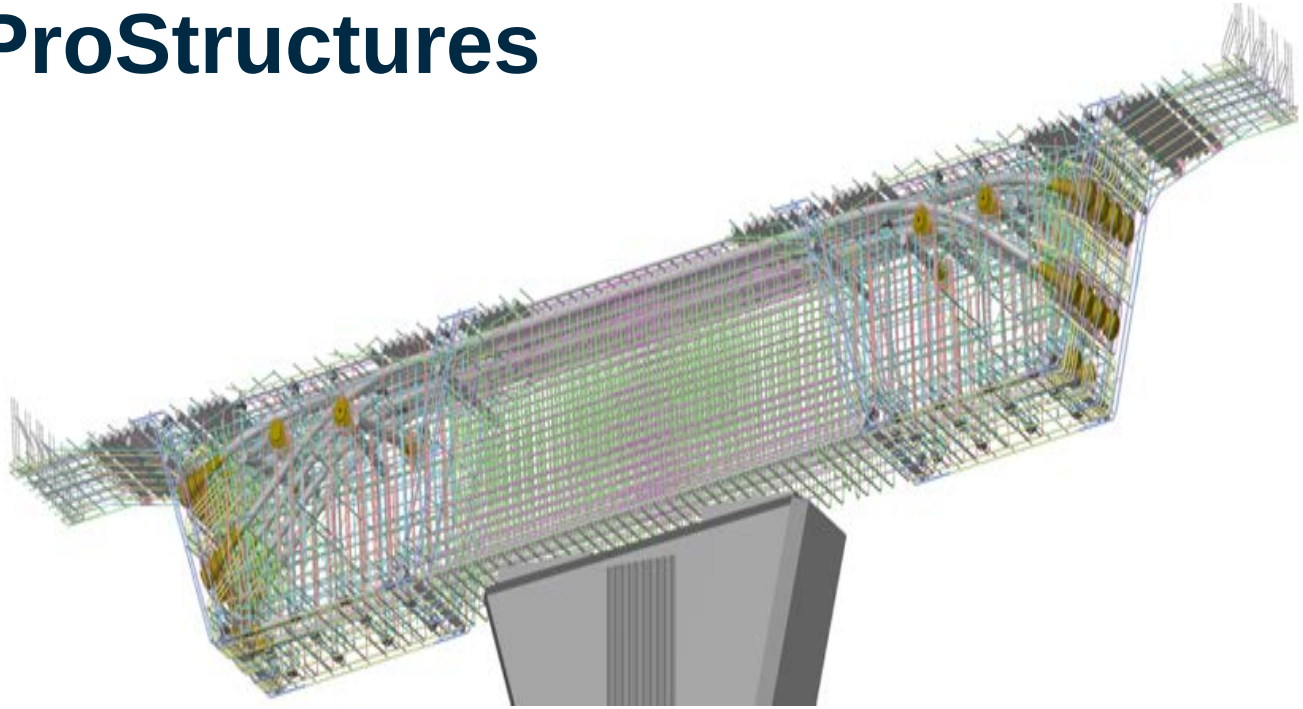
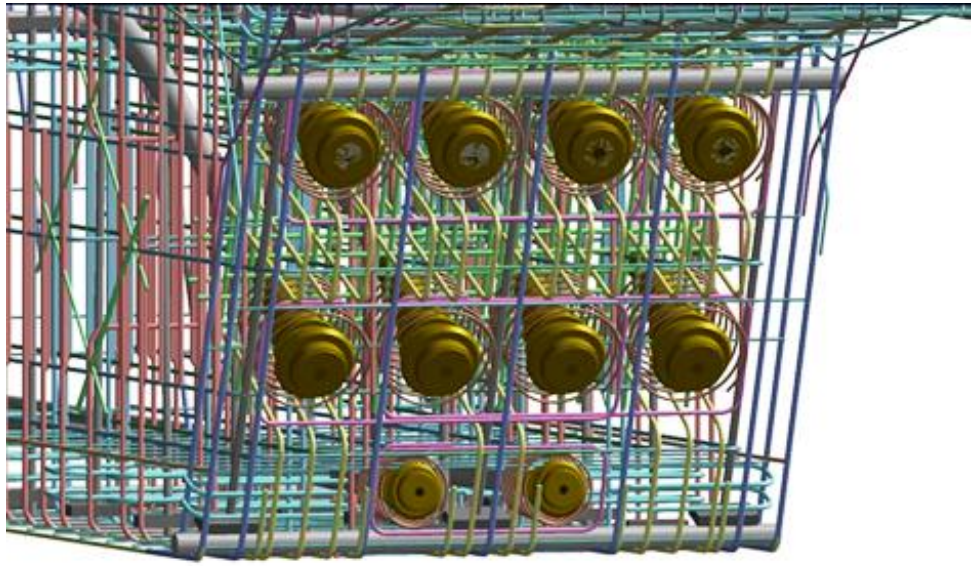
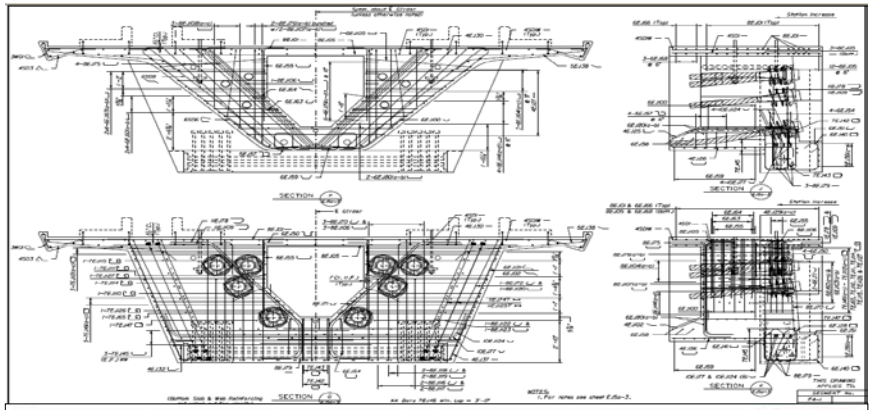
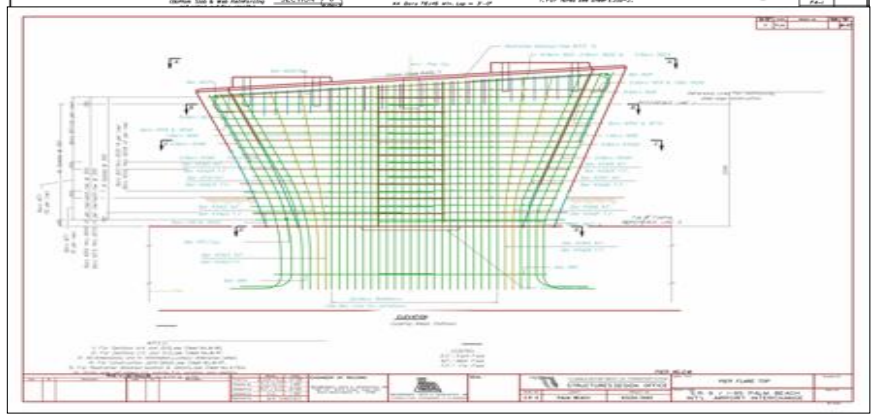
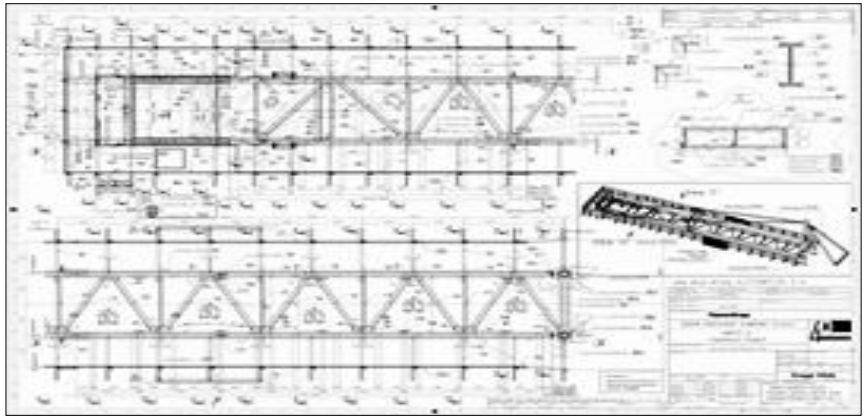
ProStructures











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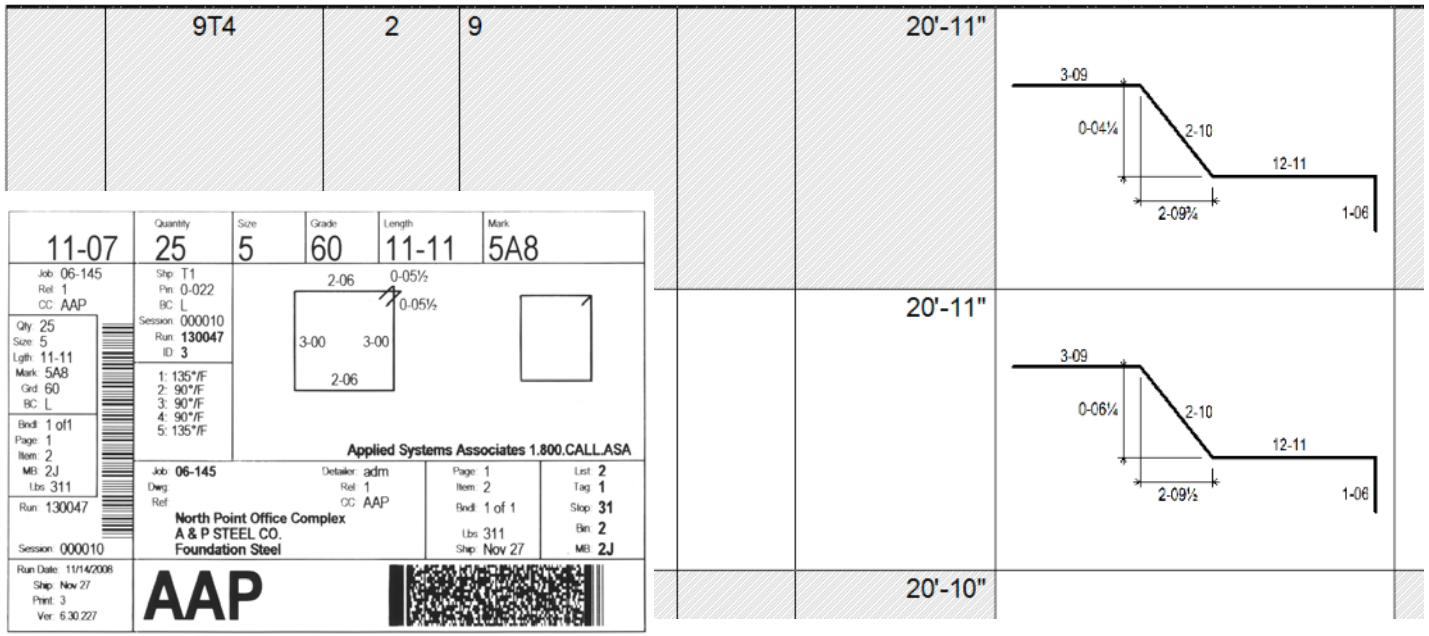
Bar Bending Schedules

- User-defined reports

Order Name:	Building Owner:		
Order	Bentley Systems		
Project Name:	Project:	Drawing Name:	Index:
ProStructures	Pro 001		
	Signed by:	Created at: Time:	19.5.2011 8:43 h

Colour	Bar Mark	Quantity	Product	E/R	Length	Bar Style	R
	9T4	2	9		20'-11"		
					20'-11"		
					20'-10"		



Concrete shapes report

Page 1

Project Name:	Project:	Drawing Name:	Index:
Training Project	2008-001	Platform	1
	Signed by: TZ/GJ/JB	Created at: Time:	23.6.2011 14:52 h

ObjectType	PosNum	Grade	Name	Qty	S.Area (SF)	Volume (Yd^3)	Weight (Lbs)	Height	Width	Length
Column	2	5000 psi	Concrete 1'-4"x1'-4"	1	40.9	0.46	1,808	1'-4"	1'-4"	7'
Column	2	5000 psi	Concrete 1'-4"x1'-4"	1	40.9	0.46	1,808	1'-4"	1'-4"	7'
Column	3	5000 psi	Concrete 1'-4"x1'-4"	1	30.2	0.33	1,292	1'-4"	1'-4"	5'
Footing	4	3000 psi	Footing	1	53.0	0.60	2,373	1'	2'	8'-2"
Footing	5	3000 psi	Footing	1	76.7	1.23	4,843	1'-4"	5'	5'
Footing	5	3000 psi	Footing	1	76.7	1.23	4,843	1'-4"	5'	5'
Footing	5	3000 psi	Footing	1	76.7	1.23	4,843	1'-4"	5'	5'
Footing	6	3000 psi	Footing	1	32.0	0.35	1,356	1'	2'	4'-8"
Footing	7	3000 psi	Footing	1	29.3	0.31	1,223	1'	2'	4'-3"
Footing	8	3000 psi	Footing	1	41.2	0.59	2,301	3'	2'	3'-11"
Panel	10	5000 psi	Panel	1	200.0	2.98	11,696	8'	1'	11'-6"
Panel	11	5000 psi	Panel	1	196.0	2.96	11,624	8'	1'	10'
Panel	12	5000 psi	Panel	1	157.8	2.33	9,154	8'	1'	7'-11"
Panel	13	5000 psi	Panel	1	103.0	1.44	5,666	6'	1'	6'-6"
Panel	9	5000 psi	Panel	1	338.0	5.35	21,000	10'	1'	14'-5"
Page totals:										
Quantity				15						
Volume						21.88	Yd^3			
Weight							85,830	Lbs		

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DOT Perspective

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Questions ???

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BIM for Bridges: OpenBridge Designer

Comprehensive Modeling and Design from Planning to Construction

Steve Willoughby
Senior Engineering Consultant

Bentley
Advancing Infrastructure