



Webinar : BIM in Structural Engineering

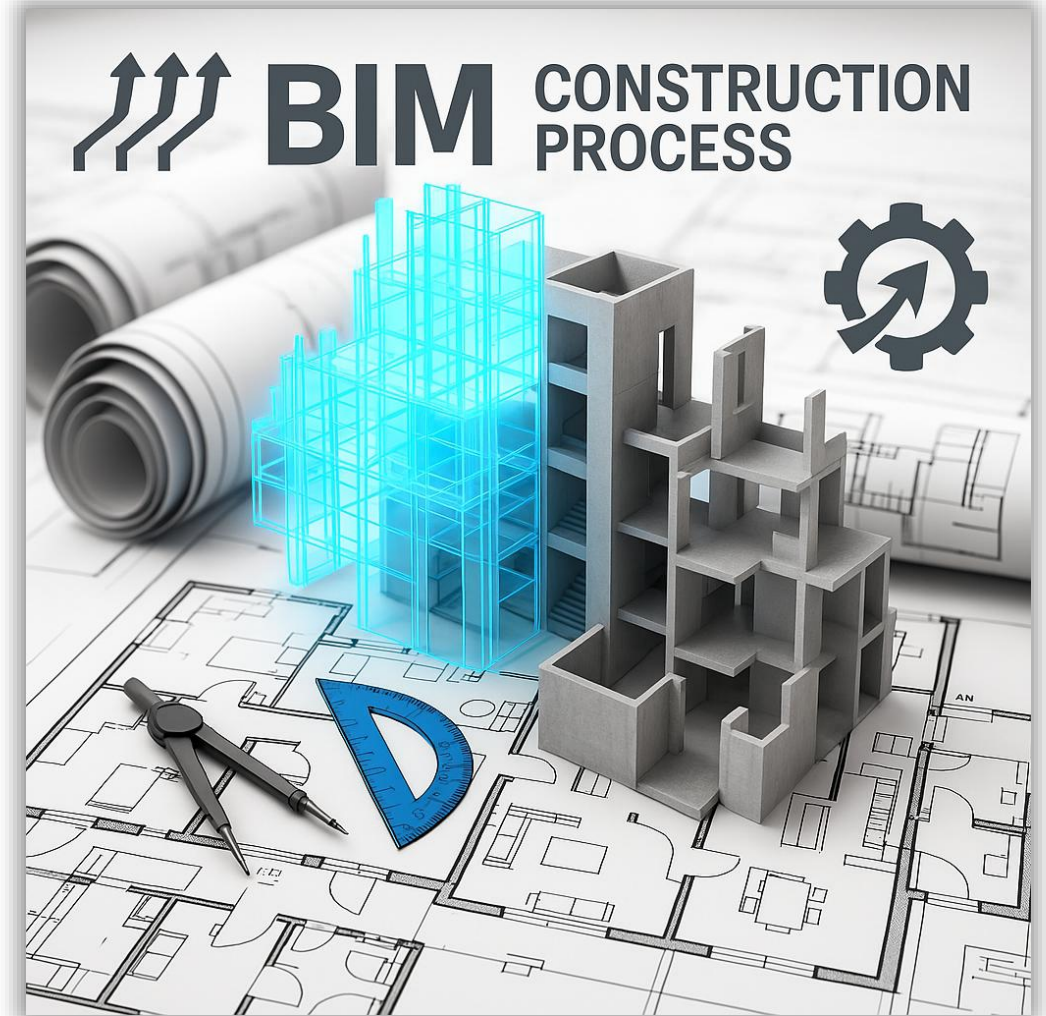
Biswa
Senior Structural Engineer / BENTLEY SYSTEMS

BIM

The Future of Smart Construction

What is BIM?

BIM (Building Information Modelling) is a digital process that involves creating and managing detailed 3D models of physical structures, such as buildings, bridges, roads, and other infrastructure. BIM integrates multidisciplinary data to represent not only the geometry of a structure but also its functional characteristics, lifecycle information, and various other attributes relevant to construction and operation.



BIM

The Future of Smart Construction

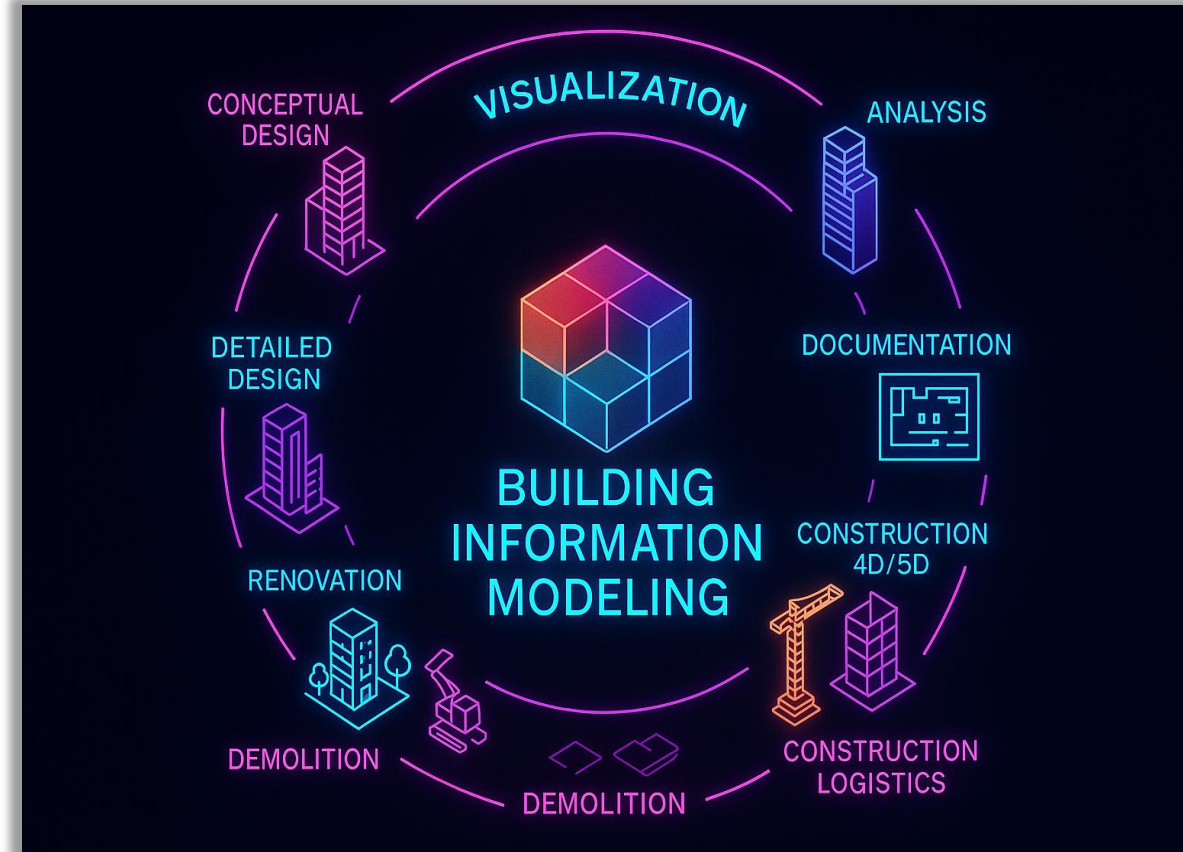
Key Aspects of BIM

- ✓ 3D Modeling : Detailed digital representation of physical and functional characteristics.
- ✓ Simulation & Analysis : Facilitates energy, structural, and environmental performance evaluations.
- ✓ Collaboration : Shared platform for architects, engineers, contractors, and owners to work together seamlessly.
- ✓ Lifecycle Management : Supports design, construction, operation, and decommissioning.
- ✓ Interoperability : Enables seamless data exchange between tools and stakeholders.



BIM

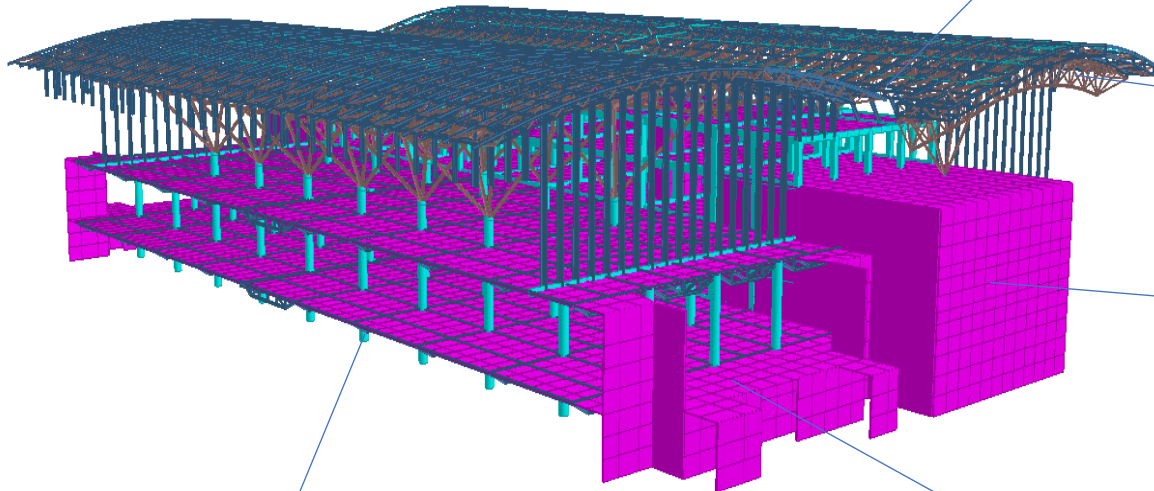
The Future of Smart Construction



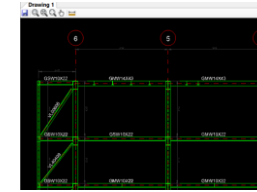
Data Exchange **without** iTwin Analytical Synchroniser

Why Structural WorkSuite ?

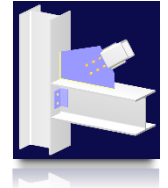
STAAD
2024



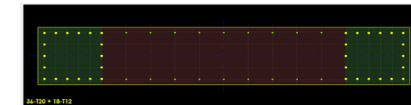
Autodrafter



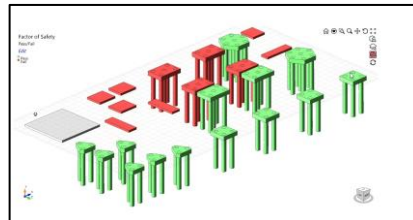
RAM Connection



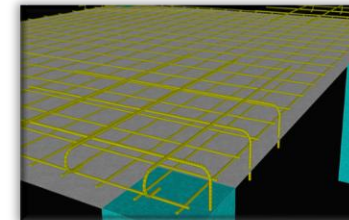
RCDC



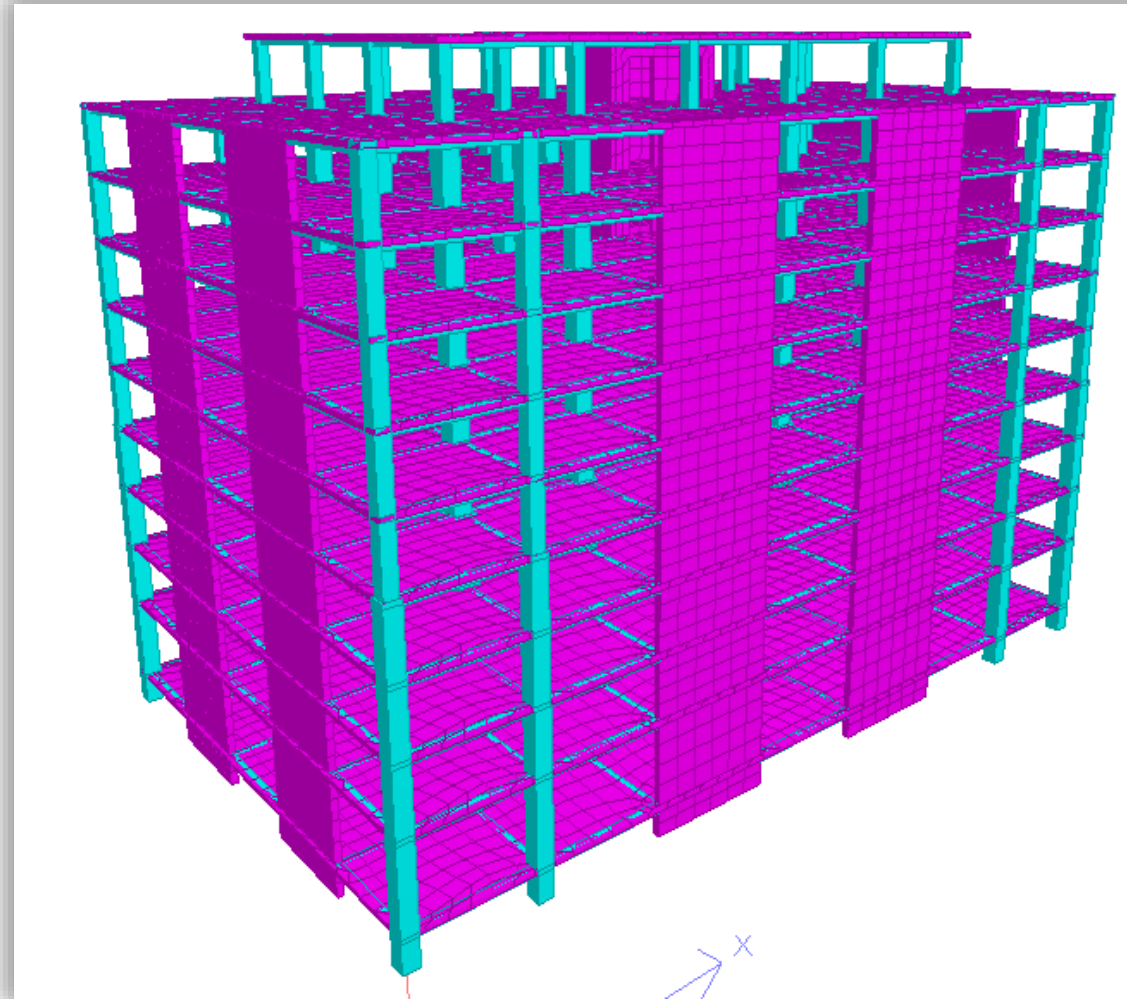
SFA 2024



RAM Concept



STAAD Model



Data Exchange with STAAD

Import



DXF (*.dxf)

Create a new model of beams/plates/solids from the objects in a DXF file.



CIS/2 (*.stp)

Analytical model per the LPM6 Structural Frame schema

Export



ADINA (*.in)

Export to ADINA-IN command input format



CIS/2 (*.stp)

Analytical model per the LPM6 Structural Frame schema



3D DXF (*.dxf)

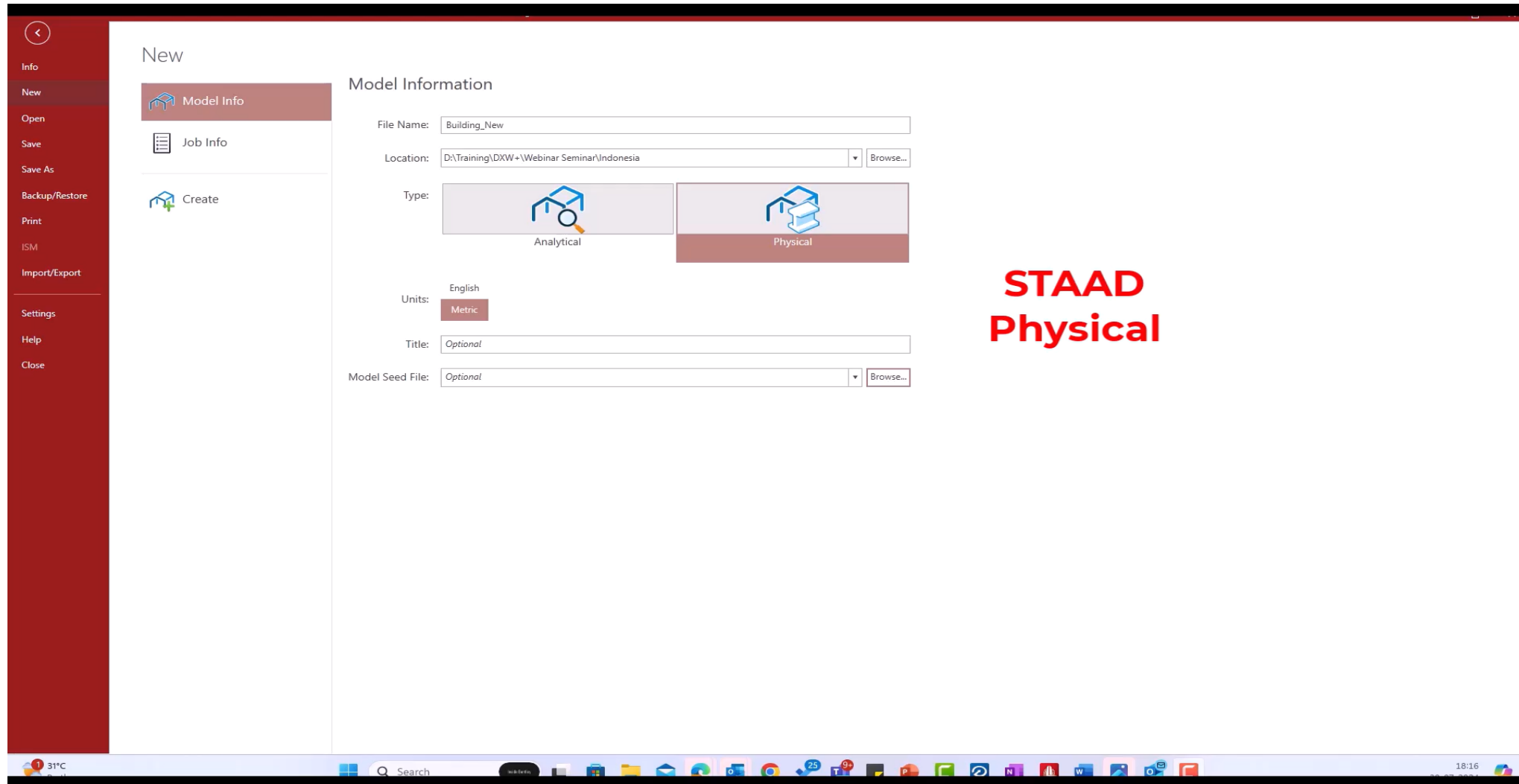
Create a 3D wireframe model of beams/plates



2D DXF (*.dxf)

Create a 2D cross section through the model in a given plane

Import from OBD to STAAD



STAAD to Advanced Concrete Designer

Autorecovery On | bkkk1.STD - STAAD.Pro Advanced 2023

File | Geometry | View | Select | Specification | Loading | Analysis and Design | Utilities

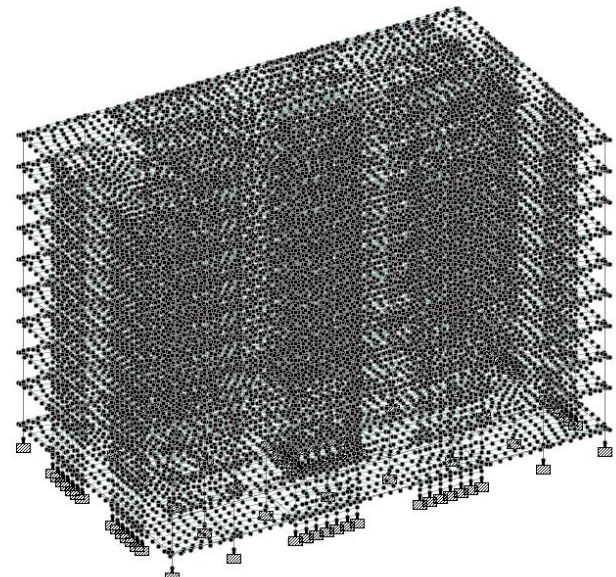
Clipboard | Structure | Node | Beam | Plate | Solid | Physical Member | Composite Deck

Workflow

- Analytical Modeling
- Physical Modeling
- Piping
- Postprocessing
- Foundation Design
- Steel AutoDrafter
- Chinese Steel Design
- Connection Design
- Advanced Concrete Designer
- Advanced Slab Design
- Earthquake
- Reports

Analytical Modeling: Geometry | Properties | Materials | Specifications | Supports | Loading | Analysis | Design

bkkk1.STD - Whole Structure



bkkk1.STD - Nodes

Node	X m	Y m	Z m
321	0.000	8.520	0.0
322	0.000	10.020	0.0
323	0.000	8.520	-25.0
324	0.000	10.020	-25.0
325	6.000	8.520	0.0
326	6.000	10.020	0.0
327	6.000	8.520	-5.0
328	6.000	10.020	-5.0
329	6.000	8.520	-10.0
330	6.000	10.020	-10.0
331	6.000	8.520	-15.0
332	6.000	10.020	-15.0
333	6.000	8.520	-20.0
334	6.000	10.020	-20.0
335	6.000	8.520	-25.0

bkkk1.STD - Beams

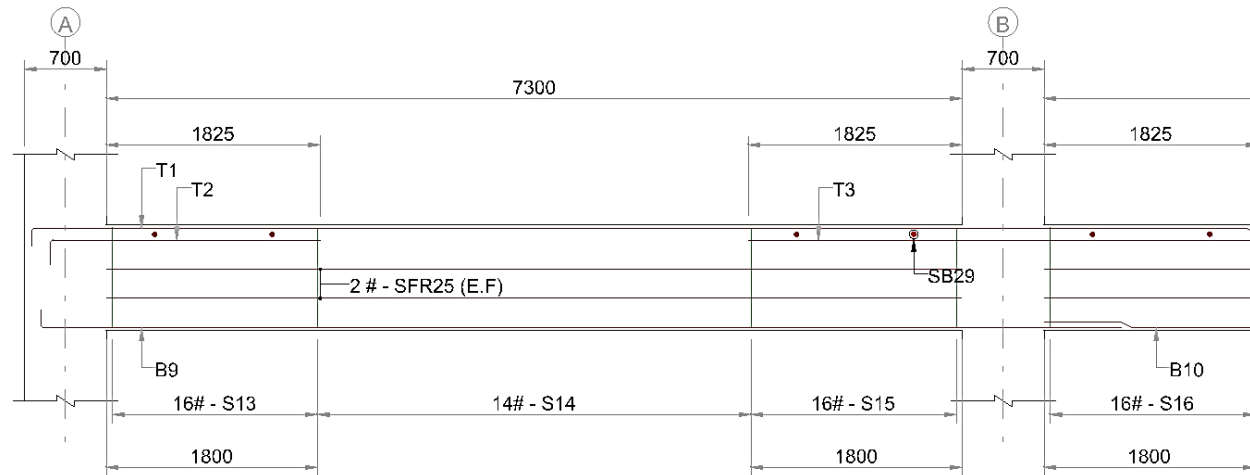
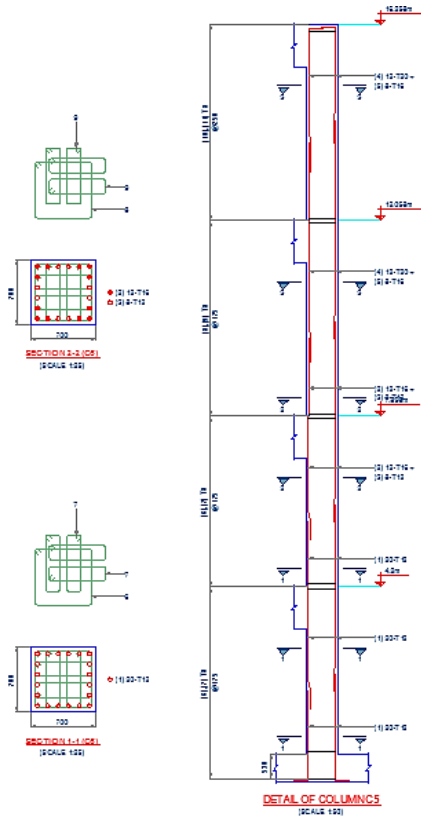
Beam	Node A	Node B	Property R
161	321	1323	11
162	323	1069	11
163	325	1744	11
164	327	1559	12
165	329	2281	12
166	331	1779	12
167	333	1605	12
168	335	1358	11
169	337	2066	12
170	339	2113	12
171	341	2232	12
172	343	1785	12
173	345	2062	12
174	347	1199	12
175	349	1192	12

Load 1

For Help, press F1 | Analytical Modeling Workflow | Load : 1: SEISMIC X | Input Units : kN-m

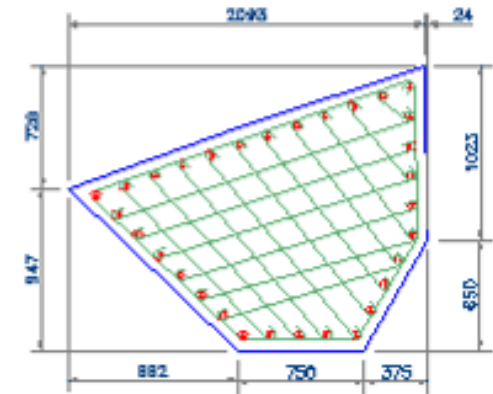
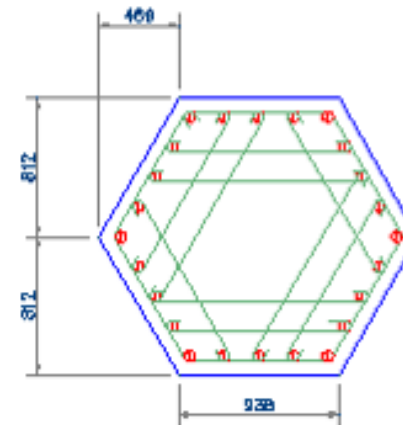
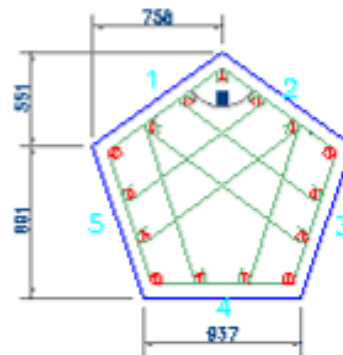
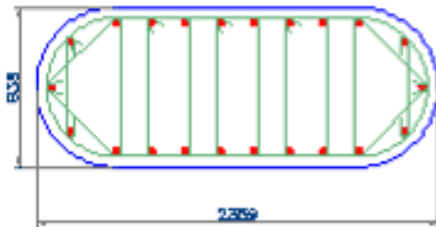
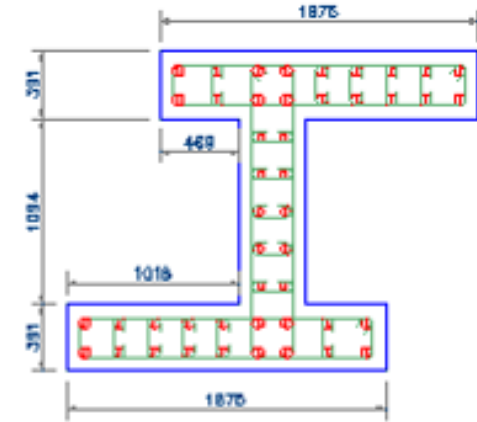
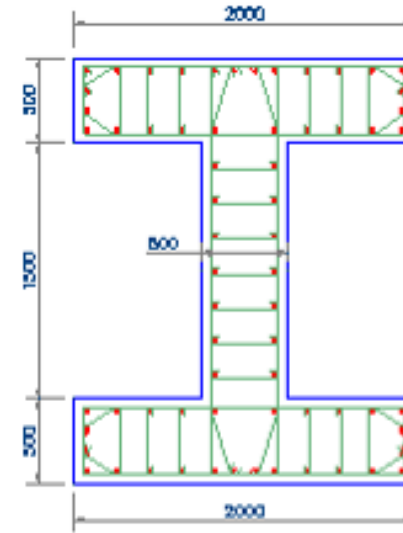
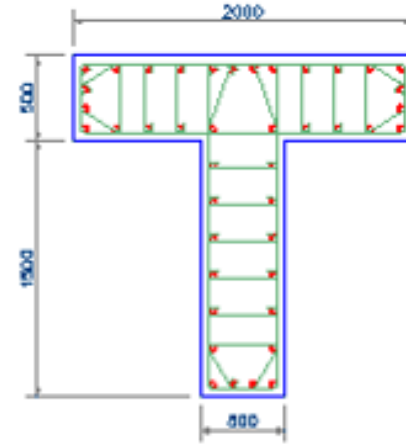
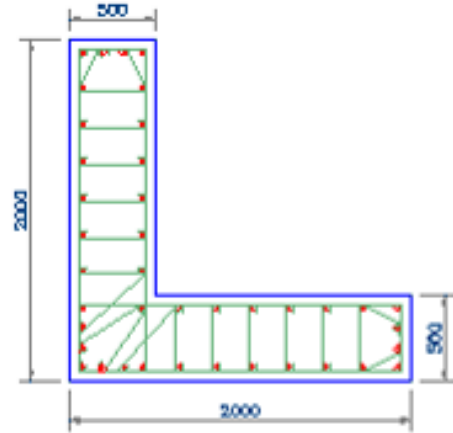
ENG | 00:27 | 26-07-2024

Drawing and bending detail

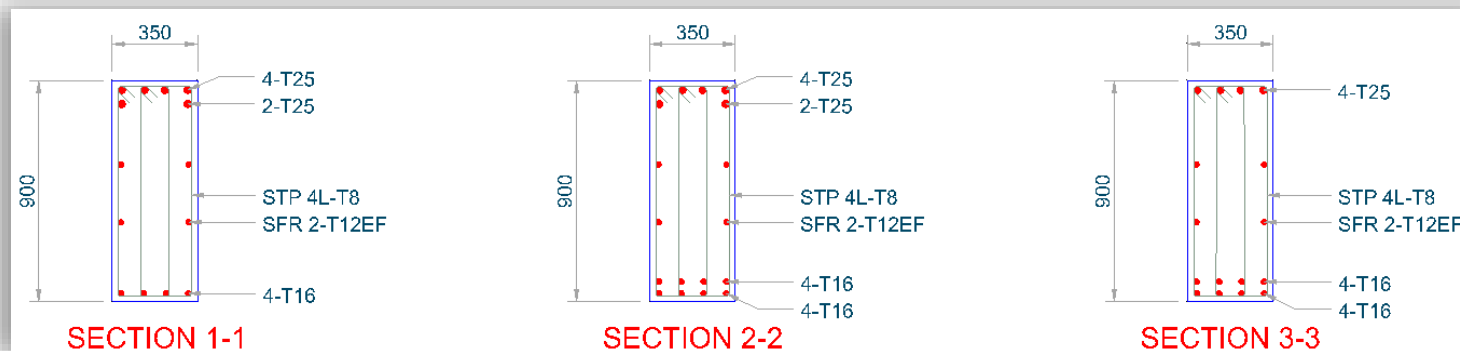
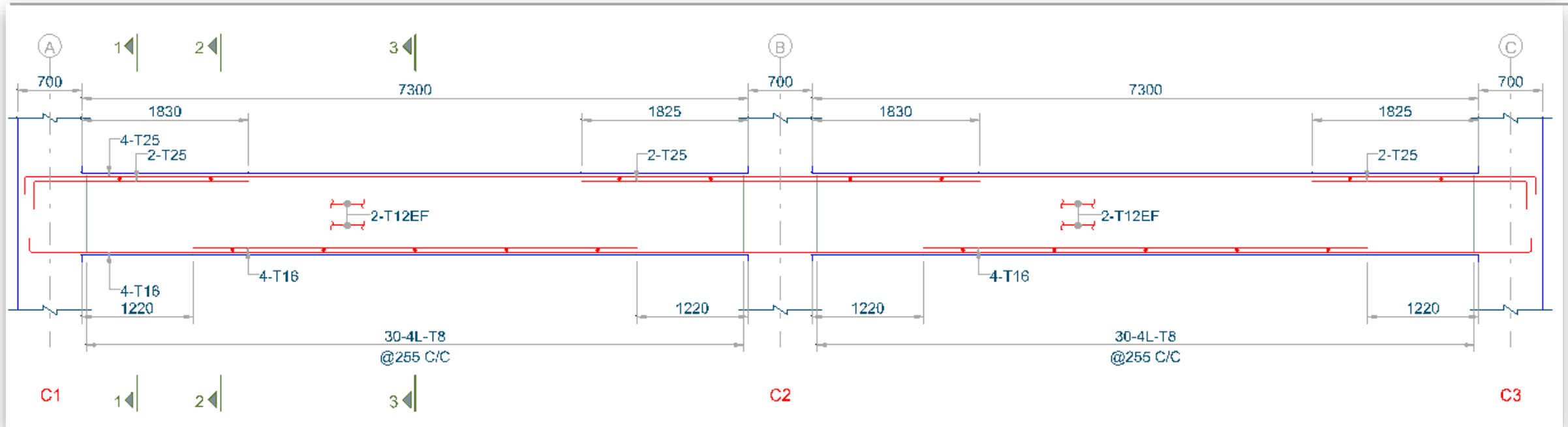


Bar Mark	Element	Level	Nos	Dia	Shape	Total L	A	B	C	D	E
T1	B1	-	5	16	A	11225	150	10368	98	16	656
T2	B1	-	4	16	A	2470	210	2304			
T3	B1	-	4	16	A	4350	4350				
T4	B2	-	5	16	A	11650	11650				
T5	B2	-	4	16	A	4350	4350				
T6	B3	-	5	16	A	11185	656	98	16	10327	150
T7	B3	-	4	16	A	4345	4340				

Polygonal Column Design



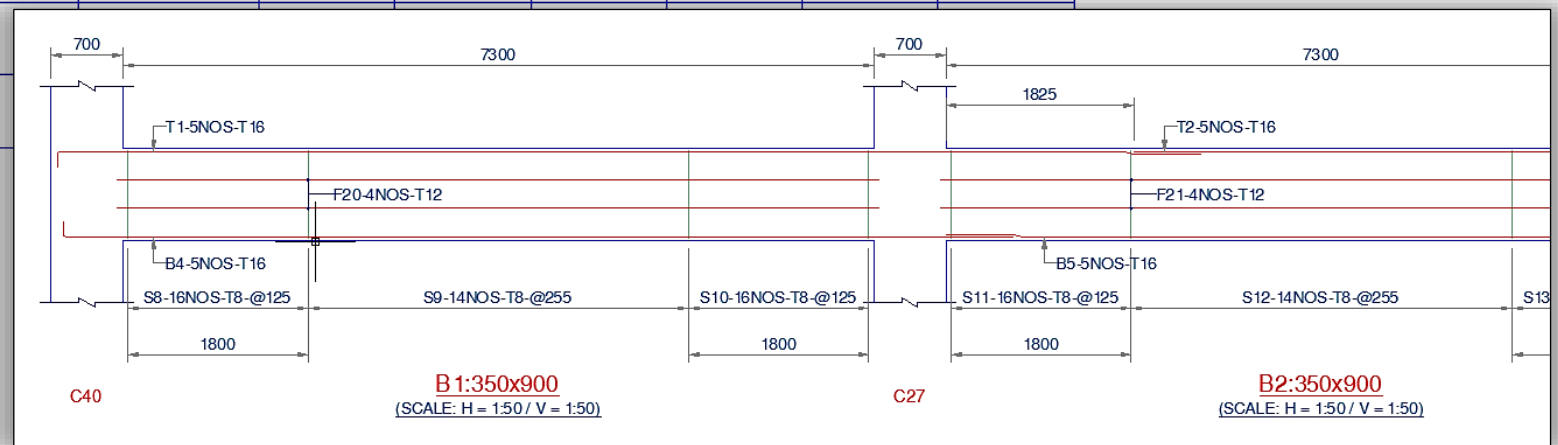
Beam Detailing



Bar Bending Schedule



ELEMENT	BAR MARK	BAR NOS.	BAR DIA.	BAR SHAPE	CUTTING LENGTH (MM)	DIMENSIONS					
						A	B	C	D	E	R
B1, B2 B3, B4	T1	5	16		11215	150	10359	98	16	656	64
	T2	5	16		11650	11650					
	T3	5	16		11171	150	10315	98	16	656	64
	B4	5	16		9340	150	9238				64
	B5	5	16		8658	656	98	16	7904		64
	B6	5	16		8658	656	98	16	7904		64
	B7	5	16		7942	150	7086	98	16	656	64
	S8	16	8								
	S9	14	8								



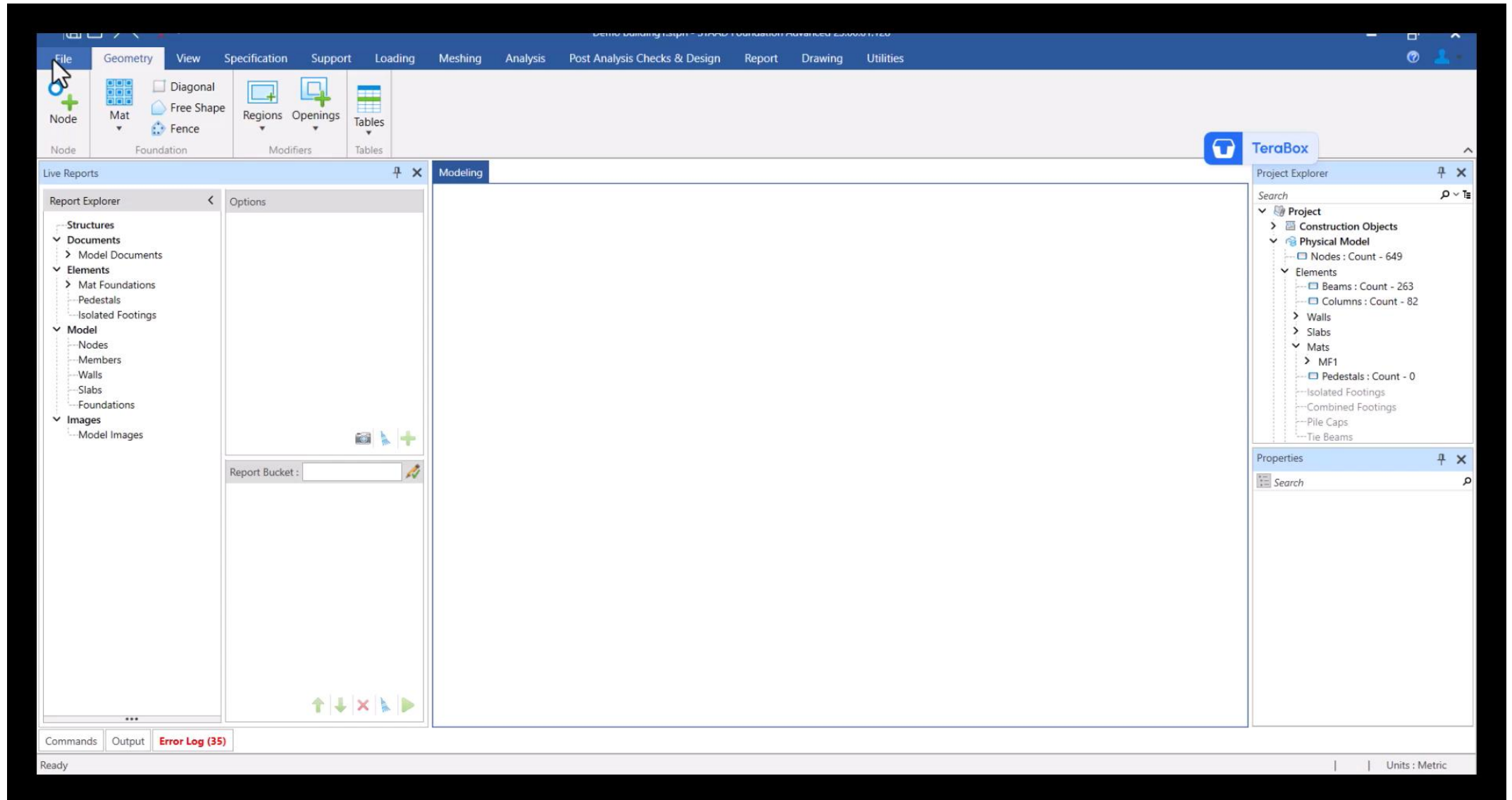
Reports and BOQ



- Detailed design calculations
- Design summary
- Failure Diagnostics
- Bill of materials for concrete and steel
- Member properties changed

<u>BOQ Summary</u>					
Element :		Column			
No.	Material	Unit	Quantity	Rate (Rs.)	Cost(Rs.)
1	Concrete M20	(cuM)	122.04	3600.00	439336
2	Concrete M30	(cuM)	129.31	4000.00	517232
3	Concrete M40	(cuM)	243.01	4400.00	1069235
Sub Total			494.35		20,25,803
4	Steel T8 (Fe415)	(kg)	20981.71	45.00	944177
5	Steel T10 (Fe415)	(kg)	45.93	45.00	2067
6	Steel T12 (Fe415)	(kg)	4625.75	45.00	208159
Sub Total			25653.39		11,54,402
7	Shuttering	(sq.M)	4395.35	350.00	1538374
Sub Total					15,38,373
Grand Total					47,18,579

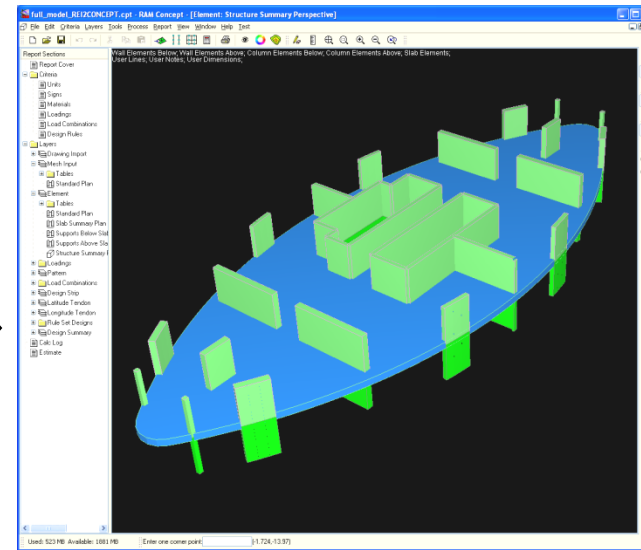
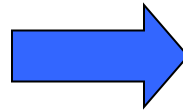
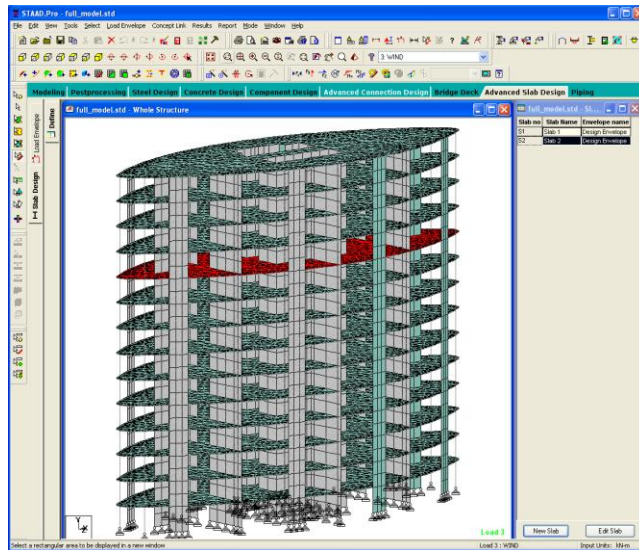
STAAD to SFA



Integration of STAAD and RAM Concept

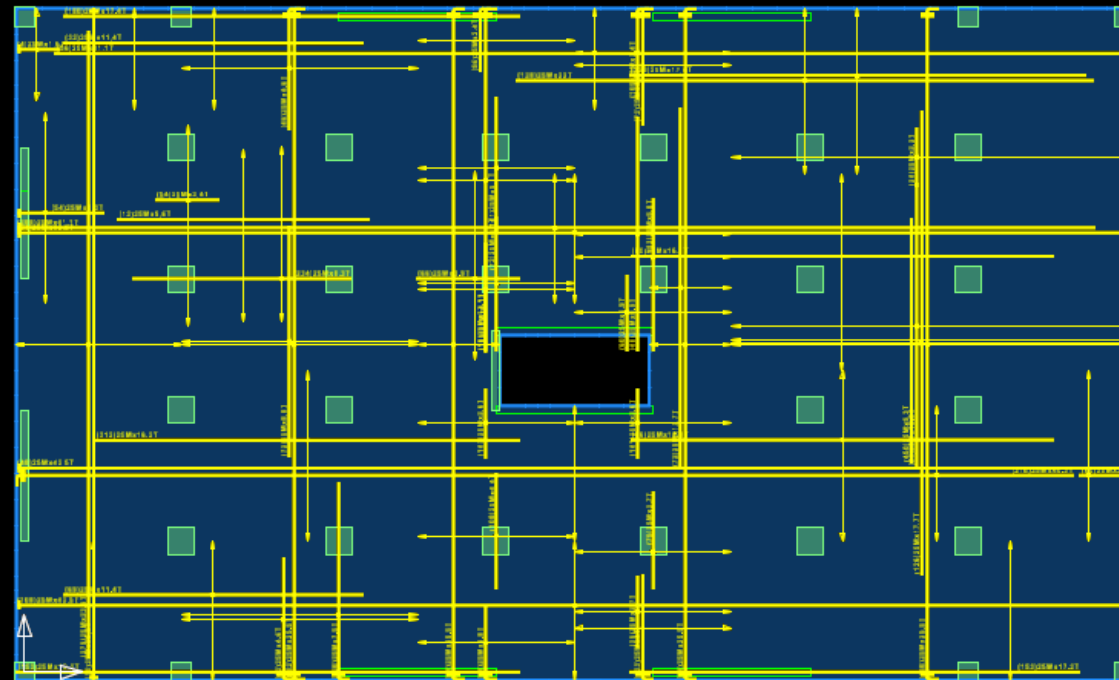
Workflow:

1. Model Structure and Loads and in STAAD
2. Analyze Building Frame in STAAD
3. Launch Concept to Design PT/RC Slabs
4. Easily Update Concept Model (if necessary)

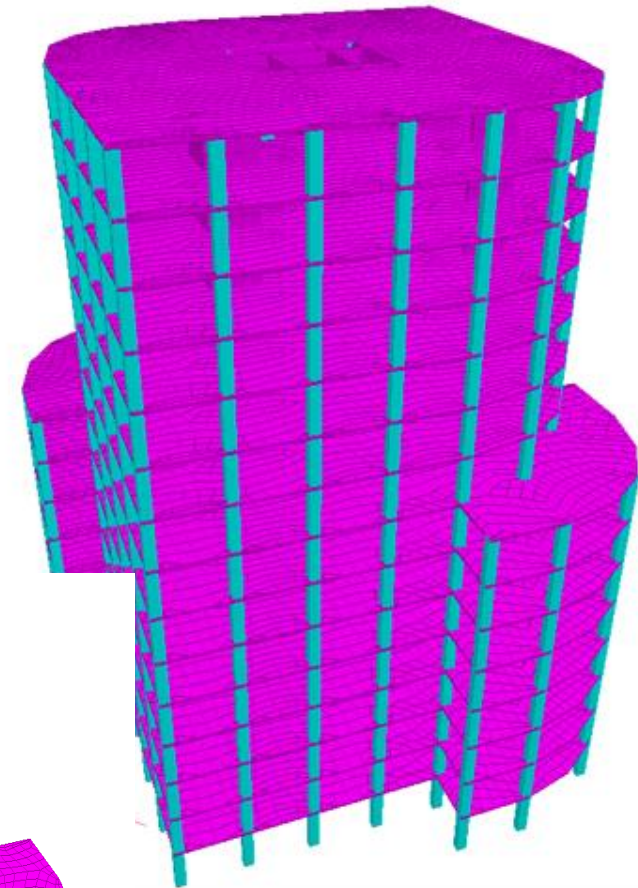
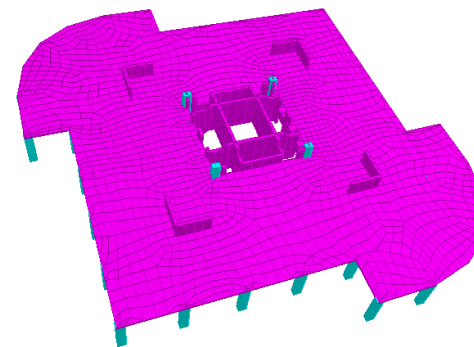
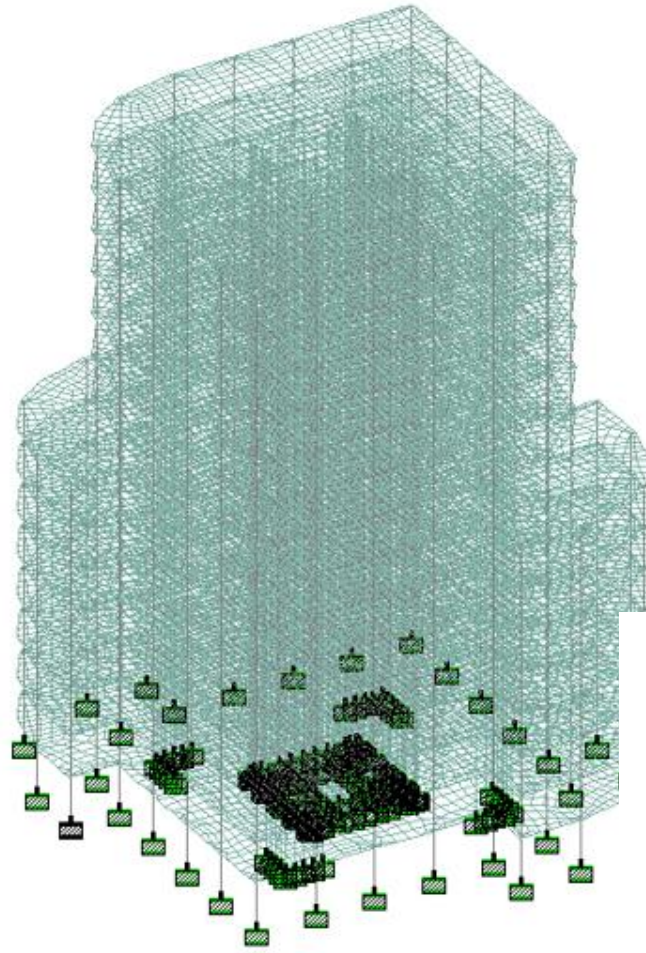


RAM Concept

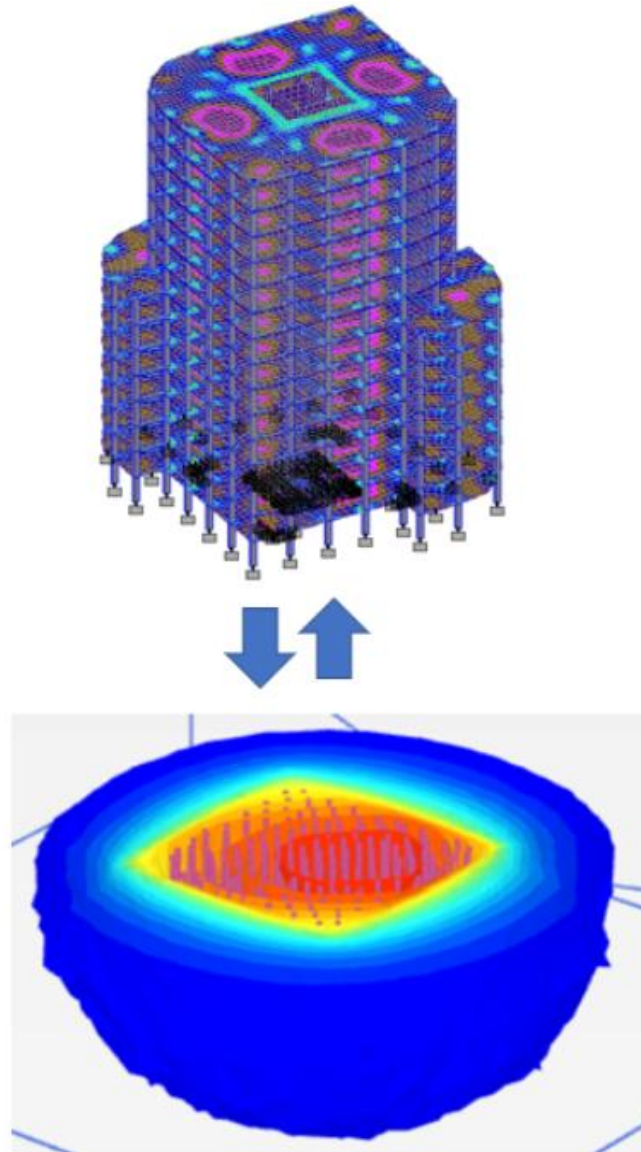
Reinforcement: User Lines, User Rules, User Dimensions, LeftRule User Concentrated Reinf., LeftRule User Distributed Reinf., LeftRule Program Concentrated Reinf., LeftRule Program Distributed Reinf., LongRule User Concentrated Reinf., LongRule Program Concentrated Reinf., LongRule User Distributed Reinf., LongRule Program Distributed Reinf.
Element: Wall Elements Below, Wall Elements Above, Wall Elements Outline Only, Column Elements Below, Column Elements Above, Slab Elements, Slab Elements Outline Only.
Scale = 1/100



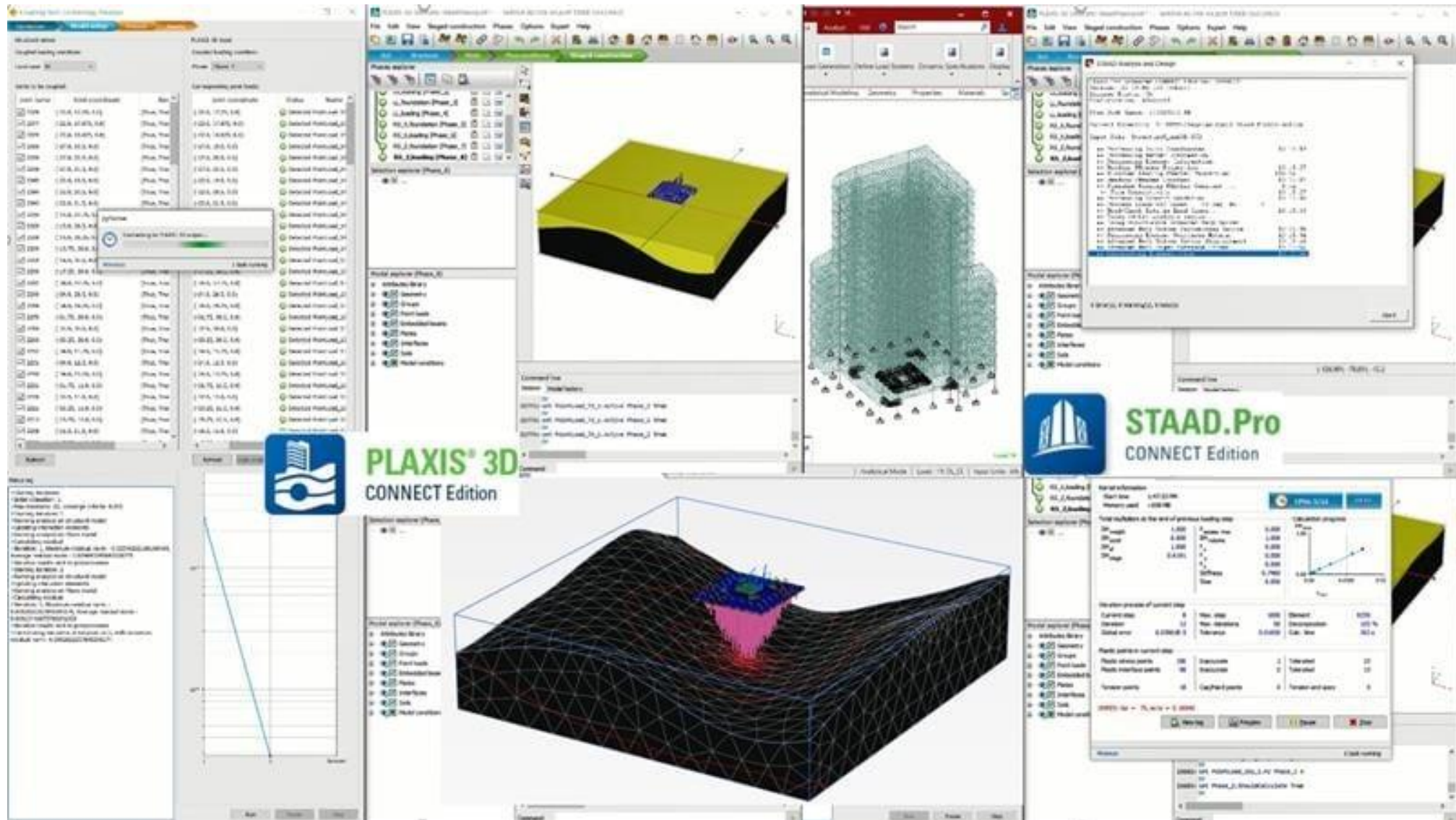
FE model in Staad CE



Staad-Plaxis 3D Interactive Analysis

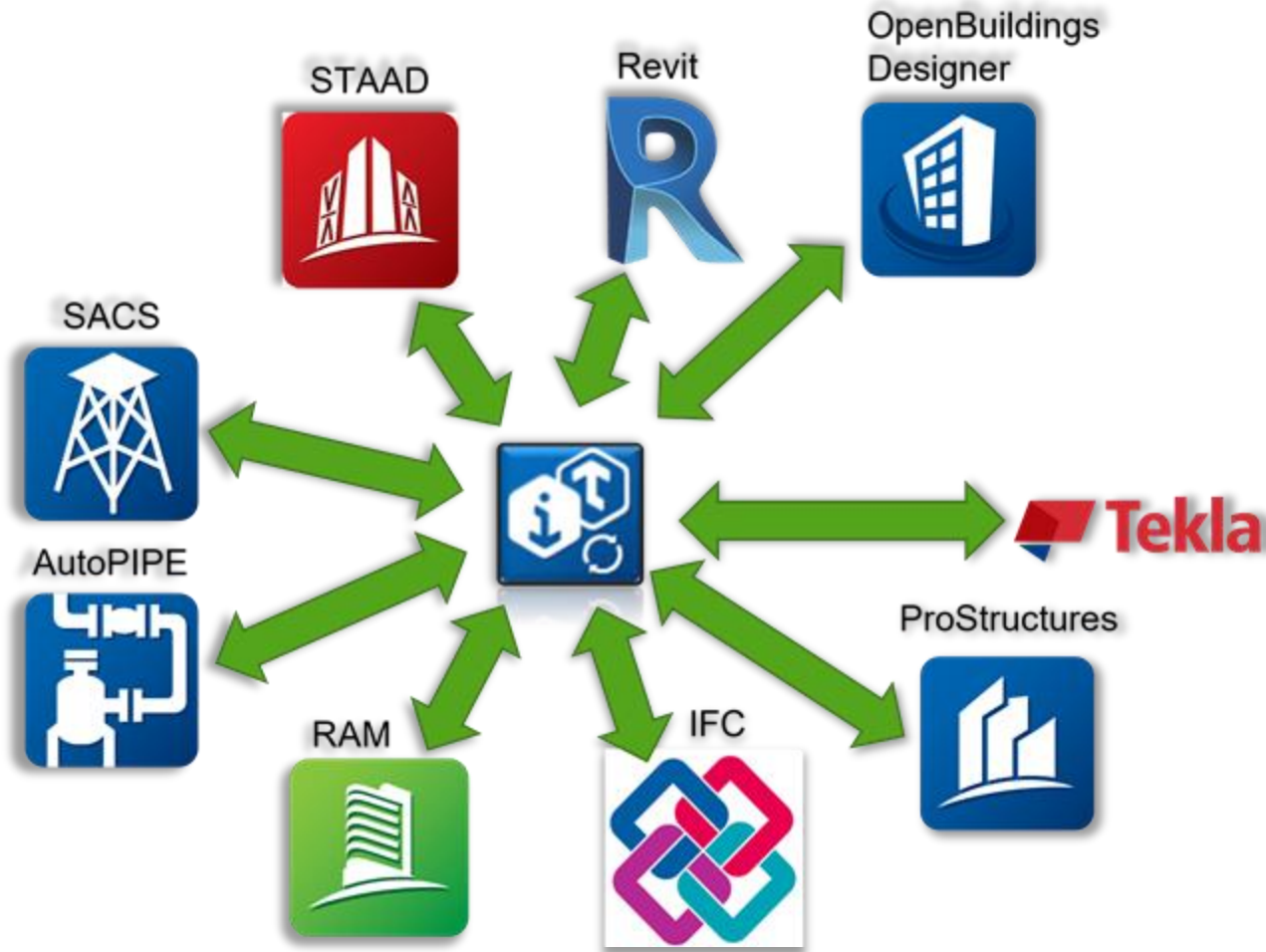


Staad-Plaxis 3D Interactive Analysis



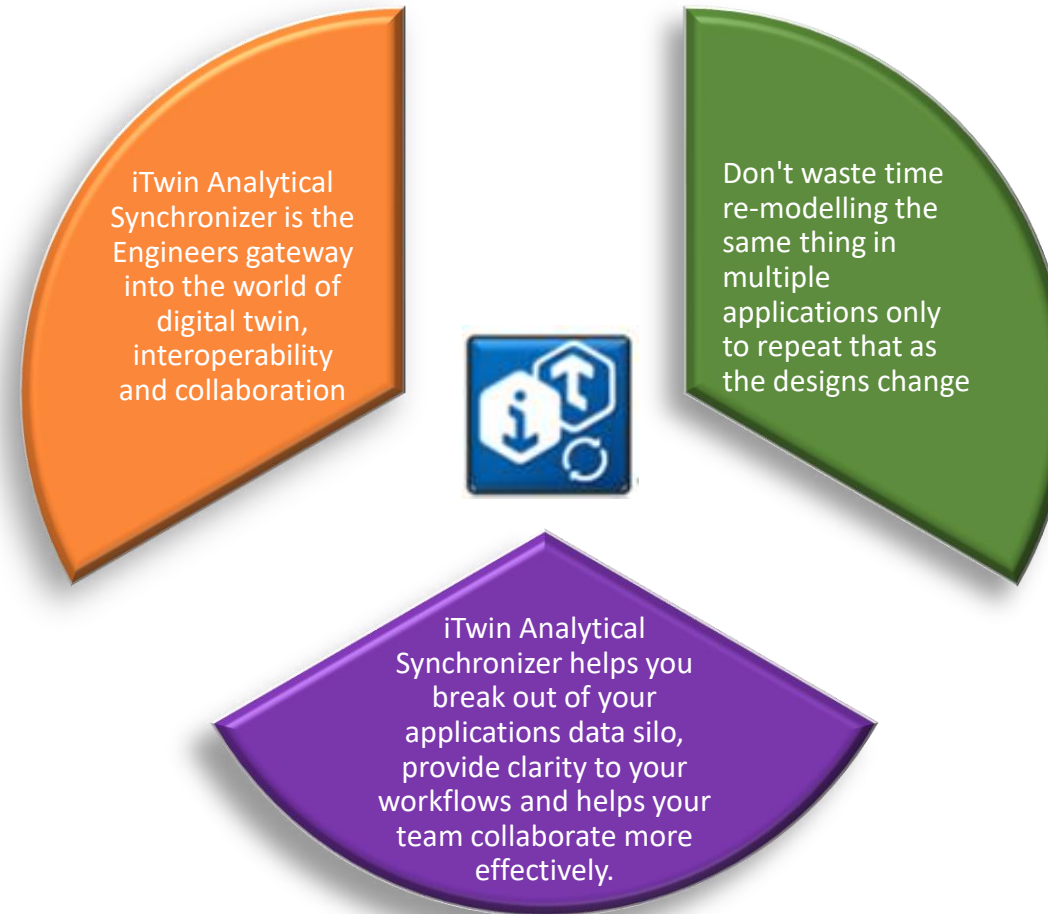
Data Exchange **with** iTwin Analytical Synchroniser

iTwin Analytical Synchronizer iTwin®



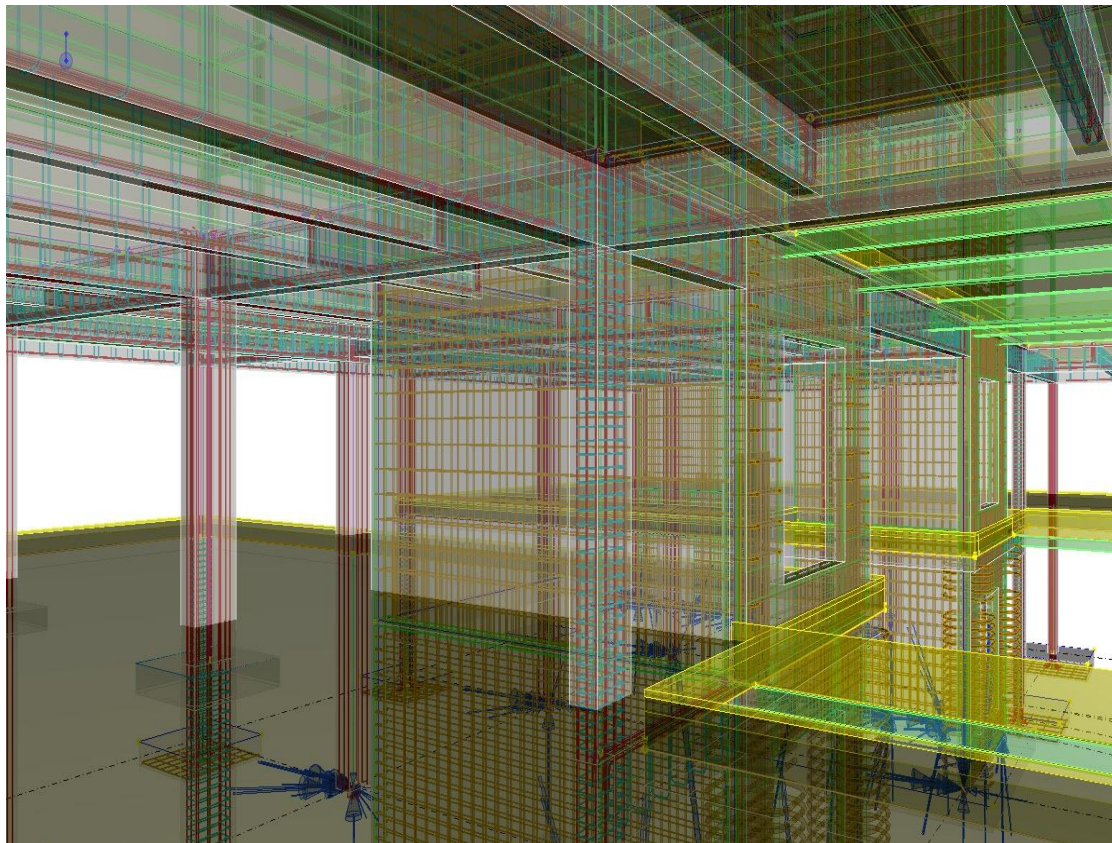
iTwin Analytical Synchronizer iTwin®

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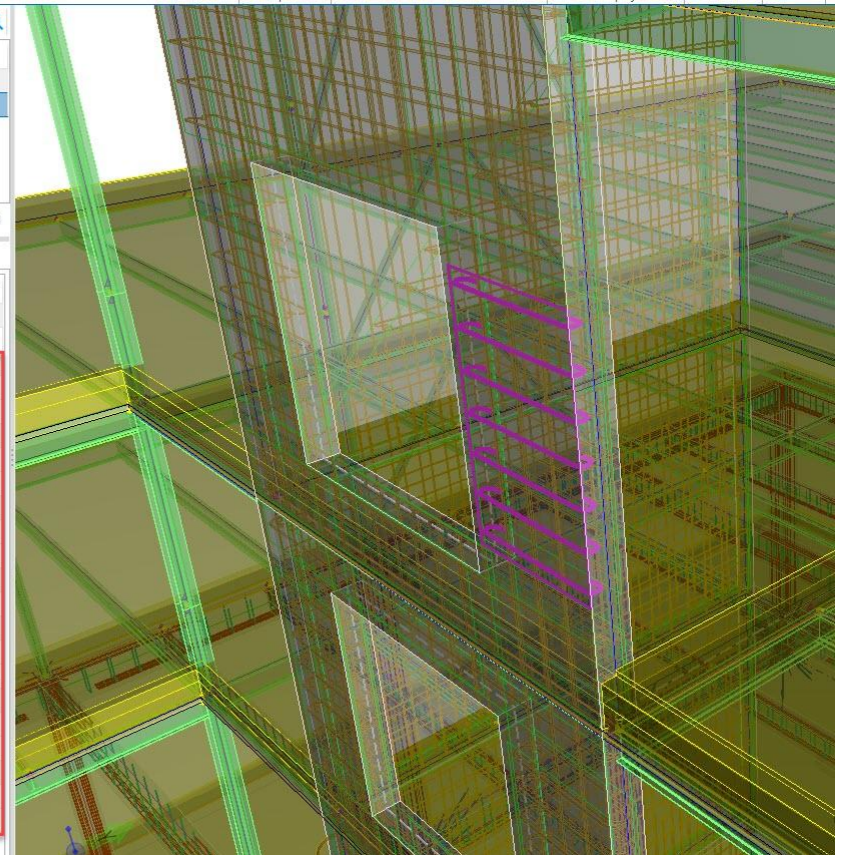


Visualization – Structural Information

Analysis and design details are available in ISM and can be used for review.



Objects	
Shor...	Type
Label	Story
Type: Area Surface Rebar	
777-...	Area Surf...
1 Selected	
Select All Clear All	
Properties	
Property	Value
Object	
Short ID	777-526
Rebar	
End Hook	Hook 180
Start Hook	Hook 180
Surface Rebar	
Bar Direction	(1,0,0)
Bar Spacing	30 cm
Perpendicular Rebar	
End Hook Direction	90 degrees
Start Hook Direction	90 degrees
Curve Member	
Use	Primary
Area Surface Rebar	
Consider Member Openings	True
Layout Boundary	(14.74, 5.877, 16.99)(14.74, 5.877, 16.99)
Calculated	
Bar Count	7
Group Bar Weight	17.34 kg
Related Items	
Material	#16
Members	[Wall: 30 cm: 30 N/mm ²]



iTwin Analytical Synchronizer iTwin®



Cloud Sync

EAP Participants

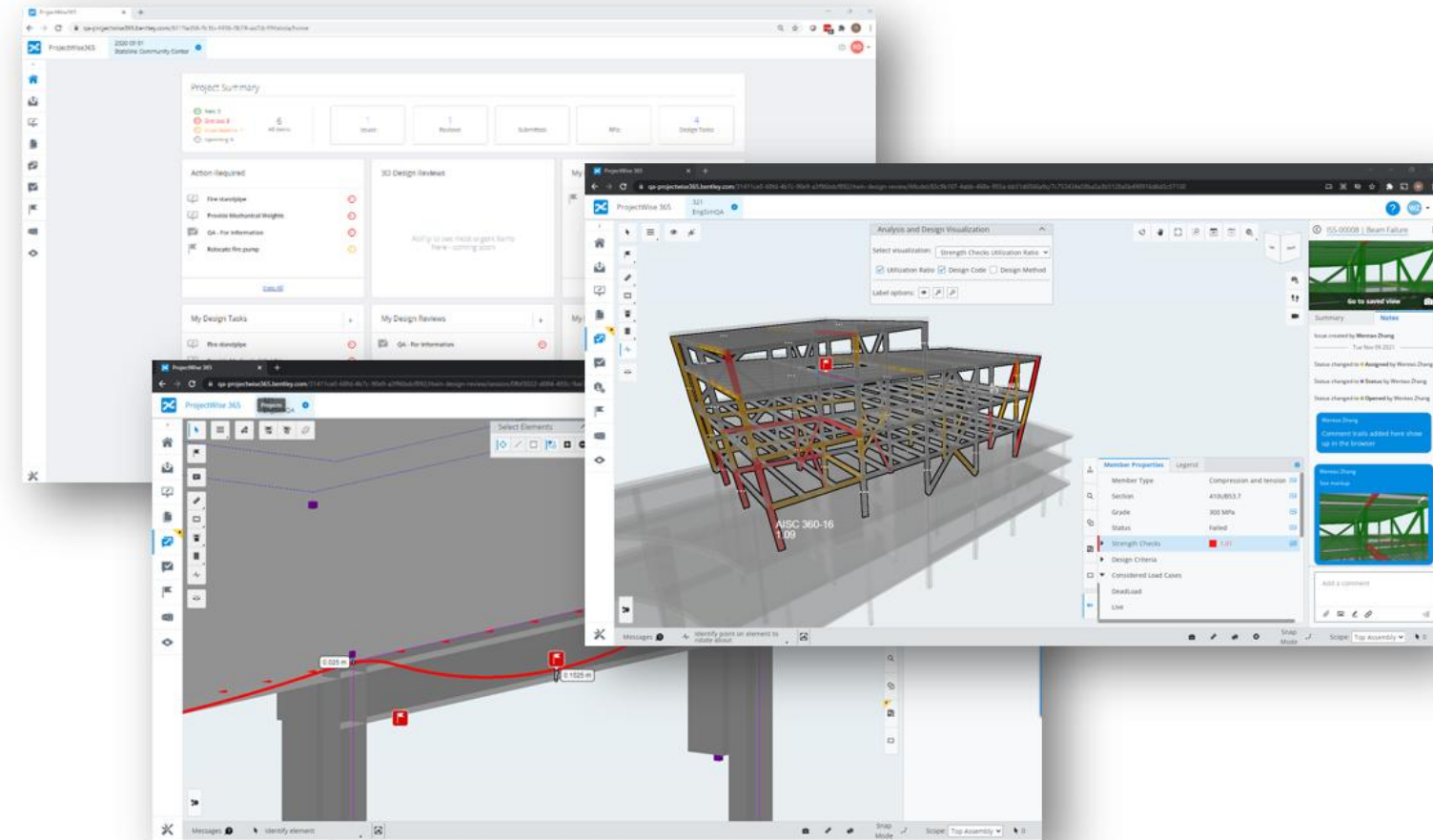


File Sync

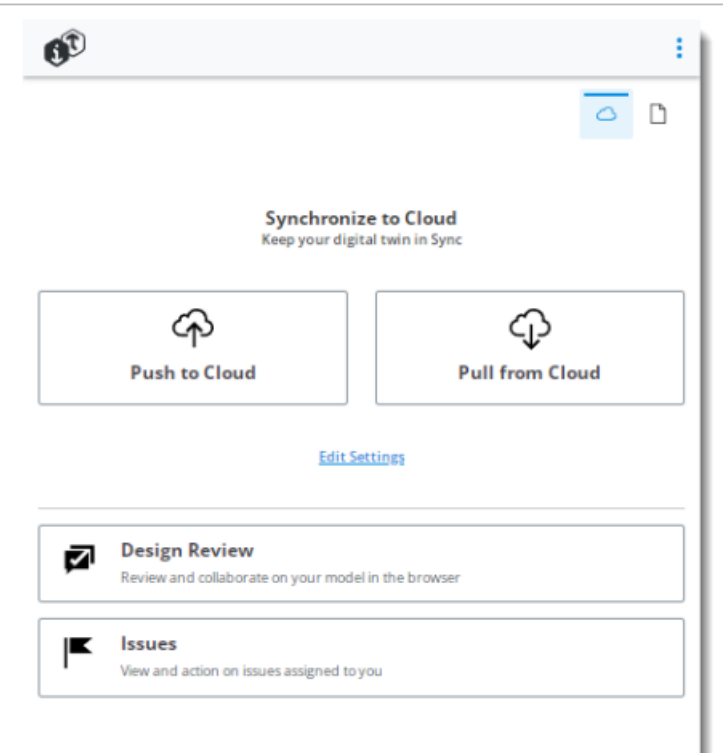
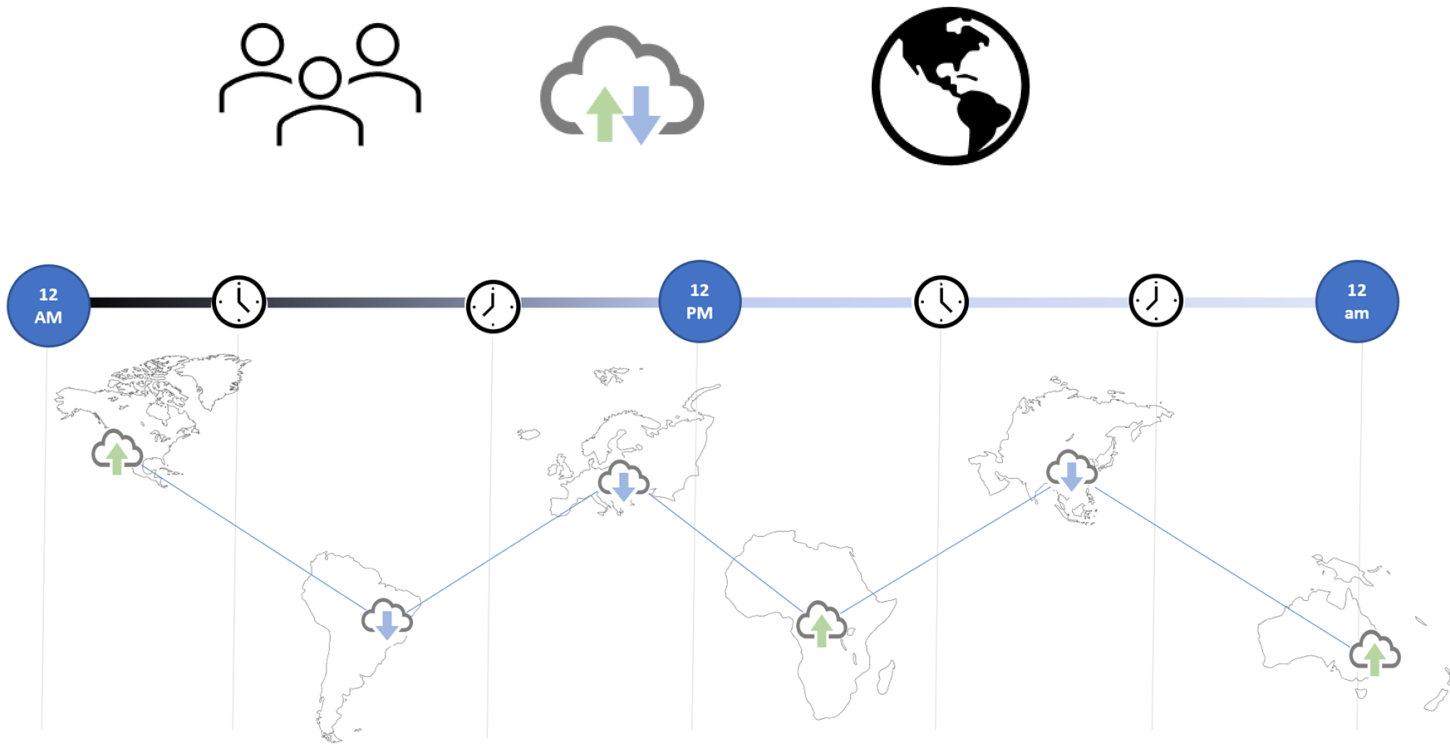
All Users

File Based Synchronization (EAP Participants)

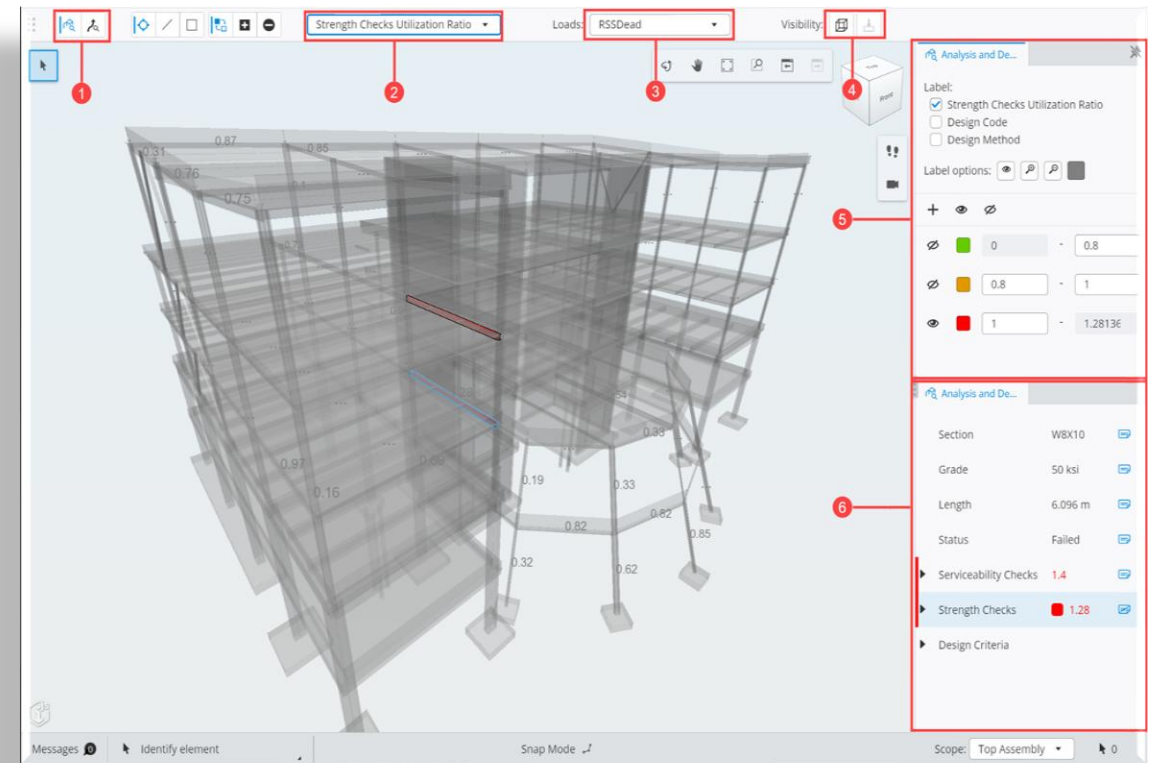
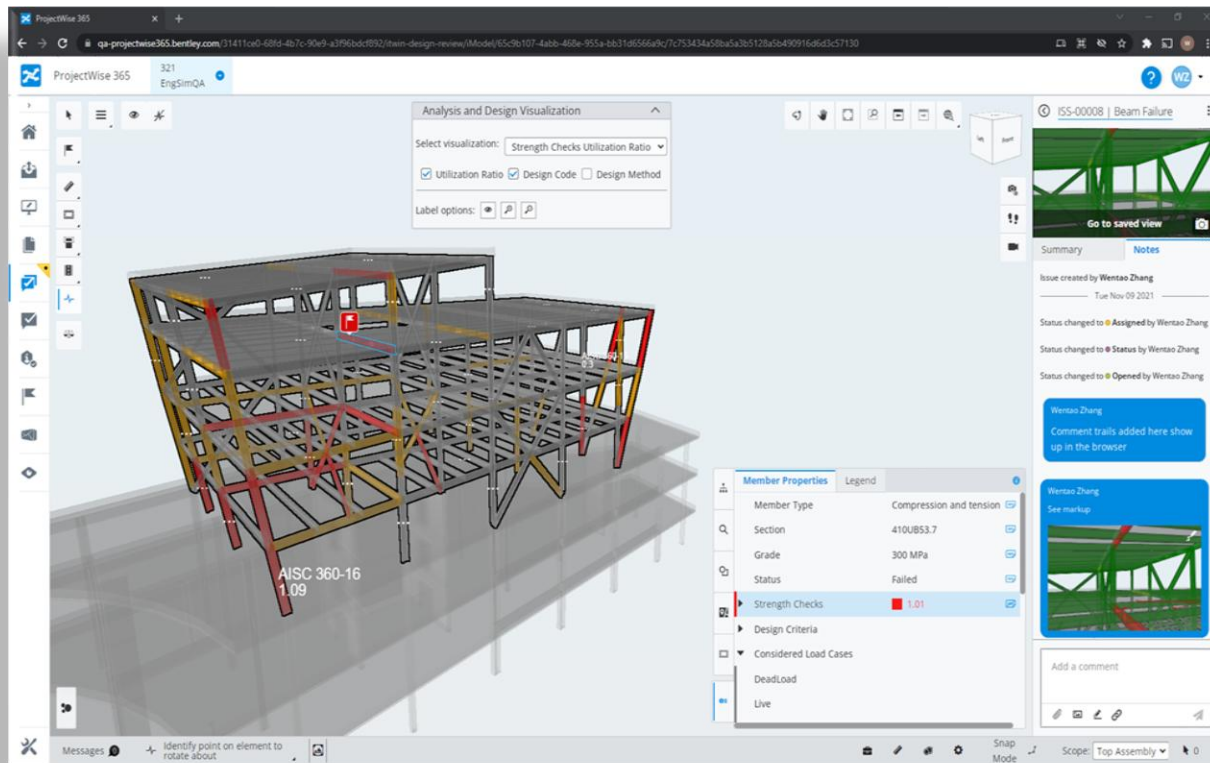
- Unlock “cloud” mode in **iTwin Services sidebar** in the latest versions of STAAD, RAM Structural System, RAM Concept, and SACS.
- Take advantage of your cloud iModel as a single source of truth for bidirectional change management.
- Use Design Review to investigate and query analytical and design results in the model, including utilization ratios.
- Mark 3D model points of interest in the browser as issues and update their status directly in your desktop application.



File Based Synchronization (EAP Participants)



File Based Synchronization (EAP Participants)



Purpose of iTwin

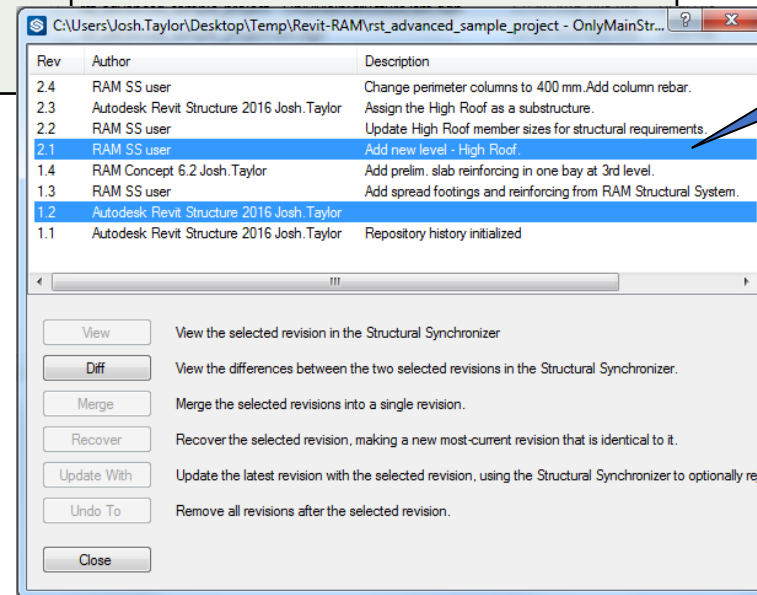
Software enabling unified data across platforms

Within ISM:

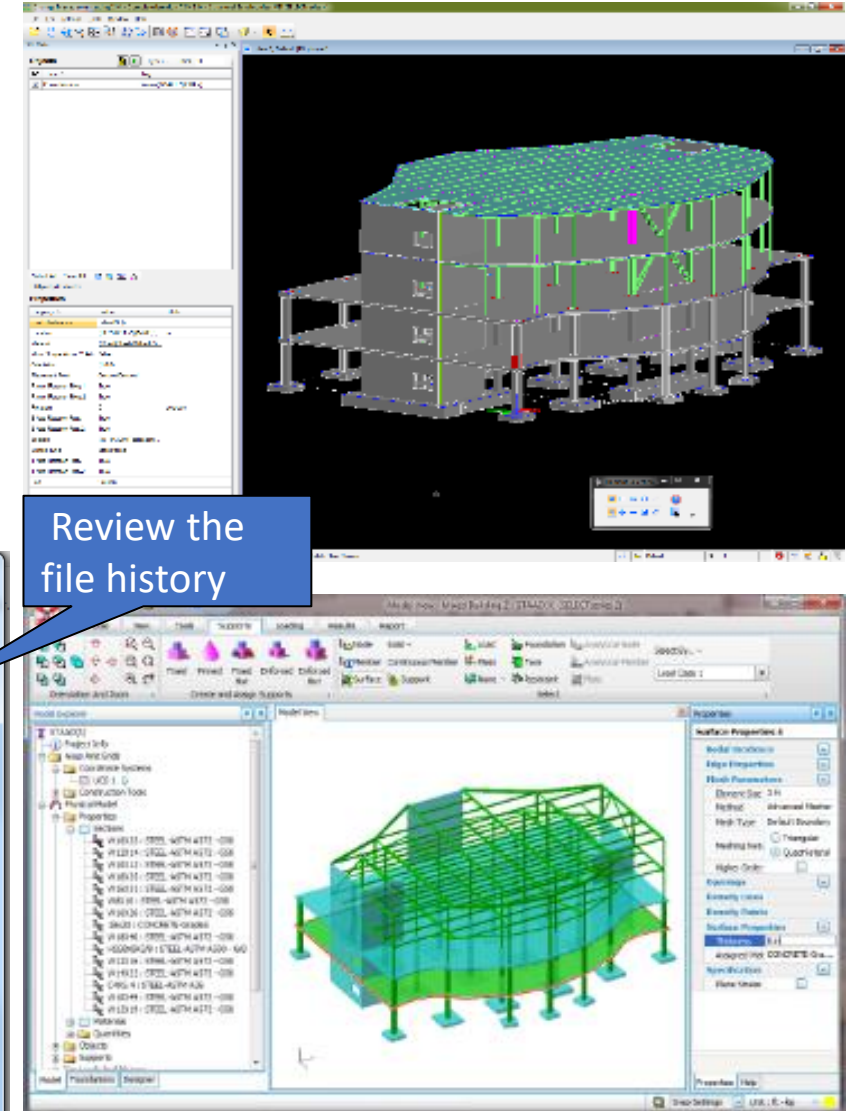
- ✓ Model Review
- ✓ Revision Management
- ✓ Visualization
- ✓ Track progress
- ✓ Compare alternatives
- ✓ Publish deliverables

Primary Uses:

- ✓ Structural Projects
- ✓ Synchronize revisions
- ✓ Exchange Data
- ✓ Visual effects

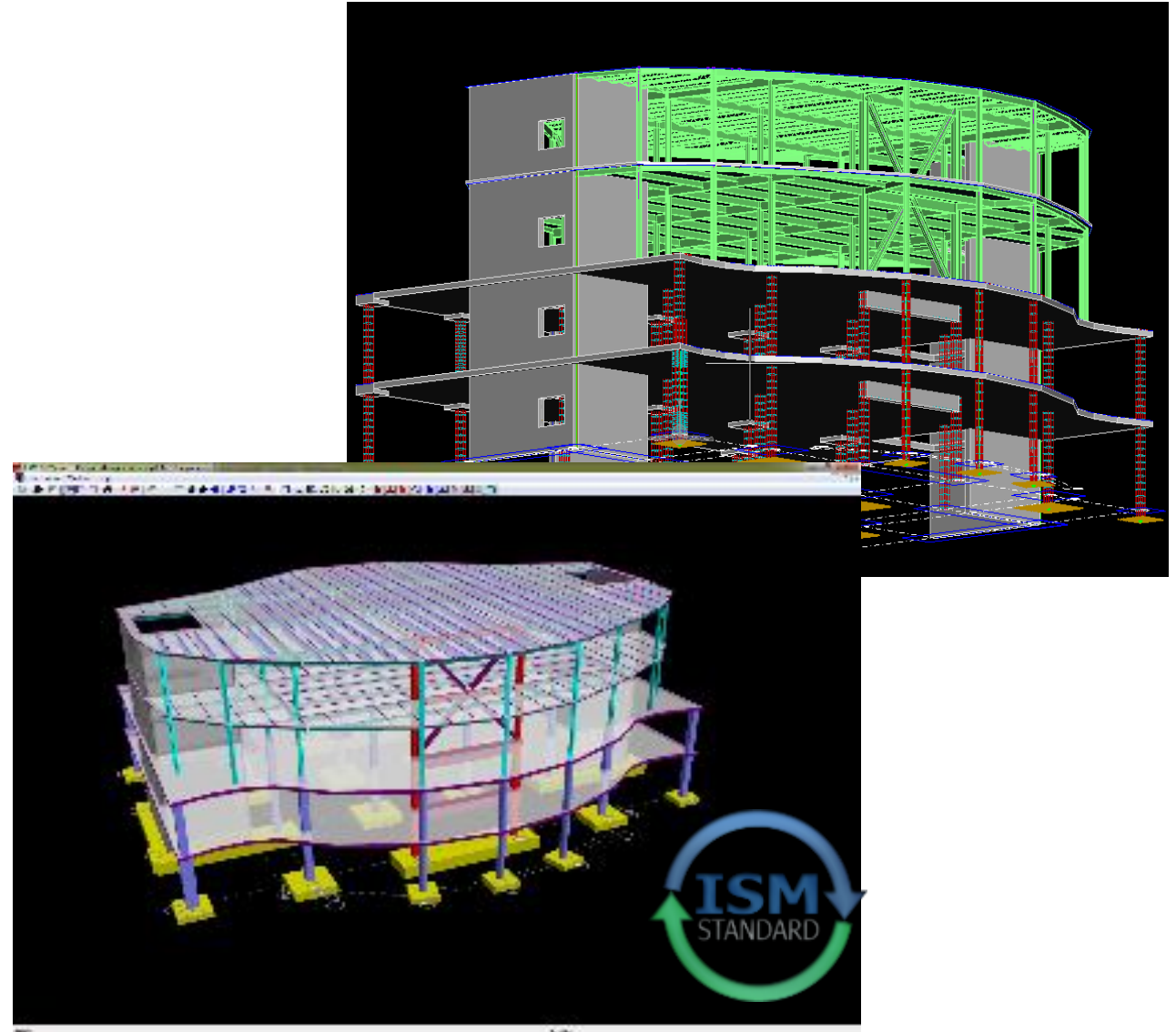


Review the file history



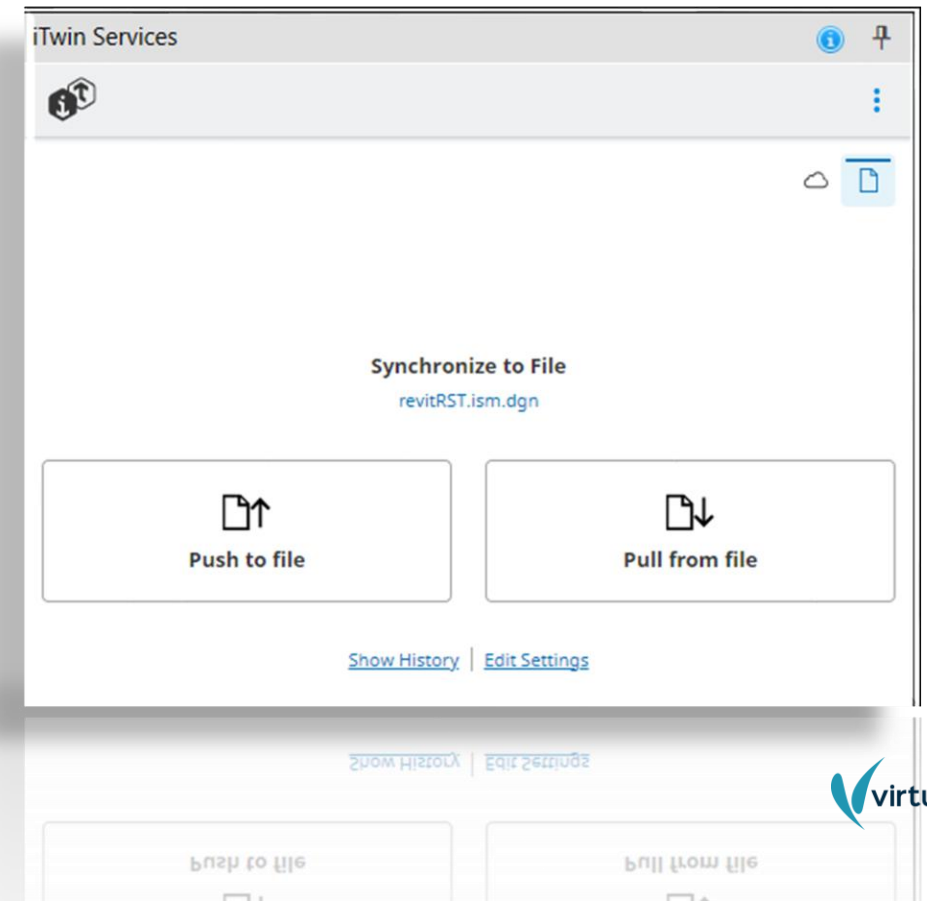
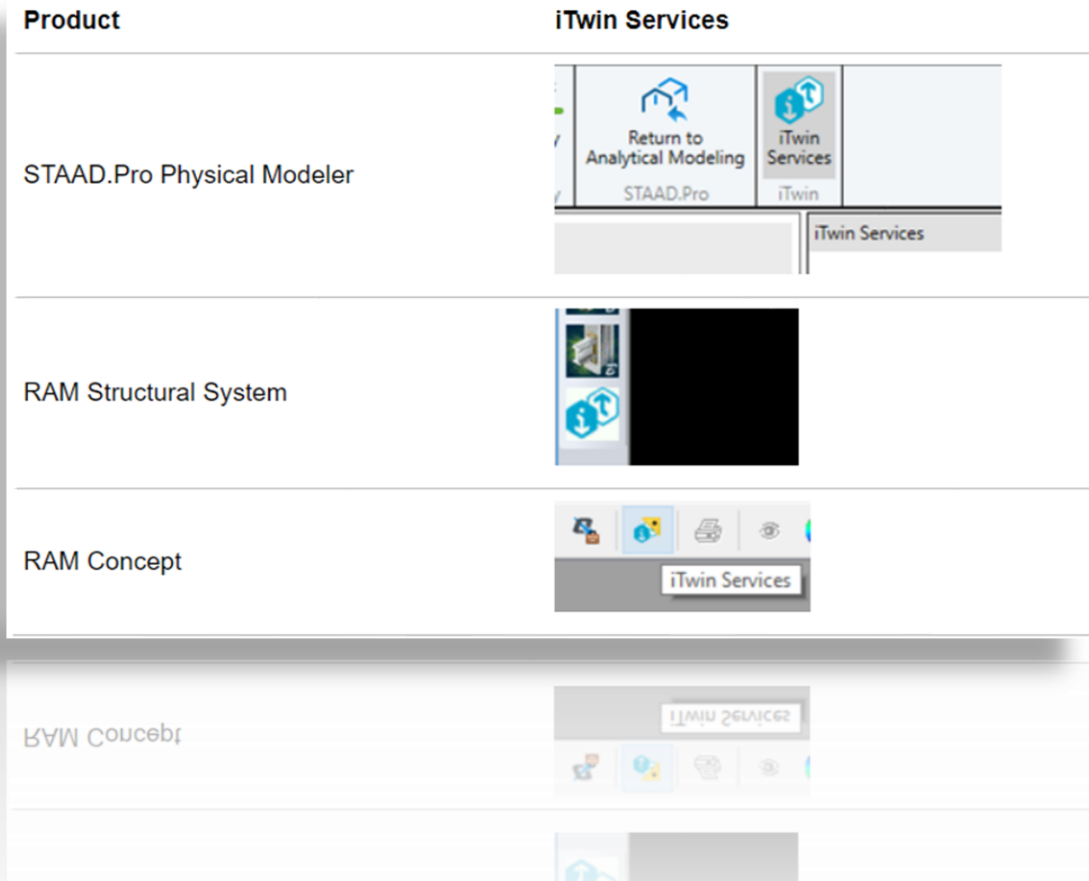
Transferable data in iTwin

Accepted Geometry
Accepts Most Materials
Beams, Columns and Braces
Walls
Sloped Framing
Deck/Slabs
Web Openings
Reinforcement
Connection Tags
Analysis Results



File Based Synchronization

- iTwin Services
- File based workflows

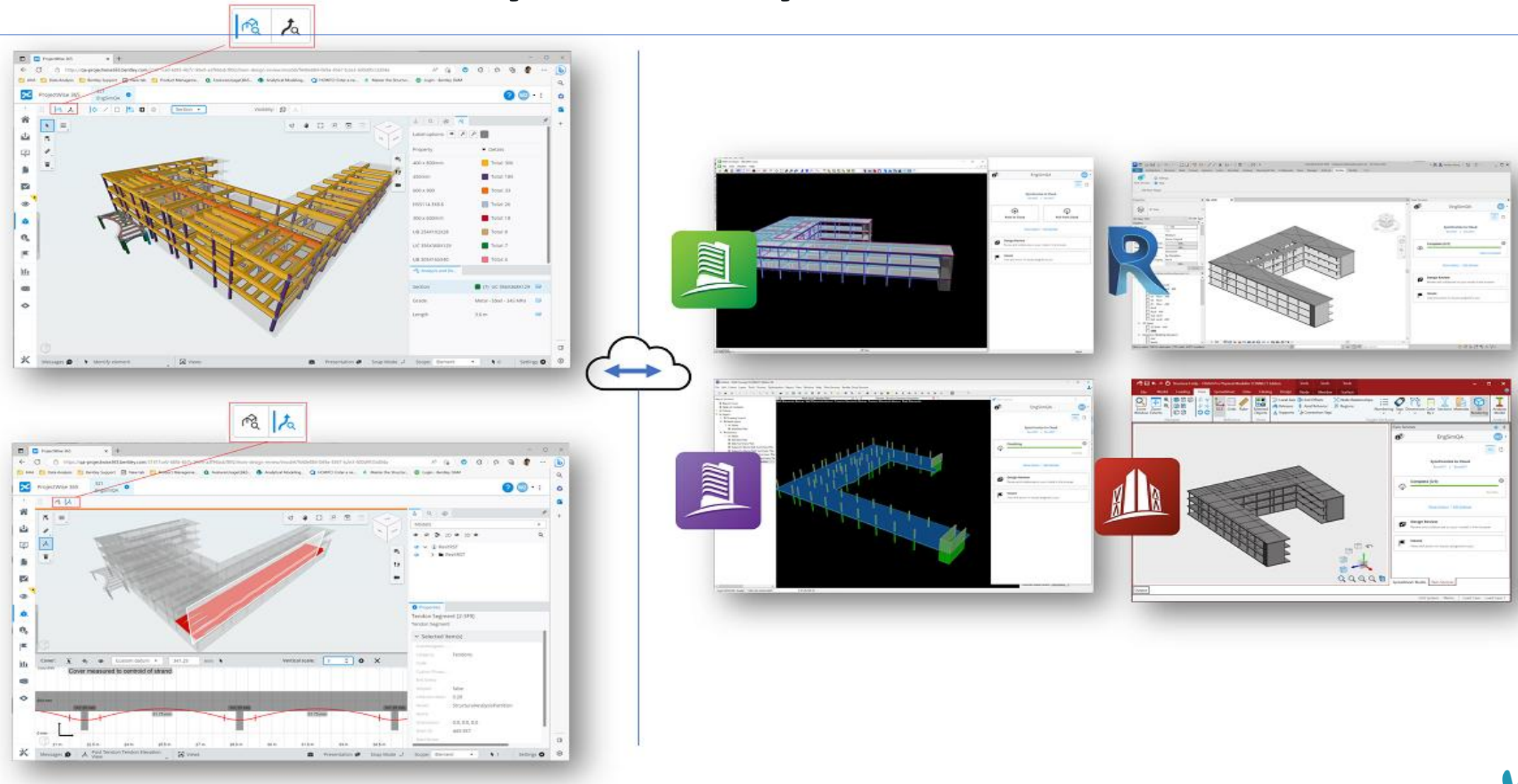


iTwin Analytical Synchronizer iTwin®

 Cloud	Features	 File
☒	Interoperability	☒
☒	Collaboration	
☒	Cloud Services	

Cloud Sync provides interoperability and collaboration solution for dispersed teams

iTwin Analytical Synchronizer iTwin®



iTwin Analytical Synchronizer iTwin®

Data Interchange – Revit & STAAD.Pro



Step 1:

Download and install ISM Revit Plugin

Step 2:

Generate ISM (.ism.dgn) file from Revit

Step 6:

Update Revit model using ISM file



Bentley STAAD.Pro Advanced 2023

Step 4:

*Pull structural information in STAAD.Pro
Physical/Analytical modeler from ISM file*

Step 5:

Update ISM file with modified information

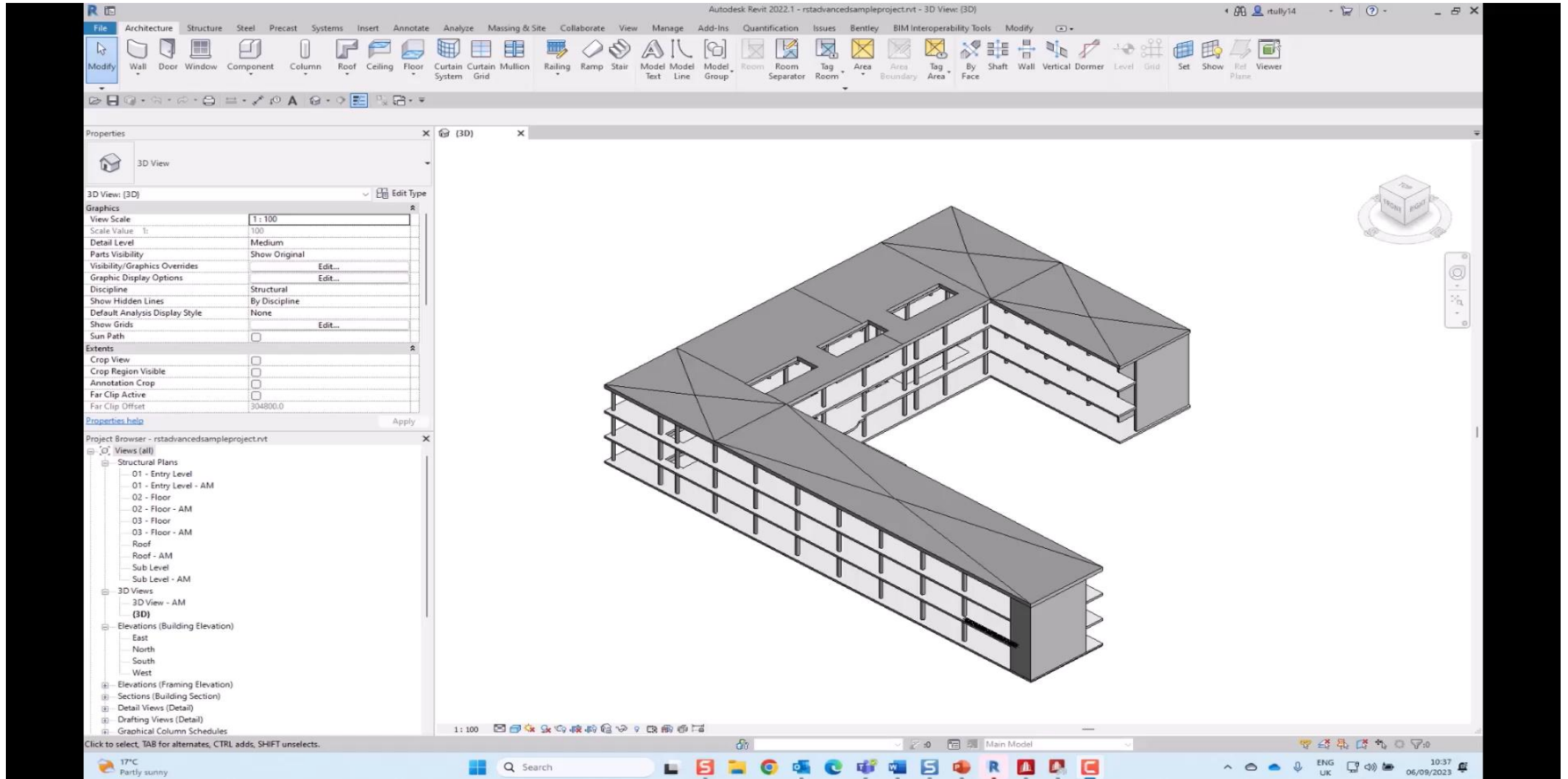


Step 3 (optional):

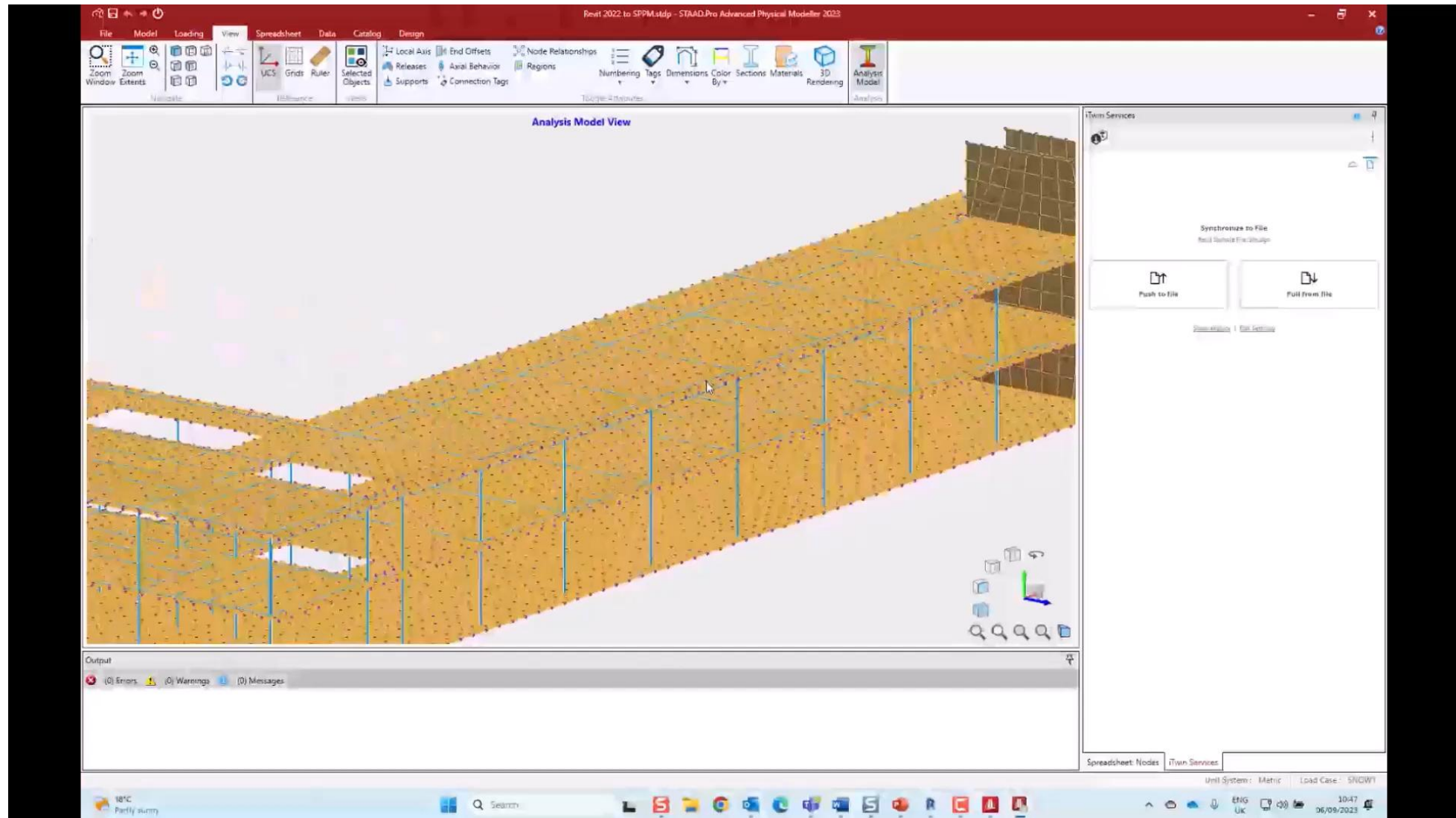
Check data in iTwin Analytical Synchronizer

*Two-way data interchange
between STAAD.Pro &
Revit using ISM.*

iTwin Analytical Synchronizer iTwin®



iTwin Analytical Synchronizer iTwin®





D:\Training\DXW+\Webinar\RCDC Ram connection\New1.ism.dgn - iTwin Analytical Synchronizer 2023

FileViewTools

SelectPanRotateZoom AreaZoom Tool

Fit ViewIsometricPreviousBottomNext

FlyWalkPerspective

ConcreteSteelAnalysisLoad CasesAll levels visible

Transparent DisplaySteel Deck Detail

SI Metric Imperial

Measure Distance Measure

Objects

Sh...TypeLabelStatusChangeStory

Type: Surface Member

369-1...Surface Me...slab1; Slab;...AddedAcceptedTenth (085-249)

Select AllClear AllAcceptRejectUndecide

1 Selected

Properties

PropertyNew ValueOld ValueStatusChange

Object

Short ID369-107AddedAccepted

Nameslab1AddedAccepted

Member

Load Resista...Gravity and L...AddedAccepted

Surface Member

Location< TrimmedSu...AddedAccepted

Select AllClear AllAcceptRejectUndecide

107 Selected

Modified 0Added 4140Deleted 0Unchanged 0

PreviewUpdateCancel

Select model elements in view

Creating: D:\Training\DXW+\Webinar\RCDC Ram connection\New1.ism.dgn

File Version: ISM 9.1

Sign In

21:34
24-07-2023

Objects

Type: Surface Member

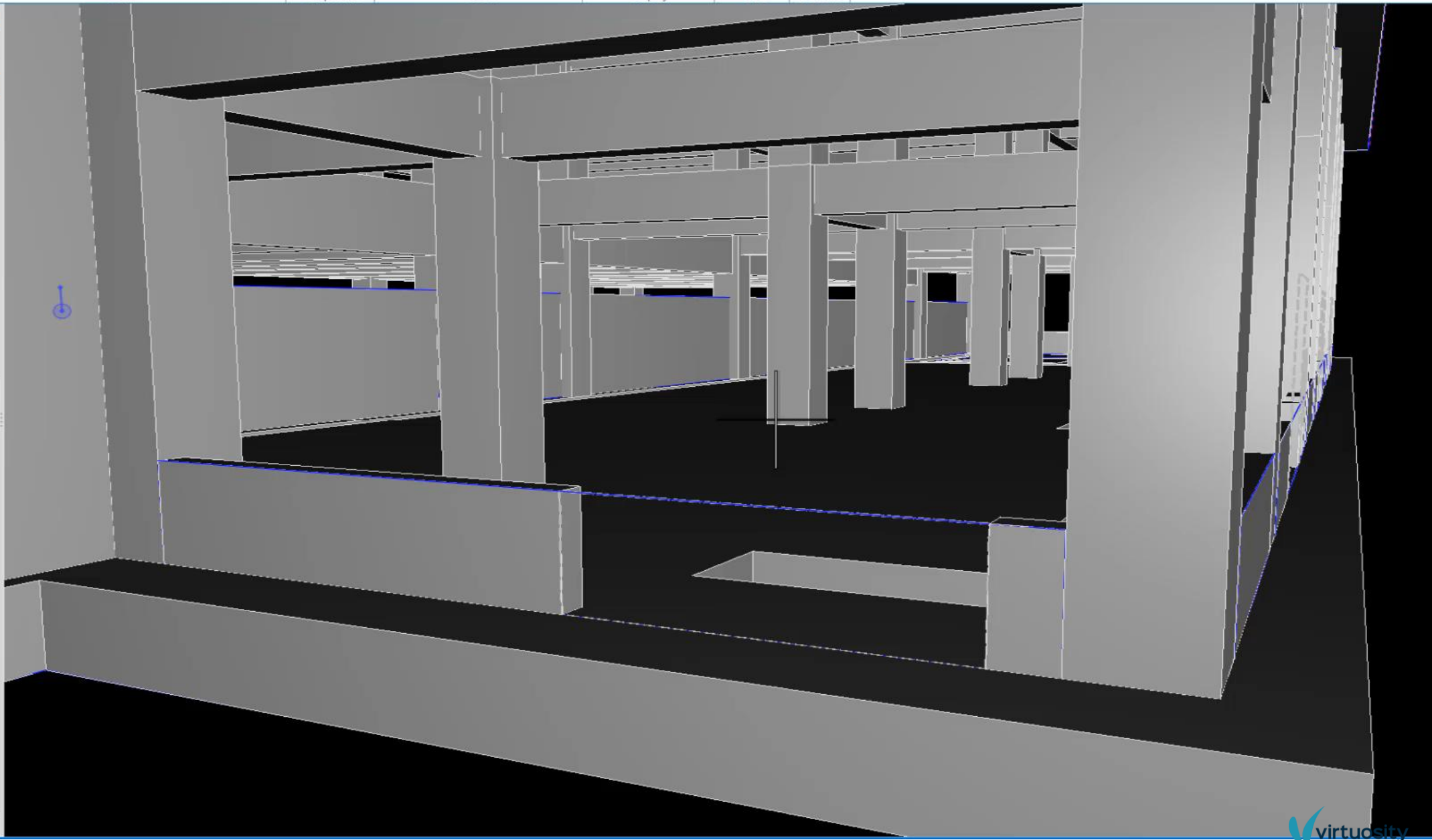
☒	12...	Surfac...	Wall: 1...	Level 02 (7...
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Select All Clear All 1 Selected

Properties

Property	Value
Object	
Short ID	129-465
Member	
Load Resistance	Gravity Only
Surface Member	
Placement Surface	Top
System Kind	Concrete Unspecified
Thickness	15 cm
Use	Wall
Location	<TrimmedSurface3D...
Calculated	
Area	87.19 m^2
Volume	13.08 m^3
Related Items	
Story	[Level 02]
Material	[concrete]

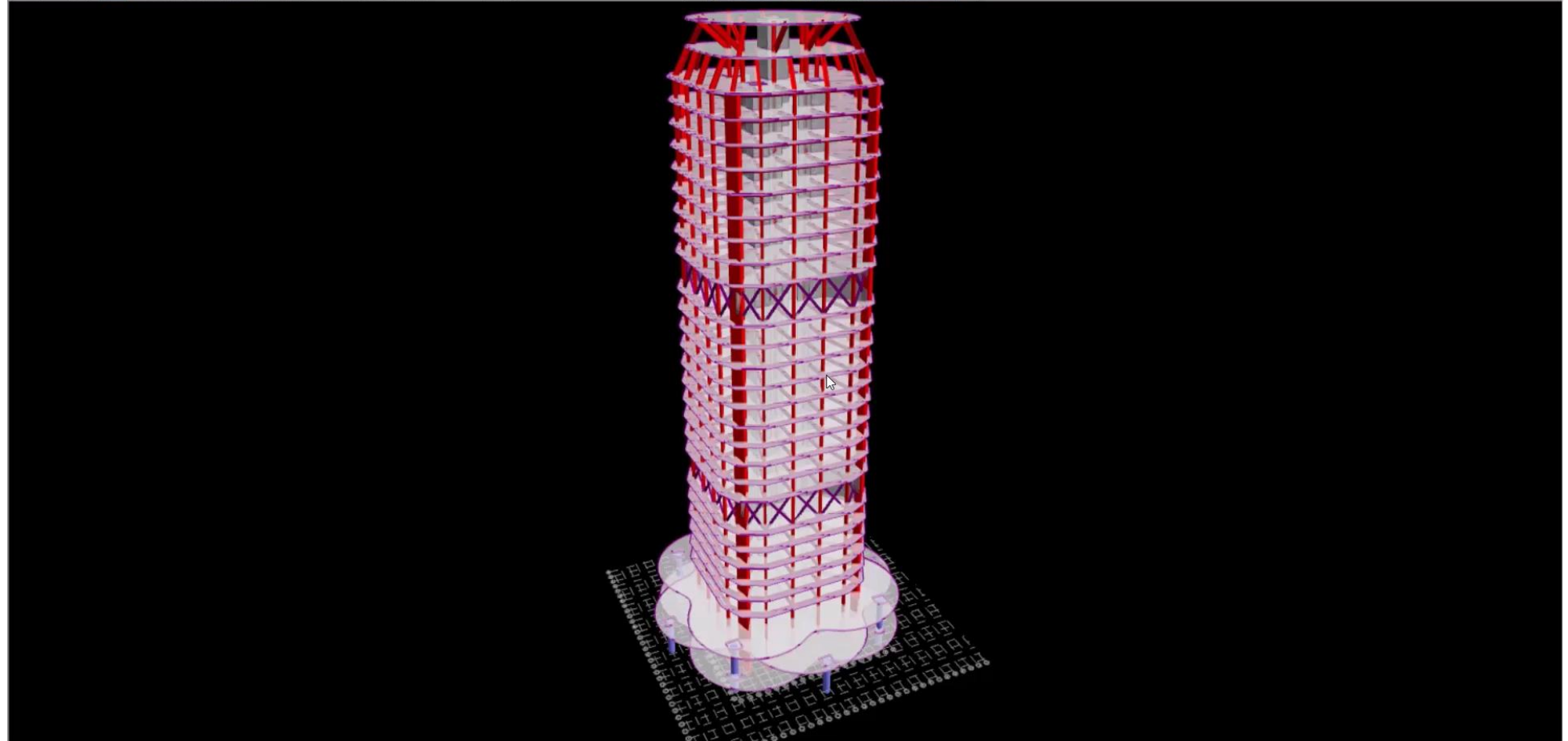
Close





RAM 3D Viewer - [SPIRAL3obliskrss.ram]

File View Window Help



Completed...

3D View



Tekla Integration



The Trimble logo features a blue icon of a globe with a white 'T' inside, followed by the word 'Trimble' in a blue sans-serif font.

The Tekla Warehouse logo features a blue icon of a warehouse building, followed by the text 'Tekla Warehouse' in a blue sans-serif font.

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ISM link

A small blue icon of a chain link.

The Trimble logo features a blue icon of a globe with a white 'T' inside, followed by the word 'Trimble' in a blue sans-serif font.

The Tekla Structures logo features a blue icon of a building, followed by the text 'Tekla Structures' in a blue sans-serif font.

A blue icon of a document with the text 'ISM' inside.

The Bentley logo features the word 'Bentley' in a red sans-serif font.

Two blue arrows, one pointing up and one pointing down, indicating a bidirectional relationship.

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NOTE - *** the phase II version of the link can only be used with Tekla Structures 2016/2016i/2017/2017i/2018/2018i and the Bentley ISM Connect Edition *** Bentley's Integrated Structural Modeling (ISM) is a technology for sharing structural engineering project information among structural modeling,...

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