

TEKLA BASECAMP

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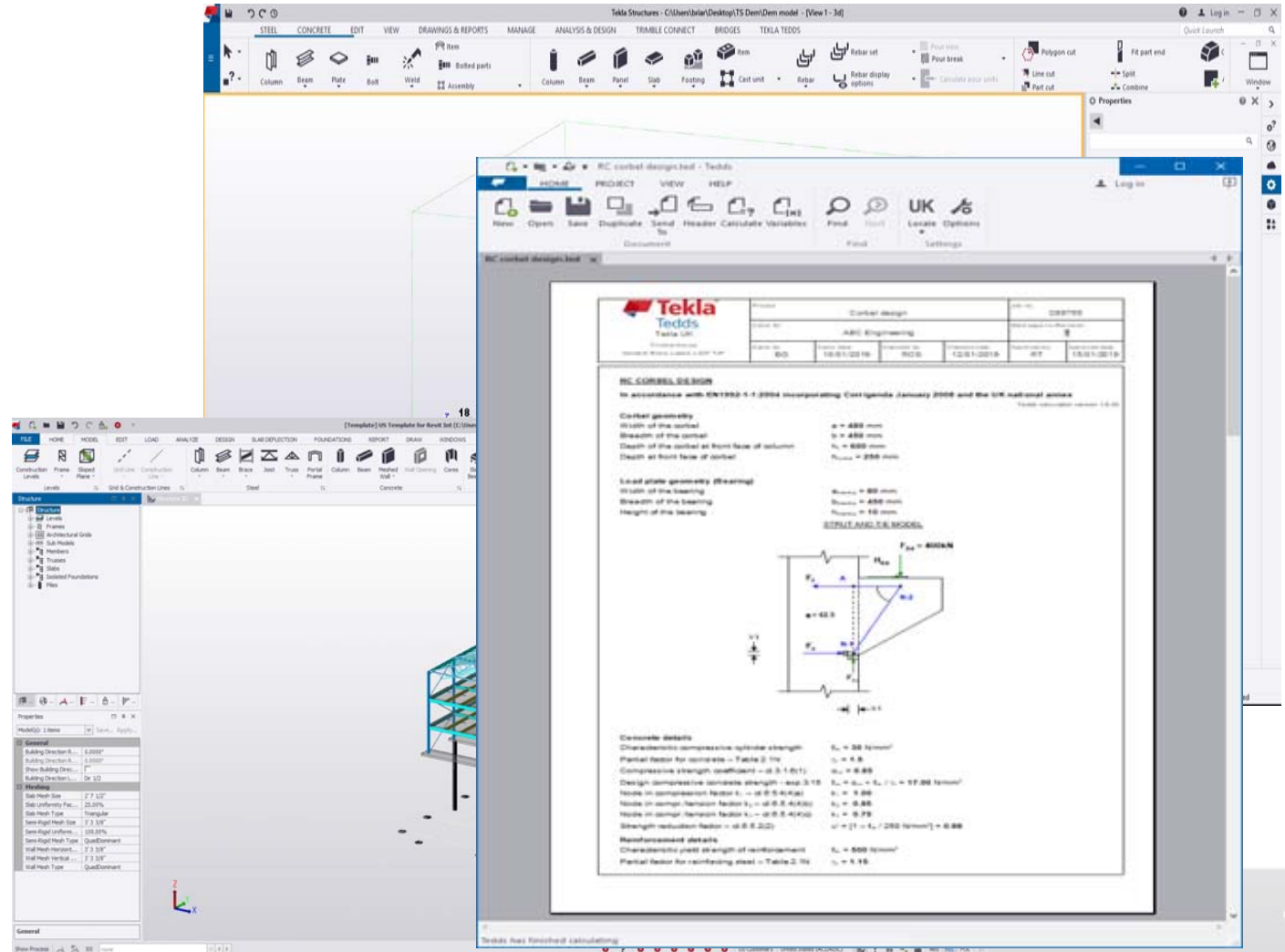
Introduction to Tekla's Analysis and Design Solutions:
Tekla Structural Designer and Tekla Tedds

Brian Armour, PE
Business Manager, Analysis and Design



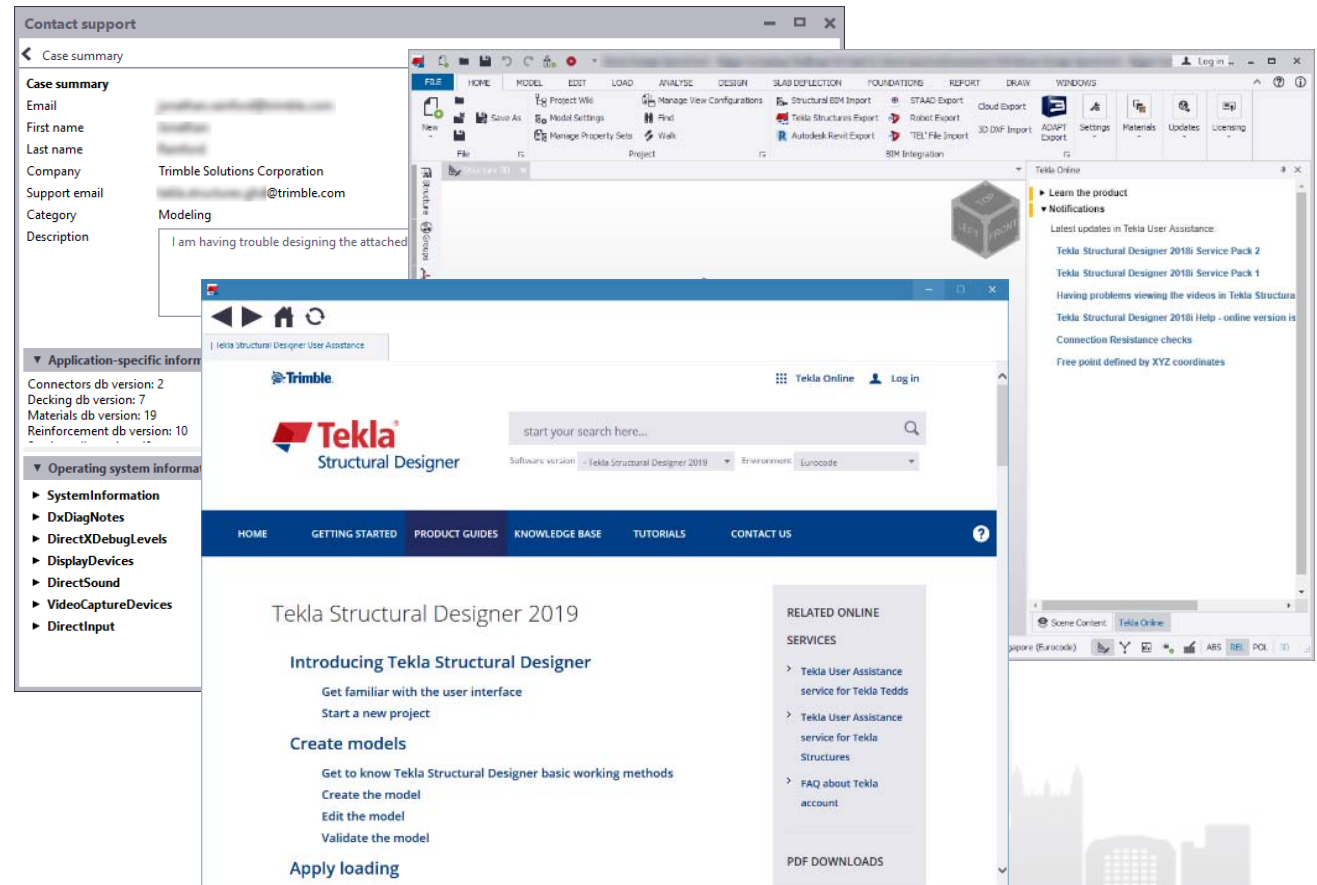
Tekla- One Solution

- Aligned the interface for common experience across Tekla software

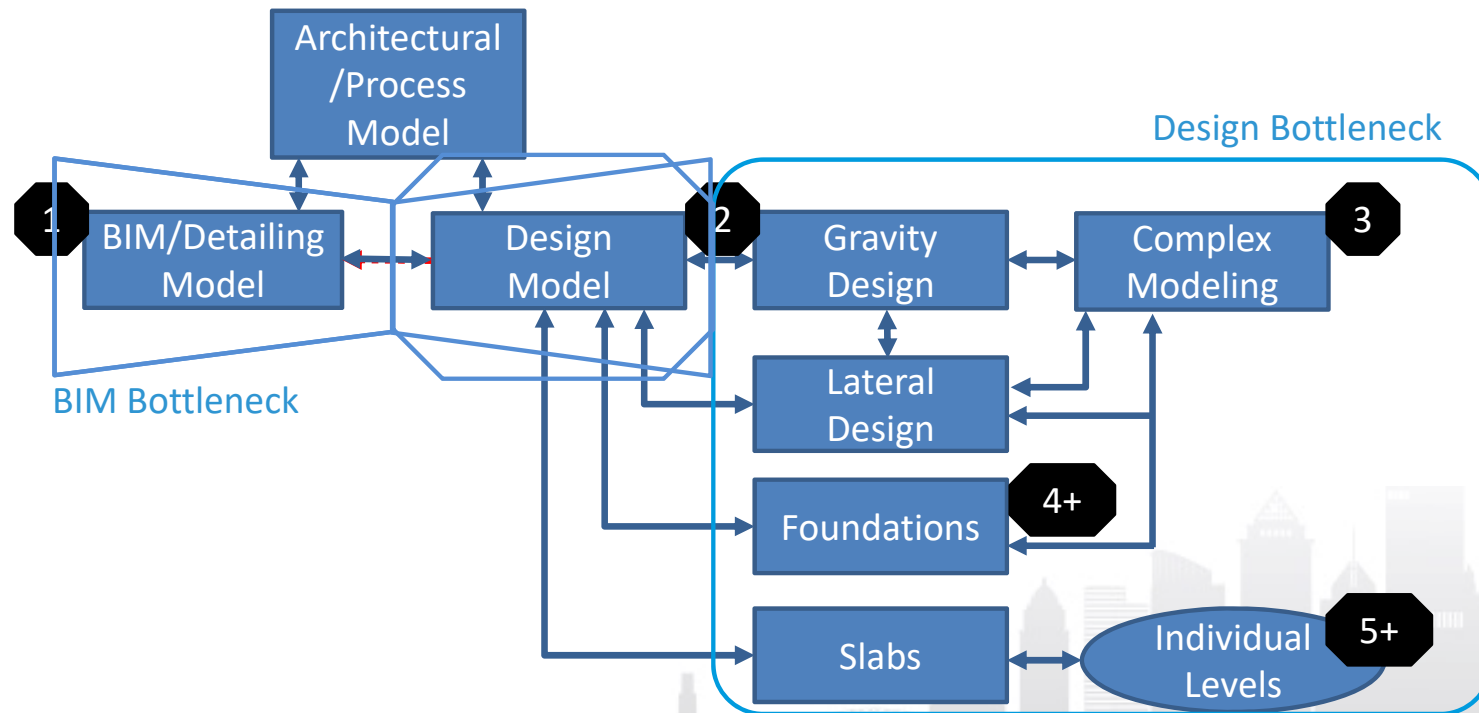


Tekla- One Solution

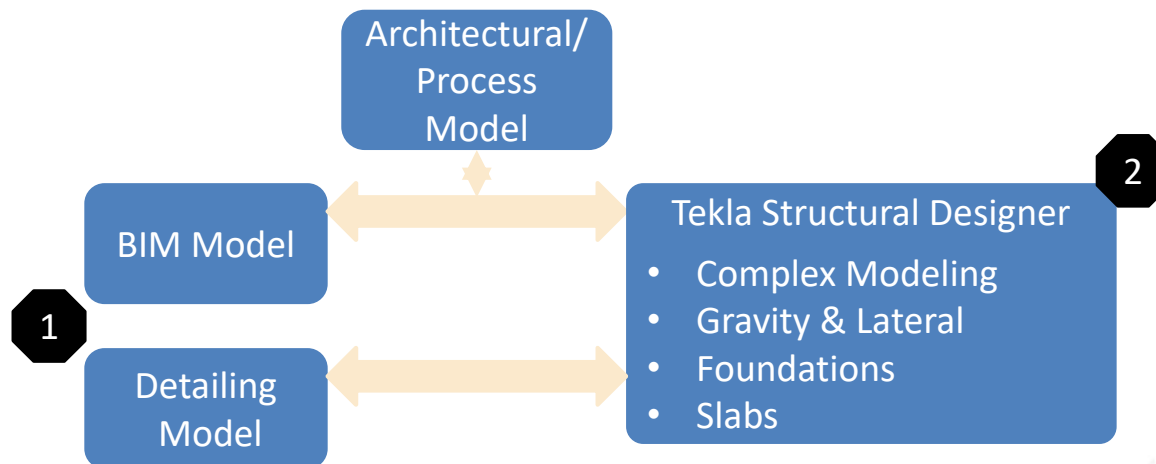
- Giving you a common user experience when using Tekla
- Common Controls are now included in all applications
 - Support Tool
 - Side Pane
 - Help Viewer
 - ATC Login



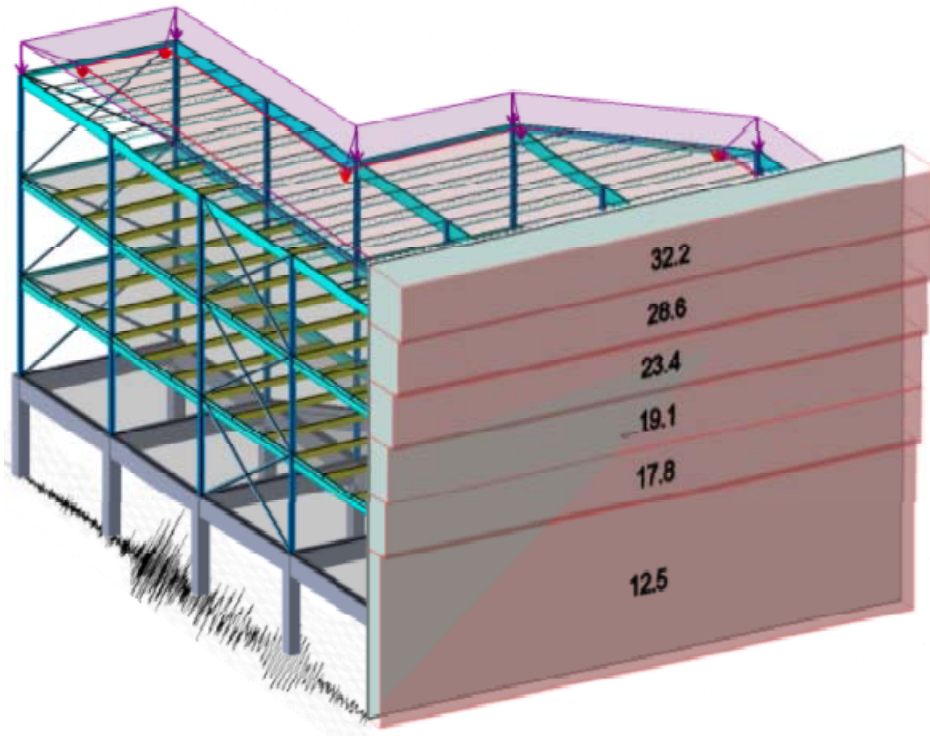
Current Project Workflow



Enhanced Project Workflow



Confidence in Loading- Automated snow, wind and seismic



Velocity Pressures

All Heights Building Geometry

Geometry

Ground Level in Model (Ignore Wind Below) 0'

Orientation 90.0

Mean Roof Height, h 81' 0"

Level of Highest Opening in Building 81' 0"

Overall Building X' Dimension 244'

Overall Building Y' Dimension 310'

Velocity Pressures

Basic Wind Data

Basic Wind Speed, V 115

Directionality Factor, K_d 0.8

Enclosure Classification Enclosed

Gust Effect Factor, G 0.850

Principal Axis	Exposure Category	Topographic Feature	Crest Height, H [ft, in]	Crest
+X	B	None	0"	0"
+Y	B	None	0"	0"
-X	B	None	0"	0"
-Y	B	None	0"	0"

Seismic Wizard

Basic Information

Structure details

Height to the highest level 30' 0" ft, in

Ignore seismic in floor (and below) none

Number of stories 5

Site Occupancy

Site Class D - Stiff soil

Risk Category II

I_e - Importance Factor 1.000 Override

Seismic Design Category

Seismic Design Category D

Alternative SDC

User Defined SDC

Seismic Force Resisting System

Seismic Force Resisting System Dir1

System C. Moment-Resisting Frame Systems

Type 4. Ordinary steel moment frames

Seismic Force Resisting System Dir2

System B. Building Frame Systems

Type 2. Special steel conc. braced frames

Coefficients & Factors Dir1

R - response modification coefficient 3.500

Ω_s - system over-strength factor 3.000

C_d - deflection amplification factor 3.000

ρ - redundancy factor 1.300

Coefficients & Factors Dir2

R - response modification coefficient 6.000

Ω_s - system over-strength factor 2.000

C_d - deflection amplification factor 5.000

ρ - redundancy factor 1.300

Design Confidently- Transparency in design

-  Unknown
-  Beyond Scope
-  Error
-  Warning
-  Fail
-  Pass

SB1 results (ACI 318, 2011)

- SB1 14"x24"
- Design summary bending top
- Design summary bending bottom
- Design summary shear and torsion
- Concrete Cover
- Longitudinal Bars
 - Top: 0" - 4' 4 1/2"
 - Top: 4' 4 1/2" - 6' 7 1/2"
 - Top: 6' 7 1/2" - 8' 10 1/2"
 - Top: 8' 10 1/2" - 13' 3"
 - Bottom: 0" - 1' 11 7/8"
 - Bottom: 1' 11 7/8" - 11' 3 1/8"
- 3D Building Analysis
 - 1 Construction Stage
 - 2 LRF_D-1.2D+1.6L
 - 3 LRF_D-1.2D+1.6L+0
 - 4 LRF_D-1.2D+L+1.6S
 - Bar Limit Checks
 - Bottom: 11' 3 1/8" - 13' 3"
 - Side Face Bars
 - Deflection Check
 - Stirrups
 - Axial Force
 - Minor Axis Shear
 - Minor Axis Moment

SB1 14"x24" - Longitudinal Bars - Bottom: 1' 11 7/8" - 11' 3 1/8" - 3D Building Analysis - 2 LRF_D-1.2D+1.6L

Largest applied positive moment in region $M_{u,region} = 36.2$ kip ft
 $M_u = |M_{u,region}| = 36.2$ kip ft
 $\phi = 0.900$ ACI 318-11: Section 9.3
 $d = 1' 9 3/4"$ ft, in
 $b = 1' 2"$ ft, in
 $R_n = M_u / (\phi \times b \times d^2) = 0.073$ ksi
 $\beta_1 = 0.850$ ACI 318-11: Section 10.2.7.3
 $f'_c = 4.000$ ksi
 $\omega_s = 0.319 \times \beta_1 = 0.271$
 $R_{n,s} = \omega_s \times (1 - (0.59 \times \omega_s)) \times f'_c = 0.911$ ksi Notes on ACI 318-08 Section 10.3.4

Limiting strength coefficient of resistance $R_{n,s} \leq R_{n,s} : \text{compression reinforcement not required}$
 Steel yield strength $f_y = 60.00$ ksi
 Required tension reinforcement ratio $\rho = \text{MIN}[0.85 \times (f'_c / f_y) \times (1 - \sqrt{1 - (2 \times R_n) / (0.85 \times f'_c)})], 0.319 \times \beta_1 \times f'_c / f_y] = 0.001$ Notes on ACI 318-08 Section 7 Eq.(3)
 Required tension steel area for bending in region $A'_t = 0.00$ in²
 Required compression steel area for bending in region $A_s = \rho \times b \times d = 0.37$ in²
 Torsion stirrups are not required
 Total additional required steel area for torsion $A_t = 0.00$ in²
 Additional required steel area for torsion in region $A_{t,face} = 0.00$ in²
 Required tension steel area in region $A_{s,total} = A_s + A_t = 0.37$ in²

Settings Expand All Collapse All Report level: 4 Close

SB 2-7 results (AISC)

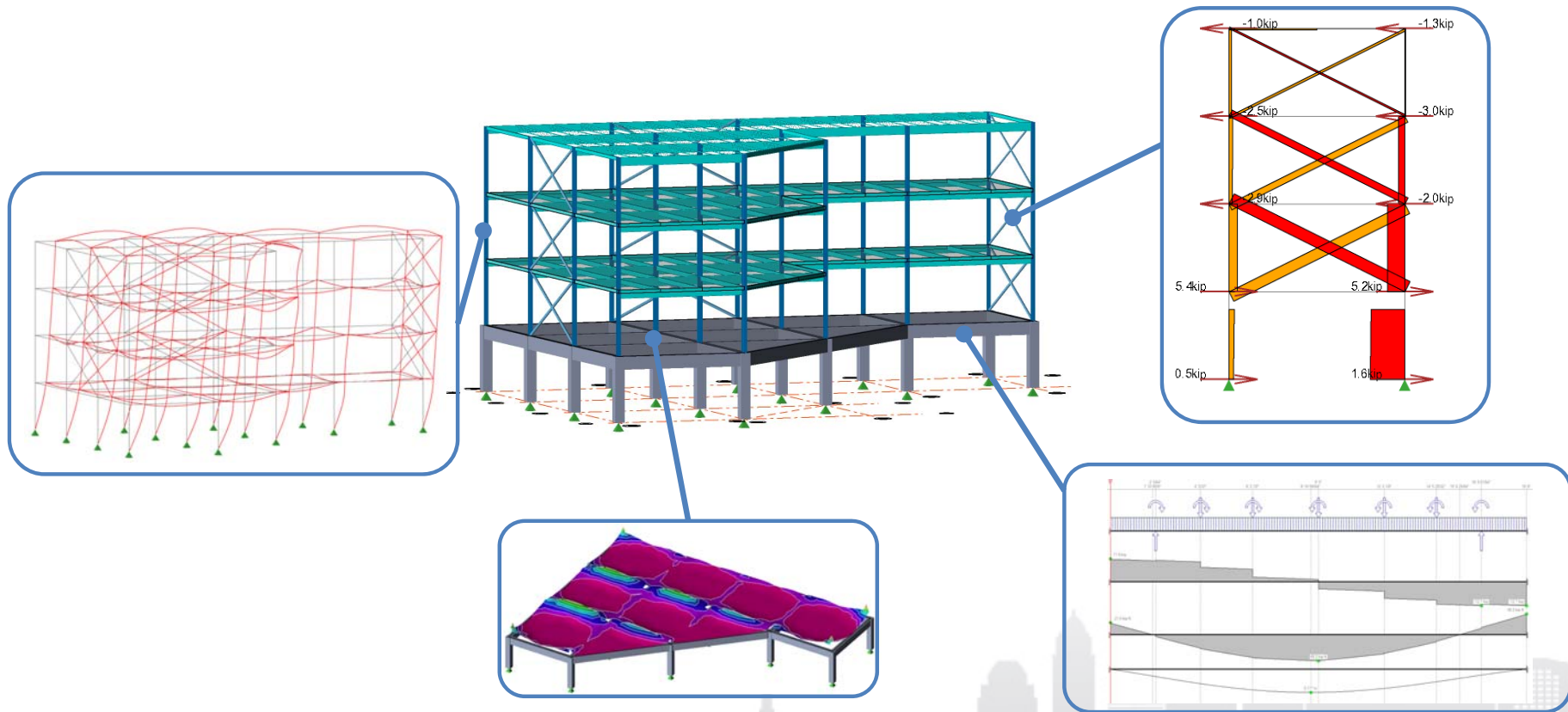
- Summary
- Classification
- Shear Moment
- Shear Moment
- Flexure
 - 1 Construction Stage
 - 2 LRF_D-1.2D+1.6L
 - 3 LRF_D-1.2D+1.6L+0.5S
 - Span 1 W 8x21 A992-50
 - Yielding: 12.0"
 - Flange Top
 - LTB Flange Btm: 0" - 12.0"
 - 4 LRF_D-1.2D+L+1.6S
- Flexure Minor
- Axial Tension
- Axial Compression
- Combined Forces
- Torsion
- Deflection

SB 2-3

SB	Flange class	Minimum yield stress, F_y	Plastic section modulus, Z_x	Nominal flexural strength, $M_{n,x}$	Flexural resistance factor, ϕ_b	Design flexural strength	Ratio	Pass
SB 3-3	SBR1	1	W 8x21	A992-50	8' 0"	0.041	✓ Pass	Results...
SB 2-4	SBR2	1	W 8x21	A992-50	15' 0"	0.384	✓ Pass	Results...
SB 3-4	SBR2	1	W 8x21	A992-50	15' 0"	0.368	✓ Pass	Results...
SB 2-5	SBR2	1	W 14x30	A992-50	15' 0"	0.060	✓ Pass	Results...
SB 3-5	SBR2	1	W 8x21	A992-50	15' 0"	0.191	✓ Pass	Results...

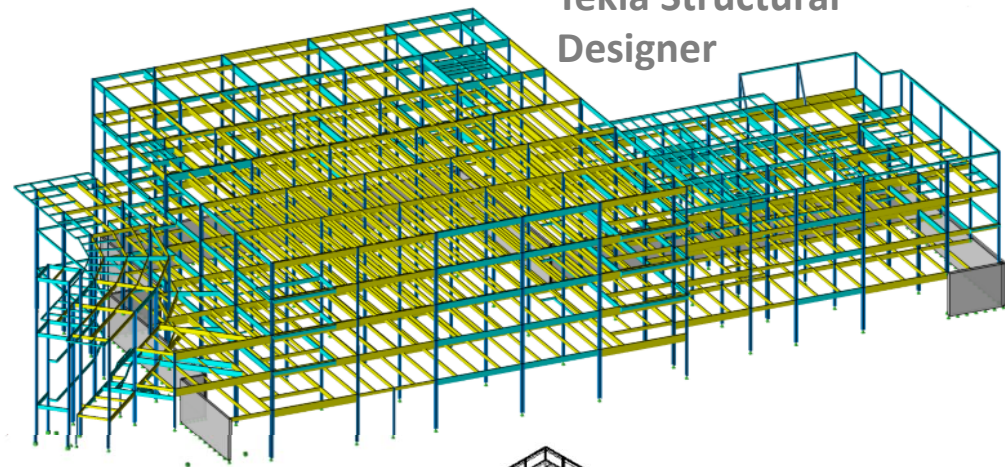
Settings Expand All Collapse All Report level: 1 Close

Review Confidently: Graphical results – model, level, individual



Tekla Structural Designer- Moving structural engineering forward

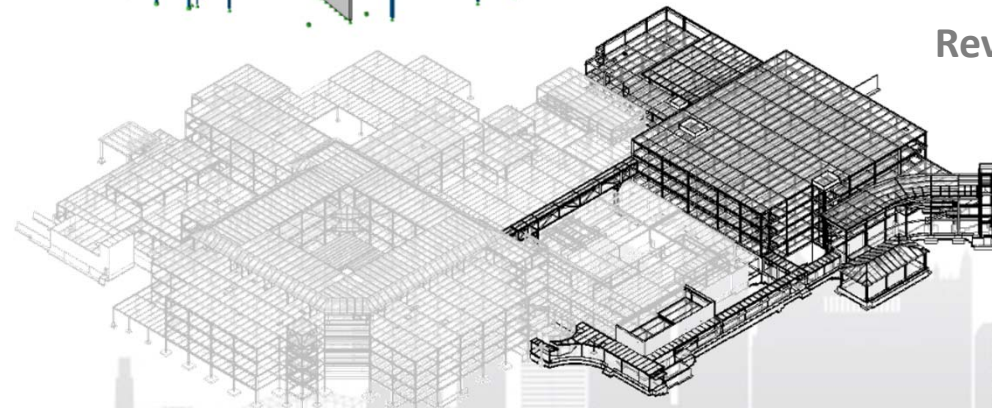
Tekla Structural Designer



"The TSD to Revit link has been a significant timesaver between engineer and technician. Another benefit we have found is the certainty that our analytical model is identical to our Revit model in plan geometry and sizing."

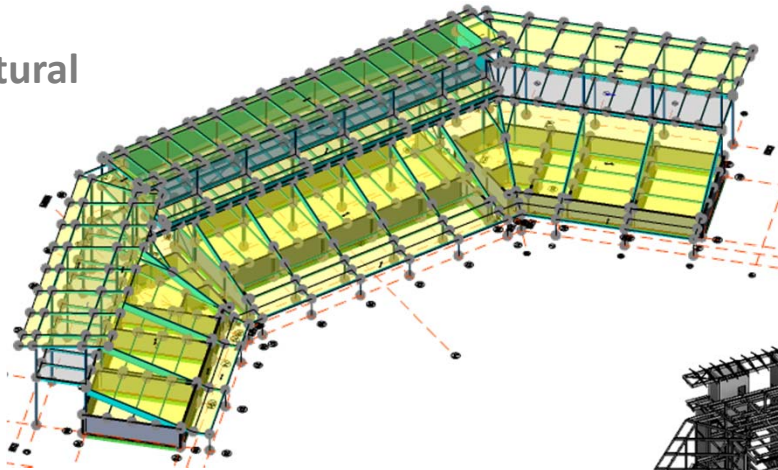
~Daniel Kilbert, P.E., LEED AP

Revit



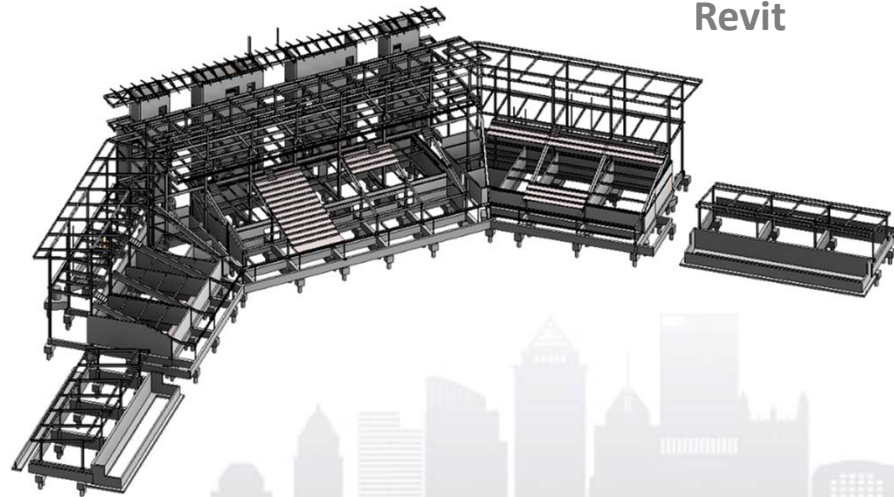
Tekla Structural Designer- moving the industry forward

Tekla Structural
Designer



Jimmy John's Field
Utica, MI

Revit



*"This is the reason we
switched from RAM to TSD"*
~Steve Murray, P.E.

SLAM

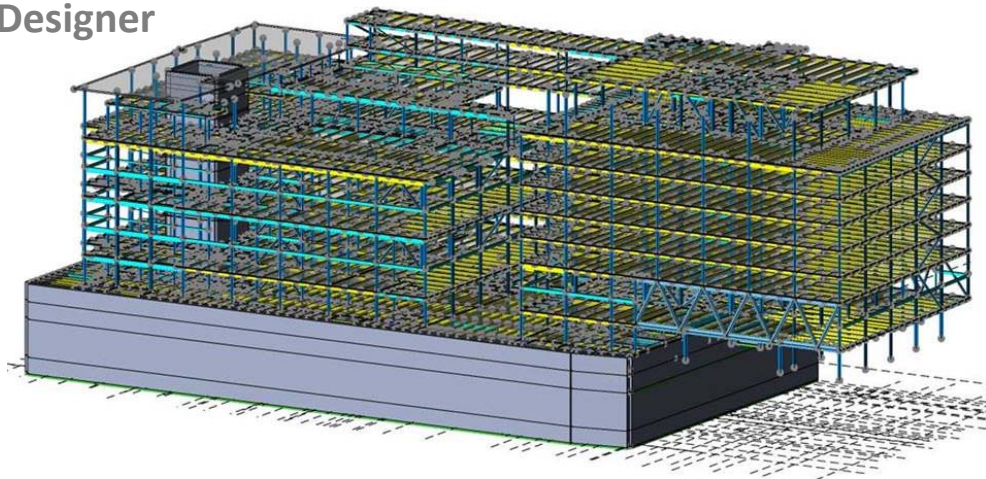
The S/L/A/M Collaborative

TEKLA
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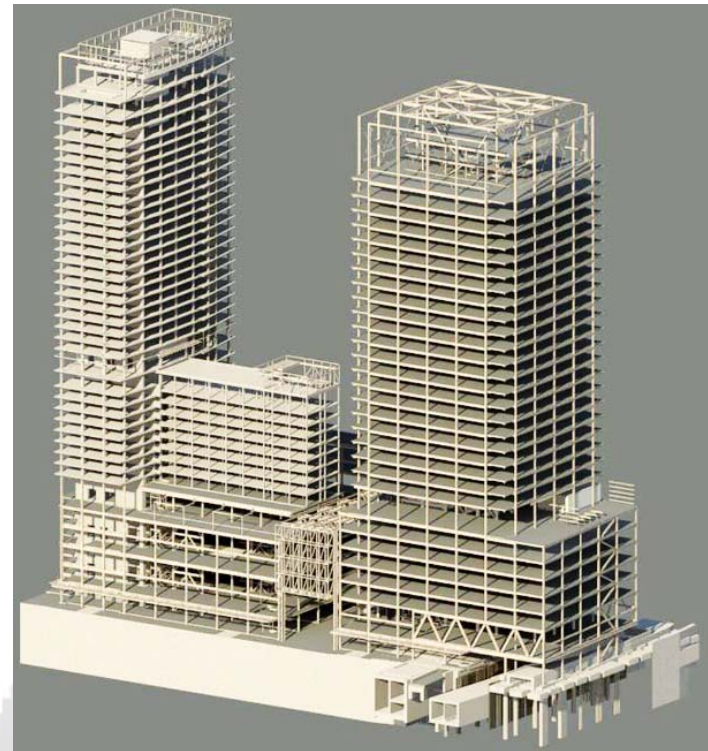
Tekla Structural Designer- moving the industry forward

The Hub on Causeway
Boston, MA

Tekla Structural
Designer



Revit



Courtesy of **LeMessurier**.

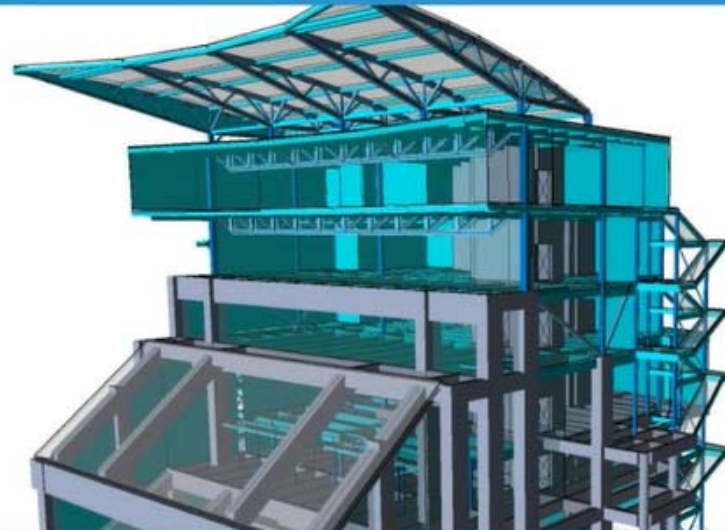
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Tekla Structural Designer- moving the industry forward



Tekla North America
BIM AWARDS 2018

WINNER IN THE TEKLA STRUCTURAL DESIGNER CATEGORY
LAWSON ESLER



CINCINNATI TENNIS CENTER COURT SOUTH PROJECT

TEKLA
BASECAMP

Introducing Trimble's Calculation Suite

The
Engineer's
Document &
Design
System



Professional Documents- By Design

Project: CONCRETE BEAM

Element:

Project No:

Date:

Prepared:

Checked:

Sheet No:

Calculations

Telecon

Meeting

Visit

File Note

Memo

REINFORCEMENT DESIGN

Notes & Assumptions

- i) Ultimate Loads
- ii) Design span
- iii) $f_y = 460 \text{ N/mm}^2$
- iv) simply supported beams.

3.4 Beam Design BS8110

3.4.4.4 Design formulae for rectangular beams
 $K = M / b d^2 f_{cu}$ assumed $K \leq K'$
 $Z = d \times LAF = d (0.5 + \sqrt{0.25 - \frac{K}{6A}})$

As required = $\frac{M}{0.87 \times f_y \times Z}$

3.4.6.5 Modification of span/depth for tension
 $f_s = \frac{\text{As provided} \times 285}{\text{As required}}$

3.4.6.3 Span/Depth Ratio for rectangular beams
 Simply supported $\Rightarrow 20$
 $\therefore \text{Max span} = 20 \times d \times \text{TMF}$

RC beam design (v2.2.11)

Beam analysis results

- Maximum bending moment
- Moment redistribution
 - There is no moment redistribution
- Design shear force
- Specify reinforcement explicitly
- Top reinforcement
 - Specify multiple layers
- Number of bars: 2



Project: What is Tedds?

Section: RC beam design

Job Ref: 1234

Sheet no. rev: 3

Calc by: ARN

Date: Feb 2015

Calc by:

Date:

RC BEAM DESIGN (ACI318-11)

Rectangular section details

Section width: $b = 12 \text{ in}$

Section depth: $h = 20 \text{ in}$

Concrete details

Compressive strength of concrete: $f_c = 4000 \text{ psi}$

Modulus of elasticity of concrete: $E = 3834254 \text{ psi}$

Reinforcement details

Yield strength of reinforcement: $f_y = 60000 \text{ psi}$

Nominal cover to reinforcement

Cover to top reinforcement: $C_{top} = 1.5 \text{ in}$

Cover to bottom reinforcement: $C_{bot} = 1.5 \text{ in}$

Cover to side reinforcement: $C_{side} = 1.5 \text{ in}$

Rectangular section in flexure (Chapter 10) - Positive moment

Factored bending moment at section: $M_u = 100.000 \text{ kip}_f\text{-ft}$

Depth to tension reinforcement: $d = h - C_{top} - \phi_s - \phi_{bar} / 2 = 17.625 \text{ in}$

Tension reinforcement provided: $4 \times \text{No. 8 bars}$

Area of tension reinforcement provided: $A_{sprov} = 3.142 \text{ in}^2$

Minimum area of reinforcement (exp. 10-3): $A_{smin} = \max(3 \text{ psi} \times (f_c / 1 \text{ psi}), 200 \text{ psi}) \times b \times d / f_y = 0.705 \text{ in}^2$

PASS - Area of reinforcement provided is greater than minimum area of reinforcement required

Stress block depth factor (cl. 10.2.7.3): $\beta_1 = \min(\max(0.85 - 0.05 \times (f_c - 4 \text{ ksi}) / 1 \text{ ksi}, 0.65), 0.85) = 0.85$

Depth of equivalent rectangular stress block: $a = A_{sprov} \times f_y / (0.85 \times f_c \times b) = 4.62 \text{ in}$

Net tensile strain in extreme tension fibers: $\epsilon_s = 0.003 \times (d - c) / c = 0.00673$

Net tensile strain in tension controlled zone

Strength reduction factor (cl. 9.3.2): $\phi_s = \min(\max(0.65 + (\epsilon_s - 0.002) \times (250 / 3), 0.65), 0.9) = 0.90$

Nominal moment strength: $M_n = A_{sprov} \times f_y \times (d - a / 2) = 240.568 \text{ kip}_f\text{-ft}$

Required nominal moment strength: $M_u / \phi_s = 111.111 \text{ kip}_f\text{-ft}$

PASS - Nominal moment strength exceeds required nominal moment strength

Minimum allowable bot bar spacing: $S_{bot, min} = \max(1 \text{ in}, 1.000 \text{ in}) = 1.000 \text{ in}$

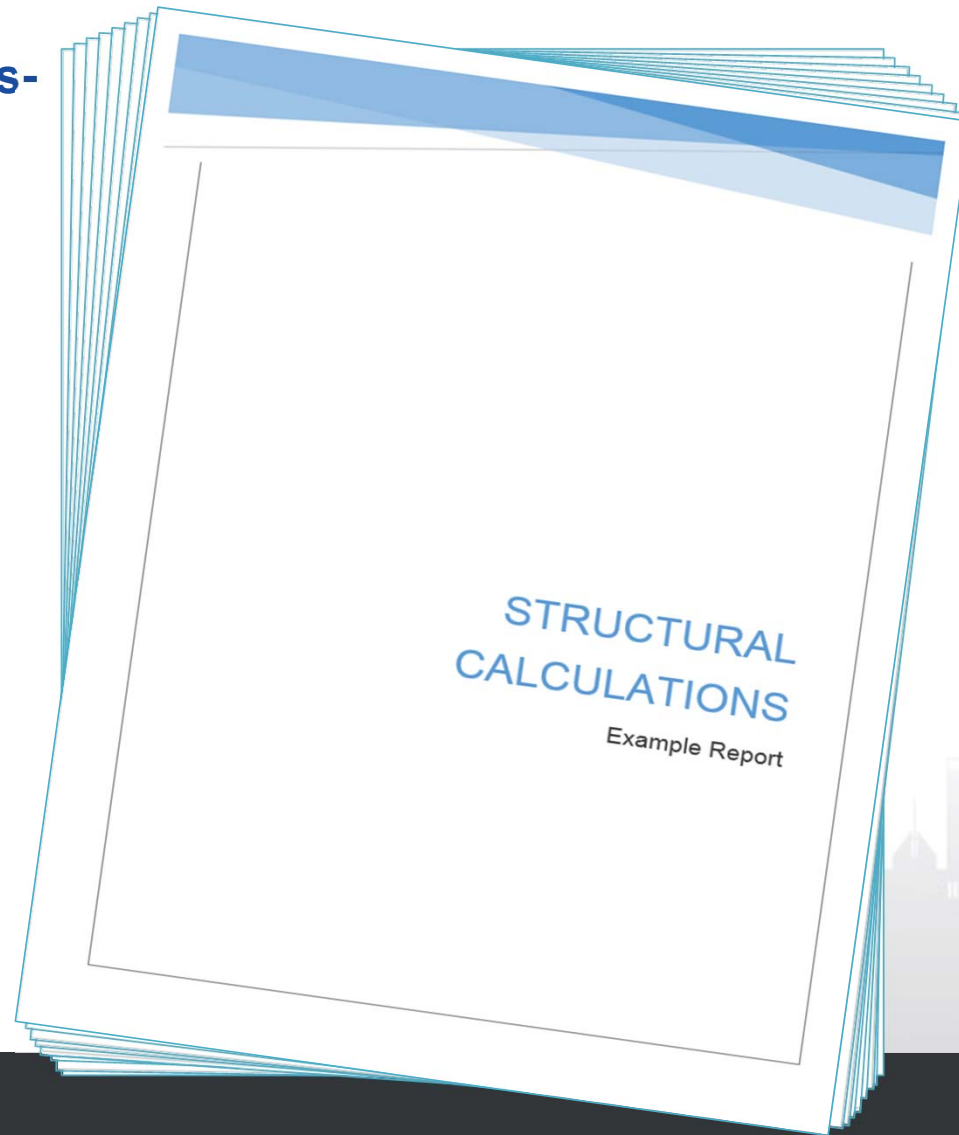
Actual bot bar spacing:

Minimum allowable top bar spacing: $S_{top, min} = (b - 2 \times C_{top} - 2 \times \phi_s - N_{bot} \times \phi_{bar}) / (N_{top} - 1) = 1.417 \text{ in}$

Actual top bar spacing:

PASS - Actual bar spacing exceeds minimum allowable

Professional Documents- Easy with TEDDS



Let's take a look!



Tekla Tedds

Tekla Tedds Integrator for Tekla Structures

Let's take a look!

Product Demonstration

