



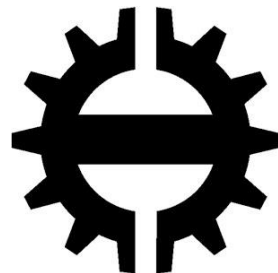
**POZNAN UNIVERSITY OF TECHNOLOGY (PUT)
FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING**

**Structural modelling with analysis using BIM tools, checking the
workflow using the IFC format.**

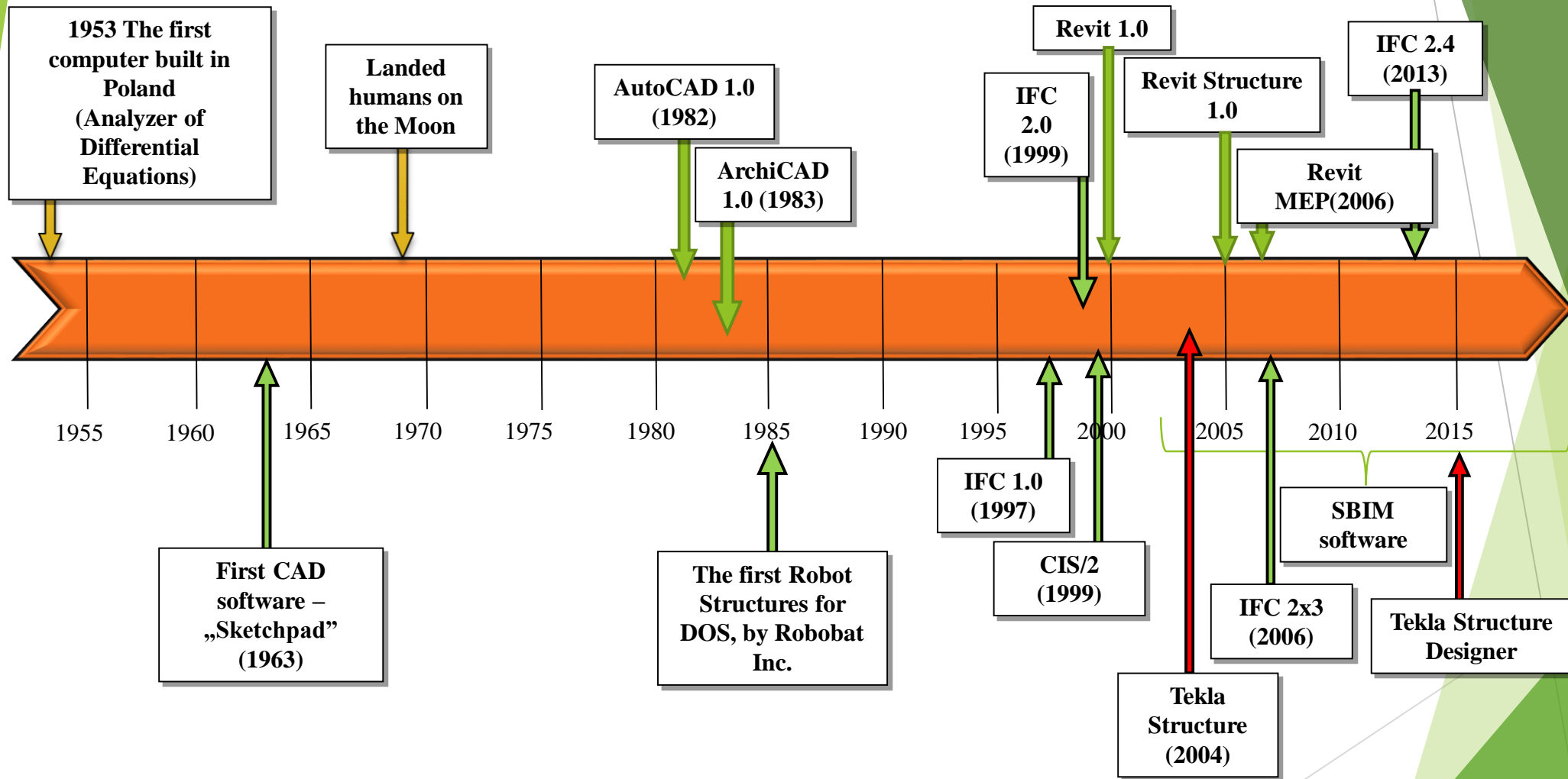
**By
Wojciech Stanisław Fleming
MAY 2016**

**Supervisors: Adam Glema, Professor PUT, Faculty of Civil Engineering at PUT
Co-supervisor: Markku Heinisuo, Professor, Faculty of Civil Engineering at TUT
Co-supervisor: Toni Teittinen, Doctoral Student, Faculty of Civil Engineering at TUT**

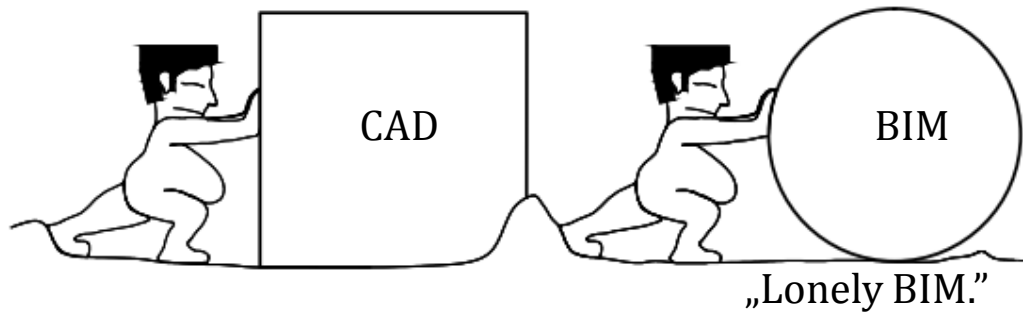
**Master thesis realized in partnership with the Tampere
University of Technology, Finland.**



BIM Timeline

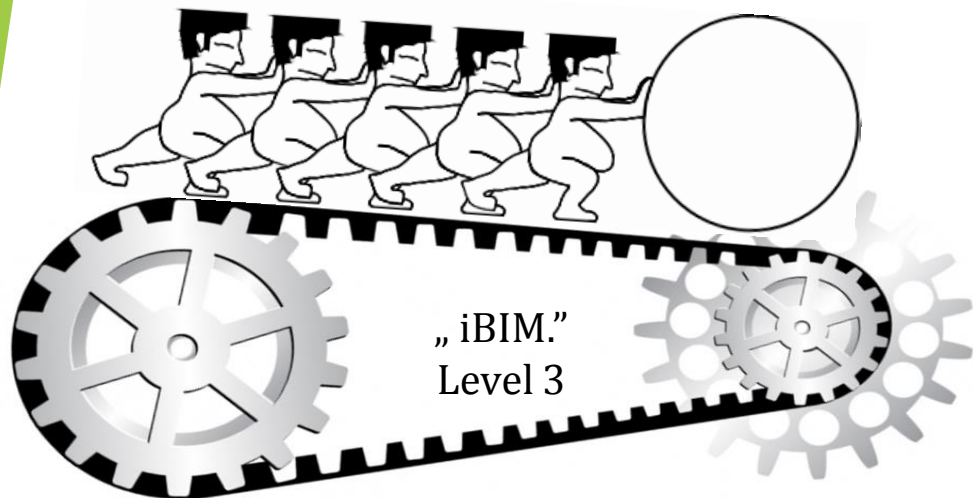
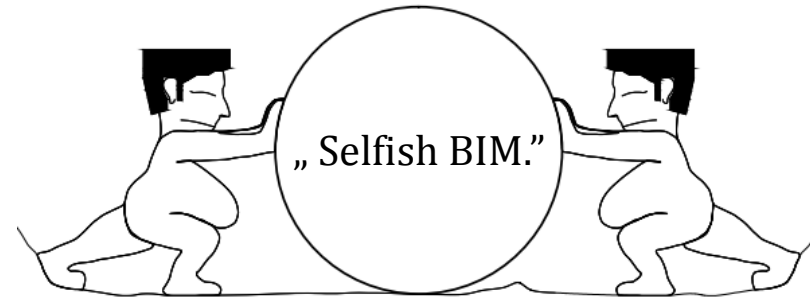


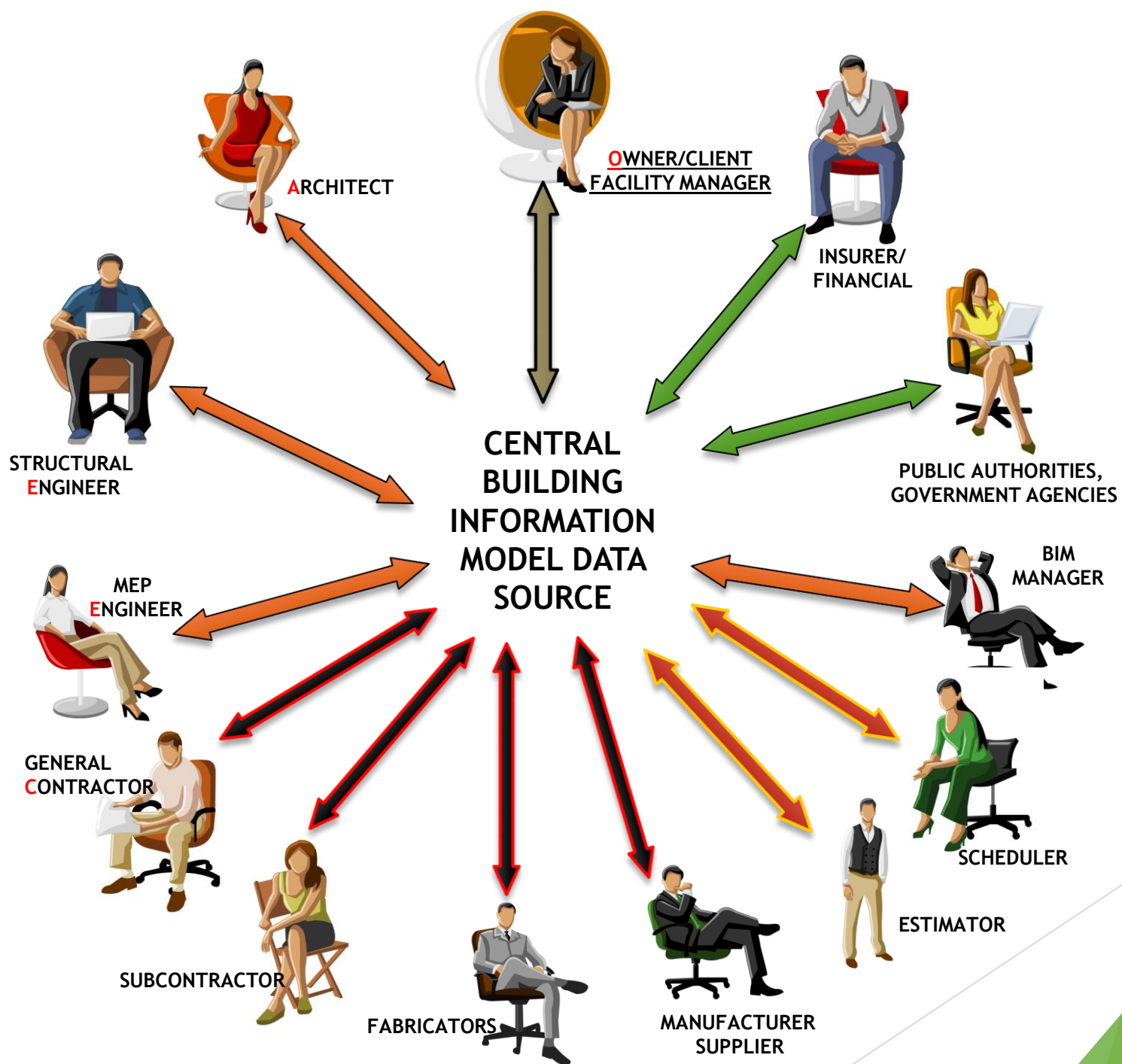
BIM



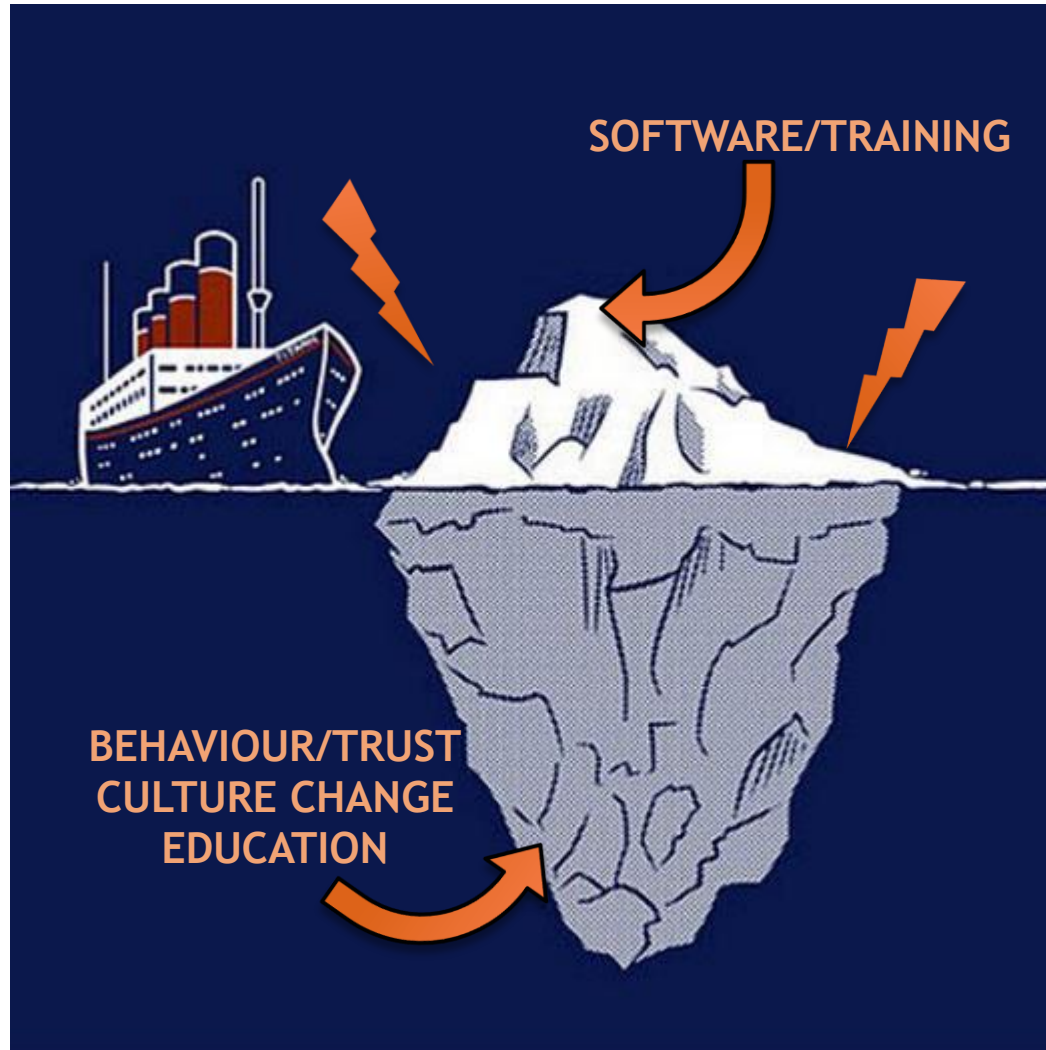
“

„ BIM is 10 percent technology and
90 percent sociology.”

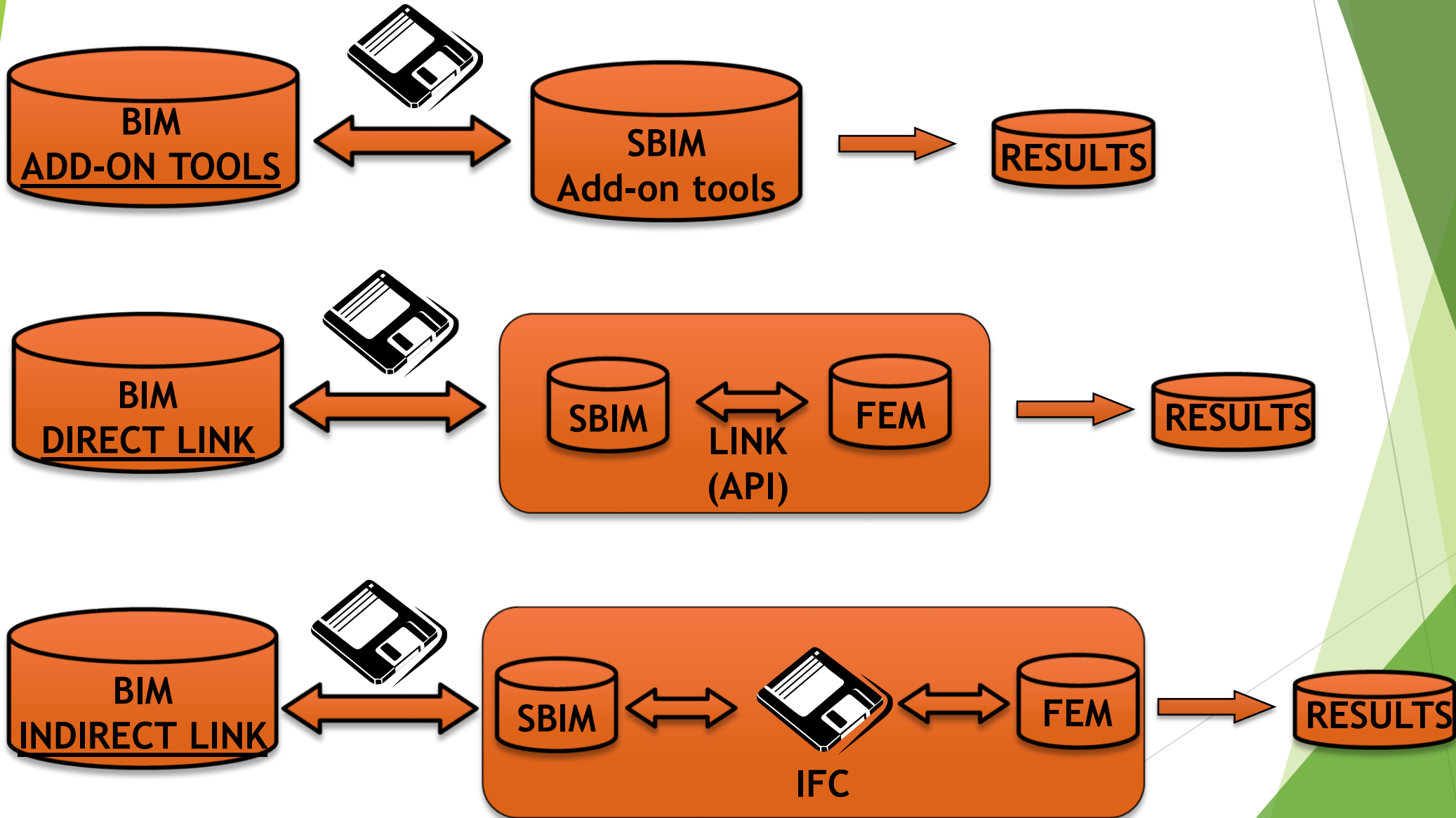




THE HIDDEN LIMITATIONS OF BIM PROCESS



THREE DIFFERENT LINK TYPES TO SET INTEROPERABILITY



HOUSE IFC



1 During the day.

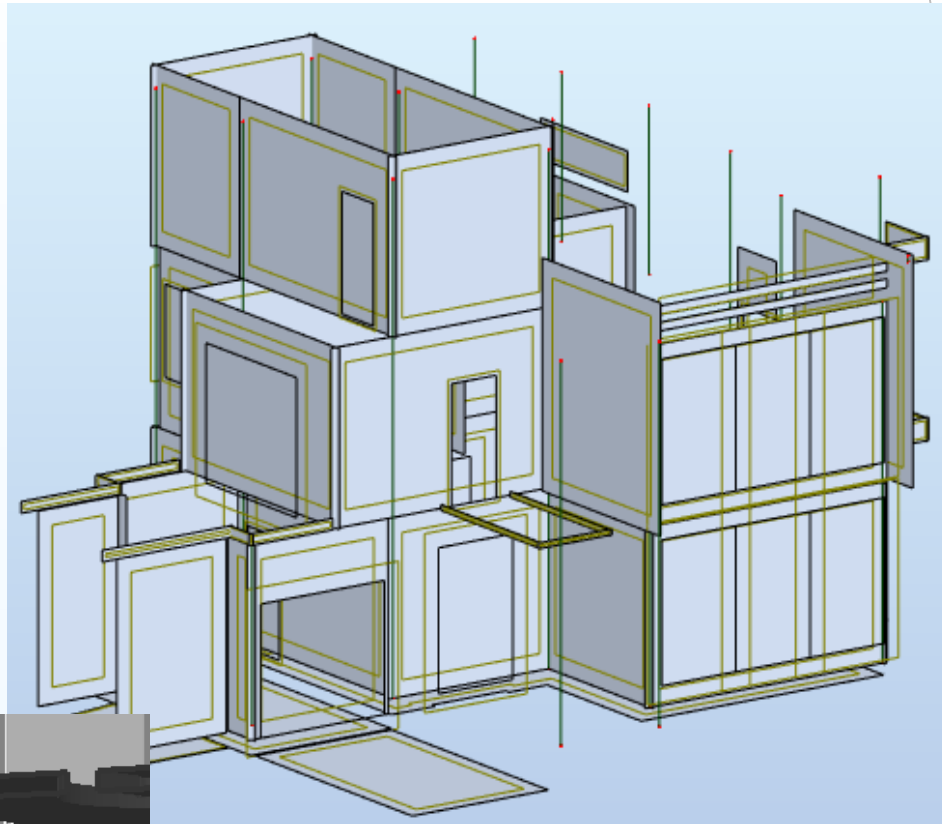


2 During the night

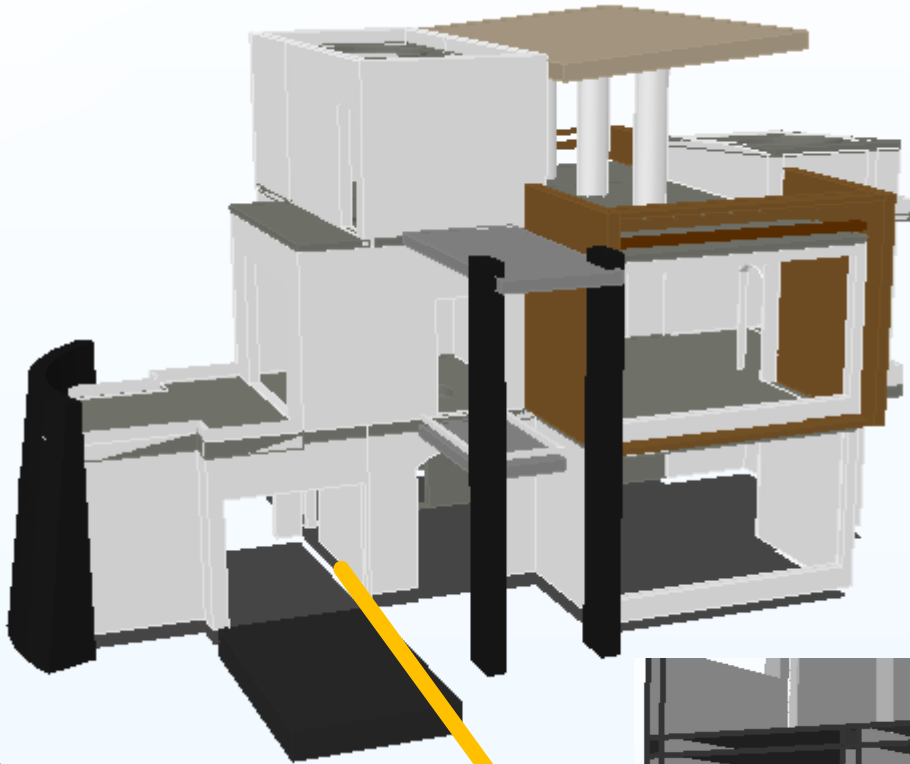
HOUSE IFC



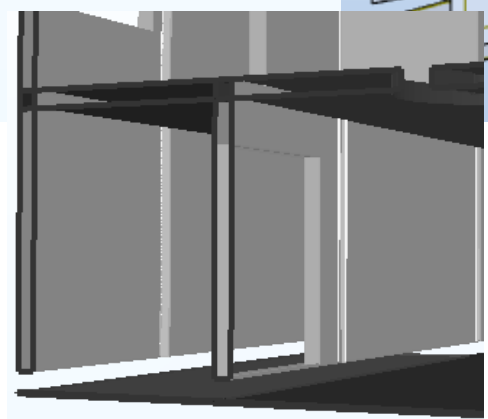
HOUSE IFC



1 Model in ARSAP.

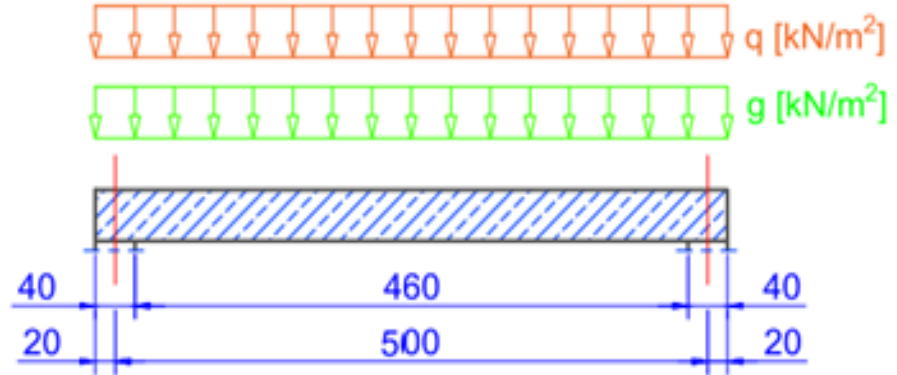
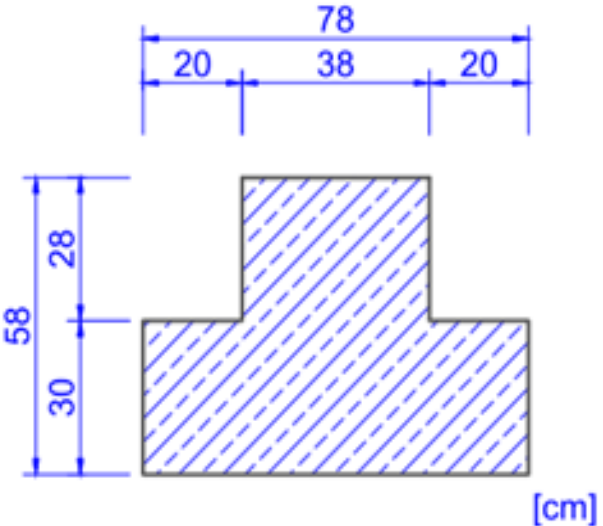


2 Model in IFC format

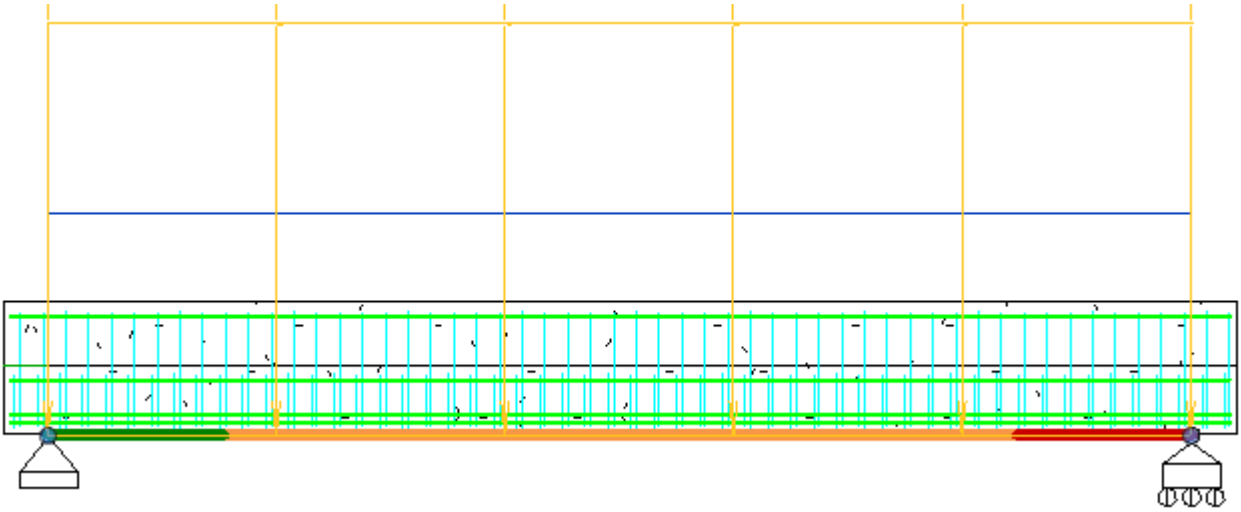
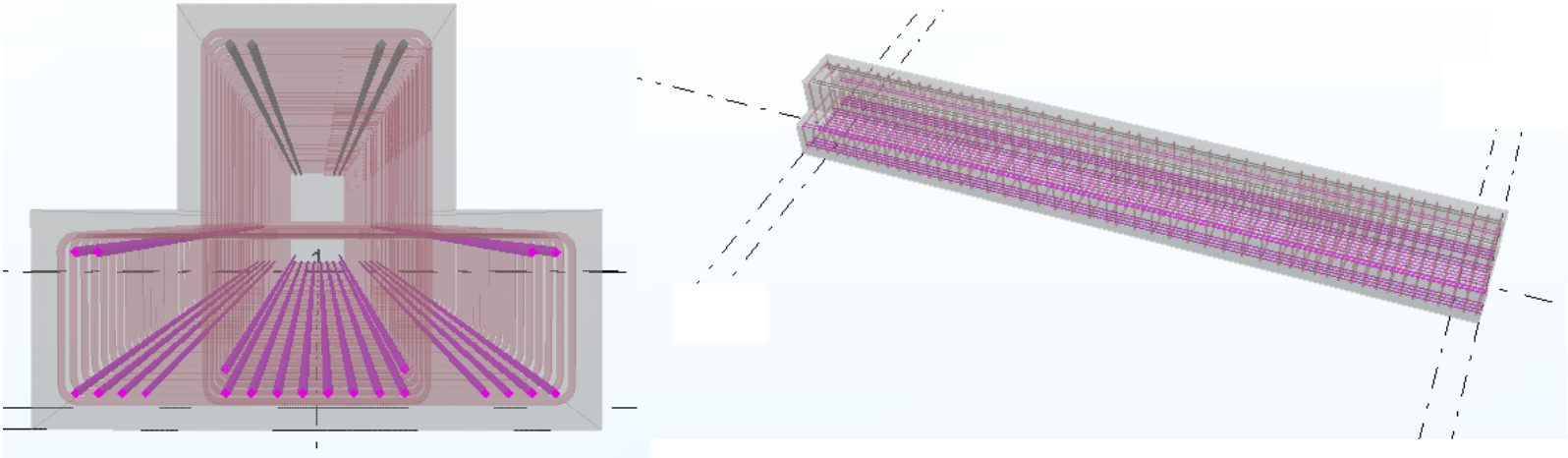


3 Design errors.

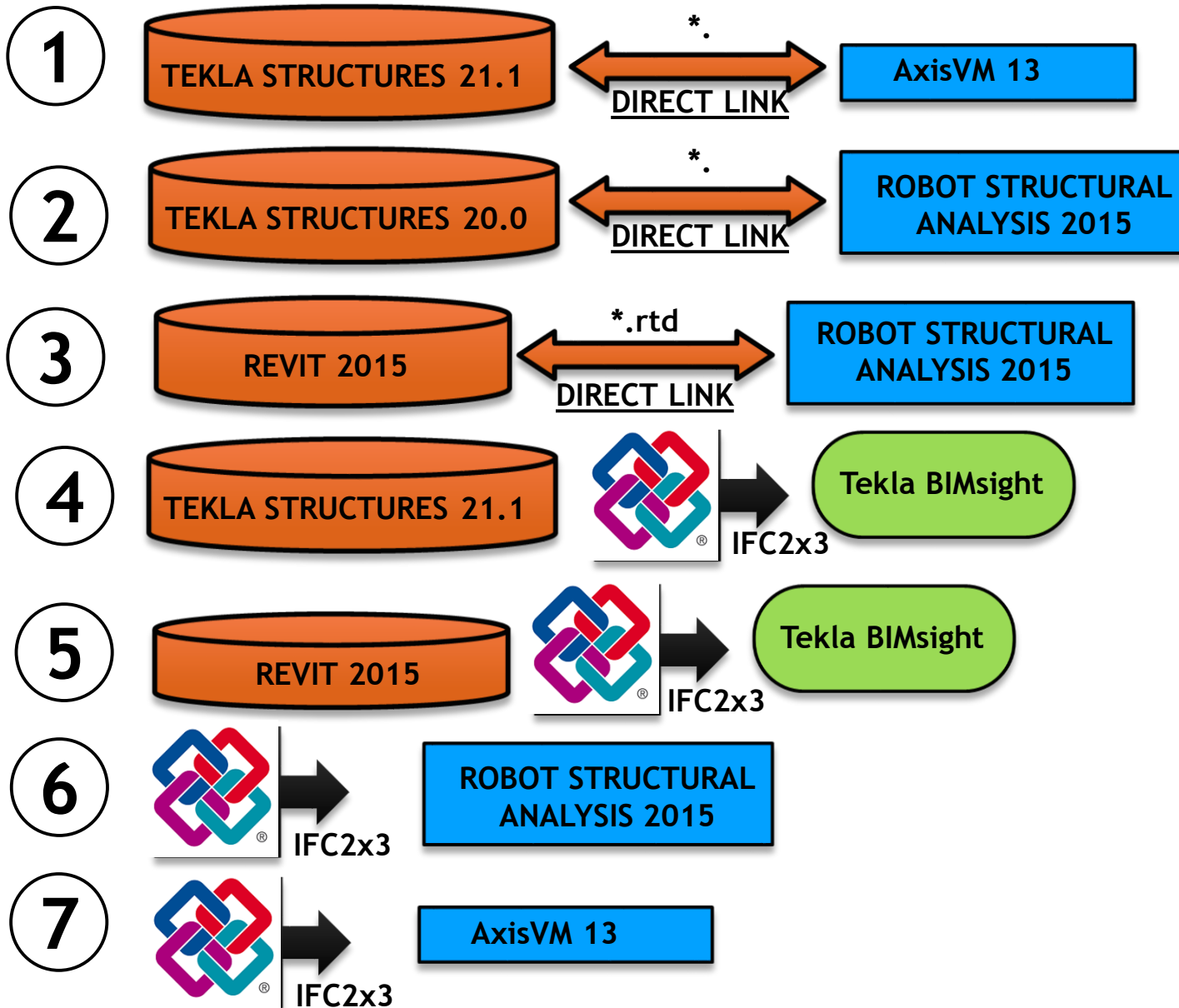
LEDGE BEAM



LEDGE BEAM



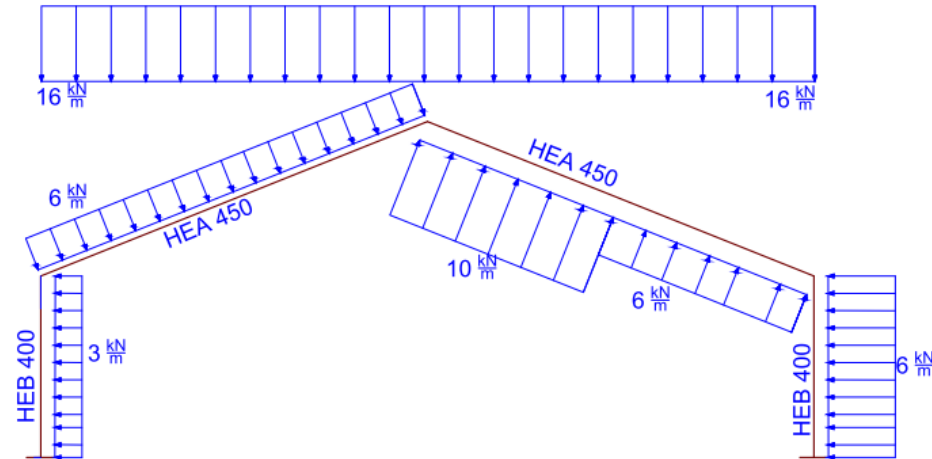
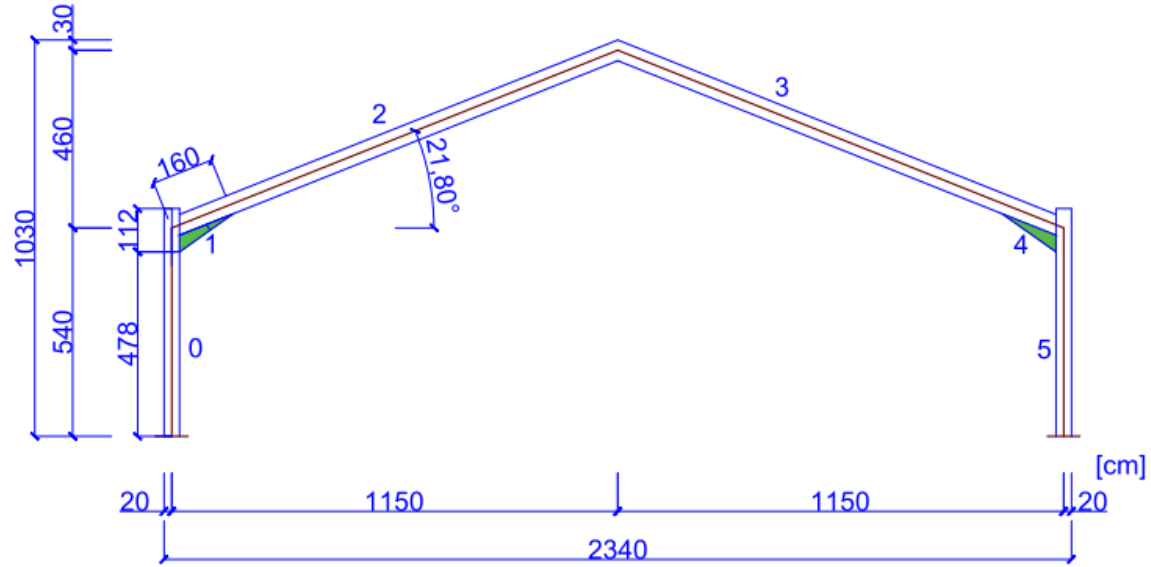
TESTED PATHWAY OF DATA WORKFLOW



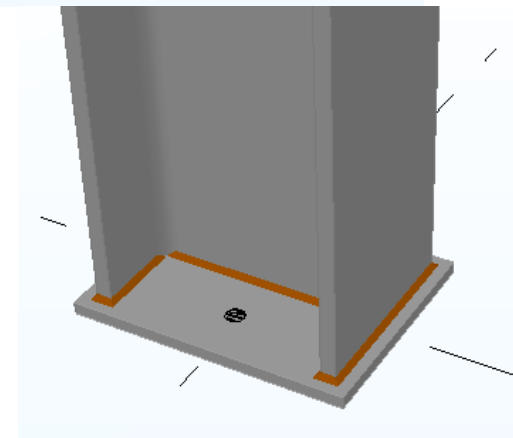
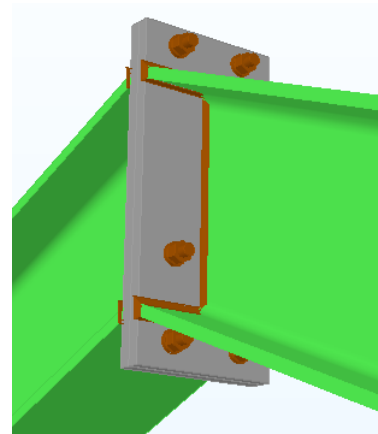
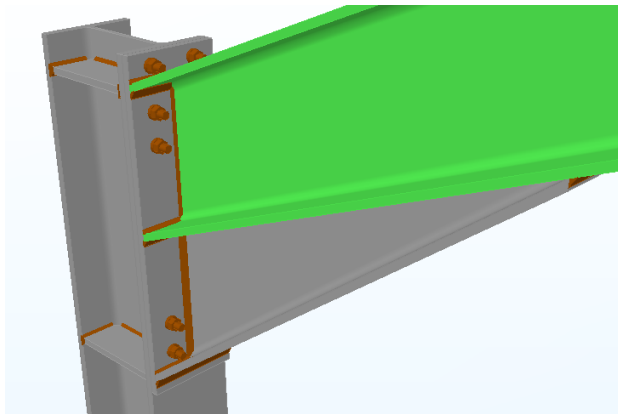
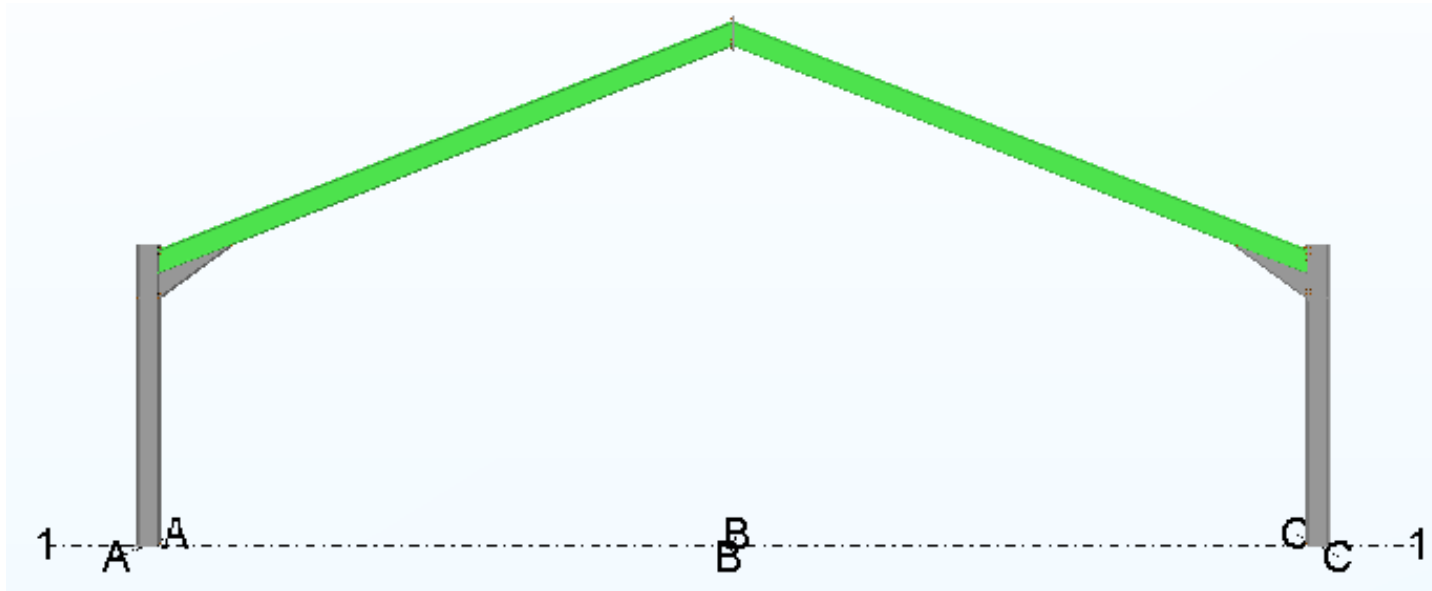
RESULTS

Exchange scenario	1	2	3	4	5	6	7
1. SECTION PROPERTIES							
Height, h	✓	✓	✓	✓	✓	X	X
Width, b	✓	✓	✓	✓	✓	X	X
Area, A	✓	✓	✓	✓	✓	X	X
Main reinforcement	X	X	X	✓	✓	X	X
Stirrups	X	X	X	✓	✓	X	X
1. GEOMETRY							
Length, l	✓	✓	✓	✓	✓	✓	✓
Position of analytical line	✉	✓	✓	X	X	✓	X
Length of analytical line	✓	✓	✓	X	X	X	X
1. MATERIAL PROPERTIES							
Yield strength of reinforcement, f_{yk}	X	X	X	✓	✓	X	X
Strength of concrete, f_{ck}	✓	✓	✓	✓	✓	X	X
Modulus of elasticity, E	✓	✓	✓	✓	✓	X	X
Density, ρ	✓	✓	✓	✓	✓	X	X
Ultimate compressive straint, ϵ_{cu3}	✓	✓	✓	✓	✓	X	X
1. LOADS							
Names	✓	✓	✓	X	X	X	X
Magnitude, q	X	✓/⊗	✓	X	X	X	X
Position	X	✓/✉	✓	X	X	X	X
Combination	X	✓	✓	X	X	X	X
1. BOUNDARY CONDITIONS							
Pinned	X	✓	✓	X	X	X	X
Roller	X	✓	✓	X	X	X	X

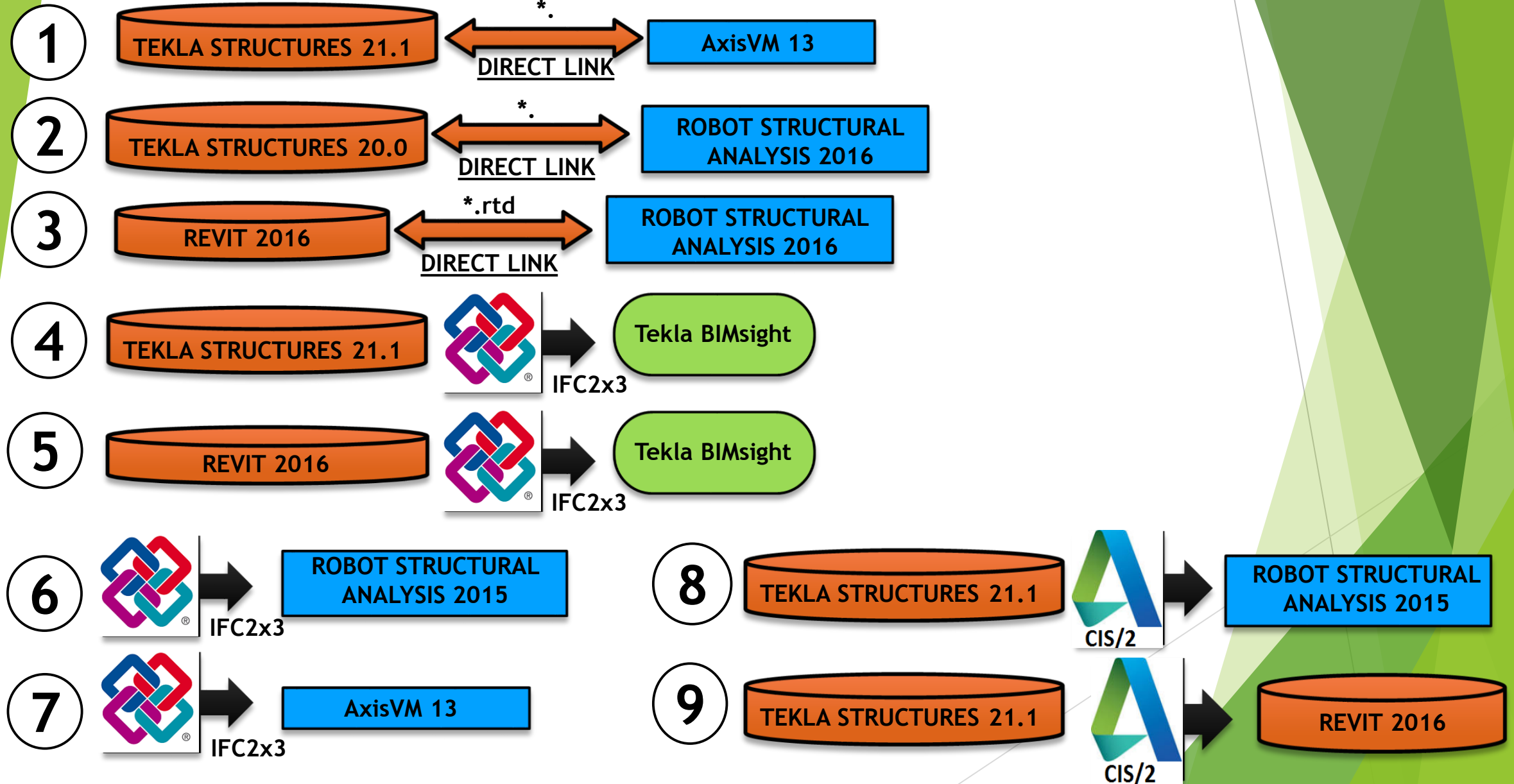
PORTAL FRAME



PORTAL FRAME



TESTED PATHWAY OF DATA WORKFLOW



RESULTS

	1	2	3	4	5	6	7	8	9
1. SECTION PROPERTIES									
Cross sections	✓	✓	✓	✓	✓	X	X	✓	✓
Height, h	✓	✓	✓	✓	✓	X	X	✓	✓
Width, b	✓	✓	✓	✓	✓	X	X	✓	✓
Web thickness, t_w	✓	✓	✓	✓	✓	X	X	✓	✓
Flange thickness, t_f	✓	✓	✓	✓	✓	X	X	✓	✓
Area, A	✓	✓	✓	✓	✓	X	X	✓	✓
Moment of inertia, I_y	✓	✓	✓	✓	✓	X	X	✓	✓
Moment of inertia, I_z	✓	✓	✓	✓	✓	X	X	✓	✓
Torsion constant, I_t	✓	✓	✓	✓	✓	X	X	✓	✓
Elastic modulus, $W_{el,y}$	✓	✓	✓	✓	✓	X	X	✓	✓
Plastic modulus, $W_{pl,y}$	✓	✓	✓	✓	✓	X	X	✓	✓
All sections	✓	✓	✓	✓	X	X	X	✓	X
1. GEOMETRY									
Length, l	✓	✓	✓	✓	✓	X	X	✓/⊗	✓/⊗
Position of analytical line	✓	✓	✓	X	X	X	X	✓/⊗	X
Position of cross section	☒	✓	✓	✓	X	X	X	✓	X
Length of analytical lines	✓	✓	✓	X	X	X	X	X	X
1. MATERIAL PROPERTIES									
Yield stress, f_y	✓	✓	✓	✓	✓	X	X	✓	✓
Modulus of elasticity, E	✓	✓	✓	✓	✓	X	X	✓	✓
Shear modulus, G	✓	✓	✓	✓	✓	X	X	✓	✓
Density, ρ	✓	✓	✓	✓	✓	X	X	✓	✓
1. LOADS									
Magnitude, q	⊗/☒	⊗	✓/⊗	X	X	X	X	X	X
Position	⊗/☒	⊗	✓/⊗	X	X	X	X	X	X
1. BOUNDARY CONDITIONS									
Pinned	X	✓	✓	X	X	X	X	X	X
Roller	X	✓	✓	X	X	X	X	X	X

WALL

