TEKLA BASECAMP

AUG.27-29 2019

Trimble

BURNS & McDONNELL

- Daniel LaBorde
  - Senior Structural Designer.
  - 20+ years of detailing and design experience.
  - 15 years at Burns and McDonnell.

2019

BURNS McDONNELL

100% EMPLOYEE OWNED

Same accountability & entrepreneurship an owner brings to his/her company.

<4% TURNOVER

Here to stay. You'll see consistent faces year after year.

90% REPEAT BUSINESS

Focused on relationships built on predictable, successful project execution.

LARGE FIRM RESOURCES SMALL FIRM RESPONSIVENESS

Founded in 1898, Burns & McDonnell is a fully integrated EPC firm with 7,000 professionals, generating $3.2B in annual revenue with an employee compensation model focused on pay-for-performance

2019

OIL, GAS, AND CHEMICALS

2019

TEKLA
BASECAMP

BURNS McDONNELL

THE CLIENTS WE SERVE

PHILLIPS 66

VALERO

ENABLE MIDSTREAM PARTNERS

Chevron Phillips Chemical Company LLC

HUNTSMAN
Enriching lives through innovation

CVR Energy

MARATHON

ONEOK

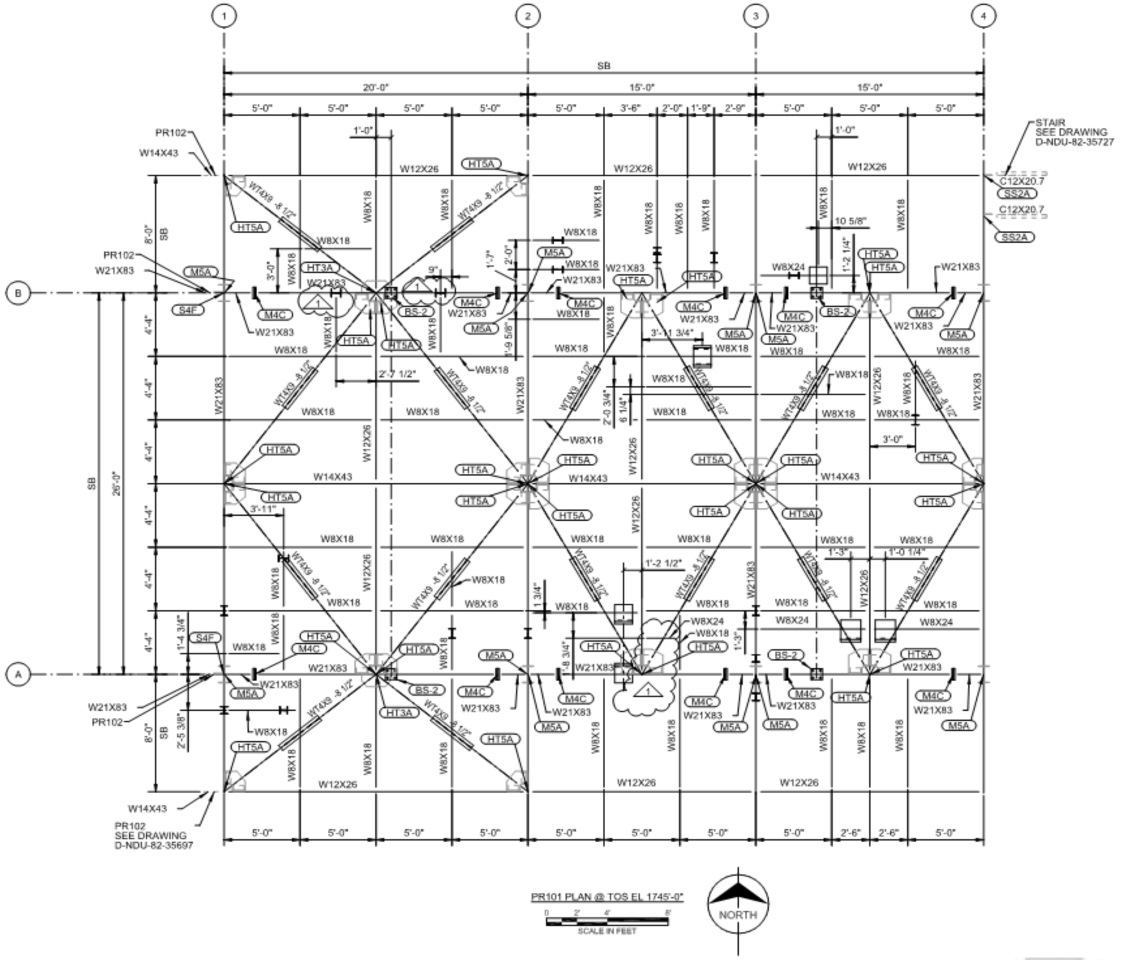
GOODYEAR

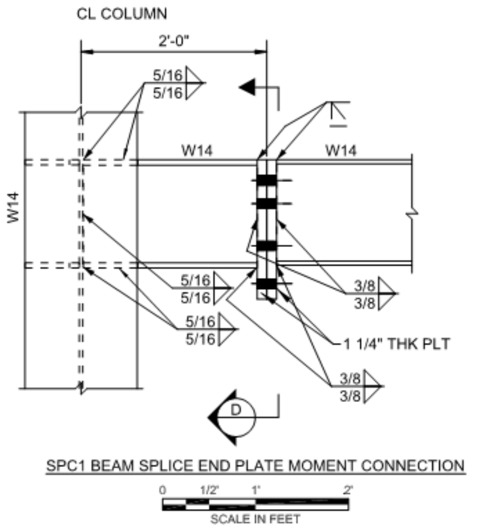
BURNS McDONNELL

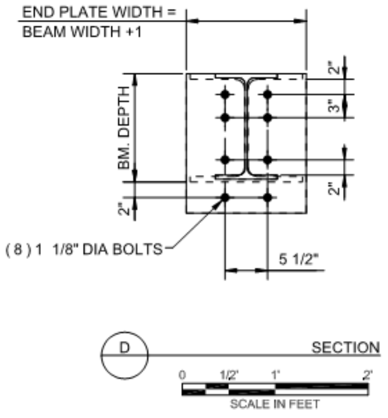
- 1800 TONS OF STEEL
- 6800 CUBIC YARDS OF CONCRETE
- 1000 AUGER CAST PILES

2019

- Client Deliverables include.
  - Simple plans and elevations with Fully connected Tekla model.
  - Fully connected Tekla model.
  - Fully detailed engineering drawings. Shop drawings.
  - AutoCAD/MicroStation at project completion.
  - Spreadsheet data such as schedules of piles and anchor bolts
  - IFC, CIS2, etc….



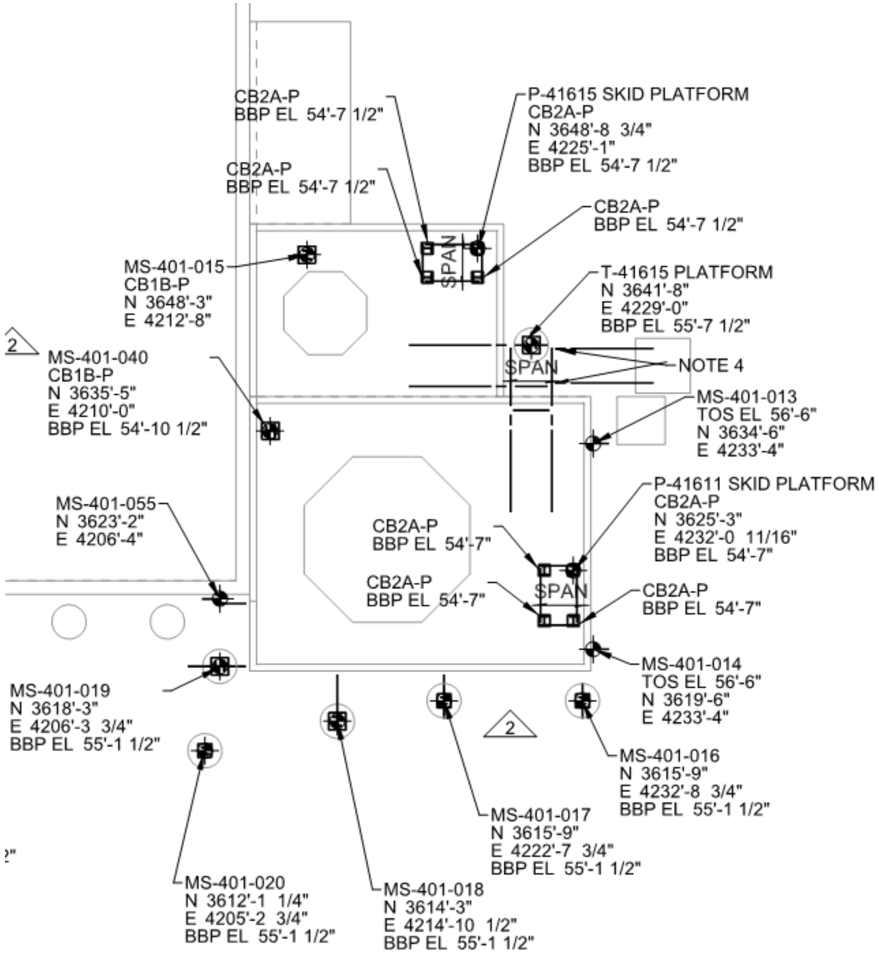


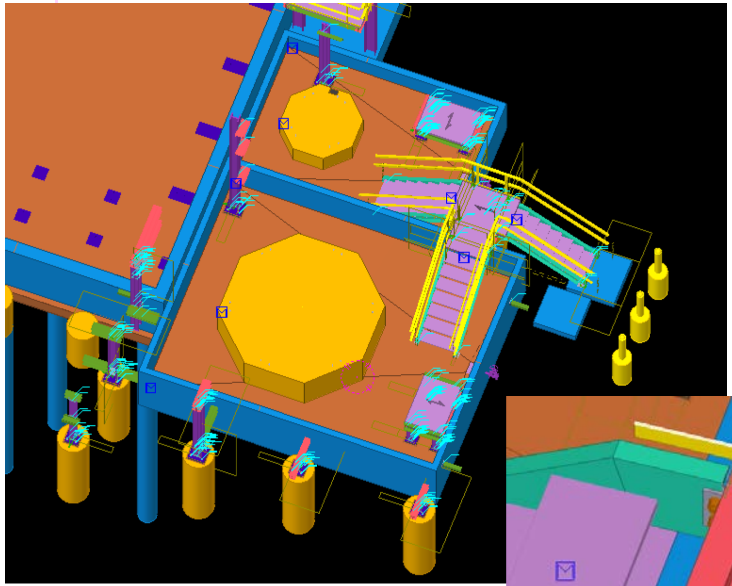


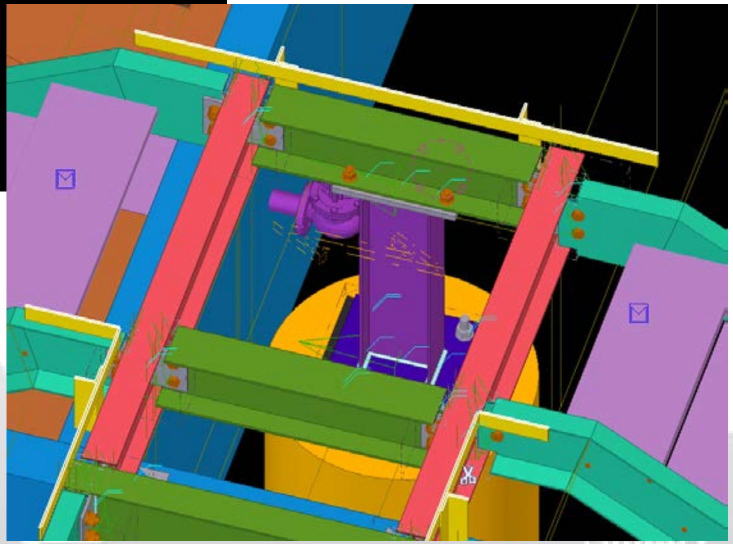
2019

TEKLA BASECAMP

BURNS McDONNELL







2019

TEKLA BASECAMP

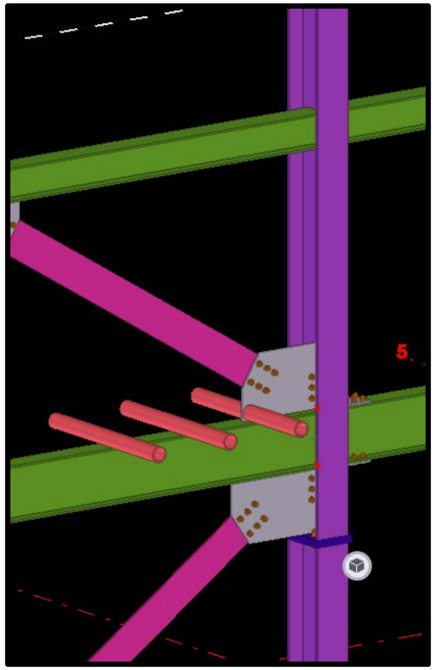
BURNS McDONNELL

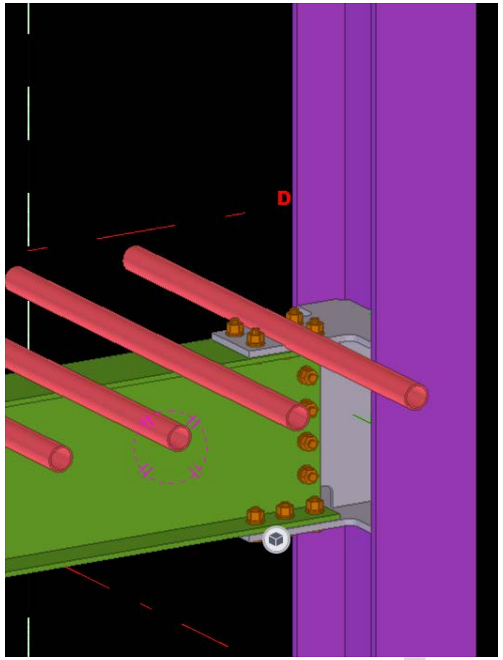
TAG NAME	BASE PLATE DETAIL	TYPE	NO. REQ'D	SIZE "D"	MTL SPEC	PROJ	BOLT LENGTH	"A"	K"	"S"	"SL"	PL "W"	PL "T"	TWO NUTS
E-12-115-STR	CB1A	TYPE VII	16	1"	F1554-36	5"	2'-0"	3"	5"	-	-	-	-	NO
EAST RACK	CB1D	TYPE VII	4	1 1/2"	F1554-36	6 1/2"	2'-10 1/2"	4"	6"	-	-	-	-	NO
MPS-03-104	CB1C	TYPE VII	4	1 1/4"	F1554-36	6"	2'-5"	3"	5 1/2"	-	-	-	-	NO
MPS-03-176	CB1C	TYPE VII	4	1 1/4"	F1554-36	6"	2'-5"	3"	5 1/2"	-	-	-	-	NO
MPS-04-273	CB1B	TYPE VII	8	1"	F1554-36	5 1/4"	2'-0 1/4"	3"	5"	-	-	-	-	NO
MPS-2-001	CB1C	TYPE VII	4	1 1/4"	F1554-36	6"	2'-5"	3"	5 1/2"	-	-	-	-	NO
E-51	CB1F	TYPE VII	8	1 1/2"	F1554-36	6 1/2"	2'-10 1/2"	4"	6"	-	-	-	-	NO
REACTOR-STRUCTURE	CB1D	TYPE VII	4	1 1/2"	F1554-36	6 1/2"	2'-8 1/2"	4"	6"	-	-	-	-	NO
E-52E	CB1H	TYPE II	8	1 1/2"	F1554-36	7"	2'-9"	4"	6"	-	-	3 1/2"	3/8"	NO
FRAC-STRUCTURE	CB1J	TYPE VII	56	1 1/2"	F1554-36	7"	2'-11"	4"	6"	-	-	3 1/2"	3/8"	NO
REACTOR-STRUCTURE	CB1K	TYPE II	52	1 3/4"	F1554-105	8 1/4"	2'-10 1/4"	4"	6 1/2"	-	-	5 1/2"	1"	NO
REACTOR-STRUCTURE	CUSTOM	TYPE VII	16	1"	F1554-36	5 1/4"	2'-0 1/4"	3"	5"	-	-	-	-	NO
V-12-001-PLT	CB2A	TYPE VII	8	1"	F1554-36	5 1/4"	2'-0 1/4"	3"	5"	-	-	-	-	NO
DEPENTANIZER PUMP	CB2A	TYPE VII	4	1"	F1554-36	5 1/4"	2'-0 1/4"	3"	5"	-	-	-	-	NO
V-12-102-VALVE-PLT	CB2A	TYPE VII	4	1"	F1554-36	-	-	-	-	-	-	-	-	NO
WEST-PIPERACK	CB2B	TYPE VII	24	1"	F1554-36	5 1/4"	2'-2 1/4"	3"	5"	-	-	-	-	NO
E-12-006-STR	CB2B	TYPE VII	16	1"	F1554-36	5 1/4"	2'-4 1/4"	3"	5"	-	-	-	-	NO
E-12-109-STR	CB2B	TYPE VII	16	1"	F1554-36	5 1/4"	2'-4 1/4"	3"	5"	-	-	-	-	NO
EAST RACK	CB2B	TYPE VII	4	1"	F1554-36	5 1/4"	2'-0 1/4"	3"	5"	-	-	-	-	NO
REACTOR-STRUCTURE	CB2B	TYPE VII	8	1"	F1554-36	5 1/4"	2'-0 1/4"	3"	5"	-	-	-	-	NO
ACID-BLOWDOWN-STR	CB2C	TYPE VII	24	1 1/2"	F1554-36	6 1/2"	2'-0"	4"	6"	-	-	-	-	NO
REACTOR-STRUCTURE	CB2C	TYPE VII	32	1 1/2"	F1554-36	6 1/2"	2'-4 1/2"	4"	6"	-	-	-	-	NO
ACID-BLOWDOWN-STR	CB2D	TYPE VII	24	1 1/2"	F1554-36	6 1/2"	2'-0"	4"	6"	-	-	-	-	NO
E-52E	CB2D	TYPE VII	24	1 1/2"	F1554-36	6 1/2"	2'-10 1/2"	4"	6"	-	-	-	-	NO
REACTOR-STRUCTURE	CB2D	TYPE VII	20	1 1/2"	F1554-36	6 1/2"	2'-8 1/2"	4"	6"	-	-	-	-	NO
E-52W	CB3A	TYPE VII	128	1 1/2"	F1554-36	5 3/4"	2'-9 1/2"	4"	6"	-	-	-	-	NO
C-12-001-FDN	-	TYPE III	44	3"	F1554-105	29 1/2"	5'-11 1/2"	7	12"	4"	2'-11"	-	-	YES
C-12-102-FDN	-	TYPE III	32	2 1/2"	F1554-105	27 3/4"	5'-7 3/4"	5"	10 1/2"	3-1/2"	2'-11"	-	-	YES
C-12-201-FDN	-	TYPE III	24	2"	F1554-105	23 1/4"	4'-1 1/4"	4"	9"	3"	1'-10"	-	-	YES

2019

- Workflow
  - – Start using Tekla in early planning for layout and MTO.
  - – Risa/STAAD import to Tekla
  - – Using API to automate daily reporting of material quantities.
  - – Tracking quantities from bid through detailed design.
  - – Start connections in detailed design phase.
  - – Share models with fabricators.
  - – Starting shop detailing early.

- Value?
  - Accurate model equals less field re-work





BURNS & McDONNELL

- Value?
  - Automation of a variety of tasks using API.
  - Faster fabricated steel to site.

- Challenges
  - INTEROPERABLITIY. (Smart3d)
  - Selling the idea of less or even no drawings.
    - How to seal documents or model?
    - Conveying the design intent to our clients and contractors
  - 3rd party data such as references and laser scan data.

- Future……
  - Ability to use data as you see fit from a multitude of sources.
  - Ability to track model assemblies from design to fabrication and through construction.
  - API automation will only increase in all facets of design, checking, construction progress, etc.

THANK YOU!

Thornton Tomasetti

- Engineering Consulting Firm: Headquarters in NYC
- 1500+ person and 50+ offices
- 10 Practice Areas

Weidlinger Transportation
Forensics
Sustainability
Weidlinger Applied Science
Renewal
Façade Engineering
Property Loss Consulting
Weidlinger Protective Design
Construction Engineering
Structural Engineering

Construction Engineering Practice

- Contractor Support Services
- Crane, Heavy Lift, and Erection Planning
- Structural Steel Connection Design
- Advanced Project Delivery™

Advanced Project Delivery (APD)TM

- Structural Steel connection design and detailing are traditionally the responsibility of the steel subcontractor. This work is classified as part of the construction phase, and as such, begins well after the design of the structure has started, and often near when it is complete.

- With APD, the steel connection design and detailing begins in the design phase.

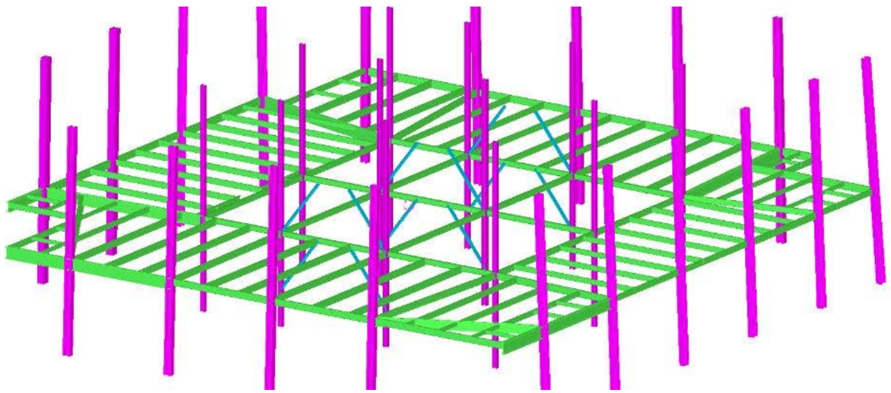
- APD process results in a structural model that is coordinated with the overall design and in a format and manner in which the steel fabricator can rely on the information. This model becomes the structural steel deliverable to both the contractor and fabricator and is used throughout the project for trade coordination / clash detection, to produce steel shop drawings, and to fabricate the structural steel.

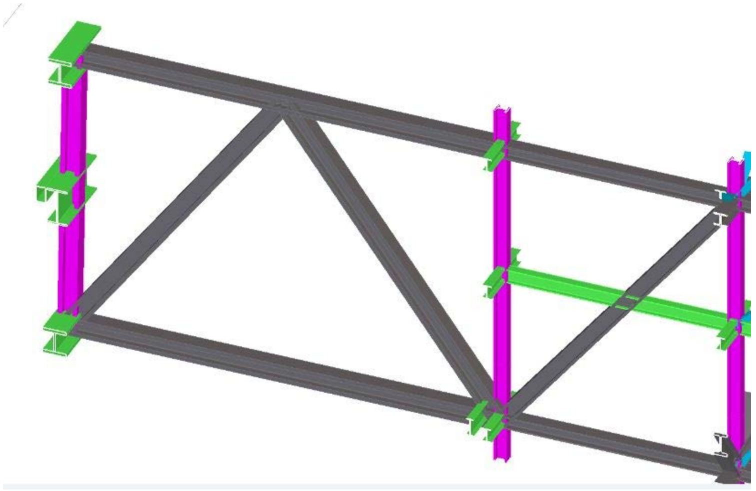
Advanced Project Delivery

From the Model to the Site

- Advance Bill of Materials
- Released for Detailing
- Fabrication / Erection

Phase 1: Mill Order / Advanced Bill of Materials (ABM) Model



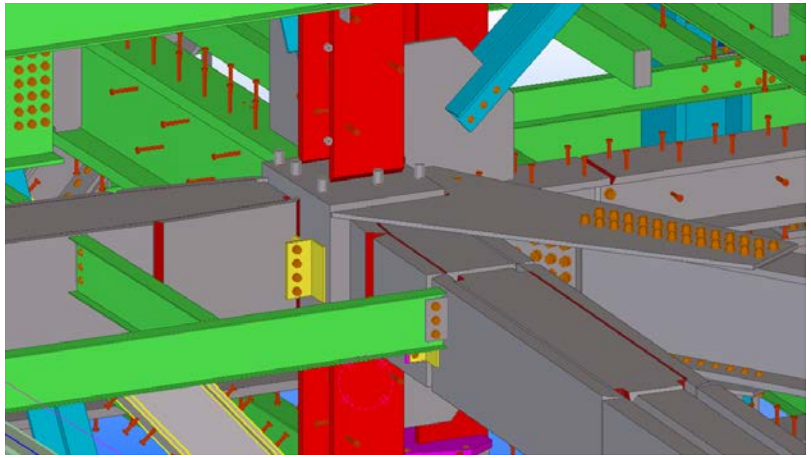


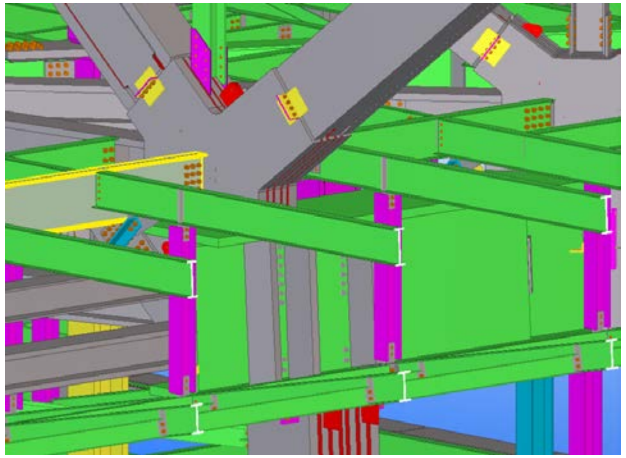
Tekla Model Deliverable

Phase I: Mill Order Model

- Defined Geometry
- Members inputted w.p. to w.p.
- Member Sizes, Material, CVN

Phase 2: Released For Detailing (RFD) / Connected Model

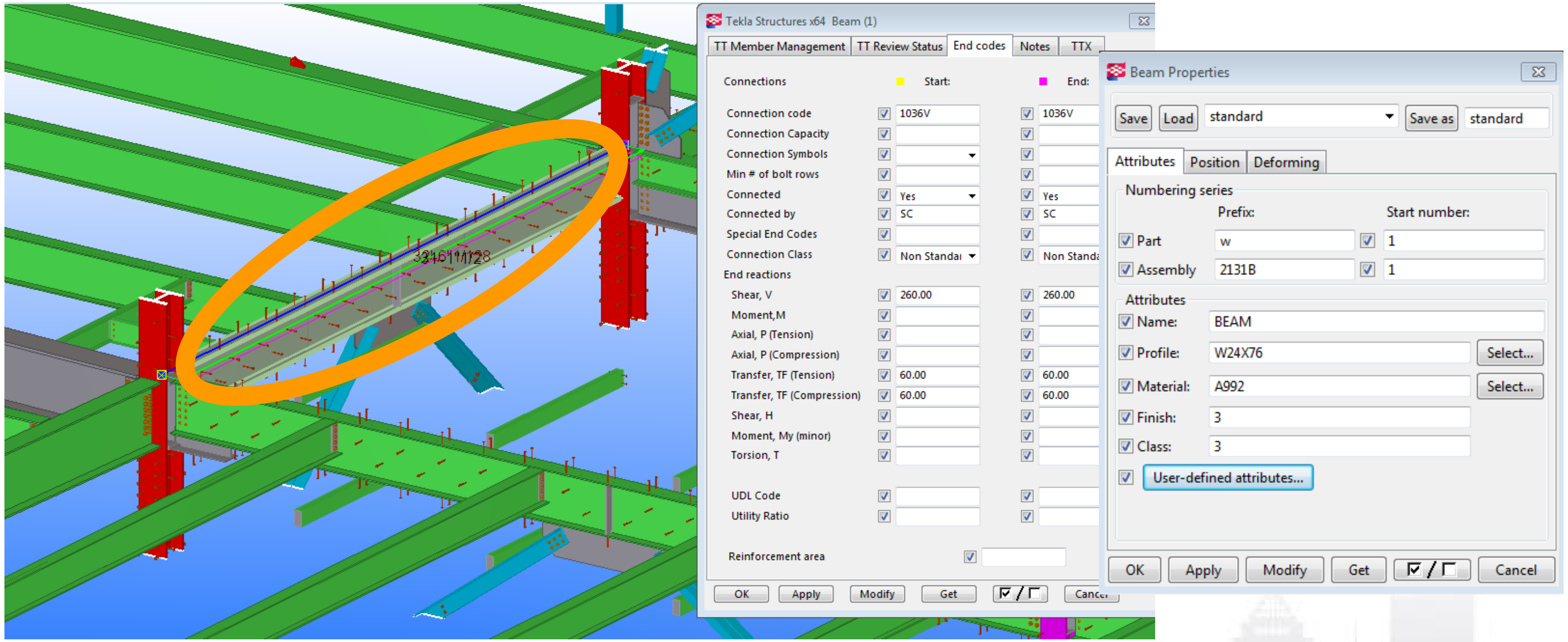




Phase 2: Connected Model

- All connections of Main members modeled
- Issued to Fabricator to start the shop drawing process

Tekla Model Transmitted to Fabricator



- Transmits Smart Information to Fabricator
- Size, Orientation, Grid Labels, CVN Requirements, End Codes, Connection Forces, Connection Plates, Bolt, Weld Information

2019

APD Benefits to the Project

- **Early Coordination** - steel detailing begins in design phase – ability to work out early detailing problems
- **Accurate take-offs** - model delivery aids contactors with better responsible bid information
- **Reduces RFI's** - Building the model identifies issues (geometry, connection clashes, questionable forces, etc.) and resolves them within the design team. The construction and fabrication team will not even see these RFIs, thus less formal RFI processing time.
- **Reduces risk** traditionally seen with connection design by a third party by having the connection design responsibility controlled by the owner/construction/design team. This can run parallel to the design and provides better and more complete information earlier in the process.

APD Benefits to the Project

- **Reduce Costs –** Models with connections already inputted can reduce member lengths that need to be purchased from mill which would otherwise be wasted material drop.
- **Right of Reliance** - Fabricator can rely on the model information received.
- **Improves Constructability** – Provides for a greater understanding of complex connections earlier in the project which in turn reduces owner and contractor risk for delays and change orders
- **Reduced or Validating Change Orders -** Quantities and complexity are identified as the design progresses. Changes, once a model or drawings are issued, can be tracked and compared as well as quantities verified. Utilizing a collaborative design/construction approach, potential change orders are identified early and discussions on the necessity of the change can be valuated prior to implementing, thus leading to reduced change orders.

APD Benefits to the Project

- **Schedule Certainty** – Proactively manage design and model release schedule to ensure project schedule
- **Cost Certainty –** The APD approach typically allows for progress Tekla models to be issued with the bid documents. These models, although provided only for reference, contain detailed examples of some of the more complex connections in 3D. Combined with a tonnage schedule provided with the bid documents, all fabricators are on a level playing field with respect to the project's scope and complexity. Thus the steel bids typically have a low percentage spread between high and low bidders.

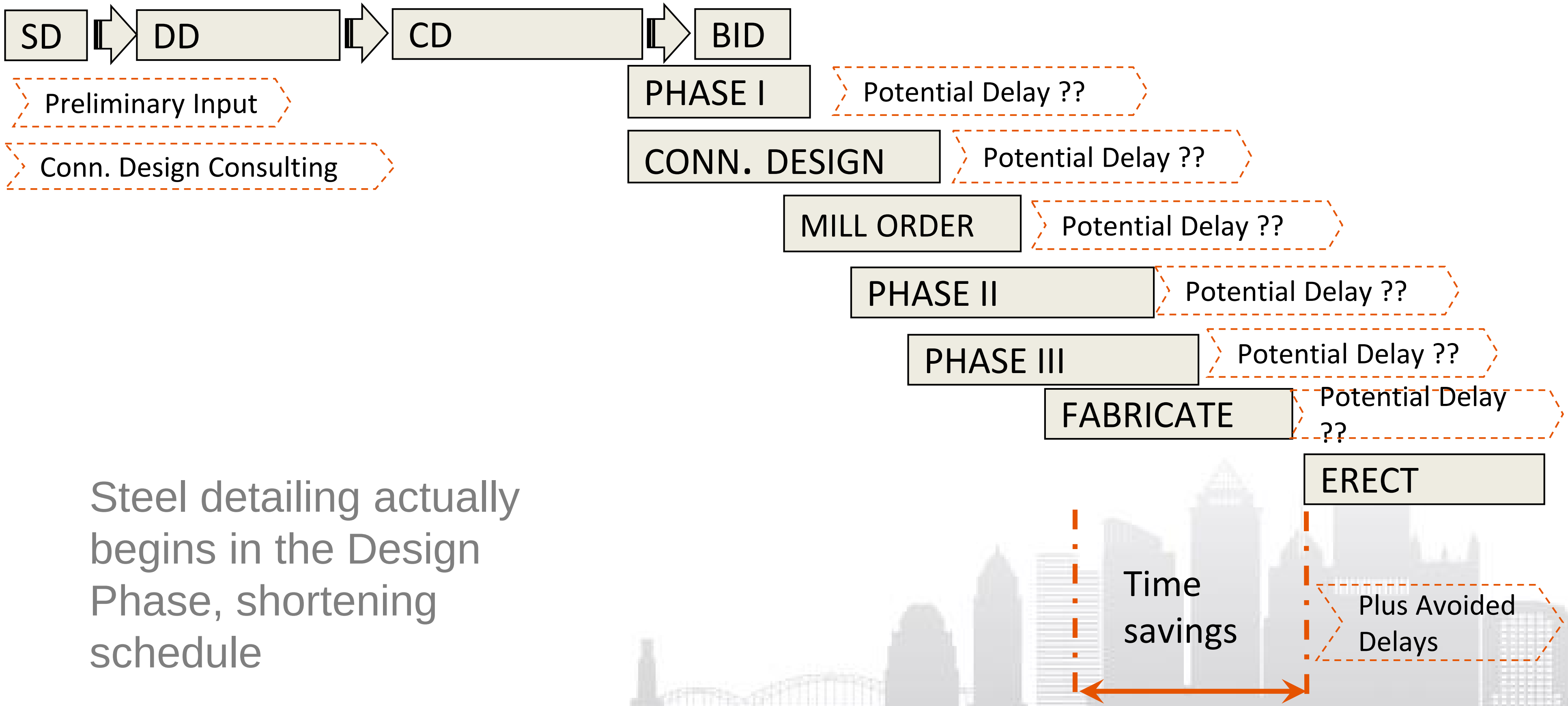
Advantages of Tekla as Advanced Project Delivery

- **Schedule Advantages** and **Expedited Construction**
- **Collaboration, Risk Mitigation** and **Cost Certainty**

Schedule Savings

- Traditional process without TEKLA as Deliverable

Process with TEKLA as Deliverable



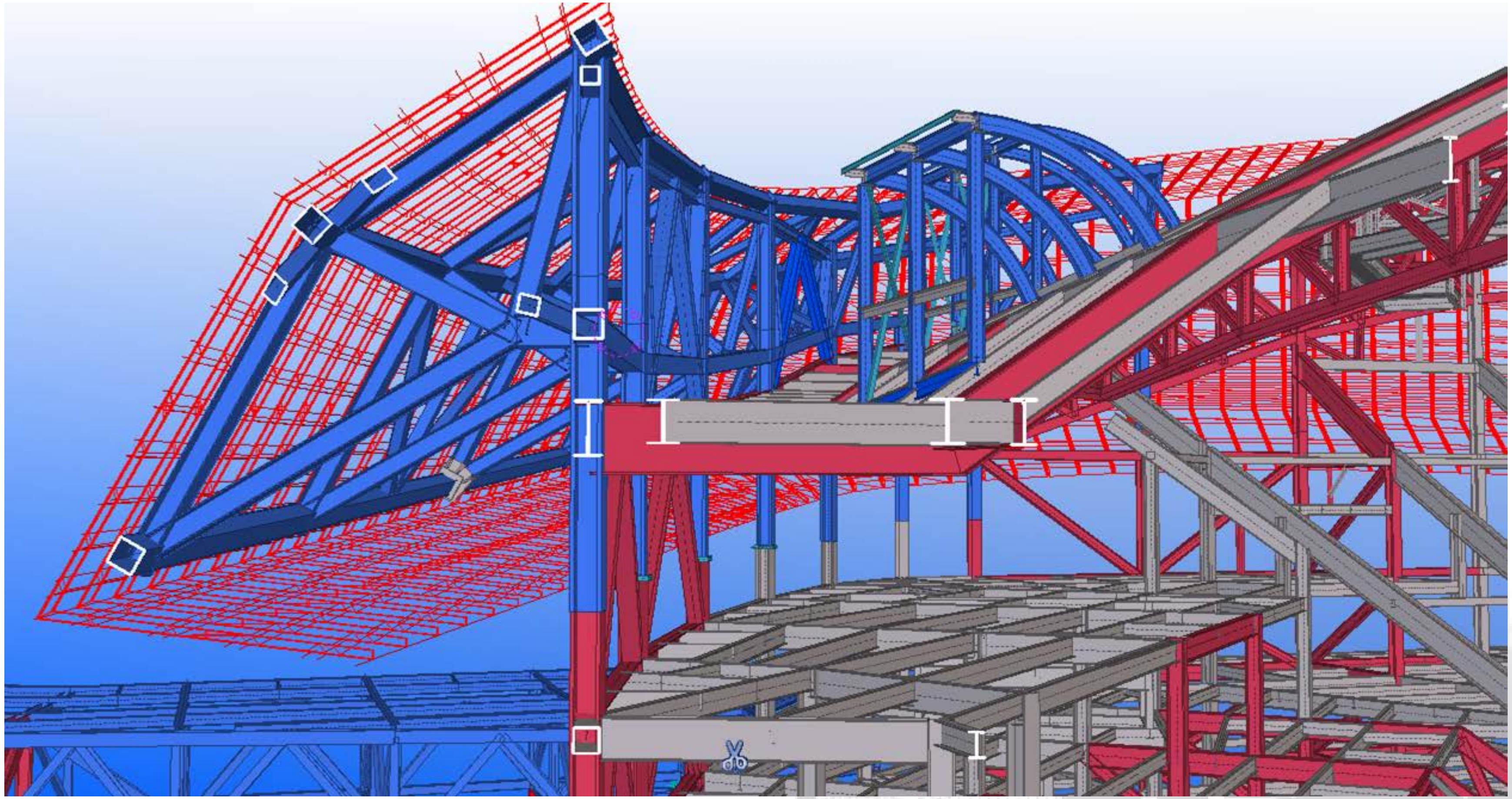
Steel detailing actually begins in the Design Phase, shortening schedule

Expedited Construction

- Early integration of structural design and detailing gives fabricator more detailed information months sooner than with a conventional delivery, improving constructability and reducing owner and contractor risk for delays.
- Steel Fabricator can order steel day of awarded contract.
- Steel Fabricator can start shop drawings very quickly after awarded contract, without the need for numerous RFIs or connection design submittals.
- Steel can be on site earlier than the traditional process.
- Other trades can start earlier.
- This provides Schedule Certainty for the project.

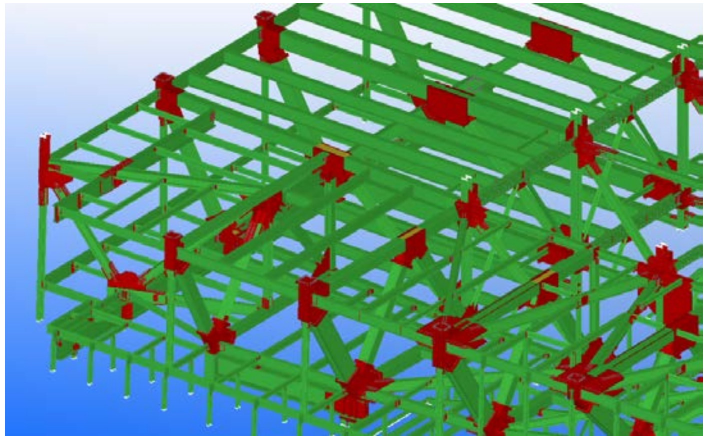
Collaboration

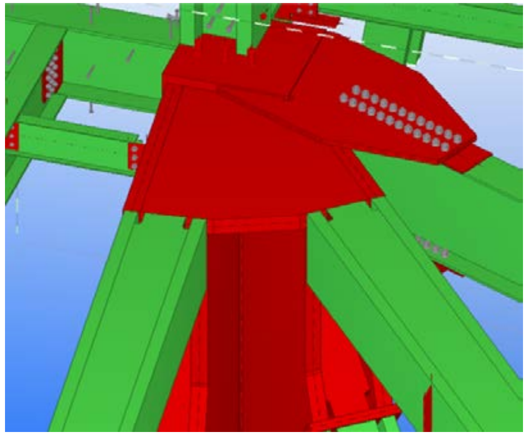
Trade Coordination: Façade

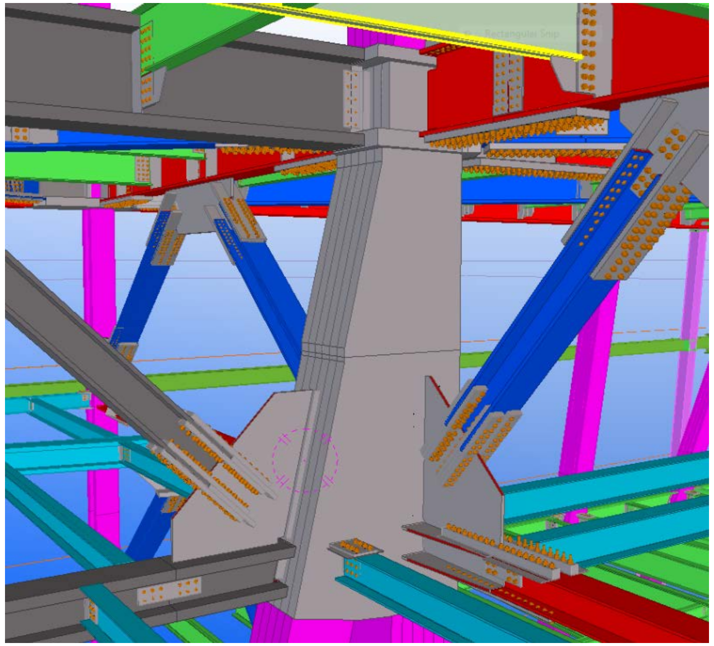


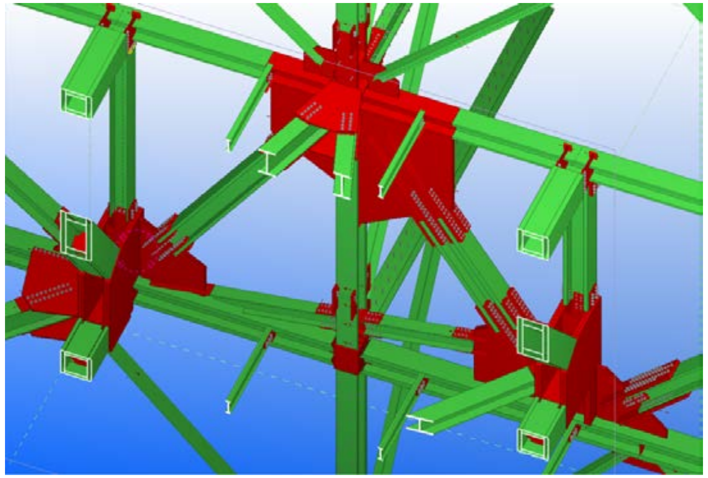
Risk Management

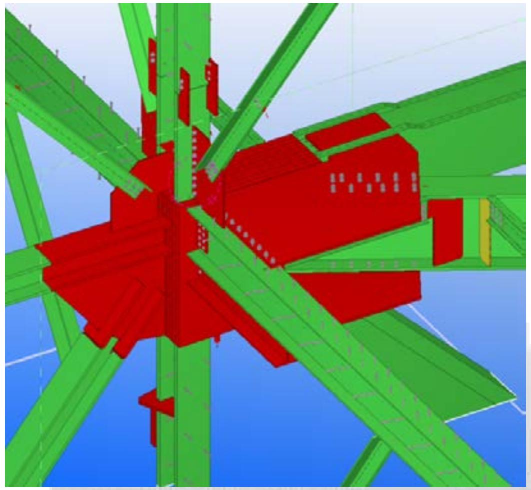
Mitigate Procurement Risk by Defining Complexity



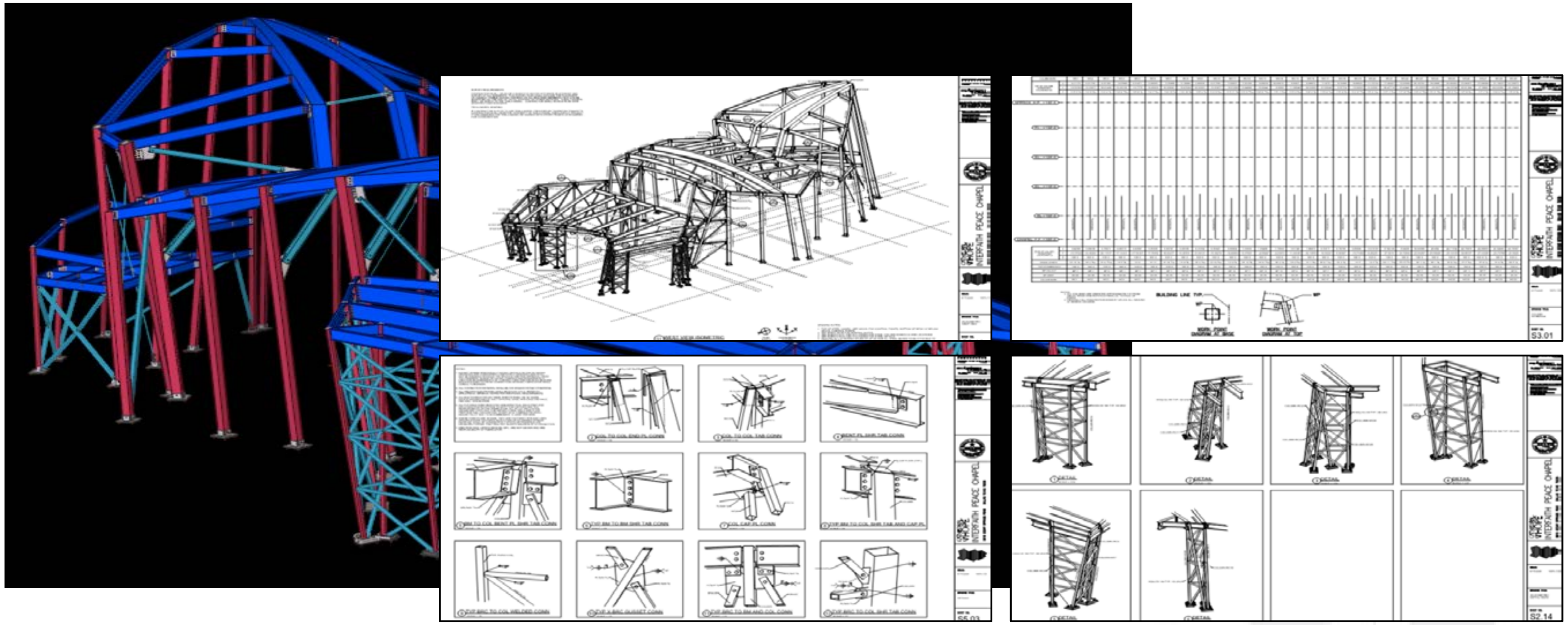








Cathedral of Hope - Texas



BIM (Building Information Modeling) for Better Bridge Design and Construction

Bridges improve the quality of the ordinary citizens life - Provides mobility and aesthetics

Douglas J. Dunrud

BIM/VDC - SENIOR ENGINEERING SPECIALST

CAREER SUMMARY

Mr. Dunrud has 31 years of experience as a bridge engineer in the highway transportation sector. He has a demonstrated record of managing projects scope (quality), schedule and budget that meets or exceeds the stakeholders expectations. He is a pioneer in the development of Building Information Modeling (BIM) for bridges and structures and Virtual Design and Construction (VDC) which promises to improve quality, accelerate project schedules and increase value to clients on transportation infrastructure projects.

YEARS OF EXPERIENCE

31

YEARS with WSP

1.5

EDUCATION

B.S. Civil Engineering/ Applied Math
Colorado State University
1987

LICENSES AND REGISTRATIONS

Professional Civil Engineer: California (#47240)

PROFESSIONAL EXPERIENCE

BIM/VDC – Senior Engineering Specialist, WSP-USA: As part of the Complex Bridge Group, Mr. Dunrud is a national resource to WSP's U.S Transportation and Infrastructure Sector. He is leading the effort to load rate the Richmond-San Rafael bridge using CSIBridge as well as assisting in the development of an Asset Management Plan for the bridge. Mr. Dunrud modeled the new inverted fink truss pedestrian bridge at Utah Valley University in Orem, Utah. He also modeled the Marshall Road Over Cobbs Creek in Pennsylvania. He provides hands-on expertise with multiple software packages and has demonstrated an ability to help teams transition from CAD to BIM. (February 2018 to August 2019)

Branch Chief in Structure Design: Mr. Dunrud was responsible for the delivery of dozens of projects, including developing the project scope and keeping them on schedule and within the resource budget for various stakeholders including the San Diego Area Governments (SanDAG). He assigned work to engineering and technician staff and managed the quality of the deliverables in accordance with the AASHTO Load and Resistance Factor Design (LRFD) and the Caltrans Quality Management System (QMS). He implemented the "Civil 3D Best Practices" in his branch and initiated a whole new era of collaboration with Roadway Engineers. He developed a BIM implementation Plan for the Division of Engineering Services and was actively involved with the Department's Virtual Design and Construction Committee, including working with academia to develop a strategic plan. Mr. Dunrud participated in the AASHTO T-19 "Bridge Information Modeling Standardization" completed in 2016. On September 14, 2016, he organized and facilitated a national Bridge Industry Forum entitled "3D Models for Construction". He has developed and maintained a partnership with most of the key people in industry who share a common goal of using BIM for bridges and structures. (March 2006 to February 2018).

Outline

I. WSP – who we are
II. Model-centric workflow
III. Challenges to implementing BIM
IV. Future Plans

We are the sum of our collective passion, vision and expertise.

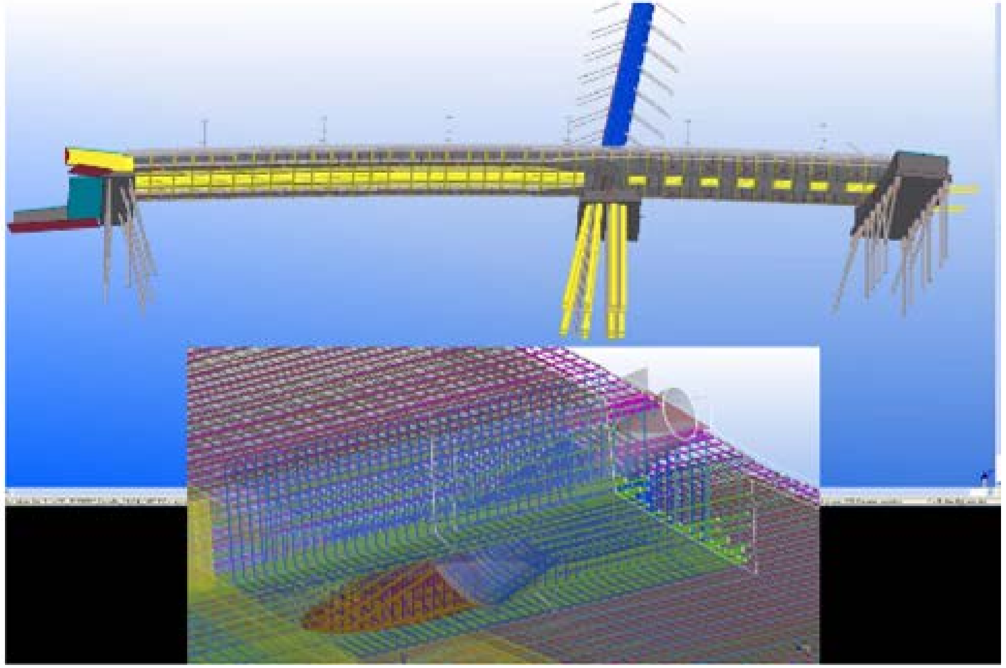
- 130-year history
- 48,000 employees globally
- 7,770 employees in more than 100 office in the US

#1 Building Design + Construction Giants List (BD+C Giants 300 Report)
#1 Transportation (ENR)
#1 International Design Firms (ENR Top 225 International Design Firms)

Bridges and Structures PAN   PAN Directory

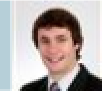
NEXTBridge

- **Home**
- About Us
- Discussions List
- Complex Structures Homepage
- Bridge Project Library Survey
- Transport & Infrastructure Intranet
- Global Technical Excellence Initiative
- SPAN Archive



Contacts

new item or edit this list

✓	Contact	Title
	Brenner, Joseph M. Lead Structural Engineer, 9352 STRUCTURES MA	NEXTBridge Coordinator

Automation levels

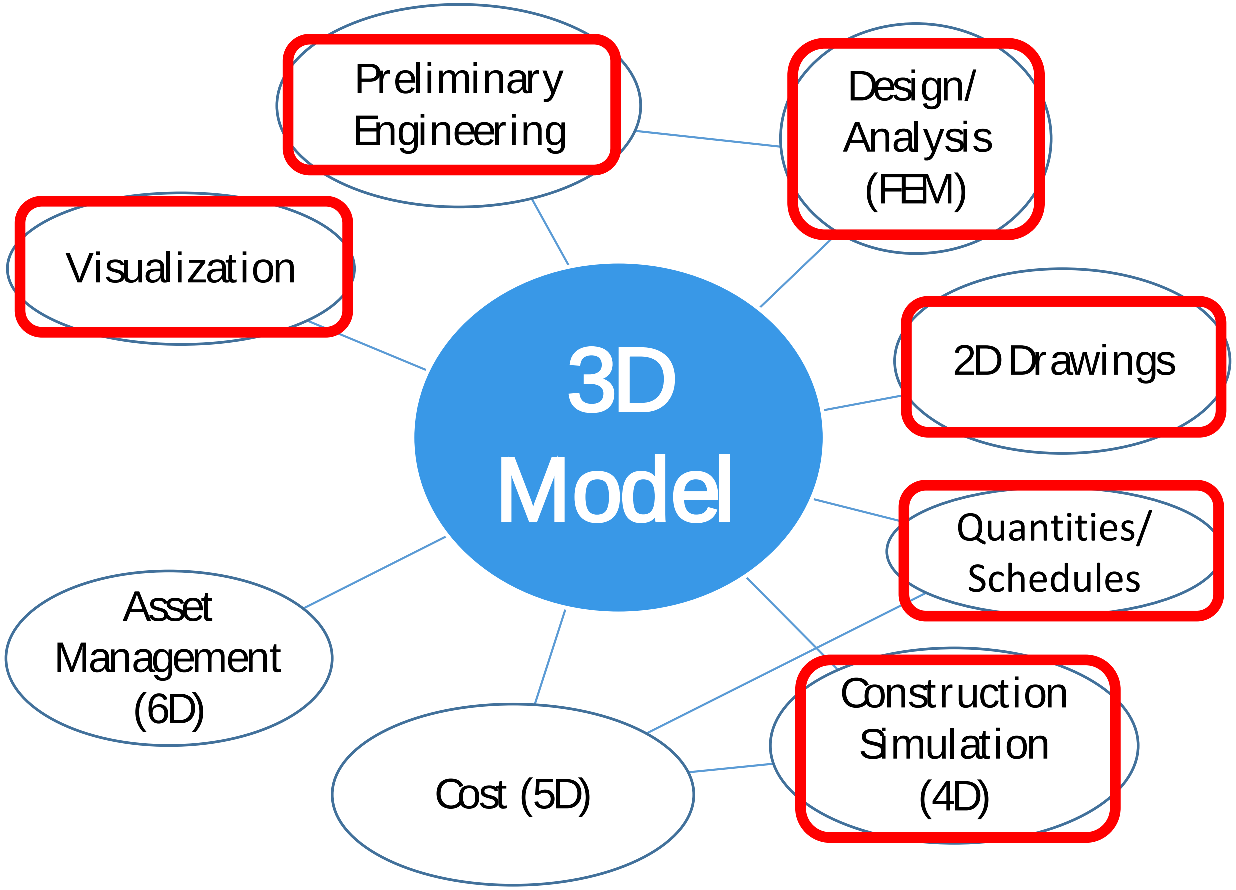
Automation is a broad term and here mainly refers to enhancement of processes or services by utilizing different kinds of programing, e.g. rapid design by linking different software.

Automation can be divided into different levels. Please rank your tool within this framework, 1-5.

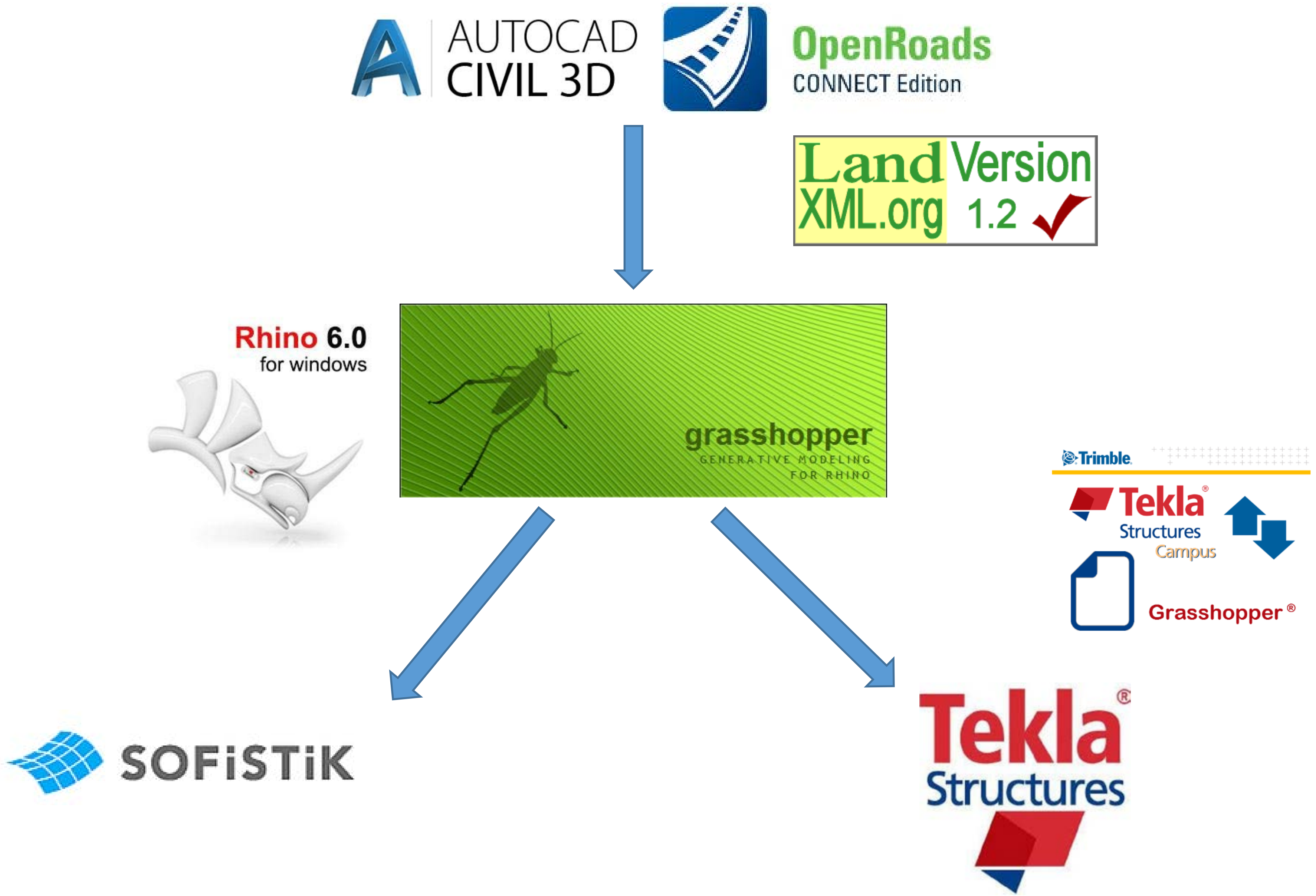
Level	Name	Protection	Instructions/manuals	Quality control	Best practice Programming	Product Owner	Product Management	Description
1	Production efficiency tools							Tools used by individuals to enhance personal efficiency. Hard to use for others. E.g. a standardized spreadsheet for recurring design work.
2	Low Automation							Involves some level of integration of processes that usually are separate, e.g. steering one program with another. Makes use of well known coding language and not only e.g. Excel.
3	Partial Automation	x	x					Involves a higher level of integration and quality of coding which is protected to some extent (GUI, NDA, closed server, etc). Has some kind of simple explanatory instructions. Usage still involves several manual elements.
4	High Automation	x	x	x	x	x		The process is automated to a large extent but has a few manual elements. The process is standardized and closed/protected to a large extent. Has undergone quality control and is under continous product management. Has an assigned product owner.
5	Full automation	x	x	x	x	x	x	The process is fully automated in a coherent and closed process, preventing any amendments other than by assigned developers. Has undergone quality control and is under continuous product management. Has an assigned product owner.

wsp

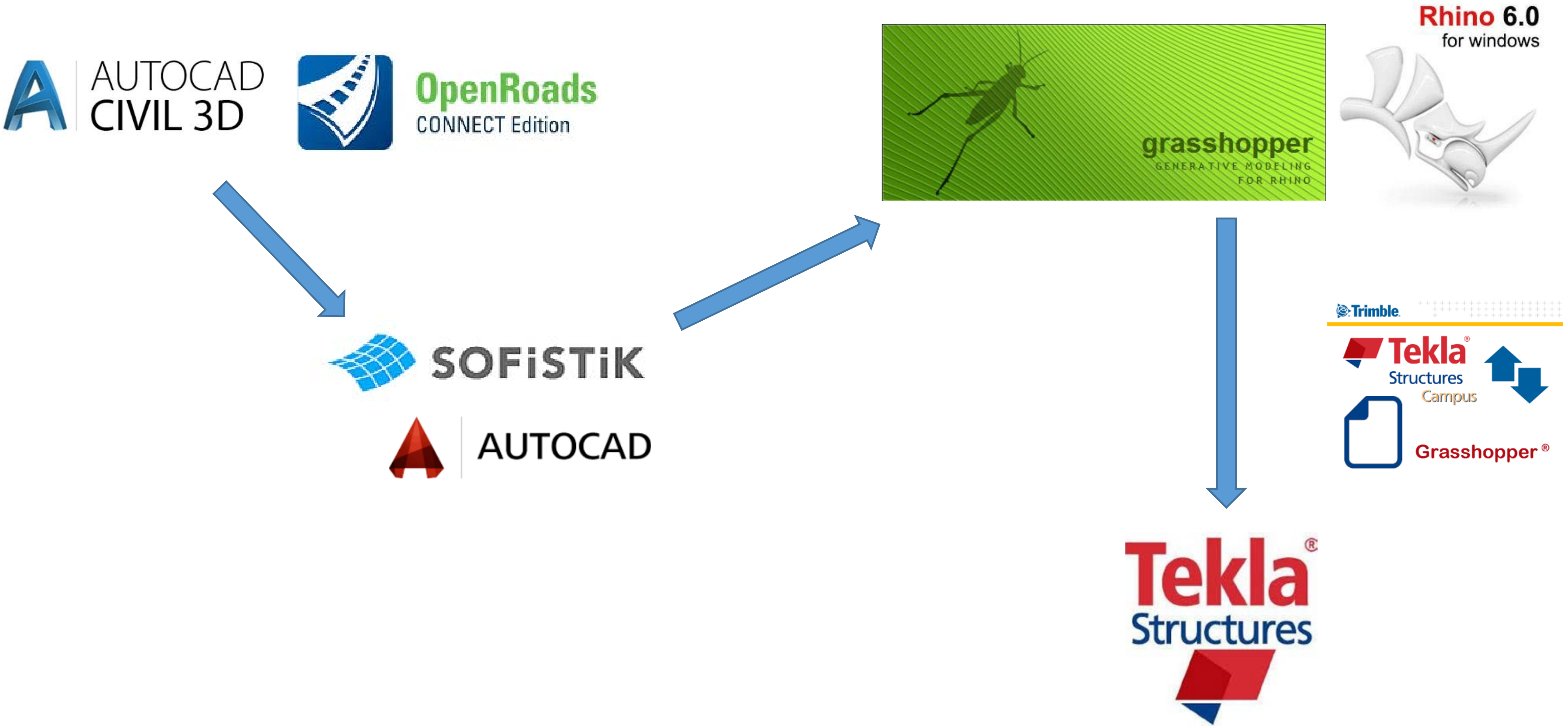
II. Model-centric workflow



Grasshopper workflow



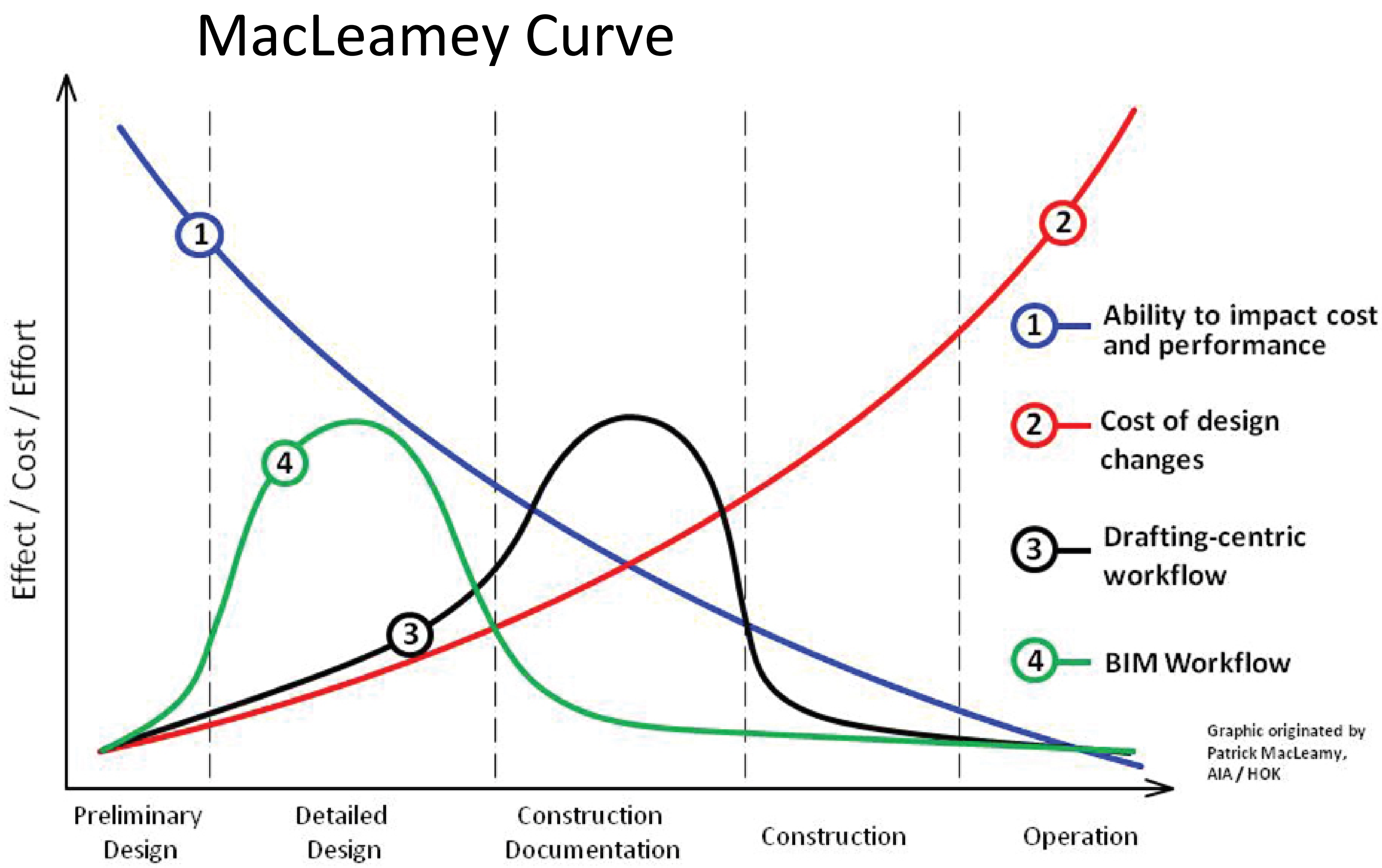
Grasshopper workflow



Kruunuvuorensilta, Finland

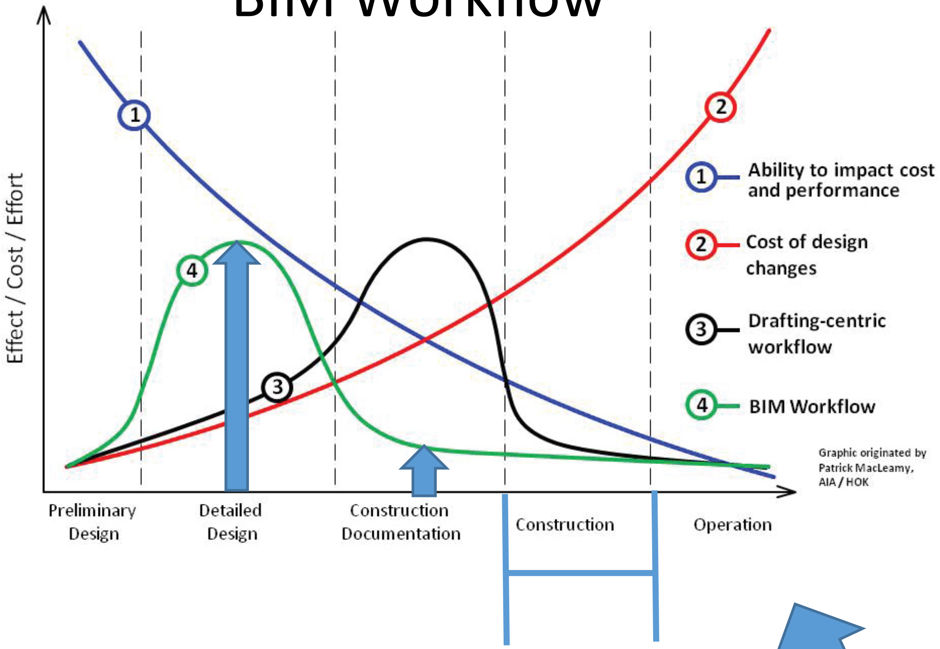
- Bridge fully modelled in Grasshopper
- Links out to Sofistik and Tekla

III. Model-centric workflow



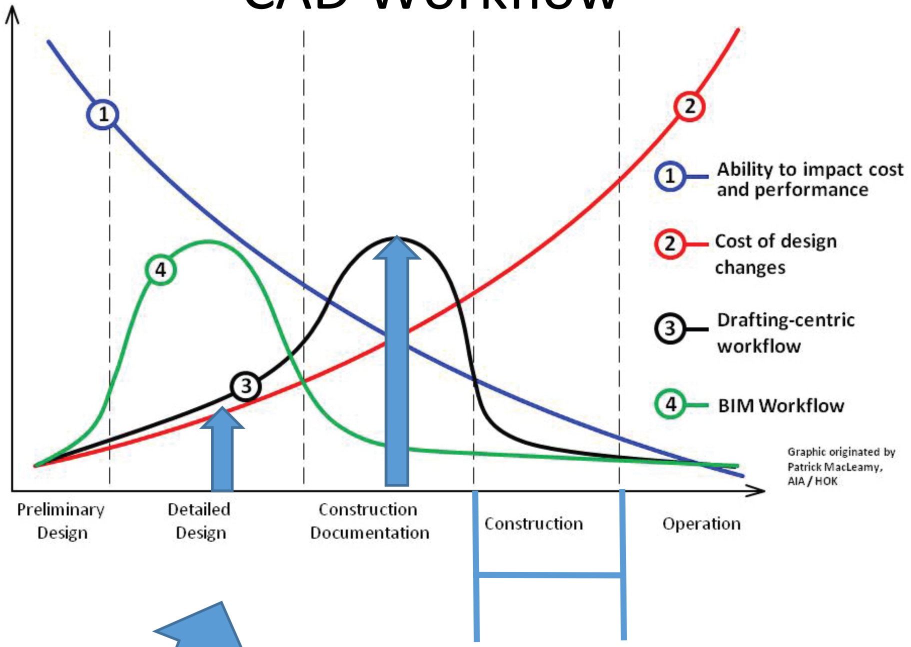
Bridge Projects do not require BIM deliverables and PM’s scope projects based on CAD Workflows.

BIM Workflow



RFI’s: low
CCO’s: low

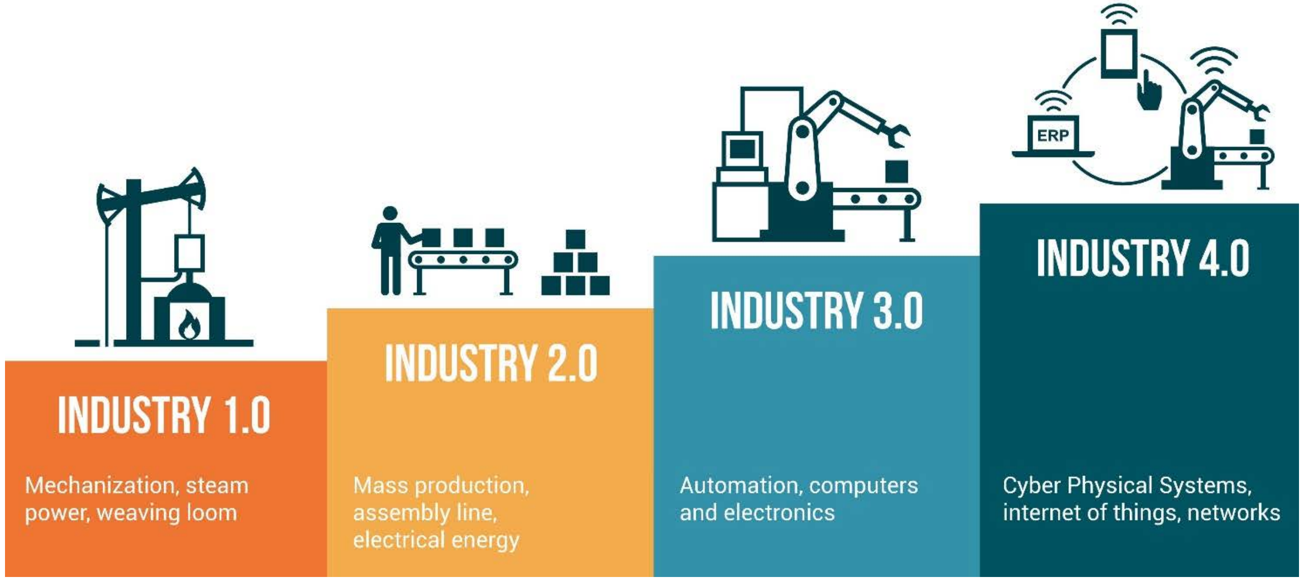
CAD Workflow



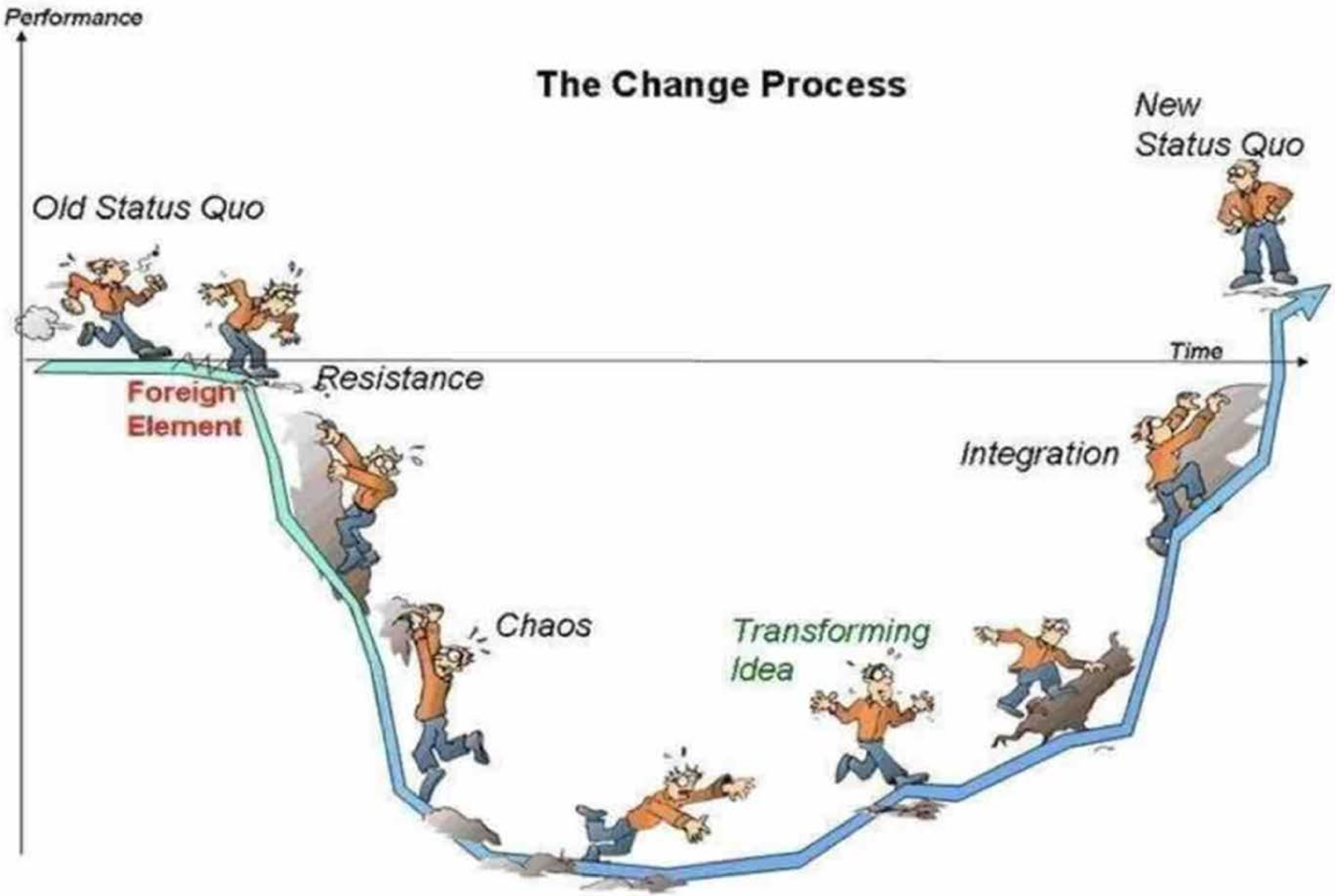
RFI’s: high
CCO’s: high

IV. Future Plans

Fourth Industrial Revolution
See also: Industry 4.0



The Fourth Industrial Revolution builds on the Digital Revolution, representing new ways in which technology becomes embedded within societies and even the human body.[10] The Fourth Industrial Revolution is marked by emerging technology breakthroughs in a number of fields, including robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, The Internet of Things (IoT), 3D printing and autonomous vehicles.


Performance
The Change Process
New
Status Quo
Old Status Quo
Time
Resistance
Foreign
Element
Integration
Chaos
Transforming
Idea

Overview of business-

- McDermott is an EPC company. Power Division based in Charlotte, NC.
- In past 13 years we have performed full EPC services for 3 coal plants, 9 combined cycle plants and a large portion of 2 AP100 nuclear plants.
- Project values range from $500M - $14B.
- Client: Duke Energy, Dominion Energy, Indiana Power and Light, Calpine, Entergy, Southern Co.

Where does Tekla fit into workflow-

- We have produced structural steel models with material reporting and drawings in Tekla for 7 of our Combine Cycle projects with good success in all three areas.
- Tekla concrete was introduced on nuclear projects to model bar for construction to identify non-conformance and clash detection in an effort to reduce delays. No drawings. The effort was successful and continued at the site with onsite engineering and construction personnel.
- 2015 a decision was made to use Tekla steel and concrete to perform all power EPC projects (models, reporting & drawings). Steel performed as expected; the surprise to management was the advantages of modeling rebar. The man-hours to produce models and drawings reduced noticeably from other systems used in the past. To date Tekla concrete has been used for 5 Combined Cycle projects.
- 2018 Unit Rate Comparison study was performed on Concrete Drawings for Combined Cycle projects.
- Generation 1 Projects and Generation "Copy" 2 Projects.

GENERATION 1 PROJECTS

- **UNIT RATE COMPARISON**

MicroStation

- Duke Buck
- Entergy Nine Mile

Trimble Tekla

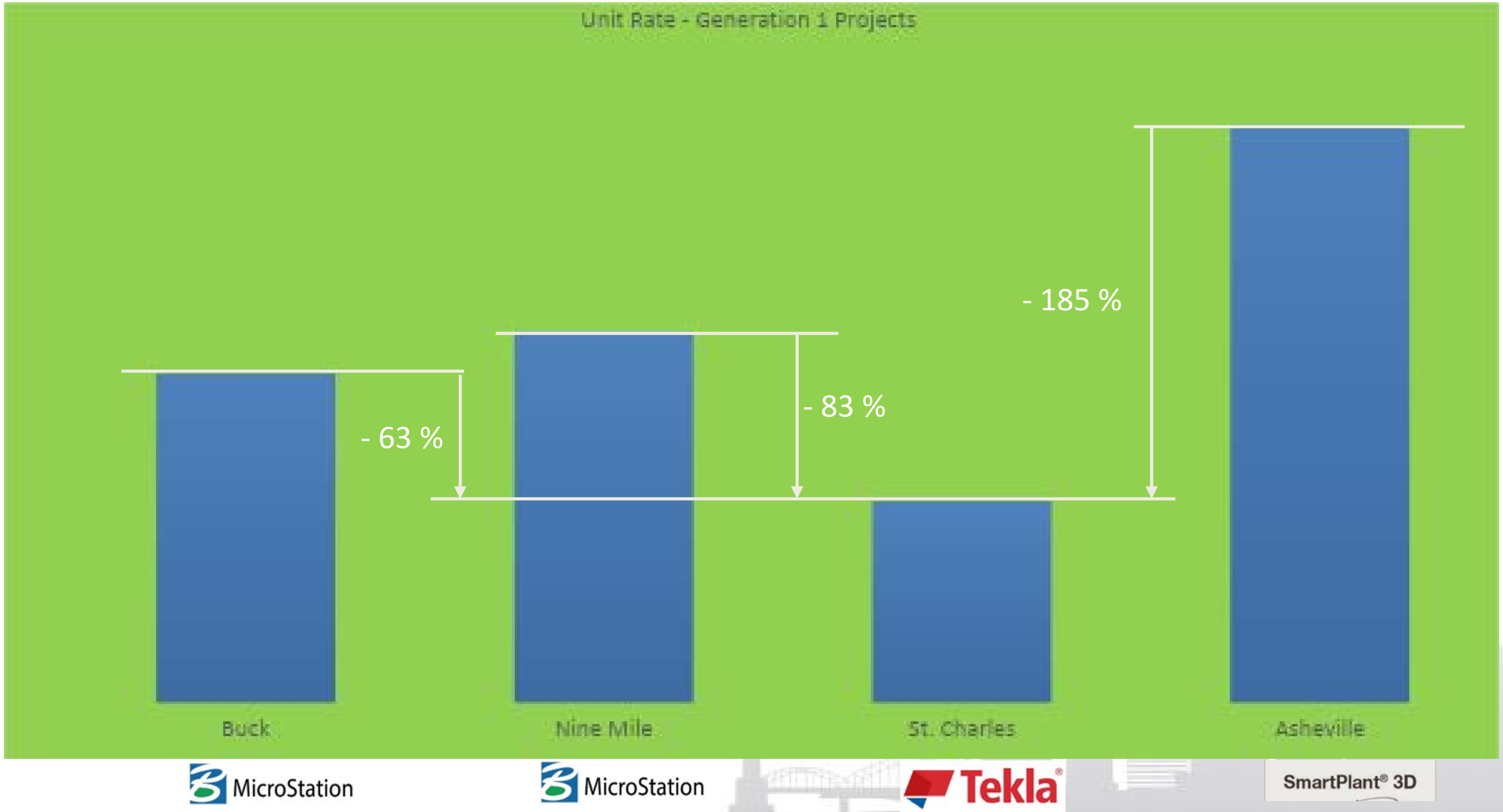
- Entergy St. Charles

SmartPlant® 3D INTERGRAPH

Duke Asheville

GENERATION 1 PROJECTS

UNIT RATE COMPARISON – CONCRETE DRAWINGS



GENERATION 2
“COPY” PROJECTS

- **UNIT RATE COMPARISON**

MicroStation

- Duke Buck (G1)
- Duke Dan River (G2)

Trimble
Tekla

- Entergy St. Charles (G1
- Entergy Lake Charles (G2)

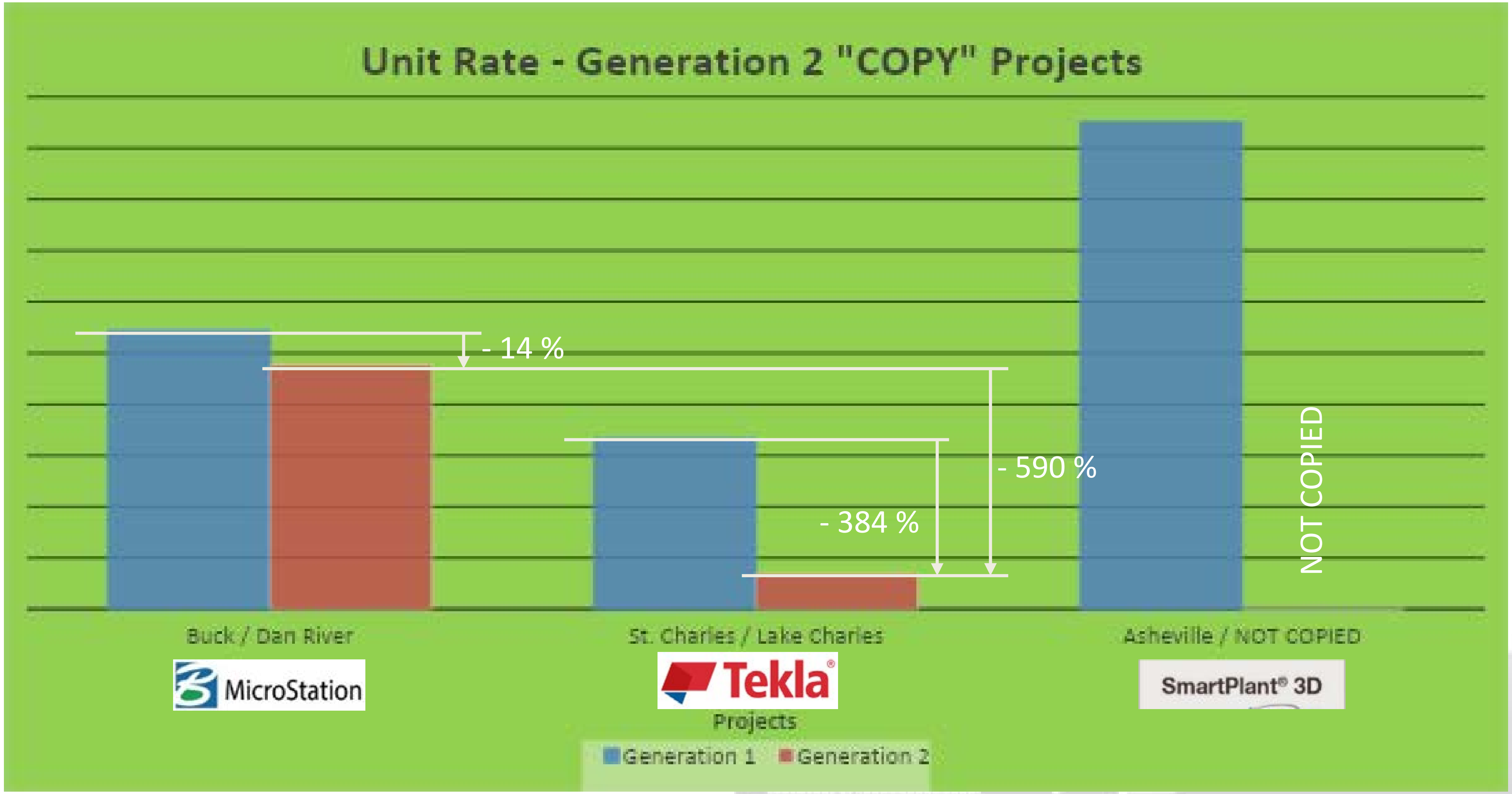
SmartPlant® 3D
INTERGRAPH

Duke Asheville (G1)

Not available (G2)

GENERATION 2 "COPY" PROJECTS

- UNIT RATE COMPARISON – CONCRETE DRAWINGS



What is the value of a constructible model-

- Ability to provide both steel and rebar Fabricators a working model and drawing to reduce their turnaround time and as a result reduce the time to get material to the site.
- Ability to sequence erection inside the model and manage time more efficiently.
- Ability to manage material laydown area. (This is still a work in progress)
- For the first time engineering had the ability to identify rebar clashes with embedments and resolve before fabrication.
- Construction could visually see the bar in BIM site, understand the magnitude of tie-up and have the ability to suggest any time saving changes to engineering before fabrication.

Challenges -

- Changing the embedded way engineers see things. Not all engineers bought into modeling rebar, embeds and anchor bolts. They considered it over kill and it would drive up the time to produce models and drawings. Once they saw the man hour savings along with the improved reporting and use of BIM models for review. They all bought in and count on the product deliverables daily.

Going forward in Power-

- Tekla performs well for McDermott Power and is our preferred tool for engineering and project execution.