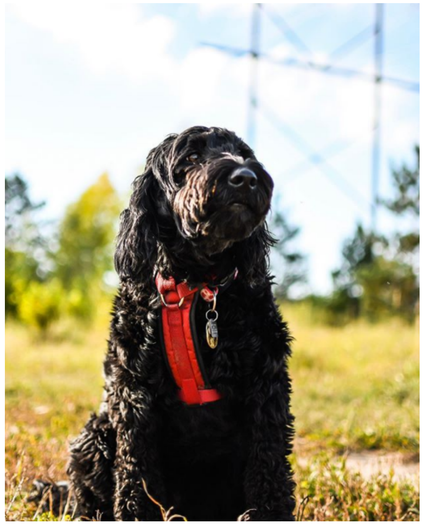
BES322346
Mining and Heavy Industrial Projects Using the Architecture, Engineering & Construction Collection

Steven Matschke, A.Sc.T.

Structural Designer

Stantec Consulting Inc.

AUTODESK. UNIVERSITY



Introduction to the Speaker

Steven Matschke, A.Sc.T.

- Graduate from:
  - Civil Engineering Technology from Saskatchewan Polytechnic
  - Bachelor of Technology – Applied Science and Engineering from Memorial University of Newfoundland
- Experienced in the design of mining and milling facilities as an engineering consultant, with extensive experience in Potash, Uranium, Canola, and Salt commodities
- Design and Technology Enthusiast
- https://www.linkedin.com/in/steven-matschke-69902375/
- Hobbyist photographer and tinkerer (currently mostly with my Miata)
- https://www.instagram.com/stevematchkey/

Confidentiality and Recommendations Disclaimer

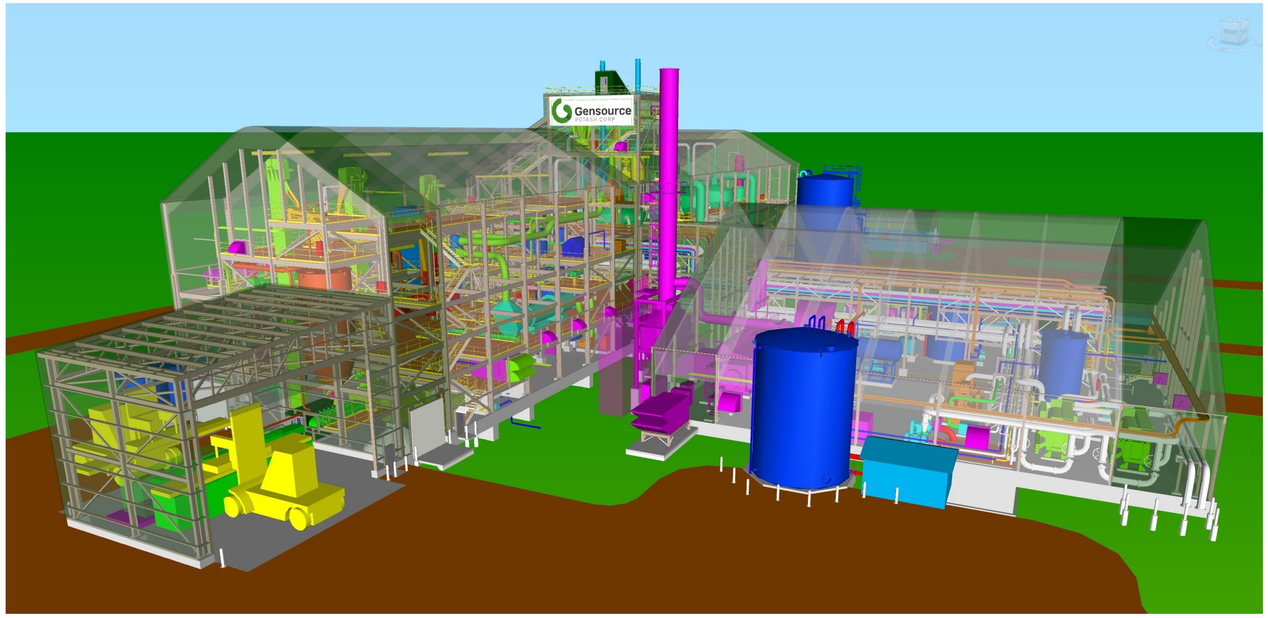
- Don’t worry, theirs no confidentiality with this presentation!

- Industrial and mining industries are typically highly confidential, so the contents of this presentation won’t be including any trade secrets or process methodologies. All client specific reference content can easily be found from quick searches with your favorite search engine.

- The ideas and recommendations provided here are based upon my research and experience only, and it is up to you to determine how they should be applied in your situation.

Outline

- Saskatchewan – A Province of Lakes and Commodities
- The Saskatchewan Potash Industry
- Building Information Modeling Technology – What is it?
- Architecture, Engineering, and Construction (AEC) Collection Software Relationship
- BIM Execution Planning on Industrial Projects
- Using Revit for Industrial Projects



Gensource Potash Corps Feasibility Study Model - Retrieved from https://www.businesswire.com/news/home/20170531006367/en/Gensource-Announces-Results-Vanguard-Feasibility-Study

Saskatchewan – A Province of Lakes and Commodities

Saskatchewan – The Province

- Where I was born and raised
- Roughly the same land mass as Texas, USA with ~1/25th of the population
- Known as the “Land of the Living Skies”, Saskatchewan is known for it’s vast prairie Landscapes

Prairie Landscape in Saskatchewan - Retrieved from https://www.cbc.ca/news/canada/saskatchewan/pictures-life-saskatchewan-2017-1.4469256

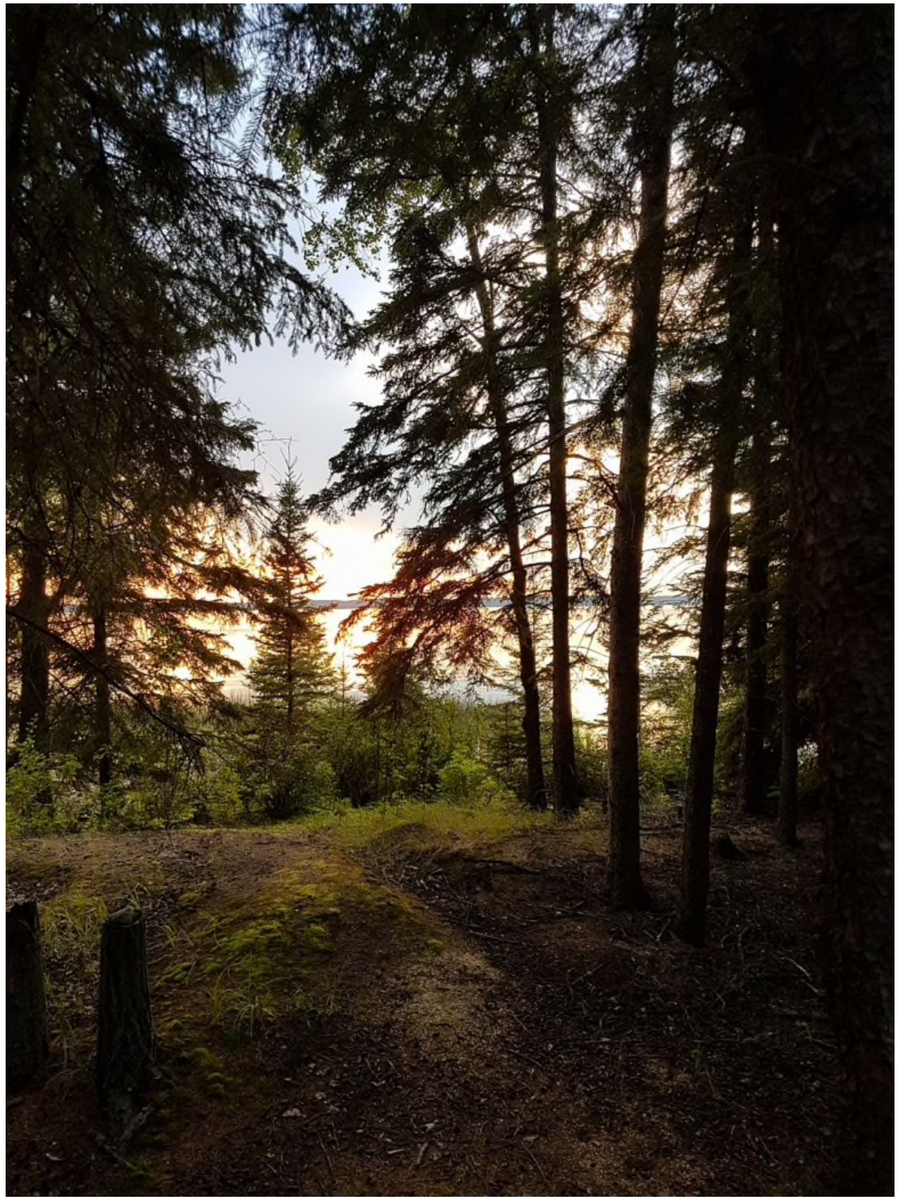
Saskatchewan Facts:

Population: **1.2 million**	**World’s largest** producer of potash
GDP: **$82.5B CAD** ($62.8B USD)	**2nd largest** oil producer in Canada
Land mass: **651,036 km²** (251,366 mi²)	**34 million** hectares of forest
100,000 lakes	**40%** of Canada’s cultivated farmland

Harvest in Saskatchewan - Retrieved from https://www.saskatchewan.ca/business/environmental-protection-and-sustainability/a-made-in-saskatchewan-climate-change-strategy

Saskatchewan Fields during Harvest Season - Retrieved from http://arbutusridgefarms.ca/arbutus_blog-item/saskatchewan-foodie-glory/

Tumble House - Retrieved from https://globalnews.ca/news/5207374/saskatchewan-weather-outlook-heavy-snow-strong-wind-this-weekend/



Northern Saskatchewan Lake View - Retrieved from https://globalnews.ca/news/5207374/saskatchewan-weather-outlook-heavy-snow-strong-wind-this-weekend/

Northern Saskatchewan Lake View - Retrieved from https://globalnews.ca/news/5207374/saskatchewan-weather-outlook-heavy-snow-strong-wind-this-weekend/

Saskatoon, Saskatchewan’s largest city - Retrieved from https://www.ckom.com/2018/10/23/426060/

Typical summer day in Saskatoon, Saskatchewan - Retrieved from https://www.todocanada.ca/things-see-saskatoon/

Typical winter day in Saskatoon, Saskatchewan - Retrieved from https://www.tourismsaskatoon.com/plan-your-trip/tools-and-tips/weather/

Saskatoon in the Summer

- Mid-summer in July, temperatures can reach 30 degree Celsius (86 Farenheit)
- Many rivers and beaches in the province allow for sunbathing

Saskatoon During the Winter

- Mid-Winter in January, temperatures are regularly -20 degrees Celsius, and many times can get as low as -40 degrees Celsius (which is also -40 degrees Farenheit!)
- Hoar Frost (As seen on the trees in the image above) is a regular occurrence during the winter, and the lakes freeze over enough that we can drive on them

Typical strike during winter in Saskatoon, Saskatchewan - Retrieved from https://thestarphoenix.com/news/local-news/saskatoon-co-op-strike-continues-after-union-votes-against-newest-offer

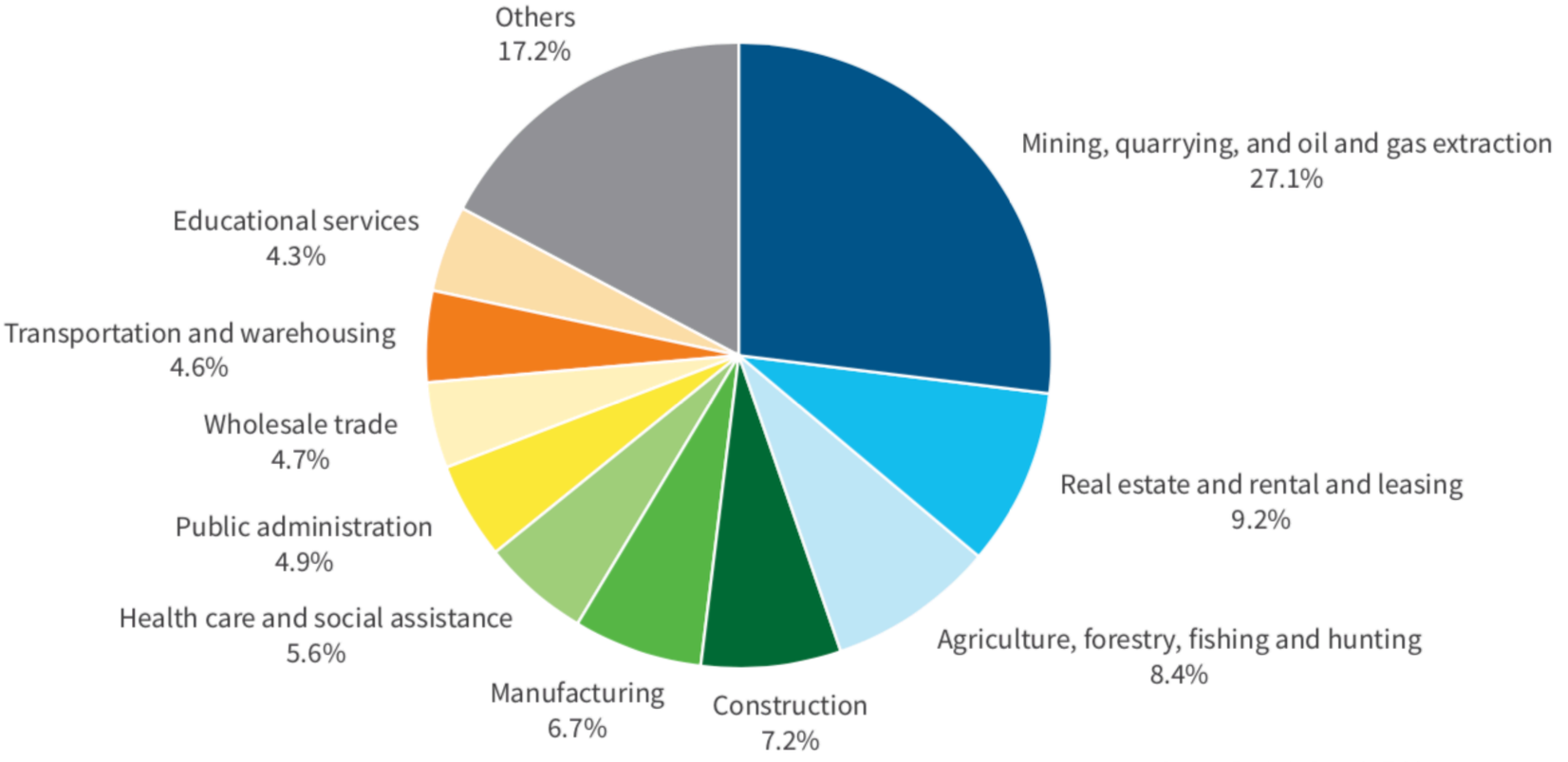
Industry in Saskatchewan

- Saskatchewan exports totaled $30.7 billion in 2018
- The US is Saskatchewan's top export market, receiving almost 50% of total exports, followed by, China, Japan, Brazil, and Mexico
- Top Exports may be surprising!

Top Export Products of 2018 from Saskatchewan - Retrieved from https://www.saskatchewan.ca/business/investment-and-economic-development/economic-overview

2018 Gross Domestic Product (GDP)

(GDP by Sector and at Basic Prices)



Source: Statistic Canada Table 36-10-0402-01, Chained 2012 dollars.

Top Export Products of 2018 from Saskatchewan - Retrieved from
https://www.saskatchewan.ca/business/investment-and-economic-development/economic-overview

The Saskatchewan Potash Industry

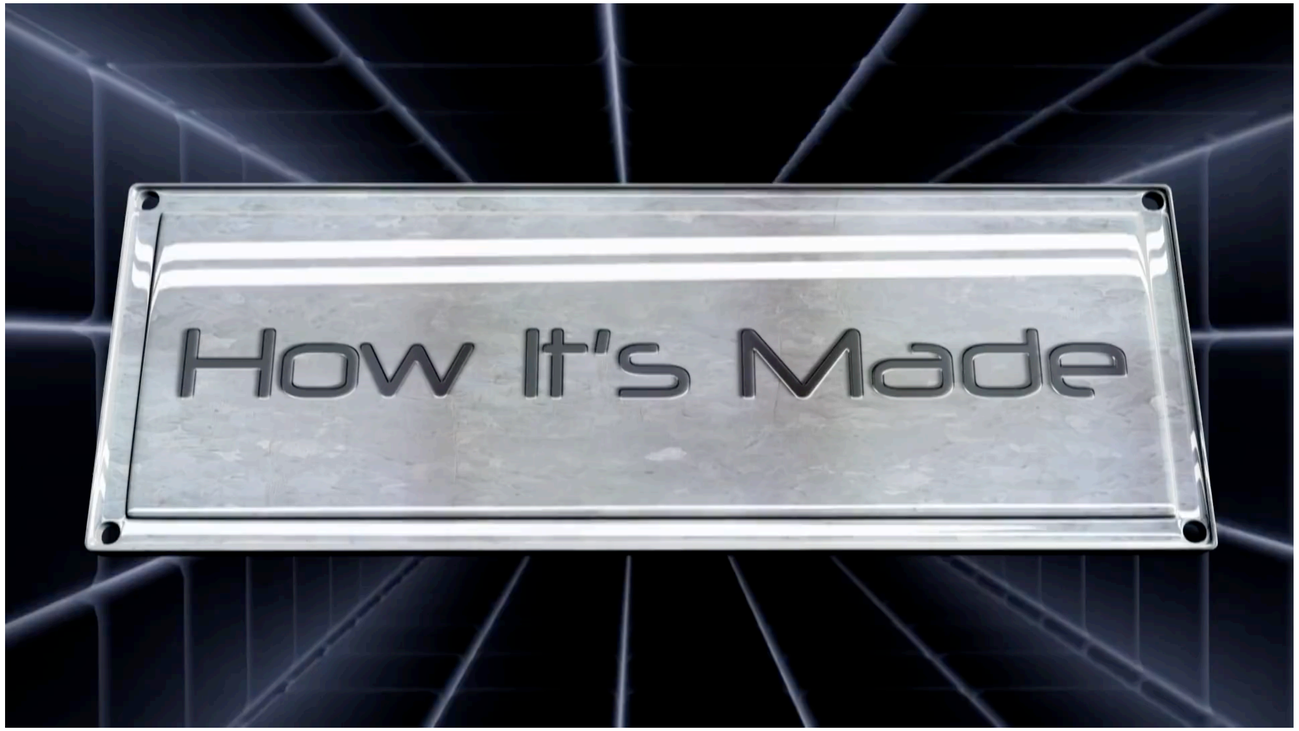
What is Potash?

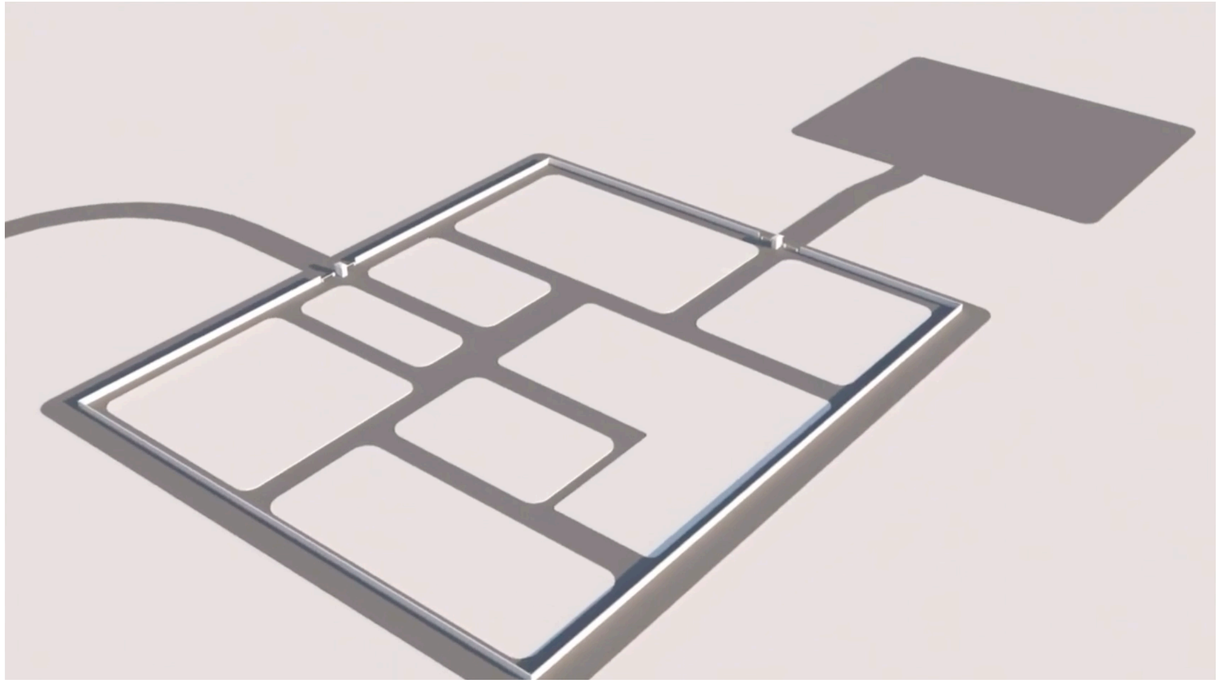
How it's Made – 1376 Potash

By: How Its Made

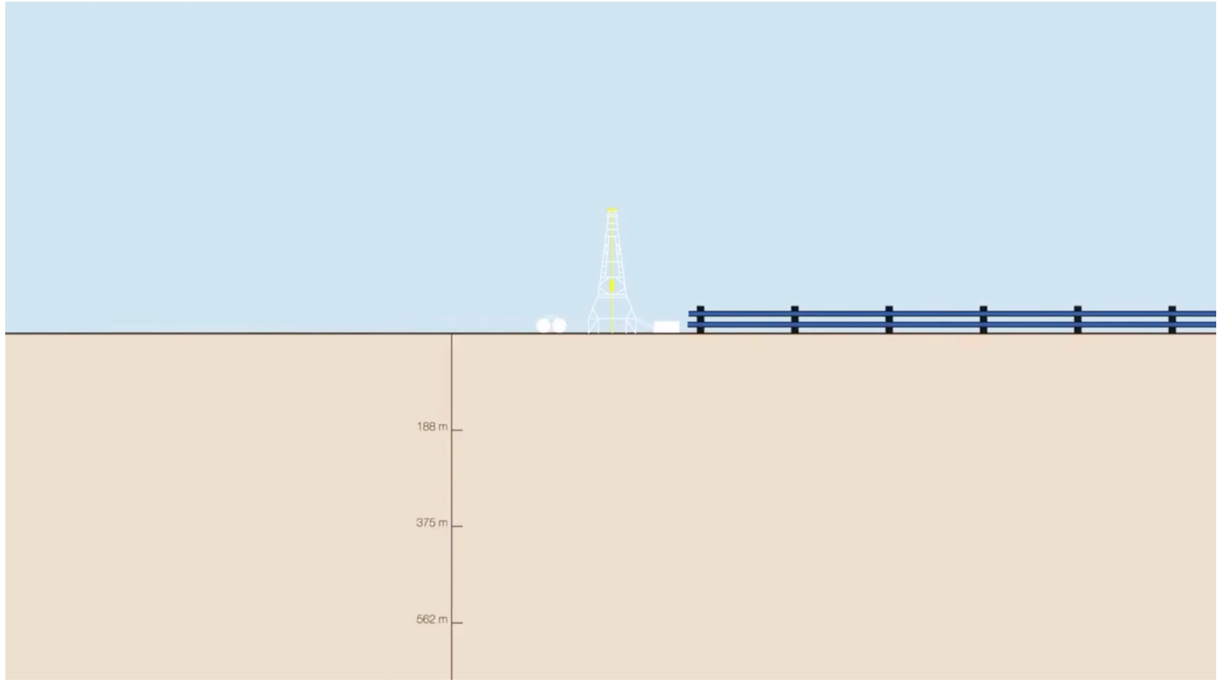
https://youtu.be/XELGBB-jqNQ

- *Note: As you watch this video, take note of some of the typical items that may be designed by an engineering professional. What type of things do we see?*
  - Structural steel
  - Concrete
  - Mechanical equipment
  - Piping
  - Electrical
  - Building Finishes
- All items that are part of industrially designed structures





Nutrien Conventional Potash Mining Facility - Adapted from https://www.youtube.com/watch?v=OFECEkOcb4w&t=10s



K+S Solution Mining Process Diagram - Adapted from https://www.youtube.com/watch?v=6Bpi21BovNw

Large Facilities have Large Problems!

- Potash has been the backbone of the Saskatchewan economy for several generations. Many facilities have been around for more than 60 years!

- Building a local engineering community
  - Each of these facilities requires engineering professionals to design and modify their structures
  - Computer Aided Design (CAD) and Building Information Modeling (BIM) are pushed to their limits to satisfy some of the biggest problems in the industry, and sometimes, the world!
  - Design-Bid-Build projects are very normal, and the industry has been built around that project execution

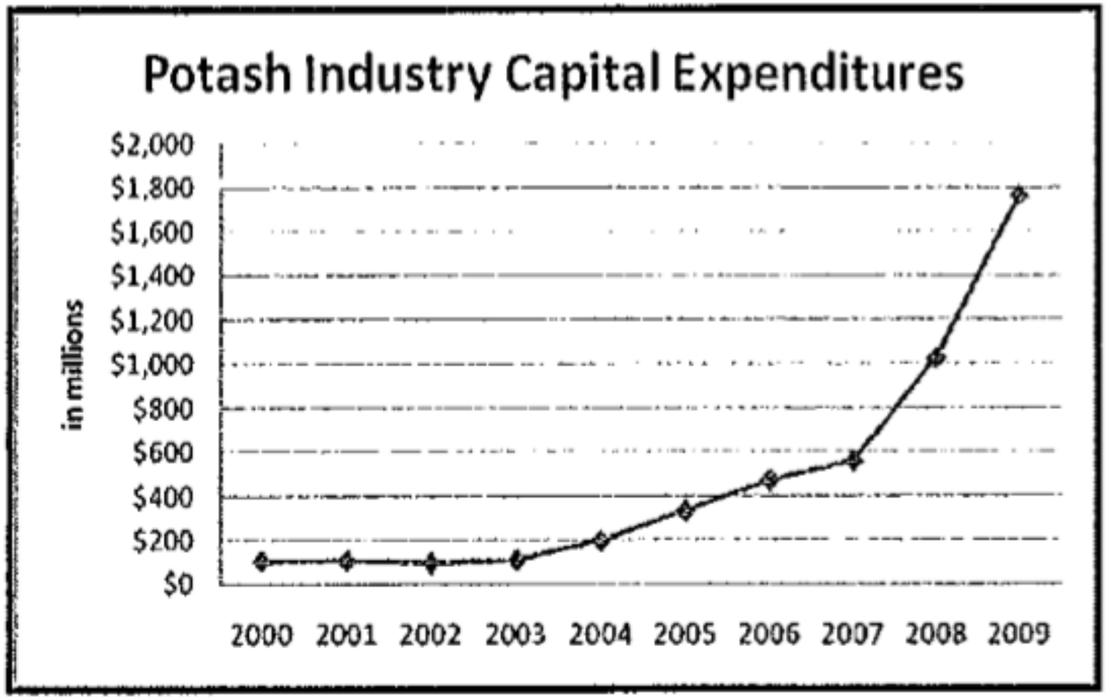
Nutrien Rocanville Potash Operations - Retrieved from http://www.canadianminingjournal.com/news/potash-potashcorp-competes-rocanville-expansion/

The Potash Boom

- In 2003, Saskatchewan's acting NDP government made two major changes to the mining tax system, the:
  - Mineral exploration incentive program
  - Profit tax exemption program

- This led to frantic design and construction of expansions, as Potash producers desired to get the most out of their product

- Massive investments were made:
  - K+S Potash Corp CAPEX = CAD $4.1 Billion
  - Nutrien (then PCS) CAPEX = CAD $7 Billion



Potash Industry Capital Expenditures from 2000 to 2009 - Retrieved from Saskatchewan's Potash Royalty and Mining Tax Regime, 2011

K+S Bethune Mine - Retrieved from https://www.ks-potashcanada.com

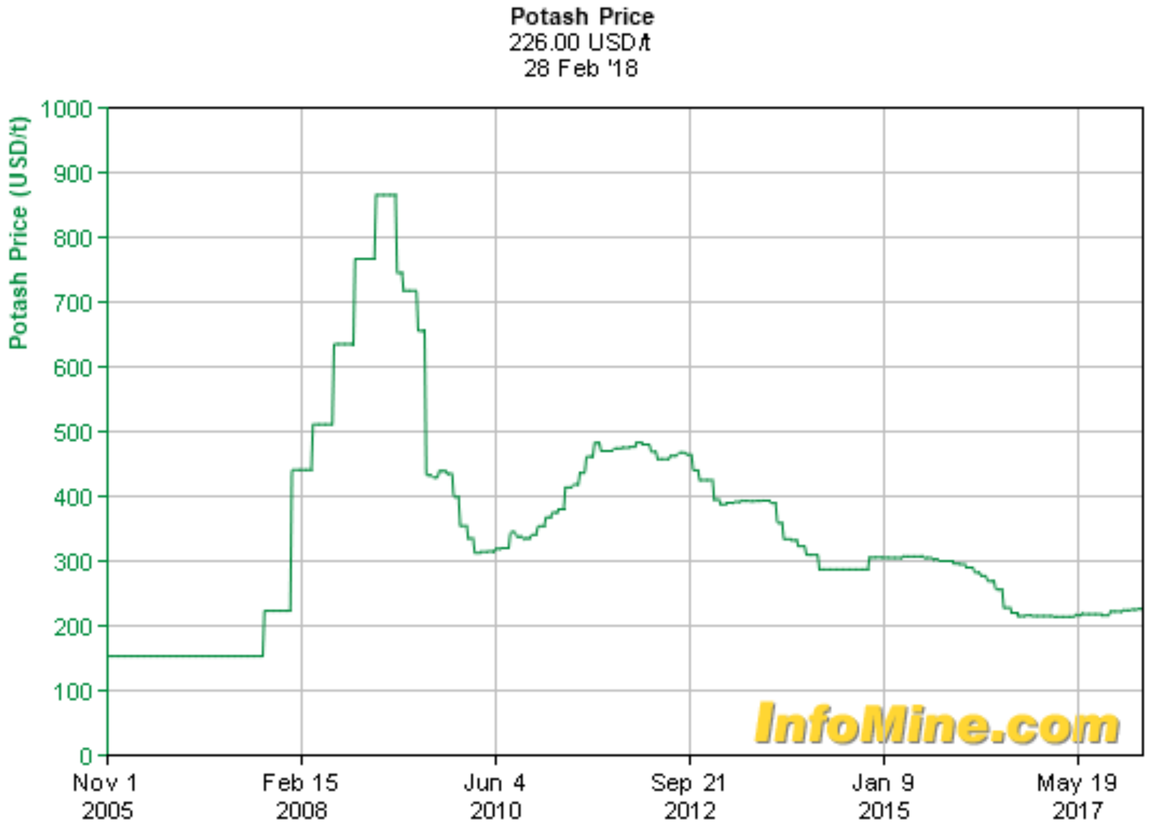
Evaporators in the wet dry area of K+S's Bethune Mine - Retrieved from https://www.680news.com/2017/05/02/ks-opens-new-potash-mine-first-new-mine-in-saskatchewan-in-more-than-40-years/

Mosaic Esterhazy K1 & K2 Expansion Project - Retrieved from https://www.hatch.com/Projects/Metals-And-Minerals/EsterhazyK1K2Expansion-Project

A new headframe for a second production shaft is built overtop of the current service shaft at the PotashCorp (Nutrien) Rocanville mine site- Retrieved from https://www.yorktonthisweek.com/news/local-news/potash-pink-gold-of-region-1.1516037

Economic Normalization

- Following the commodity increases of 2009, the Potash commodity prices have mostly leveled out
- In 2007 to 2008, Potash resource prices increased from ~$200/tonne to greater than $1000/tonne!
- In 2016, Potash prices hit their lowest point since 2008, and the surrounding economy contracted with it



Potash Historical Commodity Prices - Retrieved from Iinfomine.com, 2018

A Slowing Economy… What do we do now?!

- With economic slowdown, our professionals finally had a moment to breath.
- Many companies began to feel the extra financial weight that they had put on over the good years.
- Many companies found that their newfound tech was pushing the now thin budgets available to them and began to question the validity of their purchase.

Learning from the Local Industry

- As each company began on their own adventure in innovating on their internal project execution methodologies, I took a slightly different approach.

- It was around this time that I was challenged to complete an academic thesis for the final project of my degree.

- It had become very clear that local professionals had realized a lot of inefficiency in how we were executing projects using our software and technology, specifically in how we were using 3D modeling technology.

Interviewing an Industry

- I went out and began interviewing local professionals to identify what kind of technology our professionals were using, and what kind of hurdles were being experienced across the industry

- Interviewed over 30 professionals from over 10 different companies within the local industry

Industry Interview Results

Backpedaling Statements

“Do I really need all this software?”

“Could I cut the software and save myself a lot of money?”

“Do I need 3D models to execute projects?”

Progressive Statements

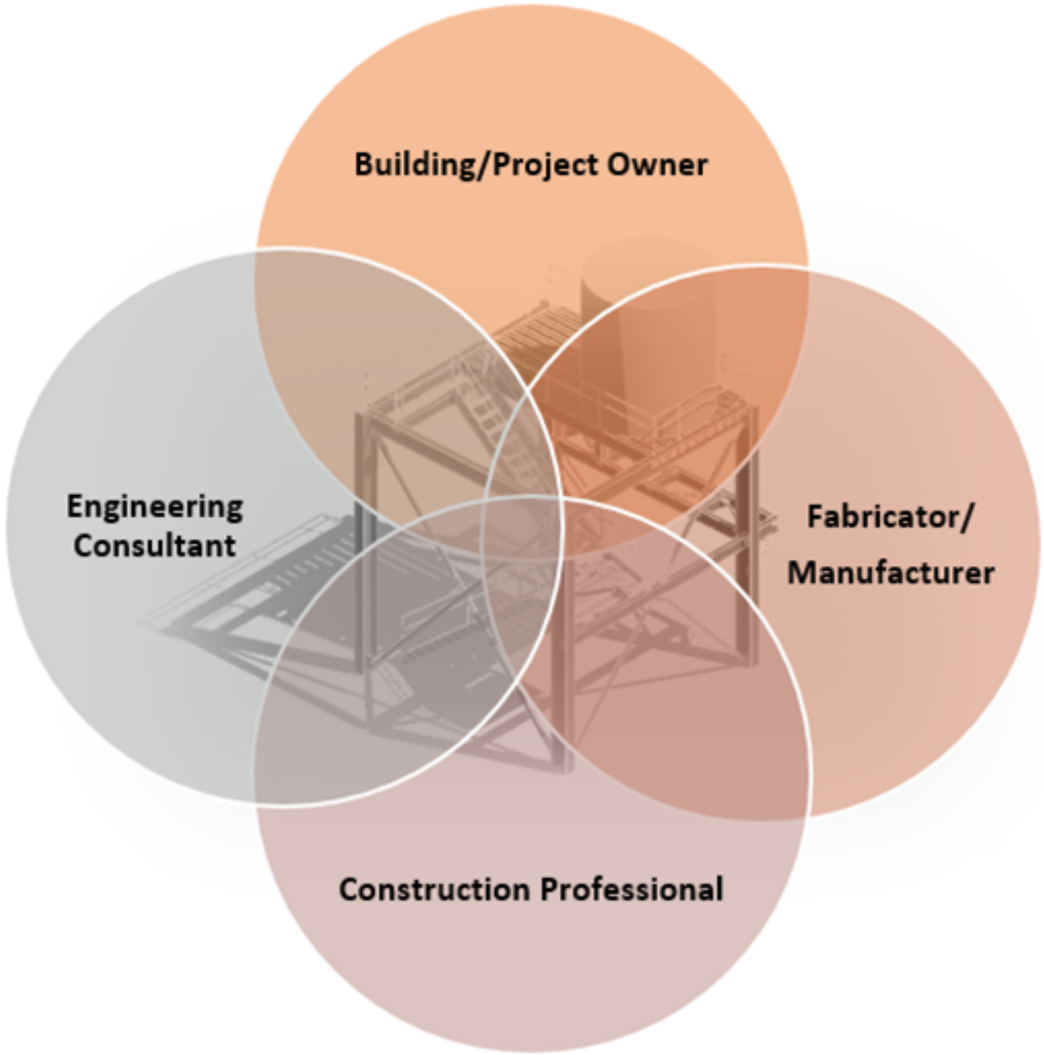
“Why is each company creating different 3D models?”

“Could we create a 3D model that would just replace all these 2D drawings?”

“How much information is needed to communicate our project in a 3D model?”

Research Results

- When our professionals were wondering how they could create intelligent and connected models that could be delivered at the end of the project, what were they asking for? **They were asking for Building Information Modeling (BIM)!**
- When our professionals were struggling to identify how they could create 3D models and communicate them between project stakeholders, what were they looking for? **They were looking for a BIM Execution Plan!**
- When our professionals were struggling to identify how much information should be placed in a model, what were they looking for? **They were looking for a Level of Detail (LOD) standard!**



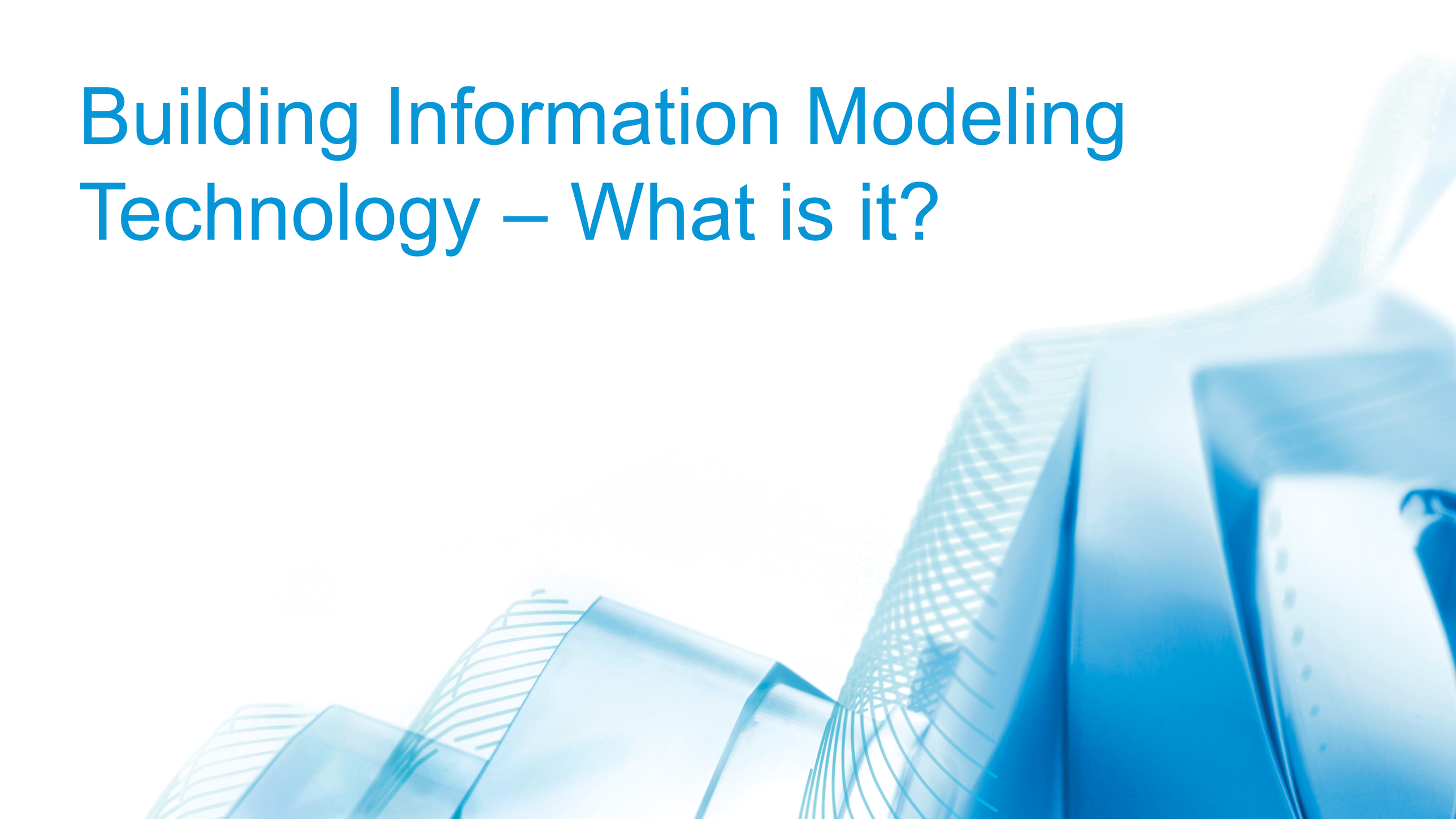
Framework of how Saskatchewan's engineering and construction professionals want to work

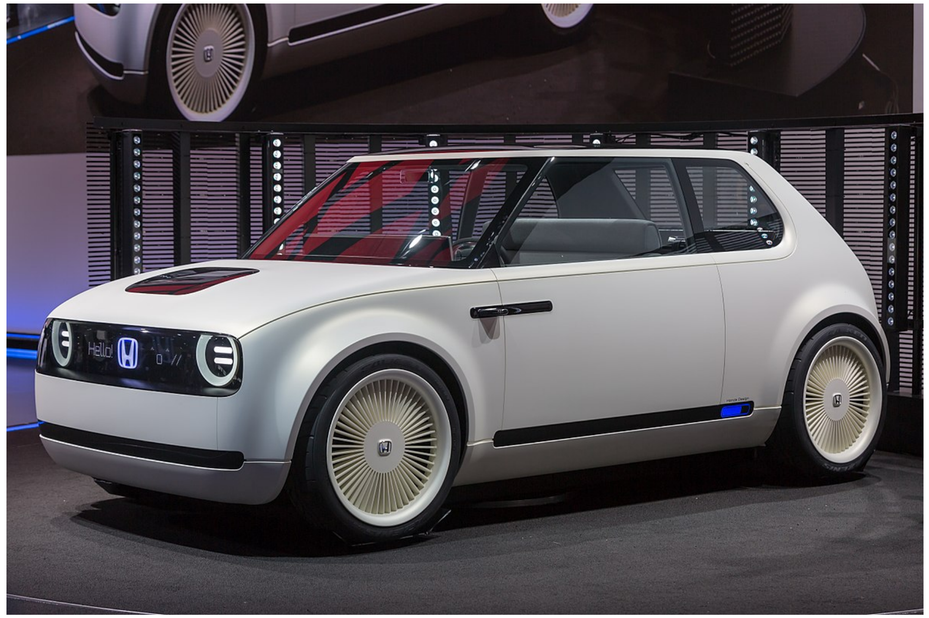
“OO + NT = EOO

(Old Organization + New Technology = an Expensive Old Organization)”

Retrieved from BIM and Construction Management, by Hardin and McCool

Building Information Modeling Technology – What is it?

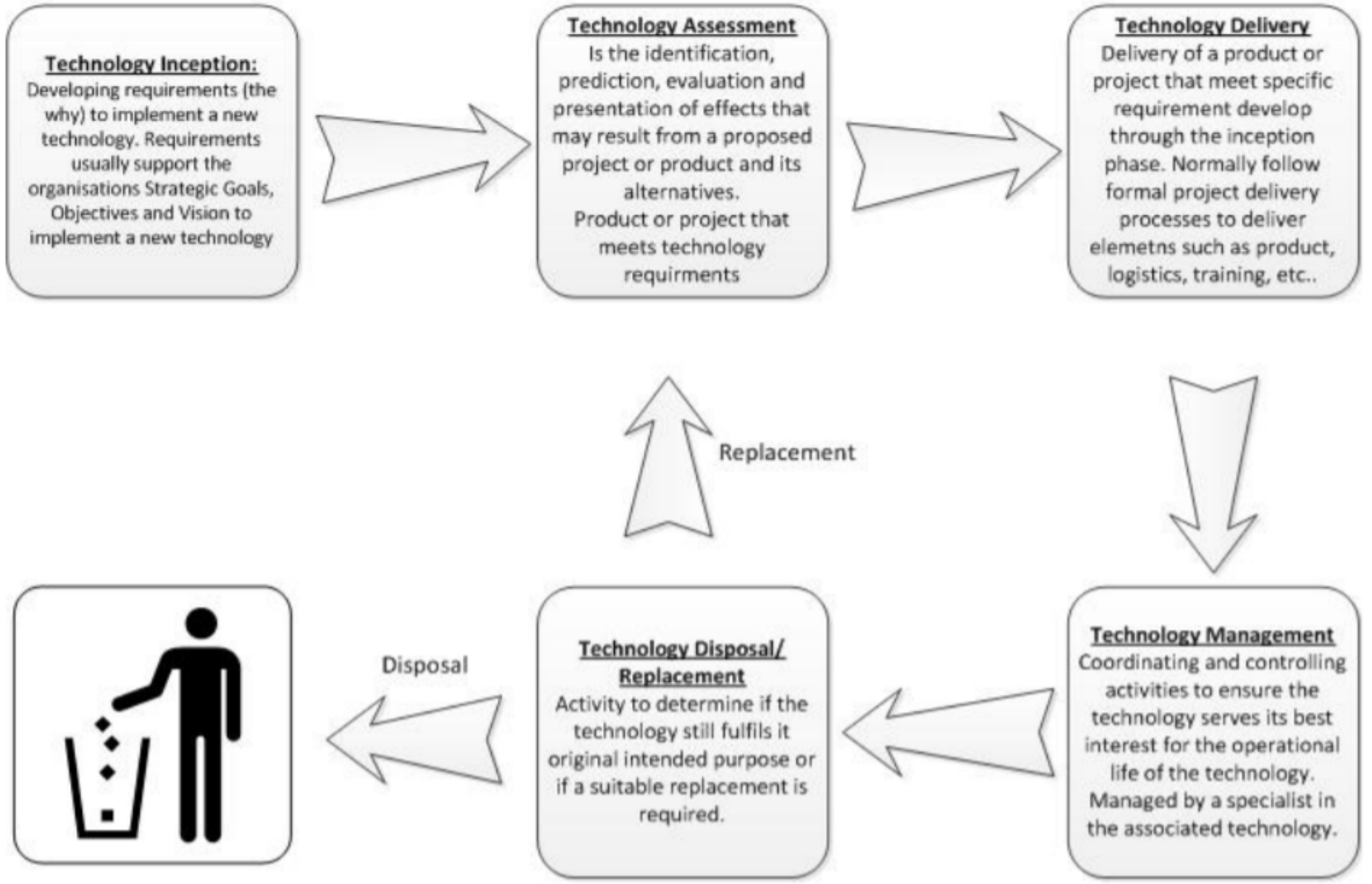




Technology Delivery Process and BIM

What is Technology?

“Technology is a form of human cultural activity that applies the principles of science and mechanics to the solution of problems. It includes the resources, tools, processes, personnel, and systems developed to perform tasks and create immediate particular, and personal and/or competitive advantages in a given ecological, economic, and social context.” - Bush, C. L. (1981). Taking hold of technology: Topic guide for 1981–1983.



Typical Technology Delivery Process

Carl Storm's, the BIMsider - Retrieved from https://thebimsider.com/about-2/

"Are we BIM'ing yet?"

One of my favorite presentations on this topic, "Are we BIM'ing yet?" by Karl Storms, describes the expectation of BIM perfectly!

So, are we?

The Master Builder Era

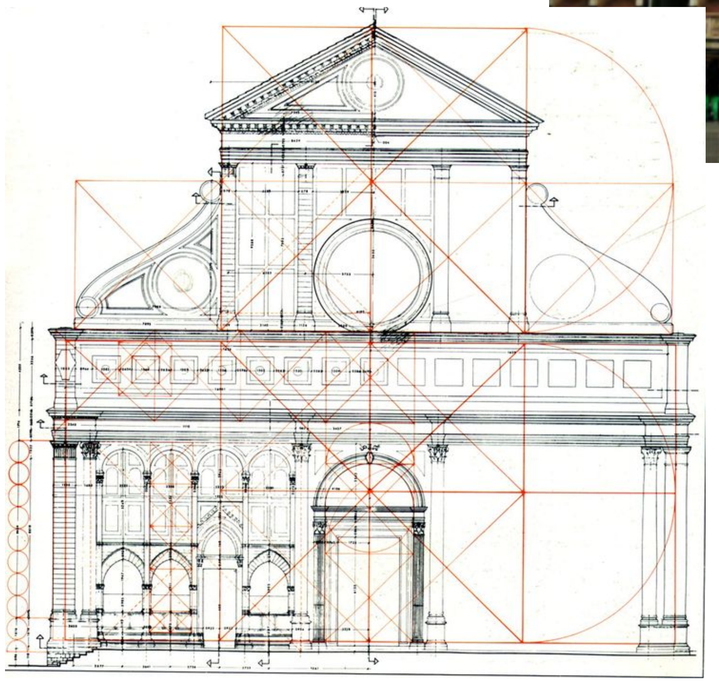
- In the earliest years of our society, one profession led the building design and construction industry, named the **Master Builder**
- The **Master Builder** possessed all knowledge in architectural and engineering practices, and advanced methods for construction
- Before the fifteenth century, construction of a structure was a relatively simple process: An **owner** would hire a **master builder** who oversaw all aspects of design and construction for an entire project

The Advent of 2D drawings

- Historical roots of paper can be tracked back through Chinese records to **105AD**

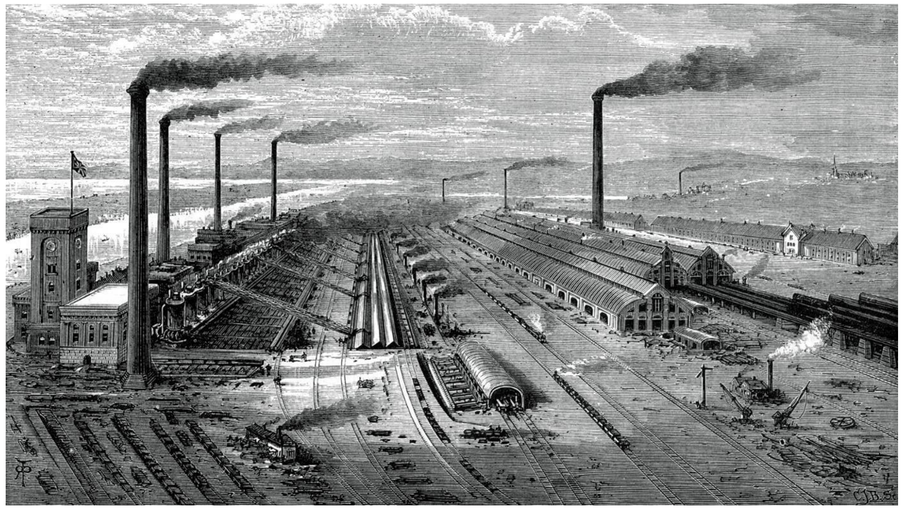
- **Leon Battista Alberti** used paper to deliver design intent during the **mid-fifteenth century** for the new façade of **Florence's Gothic church**

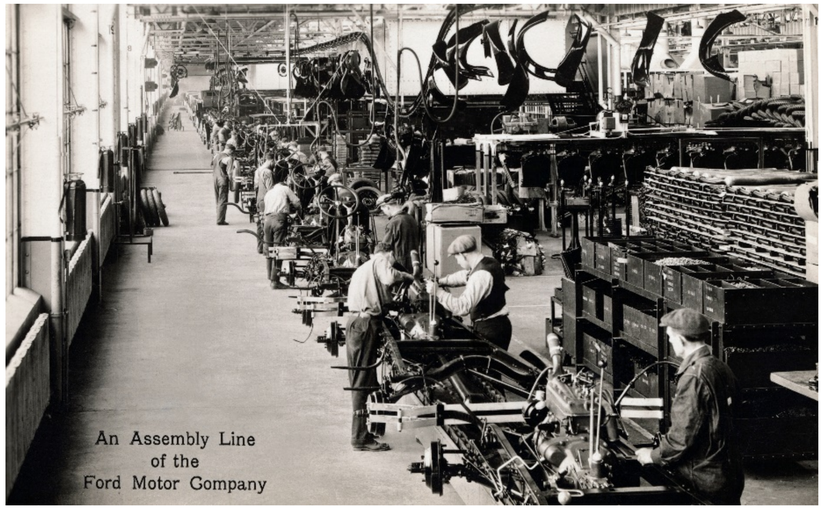
- Generally believed to be the first occurrence of delivering drawings, deviating from the master builder approach



Fragmentation of the Industry

- Paper enabled fairly reliable communication between designers and constructors of buildings, which bridged distances in **time, space, and profession**, allowing for specialized professions to emerge, like architect, engineer, technologist, and tradesperson
- As society progressed into the Industrial Revolution, unique problems required highly specialized personnel to solve unique production and facility needs





Fragmentation of the Industry

- Specialization in the design and construction industries led to development of professional societies, such as the **American Institute of Architects (AIA) in 1857**, and the **Associated General Contractors of America (AGC) in 1918**.

- Further exacerbated due to legal requirements, such as:
  - Miller Act in 1935
  - Brooks Act in 1972

- Many Saskatchewan associations exist to maintain the minimum legal requirements of professionals

AGC of America
THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA
Quality People. Quality Projects.

AIA

APEGS
Association of Professional Engineers & Geoscientists of Saskatchewan

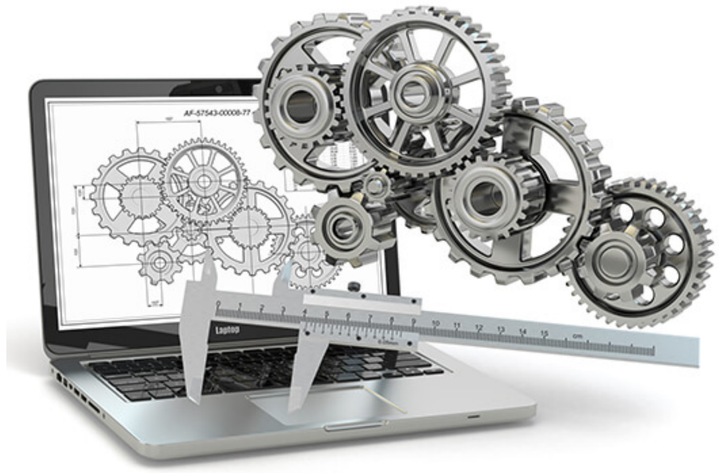
SASKATCHEWAN
ASSOCIATION OF ARCHITECTS

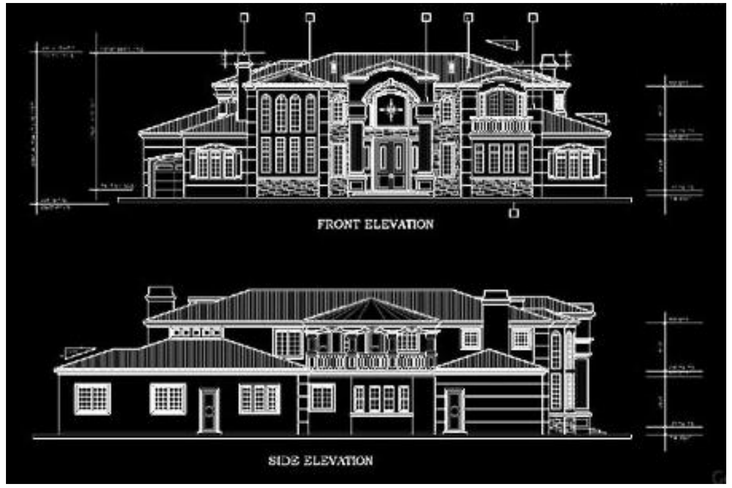
Saskatchewan Applied Science Technologists and Technicians

SASKATCHEWAN CONSTRUCTION ASSOCIATION

The Advent of Computer-Aided Design (CAD)

- Similar to paper, invention of computers and digital technologies redefined how building projects were performed and communicated
- Two ideas emerged for conducting digital projects:
  - Computer-integrated construction (An early version of BIM)
  - Replacement for paper-and-ink drawing boards





The Advent of Computer-Aided Design (CAD) (cont.)

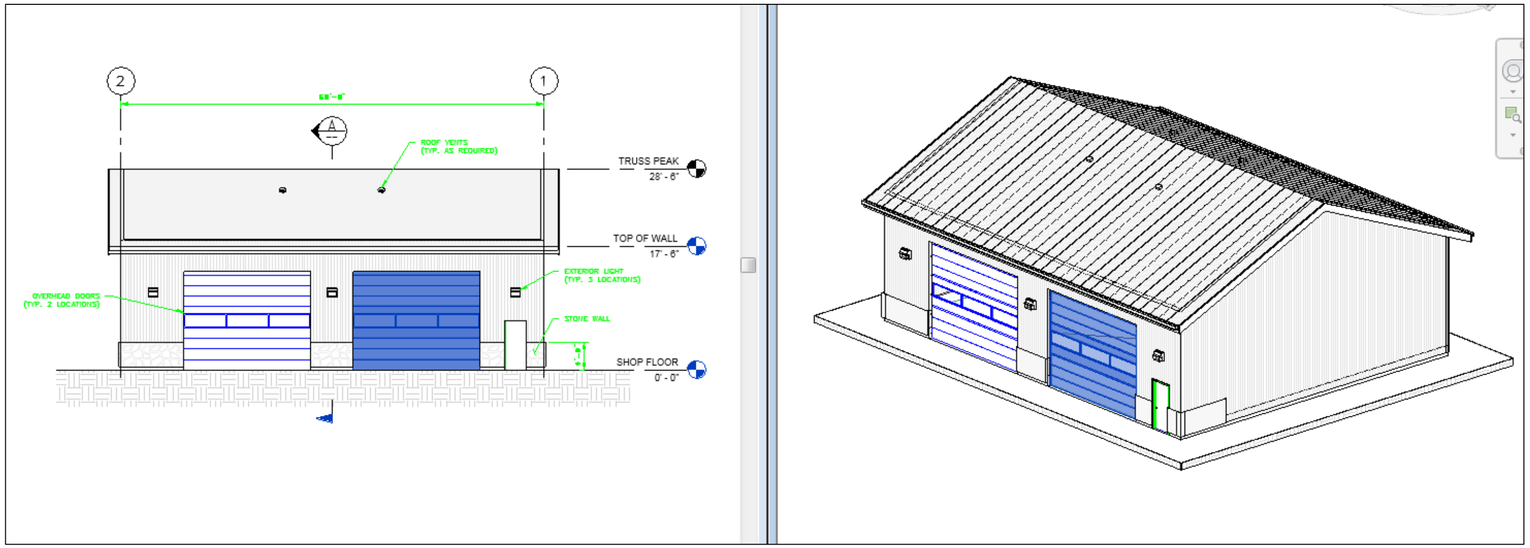
- Paper-and-ink technologies, which became Computer-Aided Design (CAD) technologies, developed quickly and pushed the industry in a direction of digital documentation
- CAD provided 2D capabilities as well as 3D modeling, but this did not come without its issues:
  - Functionally powerful but overwhelmed computing power
  - Initially expensive
  - Designing in 3D was conceptually foreign for most designers, who were more comfortable working in 2D

AUTOCAD

MicroStation

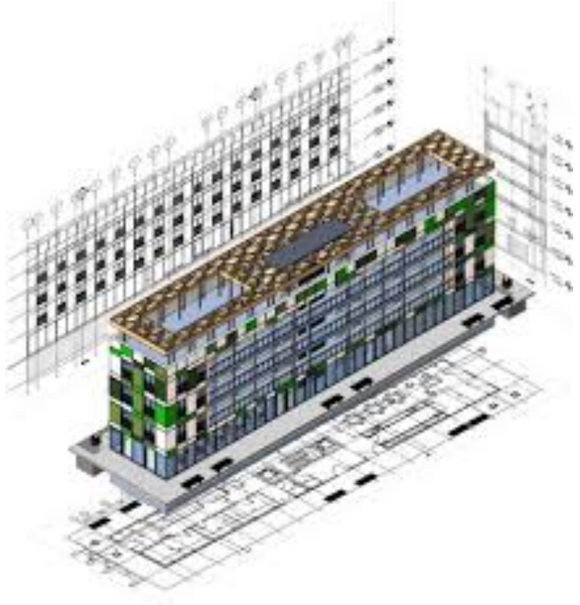
Parametric Modeling and Building Information Modeling (BIM)

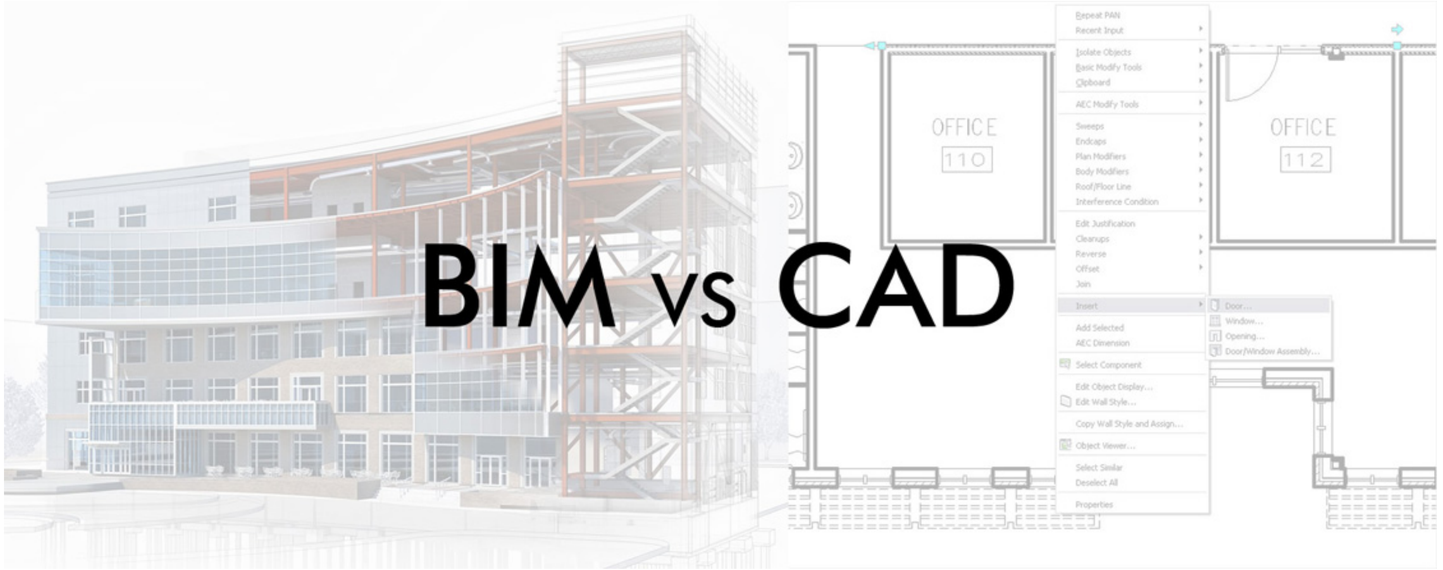
- As CAD software and computing power continued to evolve, the disconnected relationship between generation of 2D drawings and 3D models began to mold together
- **Parametric Modeling** emerged allowing for connected 2D drawings and 3D models to reduce the rework found in CAD workflows



Building Information Modeling (BIM)

- Parametric modeling opened the AEC industry up to a whole new method for design, but this was only cracking the surface to the already identified industry segregation issue
- **Building Information Modeling (BIM)** is the AEC industries answer to a long standing problem that extends beyond CAD!
- BIM allows for all project information to be centralized, shareable, and useable by all stakeholders





References

- This is an abridged version of the content provided in the the following two books:
- BIM Handbook, by Sacks, Eastman, Lee, and Teicholz
  - As shown on the top right
- BIM and Construction Management, by Hardin and McCool
  - As shown on the bottom right

- I highly recommend reading these!

So, “Are we BIM’ing Yet?”

BIM Technology is not a single product, it’s not Revit, it’s not BIM360, it’s not Bentley AECOsim, it’s not Aveva E3D, rather it’s the idea of a group of software, devices, and processes that enable BIM Technology to be utilized

AEC Collection Relationship

ARCHITECTURE, ENGINEERING & CONSTRUCTION COLLECTION

Integrated BIM tools for building design, civil infrastructure, and construction

Included products A-Z

- 3ds Max
- Advance Steel (US Site)
- AutoCAD
  Includes AutoCAD, AutoCAD Architecture, AutoCAD Electrical, AutoCAD Map 3D, AutoCAD Mechanical, AutoCAD MEP, AutoCAD Plant 3D, AutoCAD Raster Design, AutoCAD mobile app, and AutoCAD web app
- Autodesk Drive
- Autodesk Rendering
- Civil 3D
- Dynamo Studio
- Fabrication CADmep (US Site)
- FormIt
- InfraWorks
- Insight (US Site)
- Navisworks Manage
- ReCap Pro
- Revit
- Revit Live (US Site)
- Robot Structural Analysis Professional (US Site)
- Structural Bridge Design (US Site)
- Vehicle Tracking

AEC Collection Relationship

REVIT

Pros

- Great for layout and structural design tool
- Fully parametric

Cons

- Struggles when finely detailing components

INVENTOR

Pros

- Great for detailed equipment design

Cons

- Struggles with large scale building/plant layout items, like piping, HVAC, and large structures

AUTOCAD

Pros

- Great for detailing with many specialized detailing tools

Cons

- Struggles with full parametric link and quick 3D layout

NAVISWORKS

Pros

- Allows connectivity of Autodesk and other file types!
- Easy to Navigate
- Free version available

Cons

- Is only a viewer/analyzer and cannot be used for design

Better Together

- You'll notice that one piece doesn't quite do everything
- This is perhaps a perceived weakness, rather this should be perceived as Autodesk's greatest trait: **Adaptability**
- These tools can be used to solve almost any design problem, with the caveat that a good interoperability plan is in place… A BIM Execution Plan

BIM Execution Planning on Industrial Projects

BIM Execution Planning

- It is not normal to just see one or two applications used on a project; rather, it is very normal for an organization to use tens of applications, even for small projects

- Avoid the temptation of adopting a new piece of software and assuming it will immediately solve all of your project problems

- Spend the time to review the requirements of the project, look at the BIM capabilities available (both from a software and stakeholder standpoint), gather a team of technical leads to develop the process, and develop a BIM Execution Plan to suit!

Creating A Plan… A BIM Execution Plan!

How do we solve this massively complicated problem?

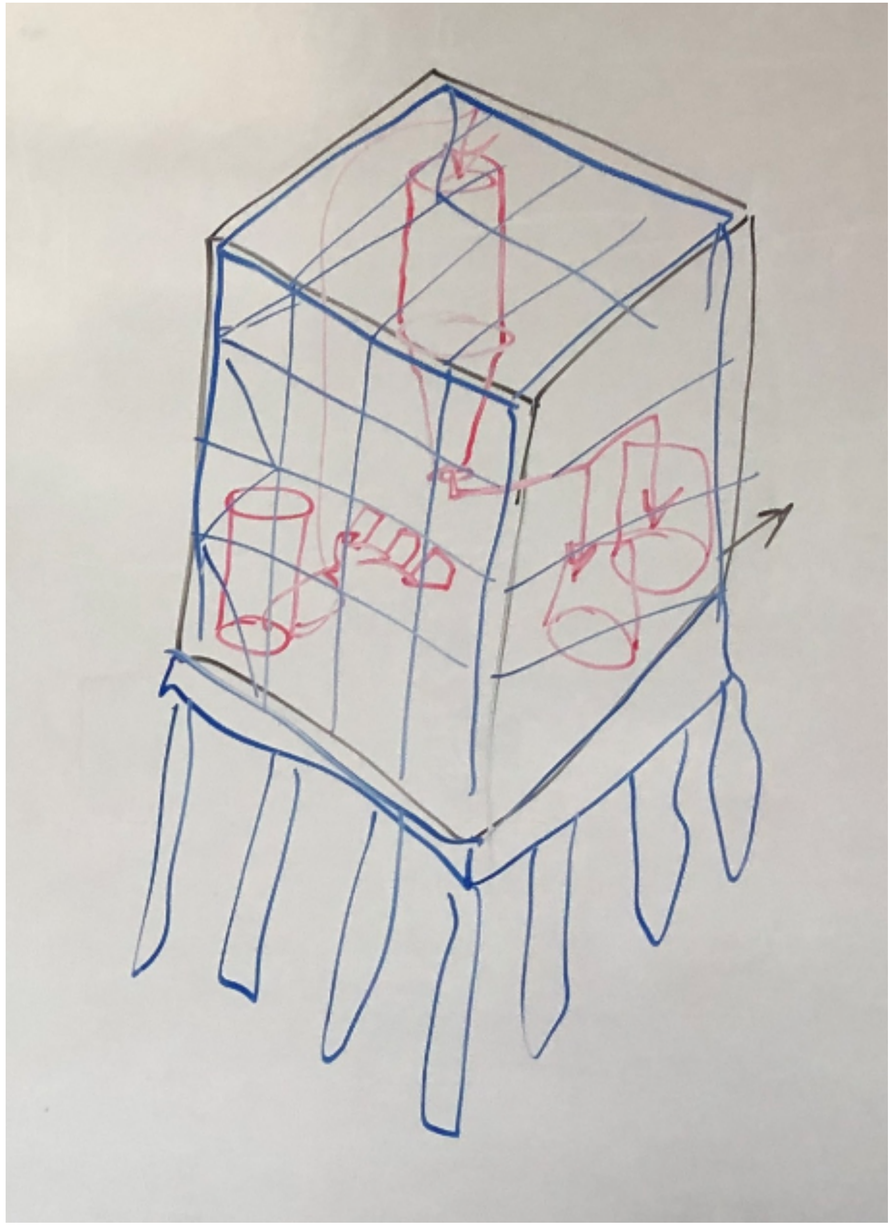
With three important steps:

1. Identify your projects BIM Uses
2. Develop you BIM Interoperability Framework(s)
3. Identify your Level of Detail (LOD) Standard

Sounds simple, right? Well, it does if you know what each of these components entails.

100’ Cube Process Facility

- To create our BIM Execution Plan, lets use our imagination for a second.
- Lets say your team needs to design a 100’ cube structure.
- Design Criteria:
  - 100’ cube structure
  - 60+ year life, throughout its life it will likely have:
    - Debottlenecking projects
    - Expansions
    - Sustaining capital projects
    - Require a facility management team to manage future projects
  - Mechanical, Structural, Electrical, all required



Step 1: Identify your project BIM Uses

Choosing Your BIM Uses

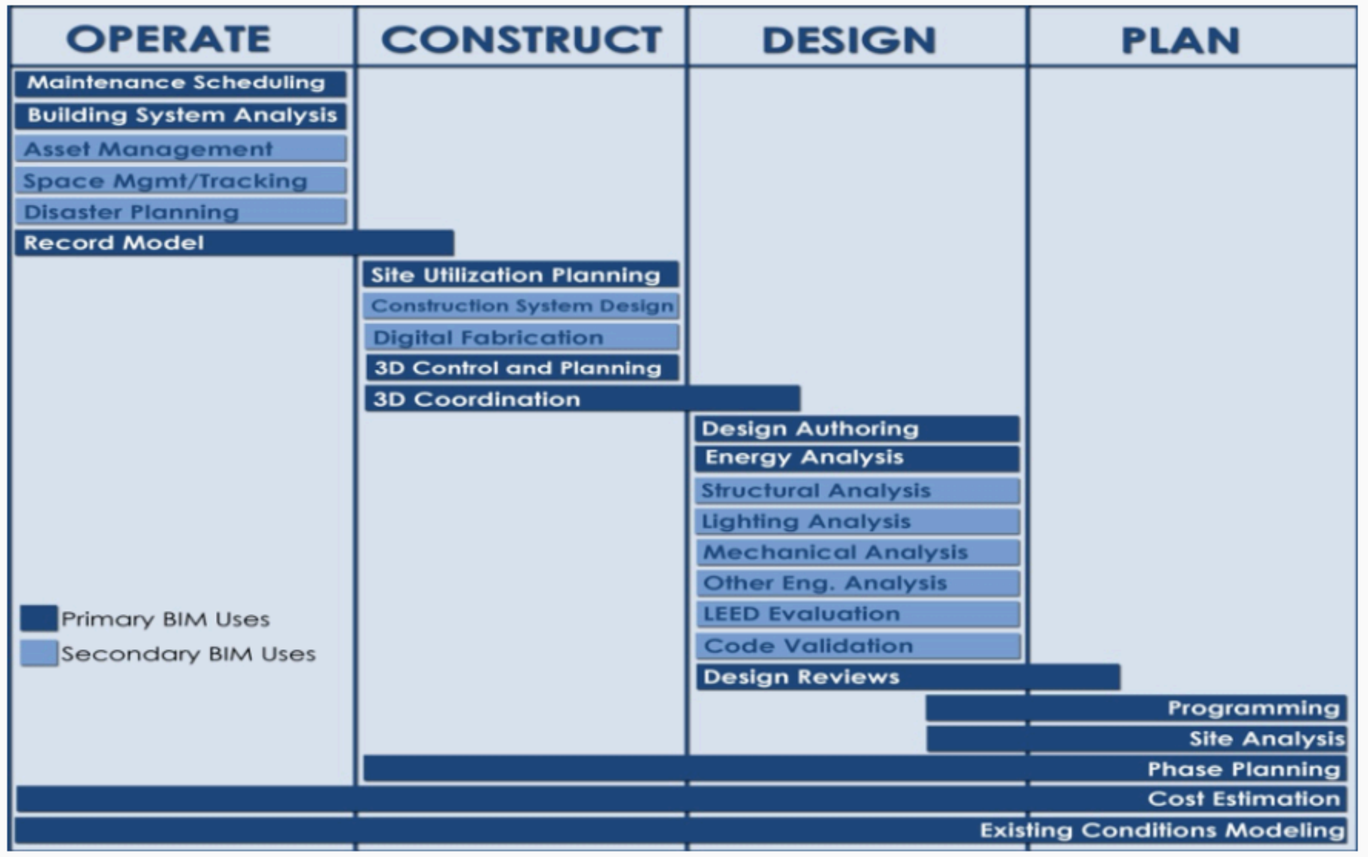
- Start with the end in mind. Identify your end deliverables and work your way backwards.
- BIM Uses are, in short, the ways that BIM Technology can be used to execute your project!
- Many resources available on this topic, and many organizations have their own method for identifying their own BIM Uses.
- If you are new to this idea, don’t’ worry! One resource I lean on is PennState’s Computer Aided Construction research program has developed a comprehensive guide that currently covers 21 different BIM Uses and how to consider them on your project.

Appendix B: BIM Use Descriptions

See Chapter 2 for guidance regarding the selection of potential BIM Uses. Please note that BIM Uses are organized in reference to Figure 2-3:

1. Building (Preventative) Maintenance Scheduling
2. Building System Analysis
3. Asset Management
4. Space Management and Tracking
5. Disaster Planning
6. Record Modeling
7. Site Utilization Planning
8. Construction System Design
9. Digital Fabrication
10. 3D Control and Planning
11. 3D Coordination
12. Design Authoring
13. Engineering Analysis
    a. Energy Analysis
    b. Structural Analysis
14. Sustainability Evaluation
15. Code Validation
16. Programming
17. Site Analysis
18. Design Reviews
19. Phase Planning (4D Modeling)
20. Cost Estimation
21. Existing Conditions Modeling

BIM Uses as defined by the Penn State BIM Project Execution Planning Guide - Retrieved from https://www.bim.psu.edu



BIM Uses throughout a Building Lifecycle (organized in reverse chronological order from project implementation) - Retrieved from https://www.bim.psu.edu

What about for our 100’ cube?

ASSET MANAGEMENT

Is this model going to be used for future asset management? If so, should this be handled now or later? If later, have you chosen a software that can allow for this?

RECORD MODELING

Record modeling is keeping a model that is a record of the current as-built status of the facility. This can be provided in a varying level of details, but the important thing here is to understand how the model should be used and communicated for future projects.

3D COORDINATION

3D coordination is the connection of all project model information for visual interaction to complete clash detection. Models must all be connected in one source (usually using a software like Navisworks).

DESIGN AUTHORING

Which tool will be used to create your building information model? In the case of the structural model, Revit provides exceptional tools for structural modeling

What about for our 100’ cube?

ENGINEERING ANALYSIS

Structural analysis can be performed in a variety of ways, but, luckily, Autodesk provides a powerful working connection between Revit and Robot! These two software pieces can be used to take information out of Revit, analyzed in Robot, and, if set up correctly, changes can be pushed back into Revit!

DESIGN REVIEWS

Design reviews are one of the AEC industries favorite uses for BIM that benefits the entire project team. Does your team intend to have design review meetings with the client?

COST ESTIMATION

Does your team need to create cost estimates during the project? How will you utilize the software to accomplish this?

EXISTING CONDITIONS MODELING

Does your team need to account for changes to an existing structure, or to the existing site? How will this data be acquired and used?

What about for our 100’ cube?

I know what you’re thinking…

- Yes, there is a lot of things to overcome here, but, thankfully, many of these items can be solved quickly by an experienced team!

- Also, each of these items are, in my opinion, great items to pursue for developing a team.

- Imagine a list of items that can easily move your team forward using our most up to date design technologies!... Hopefully you’re imagining that list of 21 BIM Uses I just showed you.

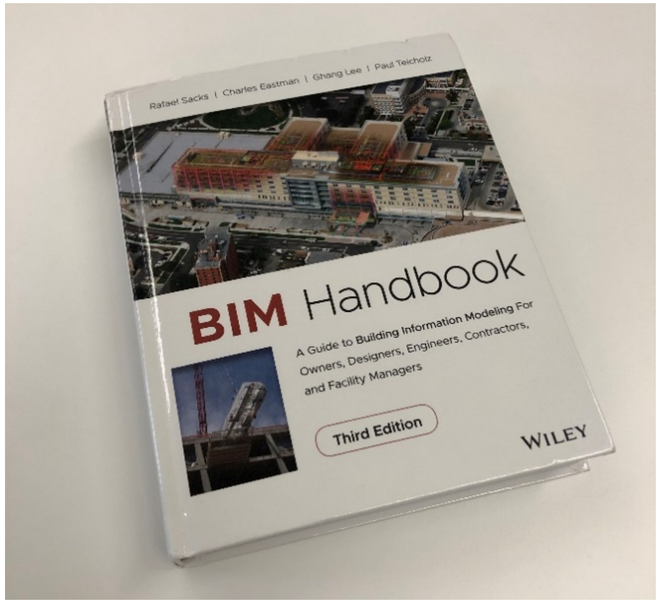
Choosing Project Leadership

- Carefully, carefully, choose your project leads!
- Choose the person with the most experience, but don’t only choose the person with the most experience!
- Identify your experienced leadership across discipline, technology, project management, and project administration, and let this team push the boundaries of what they know!

Step 2: Develop your BIM Interoperability Frameworks

A bit of Interoperability Theory

- My favorite resource for BIM Theory is the BIM Handbook!



Data Exchange Formats

- The BIM Handbook identifies 3 different data exchange formats:

1. Direct Links

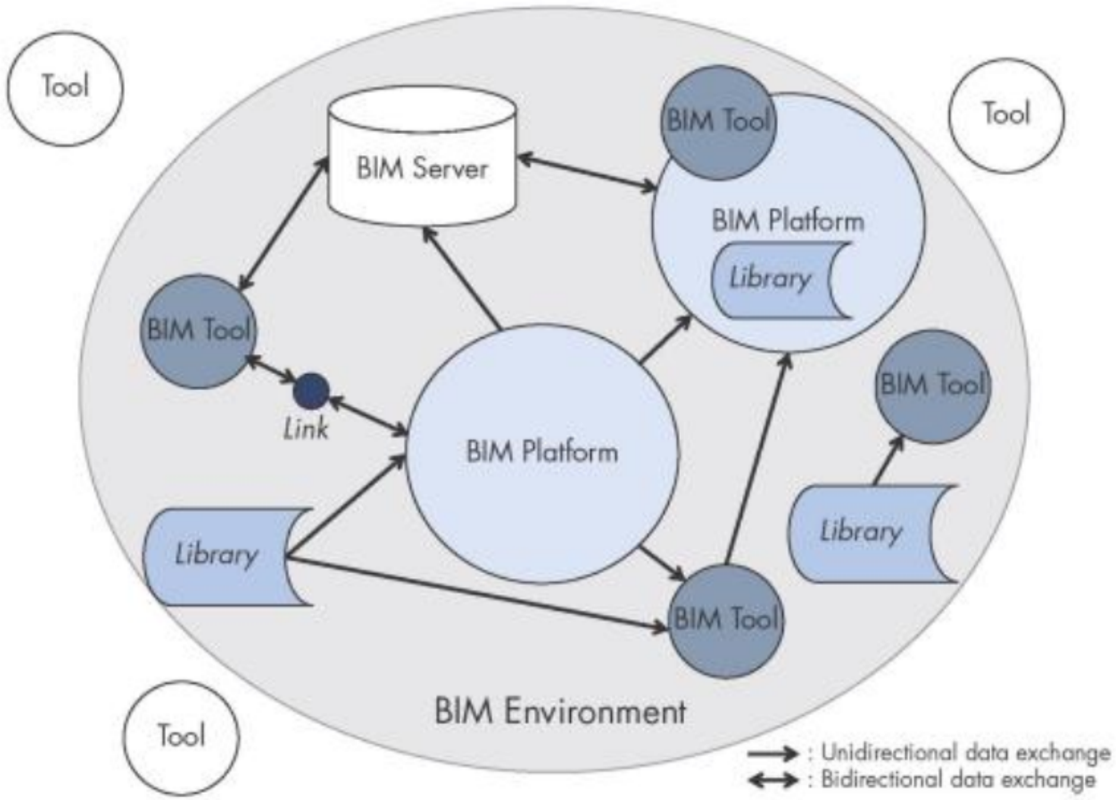
2. File-based data exchange’s

3. Model-server based data exchange’s

BIM Interoperability Framework

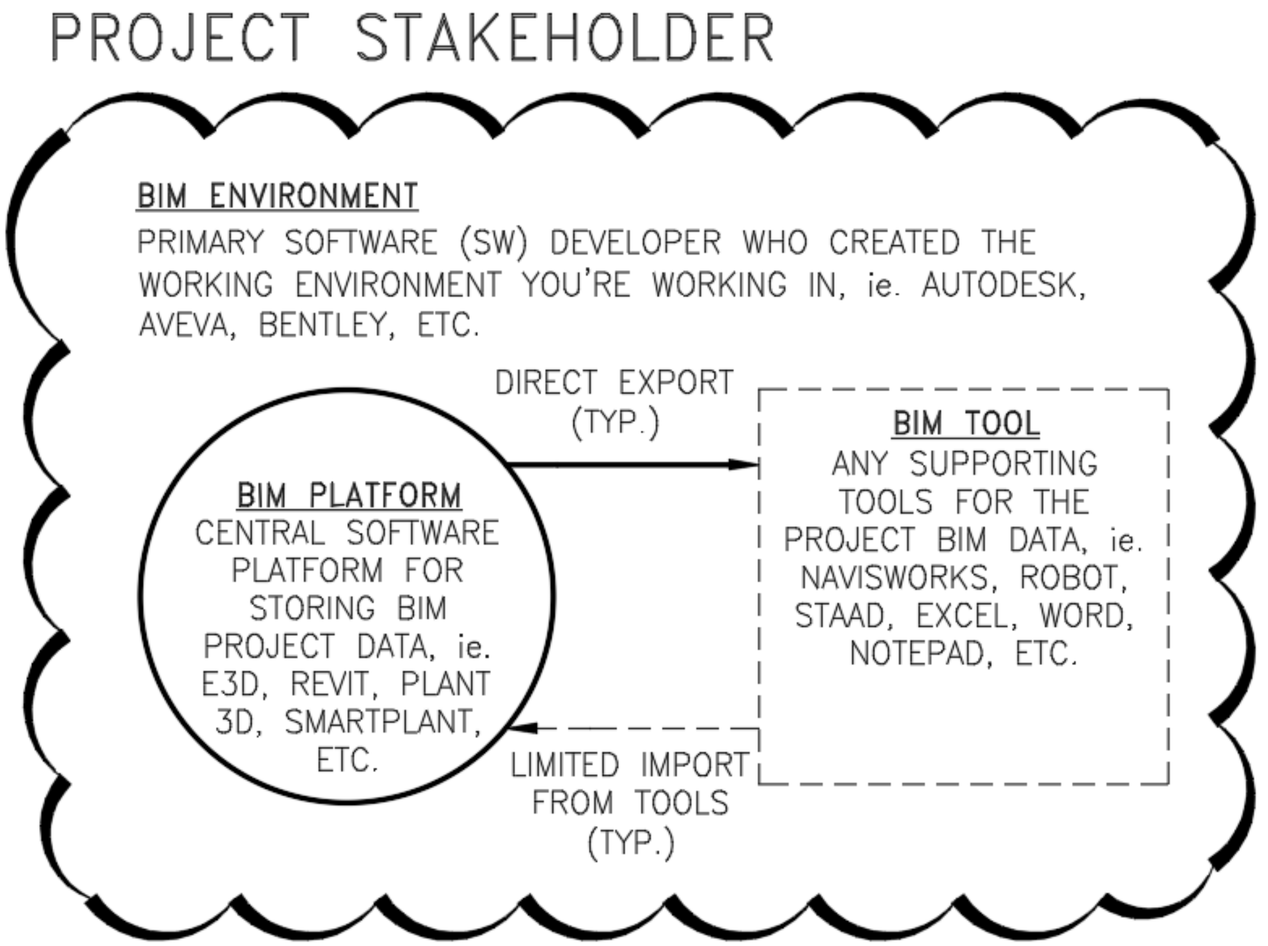
- There are three different considerations to make when building your BIM interoperability:
  1. BIM Environment
  2. BIM Platform
  3. BIM Tools

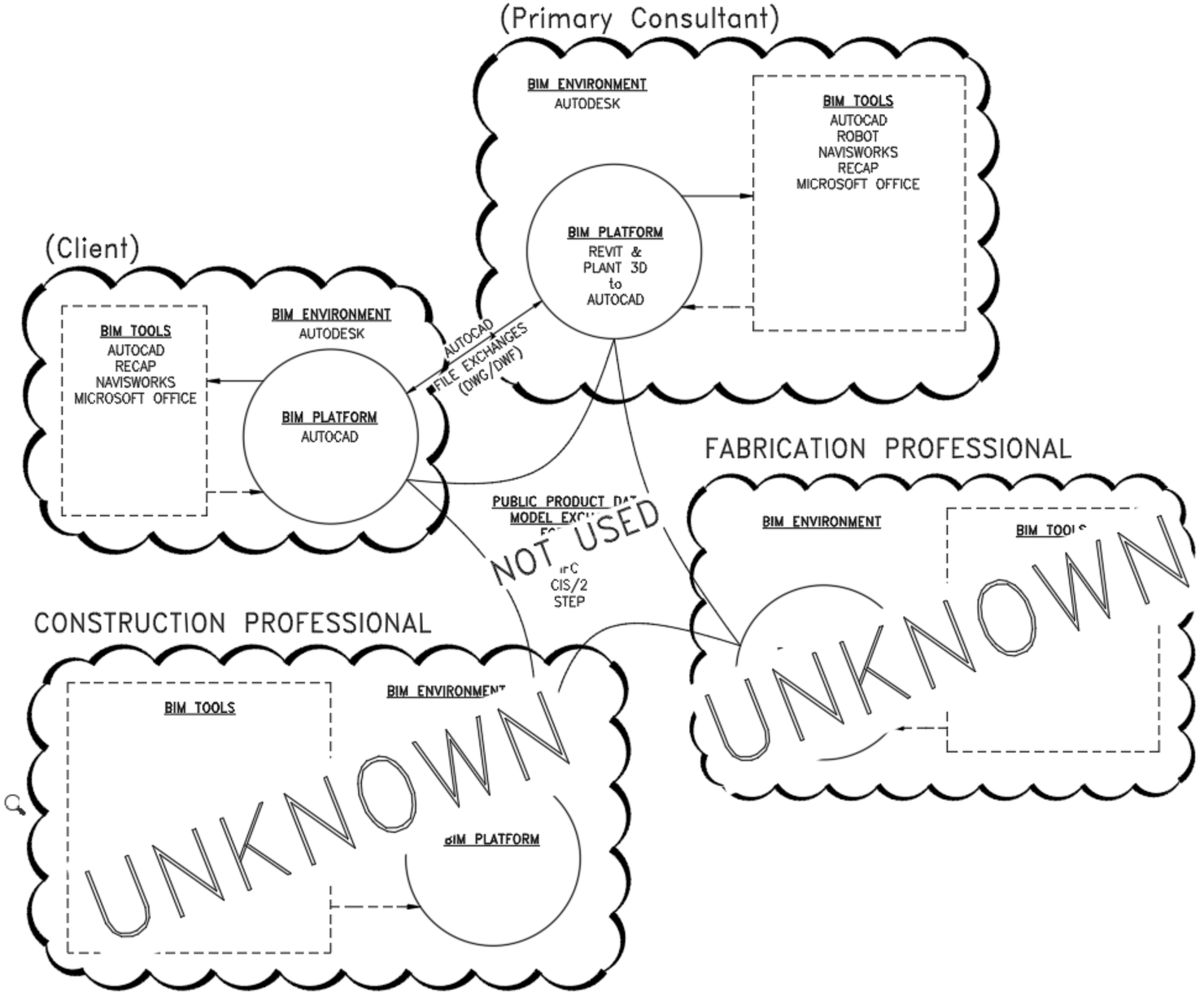
- Understanding this relationship is the key to developing a successful BIM Execution Plan!

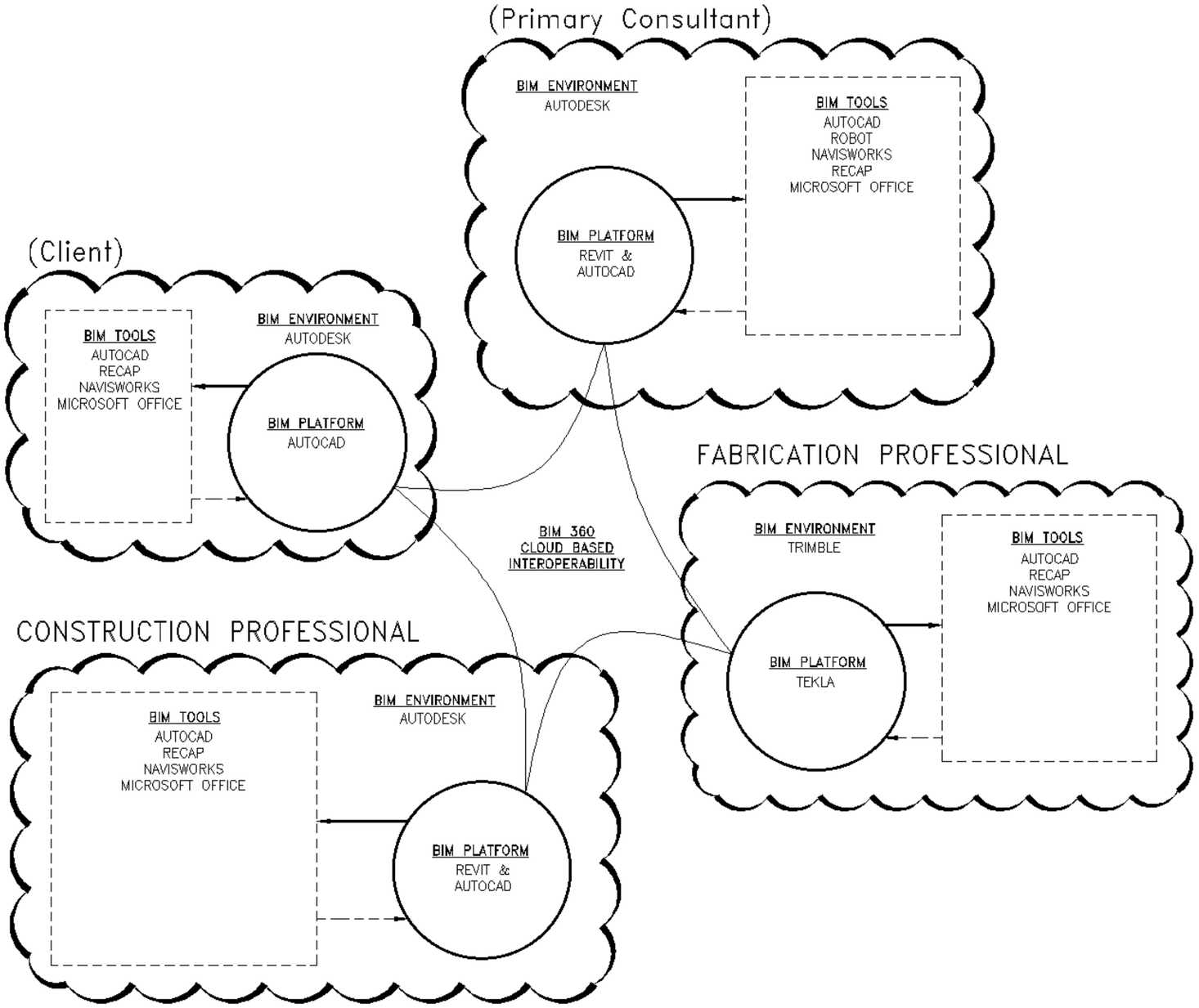


BIM Uses throughout a Building Lifecycle (organized in reverse chronological order from project implementation) - Retrieved from the BIM Handbook, Third Edition

The BIM Interoperability Framework




(Primary Consultant)
BIM ENVIRONMENT
AUTODESK
BIM TOOLS
AUTOCAD
ROBOT
NAVISWORKS
RECAP
MICROSOFT OFFICE
BIM PLATFORM
REVIT &
PLANT 3D
to
AUTOCAD
(Client)
BIM TOOLS
AUTOCAD
RECAP
NAVISWORKS
MICROSOFT OFFICE
BIM ENVIRONMENT
AUTODESK
BIM PLATFORM
AUTOCAD
AUTOCAD
FILE EXCHANGES
(DWG/DWF)
PUBLIC PRODUCT DA
MODEL EXCH
NOT USED
IFC
CIS/2
STEP
FABRICATION PROFESSIONAL
BIM ENVIRONMENT
BIM TOOLS
UNKNOWN
CONSTRUCTION PROFESSIONAL
BIM TOOLS
BIM ENVIRONMENT
UNKNOWN
BIM PLATFORM


(Primary Consultant)
BIM ENVIRONMENT
AUTODESK
BIM TOOLS
AUTOCAD
ROBOT
NAVISWORKS
RECAP
MICROSOFT OFFICE
BIM PLATFORM
REVIT &
AUTOCAD
(Client)
BIM TOOLS
AUTOCAD
RECAP
NAVISWORKS
MICROSOFT OFFICE
BIM ENVIRONMENT
AUTODESK
BIM PLATFORM
AUTOCAD
BIM 360
CLOUD BASED
INTEROPERABILITY
FABRICATION PROFESSIONAL
BIM ENVIRONMENT
TRIMBLE
BIM TOOLS
AUTOCAD
RECAP
NAVISWORKS
MICROSOFT OFFICE
BIM PLATFORM
TEKLA
CONSTRUCTION PROFESSIONAL
BIM TOOLS
AUTOCAD
RECAP
NAVISWORKS
MICROSOFT OFFICE
BIM ENVIRONMENT
AUTODESK
BIM PLATFORM
REVIT &
AUTOCAD

BIM Execution Paralysis

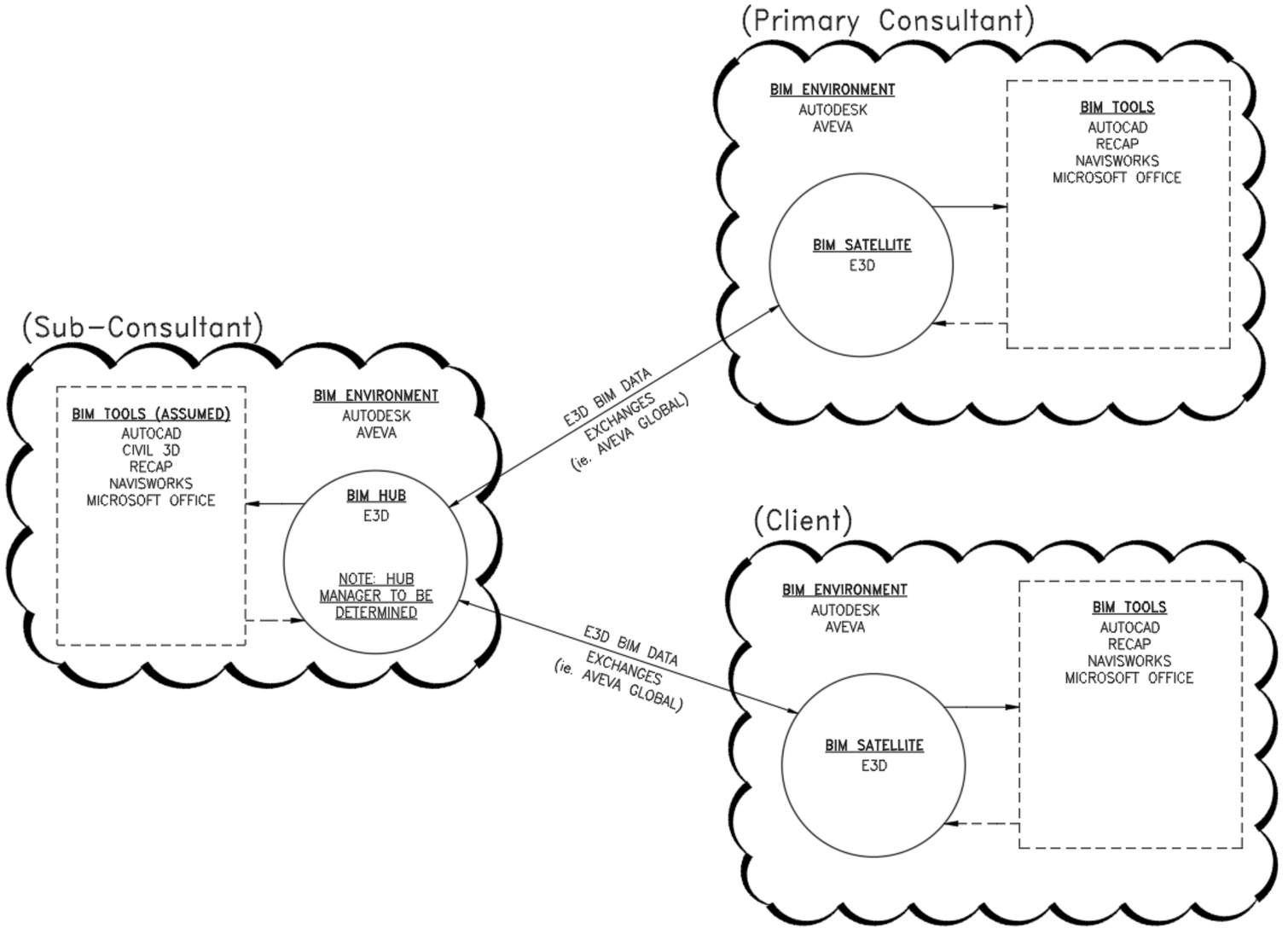
- So, what happens when the project you are faced with is such a huge problem with such a huge budget that every potential software was available to you?!?

- If you have access to every software available, that might sound great for providing unlimited capabilities to your team, but it can cause, what I like to call, BIM Execution Paralysis.

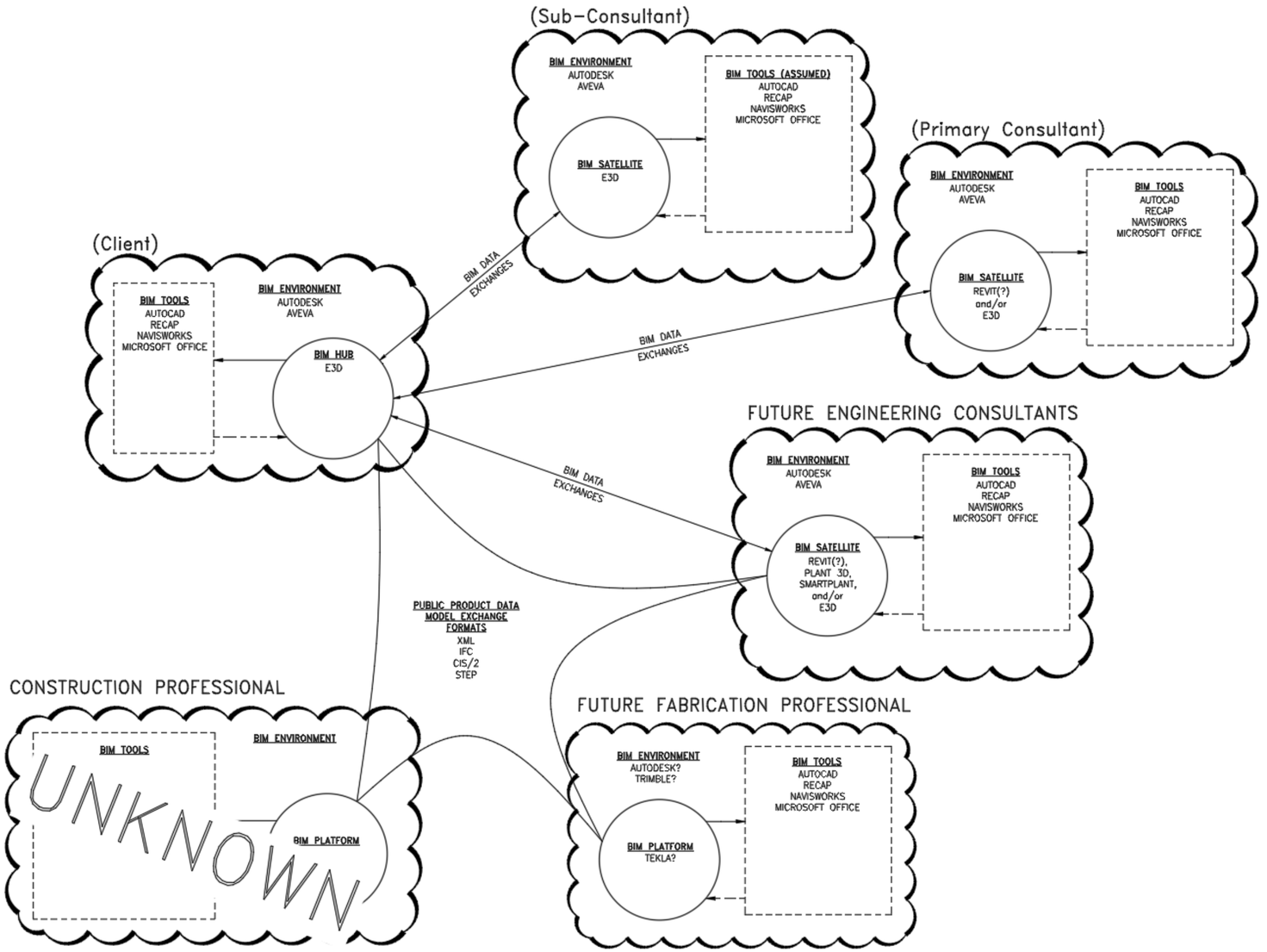
- BIM Execution Paralysis is what happens when a project team begins thinking about how they're going to execute a project and, when the hurdles become to big they say "We'll just figure that out later".

How can we prevent BIM Execution Paralysis?

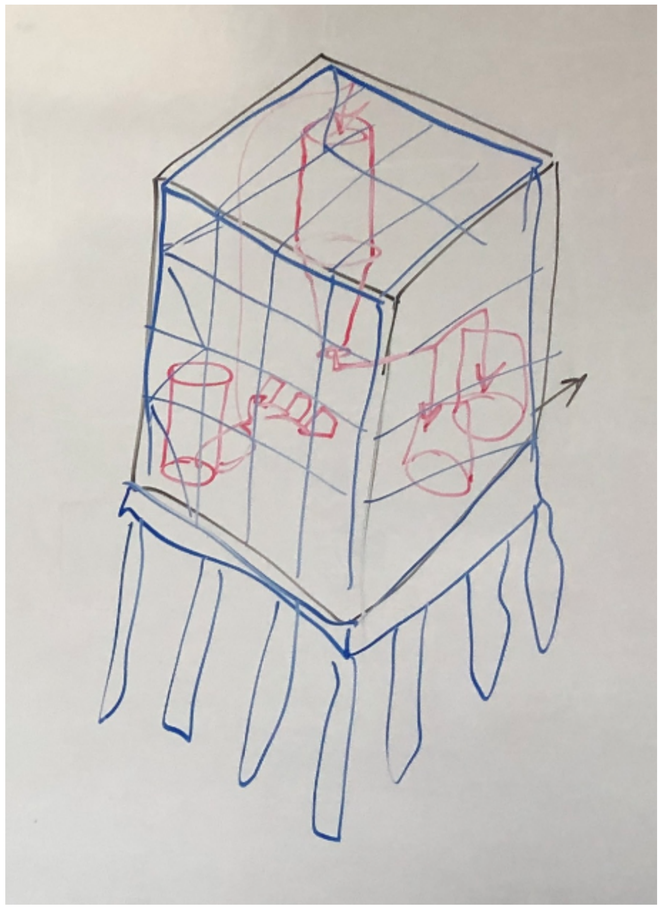
Think with the end in mind!

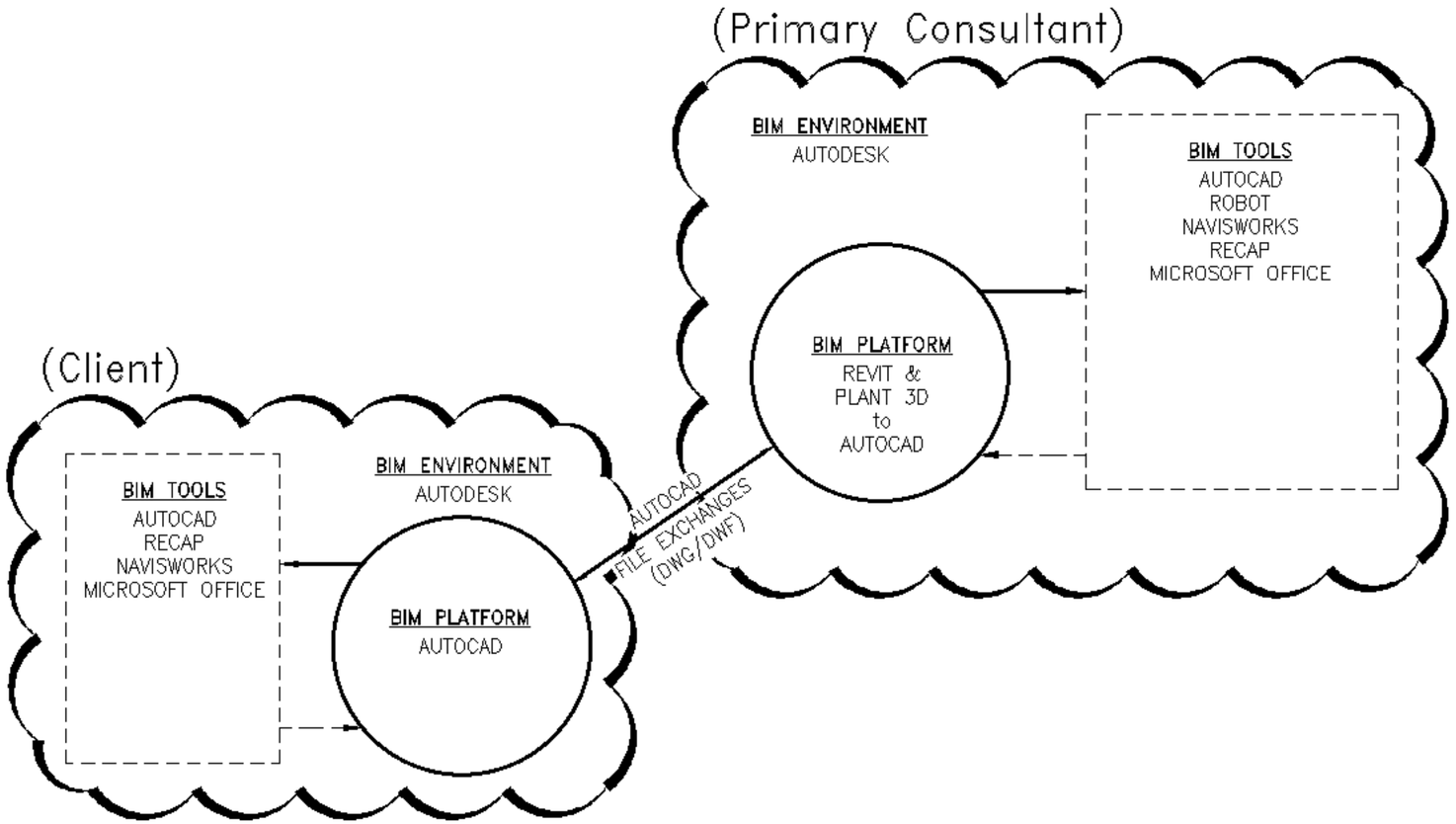

(Primary Consultant)
BIM ENVIRONMENT
AUTODESK
AVEVA
BIM TOOLS
AUTOCAD
RECAP
NAVISWORKS
MICROSOFT OFFICE
BIM SATELLITE
E3D
(Sub-Consultant)
BIM TOOLS (ASSUMED)
AUTOCAD
CIVIL 3D
RECAP
NAVISWORKS
MICROSOFT OFFICE
BIM ENVIRONMENT
AUTODESK
AVEVA
BIM HUB
E3D
NOTE: HUB MANAGER TO BE DETERMINED
E3D BIM DATA EXCHANGES (ie. AVEVA GLOBAL)
(Client)
BIM ENVIRONMENT
AUTODESK
AVEVA
BIM TOOLS
AUTOCAD
RECAP
NAVISWORKS
MICROSOFT OFFICE
BIM SATELLITE
E3D
E3D BIM DATA EXCHANGES (ie. AVEVA GLOBAL)

(Client) – FUTURE PROJECT EXECUTION



Adapting to the 100’ Cube





Can One Software do Everything?

- Although other software competitors claim that their software can do everything in one software piece, these tend to act more like a “jack of all trades, master of none” software.

- Many times, these products need supporting software (AutoCAD is still used often to fill in gaps!)

- In some cases, these products fit the bill perfectly, but in other cases design professionals are restricted in how they execute their projects, and this can actually hurt project execution. Be careful with the marketing and luxury of these products... Lean on your BIM Execution Plan!

Step 3: Identify your Level of Detail (LOD) Standard

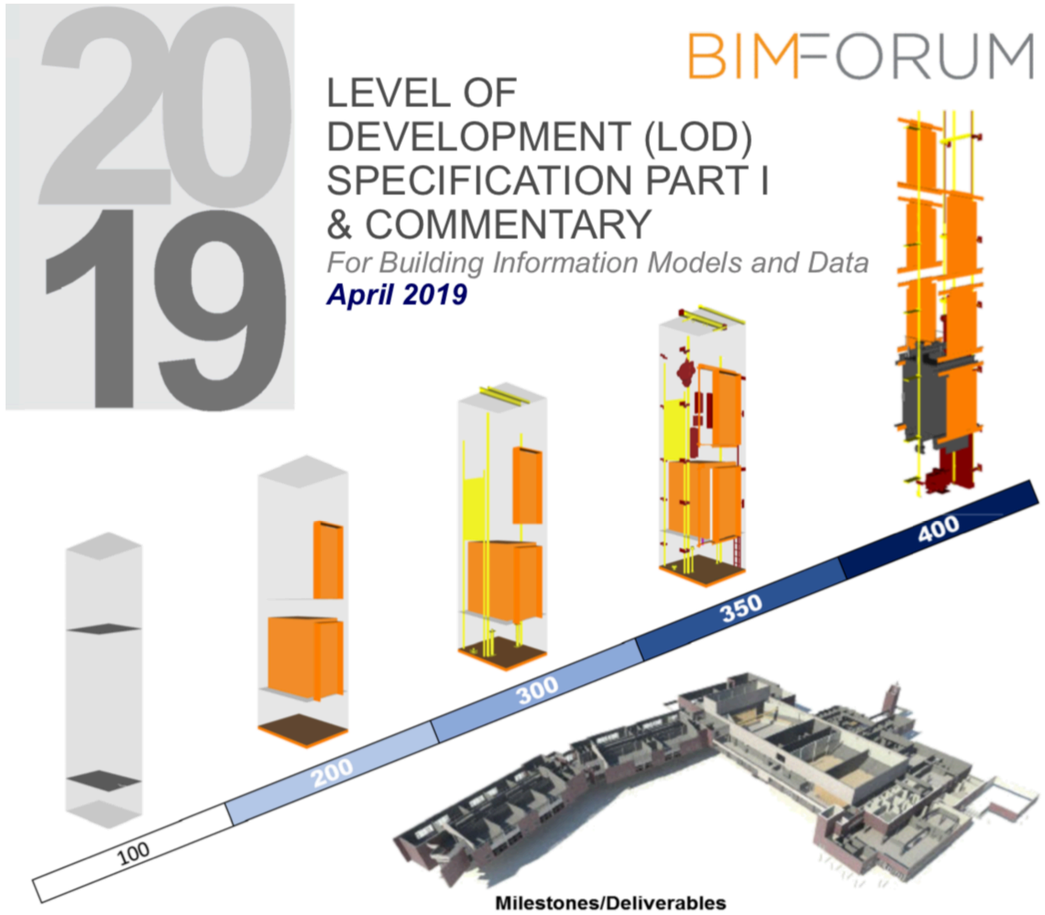
Level of Detail/Development (LOD)

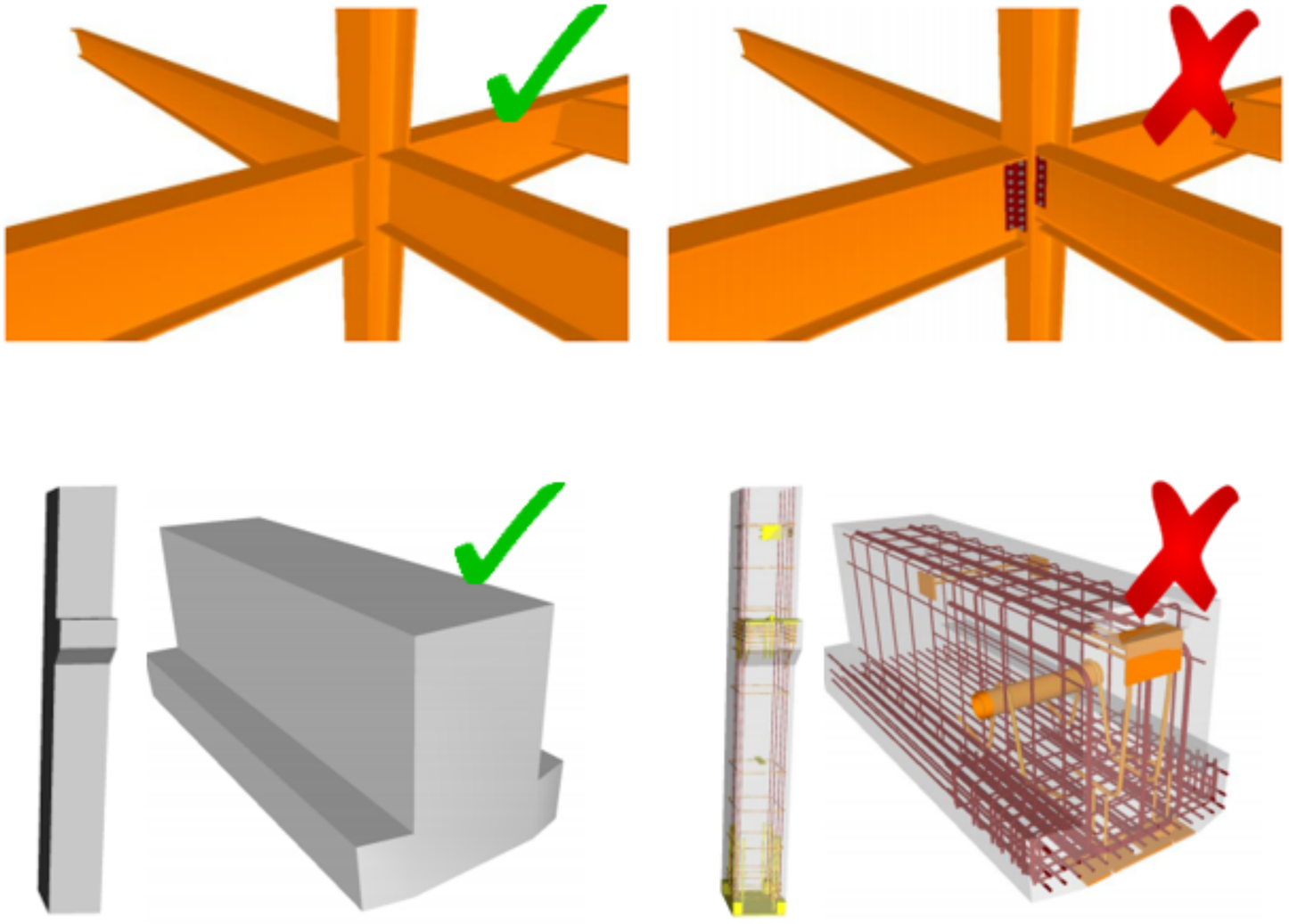
- A topic of debate in our local industry for a number of years, mostly in when and how this should be communicated
- The LOD standard makes sense to all professionals immediately when it is explained to the team, but it is an intimidating topic to have to formally communicate and dictate to the team

- Thankfully, there is another available resource here for our industry to lean on, the BIMForum Level of Development (LOD) specification, which can be found at: https://bimforum.org/lod/

Developing Your LOD

- LOD does not always need to have levels as dictated with the 100 to 500ish scale
- Sometimes the right LOD can be communicated with some verbiage and a couple quick pictures to illustrate
- For projects where a more in depth LOD is required, remember to keep it as simple as possible!





An example of a quick and easily useable LOD Standard – Adapted from https://bimforum.org/lod/

Is that it? Do we have our BIM Execution Plan?

- Well, in essence, yes!

- Of course, there is more material to consider here, but this process can help to alleviate one of the most difficult parts of creating the BIM Execution Plan, solving the project interoperability.

Using Revit for Industrial Projects

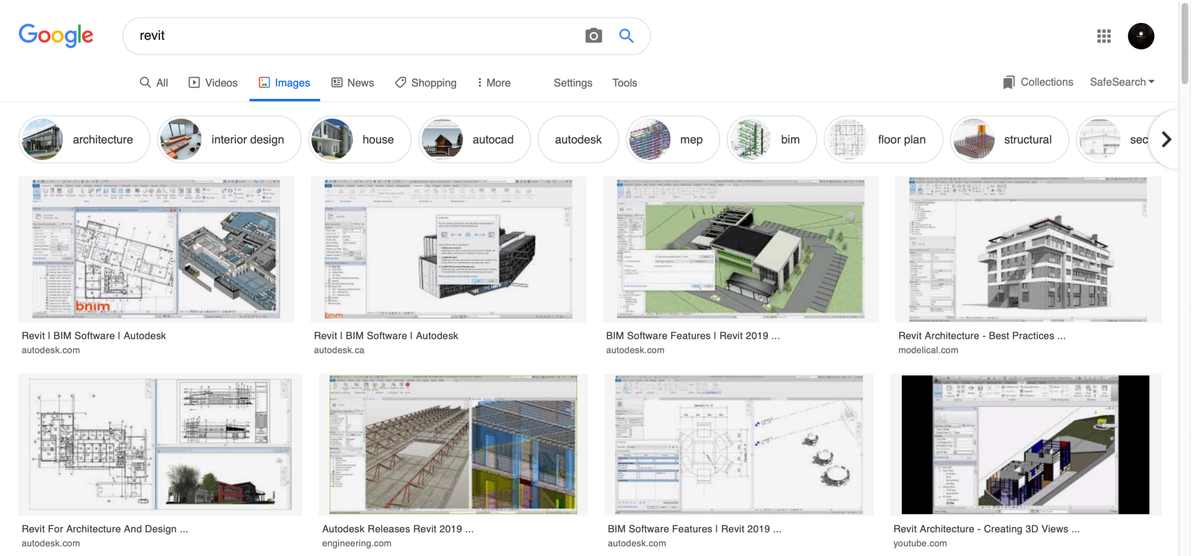
An industrial structure modeled using Tekla - Retrieved from https://www.tekla.com/uk/products/tekla-structures

Revit for Industrial Projects?

Can Revit really be used for large scale industrial projects? Well, lets talk about this a bit and find out.

Revit Capabilities

- First off, Yes, Revit can be used for industrial engineering projects!
- Unfortunately, Revit is not well represented commercially as a tool that can be used for these type of projects.
- This is an unfortunate representation of the software, as it can really be used for much more than just those use cases.
- **Where the commercial and institutional environments overlap with the Heavy Industry and Mining world is in Buildings and in BIM. This relationship is important, and having an understanding of these limitations is proving to be a highly desirable industry trait!**



The first three image results shown from a Google search of “Revit” - Retrieved from Google.ca

Revit Weaknesses

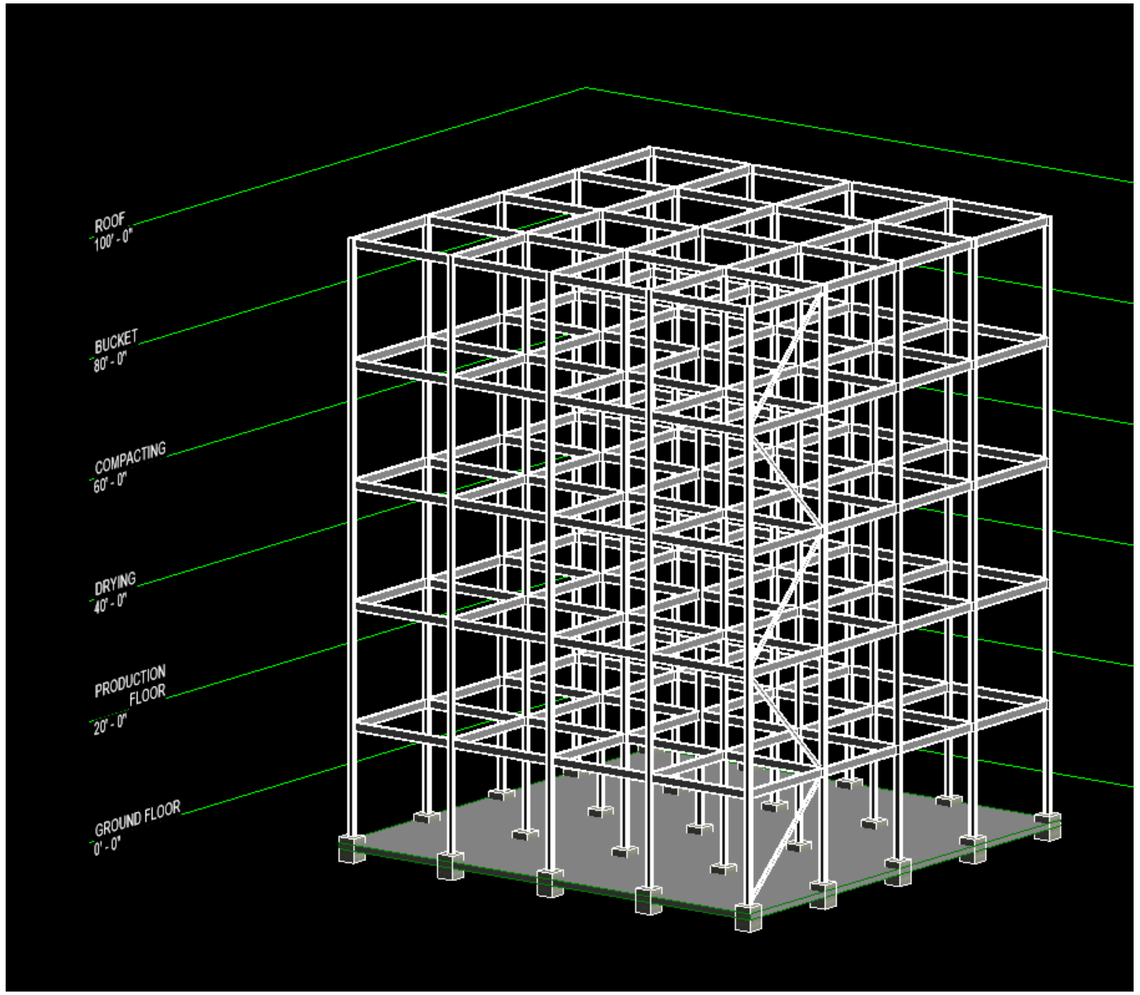
- As defined by the BIM Handbook:
  - Very CPU and Graphics heavy software
  - In-memory system that slows down significantly for projects larger than about 100 to 300mb in the case of Revit 2018 when the memory size is 4gb
  - Lacks object-level timestamps
  - Does not provide needed support for full object management in a BIM environment

- Although these can be seen as limitations, each of these items (except for object-level timestamps) can be overcome by setting up Revit appropriately!

Using Revit to create the 100’ Cube

- Creating a structural steel model for project layout can happen very quickly

- With a well developed project template, a model like this can be created in a very short amount of time!
  - ~15-30 minutes
  - 1mb in file-size
  - 2D parametric drawings can be created instantly
  - Links directly with .dwg models
  - Creates parametric MTO’s
  - Imports natively into Navisworks
  - Can be exported to Robot for structural analysis and imported back in for model changes
  - Can be customized to provide custom properties for…



Using Revit to create the 100’ Cube (cont.)

- The list really does go on!
- Object level management
- Beyond the built in features, the interoperability features are where the software really comes into its own.

Structural Framing Schedule

<Structural Framing Schedule>

A	B	C
Family and Type	Length	Reference Level
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO
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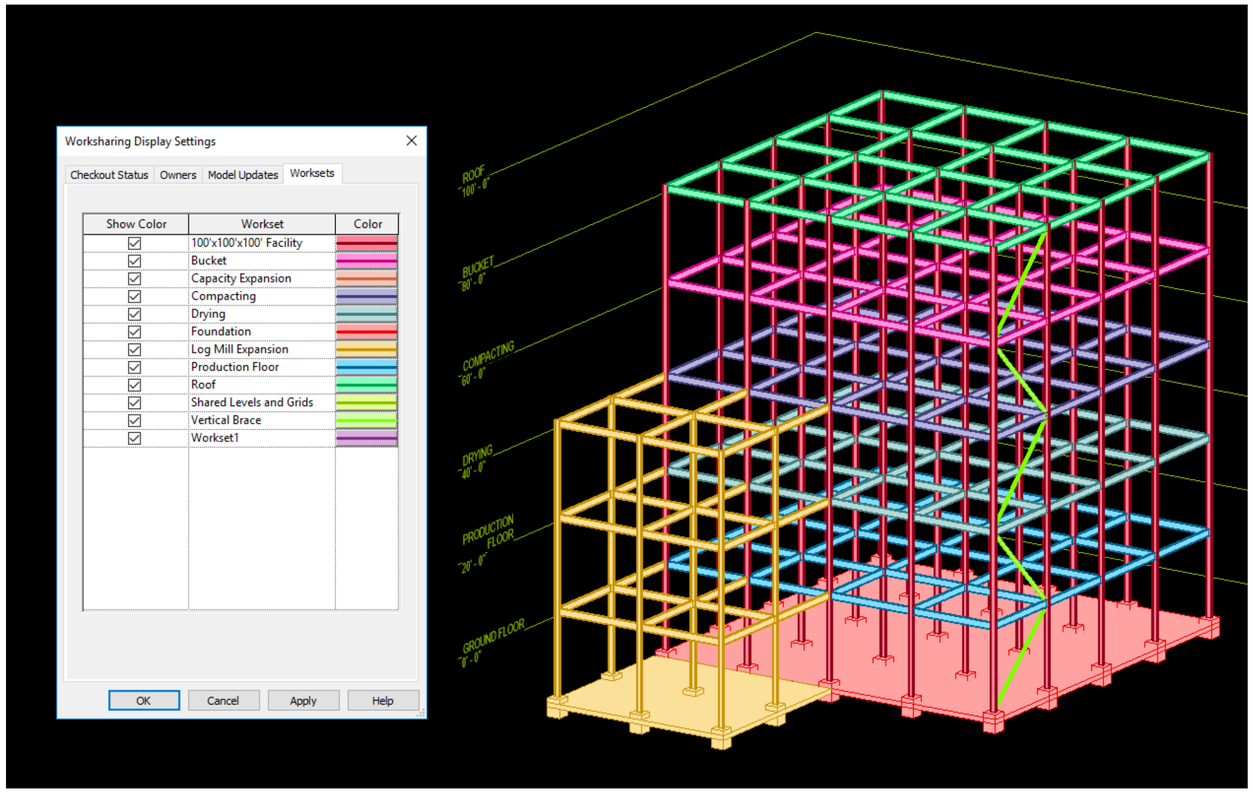
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO
Beam-Steel-AISC-	20' - 0"	PRODUCTION FLO

Using Worksharing

- Worksharing is the secret to being able to scale your project model up for large project teams!
- Creating functional worksets allows the building to be separated in a way that condenses the model into workable chunks, preventing Revit from maxing out its computing power limitations!
- Items don’t need to be modeled in Revit for them to be given a Workset, which allows for a great amount of control over your project and the models



Revit as a BIM Tool

- Remember how I mentioned that Revit can act as a BIM Tool? Lets talk about that.

- Using Revit as a BIM Platform utilizes some of the best and most capable features of the software, but utilizing Revit as a BIM Tool can still be very powerful for projects where the client expects the deliverable to be provided in other formats, like AutoCAD.

- This is a great way to get your team set up for using Revit as a BIM Platform as it allows for incremental innovation from your internal team, as well as provide opportunities for sharing how an upgraded BIM Platform could benefit clients

What are the hurdles?

- Well, lets go back to the statement I made at the start of my presentation, “Industrial and mining industries are typically highly confidential”
  - This, in my opinion, is the current defining factor preventing Revit from being fully utilized in our industry!
  - Many times, Revit is the perfect software for the project that is being executed, but it is glanced over for alternatives with more presence online and on-site.

- I don’t believe that it is the perfect solution to each project problem, but that doesn’t mean that it shouldn’t be considered.

Let’s talk about the Future

Interoperability

- Thinking with the end in mind is the new norm – BIM Execution Planning is done in some way on every single project! BIM Management is evolving to combine with Project Management Science, and our projects continue to become more technologically advanced with each successful execution.

- Complete project connectivity is a thing that is being sold as a benefit from some software providers, but all require establishing a BIM Execution Plan! Autodesk provides everything you need to execute a project, all while separating items in a way that professionals can learn and execute projects quickly and efficiently!

- Interoperability, which was once one of the biggest project hurdles, can, and in some cases has, been solved! By creating a BIM Execution Plan and utilizing the interoperability file types and cloud resources, all software developers have a way to communicate.

Revit and BIM Technology

- Revit is being used more and more on every single project! As we push the limits of the technology, our professionals are continuing to learn and grow their capabilities. Structural, Mechanical Equipment, Electrical, Piping, and other parts of the project are all migrating more and more into Revit.

- Recognizing BIM as a Technology – BIM Technology is being accepted as an industry change rather than one single software piece. Collaboration between project stakeholders has never been so open.

- Cloud based interoperability is here! – This was an idea a couple years ago and BIM 360 and other cloud based solutions are making a real impact on project execution.

- Vast amount of design technology and supporting hardware (3D Scanners, iPads, etc. available)

Innovation in the Saskatchewan Mining Industry

- An Industry of Continued innovation
  - Long term industry clients, like Nutrien, Mosaic, and K+S are continually learning and evolving their project execution to utilize the most up to date technology.
  - Junior companies, like Gensource Potash Corp, Western Potash Corp, and YanCoal, are now reaping the benefits of new technology by leapfrogging ahead with technology thanks to the investments made in the industry.
  - Many startups can be found throughout the province that are developing technologies within the industry!
  - Cloud based facility management tools are in development that will revolutionize how we are all using our software.

- Saskatchewan's Mining Industry was booming, and, although it has recently been slow, it will inevitably boom again in the future. There are many indications that the next boom is coming sooner than later.

Saskatchewan – Land of the Living Skies,

but, also…

Saskatchewan – Land of technological innovation in heavy industry and mining

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