3D Multi-disciplinary Plant Engineering, Collaboration and Execution using AEC Collection

Khaled Aboughanem

BIM Manager, JNE Consulting

Mathieu Binette

Team Leader, Graitec Inc.

AUTODESK.
UNIVERSITY

Introduction

About the speaker

Khaled Aboughanem

My background is civil engineering. After graduation, I started my career in the construction industry and worked for four years as a site engineer. Shortly after, I worked as a civil estimator, then decided to go back to college for MicroCAD Specialist one-year Co-op Program; I started working for JNE as a co-op student, then was hired as a full time designer after graduation. This is my 26th year with JNE, holding the BIM Manager role since 2000 and supporting all North America offices. During my various roles, I got to learn AutoCAD Plant 3D, Advance Steel, Revit, Civil 3D, Recap Pro, Navisworks and various other CAD systems.

THE **JNE** GROUP
OF COMPANIES

About Us

JNE provides multi-disciplinary engineering and project services to industries around the world. Our diverse teams work together to achieve the best engineering solutions without compromise.

From project management to design engineering and construction, we bring strategic value and decades of experience to every stage of a project. Our global headquarters are in Hamilton, ON and our US headquarters are in Pittsburgh, PA.

Engineering Success

GLOBALLY SINCE 1980

JNE Consulting

Comprehensive **multi-disciplinary engineering and project delivery services**, enabling clients to deal with a single source through all phases of a project.

JNE Automation

With TÜV Rheinland certification, we design **custom control systems** to optimize productivity, quality performance and reduce operational cost and risk.

JNE Power

Steam and gas powered turbo-generator systems (natural and process waste gases), reciprocating engine systems, and **renewable energy** projects.

JNE Environmental

Resolving **wastewater issues** for all major industries, we design the process, implementation, and chemicals to effectively treat many types of industrial wastewater.

Our Clients

THE JNE GROUP OF COMPANIES

SOLVAY · JSW · SIEMENS · TMMC · PRAXAIR · LANXESS Energizing Chemistry · NUCOR · GREENFIELD GLOBAL · Diversey · FCA FIAT CHRYSLER AUTOMOBILES · ArcelorMittal · SDI Steel Dynamics · LaurelSteel A DIVISION OF HARRIS STEEL ULC · PURINA · Ford · PRIMETALS TECHNOLOGIES · TIMET · FOX E.S. CONSTRUCTORS LTD. · Pacific Ethanol, Inc. · CGC · STELCO · Campbell's · ALGOMA STEEL INC. · TransAlta · P&G

About the speaker

Mathieu Binette

Started the Advance Steel journey in 2013, as a Business Development Manager for GRAITEC in Montreal, Canada and shortly after, he became one of the main Advance Steel evangelist in North America. In 2015, Mathieu created the first Advance Steel Academy (User Group) in the U.S. which is now happening every year at the NASCC Steel Conference (2020 : Atlanta). This 3 days event is allowing attendees to follow classes covering complex topics such as Drawings Styles, Data Base Management and workflow with complimentary Autodesk solutions. Today, Mathieu is managing the GRAITEC Advance Steel sales & technical team in North America and he is, on a daily basis, helping new Advance Steel users with their learning curve, implementation and support.

Graitec KEY Facts

GRAITEC

01

30 years + old

- Headquartered in **Bievres, France**
- Software Developer for BIM, Analysis & Fabrication
- Operating in **11 countries** worldwide (NAMER, EMEA & Russia)
- Through **Over 48** offices

02

Healthy, Profitable and Growing

- Growth of **2.5x** in the last **4 years**
- With revenues of **130m+** expected in **FY19**
- With a **strong balance sheet** and an acquisitive nature, Graitec is uniquely positioned in the CAD/CAE environment and has quickly become one of the **largest Autodesk** partners worldwide

03

DNA

With over **550** staff..

- **100** of whom are located in our **R&D** centre in Romania producing class leading BIM solutions
- **200** Industry consultants focused on customer delivery and outcomes
- Local **Project** and **Product** Management

04

Customer First

- **'000,000** of projects competed in Graitec software worldwide
- **98%** Excellent or Good for our customer support rating (over **50,000** support cases per year)
- **3500+** training courses delivered per year

Class Summary

This class outlines the best practices and workflows for model management, design collaboration and project execution among multiple disciplines by using Autodesk Architecture, Engineering, and Construction (AEC) collection products and tools.

This session features: AutoCAD Plant 3D, Advance Steel, Revit, Paneldes 3D (Elecdes Design Suite), AutoCAD MEP and Navisworks Manage.
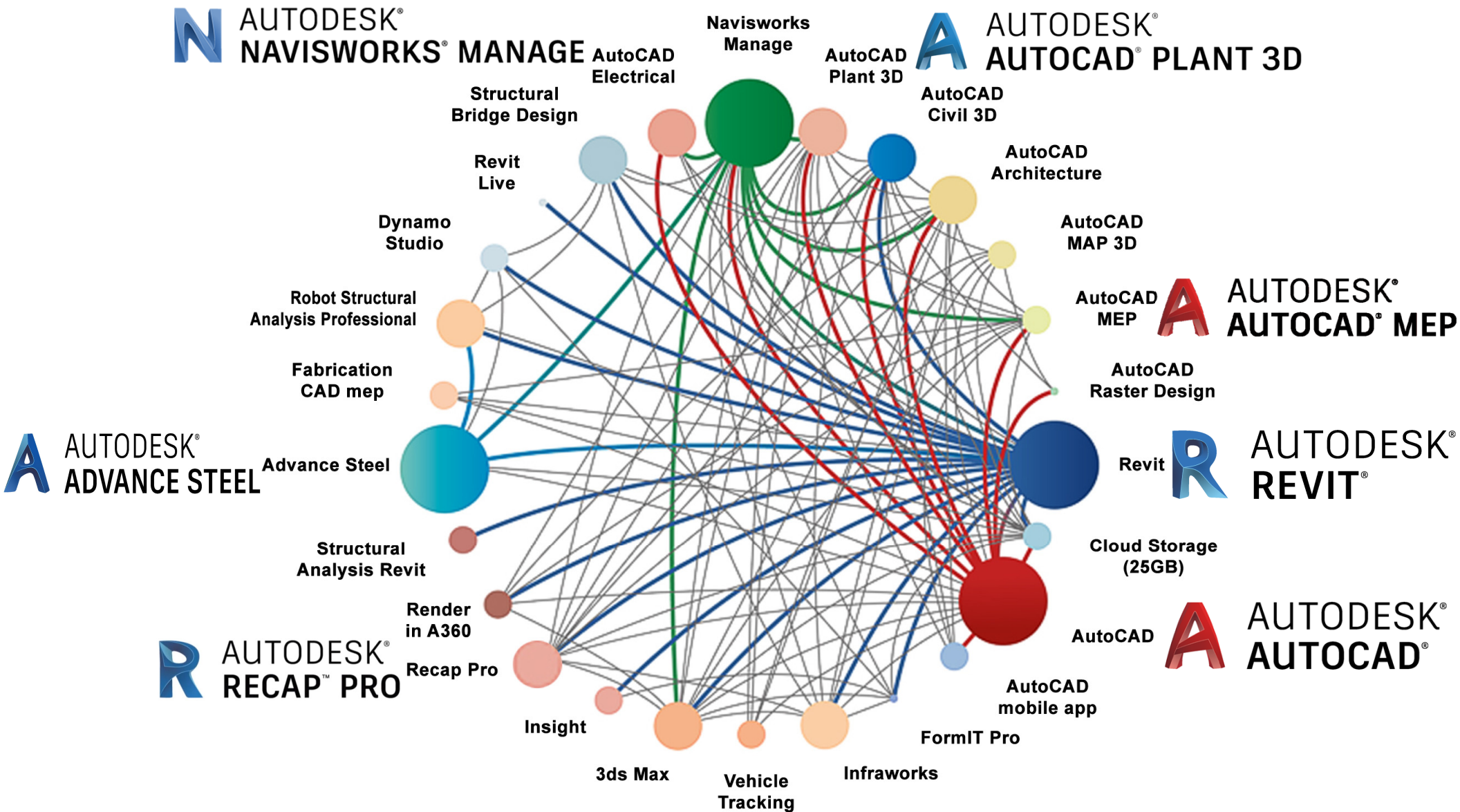
Learning Objectives

This presentation is intended for beginners to intermediate audience.

At the end of this class, you will be able to:

- Learn the best practices and tips to setup, manage, and optimize a 3D multi-disciplinary project model

- Plan, communicate, implement to succeed; and as they say "Failing to plan, is planning to fail"

- Work and collaborate with disciplines and OEM/vendor models

- Share multi-disciplinary data between AEC software successfully

- Import a point cloud into any AutoCAD based software and visualize its data in Navisworks for accurate 3D conceptual modeling

- Work together as a team and manage your models efficiently maintaining the project integrity

Planning, Communication, and Implementation

AUTODESK® NAVISWORKS® MANAGE

AUTODESK® AUTOCAD® PLANT 3D

AUTODESK® AUTOCAD® MEP

AUTODESK® REVIT®

AUTODESK® ADVANCE STEEL

AUTODESK® RECAP™ PRO

AUTODESK® AUTOCAD®

Navisworks Manage

AutoCAD Electrical

Structural Bridge Design

Revit Live

Dynamo Studio

Robot Structural Analysis Professional

Fabrication CAD mep

Advance Steel

Structural Analysis Revit

Render in A360

Recap Pro

Insight

3ds Max

Vehicle Tracking

Infraworks

FormIT Pro

AutoCAD mobile app

AutoCAD

Cloud Storage (25GB)

Revit

AutoCAD Raster Design

AutoCAD MEP

AutoCAD MAP 3D

AutoCAD Architecture

AutoCAD Civil 3D

AutoCAD Plant 3D

Autodesk AEC Collection Software Covered in Today's Presentation + EDS

Task Coverage

RECAP PRO

Create 3D models from photographs or laser scans. The final product is a point cloud or mesh ready for CAD and BIM authoring tools.

P&ID DESIGN & DRAFTING

Autodesk® AutoCAD® P&ID

Create, modify, and manage P&IDs, and then help reconcile underlying data with the 3D model.

GENERAL DESIGN & DRAFTING

Autodesk® AutoCAD®

Design and draft with the powerful and flexible features of one of the world's leading CAD tools.

PROJECT VISUALIZATION & REVIEW

Autodesk® Navisworks® Manage

Aggregate models from multiple design packages, create near-photorealistic project visuals, and help identify clashes.

3D MODELING & DOCUMENTATION

Autodesk® AutoCAD® Plant 3D

Design, model, and document process plants with easier isometric and orthographic creation.

STRUCTURAL DESIGN

Advance Steel
Autodesk® Revit®

Design and model 3D structural components and structural details.
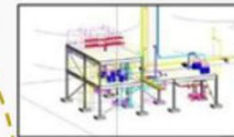
AUTOCAD MEP

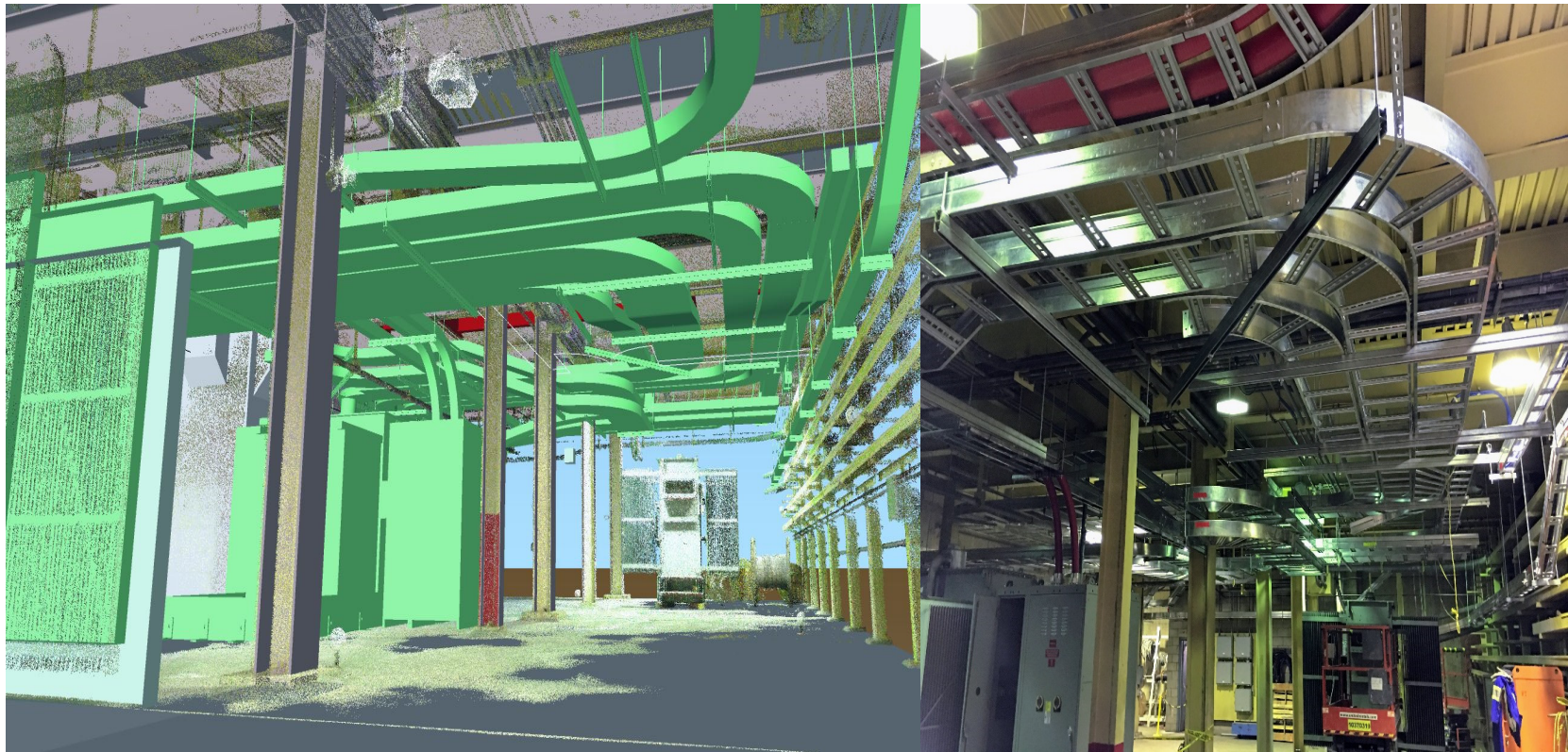Design and model 3D mechanical, electrical, and plumbing components
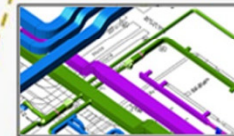
EDS (PANELDES 3D)

Produce intelligent circuit diagrams and create plant raceway models

AUTODESK® ARCHITECTURE, ENGINEERING & CONSTRUCTION COLLECTION
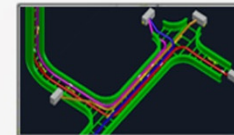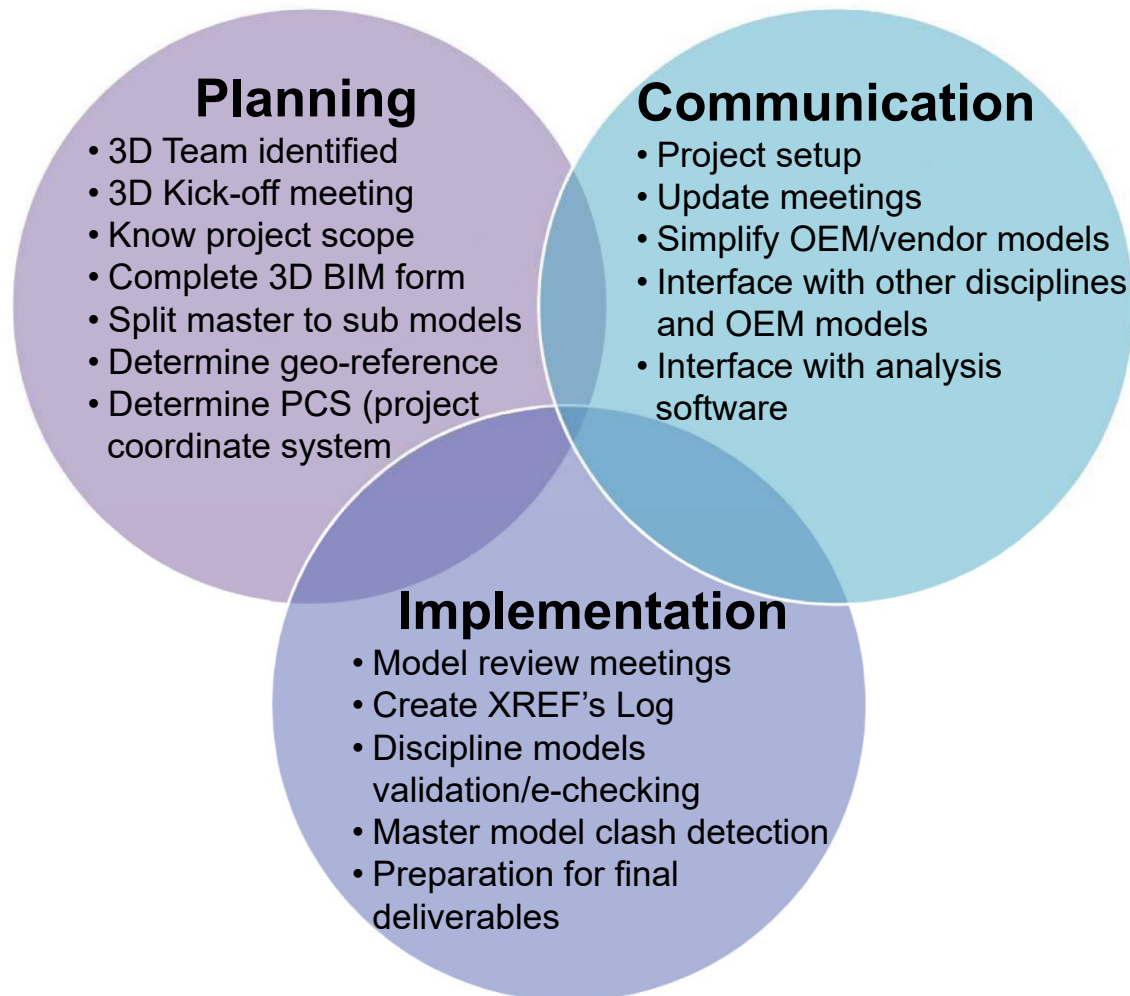
AUTODESK®

Elecdes Design Suite (EDS)

- Elecdes: An intelligent software that automate and speed the production of single line, wiring, schematics, cable block, and loop diagrams
- **Paneldes** Raceway enables users to design plant raceway models and perform cable routing, cable filling, and cable length calculations
- Plant Instrument Manager: A data-centric instrument design and documentation system with auto-production of instrumentation documents

The 3 Key Processes

Planning
- 3D Team identified
- 3D Kick-off meeting
- Know project scope
- Complete 3D BIM form
- Split master to sub models
- Determine geo-reference
- Determine PCS (project coordinate system

Communication
- Project setup
- Update meetings
- Simplify OEM/vendor models
- Interface with other disciplines and OEM models
- Interface with analysis software

Implementation
- Model review meetings
- Create XREF's Log
- Discipline models validation/e-checking
- Master model clash detection
- Preparation for final deliverables

Best Practices – Managing a Project

- There are many different ways to organize a project. We'll suggest one way, but you can modify these suggestions in order to suit your project requirements better

- Large projects are to be split up into areas so it can be handled by many designers working together as a team

- Organize your project in a way it remains a single fully integrated project for reporting, and including many model files. This will enable designers of different disciplines to work together with manageable data sets, and allowing modeling response to remain good. The way we will do this is through extensive use of XREF's

- Before you start to create the project in various software, take a step back and look at the project as a whole. Think about how to logically split it up. If it is a big site, all on one level mainly, then look at a site plan and then divide it up into areas. Each area may be a process unit, or it may be a logical sub-division of a process unit, but consider it as an AREA. In the case of a multi-storey plant, you may want to treat each floor as an area and then sub-divide into physical areas. In our example, we have a site plan divided up into (3) areas

- Within each area you have to consider equipment, structures and piping. And if you have different designers focusing on each discipline, it is preferably to divide up the areas into the disciplines.

Best Practices – Setting Up a Project

- Using the example in the above slide we will have (3) areas. Each Area can be managed by a lead designer but each area has a design team composed of equipment layout designers, structural layout designers, piping designers, and electrical designers

- We have allocated discipline folders for each discipline **05E** (Electrical / Instrumentation), **06M** (Mechanical / Piping / HVAC), **07C** (Civil / Structural / Site Work), where we will store or reference the discipline models and drawings files

- We have also allocated folder for external reference models (**12X**), where we will reference it to the discipline models in their discipline folders. Plus the point cloud RCP file will be referenced as an Xref and is placed here too

- We have also allocated folder for Navisworks files (**13N**), where we store the associated NWF files which will allow us to assign materials to the model files in order to create realistic renderings of the model under design; and we can also place the NWD files for project review sessions. This allow project reviews to take place while design work is in progress, without interrupting the design work

- This structure keeps the file content small and manageable and allows maximum flexibility in working in the project. By using Xref's, the designer can focus on the specific part of interest of the model at any moment by unloading the unneeded Xref's. When additional information is needed, simply reload the Xref's for full model realization.

Project Folders & Models

Folders Structure

Area Model Attaching

Area 10

*...\13N\
JOBNO-3D-10
(*.DWG & *.NWF)

Denotations:
A: Attachment
E: Electrical
H: HVAC
P: Piping
RC: Revit Civil
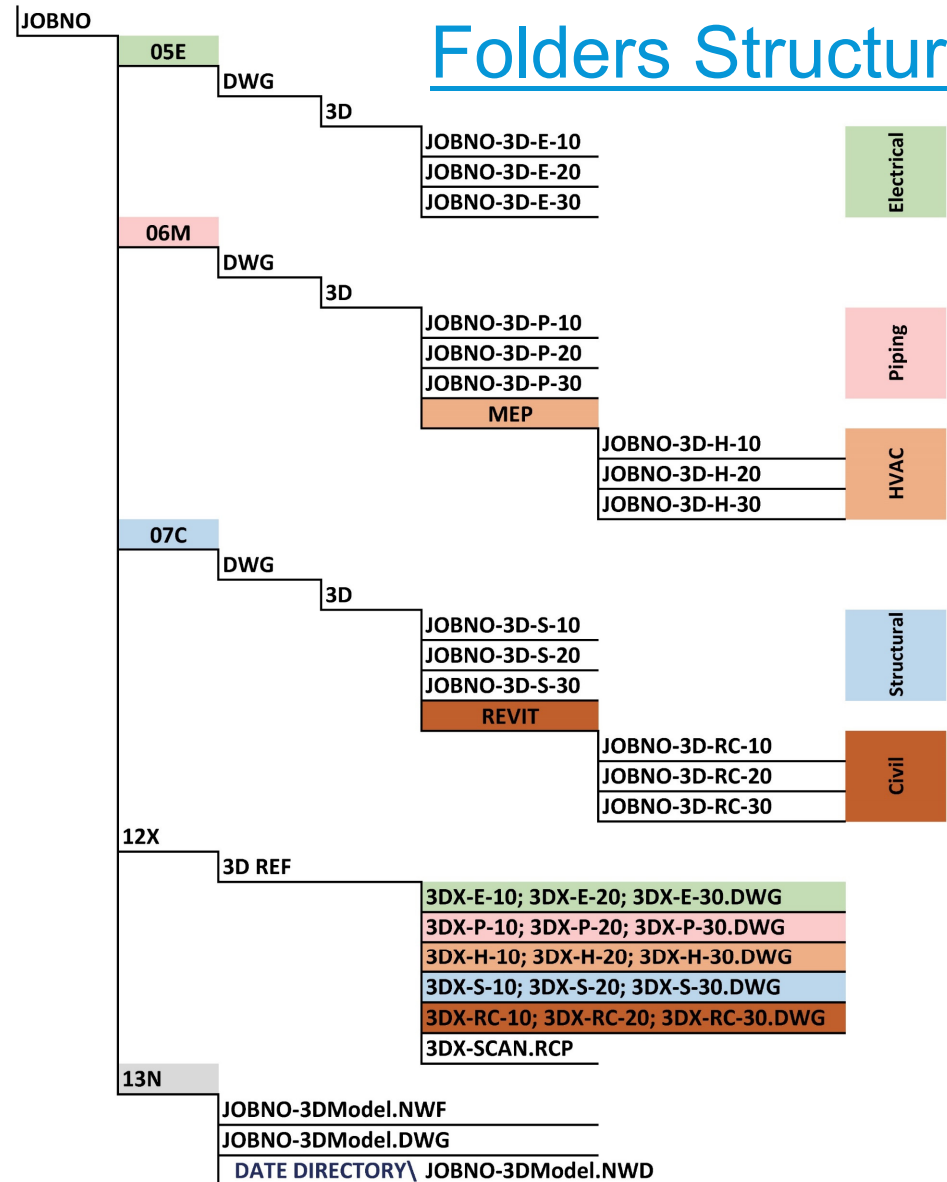**S:** Structural
3DX: 3D XREF

A   A   A   A   A

...\12X\
3D Ref\
3DX-E-10

...\12X\
3D Ref\
3DX-P-10

...\12X\
3D Ref\
3DX-S-10

...\12X\
3D Ref\
3DX-H-10

...\07C
\DWG\3D
\Revit\
3DX-RC-10

JOBNO

05E
  DWG
    3D
      JOBNO-3D-E-10
      JOBNO-3D-E-20
      JOBNO-3D-E-30 — Electrical

06M
  DWG
    3D
      JOBNO-3D-P-10
      JOBNO-3D-P-20
      JOBNO-3D-P-30 — Piping
      MEP
        JOBNO-3D-H-10
        JOBNO-3D-H-20
        JOBNO-3D-H-30 — HVAC

07C
  DWG
    3D
      JOBNO-3D-S-10
      JOBNO-3D-S-20
      JOBNO-3D-S-30 — Structural
      REVIT
        JOBNO-3D-RC-10
        JOBNO-3D-RC-20
        JOBNO-3D-RC-30 — Civil

12X
  3D REF
    3DX-E-10; 3DX-E-20; 3DX-E-30.DWG
    3DX-P-10; 3DX-P-20; 3DX-P-30.DWG
    3DX-H-10; 3DX-H-20; 3DX-H-30.DWG
    3DX-S-10; 3DX-S-20; 3DX-S-30.DWG
    3DX-RC-10; 3DX-RC-20; 3DX-RC-30.DWG
    3DX-SCAN.RCP

13N
  JOBNO-3DModel.NWF
  JOBNO-3DModel.DWG
  DATE DIRECTORY JOBNO-3DModel.NWD

Model Files Location

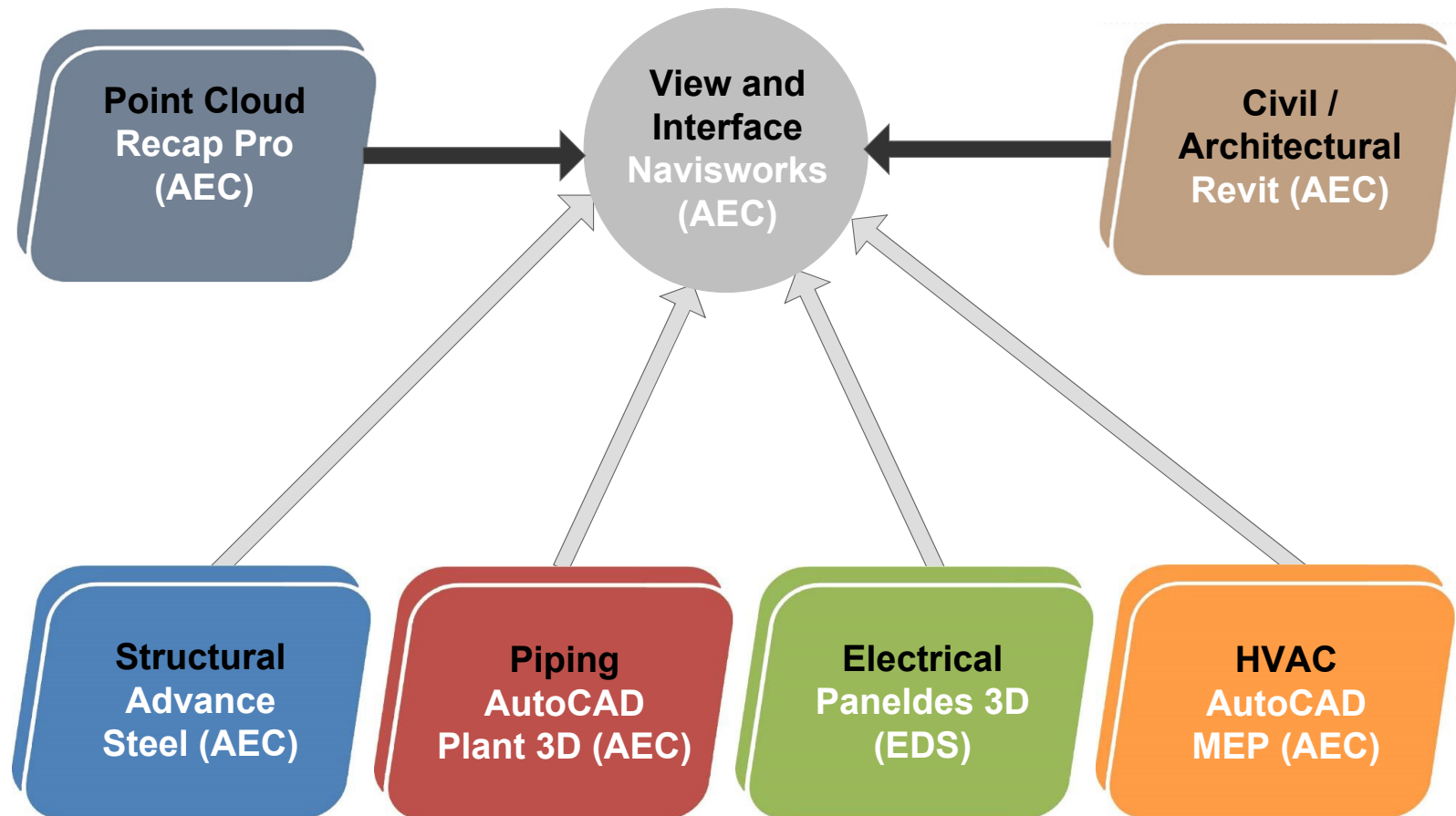| 3D Filename	Network Location	Model File Usage and Description	Discipline 2D Creation Location
Electrical			
3DX-E-XX	...\12X\12.2 3D REF\	These models are used for all Electrical 3D modeling. Other discipline 3DX models can be attached as "Overlay" with "Relative Path" as needed for interactive design	No 2D generation
JOBNO-3D-E	...\05E\...\3D\...	This is the Electrical 3D Model that include other disciplines 3DX's attached as "Overlay" with "Relative Path". It is used for e-checking the model design integrity and to generate 2D drawings	...\05E\...
Piping			
3DX-P-XX	...\12X\12.2 3D REF\	These models are used for all the Piping 3D modeling. Other discipline 3DX models can be attached as "Overlay" with "Relative Path" as needed for interactive design	No 2D generation
JOBNO-3D-P	...\06M\...\3D\...	This is the Piping 3D Model that includes other disciplines 3DX's attached as "Attachment" with "Relative Path" for clearances; and it is used for e-checking the model design integrity and to generate 2D drawings	...\06M\...
Structural			
3DX-S-XX	...\12X\12.2 3D REF\	Is an empty file with all of the Structural 3D Models attached as "Attachment" with relative path. It is linked directly to the 3D working model under ...\07C\... (This is done differently due to software restrictions)	No 2D generation
JOBNO-3D-S	...\07C\...\3D\...	Used for all the Structural 3D modeling. Other disciplines 3DX's are attached as "Overlay" with "Relative Path" as needed for interactive design. Also used for e-checking the model design integrity and to generate 2D drawings	...\07C\...
HVAC			
3DX-H-XX	...\12X\12.2 3D REF\	These models are used for all the HVAC 3D modeling. Other discipline 3DX models can be attached as "Overlay" with "Relative Path" as needed for interactive design	No 2D generation
JOBNO-3D-H	...\06M\...\3D\...	This is the HVAC 3D Model that includes other disciplines 3DX's attached as "Overlay" with "relative path". It is used for checking the model design integrity and to generate 2D drawings	...\06M\...
Architectural / Civil			
3DX-RC-XX.nwc	...\07C\...\3D\Revit\...	NWC snapview of the Revit Civil 3D model, so other disciplines can attach it to their models as "Coordination Model" as needed for interactive design. NWC is outputted thru "External Tools" from the "Add-Ins" ribbon (in-place) at the same location of the working Model	Not applicable
3DX-RC-XX.dwg	...\12X\12.2 3D REF\	DWG is the output file of the Revit 3D working model used for final deliverable; and if needed for interactive design it can be attached to other disciplines models as "Overlay" with "Relative Path". This output file will be attached to the final overall model for delivery	Not applicable
Multi-Discipline			
JOBNO-3DModel	...\13N*.nwf	This 3D model file includes all disciplines 3DX references. All attached as "Overlay" with "Relative Path" for clearances and clash detection; at the same time used to generate the daily or weekly review NWD files	Not applicable
JOBNO-3DModel	...\13N\Date*.nwd	This is the daily or weekly review 3D model as NWD to be circulated to all project team, clients, and all stake holders as required	Not applicable

Model Collaboration

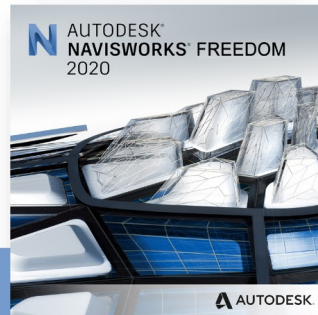# Collaboration Using AutoCAD Xrefs
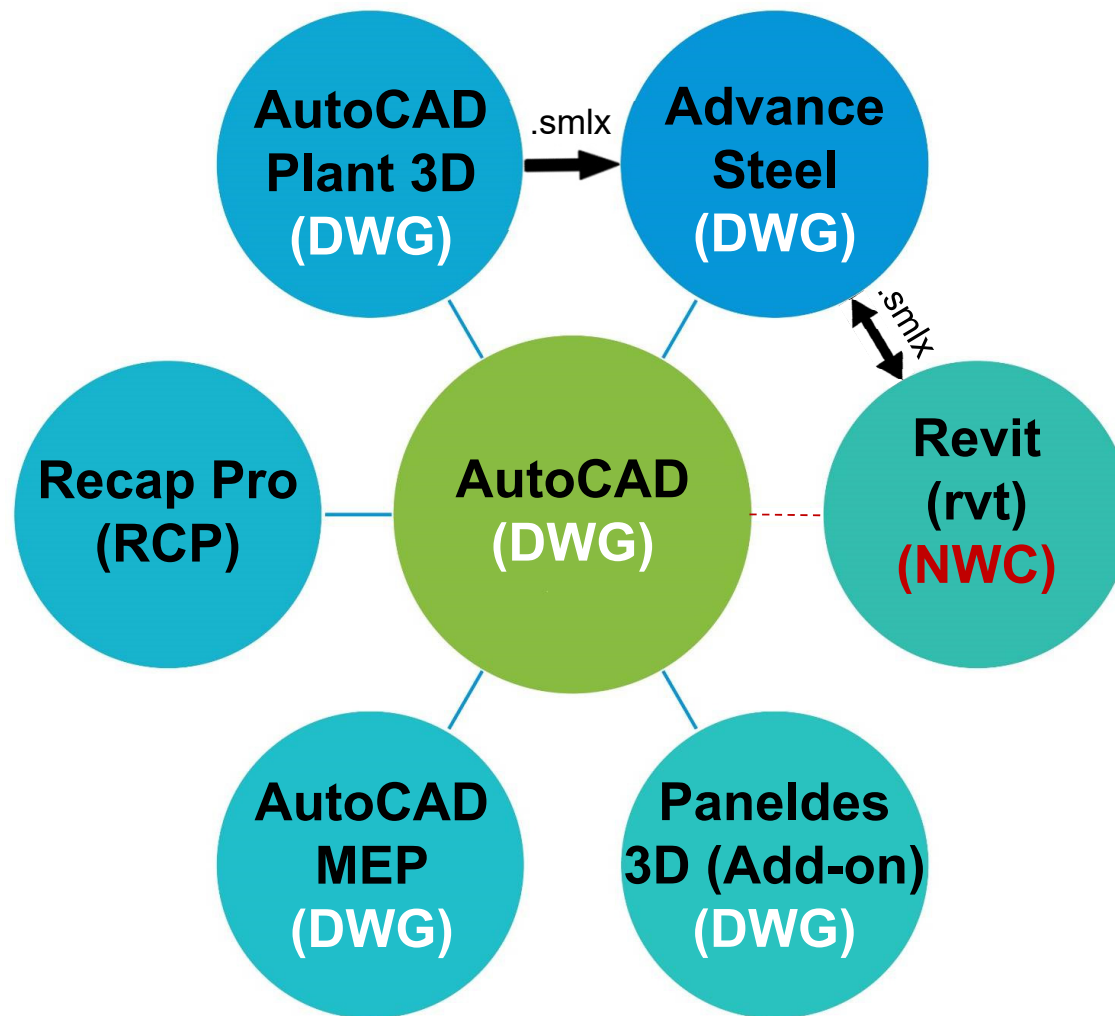
Working with Xrefs

- One useful way of managing the Area Model Xref's is to have a Plant Master model drawing. The Plant Master Model is basically an **empty** model file with all the Area Models loaded as Xref's. It is important that these Xref's be loaded as **"Attachment"** and it is recommend to use "**Relative path**" type

- The Area Model file is maintained by a 3D Admin., who ensures that all the model files in that area are attached. The reason we will use **"Attachment"** reference type, rather than the usual overlay, is that we will be using these Area Model files as Xref's in the Plant Master Model and we want the nested Xref's to display.

- By creating these Area Master models, we make managing model files in the area simpler. Now designers working in that area simply attach this one file as an Xref, but in this case as "Overlay" type, ensuring that all the models in that area are attached. (A warning message detecting circular references may be displayed, simply click on Continue.) If working across areas, for example connecting pipes to a pipe rack that may be in a separate area (for example attaching to pipes in Pipe Racks), then simply attach that Plant Master drawing and then detach (or unload) when no longer needed

- **Circular References Warning:** If you follow the guidelines above, then circular references (file referring back to itself as a lower nested Xref file) will be taken care of by AutoCAD. The danger arises when you need to Xref a file in another area. In this case if you attach the **external area** file to your model file as an **attachment**, you will create circular references in the Plant Master Model file. To avoid this problem, best practice is to use the **overlay** reference type for these external files
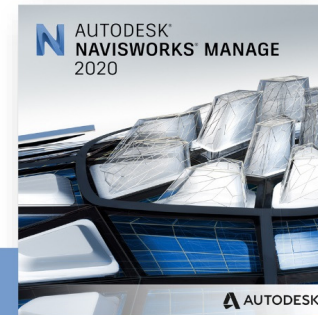
Interface Thru Navisworks

Point Cloud
Recap Pro
(AEC)

View and Interface
Navisworks (AEC)

Civil / Architectural Revit (AEC)

Structural Advance Steel (AEC)

Piping AutoCAD Plant 3D (AEC)

Electrical Paneldes 3D (EDS)

HVAC AutoCAD MEP (AEC)

Navisworks Products

Freedom

- Free
- Reads NWD and DWF only
- Basic Review Functionality

Manage

- Premium
- Reads all formats
- Works with BIM 360
- All Tools including Clash
- Included in AEC Collection

Navisworks File Formats

Model Coordination	Model Review/Delivery	Model References/Updates
NWC	**NWD**	**NWF**
Cache and Export File	Snapshot File	Referencing File
Geometry and Properties	Geometry Properties & Navisworks Data	Navisworks data

Live Collaboration Using Navisworks

AutoCAD Plant 3D (DWG)

Advance Steel (DWG)

Recap Pro (RCP)

Navisworks Manage (NWF\NWC \NWD)

Revit (RVT)

AutoCAD MEP (DWG)

Paneldes 3D (DWG)
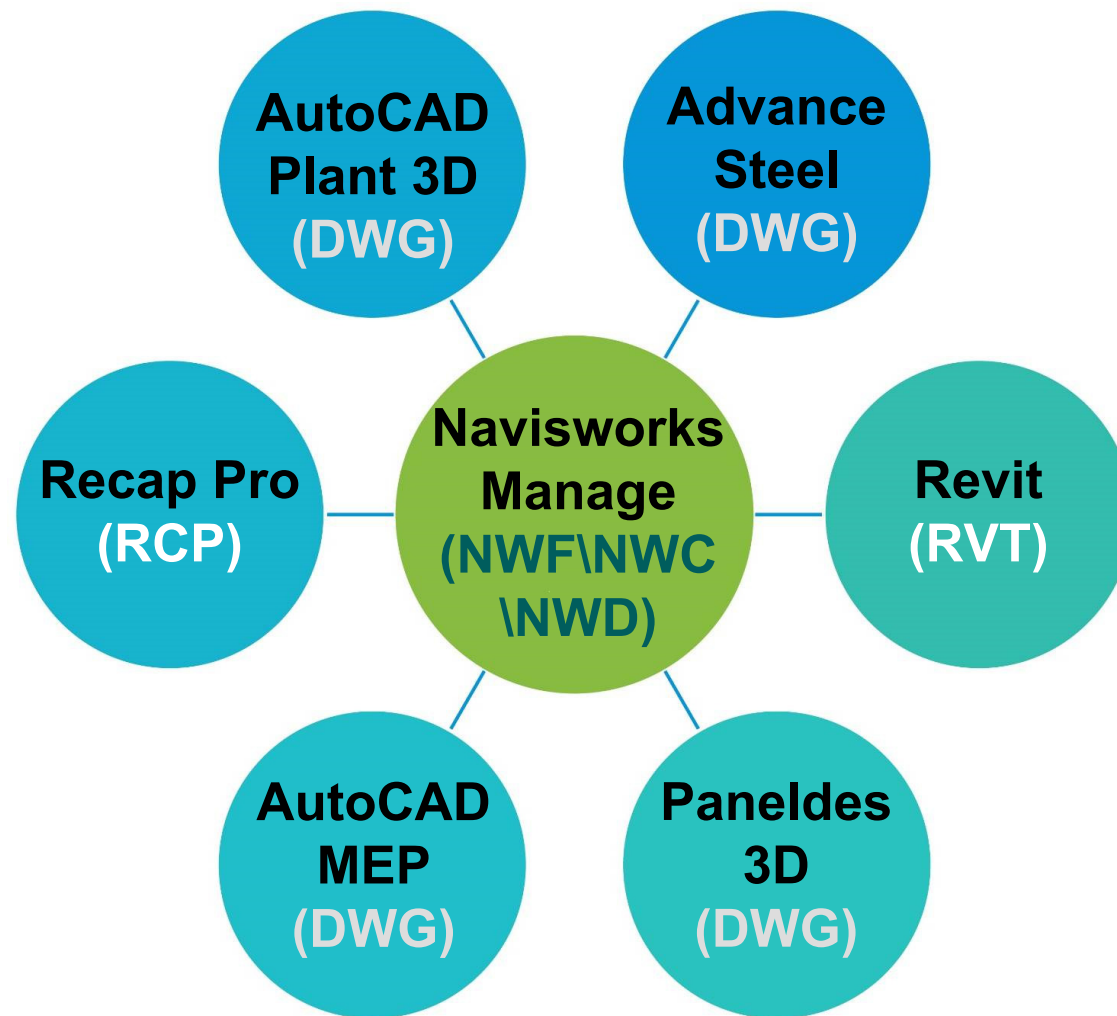
Model Setup for Navisworks

- To check on project progress, the project Plant Master Model is created by creating a model file that Xref's ALL the Areas' Models files and this will become the basis for project reviews (attach Xref's as overlay with relative path in order to avoid circular references)

- The first time you set up for a Navisworks review, open the Master Model **DWG** file. Now before performing any operations, save the model as a **NWF**. In future reviews, when you open the NWF file; comments and materials are retained even after the **DWG** files referenced have been updated

- Sometimes you want to do reviews at a particular milestone and want to save the project for further reviews while the project design is in progress. In this case, open the Area Model **DWG** in Navisworks, and then save as **NWD.** All the model entities are now saved in a single source model that can be viewed using Navisworks Freedom

- Daily progress model reviews can be achieved by simply reloading the Xref's at certain times in the project (by clicking "Refresh"), then you will have a project review model which can be exported to Navisworks as NWD format. A script can be created to run the daily progress during off working hours to produce a NWD file which can be viewed by all stake holders using Navisworks Freedom

Working with Navisworks

Navisworks Typical Workflow

Model Workflow & Development

Model Development per Discipline

Denotations:
O: Overlay
A: Attachment
E: Electrical
H: HVAC
P: Piping
RC: Revit Civil
S: Structural
3DX: 3D XREF

Plant with 3 areas

AREA 10 | AREA 20 | AREA 30

(MASTER MODEL)
...\13N\JOBNO-3DModel
(*.DWG & *.NWF)

JOBNO-3D-20
(*.DWG & *.NWF
similar to 10)

*...\13N\
JOBNO-3D-10
(*.DWG & *.NWF)

JOBNO-3D-30
(*.DWG & *.NWF
similar to 10)

(PANELDES) (PLANT 3D) (ADVANCE STEEL) (MEP) (REVIT)

...\05E\DWG\3D\
JOBNO-3D-E-10
(*.DWG)

...\06M\DWG\3D\
JOBNO-3D-P-10
(*.DWG)

...\07C\DWG\3D\
JOBNO-3D-S-10
(*.DWG)

...\06M\DWG\3D\
JOBNO-3D-H-10
(*.DWG)

...\07C\DWG\3D\Revit
\JOBNO-3D-RC-10
(*.RVT)

...\12X\ 3D Ref\ 3DX-E-10
...\12X\ 3D Ref\ 3DX-P-10
...\12X\ 3D Ref\ 3DX-S-10
...\12X\ 3D Ref\ 3DX-H-10

...\12X\ 3D Ref\ 3DX-E-10
...\12X\ 3D Ref\ 3DX-P-10
...\12X\ 3D Ref\ 3DX-S-10
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...\12X\ 3D Ref\ 3DX-P-10
...\12X\ 3D Ref\ 3DX-S-10
...\12X\ 3D Ref\ 3DX-H-10

...\12X\ 3D Ref\ 3DX-E-10
...\12X\ 3D Ref\ 3DX-P-10
...\12X\ 3D Ref\ 3DX-S-10
...\12X\ 3D Ref\ 3DX-H-10

...\07C \DWG\3D \Revit\ 3DX-RC-10
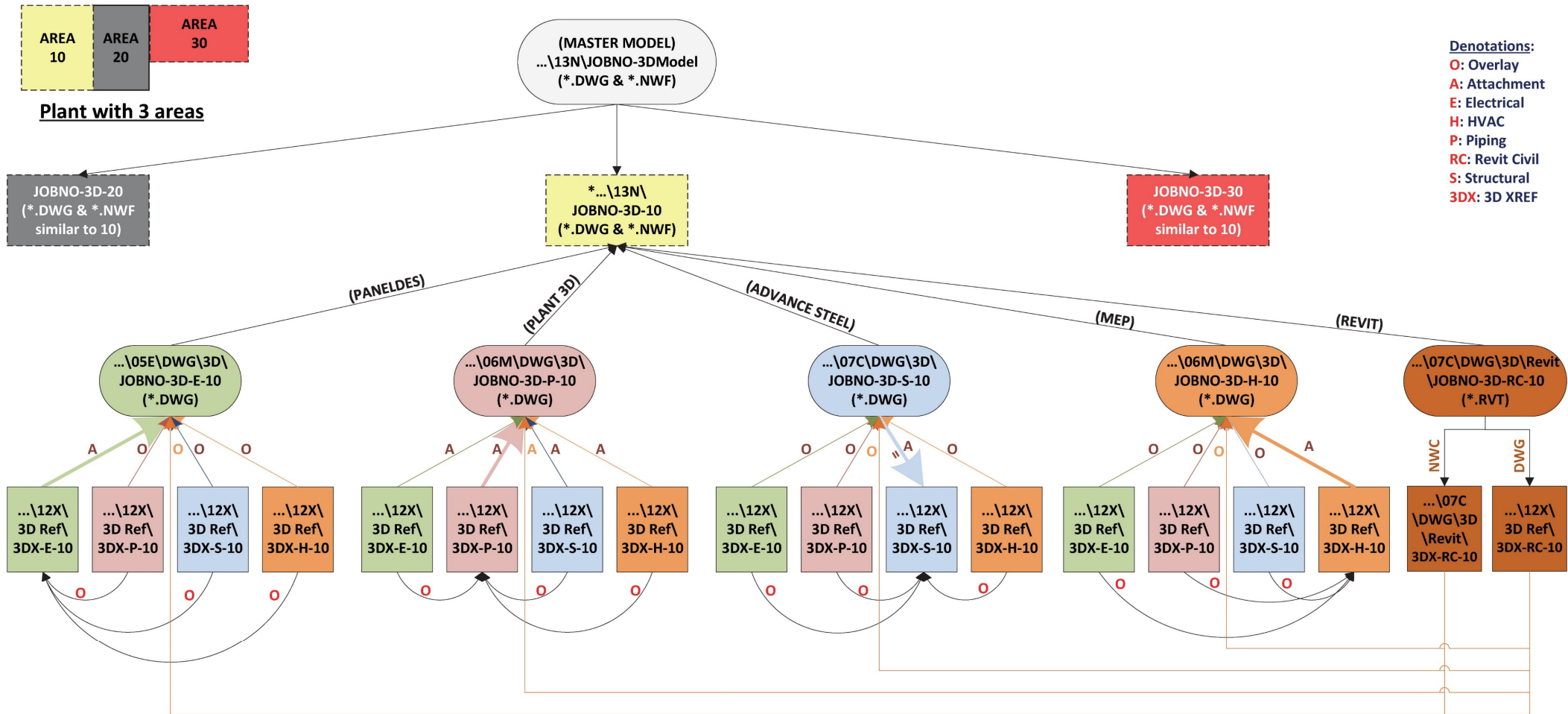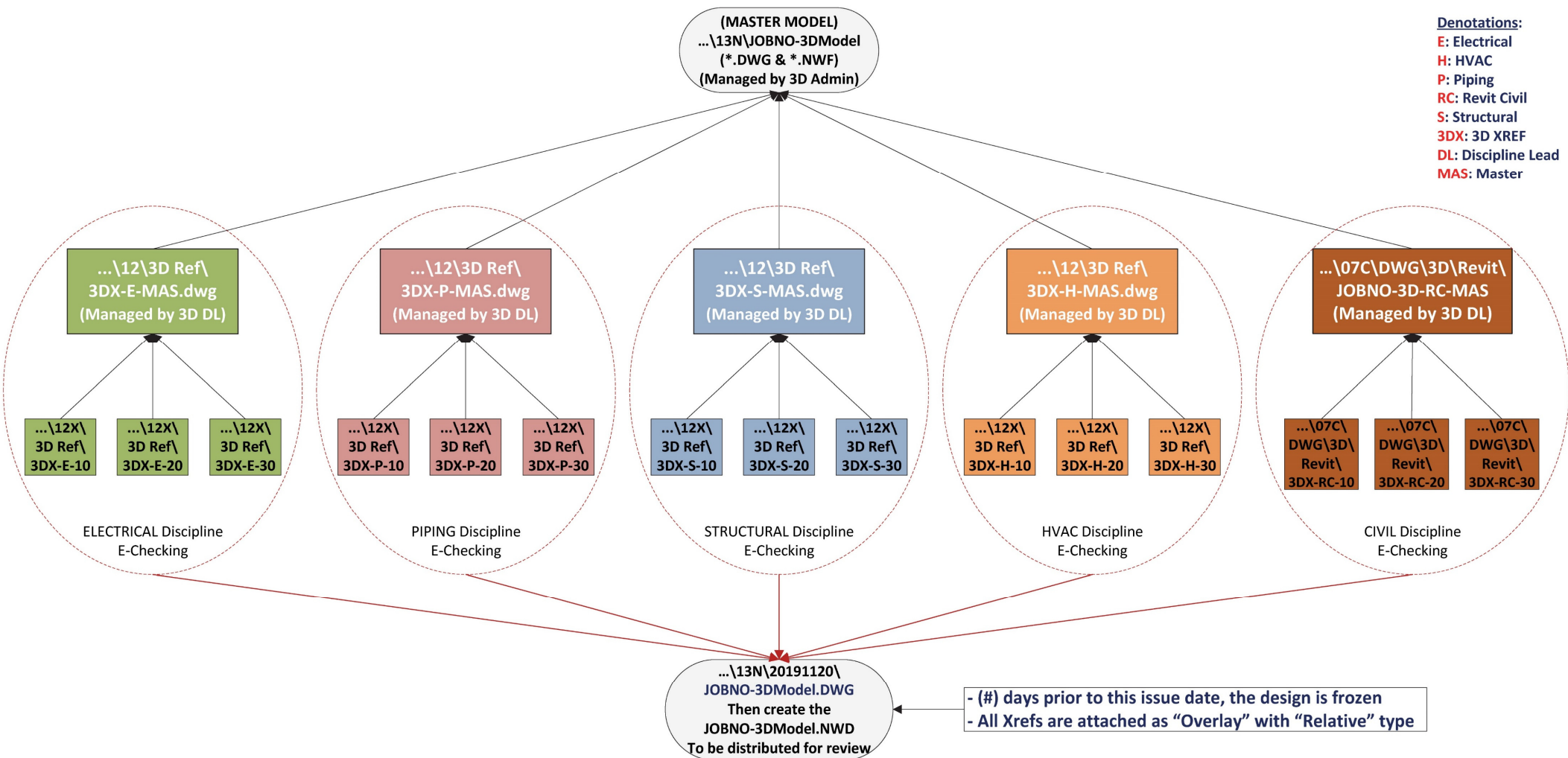...\12X\ 3D Ref\ 3DX-RC-10

NWC | DWG

Model Validation

Discipline Model E-Checking

- Single discipline model validation can be done from within the software itself, where it checks for errors in the model and model integrity; this capability is available within Advance Steel, Revit, AutoCAD Plant 3D and Paneldes.

- Single discipline model validation is to be completed by each discipline prior to submitting the discipline model(s) for the inter-discipline clash detection

- Single discipline model validation is to be completed by each discipline prior to the auto-generation of the 2D outputs. Changes are always driven from the model and will be reflected on the 2D drawing files. Changes should not be made to the 2D drawing files directly

Discipline Model E-Checking

(MASTER MODEL)
…\13N\JOBNO-3DModel
(*.DWG & *.NWF)
(Managed by 3D Admin)

…\12\3D Ref\
3DX-E-MAS.dwg
(Managed by 3D DL)

…\12\3D Ref\
3DX-P-MAS.dwg
(Managed by 3D DL)

…\12\3D Ref\
3DX-S-MAS.dwg
(Managed by 3D DL)

…\12\3D Ref\
3DX-H-MAS.dwg
(Managed by 3D DL)

…\07C\DWG\3D\Revit\
JOBNO-3D-RC-MAS
(Managed by 3D DL)

…\12X\ 3D Ref\ **3DX-E-10**
…\12X\ 3D Ref\ **3DX-E-20**
…\12X\ 3D Ref\ **3DX-E-30**

…\12X\ 3D Ref\ **3DX-P-10**
…\12X\ 3D Ref\ **3DX-P-20**
…\12X\ 3D Ref\ **3DX-P-30**

…\12X\ 3D Ref\ **3DX-S-10**
…\12X\ 3D Ref\ **3DX-S-20**
…\12X\ 3D Ref\ **3DX-S-30**

…\12X\ 3D Ref\ **3DX-H-10**
…\12X\ 3D Ref\ **3DX-H-20**
…\12X\ 3D Ref\ **3DX-H-30**

…\07C\ DWG\3D\ Revit\ **3DX-RC-10**
…\07C\ DWG\3D\ Revit\ **3DX-RC-20**
…\07C\ DWG\3D\ Revit\ **3DX-RC-30**

ELECTRICAL Discipline E-Checking

PIPING Discipline E-Checking

STRUCTURAL Discipline E-Checking

HVAC Discipline E-Checking

CIVIL Discipline E-Checking

…\13N\20191120\
JOBNO-3DModel.DWG
Then create the
JOBNO-3DModel.NWD
To be distributed for review

- (#) days prior to this issue date, the design is frozen
- All Xrefs are attached as "Overlay" with "Relative" type

Inter-Discipline Model E-Checking

- Navisworks Manage is used for the inter-discipline e-checking to identify any interferences or clashes. It integrates individual discipline models into a multi-discipline Navisworks model then it utilizes interactive 3D design among disciplines.

- Detection is done by using the "run test" option for "one discipline model" versus "other discipline model" for hard, soft, or clearance. Design clash is to be reported as "TXT", "HTML" or "XML" with all the details. Resolving the clashes has to be done in the discipline design software

- Reports and images are to be saved under a date directory (the audit date) and to be forwarded to the 3D Discipline Lead for incorporation/validation. Changes are to be made to the model within that discipline software

- After all changes are made, another e-checking process will take place by repeating the above steps till all clashes are resolved, then the model NWD file is ready to be issued for review

Inter-Discipline Model E-Checking

Image	Clash Group	Clash Name	Status	Distance	Description	Date Found	Clash Point	Item 1						Item 2					
								Item ID	Layer	Item Layer	Item Source File	AutoCad Size	AutoCad Line Number	Item ID	Layer	Item Layer	Item Source File	AutoCad Size	AutoCad Line Number
		CG1	New	-1095.5	Hard	2017/11/24 19:27.0	x:-349506.1, y:348428.0, z:78460.6	Entity Handle: 59C55	6_HYD-P1	6_HYD-P1	3DX-20-P-20-01.dwg	6"	6" HYD-P1	Entity Handle: 14CA17	0-Existing Concrete AS Not	0-Existing Concrete AS Not	60140000-3D-C-20.dwg		
	CG1	Clash1	New	-1095.5	Hard	2017/11/24 19:27.0	x:-349506.1, y:348428.0, z:78460.6	Entity Handle: 59C55	6_HYD-P1	6_HYD-P1	3DX-20-P-20-01.dwg	6"	6" HYD-P1	Entity Handle: 14CA17	0-Existing Concrete AS Not	0-Existing Concrete AS Not	60140000-3D-C-20.dwg		
	CG1	Clash2	New	-700.8	Hard	2017/11/24 19:27.0	x:-349446.1, y:348828.0, z:78460.6	Entity Handle: 77CB9	1 1_2_HYD-T2	1 1_2_HYD-T2	3DX-20-P-20-01.dwg	1 1/2"	1 1/2" HYD-T2	Entity Handle: 14CA17	0-Existing Concrete AS Not	0-Existing Concrete AS Not	60140000-3D-C-20.dwg		
		CG2	New	-373.6	Hard	2017/11/24 19:27.0	x:-346292.7, y:365630.7, z:78731.2	Entity Handle: 7BA57	8_HYD-T2	8_HYD-T2	3DX-20-P-20-01.dwg	8"	8" HYD-T2	Entity Handle: 58BD4	Floor Cover	Floor Cover	60140020-3D-S-20.dwg		
	CG2	Clash3	New	-373.6	Hard	2017/11/24 19:27.0	x:-346292.7, y:365630.7, z:78731.2	Entity Handle: 7BA57	8_HYD-T2	8_HYD-T2	3DX-20-P-20-01.dwg	8"	8" HYD-T2	Entity Handle: 58BD4	Floor Cover	Floor Cover	60140020-3D-S-20.dwg		
	CG2	Clash4	New	-281.8	Hard	2017/11/24 19:27.0	x:-346038.9, y:381397.3, z:78756.2	Entity Handle: 57C30	4_HYD-T2	4_HYD-T2	3DX-20-P-20-01.dwg	4"	4" HYD-T2	Entity Handle: 58BD4	Floor Cover	Floor Cover	60140020-3D-S-20.dwg		
	CG2	Clash5	New	-244.7	Hard	2017/11/24 19:27.0	x:-345637.3, y:381397.3, z:78756.2	Entity Handle: 57A1F	3_HYD-P1	3_HYD-P1	3DX-20-P-20-01.dwg	3"	3" HYD-P1	Entity Handle: 58BD4	Floor Cover	Floor Cover	60140020-3D-S-20.dwg		
	CG2	Clash6	New	-164.1	Hard	2017/11/24 19:27.0	x:-346523.6, y:365363.2, z:78731.2	Entity Handle: 50D1D	1 1_2_HYD-D2	1 1_2_HYD-D2	3DX-20-P-20-01.dwg	1 1/2"	1 1/2" HYD-D2	Entity Handle: 58BD4	Floor Cover	Floor Cover	60140020-3D-S-20.dwg		

Model Management

Best Practices - 3D General Notes

- Model is the master centralized data source. Commitment to As-Built and maintain the model

- Master Model can be split into geographical volumes - compilation of smaller volumes - area models

- Navisworks becomes the interface for all software and the project team

- Master model published in Navisworks (NWD) and made viewable to all

- Xrefs are used for interface/interact among disciplines' models

- Purge, -purge (regapps), audit, simplify OEM and other models prior attaching it

- Make sure that the latest service pack for each application and all extensions are installed (especially Advance Steel, Revit, AutoCAD Plant 3D and Civil 3D)

Best Practices - 3D General Notes (Cont'd)

- DO NOT pre-set your AutoCAD session to save as a lower AutoCAD version (2013 or so)

- Object enablers are required to be installed for Advance Steel, AutoCAD Plant 3D, and Civil 3D. Remind you that Revit DO NOT have object enables

- In AutoCAD Plant 3D, do not "save as" drawing file, always right-click and "Export to AutoCAD"

- It is strongly recommended that users do not modify any objects during the checking process

- If some objects are not required to be viewed in Navisworks, then it's layer must be FROZEN in AutoCAD

Best Practices - 3D XREF's Notes

- It is preferred to have the Xrefs purged and cleaned up prior to attaching

- Attaching Xrefs is to be inserted in model space at (0,0,0) on "layer 0" with 1=1 scale

- It's recommended that Xrefs are attached using the "Relative path" type using the "Overlay" type

- No Xref moving or rotating or renaming or adding text or dimensions, its strictly CAD objects

- Xrefs (3DX-…) are attached to plant master model or discipline models as per the 3D software requirements and limitations (see 3D development flowchart); No discipline 3D models other than 3DX's are to be attached. Attach 3D point cloud to a blank DWG file (3DX-Scan) & geo-reference it there

- Create a Xref Log for all disciplines specifying which Xrefs are attached to each of the 3D models within the discipline itself and with other disciplines. This Xref Log is to be managed by the 3D Admin

- No Xrefs binding at any time; except for the final 2D deliverables only; and to be coordinated by 3D Discipline Lead (DL) and 3D Admin. It's recommended that this process is to be completed outside the project working directory

Model Exchange Tips

- It's recommended to simplify the AutoCAD Plant 3D model prior to exporting it

- It's recommended to simplify (suppress) the Revit model prior to exporting it, only export the objects that are required for the design

- AutoCAD Plant 3D can import an Inventor "ADSK" file format as an AutoCAD Plant 3D equipment, where it can be integrated into the piping model with intelligence

- STP or SAT are the preferred formats for OEM and vendor models. It's recommended to clean-up and purge the received models prior to attaching it to any project models

- Set-up a benchmark to be used as a reference point for insertion during models exchange

By doing all of the above; as applicable; the results are:

✓Decreasing the time of the export process

✓Create a smaller model file size that will be easier to work with

✓Decreasing the AutoCAD Plant 3D Orthoview generation time

Best Practices - Roles and Responsibilities

3D Administrator is responsible to:

- Assemble, and maintain the multi-discipline CAD and Navisworks models (Master model)

- Facilitate the use of multi-discipline Navisworks design model in the design review and coordination meetings

- Determine the project geo-reference point and PCS

- Assure all disciplines' models are properly referenced and create Xref Log for all project models

- Interface with OEM for data and file exchange as required

- Integrate 3D scanning in the single and multi-discipline models as required

- Coordinate sub-models from all disciplines for inter-discipline interferences

- Arrange for internal e-audits and organize internal and external review meetings as needed

Best Practices - Roles and Responsibilities

3D Discipline Lead is responsible to:

- Manage their Discipline 3D modeling and create Xref log for their discipline models

- Ensure the project insertion point and the PCS within their discipline are followed

- Coordinate discipline 3D model development and assign work as required

- Ensure quality and design data integrity of all models within their discipline

- Arrange for internal e-audits and internal review meetings as needed

Managing Deliverables

Model Preparation for Delivery

- **Exporting Revit Model**: Before exporting the models, make sure to check the export options for Revit to ensure that solids are set to ACIS solids versus Polymesh. Then select File>Export>CAD Formats>ACIS to output the Revit model as ACIS solids and save it in another location outside the project directory, allowing it to be incorporated with other disciplines models

- **Exporting Plant 3D Model**: Open the desired model to be exported to Revit, then from within the "Project Manager" tool right-click on the model and select "**Export to AutoCAD**" function that will process all Plant 3D objects (equipment, pipes, valves, fittings, and all other piping components) and convert them to ACIS solids and save it at the desired location outside the project directory, allowing it to be incorporated with other disciplines models

- **Exporting Paneldes and MEP Models**: The Paneldes and MEP models are good as is, so nothing is to be done, copy it from its original location to the other location outside the project directory, where all other 3D models are saved, allowing it to be incorporated with other disciplines models

- **Exporting Advance Steel Model**: Using the "Graitec PowerPak" Tool for Advance Steel, select "Export model to ACIS" from the "Explode" on the "Graitec PowerPak" ribbon to output the model as ACIS solids, then save it in the other location outside the project directory, allowing it to be incorporated with other disciplines models

Now all the above exported models are to be attached to the Plant Master Model and thus ready for delivery

Questions

Conclusion

Hope by now you have a better understanding of methods used to share models from Advance Steel, AutoCAD Plant 3D to Revit and Revit to Advance Steel and AutoCAD Plant 3D, in addition to model coordination using Navisworks Manage. Anticipating that this will expand your inter-operability between engineering and design disciplines. Should you have any questions, please feel free to reach out to us.

Enjoy the rest of Autodesk University 2019!

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