

The Importance of Standardized Data for Your Digital Twin

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Agenda



**Why
standardized
data?**



**What is
standardized
data?**



**How do ensure
standardized
data?**

About Your Speaker

- Registered Architect
- Past president of AIA Northern Virginia
- Co-Chair of the COBie Workgroup at NIBS
- Recognized expert in Revit, AutoCAD, COBie, and BIM
- Speaker at AU, BILT, NFMT, CFTA, NIBS
- Almost 30 Years of Experience in the AEC Industry
- 20+ Years as a technology consultant



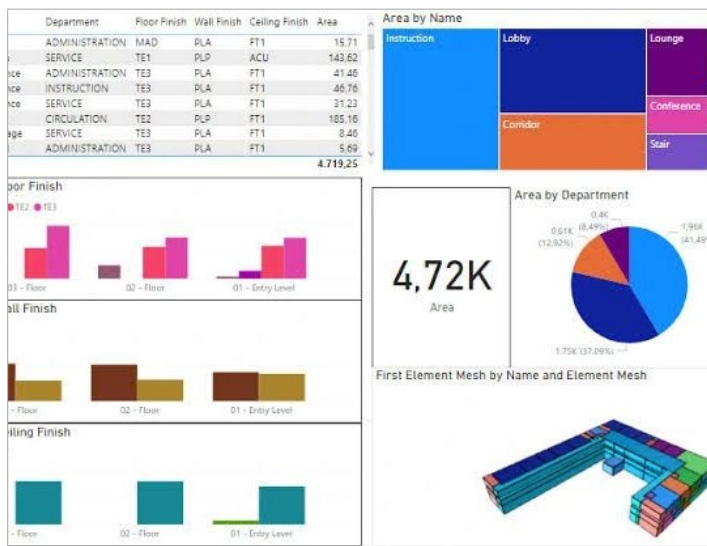
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Why Standardized Data?

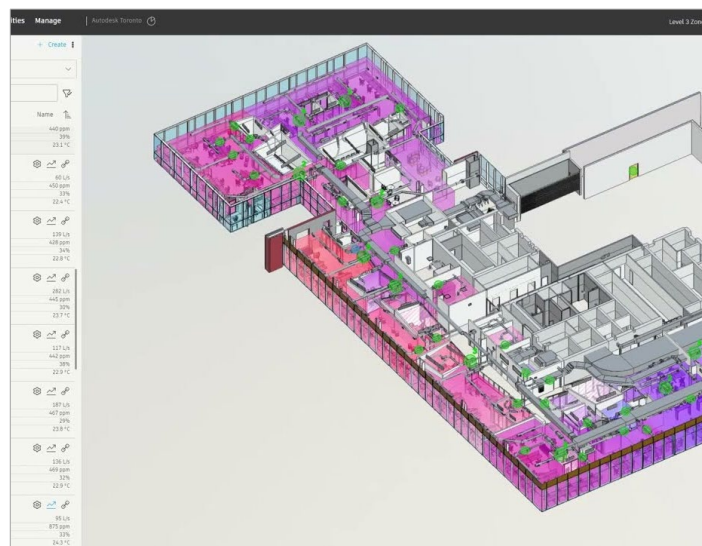
The importance of having consistent, relevant data.



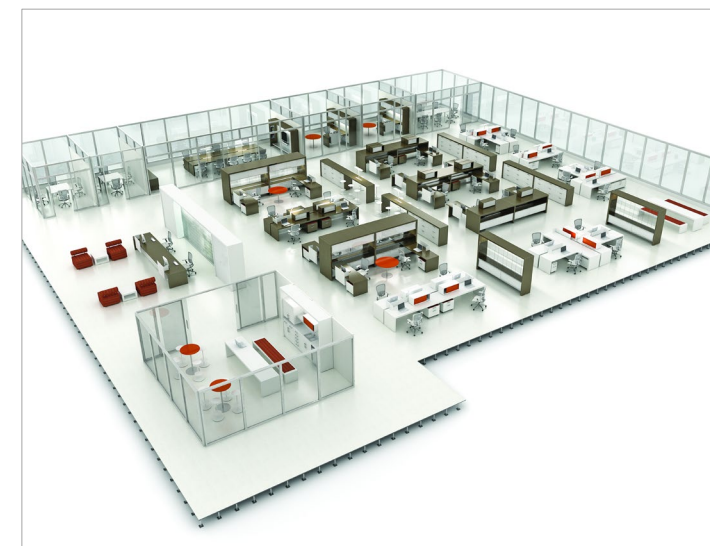
Why Standardized Data?



Accurate Reporting



Digital Twin Visualizations

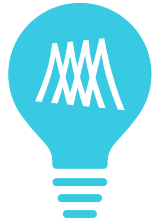


Passing Data to Your FM Systems

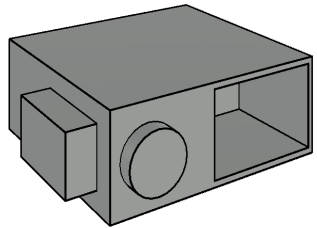
What is Standardized Data?

The different types of data.

2 Types of Data

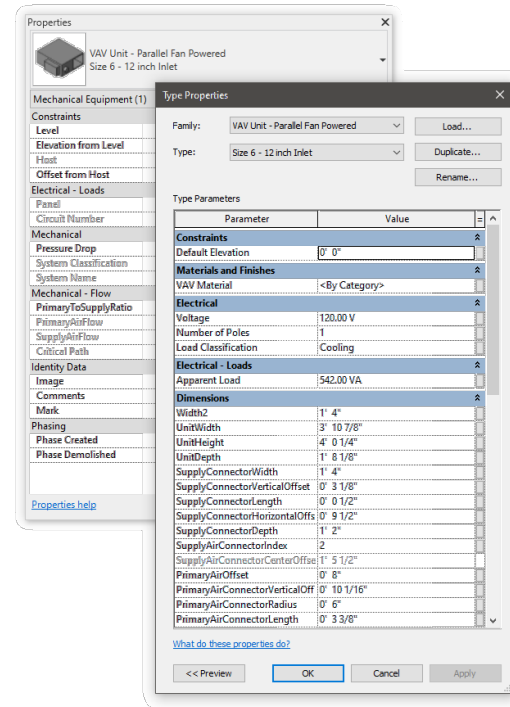


Graphical Data



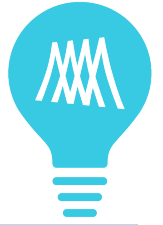
- Structural elements
- Core & Shell elements
- Site elements
- Fixtures, furniture, and equipment (assets)
- Simplified for digital twin
- 2D for space planning
- **Asset ID**

Informational Data



- Identification (manufacturer, make, model, etc.)
- Location (floor, room, etc.)
- Engineering/functionality (power, flow, etc.)
- Installation (serial number, warranty information, etc.)
- Manuals (operational, maintenance)
- **Asset ID**

Data Collection

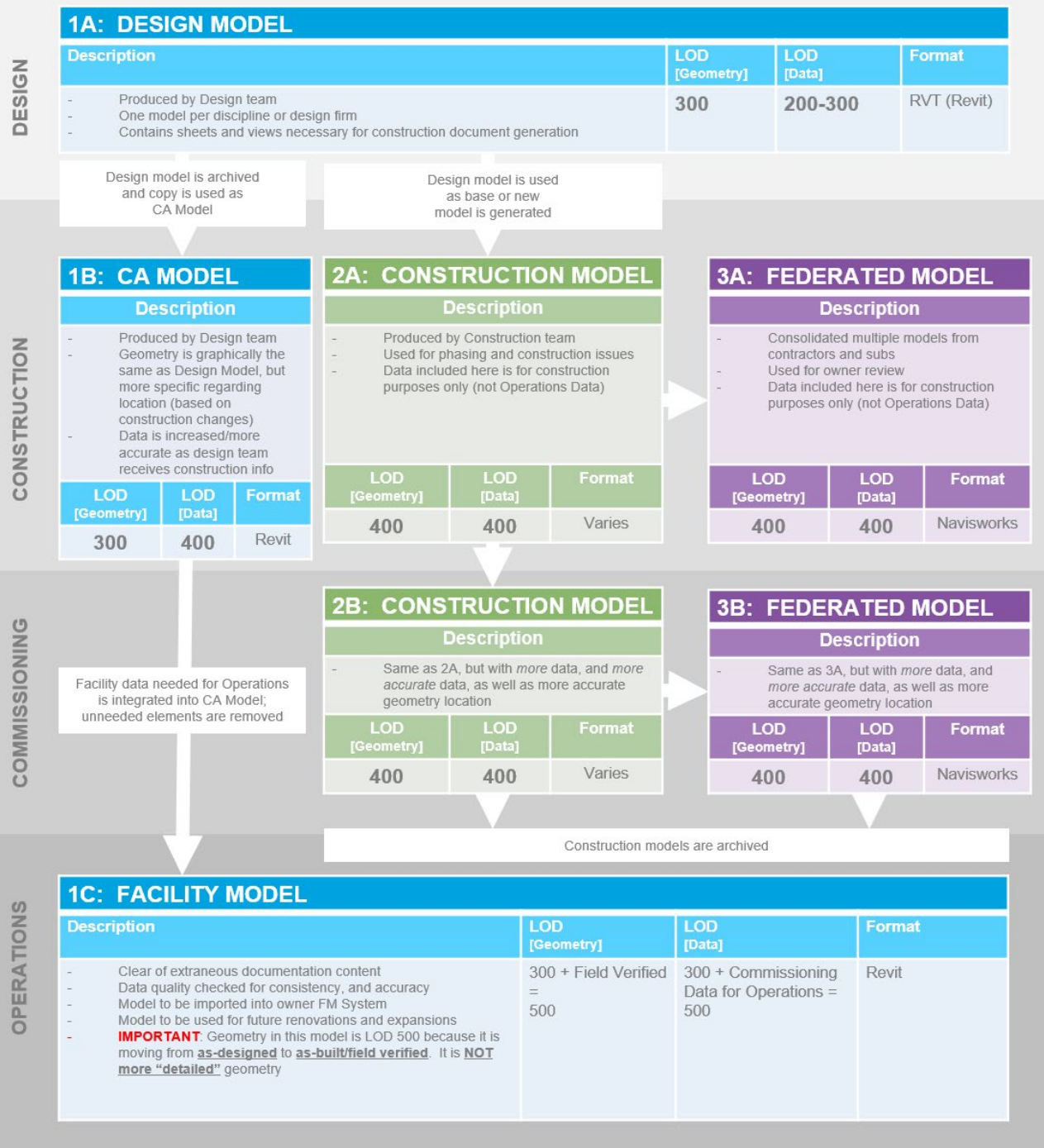


WHO	WHEN	HOW	WHAT
Architects and Engineers	Design + CA	<ul style="list-style-type: none"> Updating the Revit models 	<ul style="list-style-type: none"> Data in parameters (informational data) Updated geometry to match RFIs, Redlines (graphical data)
Contractors	Construction	<ul style="list-style-type: none"> Generating redline drawings Gathering documents 	<ul style="list-style-type: none"> As-built conditions (graphical data) Documentation about equipment including their manuals, warranties, etc. (informational data)
Commissioning Agent	Commissioning	<ul style="list-style-type: none"> Capturing data Gathering documents 	<ul style="list-style-type: none"> Installation and performance (informational data) Documentation about equipment including their manuals, warranties, etc. (informational data)



Model Lifecycle

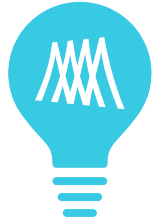
- Construction models do not make good operations models
- They include too much detail and are modified to accommodate means and methods in construction
- Design models updated with redlines should be carried through to operations
- Ideally, LOD 300 models (geometry), as they will be your backgrounds for future work/renovations
- You want all the data and just enough geometry



How do I ensure standardized data?



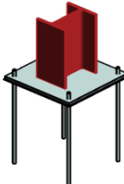
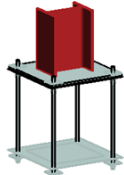
Tools, techniques, best practices, and recommendations.

LOD Designations



ISSUES

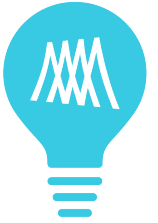
- No national standard for LOD
- Based on a linear relationship (e.g., 100, 200, 300, 350, 400, 450, 500)

200	Inclusions: <ul style="list-style-type: none">• General shape	
300	Inclusions: <ul style="list-style-type: none">• Specific section type and size	
350	Inclusions: <ul style="list-style-type: none">• Member connections such as, base plates and gusset plates, anchor rods• Connection details with correct and reliable dimensions• Steel structure reinforcements and stiffeners (e.g. for penetrations)• Cap plates	
400	Inclusions: <ul style="list-style-type: none">• Welds• Coping of members• Washers, nuts, etc.	

RECOMMENDATIONS

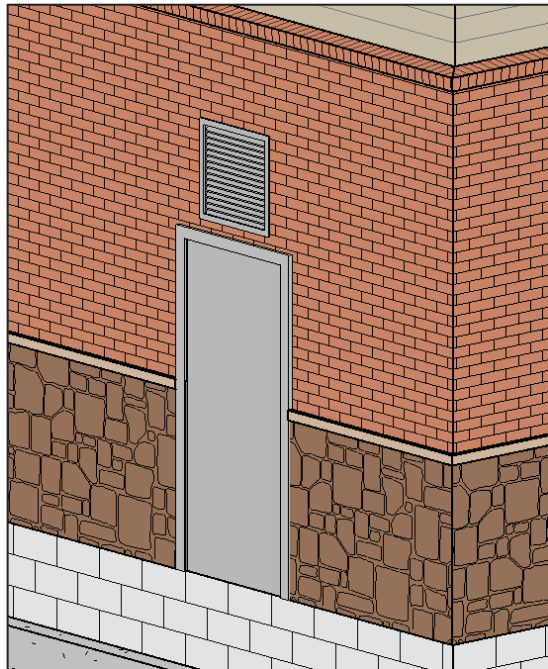
- Separate LOD for **Graphical Data** and **Informational Data**
- Use 100, 200, 300, 400 for graphics and A, B, C, D for data
- For example, instead of LOD 300, define it as LOD 300C

LOD Elements



ISSUES

- Typically organized by UniFormat or MasterFormat
- Not all classifications have equivalent elements in the model authoring software



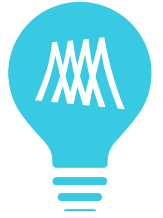
RECOMMENDATIONS

- Base your LOD on Revit family categories

Level of Development (LOD) Tables

- Air Terminals
- Areas
- Cable Tray
- Cable Tray Fittings
- Casework
- Ceilings (Exterior)
- Ceilings (Interior)
- Columns (Non-Structural)
- Communication Devices
- Conduits
- Conduit Fittings
- Curtain Panels
- Curtain Wall Mullions
- Data Devices
- Detail Items
- Doors (Exterior)
- Doors (Interior)
- Ducts
- Duct Accessories
- Duct Fittings
- Duct Insulation
- Duct Linings
- Duct Placeholders
- Duct Systems
- Electrical Equipment
- Electrical Equipment (Fire Alarm)
- Electrical Fixtures
- Entourage

LOD Elements



Plumbing Fixtures

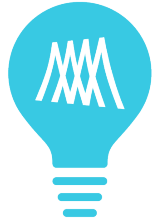
General Information

SUBSET	N/A
EQUIVALENT BUILDING ELEMENTS	Drains, drinking fountains, lavatories, mop sinks, showers, toilets, urinals
CLASSIFICATIONS	
Uniformat 2010	D2010.60: Plumbing Fixtures
OmniClass Table 21	21-04 20 10 60: Plumbing Fixtures
MasterFormat	22 40 00: Plumbing Fixtures
OmniClass Table 22	22-22 40 00: Plumbing Fixtures
OmniClass Table 23	23-31 00 00: Plumbing Specific Products and Equipment
NOTES	Plumbing fixtures can be modeled in both the architectural and MEP models. However, only one model will be designated the single source for all plumbing fixture locations

Graphics and Facility Data

	GRAPHICS	FACILITY DATA
LOW DETAIL	100 INCLUDES: generic modeling with preliminary geometry and dimensions	A INCLUDES: phasing, length, width, height, subcategory (see Section S6.F)
MEDIUM DETAIL	200 INCLUDES: "basis of design" modeling with general geometry and dimensions	B INCLUDES: same as A + mounting type, mounting height, location detectable by Room or Space
HIGH DETAIL	300 INCLUDES: "basis of design" modeling with detailed geometry and dimensions, code clearances	C INCLUDES: same as B + "basis of design" specifications + UniFormat & MasterFormat classification
EXTRA DETAIL	400 INCLUDES: <u>manufacturer provided</u> "as-built" modeling with accurate geometry and dimensions, code clearances	D INCLUDES: same as C + "as-built" manufacturer & model, cost

Non-Real World Elements



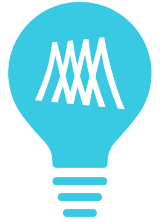
ISSUES

- Models include elements that are not equivalent to real-world elements
- For example: Views, Sheets, Details, Legends, Settings, Phases, Design Options, etc.
- Most you don't need in a model at delivery

RECOMMENDATIONS

- Make them part of your modeling standards
- Most should stay during the project as interim deliverables (INT)
- Most should be removed for final deliverables (FIN)
- Include them in your BIM Execution Plan

Non-Real World Elements



Type >		MODEL				MODEL				
Project Phase >		DESIGN				CONSTRUCTION				
Time of Exchange >		100% DESIGN DEVELOPMENT				PROJECT CLOSEOUT				
MODEL ELEMENT		LOD		RESP	NOTES	LOD		RESP	NOTES	
REVIT CATEGORY	SUBSET	GRAPHICS	FACILITY DATA	PARTY		GRAPHICS	FACILITY DATA	PARTY		
MODEL STANDARDS		REQUIREMENT		RESP PARTY	NOTES	REQUIREMENT		RESP PARTY	NOTES	
Settings	Fill Patterns	INT		ALL		FIN		ALL		
	Line Styles	INT		ALL		FIN		ALL		
	Line Weights	INT		ALL		FIN		ALL		
	Naming Conventions	INT		ALL		FIN		ALL		
	Phases and Demolition	INT		ALL		FIN		ALL		
	Project North	INT		ALL		FIN		ALL		
	True North	INT		ALL		FIN		ALL		
	Project Base Point	INT		ALL		FIN		ALL		
	Survey Point	INT		ALL		FIN		ALL		
	Project Location	INT		ALL		FIN		ALL		
	Project Units and Precision	INT		ALL		FIN		ALL		
	Sheet Issues/Revision	INT		ALL		FIN		ALL		
	Organization	Assemblies	INT		ALL		FIN		ALL	
		Browser Organization	INT		ALL		FIN		ALL	
Design Options		INT		ALL		FIN		ALL		
Detail Groups		INT		ALL		FIN		ALL		
Model Groups		INT		ALL		FIN		ALL		
Views		INT		ALL		FIN		ALL		
Worksets		INT		ALL		FIN		ALL		
Datums		INT		ALL		FIN		ALL		
Grids		INT		ALL		FIN		ALL		
Levels		INT		ALL		FIN		ALL		
Reference Planes		INT		ALL		FIN		ALL		
Scope Boxes		INT		ALL		FIN		ALL		
Modeling		INT		ALL		FIN		ALL		
Duct and Piping Systems		INT		ALL		FIN		ALL		
In-Place Families		INT		ALL		FIN		ALL		
Generic Models and Mass Families		INT		ALL		FIN		ALL		
Annotations		Materials	INT		ALL		FIN		ALL	
	Model Lines	INT		ALL		FIN		ALL		
Imports / Exports	Walls	INT		ALL		FIN		ALL		
	Annotation Types	INT		ALL		FIN		ALL		
	Tags	INT		ALL		FIN		ALL		
Imports / Exports	CAD Export Settings	INT		ALL		FIN		ALL		
	DWG Files	INT		ALL		FIN		ALL		
	Images	INT		ALL		FIN		ALL		


Data Fields



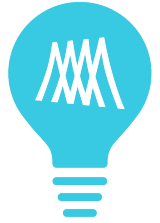
ISSUES

- The data fields in models (parameters) get lost in a sea of other data fields
- Asking for too many pieces of data will cause your consultants to either not do it, not do it correctly, or charge you too much

RECOMMENDATIONS

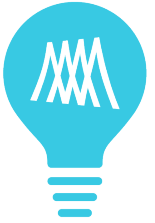
- Clear parameter naming standards that include:
 - Your organization's initials
 - The responsible party
 - Description
- Less is better...focus on the critical data needed to manage your facility
- The Autodesk Shared Parameter Tool  will add the parameters you need to any model in 2 clicks

Data Fields



1	A	B	C
	PARAMETER GROUP	PARAMETER NAME	APPLICATION
2			
3	Architecture	DGS_ARCH_Building.Name	Instance
4	Architecture	DGS_ARCH_Building.Number	Instance
5	Architecture	DGS_ARCH_Door.Card.Reader	Instance
6	Architecture	DGS_ARCH_Door.Closer	Instance
7	Architecture	DGS_ARCH_Door.Frame.Fire.Rating	Type
8	Architecture	DGS_ARCH_Door.Frame.Material	Instance
9	Architecture	DGS_ARCH_Door.Hardware.Type	Instance
10	Architecture	DGS_ARCH_Door.Hinge.Size	Type
11	Architecture	DGS_ARCH_Door.Leaf.Dimensions	Type
12	Architecture	DGS_ARCH_Door.Leaf.Material	Instance
13	Architecture	DGS_ARCH_Door.Magnetic.Hold	Instance
14	Architecture	DGS_ARCH_Roof.Construction	Type
15	Architecture	DGS_ARCH_Room.Name	Instance
16	Architecture	DGS_ARCH_Room.Number	Instance
17	Architecture	DGS_ARCH_Room.Baseboard	Instance
18	Architecture	DGS_ARCH_Room.Ceiling	Instance
19	Architecture	DGS_ARCH_Room.Floor	Instance
20	Architecture	DGS_ARCH_Room.Wall.East	Instance
21	Architecture	DGS_ARCH_Room.Wall.North	Instance
22	Architecture	DGS_ARCH_Room.Wall.South	Instance
23	Architecture	DGS_ARCH_Room.Wall.West	Instance
24			
25			
26	Commissioning	DGS_CXA_Compressor.Serial.Number	Instance
27	Commissioning	DGS_CXA_Date.Commissioning	Instance
28	Commissioning	DGS_CXA_Date.Manufacture	Instance
29	Commissioning	DGS_CXA_Engine.Serial.Number	Instance
30	Commissioning	DGS_CXA_Expected.Life	Type
31	Commissioning	DGS_CXA_Fan.Serial.Number	Instance
32	Commissioning	DGS_CXA_Serial.Number	Instance
33	Commissioning	DGS_CXA_Tank.Manufacture.Date	Instance
34	Commissioning	DGS_CXA_Warranty.Company.Name	Instance
35	Commissioning	DGS_CXA_Warranty.Contact.Email	Instance
36	Commissioning	DGS_CXA_Warranty.Contact.Phone	Instance
37	Commissioning	DGS_CXA_Warranty.Date.End	Instance
38	Commissioning	DGS_CXA_Warranty.Date.Renewal	Instance
39	Commissioning	DGS_CXA_Warranty.Date.Start	Instance
40	Commissioning	DGS_CXA_Warranty.Description	Instance
41			
42			
43	Contractor	DGS_GC_Burner.Manufacturer	Type
44	Contractor	DGS_GC_Compressor.Manufacturer	Type
45	Contractor	DGS_GC_Compressor.Model	Type
46	Contractor	DGS_GC_Date.Install	Instance
47	Contractor	DGS_GC_Drive.Part.Number	Type
48	Contractor	DGS_GC_Fan.Manufacturer	Type
49	Contractor	DGS_GC_Fan.Model	Type
50	Contractor	DGS_GC_Input.Breaker.Manufacturer	Instance
51	Contractor	DGS_GC_Input.Breaker.Model	Instance
52	Contractor	DGS_GC_Manufacturer.Name	Type

Data Fields



- Autodesk Shared Parameters Tool for Revit (SPT)
- Part of the Autodesk Interoperability Tools
- Free for all Revit users
- Allows you to map your shared parameters to the correct family categories at the correct level (type vs instance)

AUTODESK SHARED PARAMETERS TOOL FOR REVIT

Setup. Step 3. Assign
Assign settings to your parameters.

Parameters	Description	Data Type	Type or Instance	Group Under	Value by Group	Family Categories
Accessway		Yes/No	Instance	IFC Parameters	Aligned per group type	Ramp
ACN_ActivityGeneratingUseType		Text	Instance	IFC Parameters	Vary by group instance	Areas
ACN_CloseTime		Text	Instance	IFC Parameters	Vary by group instance	Areas
ACN_ConnectivityType		Text	Instance	IFC Parameters	Vary by group instance	Areas
ACN_IsOpen24HoursToPublic		Yes/No	Instance	IFC Parameters	Aligned per group type	Areas
ACN_IsPavingSpecified		Yes/No	Instance	IFC Parameters	Aligned per group type	Areas
ACN_OpenTime		Text	Instance	IFC Parameters	Vary by group instance	Areas
ACN_PavingSpecification		Text	Instance	IFC Parameters	Vary by group instance	Areas
AGF_AreaID		Text	Instance	IFC Parameters	Vary by group instance	Areas
AGF_BonusGFAType		Text	Instance	IFC Parameters	Vary by group instance	Areas
AGF_DetailedUse		Text	Instance	IFC Parameters	Vary by group instance	Areas
AGF_DevelopmentUse		Text	Instance	IFC Parameters	Vary by group instance	Areas
AGF_FacilityType		Text	Instance	IFC Parameters	Vary by group instance	Areas
AGF_Name		Text	Instance	IFC Parameters	Vary by group instance	Areas

Close Back Next Finish and Close

Data Values



ISSUES

- Your data fields have inconsistent values in them
- For example:


Identity Data	
Type Mark	
Fire Rating	1 HOUR
Cost	

Identity Data	
Type Mark	
Fire Rating	1
Cost	

Identity Data	
Type Mark	
Fire Rating	60 min
Cost	

Identity Data	
Type Mark	
Fire Rating	1 hr.
Cost	

RECOMMENDATIONS

- Create “Picklists” for your teams to use when filling in your standard parameters
- The Autodesk Standardize Data Tool  is free and lets you build Picklists in Excel

BEP Organization



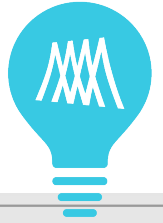
ISSUES

- Your “element responsibility” matrix is too big to manage
- Consultants struggle to find what applies only to them

RECOMMENDATIONS

- Organize your rows by discipline (consultant), then by Revit family category
- Organize your columns by milestone
- Include data groups that allow for one-click expand/collapse

BEP Organization



BIM Execution Plan Element Responsibility <<ENTER PROJECT NAME>>		MODEL DESIGN		MODEL DESIGN		MODEL DESIGN		MODEL DESIGN					
Type >		50% DESIGN DEVELOPMENT		100% DESIGN DEVELOPMENT		50% CONSTRUCTION DOCUMENTS		75% CONSTRUCTION DOCUMENTS					
Project Phase >		LOD		LOD		LOD		LOD					
Time of Exchange >		GRAPHICS	FACILITY DATA	GRAPHICS	FACILITY DATA	GRAPHICS	FACILITY DATA	GRAPHICS	FACILITY DATA				
MODEL ELEMENT		RESP PARTY	NOTES	RESP PARTY	NOTES	RESP PARTY	NOTES	RESP PARTY	NOTES				
REVIT CATEGORY	SUBSET												
STRUCTURE		STRUCTURE		STRUCTURE		STRUCTURE		STRUCTURE					
Floors	Structural	200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Area Reinforcement		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Beam Systems		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Columns		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Connections		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Fabric Areas		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Fabric Reinforcement		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Foundations	Footings	200	A	STR	200	B	STR	200	B	STR	300	B	STR
	Slabs	200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Framing		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Path Reinforcement		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Rebar		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Stiffeners		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Structural Trusses		200	A	STR	200	B	STR	200	B	STR	300	B	STR
Walls	Subgrade	200	A	STR	200	B	STR	200	B	STR	300	B	STR
ARCHITECTURE & INTERIOR DESIGN		ARCHITECTURE & INTERIOR DESIGN		ARCHITECTURE & INTERIOR DESIGN		ARCHITECTURE & INTERIOR DESIGN		ARCHITECTURE & INTERIOR DESIGN					
Areas		200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Casework		200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Ceilings	Exterior	200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
	Interior	200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Columns		200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Curtain Panels		200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Curtain Systems		200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Curtain Wall Mullions		200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Detail Items		Elements in this Revit category will not be used		Elements in this Revit category will not be used		Elements in this Revit category will not be used		Elements in this Revit category will not be used					
Doors	Exterior	200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
	Interior	200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Entourage		Elements in this Revit category will not be used		Elements in this Revit category will not be used		Elements in this Revit category will not be used		Elements in this Revit category will not be used					
Floors	Non-Finish	200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
	Finish	200	A	ARCH	200	B	ARCH	200	B	ARCH	300	B	ARCH
Furniture	Fixed	200	A	ID	200	B	ID	200	B	ID	300	B	ID
	Movable	200	A	ID	200	B	ID	200	B	ID	300	B	ID
Furniture Systems		200	A	ID	200	B	ID	200	B	ID	300	B	ID
Generic Models		Elements in this Revit category will not be used		Elements in this Revit category will not be used		Elements in this Revit category will not be used		Elements in this Revit category will not be used					
Mass		Elements in this Revit category will not be used		Elements in this Revit category will not be used		Elements in this Revit category will not be used		Elements in this Revit category will not be used					

Templates



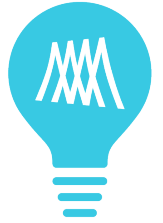
ISSUES

- Creating templates ensures all your standard modeling content is in one place
- But, your consultants refuse to use your templates because they have their own

RECOMMENDATIONS

- Consider creating a “warehouse” or “showcase” model with all your standard content
- Your consultants can easily import that content into their templates

Model Checking / QC



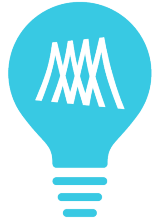
ISSUES

- It can be difficult and time-consuming to check that the model deliverables from your consultants are meeting your requirements

RECOMMENDATIONS

- Create a custom checkset for the Autodesk Model Checker for Revit
- Have your consultants run it and deliver the generated report with their models
- Your team can run it as a spot check
- The Model Checker has a cloud-based version called the Autodesk Validation Tool that can run without Revit on any number of files

Model Checking / QC



Autodesk Interoperability Tools | Model Checker

AUTODESK MODEL CHECKER FOR REVIT

R
RVT

Title Revit Model Best Practices for Revit 2023
Date Wednesday, March 23, 2022
Author Autodesk
Description Series of checks to review modeling best practices and integrity

COBieChallenge2022_Arch+MEP.rvt

53%

Check Summary 97 Checks, 10 (53%) Pass, 9 Fail, 77 Count/List, 1 Not Run
Report Date Wednesday, March 15, 2023 - 11:21:26 PM
Revit Filepath C:\Users\tj.meehan\OneDrive\Documents\Revit Samples\COBieChallenge2022_Arch+MEP.rvt
Checkset File <https://interoperability.autodesk.com/modelchecker/hostedchecks/bestpractices-2023.xml>

▾ **Revit Model Best Practices** 97 Checks, 10 (53%) Pass, 9 Fail, 77 Count/List, 1 Not Run

- Model Performance** 8 Checks, 7 Count/List, 1 Not Run
 - Checks in this section help monitor the result of actions taken over the course of a model's development, which can directly impact the model's performance. Proper management of these items can improve model performance.
- Project Settings** 11 Checks, 1 (33%) Pass, 2 Fail, 8 Count/List
 - Checks in this section are related to settings that can be configured at a project level, which may need to be verified for compliance with standards defined for the project.
- External Files** 8 Checks, 2 (100%) Pass, 0 Fail, 6 Count/List
 - A series of checks related to linked and imported files in the model.

Datum and Location Elements 17 Checks, 7 (88%) Pass, 1 Fail, 9 Count/List

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Questions?