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Rapid-Fire Autodesk Revit Data Extraction: Best Practices in Construction Data Extraction

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CR2809-P Autodesk Revit software 3D models contain rich data that is important to builders. Getting all the data, geometry, object properties, and custom parameters out of the unique data structure of Revit remains a challenge. Builders are often given models that have not been developed with their input and contain object property information that is incomplete, inaccurate, or generic. In this class, we will demonstrate how all data from Revit can be extracted quickly, enabling model quality assessment prior to performing 4D simulation, clash detection, and 5D estimating. In addition, you will learn to push new data into Revit, to better manage and comprehend Revit data as the model progresses in development, and to use techniques for model variance analysis and trends. The class will also cover strategies, workflows, and best practices for creating Revit templates that optimize data extraction and enable Revit objects to be mapped to external databases or to be further manipulated for additional analysis.

Learning Objectives

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

1. Define specific guidelines that provide project team members with a mutually beneficial model
2. Optimize data extraction from Revit in an easily usable, tabular format
3. Manipulate Revit information to concisely gather key data points that are useful for builders
4. Construct views in Autodesk® Navisworks® software that map directly to the Revit data being extracted

About the Speaker

As Director of the Center of Excellence, it is James' responsibility to plan, develop, and help lead continuous organization improvement/learning in Building Information Modeling (BIM), Lean Construction Principles (LEAN), Design Build Project Delivery, Integrated Project Delivery (IPD) and Sustainable Design. James also provides oversight of the research and development activities of Swinerton Labs. James is an 28-year industry professional with experience in each sector of the AEC industry managing multi-million dollar programs and projects on schedule and within budget. James has extensive expertise with project delivery methods that emphasize integrated practice (such as Design Build contracts and IPD principles) and is a recognized industry expert in the usage of Building Information Modeling (BIM). Prior to Swinerton James managed the Student Housing Capital Projects Group at Stanford University and is a former AEC industry Solutions Executive for Autodesk. James is a four-time presenter at Autodesk University.

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OVERVIEW

The most well-known aspect of BIM is 3D, object based, parametric modeling. Parametric technology allows 3D model building objects (e.g., walls, floors, doors, roofs, etc.) to "relate" to each other via established or user-defined parametric "rules". The parametric rules associate one object to another (e.g., wall is associated to a door frame) and allow changes to the relationship between objects to be modified automatically. The objects within a 3D model have "attributes" or "properties" (data regarding an object) embedded within them. This BIM data is readily available to all project team members.

Finith Jernigan in his epic book "Big BIM little BIM" states that BIM needs to put into context and that architects are faced with the dilema "that they make too many decisions at the wrong time, with too little information". Jernigan continues that use of BIM technology "does not require that architects throw away al their proven tools and experiences but does require them to separate the things that should be kept from those that should be replaced.

BIM is a term that was conceived to describe a process that involves the use of virtual models containing information that can be readily shared. The parametric, object oriented technology used in 3D models contain rich data that greatly reduce errors in design and construction and improve facility performance.

While much has been written on the technology of BIM it is more important to understand that the human factors such as though processes, mindsets and attitutes in BIM useage has far greater importance.

Modeling a building is a much different process then traditional drawing. As Francois Levy states in his book BIM in *Small Scale Sustainable Design* "modeling represents a radical departure from the way we architects have traditionally undertaken the work of our profession for centuries. This not only represents a change in the mechanics of our work, but I contend it is a shift in the cognitive processes that accompany and ultimately drive that work".

BIM tools can be used to accelerate, automate and streamline tedious information gathering and decision-making processes so effort can be placed on finding the optimal solution rather than the most convenient one.

3D modeling tools such as Revit can accelerate the response time to potential project issues because the 3D visual nature and the rich data contained in the model allow you to see problems, in a collaborative manner, well in advance as well as to exploit new cost savings and revenue opportunities. Revit improves the coordination of capital expenditures by identifying and removing building system redundancy and establishing building performance metrics resulting in lower initial costs and long-term operational costs.

Revit can also link project activities with business goals and allow the project team to interface with the business of the company which results in a greater understanding of the culture, values and business drivers of an organization.

Finally BIM tools help you define what is unclear and can provide a map through uncharted territory resulting in a higher level of services with emphasis on value to the client far sooner and with a greater level of detail than could ever be delivered with 2D CAD tools.

NEED FOR RAPID DATA EXTRACTION

Speed of business

Know what you have in your model quickly. Much effort can be spent reviewing a 3D model in its native format.

Revit "hidden data"

Revit has data that not is easy to find in its native format and must be flushed out and viewed in a tabular format.

Revit Data Management

The data-centric nature of BIM requires a high level of data integrity and structure. To achieve an accurate database, we start by examining what the end result should look like. The structure of the database needs to contain information that will be used by facility managers after the construction period. Imagine a facility technician receiving a call for an exam room with a malfunctioning light fixture. The technician carries an iPad and scans a QR code on the door jamb, pulling up a 3D image of the room with smart objects containing all of the information about the room, including equipment above the ceiling. The technician clicks on the faulted light fixture, which pulls up a description of the fixture, including a spare parts list and as-built information, noting the panel and circuit it is fed from. The technician can then immediately start to investigate the problem and take steps to correct the issue.

Proper management data in a BIM environment data requires that your able to answer the following questions:

- How is data entered ?
- Does data sit in a silo ?
- Analyze where there are data “overlaps”
- Examine what data is not electronic & whether it can digitized
- Where is data stored ? Multiple locations ?
- Evaluate how data is transmitted and in what format

REVIT MODELING SUCCESS=PLANNING+CONTINUOUS COLALBORATION AND FEEDBACK

Modeling success does not come automatically. Considerable planning is needed and agreements on data exchange by all involved in the design and construction process. Successful modeling also requires continuous collaboration between project team members. Model updates should be on a short interval in order to allow project team member to give real time feedback and make quick model adjustments.

REVIT MORPHOLOGY

Understanding Revit's unique single file nature needs to be completely understood in order to achieve successful and efficient modeling practices and data extraction for use in downstream applications. The following of the characteristic's that make up Revit's morphology.

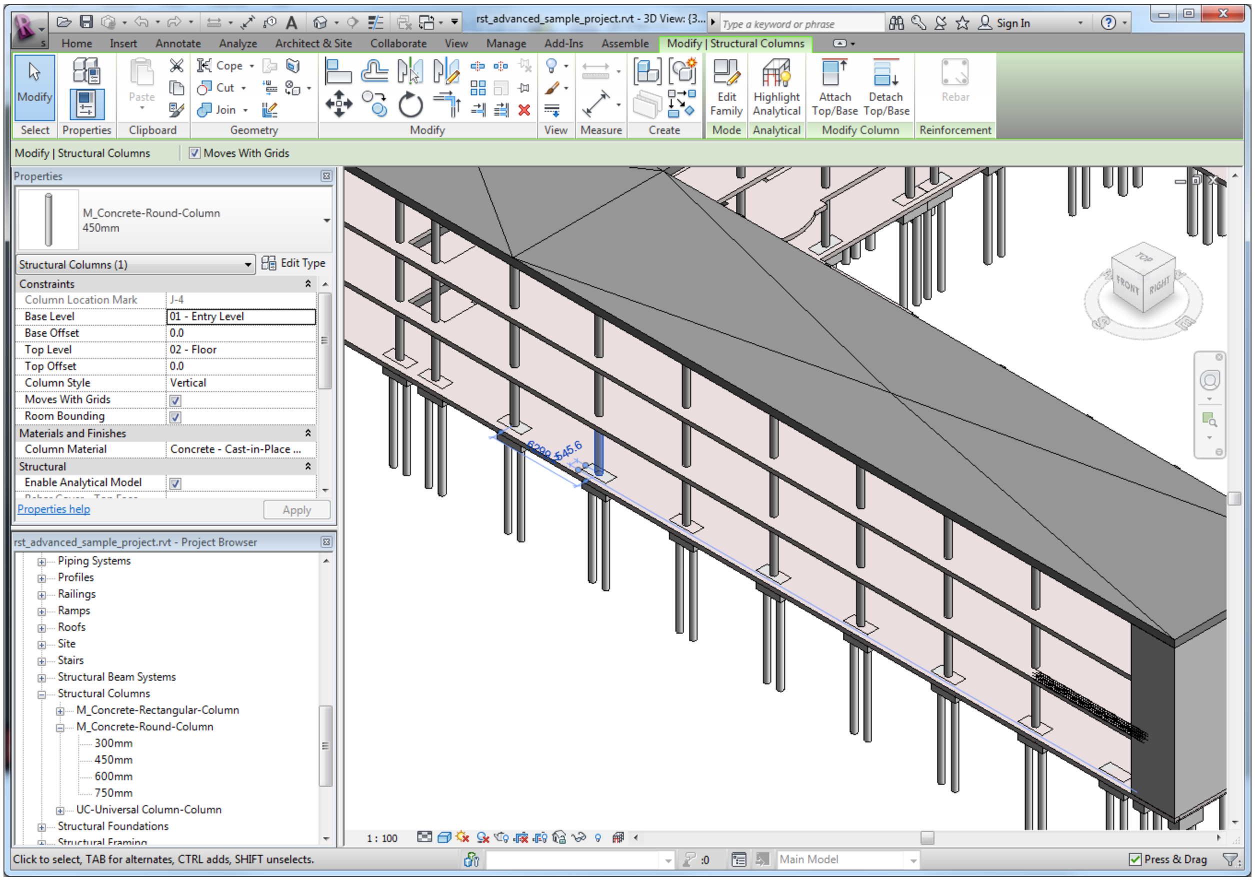
- Single, unified representation of the building (full description not just a 3D model)
- Generates all necessary documentation
- Modeling instead of drawing using building components such as walls, windows, floors, ceilings, etc.
- Revit recognizes form (geometry) and behavior of building components
- Object based
- Parametric relationships
- Objects, parameters and values

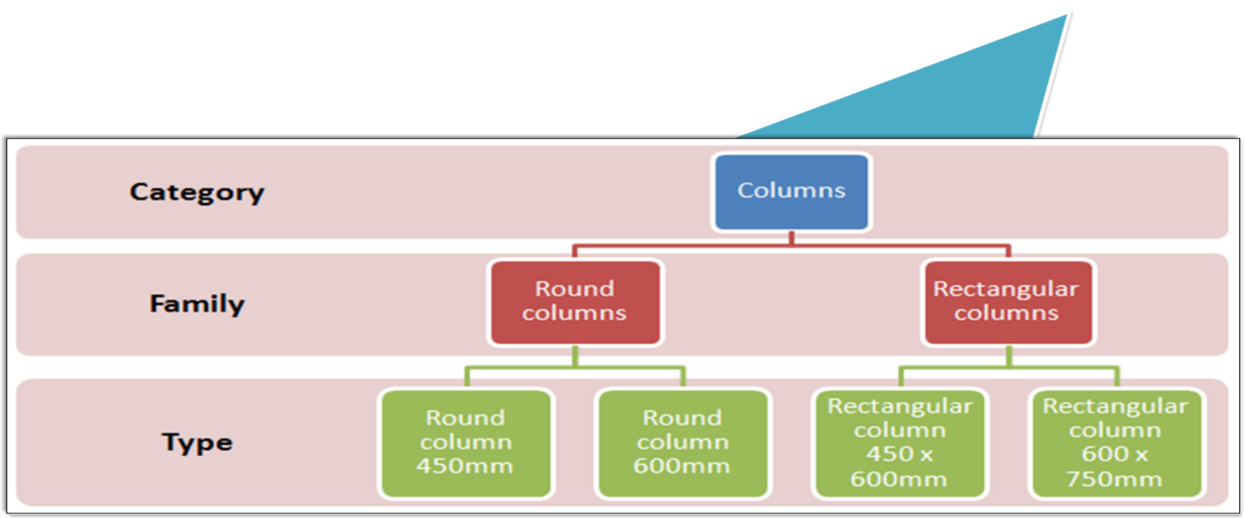
Revit Data Structure Hierarchy

Revit has a unique data structure that needs to be understood in order to be able to manage the data it produces. The following is Revits data hierarchy:

- Category
  - Family
    - Type
      - Instance
- Parameters
  - Family
    - Type
      - Instance

Rapid-Fire Autodesk Revit Data Extraction





THE IMPORTANCE OF LEVEL OF DETAIL (LOD)

When extracting data from Revit it is important to understand the Level of Detail the model is in. The higher the LOD the larger the file and the more data you can expect to extract. This is where having an a tool that can extract data quickly and place it in a pre-dined tabular format can help with productivity. Builders must be careful in understanding what LOD there model is. Looks can be deceiving. A LOD 100 model may look buildable but in reality lacks the data needed for construction. Modeled elements will need to be at least LOD 300 if used for construction.

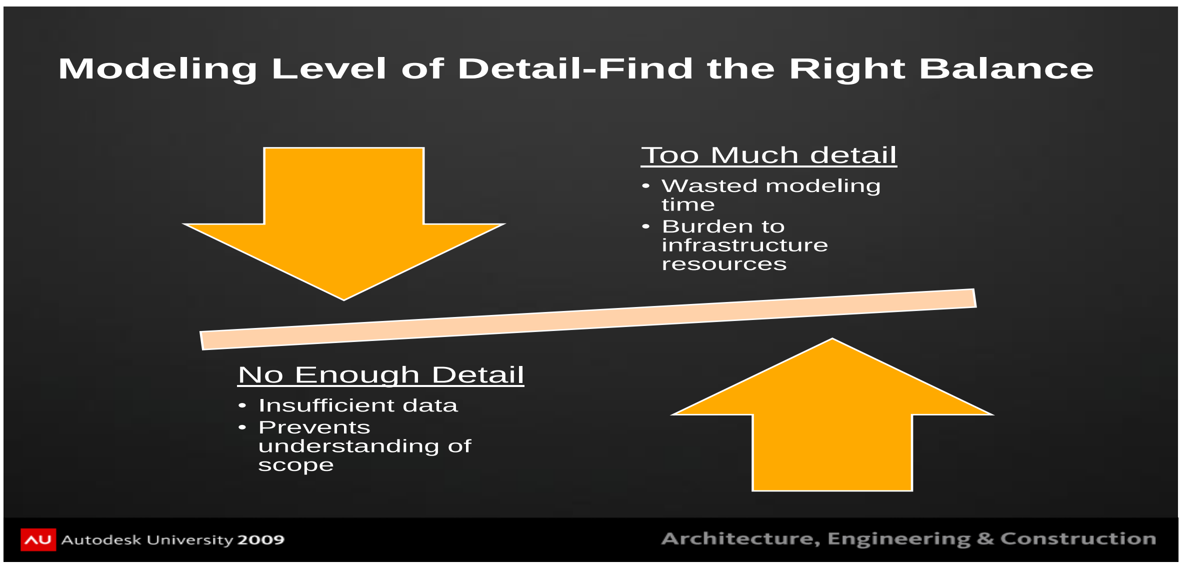
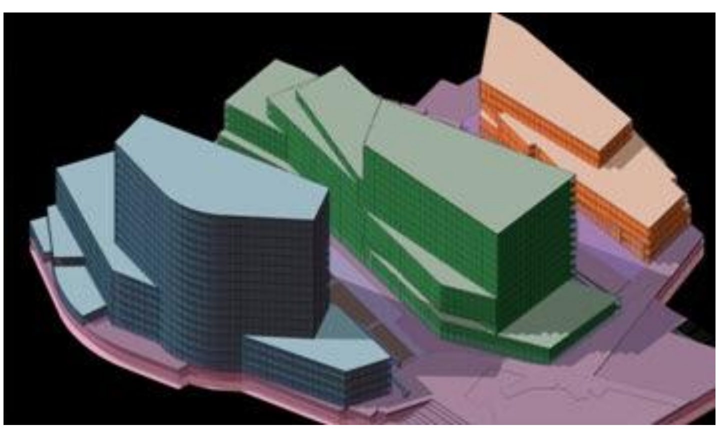


Image from: "BIM Means Business" by James McKenzie, Autodesk Unviersity 2009

LOD 100: Conceptual Level

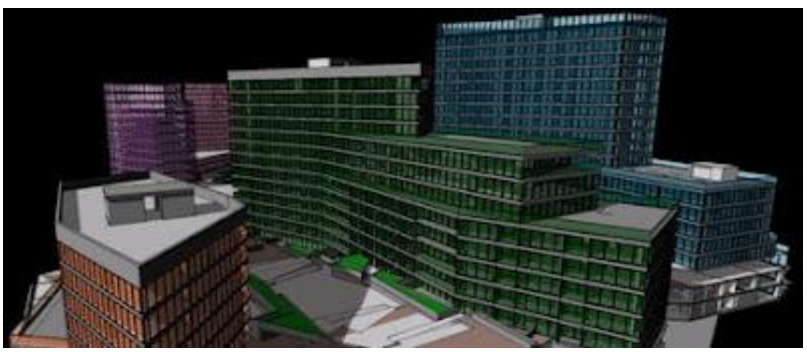


Model elements indicative of area, height, volume, location, and orientation may be modeled in three dimensions or represented by other data (e.g., a pump would be represented as a cube)

Uses:

- Total project duration
- Phasing of major elements
- Conceptual cost allowance ($/SF of floor area)
- Cost assumption of future content

LOD 200: Approximate Geometry



Model elements are modeled as generalized systems or assemblies with approximate quantities, size shape, location, and orientation. Non-geometric information may also be attached to Model Elements (e.g., a pump would be a generic pump of approximate size)

Uses:

- Time-scaled, ordered activities
- Estimated cost based on generic elements

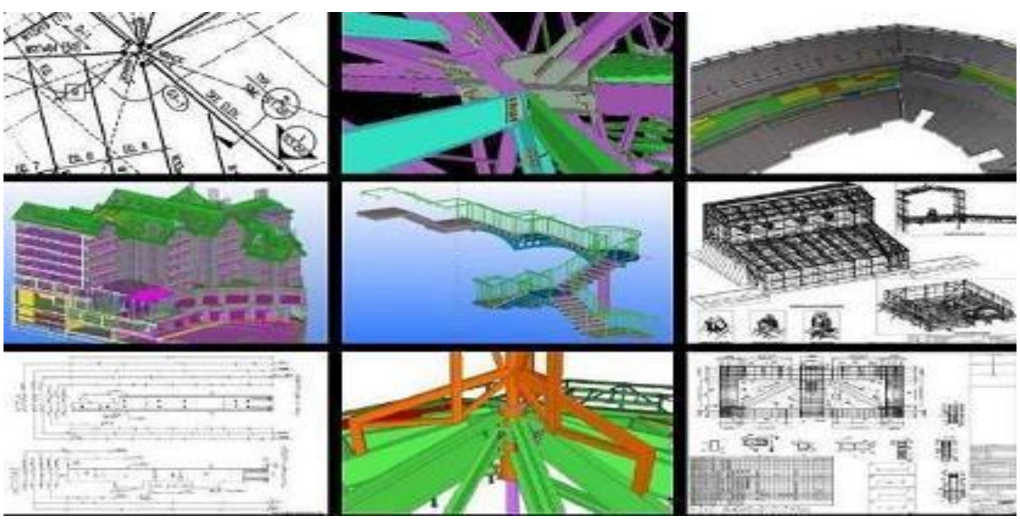
LOD 300: Precise Geometry

Model elements are modeled as specific assemblies accurate in terms of quantity, size, shape, location, and orientation. Non-geometric information may also be attached to Model Elements. Accurate to contract documents. (e.g., pump would be a generic pump of accurate size complete with connections and clearances for a complete system.)

Uses

- Time-scaled, ordered assemblies
- Estimated cost based on specific assemblies (e.g., specific wall type)

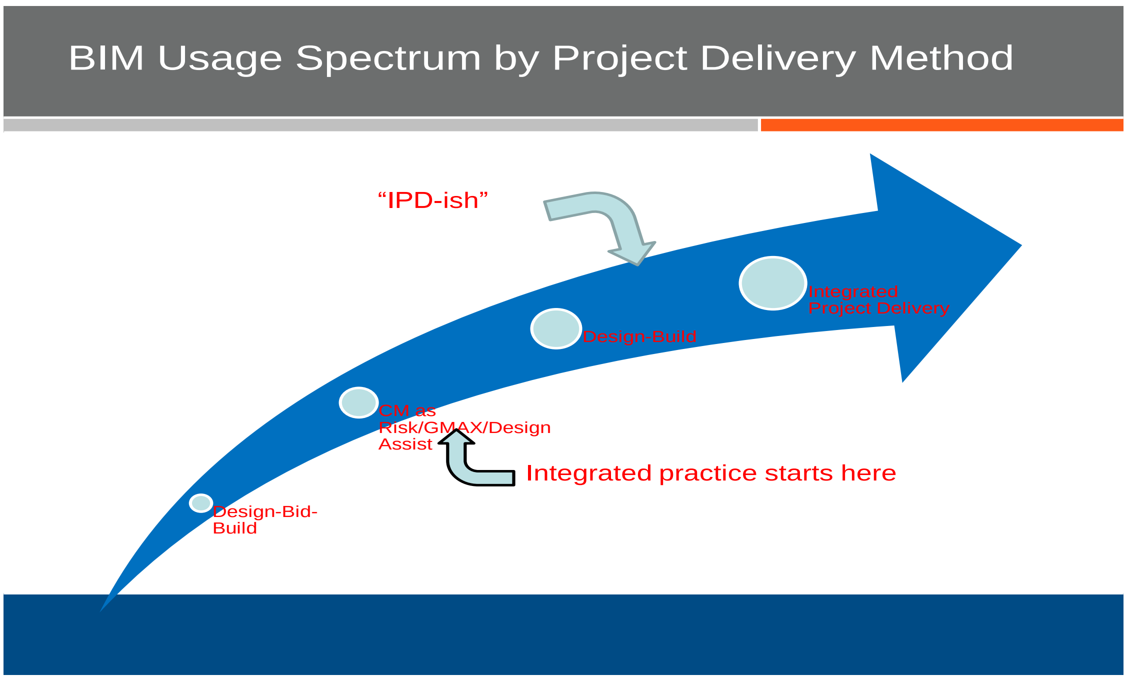
LOD 400: Fabrication



LOD 500: As-built

COLALBORATION USING BIM

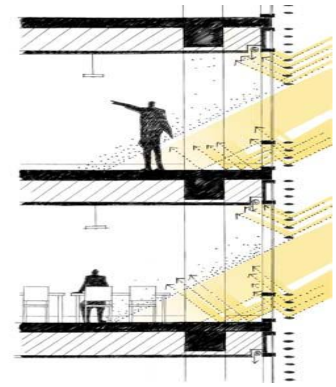
BIM Usage Spectrum by Project Delivery Method



Currently there are four project delivery methods in which BIM can be used. BIM usage and project delivery can be considered a spectrum that ranges from DBB being the least optimal to IPD which represents the most optimal usage of BIM with design build and CM at Risk being in the middle of both extremes.

While BIM processes and tools can be used in each project delivery method, when and how BIM is used and to what degree it affects the streamlining of the project process varies significantly. Project delivery method, contractual requirements, and a project team's BIM capabilities will determine the amount and nature of collaboration between the designer and contractor. The true integration occurs when: (1) contractors can start a construction model during the design phase (2) key design decisions, based on rich data, are made early in the design process and (3) schedule is compressed due to a non-linear process.

Design Intent Models vs. Construction/Fabrication Models



The factors that separate a design intent model from one that is construction fabrication level are:

- Level of Detail
- From Generic Objects to well-defined objects
- Scale

Importance of a BIM Management Plan

Successful use of BIM on this project requires a strong framework and management plan that aligns roles, responsibilities, expectations, and deliverables. A well- developed plan that involves the owner, builder, architect, engineering consultants, trade contractors, fabricators and material vendors ensures that the detail and scope of the information can be shared and incorporate the relevant business processes and technology. The BIM Execution Plan will promote communication, collaboration and will help project team members focus on owner's business drivers and related project goals.

Model Execution Plan

Minimum Modeling Matrix (M3)
US Army Corps of Engineers
Document Release: 20120913

							DESIGN MODEL (CONSTRUCTION DOCUMENTS)	RECORD MODEL (AS-BUILTS)	FOR AGENCY OR CONTRACTOR INTERNAL USE. NOT A CONTRACTUAL REQUIREMENT.	
Level	Element ID	OmniClass ID	UniFormat ID	MasterFormat ID	Included in Facility or Site? (change to NO if NOT part of project scope)	LOD	GRADE (CD)	GRADE (AB)	Primary Discipline (This will allow design team to identify discipline specific areas of content)	Notes
Level 1	SUBSTRUCTURE	21-01 00 00	A		Yes	•	•	•	Structural	
Level 2	Foundations	21-01 10	A10		Yes	•	•	•	Structural	
Level 3	Standard Foundations	21-01 10	A1010		Yes	•	•	•	Structural	
Level 4	Wall Foundations	21-01 10 10	A1010.10		Yes	300	A	A+	Structural	
Level 4	Column Foundations	21-01 10 10 10	A1010.30		Yes	300	A	A+	Structural	
Level 4	Standard Foundation Supplementary Components	21-01 10 10 30	A1010.90		Yes	200	C	C+	Structural	
Level 3	Special Foundations	21-01 10 20	A1020	31 60 00	Yes	•	•	•	Structural	
Level 4	Driven Piles	21-01 10 20 10	A1020.10	31 62 00	Yes	300	A	A+	Structural	
Level 4	Bored Piles	21-01 10 20 15	A1020.15	31 63 00	Yes	300	A	A+	Structural	
Level 4	Caissons	21-01 10 20 20	A1020.20	31 64 00	Yes	300	A	A+	Structural	
Level 4	Special Foundation Walls	21-01 10 20 30	A1020.30	31 66 16	Yes	300	A	A+	Structural	
Level 4	Foundation Anchors	21-01 10 20 40	A1020.40	31 68 00	Yes	100	C	C+	Structural	
Level 4	Underpinning	21-01 10 20 50	A1020.50	31 48 00	Yes	100	C	C+	Structural	
Level 4	Raft Foundations	21-01 10 20 60	A1020.60	03 71 00	Yes	300	A	A+	Structural	
Level 4	Pile Caps	21-01 10 20 70	A1020.70		Yes	300	A	A+	Structural	
Level 4	Grade Beams	21-01 10 20 80	A1020.80		Yes	300	A	A+	Structural	
Level 2	Subgrade Enclosures	21-01 20	A20		Yes	•	•	•	Architectural, Structural	
Level 3	Walls for Subgrade Enclosures	21-01 20 10	A2010		Yes	•	•	•	Architectural, Structural	
Level 4	Subgrade Enclosure Wall Construction	21-01 20 10 10	A2010.10		Yes	300	A	A+	Architectural, Structural	
Level 4	Subgrade Enclosure Wall Interior Skin	21-01 20 10 20	A2010.20		Yes	300	A	A+	Architectural	
Level 4	Subgrade Enclosure Wall Supplementary Components	21-01 20 10 90	A2010.90		Yes	200	C	C+	Architectural, Structural	
Level 2	Slabs on Grade	21-01 40	A40		Yes	•	•	•	Structural	
Level 3	Standard Slabs-on-Grade	21-01 40 10	A4010		Yes	300	A	A+	Structural	
Level 3	Structural Slabs-on-Grade	21-01 40 20	A4020		Yes	300	A	A+	Structural	
Level 3	Slab Trenches	21-01 40 30	A4030		Yes	300	A	A+	Architectural, Structural	

The BIM Project Model Execution Plan defines uses for BIM on the project (e.g., design authoring, cost estimating, and design coordination), along with a detailed design of the process for executing BIM throughout the project lifecycle. The BIM Project Execution Plan is a living document and shall be updated and refined as required throughout the project.

Our experience has shown us that it is critical that models are created with the end in mind. Our model will be used by the facility management team long after the initial construction is complete. It is critical to establish standards for the modeling process as soon as possible to avoid the need to "remodel" the model. With these standards, a high level of interoperability can occur.

Leverage Revit Family Templates

Best practices in model management includes configuring a Revit template in accordance with the BIM Execution Plan. Family templates also allow for a more streamlined QA/QC process and tighter integration with downstream 4D and 5D processes.

Plan Contents

The Model Execution Plan should address the following:

1. Project Initiation
    a. Project Goals & Description
    b. Core Collaboration Team
    c. Collaborative Process Mapping
    d. Value Steam Mapping
    e. Project Modeling Milestones and Schedule
2. Modeling Plan
    a. Planned Models (e.g., Architectural, structural, mechanical, etc.)
    b. Modeling Standards
    c. Precision & Dimensioning
    d. Modeling Object Properties
    e. Modeling Level of Detail
    f. System of Measurement
    g. Space Object Identification (intelligent volumes)
3. Analysis Models
    a. Quantity Takeoff (5D)
    b. Scheduling (4D)
        i. Phasing
        ii. Macro Level Sequencing
        iii. Micro Level Sequencing
    c. Clash Detection
    d. MEP Coordination
    e. Visualization (including augmented and virtual reality)
    f. Constructability
    g. Energy Analysis
    h. Structural Analysis

4. Staffing Plan
    a. Organizational Structure
    b. Personnel Skills
    c. Staff Acquisition
    d. Training Requirements
    e. New Project Team Member on Boarding Process
5. Systems Implementation
    a. Client Server-based
    b. Cloud-based
6. Document Management
    a. Permissions and Access
    b. Folder Maintenance
    c. Folder Notifications
    d. File Naming Convention
7. Software Application Selection
8. Infrastructure Requirements
9. Hardware Requirements

Minimum Modeling Matrix

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2							Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Not in Model	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Dimensional Takeo	Count	Dimensional Takeo	Dimensional Takeo	Count	Dimensional Takeo
3							O	O	O	O	O	O	O	O	O	O	O	O	O	S	S	S	S	S	A	A	A	A	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A
4						**Constrained by**	Code/Covenance Requirements	Business Plan	Site Selection	Survey E. C Natural & Manmaid	Program	Performance Spec	Design Concept	System Capacity Requirements	Budget Cost & Schedule	Proforma	Arrange Financing	Preliminary Zoning Review	Land Acquisition	Foundation Bearing Elements	Caissons and Piles	Slab on Grade	Foundation Walls	Pads Pits & Trenches	Dock Pits	Floor Plates Definition	Floor to Floor Height Definition	Concept Elevation Design	Primary Structural Framing	Miscellaneous Framing - Arch	Miscellaneous Framing - Mech	Floor Decks	Roof Decks	Exterior Walls	Windows, Glass & Glazing	Exterior Doors	Flat Roofing	Sloped Roofing	Skylights	Interior Walls	Interior Doors	Interior Specialties	Interior Stairs
5					**Design & Engineer**		A0100	A0101	A0102	A0103	A0104	A0105	A0106	A0107	A0108	A0109	A0110	A0111	A0112	A1010	A1020	A1030	A2020	A4010	A4020	B0101	B0102	B0103	B1010	B1010	B1010	B1020	B1030	B2010	B2020	B2030	B3010	B3020	B3030	C1010	C1020	C1030	C2010
6	$0.00	1	Not in Model	O	Code/Covenance Requirements	A0100																																					
7	$0.00	2	Not in Model	O	Business Plan	A0101																																					
8	$0.00	3	Not in Model	O	Site Selection	A0102	X																																				
9	$0.00	4	Not in Model	O	Survey E.C Natural & Manmaid	A0103			X																																		
10	$0.00	5	Not in Model	O	Program	A0104	X																																				
11	$0.00	6	Not in Model	O	Performance Spec	A0105					X																																
12	$0.00	7	Not in Model	O	Design Concept	A0106	X		X	X	X																																
13	$0.00	8	Not in Model	O	System Capacity Requirements	A0107	X	X			X	X	X																														

Change Management

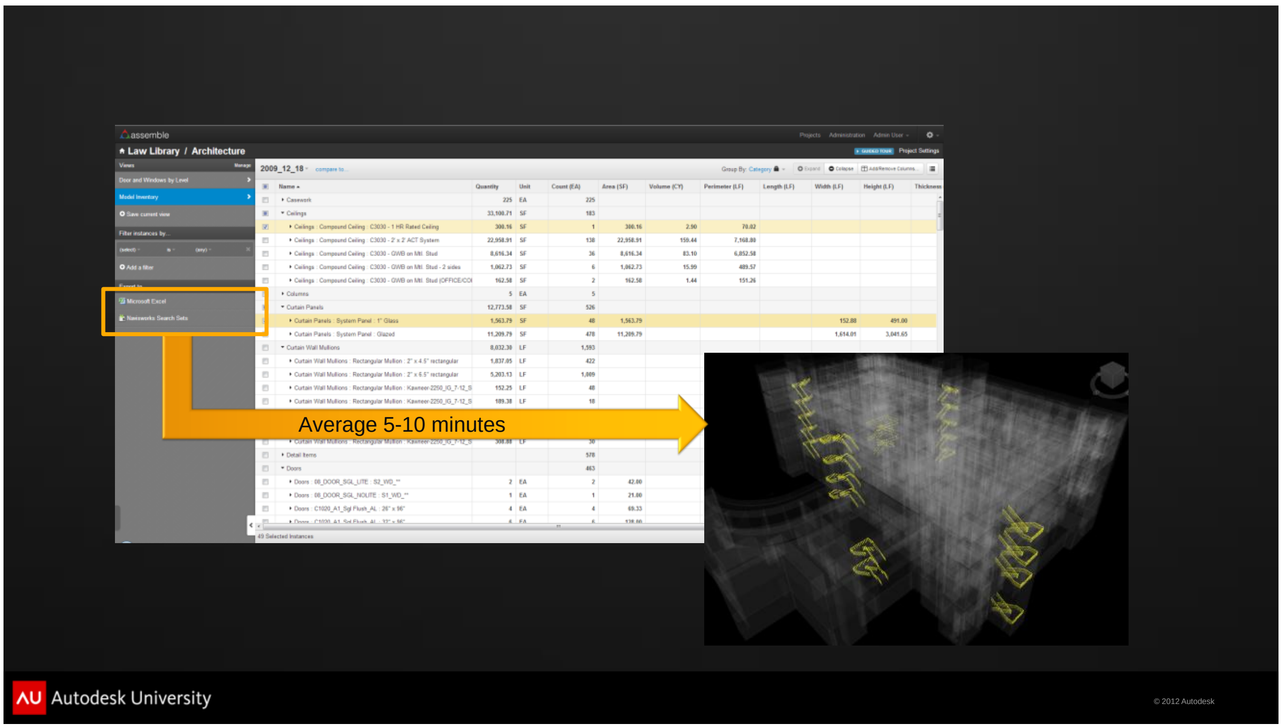
Sometimes modeling too early creates wasted effort. Dealing with change is inevitable in every design and construction project; the way you anticipate change is crucial. Modeling work can delayed while waiting for change to be communicated. The information derived from the change in the model can help identify what the impacts of the change could be.

We manage model change by using a Design Constraints Matrix in conjunction with a 3D model data extraction software such as Assemble Systems. This matrix further describes key elements of the BIM Execution Plan in terms of what to model, when, by whom, and what level of detail and what the impact to the modeling schedule would be in the case of major changes. Assemble Systems allows for distillation of the model into a tabular format, giving instantaneous variance reports between updated version of the models. As this software is cloud-based, all project team members will have access to run their own model variances, further enabling a proactive approach to model quality assurance and control.

The matrix creates a modeling scheme and sequence for logical and efficient modeling and management of the design process. Use of the matrix provides a methodology by which project stakeholders make sound design decisions. For example, the matrix would inform MEP systems modelers to delay modeling until both the architectural floor plan and reflected ceiling plan and structural system geometry is “locked in”. Another example would include not modeling casework until all light fixtures and electrical devices have been identified.

REVIT DATA EXTRACTION-POWERED BY ASSEMBLE

Leveraging Model Inventories

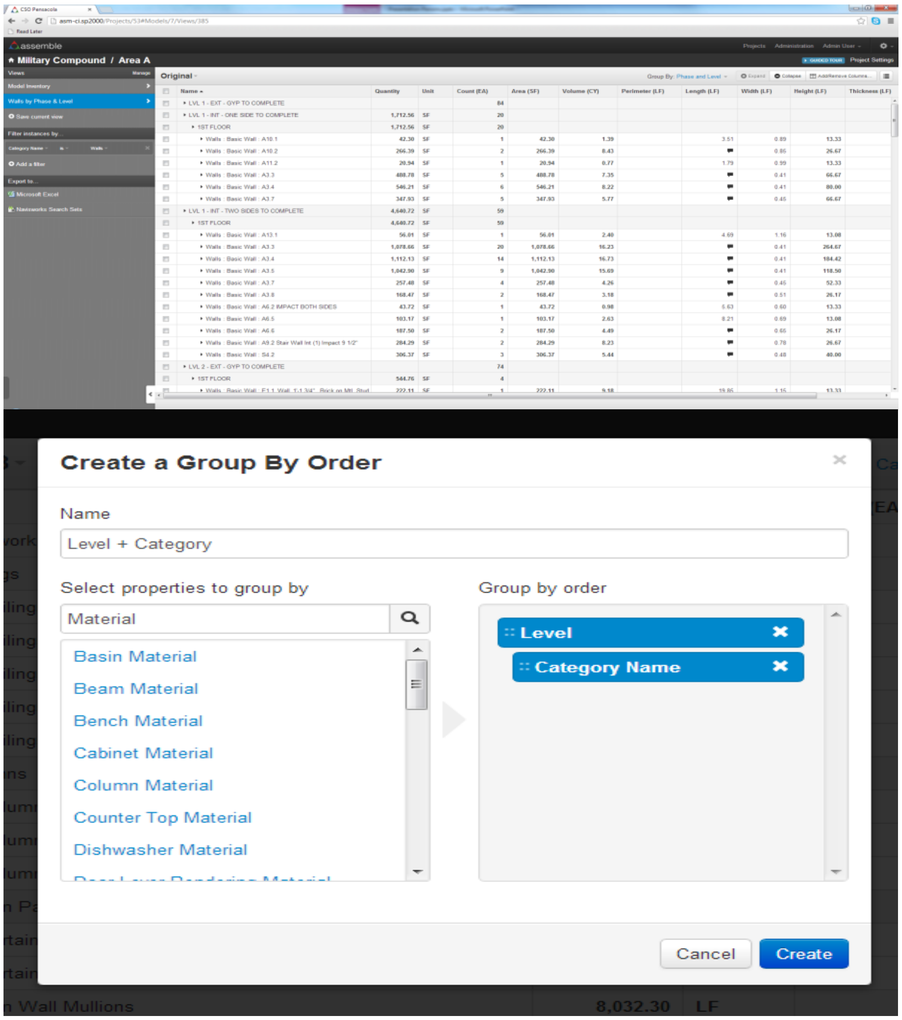


Components can be quickly isolated into specific studies or complete model takeoffs can be compiled. Navisworks Search Sets are created representing each item in the model for easy visualization.

Publishing Models and Revisions

The time it takes to open a Revit model and publish it in Assemble is about 10 minutes.

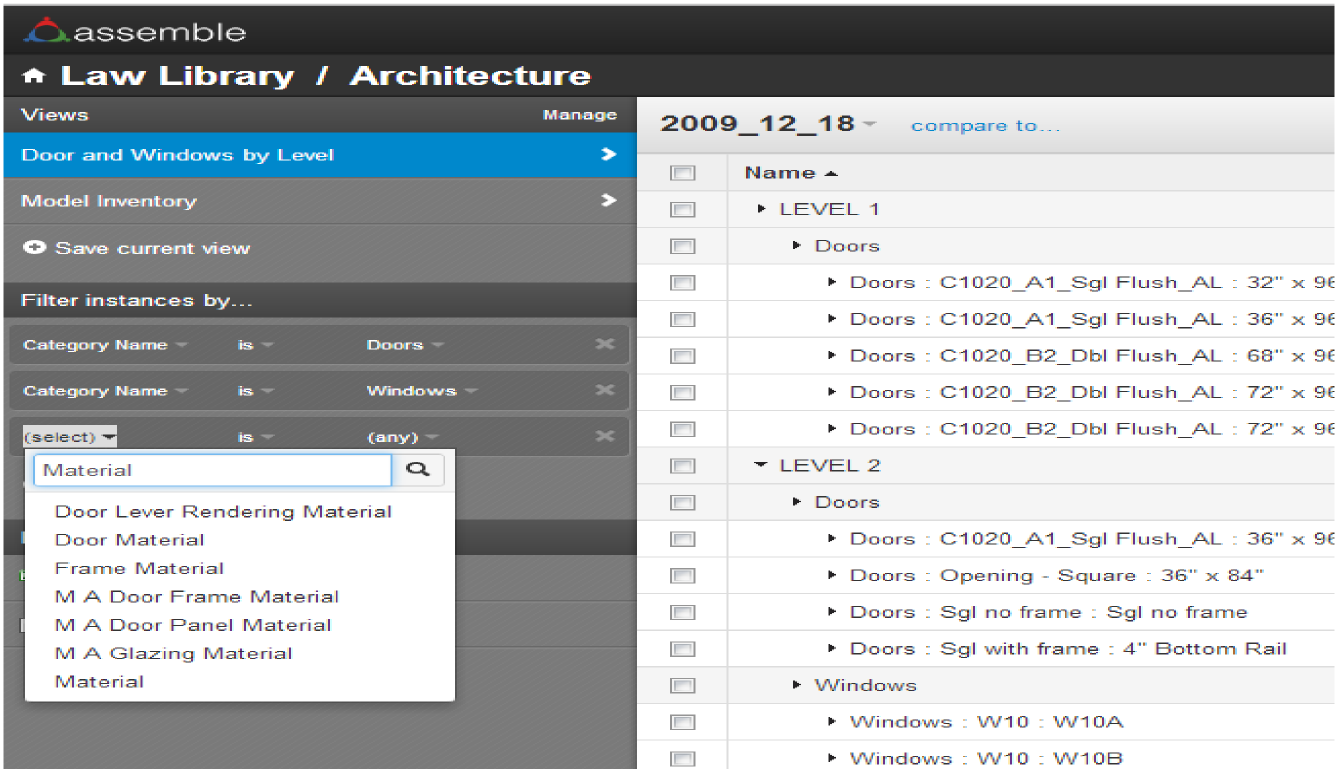
Making Sense of your Building Information



Having a logical and organized method to quickly give you an understanding of your model is the key to productivity and gives immediate feedback to the design team. Revit properties whether they are built-in or user defined can be easily grouped. Examples of groupings includes:

- Level and category
- Room and space
- MEP system type
- Work Breakdown Structure
    - Assembly code
    - Keynote
    - Omniclass

Using Smart Filters



Use of smart filters helps users focus their efforts and promotes collaboration in the following ways:

- Focus on specific studies of your project
- Filter on any property, including Quantities and text
- Create custom views you can reference for future revisions
- Quality check of models
- Create custom reports that can be shared with project stakeholders
- Produce search sets that simplify clash detection and coordination

Visually Comparing Model Versions

Overlaying Versions to Reveal Changes

Benefits of Rapid Data Extraction

Working with the Revit API

Working with Revit API maybe easy to learn but can be difficult to master. In general there is not a lot of documentation regarding Revit APIs. Making matters more complex is that there is virtually no documentation for what parameters exist for each category and that there is a myriad of project units. Managing this type of data is challenging and time consuming. Assemble's approach is comprehensive and includes built-in parameters and user-defined parameters which can promote efficiency in data management.

Organizing your Building Information

- By Level
- By Room & Space
- By Classification System
    - Assembly Code, Keynote, Omniclass

How Smart Filters can Help

Level of Detail in Extraction

Taking Advantage of Revit Shared Parameters

- Naming Conventions
    - Used for QA\QC
- Classification Systems
    - Used for Cost and Schedule
    - UniFormat (Assembly Code)
    - MasterFormat (Keynote)
    - Omniclass
- Scheduling
    - Activity Codes
    - Actual Start

   - Actual Complete

Common Gotchas

- Parameters with the same name
- Duplicate categories (ex. Structural Trusses)
- Different data types for same parameter name

DOWNSTREAM USES

Model QA/QC

Clash Detection, Constructability and Coordination

BIM and Scenario Based Planning Validation

BIM gives planner and project team leaders the ability to take data from their business plans and simulate them to validate their accuracy and to study the effects of decisions well before programs are finalized and design starts.

BIM allows you to have a validation process that focus on the most critical items of your early decision making process and to have the confidence to further develop those critical decisions.

Finish Jernigan points out in *Big BIM Little BIM* that there are eight areas of validation that “align concept, scope and budget”. Those eight areas are:

- Needs analysis-understanding the client’s physical and underlying issues
- Program analysis-clients requirements are structured and relationships are established and where concepts are first developed for possible solutions
- Digital concept prototype-high level concept model and a platform for studying and testing assumptions
- Cost model-financial tools that helps owner’s understand cost constraints and is based on quantities extracted from the concept prototype model. Place holder costs for all anticipated costs (in the estimating world building type templates)

- Design criteria-process of documenting that project's strategic decisoins and the assumptions that drive costing. 3D parametric technology allow you to run tests and analyze the model.
- Comparables-evaluate the project based on standards
- Pro forma-can provide campus leaders with the data to explore options for alternate approaches, reductions and additions.
- Validate plan-the final product is a validated program that guides the next steps in a project and becomes the statement of owner requirements to guide the design architect or design/builder.
- Jernigan goes on to state that the validation process 'identifies the strategies for successfully designing, constructing and managing your facility, project or process".

Lean Process/Digital Fabrication

Lean is a complex topic but for the purpose of this paper we can consider lean to be a way of thinking that emphasizes the elimination of waste and bringing value to an owner.

While prefabrication and modularization is actually an ancient practice. According to a recent McGraw-Hill Smart Market Report "the reemergence of prefab and modular as a new trend is tied to the rise of BIM and green building. BIM is enabling the use of model-driven prefabrication.

Prebabrication and modular construction have the ability to greatly improve productivity, improve quality, reduce cost and shorten construction in the delivery of a building.

Digital pre-fabrication requires up front planning and uses the data contained in 3D models; much of what will be fabricated on this project will be "one-of-a-kind". The collaborative process will ensure that the deep knowledge and associated efficiencies of the fabricator are embedded into the design. 3D parametric modeling and collaborative processes will allow this project to accurately produce key components off-site, such as structural steel, partition walls, exterior paneling, curtain walls and MEP systems.

Analysis

Use of a 3D, object-oriented, parametric model allows it to be paired with analysis (e.g., structural, energy, acoustical, etc.) software tools for greater opportunity to assess building performance.

Architectural design and delivery of high-performance workplaces requires quantitative building data and analysis. Rather than applying a traditional rules-of-thumb approach, BIM analysis allows project stakeholders to understand and predict various aspects of a building through the following types of analysis:

- Structural
- Energy
- Water
- Lighting (natural and artificial)
- Schedule
- Acoustical
- Hydrology
- Thermal (façade engineering)
- Cost
- Fluid Dynamics
- Wind loading and infiltration
- Site orientation
- Construction methods

Advanced Visualization

3D design visualization utilizing photo-realistic and animation technology communicates a better understanding of a building and lends the ability to quickly communicate various design features such as material finishes, spatial relationships, texture, reflectance, etc. Use of virtual and augmented reality gives end users, who may not be well-versed in architectural design, an understanding of their new workplace environment much quicker than traditional 2D drawings and hand rendered drawings. This technology will guide end users in resolving workplace design issues that could impact productivity or future adaptability of the workspace.

5D Estimating

4D Sequencing

Historical Trend Analysis

BIM Field Operations Technology

BIM-related technology for construction operations is transforming building with new efficiencies. These tools have the ability to take 3D model data and push them out to the field on mobile devices, surveying hardware, or heavy operating equipment.