IT in Construction

Lecture #8

Building Information Modeling

Level of Development

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**Construction Engineering and Management**

Outline

- BIM Level of Development (LOD)

- Plan for LOD

- BIM Data Model

- Construction Classification Systems and BIM

- COBie

BIM Level of Development (LOD)

Level of Detail

- LOD definition has evolved over the years!

- In BIM terminology LOD first represented "Level of geometry Detail" of BIM models
    - LOD 100
    - LOD 200
    - LOD 300
    - LOD 350 (Only in BIMForum definition)
    - LOD 400
    - LOD 500 (Only in AIA definition)
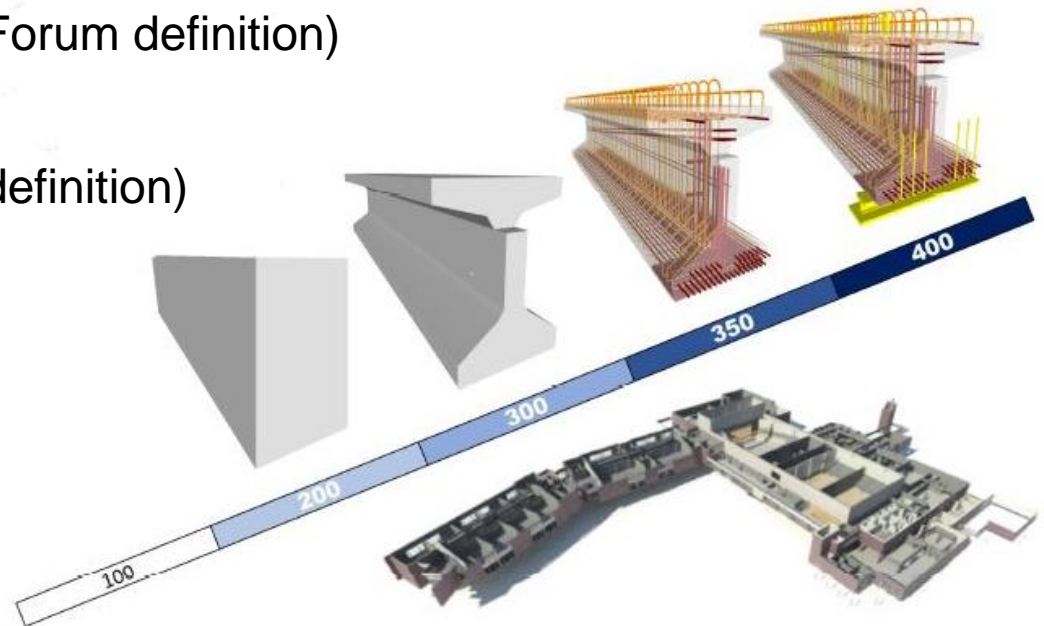
Example: Precast Inverted t-beam
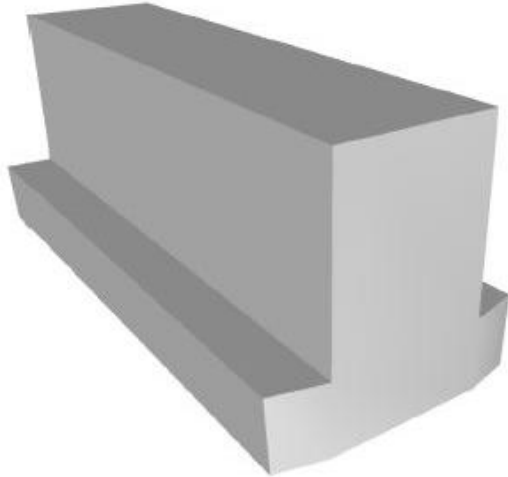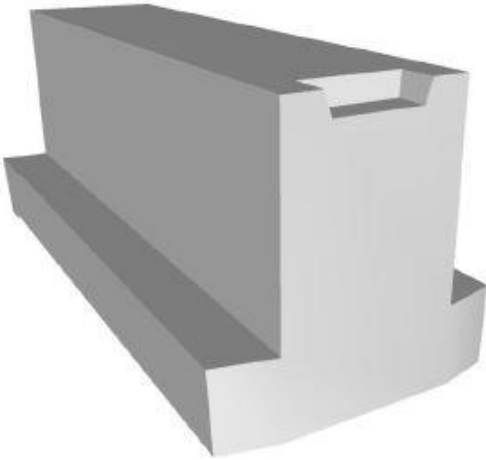
B10   **21-02 10**   **Superstructure**
Associated Masterformat Sections: 01 83 13

| 100 | Assumptions for structural framing are included in other modeled elements such as an architectural floor element that contains a layer for assumed structural framing depth; or, schematic structural elements that are not distinguishable by type or material.

Assembly depth/thickness or component size and locations still flexible. | |

| 200 | Element modeling to include:

• Type of structural concrete system
• Approximate geometry (e.g. depth) of structural elements |
19 B1010.10-LOD 200 Precast Structural Inverted T Beam (Concrete) |

Example: Precast Inverted t-beam

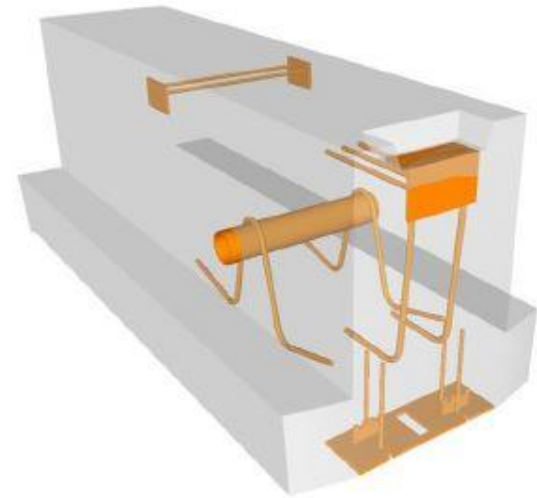| 300 | Element modeling to include:

 • Specific sizes and locations of main concrete structural members modeled per defined structural grid with correct orientation
 • Concrete defined per spec (strength, air entrainment, aggregate size, etc.)
 • All sloping surfaces included in model element with exception of elements affected by manufacturer selection |

 20 B1010.10-LOD 300 Precast Structural Inverted T Beam (Concrete) |

Example: Precast Inverted t-beam

350	Element modeling to include:
	- Reinforcing Post-tension profiles and strand locations - Reinforcement called out, modeled if required by the BIMXP, typically only in congested areas - Pour joints and sequences to help identify reinforcing lap splice locations, scheduling, etc. - Lifting devices - Expansion Joints - Embeds and anchor rods - Post-tension profile and strands modeled if required by the BIMXP - Penetrations for items such as MEP - Any permanent forming or shoring components

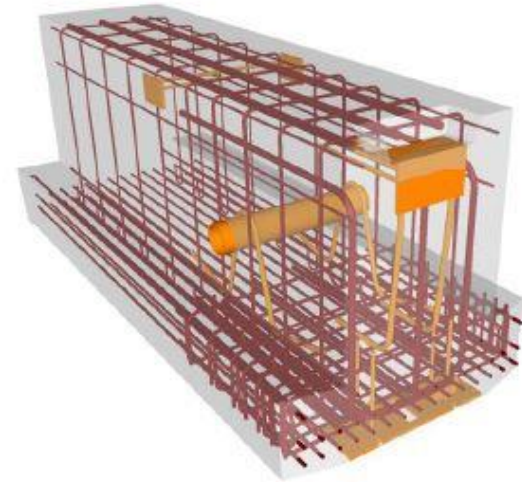21 B1010.10-LOD 350 Precast Structural Inverted T Beam (Concrete)

Example: Precast inverted t-beam

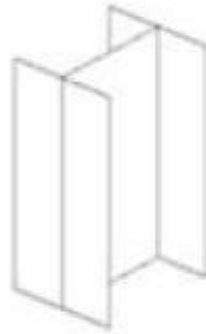| 400	Element modeling to include:	
	• All reinforcement including post tension elements detailed and modeled • Finishes, chamfer, etc.	 *22 B1010.10-LOD 400 Precast Structural Inverted T Beam (Concrete)*

Example : Steel Column Section

LOD 100 – Conceptual mass

LOD 200 – Preliminary Universal Column (UC) steel section

LOD 300 – Detailed 150UC37.2 steel section

LOD 400 – Construction details, including connection information

US (AIA) LOD convention shown with approximate graphic representation

Level of Detail

- Gradually the reliability of the developed BIM models was also considered as a complementary factor to the level of geometry detail:

Concept	DD	CD	Tender	Construction	Operation
LOD 300	LOD 100	LOD 200	LOD 300	LOD 400	LOD 300
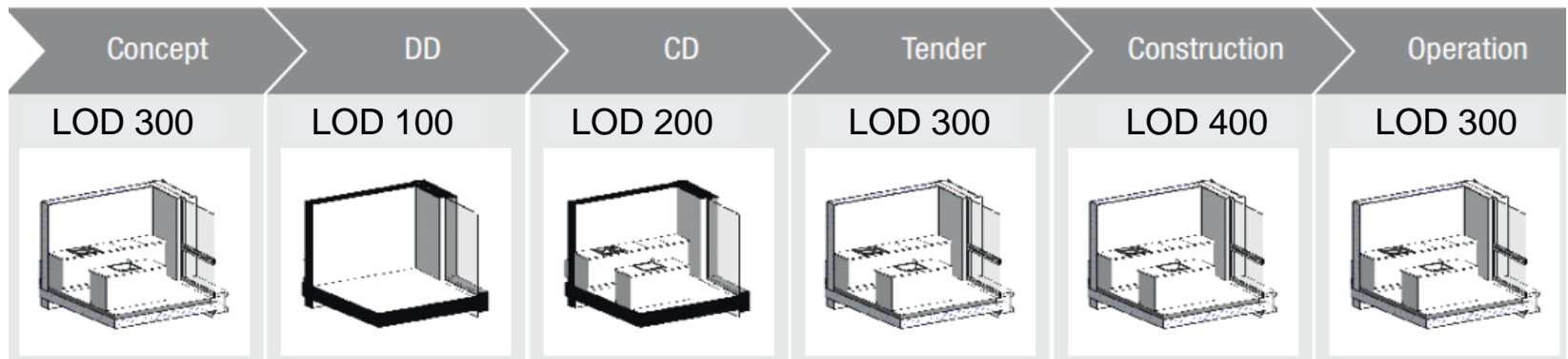
- We may increase the geometry details of BIM models in the Concept design. However, the incorporated details are used to convey the notion of the to be built facility and are not reliable!!

- We might need low level of geometry detail during operation phase. However, the model can reliably represent the built facility!!

- With this approach, LOD term was redirected to "level of development" instead of "level of detail"

Level of Development

- Level of development (LOD) itself is a concept with varying definitions over time.

- A core definition can be: LOD defines the geometric information, structured data and linked documentation as well as reliability of BIM elements.

- Not necessarily a BIM model needs further detailed as a construction project proceeds from initial to the later stages!

    - We might need to represent a concept model in a high detail to properly convey the notion of different project elements to the stakeholders. However, during the operation stage there might not be need for high geometry details

Level of Development

- It should be noted that all model components are not equally detailed in different construction project stages

  - We might need to include a high geometry detail in the structural connections while a low geometry detail is added to the main body of structural elements during the construction phase!

  - The required geometry details of the as built models of the structural elements might be low. However, at the time a high geometry details might be needed for different utility systems!

- Here, the reliability represents the extent that the model users can trust the accuracy and quality of that content.

- Expectedly, the model's LOD increases as the project advances from early design stages to the later stages in the later stages of the construction and operation phases!

Embedded Content in BIM Models

(Baldwin, 2019)

- LOD definition was primarily geared towards defining object geometry focusing on the 3D aspect of the modeling.

- Advanced applications of BIM, however, are achievable through information contents embedded in the model components!

- Consequently, over the years information contents have gained significant attention.

- This has raised the need for precise planning for the information content independent from the geometric representation.

LOG and LOI

□ LOG (Level of Geometry) describes the level of geometric detail of a model element.

□ LOI (Level of Information) describes the level of non-geometric content (metadata) of a model element.
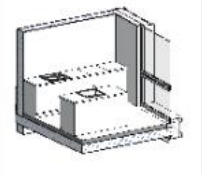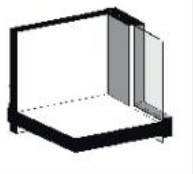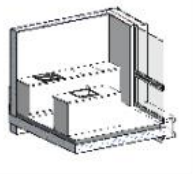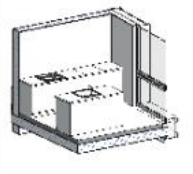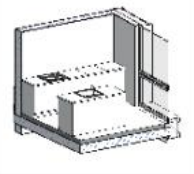
LOD, LOG and LOI

(Baldwin, 2019)

- Every construction project needs a set of supporting information.

- The BIM model plays a central role in the information management and communication tool over the lifecycle of construction projects.

- Here, proper design of the model element properties (or parameters) is quite essential,

- These properties are used for storing and using information required over the course of the project lifecycle,

- Level of detail and accuracy of project information (namely level of information of LOI) evolves as a project advances over time,

LOG and LOI

(Baldwin, 2019)

		Concept	DD	CD	Tender	Construction	Operation
Geometrie		LoG 300	LoG 100	LoG 200	LoG 300	LoG 400	LoG 300
		LoI	LoI	LoI	LoI	LoI	LoI
Information	Description	external wall	external wall	external wall	external wall	external wall	external wall
	Thickness	–	26 cm	26 cm	26 cm	26 cm	26 cm
	Length	–	–	360 cm	360 cm	360 cm	360 cm
	Height	–	–	280 cm	280 cm	280 cm	280 cm
	Material	–	Brick with external insulation	Brick with external insulation	Brick with external insulation	Brick with external insulation	Brick with external insulation
	Manufacturer	–	–	–	Swisspor	Swisspor	Swisspor
	Type	–	–	–	–	LAMBDA Vento	LAMBDA Vento
	Cost / qm	–	€ 80,00	€ 80,00	€ 85,50	€ 88,75	€ 88,75

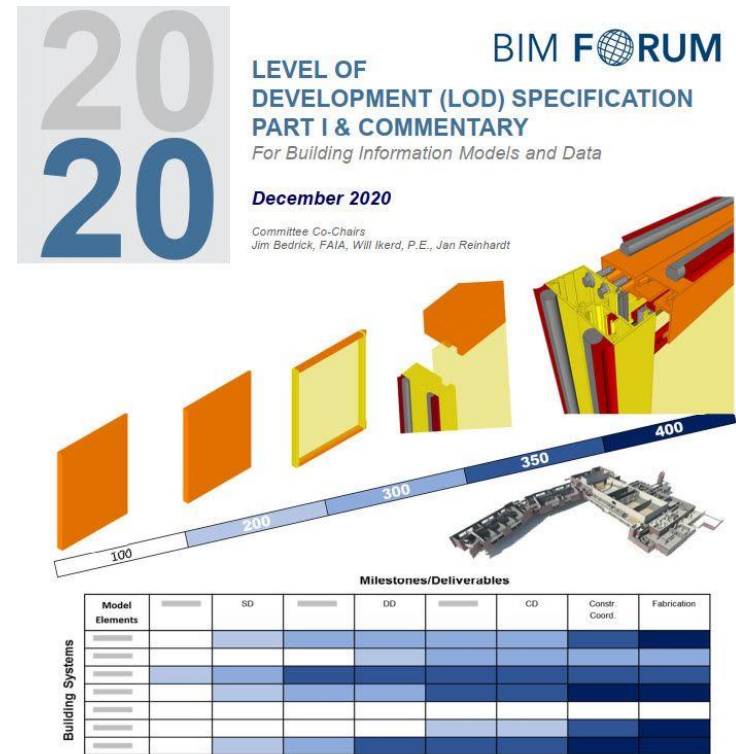**LOG vs LOI evolution during the project lifecycle**

LOD, LOG and LOI

☐ New definition for LOD (Level of Development): LOD describes the overall concept encompassing both the geometry detail (LOG) and the content (LOI) of BIM model!

LOD = LOG + LOI

LOD Guide

□ BIMForum in the US has provided an expanded guide to the AIA LOD definition.
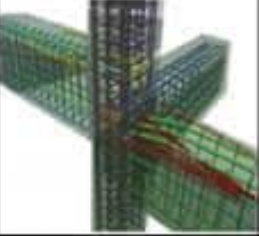
LOD Guide

□ The LOD specification provides guidance documentation, worksheets as well as model element examples, showing geometric representations for progressive LOD designation from level 100 to 500.

- □ LOD 100 - Concept Design

- □ LOD 200 - Schematic Design

- □ LOD 300 - Detailed Design

- □ LOD 350 - Construction Documentation

- □ LOD 400 - Fabrication & Assembly

- □ LOD 500 - As-Built

LOD Guide

Element-Oriented Modeling	As-Built	LOD 500	
	Fabrication and Asembly	LOD 400	
System \ Component Oriented Modeling	Detailed Design	LOD 300	
	Basic Design	LOD 200	
Conceptual Information Model	Conceptual Design	LOD 100	
	Client Requirements	Pre-Modeling	

Plan for LOD

LOD Cost

□ Higher level of LOD → Higher level of effort → Higher cost
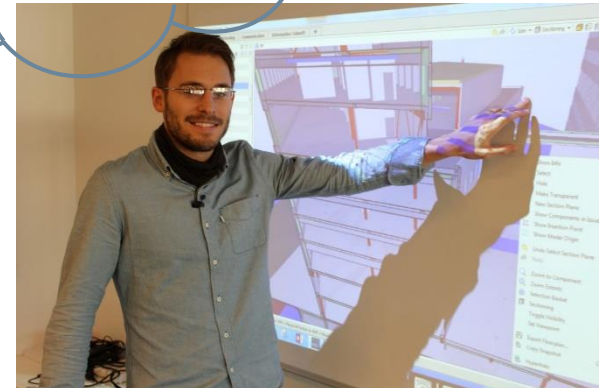
Plan Proper LOD

- Have a plan on how to approach to LOD of different model objects!

    - What is proper LOD for in different phases:

        - Conceptual Design

        - Detailed Design

        - Energy Analysis of the Building

        - Building Construction

        - Project delivery

        - Building Maintenance

    - What am I going to do with the windows, walls, joints, column, façade, cords, and pipes?

Proper LOD and BIM Application

- Selected BIM application also has a major impact on the adopted LOD:

    - I need the quantity takeoff application of BIM, What LOD is required during the detailed design phase of the building's structure (concrete)?

    - I already know the material quantity and do not need the quantity takeoff application of BIM, What LOD is required during the detailed design phase of the building's structure (concrete)?

    - I need to simulate the energy of the building. Does it have any impact on the required LOD of the building during the conceptual and detailed design of the building?

- Use sample worksheets provided by <u>BIMForum Guide</u> in your plan,

Sample LOD Plan

Sample LOD Plan

	A	B	C	D	E	F		I	K	L	M	N	O	P	Q	R	S	T	U	V	W
1						**Milestones/Deliverables**															
2	**UniFormat Level**									**Date**			**Date**			**Date**			**Date**		
3						**Building Systems**				**Conceptual**			**SD**						**DD**		
4	1	2									**50%**			**100%**			**50%**				
5							Level	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LOD	MEA	Notes	LO
6	A					Substructure	1														
7	A	10				Foundations	2														
8	A	10	10			Standard Foundations	3														
9	A	10	10	1		Footings & Pile Caps	4														
10	A	10	10	1	10	Strip Footings	5	100	A		200	E		200	E		300	E		3	
11	A	10	10	1	20	Spread Footings	5	100	A		200	E		200	E		300	E		3	
12	A	10	10	1	30	Pile Caps	5	100	A		200	E		200	E		300	E		3	
13	A	10	10	2		Foundation Walls	4														
14	A	10	10	2	10	Foundation Walls – CIP	5	100	A		200	F		200	F		300	F		3	
15	A	10	10	2	20	Foundation Walls – CMU	5	100	A		200	E		200	E		300	E		3	
16	A	10	10	2	30	Foundation Walls – Wood	5	100	A		200	E		200	E		300	E		3	
17	A	10	10	3		Perimeter Drainage	4														
18	A	10	10	3	10	Footing Drains	5	100	A		100	E		200	E		200	E		2	
19	A	10	10	4		Perimeter Insulation	4														
20	A	10	10	4	10	Perimeter Insulation – Rigid	5		A		100	E		100	E		100	E		10	
21	A	10	20			Special Foundations	3														
22	A	10	20	1		Pile Foundations	4														
23	A	10	20	1	10	Piles – CIP	5	100	A		200	E		200	E		300	E		3	
24	A	10	20	1	20	Piles – Precast Concrete	5	100	A		200	E		200	E		300	E		3	
25	A	10	20	1	30	Piles – Steel Pipe	5	100	A		200	E		200	E		300	E		3	
26	A	10	20	1	40	Piles – Steel H	5	100	A		200	E		200	E		300	E		3	
27	A	10	20	1	50	Piles – Step Tapered	5	100	A		200	E		200	E		300	E		3	
28	A	10	20	1	60	Piles – Treated Wood	5	100	A		200	E		200	E		300	E		3	
29	A	10	20	2		Grade Beams	4														
30	A	10	20	2	10	Grade Beams – CIP	5	100	A		200	E		200	E			E		3	
31	A	10	20	3		Caissons	4														
32	A	10	20	3	10	Caissons – Bell	5	100	A		200	E		200	E		300	E		3	
33	A	10	20	4		Underpinning	4	100	A		100	E		100	E		200	E		3	
34	A	10	20	5		Dewatering	4	100	A		100	E		100	E		200	E		2	
35	A	10	20	6		Raft Foundations	4	100	A		200	E		200	E		300	E		3	
36	A	10	20	7		Pressure Injected Grouting	4														
37	A	10	20	7	10	Pressure Injected Footings	5	N/M			N/M			100	E		100	E		10	
38	A	10	20	8		Other Special Foundation Conditions	4	N/M			N/M			100	E		100	E		10	

BIM Data Model

BIM Components New Data Flow Media

☐ BIM follows an object oriented approach for modeling building components!

☐ As a result BIM components have parameters and properties to store information over the course of project!

☐ BIM models can be assumed as new media for the data flow in construction projects.

☐ BIM models can create a collaborative environment where different stakeholders share and receive information.

BIM Components New Data Flow Media

□ Every construction project needs a set of supporting information.

□ BIM models can play a central role in the information management and communication tool over the lifecycle of construction projects.

□ Here, proper design of the model element parameters and properties is quite essential,

□ These parameters and properties are used for storing and using information required over the project lifecycle,

Example: Revit Project Parameters
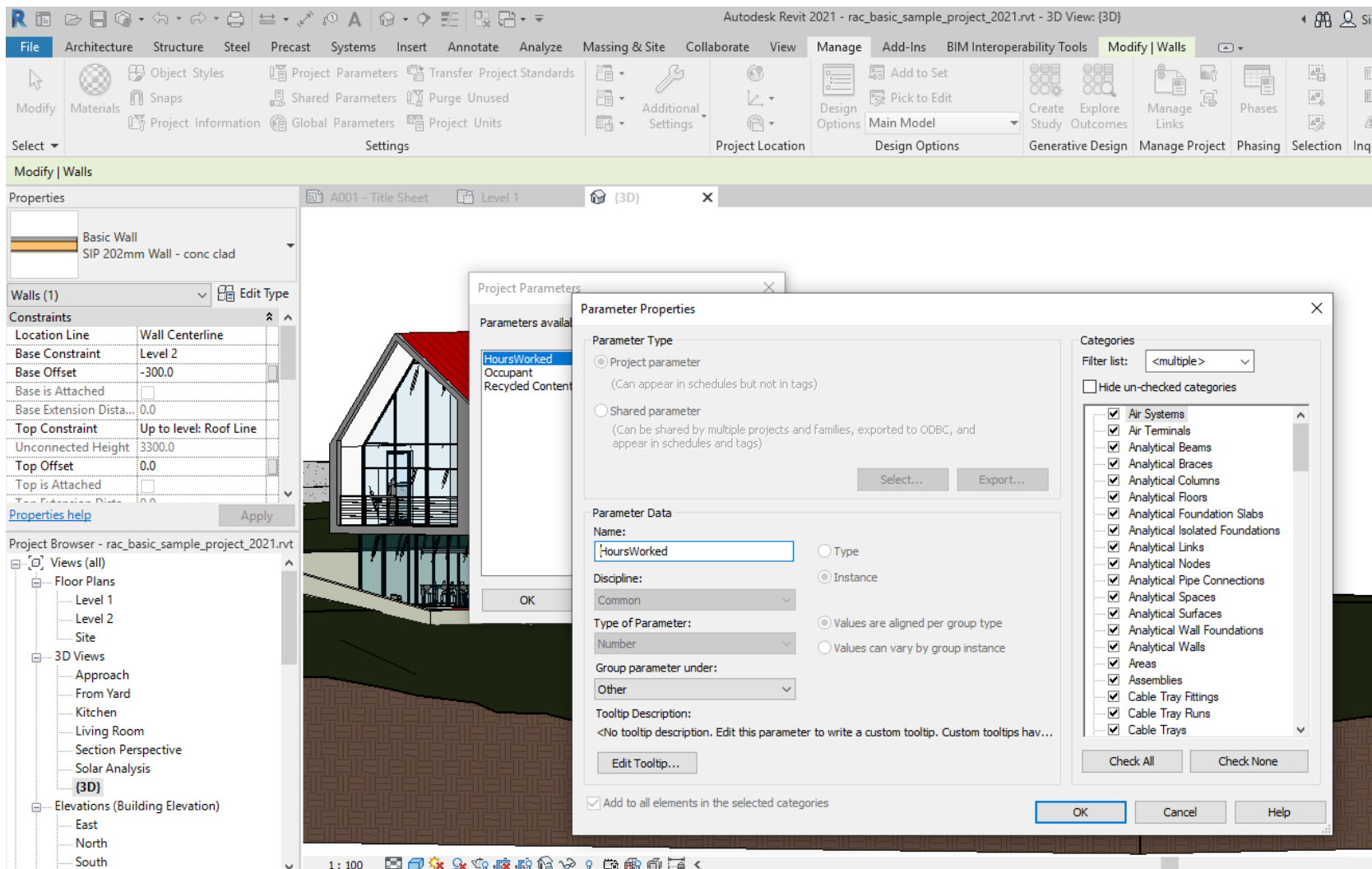
Example: Revit Project Parameters
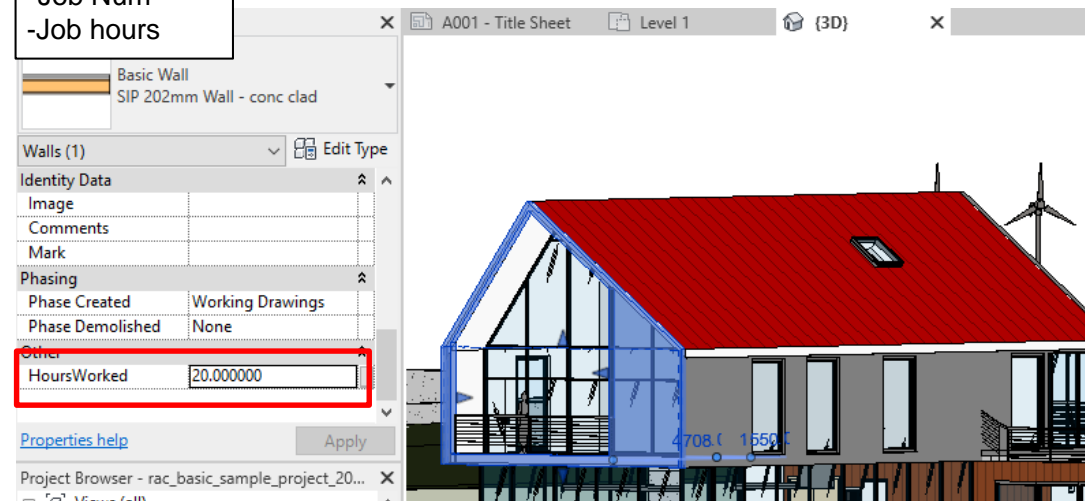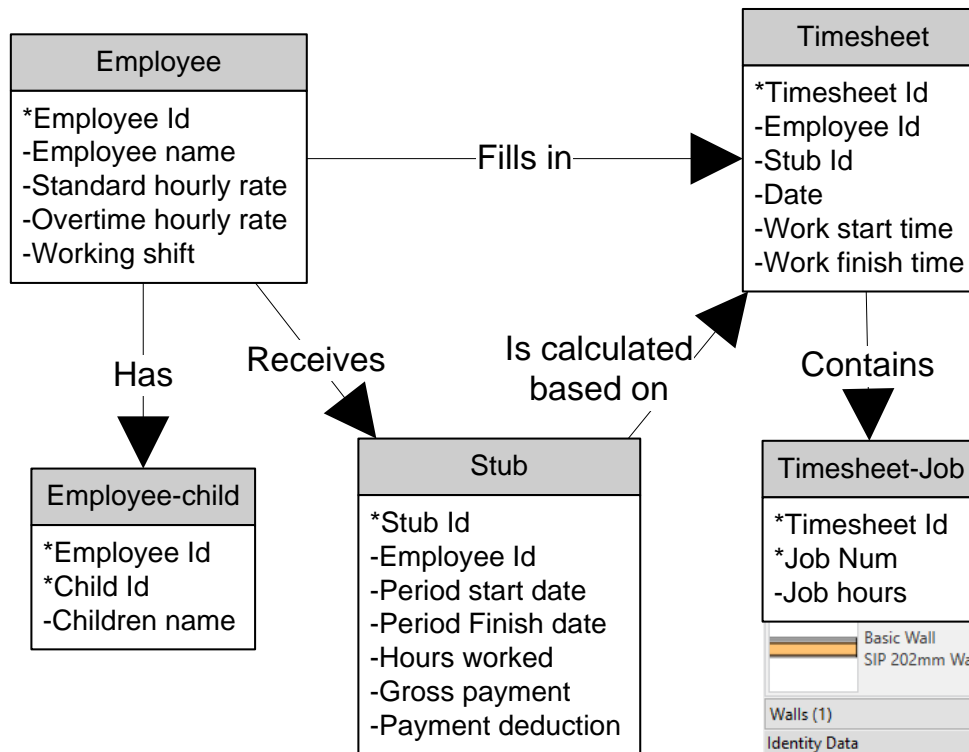
Example: Revit Project Parameters

A001 - Title Sheet	{3D}	Wall Schedule ✕		

<Wall Schedule>

A	B	C	D	E
Type	Classification.Omni	Description	Area	HoursWorked
SIP 202mm Wall - conc clad	21-02 20 10 20	Structural Insulation Panel Wall with Kiln Dried Timber Panel Rainscreen	31 m²	15
SIP 202mm Wall - conc clad	21-02 20 10 20	Structural Insulation Panel Wall with Kiln Dried Timber Panel Rainscreen	42 m²	30
SIP 202mm Wall - conc clad	21-02 20 10 20	Structural Insulation Panel Wall with Kiln Dried Timber Panel Rainscreen	16 m²	20
Wall - Timber Clad	21-02 20 10 10	Structural Insulation Panel Wall with Kiln Dried Timber Panel Rainscreen	34 m²	17
Grand total			123 m²	82

Project Information Management and BIM

💡 How can we properly design use of BIM capabilities in our project information management system?

☐ We should identify information requirements of stakeholders during different phases of the project,

☐ Follow similar steps discussed for the design and management information systems:

  ▫ System recognition, analysis, design and implementation.

Home assignment

Consider a construction procurement system where the procurement department 1) identifies to be procured items based on project plan, 2) the procurement department then needs to use the BIM model to extract the quantity of the materials to purchase, 3) the procurement department then sends inquiries to the its identified suppliers, 4)receives their quotes, 5) selects its preferred supplier, 6) puts order for the supplier, and 7) arranges the receive of the order to the inventory

P1. Prepare dfd of the abovementioned procurement process (10 mark)

P2. Prepare 3NF ERD for the procurement process (20 mark)

(Use Visio for drawing dfd and ERD!)

P3. Prepare data flow medial analysis (15 mark)

P4. Determine the LOd of the BIM Components! (10 selective architectural, 5 structural, and 5 MEP components) (15 mark)

P5. Identify parameters to be added to the BIM model components! (20 mark)

P6. Explain different steps the BIM components parameters need to be completed! (20 mark)

(**in one week**)

Construction Classification Systems and BIM

The Need for Classifications

- The activities conducted throughout the lifecycle of any facility generate an enormous quantity of data that needs to be managed,
  - i.e., properly stored, retrieved, communicated, and used by all parties involved.
- A built environment consists of many interconnected components in an organized manner.
- Various disciplines contribute to the design, construction and operation of the built environment,
- AEC practitioners from different countries gather together and participate in many construction projects. Example: Iran Mall (Tehran), Mica Mall (Kish), Burj-al-arab (Dubai), ….

The Need for Classifications

☐ We need a shared language throughout the AEC community,

☐ The lack of shared a language is the miscommunication!

Design Engineer is preparing
Revision 2 of Layout drawings

Construction is already underway
as per Revision 1 drawings

Communication gap !
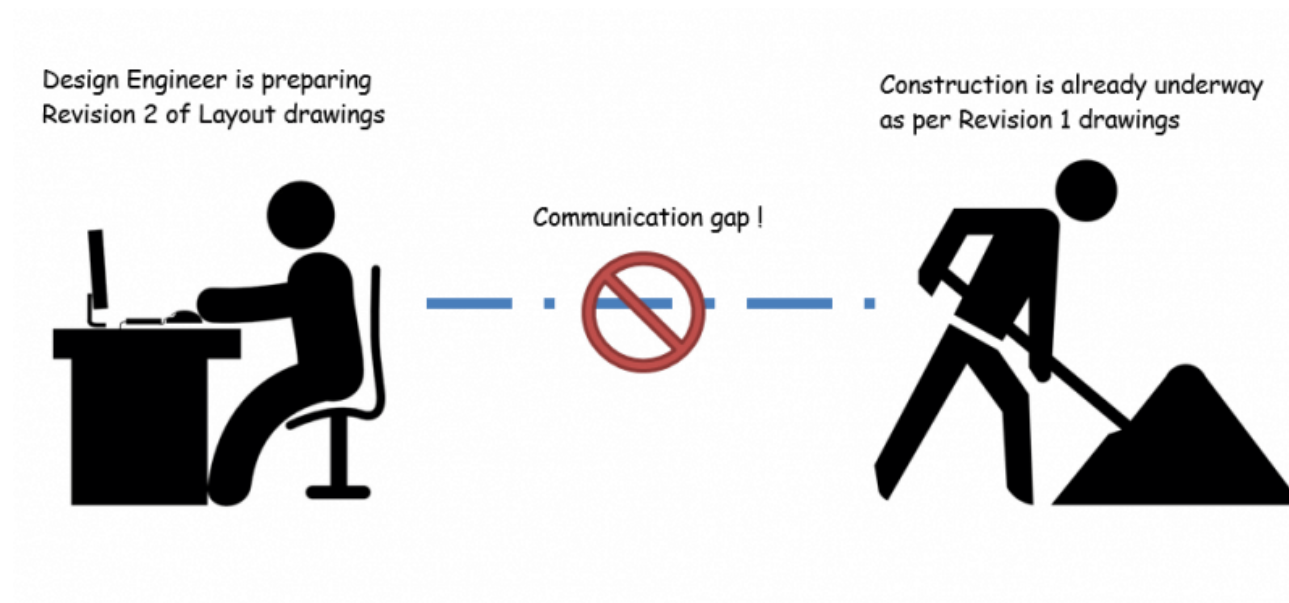
☐ Globally agreed classification is the answer!

Chaos of No Classification: Example

☐ Example: Here are samples of the chaos we observed in a big holding organization with 60 in parallel ongoing construction projects not following an agreed construction classification system:

  ☐ Every contractor prepares its own WBS with its invented/ known terminology

  ☐ Each contractor reports on its own achieved progress

  ☐ Owner's control team tries to adapt itself with 60 different construction organizational cultures and languages

  ☐ The control team can not effectively communicate with most constructors and verify the validity of the progress achieved

  ☐ The result is the daily claims and conflicts between construction parties!!!

Classification Systems

- After invention of BIM, construction industry practitioners were exposed to the massive amount of construction project elements.

- Industry organizations began to realize that with BIM a greater degree of harmonization in classifying information is now necessary and possible!!!

- ISO 12006-2:2015 defines a framework for the development of built environment classification systems.

- ISO 12006-2:2015 identifies a set of recommended classification table titles for a range of information object classes according to particular views, e.g. by form or function, supported by definitions. It shows how the object classes classified in each table are related, as a series of systems and sub-systems, e.g. in a building information model.

Classification Systems Application in Industry

▢ Each of the three typical project stakeholders have different goals for classification systems:

  ▢ Owners: Use classifications to organize data for facility & asset management, development planning, and cost estimates.

  ▢ Contractors: Use classifications for construction management, scheduling, and cost estimates.

  ▢ Architects and Engineers: Use classifications to generate project specifications.

(Autodesk, 2021)

Classification Systems

☐ Different classification systems are introduced based on ISO12006-2 to the AEC community. Two widely recognized classification systems are:

- ☐ Masterformat (North America) (currently included in OmniClass Table 22)

- ☐ Uniformat (North America) (currently included in OmniClass Table 21) (Elements)

- ☐ Uniclass System (UK) (Compatible with ISO 12006-2)

- ☐ OmniClass Construction Classification System (North America) (Compatible with ISO 12006-2)

MasterFormat

- Format specifications for construction contract documents developed by Construction Specifications Institute (CSI) and Construction Specifications Canada (CSC).

- The purpose of this format is to assist the user to organize information into distinct groups when creating contract documents, and to assist the user searching for specific information in consistent locations.

- The information contained in MasterFormat is organized in a standardized outline format within 2 Groups and 50 Divisions.

- Each divisions comes with multi-level Sections and subsections to create an extensive list of 186 pages.

```
┌──────────────┐
│    Group     │
└──────────────┘
       ▲
┌──────────────┐
│   Division   │
└──────────────┘
       ▲
┌──────────────┐
│   Section    │
└──────────────┘
       ▲
┌──────────────┐
│ Sub-Section  │
└──────────────┘
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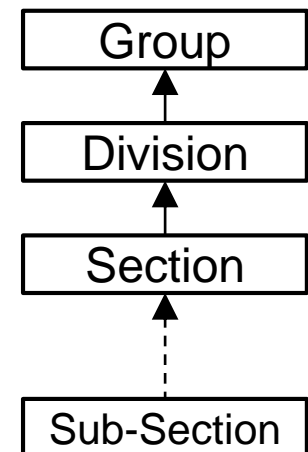
MasterFormat - Groups and Divisions

- PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP
- Division 00 — Procurement and Contracting Requirements
- SPECIFICATIONS GROUP
- General Requirements Subgroup
- Division 01 — General Requirements
- Facility Construction Subgroup
- Division 02 — Existing Conditions
- Division 03 — Concrete
- Division 04 — Masonry
- Division 05 — Metals
- Division 06 — Wood, Plastics, and Composites
- Division 07 — Thermal and Moisture Protection
- Division 08 — Openings
- Division 09 — Finishes
- Division 10 — Specialties
- Division 11 — Equipment
- Division 12 — Furnishings
- Division 13 — Special Construction
- Division 14 — Conveying Equipment
- Facility Services Subgroup:
- Division 21 — Fire Suppression
- Division 22 — Plumbing
- Division 23 — Heating, Ventilating, and Air Conditioning (HVAC)

- Division 25 — Integrated Automation
- Division 26 — Electrical
- Division 27 — Communications
- Division 28 — Electronic Safety and Security

Site and Infrastructure Subgroup:
- Division 31 — Earthwork
- Division 32 — Exterior Improvements
- Division 33 — Utilities
- Division 34 — Transportation
- Division 35 — Waterway and Marine Construction

Process Equipment Subgroup:
- Division 40 — Process Interconnections
- Division 41 — Material Processing and Handling Equipment
- Division 42 — Process Heating, Cooling, and Drying Equipment
- Division 43 — Process Gas and Liquid Handling, Purification and Storage Equipment
- Division 44 — Pollution and Waste Control Equipment
- Division 45 — Industry-Specific Manufacturing Equipment
- Division 46 — Water and Wastewater Equipment
- Division 48 — Electrical Power Generation

*Several divisions are reserved for future uses!

MasterFormat – Example Sections

00 00 00 Procurement and Contracting Requirements
00 01 01 Project Title Page
00 01 03 Project Directory
00 01 05 Certifications Page
00 01 07 Seals Page
00 01 10 Table of Contents
00 01 15 List of Drawing Sheets
00 01 20 List of Schedules
00 10 00 Solicitation
00 11 00 Advertisements and Invitations
00 11 13 Advertisement for Bids
00 11 15 Advertisement for Prequalification of Bidders
00 11 16 Invitation to Bid
00 11 19 Request for Proposal
00 11 53 Request for Qualifications
00 20 00 Instructions for Procurement
00 21 00 Instructions
00 21 13 Instructions to Bidders
00 21 16 Instructions to Proposers
00 22 00 Supplementary Instructions
00 22 13 Supplementary Instructions to Bidders
00 22 16 Supplementary Instructions to Proposers
00 23 00 Procurement Definitions

00 24 00 Procurement Scopes
00 24 13 Scopes of Bids
00 24 13.13 Scopes of Bids (Multiple Contracts)
00 24 13.16 Scopes of Bids (Multiple-Prime Contract)
00 24 16 Scopes of Proposals
00 24 16.13 Scopes of Proposals (Multiple Contracts)
00 24 16.16 Scopes of Proposals (Multiple-Prime Contract)
00 25 00 Procurement Meetings
00 25 13 Pre-Bid Meetings
00 25 16 Pre-Proposal Meetings
00 26 00 Procurement Substitution Procedures
00 30 00 Available Information
00 31 00 Available Project Information
00 31 13 Preliminary Schedules
00 31 13.13 Preliminary Project Schedule
00 31 13.16 Preliminary Construction Schedule
00 31 13.23 Preliminary Project Phases
00 31 13.26 Preliminary Project Sequencing
00 31 13.33 Preliminary Project Milestones
00 31 16 Project Budget Information
00 31 19 Existing Condition Information
00 31 19.13 Movement and Vibration Information

MasterFormat – Example Sections

03 00 00 Concrete
03 01 00 Maintenance of Concrete
03 01 10 Maintenance of Concrete Forming and Accessories
03 01 20 Maintenance of Concrete Reinforcing
03 01 23 Maintenance of Stressing Tendons
03 01 30 Maintenance of Cast-in-Place Concrete
03 01 30.51 Cleaning of Cast-in-Place Concrete
03 01 30.61 Resurfacing of Cast-in-Place Concrete
03 01 30.71 Rehabilitation of Cast-in-Place Concrete
03 01 30.72 Strengthening of Cast-in-Place Concrete
03 01 40 Maintenance of Precast Concrete
03 01 40.51 Cleaning of Precast Concrete
03 01 40.61 Resurfacing of Precast Concrete
03 01 40.71 Rehabilitation of Precast Concrete
03 01 40.72 Strengthening of Precast Concrete
03 01 50 Maintenance of Cast Decks and Underlayment
03 01 50.51 Cleaning Cast Decks and Underlayment
03 01 50.61 Resurfacing of Cast Decks and Underlayment
03 01 50.71 Rehabilitation of Cast Decks and Underlayment
03 01 50.72 Strengthening of Cast Decks and Underlayment
03 01 60 Maintenance of Grouting
03 01 70 Maintenance of Mass Concrete
03 01 80 Maintenance of Concrete Cutting and Boring

...
03 10 00 Concrete Forming and Accessories
03 11 00 Concrete Forming
03 11 13 Structural Cast-in-Place Concrete Forming
03 11 13.13 Concrete Slip Forming
03 11 13.16 Concrete Shoring
03 11 13.19 Falsework
03 11 16 Architectural Cast-in Place Concrete Forming
03 11 16.13 Concrete Form Liners
03 11 19 Insulating Concrete Forming
03 11 23 Permanent Stair Forming
03 11 26 Permanent Tier Forming
03 15 00 Concrete Accessories
03 15 13 Waterstops
03 15 13.13 Non-Expanding Waterstops
03 15 13.16 Expanding Waterstops
03 15 13.19 Combination Expanding and Injection Hose Waterstops

...
03 80 00 Concrete Cutting and Boring
03 81 00 Concrete Cutting
03 81 13 Flat Concrete Sawing
03 81 16 Track Mounted Concrete Wall Sawing
03 81 19 Wire Concrete Wall Sawing
03 81 23 Hand Concrete Wall Sawing
03 81 26 Chain Concrete Wall Sawing
03 82 00 Concrete Boring
03 82 13 Concrete Core Drilling

UniFormat

- UniFormat is a standard for classifying building specifications, cost estimating, and cost analysis in the U.S. and Canada.

- It is trademark of Construction Specifications Institute (CSI) and Construction Specifications Canada (CSC).

- The system can be used to provide consistency in the economic evaluation of building projects.

- It was developed through an industry and government consensus and has been widely accepted as an ASTM standard.

- It follows a 3-level approach for a construction project cost estimation.

UniFormat – Numbering Samples

- UniFormat Level 1 Categories:
  - A Substructure
  - B Shell
  - C Interiors
  - D Services
  - E Equipment and Furnishings
  - F Special Construction and Demolition
  - G Building Sitework
- UniFormat Levels 2 and 3 Category and Numbering sample:
  - level 1 is shown for A Substructure:
    - A10 Foundations
      - A1010 Standard Foundations
      - A1020 Special Foundations
      - A1030 Slab on Grade
    - A20 Basement Construction
      - A2010 Basement Excavation
      - A2020 Basement Walls

Question

💡 Can you name any similar or equivalent classification system to MasterFormat and UniFormat used in the construction industry in Iran?

Uniclass

- Uniclass is a unified classification system for all sectors of the UK construction industry.

- Uniclass system 2015 is heavily revised by the National Building Specification (NBS) to make it compatible with BIM.

- It contains 11 consistent tables classifying 12000 items of all scales; from facilities such as a railway or buildings, to products like anchor plates, flue liners, or LED lamps.

- Each table accommodates a different 'class' of information. These can be used to categorize information for costing, briefing, CAD layering, etc., as well as when preparing specifications or other production documents.

- It is designed to address numbering requirement of construction projects in the lifecycle.

Uniclass

Uniclass 2015 | NBS   ×   +

← → C ⟳ ⌂   🔒 thenbs.com/our-tools/uniclass-2015   ☆

| NBS FOR SPECIFIERS | NBS FOR MANUFACTURERS | NBS CHORUS | NBS SOURCE | UNICLASS 2015 | | 0345 456 9594 | SIGN IN / REGISTER |

❋ NBS   Platform   Resources   Support   Events   About   Search theNBS.com
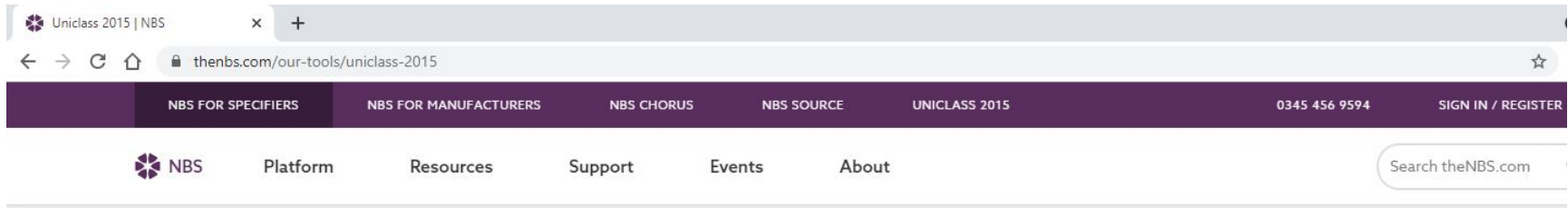
Home / Our Tools / Uniclass 2015

Uniclass 2015

Uniclass is a consistent classification structure for all disciplines in the construction industry

It contains tables classifying items of any scale from a large facility such as a railway, down to products such as a CCTV camera in a railway station.

It's an essential way of identifying and managing the vast amount of information that's involved in a project, and it's a requirement for BIM projects, as set by the BS EN ISO 19650 series of standards.

NBS Chorus, our cloud-based platform, is the only specification tool in the industry that natively supports Uniclass.

❓ What is it used for?

Uniclass 2015 is divided into a set of tables which can be used to categorise information for costing, briefing, CAD layering, annotations, etc. as well as when preparing specifications or other production documents.

The classifications within the tables, for the first time, allow buildings, landscape and infrastructure to be classified under one unified scheme.

Uniclass

Uniclass - Scheme

Uniclass - Tables

11 different related tables in MS Excel (.xls)

Co - Complexes
En - Entities
Ac - Activities
SL - Spaces/ locations
EF - Elements/ functions
Ss - Systems

Pr - Products
TE - Tools and Equipment
PM - Project management
FI - Form of information
Ro - Roles
Zz - CAD

☐ Each code consists of either four or five pairs of characters. The initial pair identifies which table is being used and employs letters. The four following pairs represent groups, sub-groups, sections, and objects. By selecting pairs of numbers, up to 99 items can be included in each group of codes, allowing plenty of scope for inclusion.

Uniclass – Numbering Categories

Complexes, entities, spaces, locations and activities

(Larger scale items – arranged broadly by industry sector and function)

10	20	25	30	32	35	40	42	45
Preparation and repair	Administrative, commercial and protective services	Cultural, educational, scientific and information	Industrial	Water and land management	Medical, health, welfare and sanitary	Recreational	Sport and activity	Residential

50	55	60	65	70	75	80	85	90
Waste disposal	Piped supply	Heating, cooling and refrigeration	Ventilation and air conditioning	Electrical power generation and distribution	Communications, security, safety and protection	Transport	Operation and maintenance	Circulation and storage

12,000 classifications across 11 tables covering all built assets

Uniclass - Numbering Example

Commercial entities	En_20_50
Auction buildings	En_20_50_05
Department stores	En_20_50_22
Financial and professional services buildings	En_20_50_29
Markets	En_20_50_50
Mixed use buildings	En_20_50_53
Motor vehicle sales entities	En_20_50_55
Shop units	En_20_50_80
Supermarkets	En_20_50_85
Wholesale buildings	En_20_50_97

Commercial activities	Ac_20_50
Ambient products wholesale selling	Ac_20_50_03
Auctioning	Ac_20_50_05
Checking out and paying	Ac_20_50_12
Department store retail selling	Ac_20_50_22
Financial and professional services activity	Ac_20_50_29
Food and drink retail selling	Ac_20_50_32

Commercial FF&E systems	Ss_40_20_15
Retail FF&E systems	Ss_40_20_15_71
Trading floor FF&E systems	Ss_40_20_15_89

Commercial spaces	SL_20_50
Ambient wholesale spaces	SL_20_50_03
Auction rooms	SL_20_50_05
Beauty salons	SL_20_50_10
Checkout points	SL_20_50_12
Department store shop floors	SL_20_50_22
Financial and professional services outlets	SL_20_50_29
Fitting rooms	SL_20_50_30
Food and drink outlets	SL_20_50_32
Hair and beauty salons	SL_20_50_36
Hair salons	SL_20_50_37
Livestock auction rooms	SL_20_50_47
Market stalls	SL_20_50_51
Motor vehicle showrooms	SL_20_50_55
Refrigerated wholesale spaces	SL_20_50_70
Retail kiosks	SL_20_50_72
Supermarket shop floors	SL_20_50_85
Tan spray booths	SL_20_50_86
Tattoo and piercing parlours	SL_20_50_87
Waste and scrap yards	SL_20_50_96

OmniClass

- OmniClass is useful for many applications from organizing library materials, product literature, and project information, to providing a classification structure for electronic databases.

- It incorporates other classification systems currently in use as the basis of many of its Tables: 22 MasterFormat for work results, 21 UniFormat for elements, and 23 EPIC (Electronic Product Information Cooperation) for products.

- OmniClass is designed to provide a standardized basis for classifying information throughout the full facility lifecycle, from conception to demolition or reuse, and encompassing all the different types of construction that make up the built environment.

- OmniClass is intended to be the means for organizing, sorting, and retrieving

OmniClass

OmniClass

OmniClass - Tables

15 different related tables in MS Excel (.xls)

Table 11 - Construction Entities by Function
Table 12 - Construction Entities by Form
Table 13 - Spaces by Function
Table 14 - Spaces by Form
Table 21 - Elements
Table 22 - Work Results
Table 23 - Products
Table 31 - Phases
Table 32 - Services
Table 33 - Disciplines
Table 34 - Organizational Roles
Table 35 - Tools
Table 36 - Information
Table 41 - Materials
Table 49 - Properties

OmniClass Vs Uniclass Tables

OmniClass Table 11 - Construction Entities by Function *OmniClass* Table 12 - Construction Entities by Form	*Uniclass 2015* Table Co - Complexes *Uniclass* 2015 Table En - Entities
OmniClass Table 13 - Spaces by Function *OmniClass* Table 14 - Spaces by Form	*Uniclass 2015* Table SL - Spaces/locations
OmniClass Table 21 - Elements	*Uniclass 2015* Table EF - Elements/functions *Uniclass 2015* Table Ss - Systems
OmniClass Table 22 - Work Results	(NBS took a decision not to have a work results table in *Uniclass 2015*. An examination of the contents of *Uniclass 2015* - Table Ss reveals many titles which are like those in *OmniClass* Table 22, often with the word "systems" appended to the end.)
OmniClass Table 23 - Products	*Uniclass 2015* Table Pr - Products
OmniClass Table 31 - Phases	*Uniclass 2015* Table Ac - Activities (*in part*)
OmniClass Table 32 - Services	*Uniclass 2015* Table Ac - Activities (*in part*)
OmniClass Table 33 - Disciplines *OmniClass* Table 34 - Organizational Roles	*Uniclass 2015* Table PM - Project management (*in part*)
OmniClass Table 35 - Tools	*Uniclass 2015* Table TE - Tools and Equipment
OmniClass Table 36 - Information	*Uniclass 2015* Table FI -Form of information (BETA) *Uniclass* 2015 PM - Project management (*in part*)
OmniClass Table 41 - Materials *OmniClass* Table 49 - Properties	No classification of properties or materials in *Uniclass 2015*

OmniClass – Nubmering Convention

- OmniClass has human-interpretable numbers assigned to all entries in OmniClass tables.

- The numbers also serve to illustrate hierarchies and levels of information detail for any given class.

- Understanding how OmniClass numbers are structured provides a mental map to a classification's location, clarifying the hierarchical level and table of any entry.

- A purely numeric approach has been followed for the numbering convention.

- The first pair of digits designates the table number (i.e. 11, 12, 13… 36, 41, 49). The table number digits are offset from the rest of the OmniClass number by a dash ("-").

- Additional pairs of digits designate each level of classification. Leading zeros are used for the first nine entries in each level, 01-09.

OmniClass – Nubmering Convention

(CSI, 2019)

☐ Double zero (00) is a special number used in many tables to fill out a numerical string for a higher level (conceptually broader) entry to six digits (such as 05 00 00). A double zero indicates no content at the level of that pair of digits in the OmniClass number.

☐ Though patterns may be observed in some tables' numbering, these patterns have no importance.

☐ Increasing specialization in levels of classification will read from left to right (the first pair of numbers will correspond to level one, or top level, of classification, the next pair represent level two, the third pair of digits represent level three, etc.)

☐ As additional classification detail is needed, additional pairs of numbers are added to the base three levels.

OmniClass – Nubmering Convention

☐ In addition to these human-interpretable numbers, OmniClass also assigns a Global Unique Identifiers (GUIDs) to all classifications.

☐ OmniClass GUIDs do not change between editions and provide a solid foundation for software to reference classifications and to map between OmniClass editions where OmniClass numbers may have changed.

☐ GUIDs follow the ISO standard ISO/IEC 11578:1996 *Information technology - Open Systems Interconnection - Remote Procedure Call (RPC)*.

OmniClass – Sample Numbers

Education Facility	11-12
Daycare or Preschool Facility	11-12 11
Daycare Facility	11-12 11 11
Preschool Facility	11-12 11 14

Education and Training Spaces	13-31
Breakout Space	13-31 11
Lecture and Classroom Spaces	13-31 13
Lecture Classroom	13-31 13 11
Classrooms (age 9 plus)	13-31 13 13
Classrooms (ages 5–8)	13-31 13 15
Lecture Hall (Fixed Seats)	13-31 13 17
Assembly Hall	13-31 13 19
Seminar Room	13-31 13 21

Institutional Equipment	21-05 10 40
Educational and Scientific Equipment	21-05 10 40 10
Healthcare Equipment	21-05 10 40 20
Religious Equipment	21-05 10 40 40
Security Equipment	21-05 10 40 60
Detention Equipment	21-05 10 40 70

General Requirements	22-01 00 00
Administrative Requirements	22-01 30 00
Project Management and Coordination	22-01 31 00
Project Coordination	22-01 31 13
Facility Services Coordination	22-01 31 14
Multiple Contract Coordination	22-01 31 16
Project Meetings	22-01 31 19
Preconstruction Meetings	22-01 31 19 13
Site Mobilization Meetings	22-01 31 19 16
Progress Meetings	22-01 31 19 23
Preinstallation Meetings	22-01 31 19 33

Hands on Revit Classification Manager
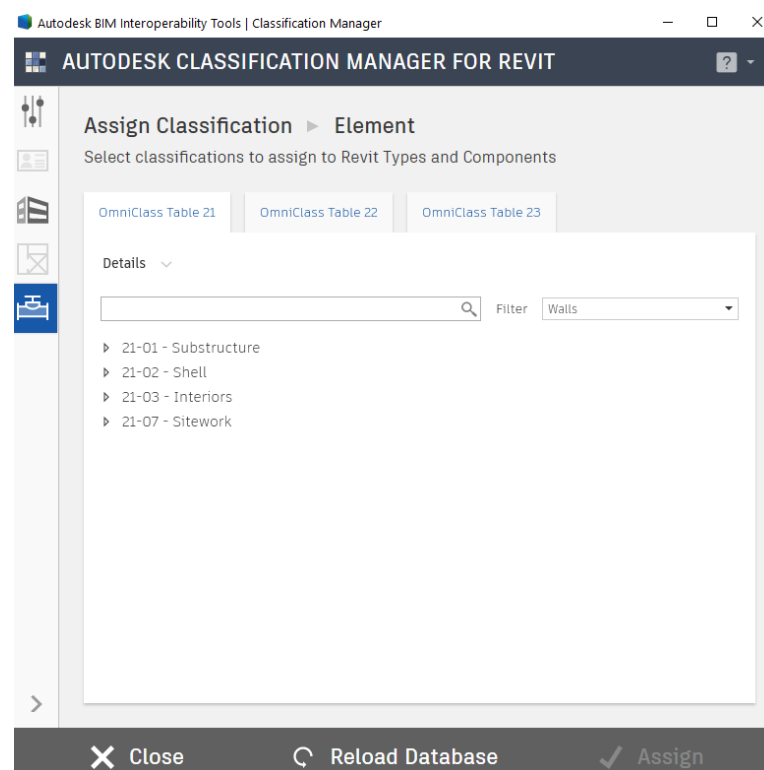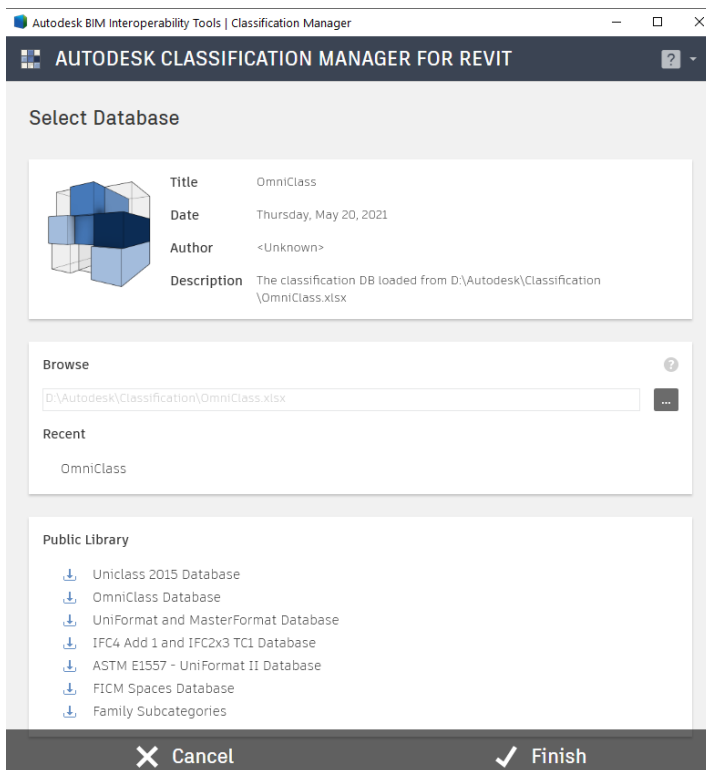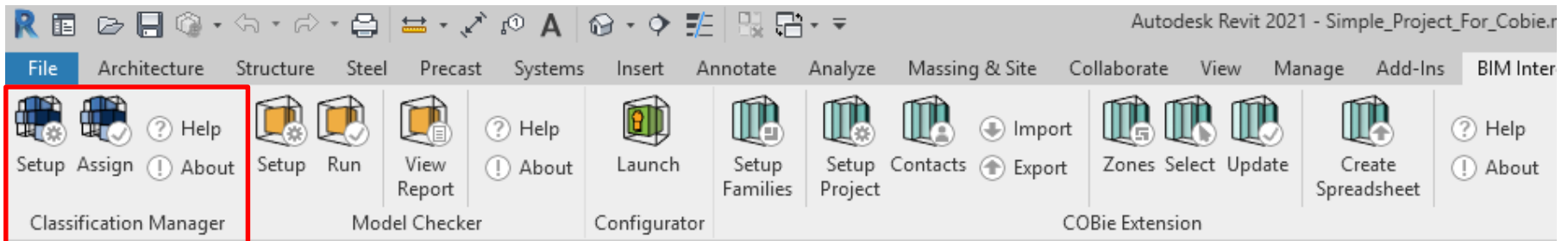
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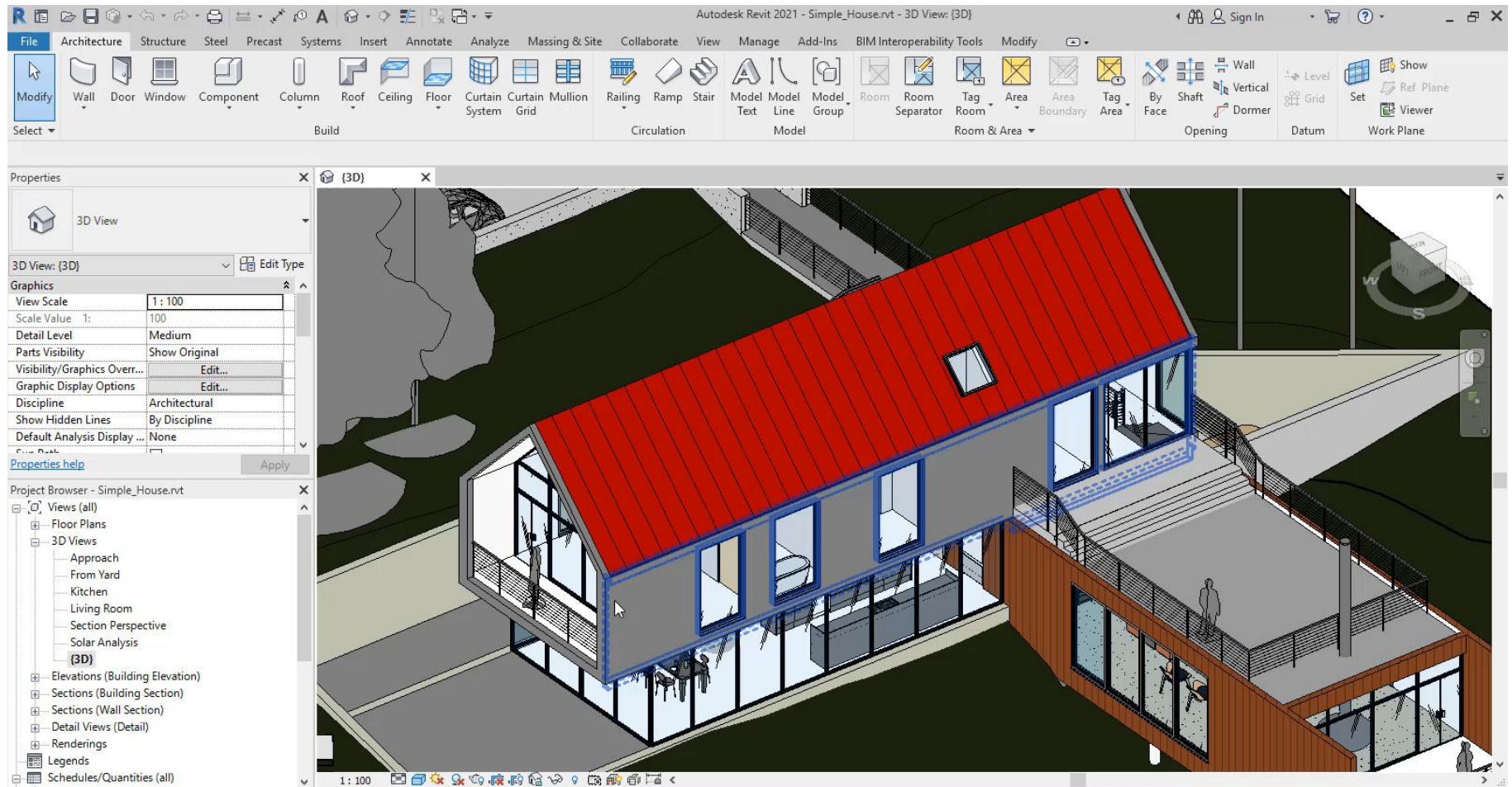
COBie

OpenBIM Standards-buildingSMART

(Baldwin, 2019)

Name	Description (function)	Standard
IFC Industry Foundation Classes	Medium for Data Transfer	ISO 16739
MVD Model View Definition	IFC View Filter	buildingSMART MVD
IDM Information Delivery Manual	Standardised Process Description	ISO 29481-1 ISO 29481-2
IFD International Framework for Dictionaries (implemented in the bSDD)	Mapping of Terms	ISO 12006-3
BCF BIM Collaboration Format	Reporting and Tracking	buildingSMART BCF

Source: buildingSMART

The buildingSMART openBIM standards

Model View Definition

- Model view definition (MVD) defines a filter to view desirable part of IFC information.

- COBie (Construction Operations Building Information Exchange) is the most famous MVD which has become an OpenBIM standard.

- COBie is a non-proprietary data format and international standard (British Standard: BS 1192-4:2014) for the publication of a subset of building information models (BIM) focused on delivering asset data as distinct from geometric information.

COBie Standard

- COBie helps organizations to electronically capture and record important project data at the point of origin, including equipment lists, product data sheets, warranties, spare parts lists, and preventive maintenance schedules at the points of origin.

- COBie contains a textual subset of IFC data and is presentable in MS Excel format.

- COBie defines set of data that clients require during a construction project's handover.

- These data need to be captured at the creation point!!

Handover Management and COBie
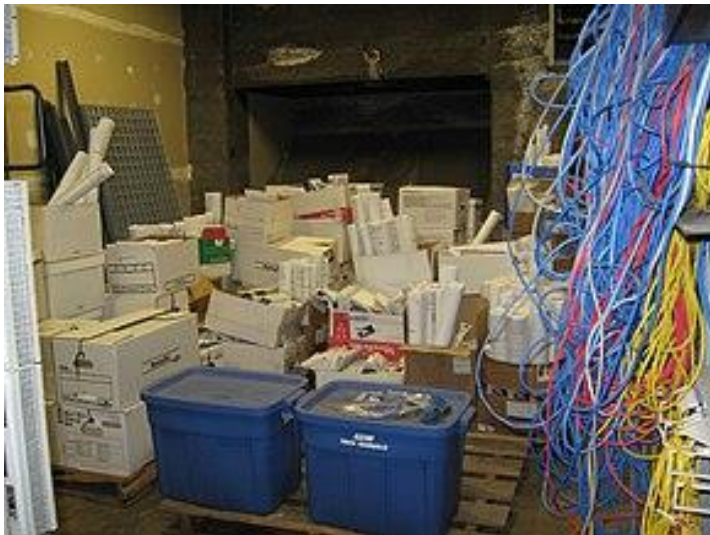
NO COBie:

Piles of non-structured drawings, CDs and files
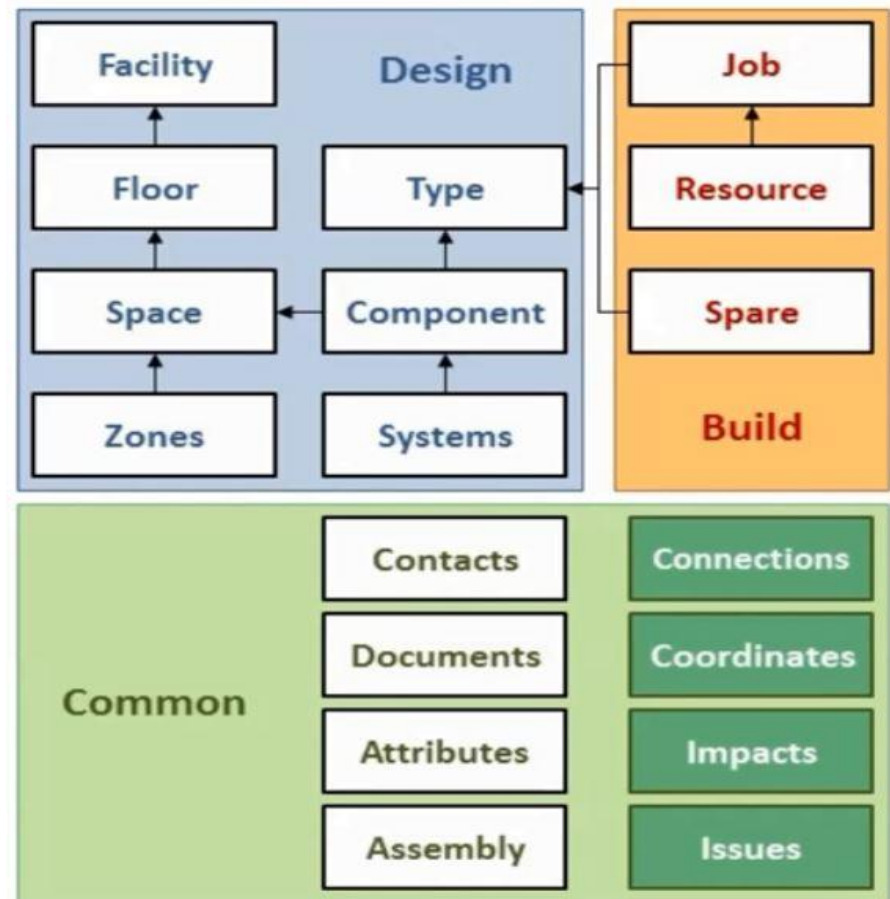
COBie: A structured hierarchicaly related electronic information!

COBie Scheme

COBie Worksheets

Tailored Data Structure

- IFC can provide a tremendous amount of data.

- Clients need to wisely define proper amount of data they require identify for the project handover

  - Do I need every door's area?

  - Do I need the exact thickness of plaster layers on the walls?

  - Do I need to locate pressure valve in the utility room?

  → Clients need to do their own chores to identify their organization's specific needs before a project begins!
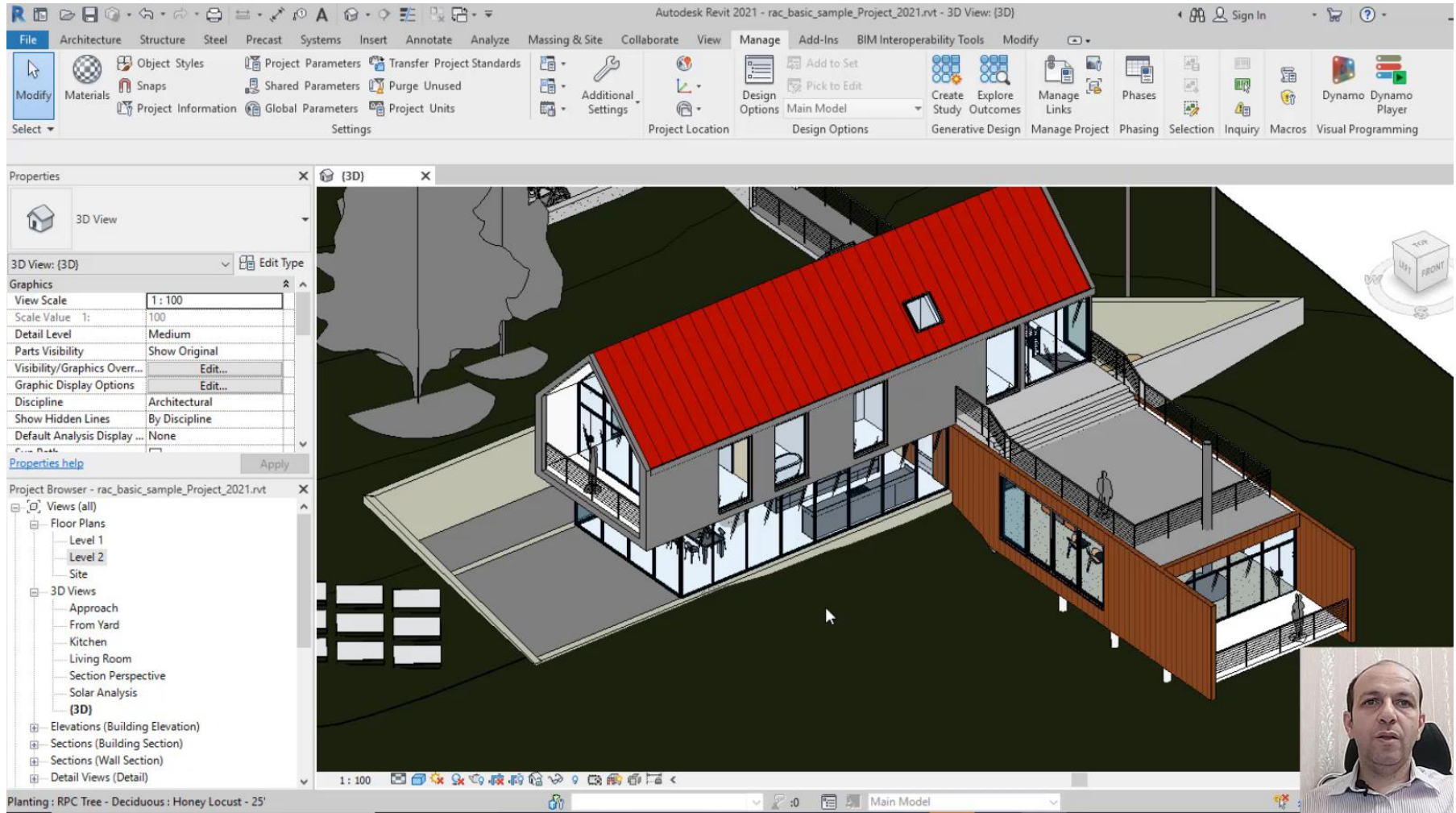
Hands on Revit COBie Extension
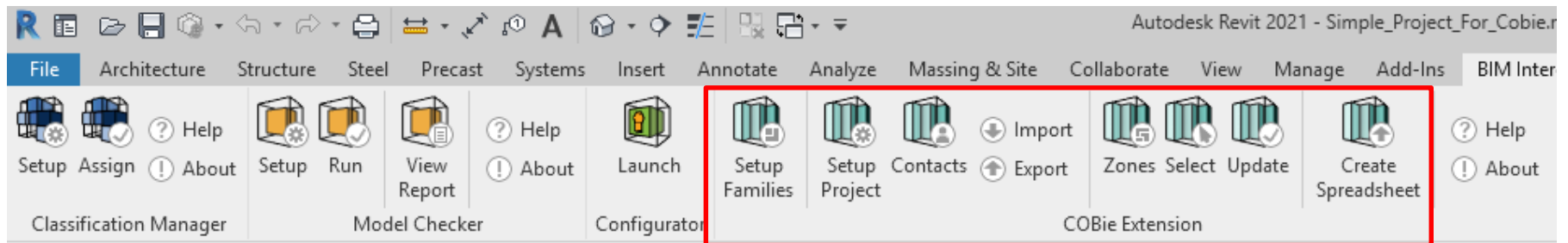
Hands on Revit COBie Extension

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Thank you!

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