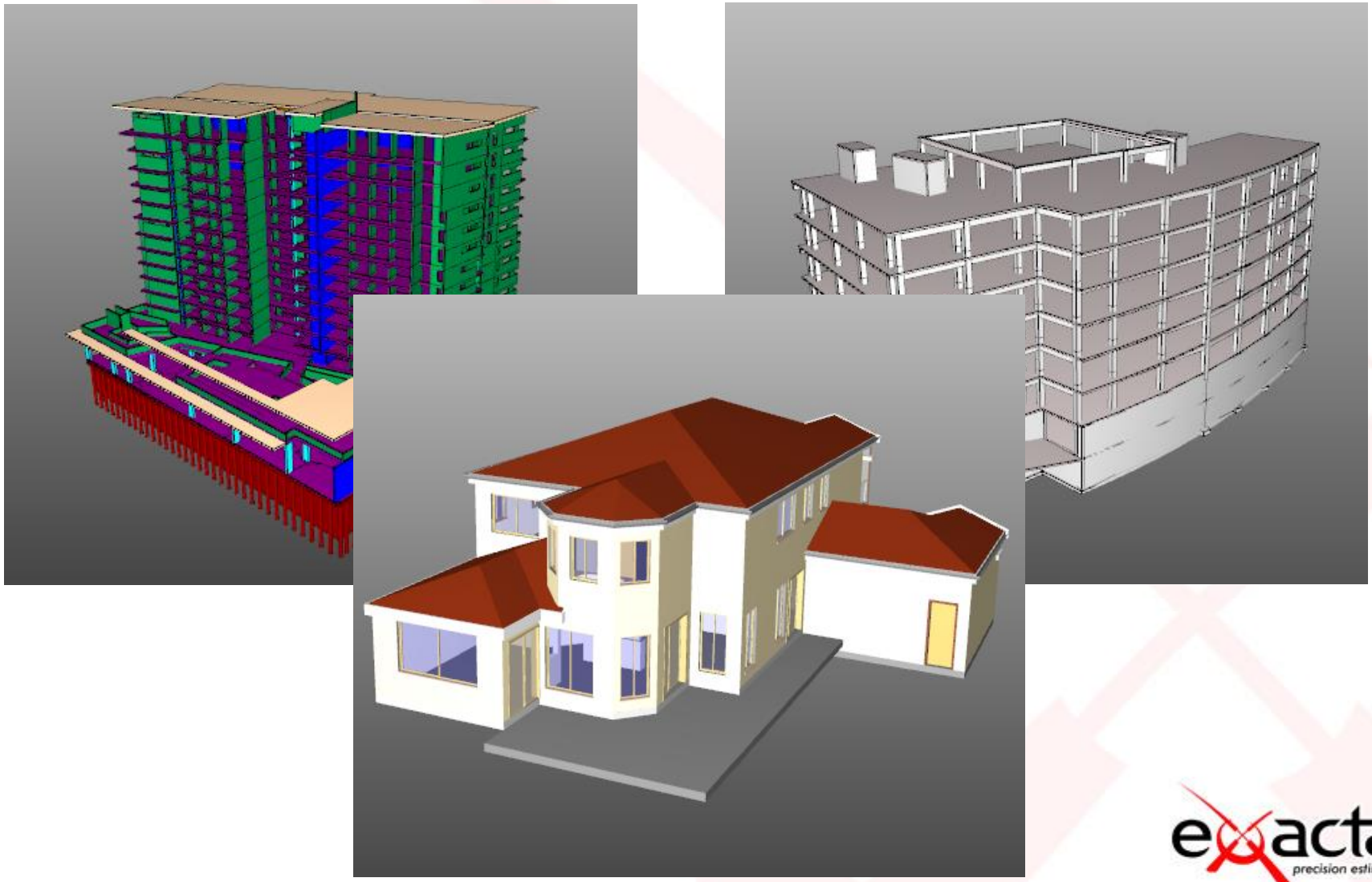
Utilising 3D BIM for Efficient QTO and Production of Cost Reports

CostX® Presentation

Ken Leung
Exactal Limited

3D BIM MODEL REVIEW



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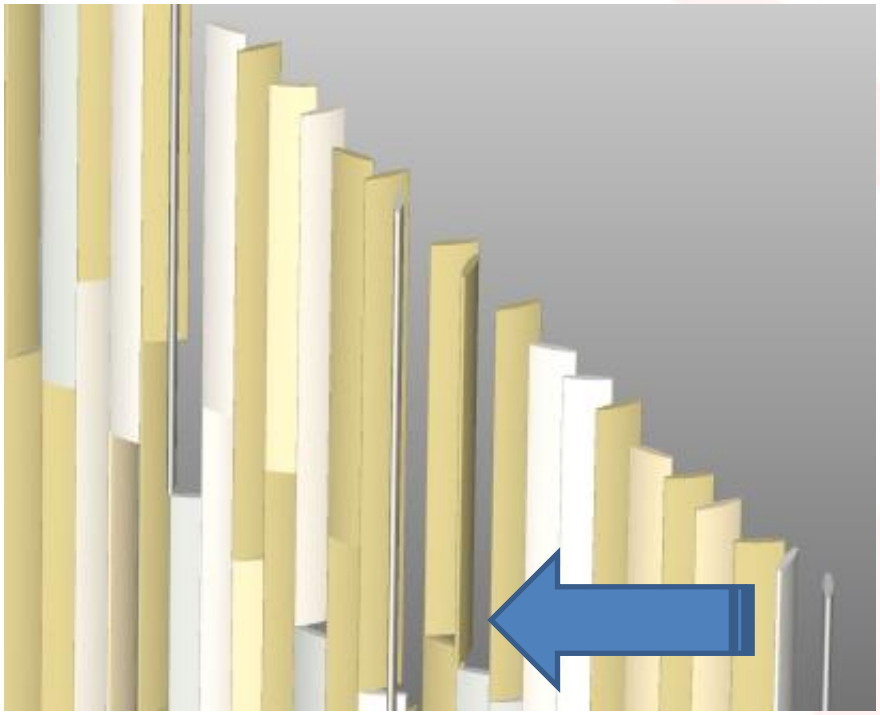
3D BIM MODEL REVIEW



Object Properties

Name	Value
<Unspecifi	
_name	VT Links
_name	eneric Models (1184)
_name	46-A-Solar Shading Fin-BVN (538)
_name	4900 (224)
_name	46-A-Solar Shading Fin-BVN [2199703]
Guid	d1261d18-f7b7-4f35-9e32-234bd3d47d9f
Id	2199703
Constraints	
Level	LEVEL 4
Exactal	
Level1	RVT Links
Level2	Generic Models
Level3	46-A-Solar Shading Fin-BVN
Level4	4900
Level5	46-A-Solar Shading Fin-BVN
Identity Data	
Type Name	4900
Other	
Family Name	46-A-Solar Shading Fin-BVN
System Property	
Instance ID	RWuCpnl0ik2Bjln3PFMjWQ

Group by Category:

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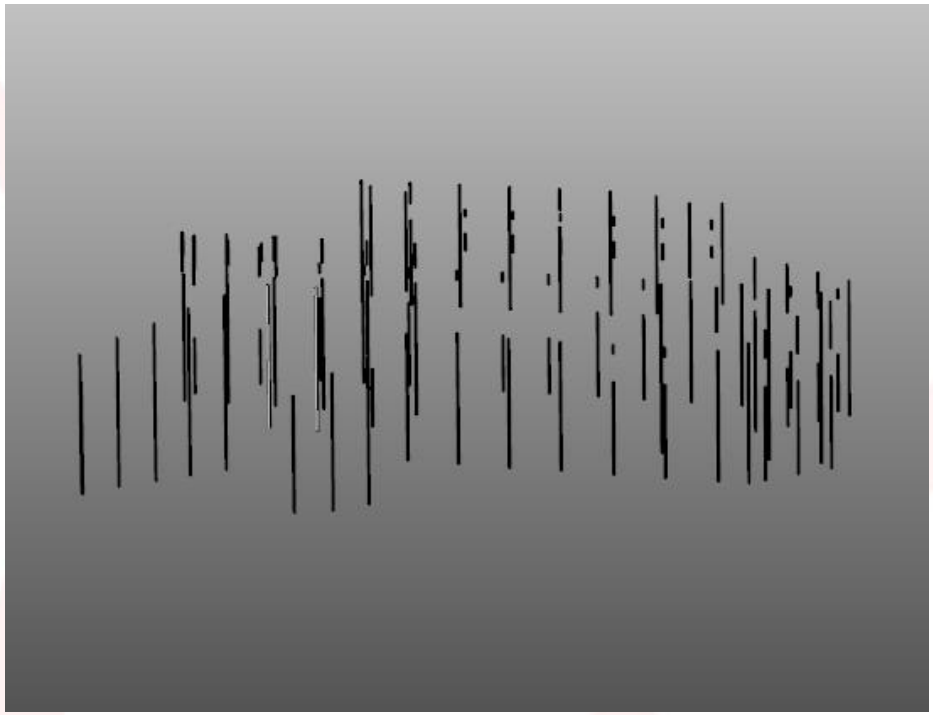
3D BIM MODEL REVIEW

Object Properties

Name	Value
<Unspecified>	
_name	Mass (117)
_name	batten3 (1)
_name	batten (1)
_name	batten3 [173538]
Id	eff220b4-2e59-41fb-89ff-d0938533514c
Dimensions	
Gross Surface Area	0 m²
Gross Volume	0.00 m³
Exactal	
Level1	Mass
Level2	batten3
Level3	batten
Level4	batten3
Identity Data	
Type Name	batten
Other	
Family Name	batten3
System Property	
Instance ID	MJvRzLPGGkmec8ir+OMvtQ



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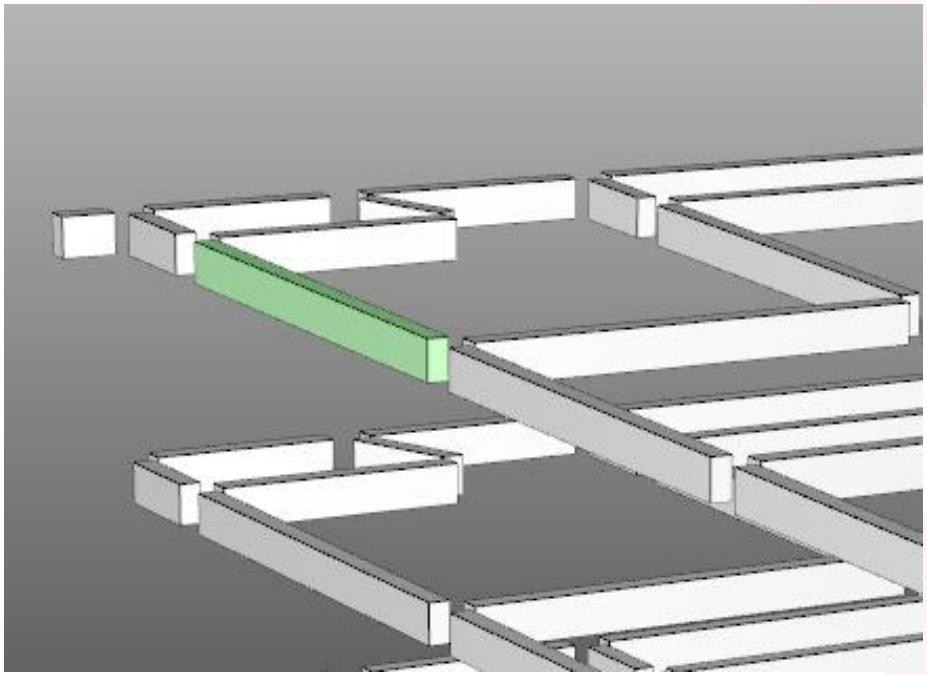
3D BIM MODEL REVIEW



Object Properties

Name	Value
Constraints	
Reference Level	Level 7
Dimensions	
Length	7315
Volume	1.21
Exactal	
Level1	Structural Framing
Level2	M_Concrete-Rectangular Beam
Level3	300 x 600mm
Level4	M_Concrete-Rectangular Beam
Identity Data	
Type Name	300 x 600mm
Other	
Family Name	M_Concrete-Rectangular Beam
Structural	
Cut Length	6715
Structural Usage	Girder

Group by Category:

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Review Questions

- *How does the QS utilize the information stored in the Revit Model?*
- *How does the QS add extra parameters within the CostX® to store information for generation of cost reports?*
- *How does the QS conduct cross-check such that the information is correct and accurate enough for cost estimating or measurement purposes?*

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New Estimating Approach

- The application of BIM in the measurement or estimating process is called “5D BIM”. Automated generation of quantities is a faster and more accurate tool to analyze data and achieve better advice.

- 5D BIM approach allows clients, designers, cost planners and estimators to collaborate and explore opportunity or possibility to eliminate risk, reduce costs and eventually produce cost effective buildings.

- 5D BIM approach allows users to provide instant itemized budgets or estimated costs for proposed buildings at any stage of the design process and perception of changes for revision.

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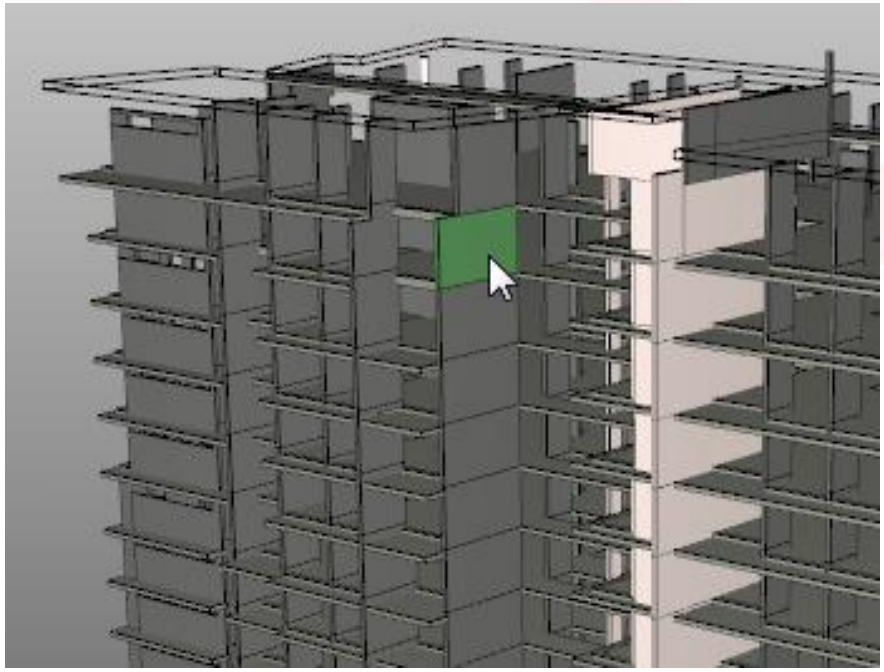
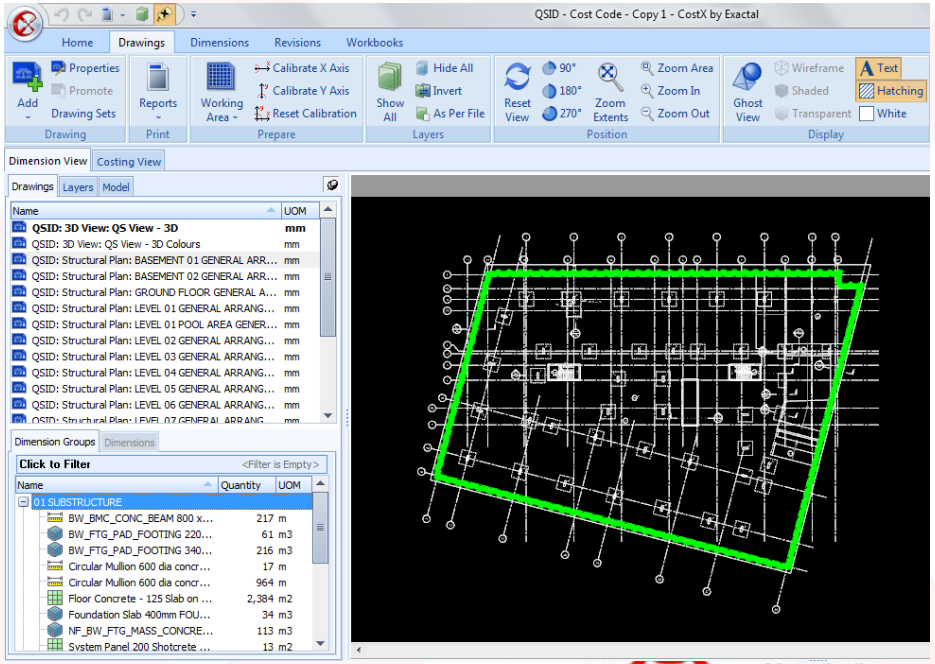
5D BIM Estimating Software



CostX® is one of 5D BIM estimating software and has many functions and features to support BIM measurement and estimating.



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5D BIM Estimating Software

As we have discovered, efficient production of cost reports depends on relevant coding or information inserted into 3D BIM models beforehand.

3 methods to improve the BIM information:

(1) Shared Parameters eg. QSID
(2) User-Defined Properties
(3) Cost Code Implementation

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Method 1 : Shared Parameters

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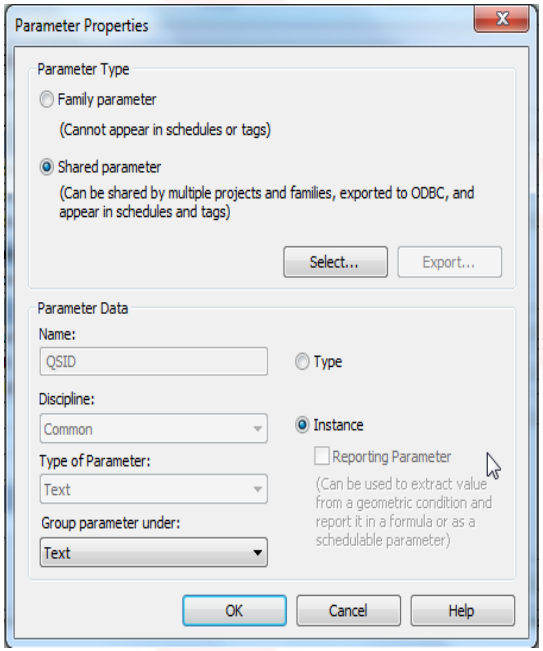
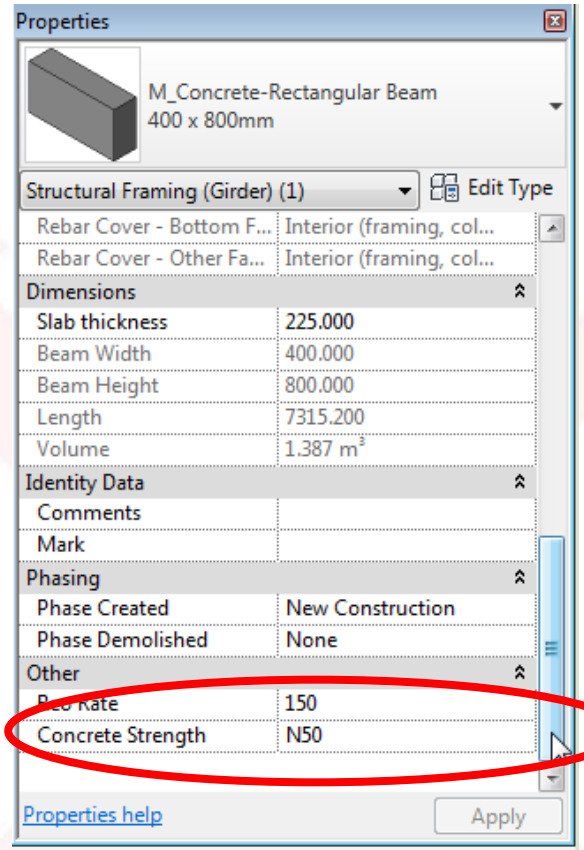
Shared Parameter in Revit®

Add extra parameters into DWF ™or DWFx from Revit® Software. For example:

- QSID
  - Elemental Code
  - S.M.M. Code
  - Trade code
- Level/Zone
- Concrete Strength
- Reo Rates





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QSID Parameter

Table 1 **Example of Elemental Code for QSID**

Standard List of Elements and Sub-Elements

Major Cost Code	Minor Cost Code	Element	Sub-Element
NET BUILDING COST	01 PRELIMINARIES	PR PRELIMINARIES	
	02 SUBSTRUCTURE	FN Foundations	FNSE Structural Elements FNBW Basements FNGF Ground Floor Slabs FNSU Foundation Sundries
	03 SUPERSTRUCTURE	SC Structure (RC)	SCFF Frame (RC) SCRF Roofs (RC) SCUF Upper Floors (RC) SCSW Structural Walls (RC) SCSL Stairs & Landings (RC) SCBR Balustrades & Handrails (RC) SCSU Structure Sundries (RC)
		SO Structure (Other)	SOFF Frame (Other) SORF Roofs (Other) SOUF Upper Floors (Other) SOSW Structural Walls (Other) SOSL Stairs & Landings (Other) SOBR Balustrades & Handrails (Other) SOSU Structure Sundries (Other)

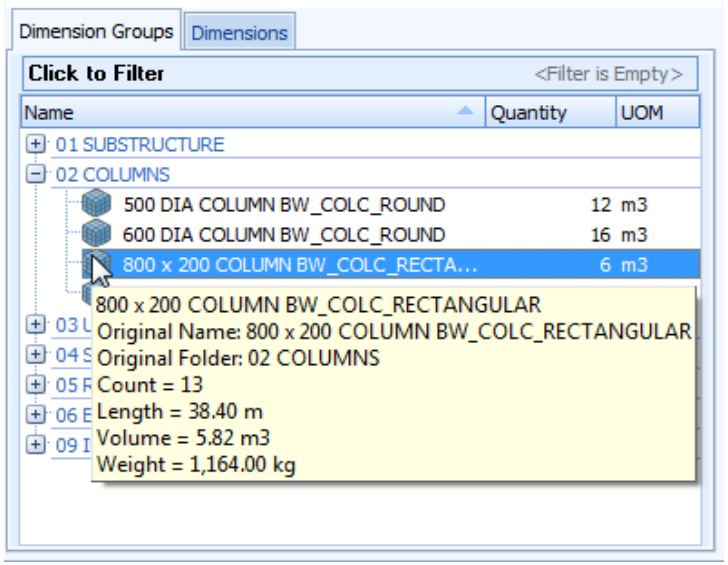
Source: ASD's SMM for Building Element

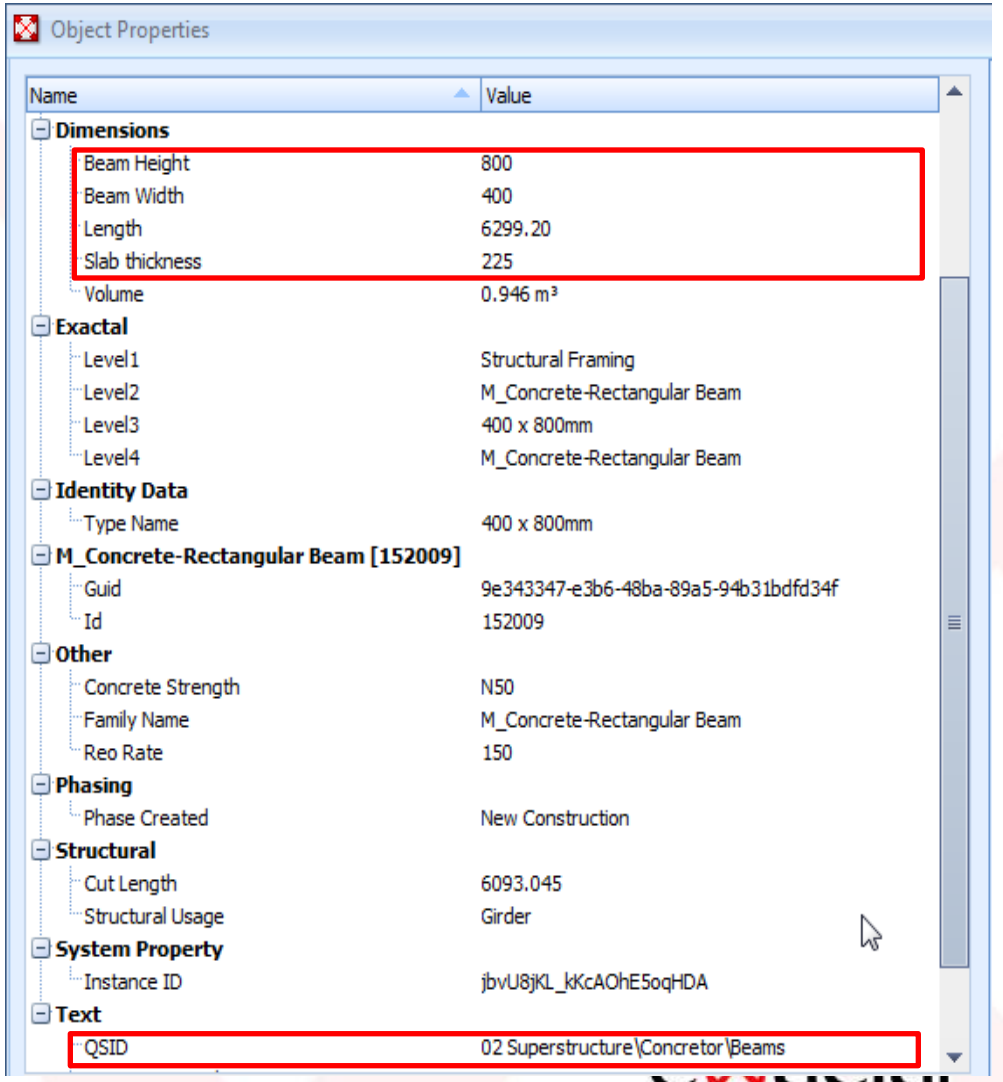
Shared Parameter - Others

Other parameter examples:

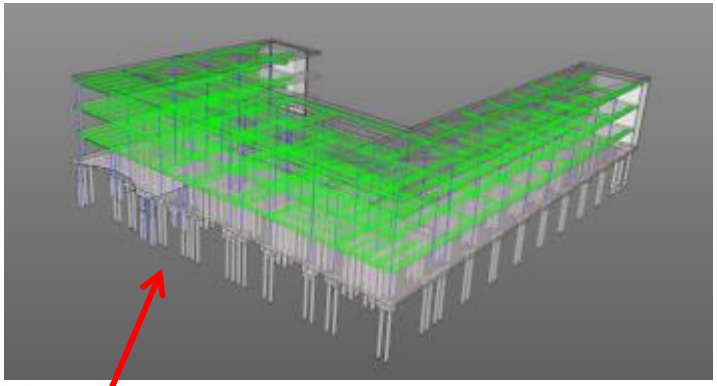
- Beam Width
- Beam Height
- Slab thickness

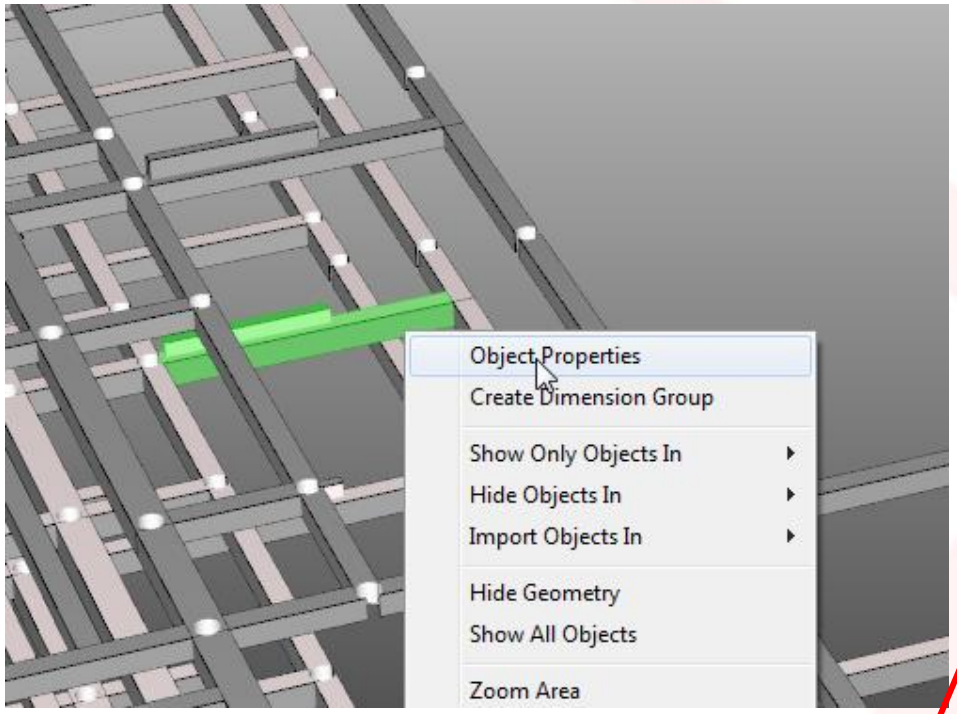
Even Formwork quantities!





Shared Parameter





Dimension Groups | Dimensions

Click to Filter <Filter is Empty>

Name	Quantity	UOM
02 Superstructure		
Concretor		
Beams		
M_Concrete-Rectangular Beam 400 x 800mm	319	m3

Object Properties

Name	Value
Dimensions	
Beam Height	800
Beam Width	400
Length	6299.20
Slab thickness	225
Volume	0.946 m³
Exactal	
Level1	Structural Framing
Level2	M_Concrete-Rectangular Beam
Level3	400 x 800mm
Level4	M_Concrete-Rectangular Beam
Identity Data	
Type Name	400 x 800mm
M_Concrete-Rectangular Beam [152009]	
Guid	9e343347-e3b6-48ba-89a5-94b31bdfd34f
Id	152009
Other	
Concrete Strength	N50
Family Name	M_Concrete-Rectangular Beam
Reo Rate	150
Phasing	
Phase Created	New Construction
Structural	
Cut Length	6093.045
Structural Usage	Girder
System Property	
Instance ID	jbvU8jKL_kKcAOhE5oqHDA
Text	
QSID	02 Superstructure\Concretor\Beams

Method 2 : User-Defined Properties

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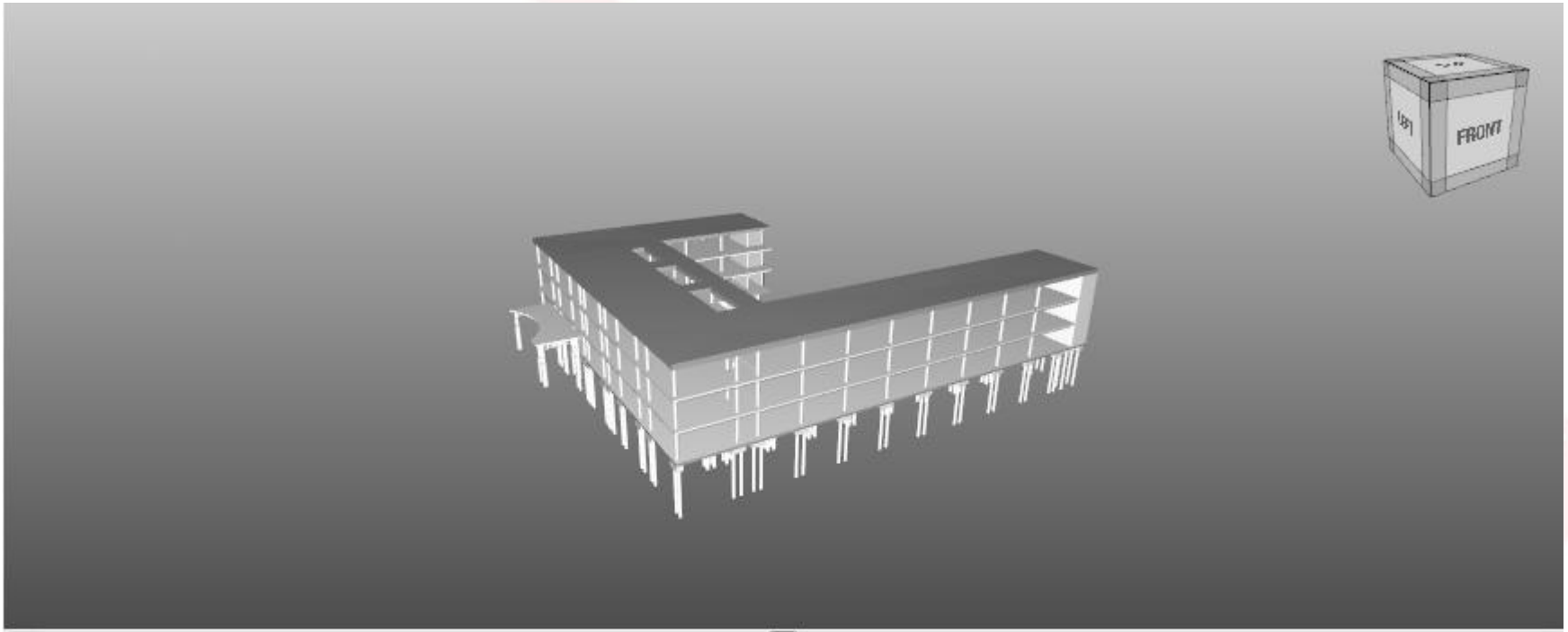
User-Defined Properties

- This function allows the users to insert additional data into the BIM Properties Schedule, which will attach to the corresponding object within the model. The data can then be used for measurement purposes.

- *Examples of User-Defined Properties data might include elemental or trade coding, additional dimensions, formula calculations, life-cycle data etc.*

	N	O	P	Q	R	S
l	Type Name	Volume	Beam Width	Beam Depth	Slab	Beam Height
	400 x 800mm	1.595 m³	400	800	225	=Q2-R2
	400 x 800mm	0.658 m³				
	400 x 800mm	1.361 m³				
	400 x 800mm	0.941 m³				

User-Defined Properties



Schedule:

Area	Assembly Code	Base Constraint	Base Level	Base Offset	Beam Depth	Beam Height	Beam Width	Cut Length	Elevation at Bottom	Estimated Reinfo
71.061 m²					800	575	400			
1631.140 m²					800	575	400			
1740.540 m²					800	575	400			
1563.806 m²					800	575	400			

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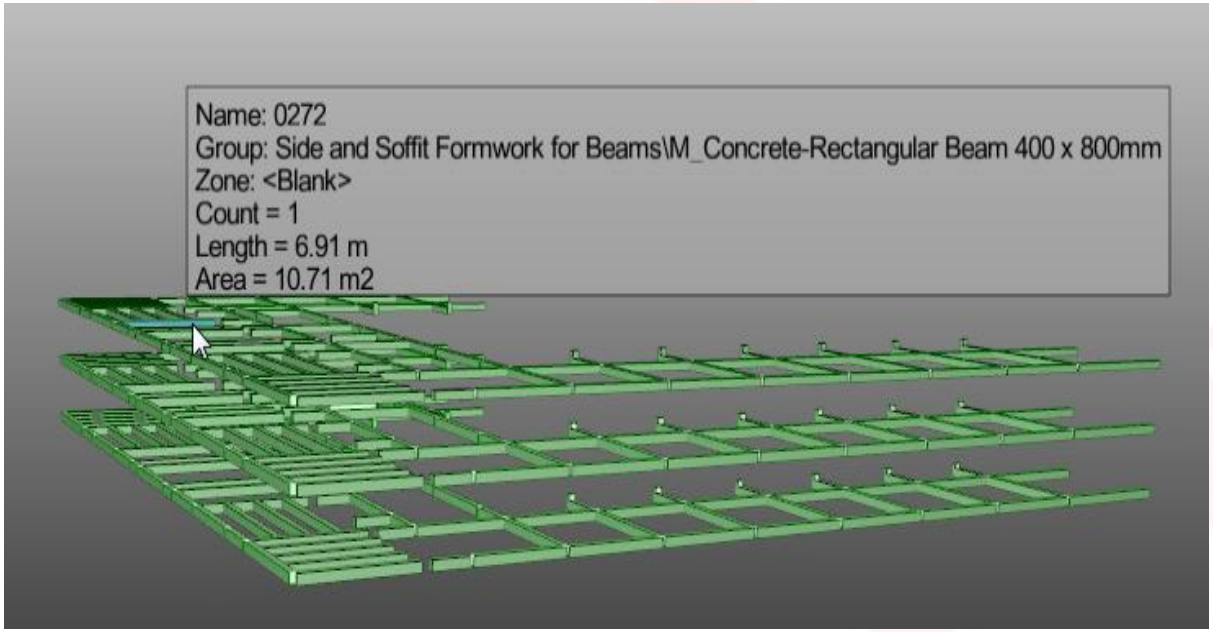
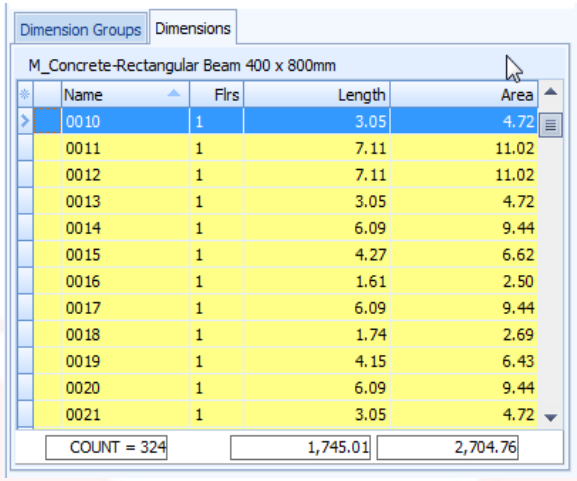
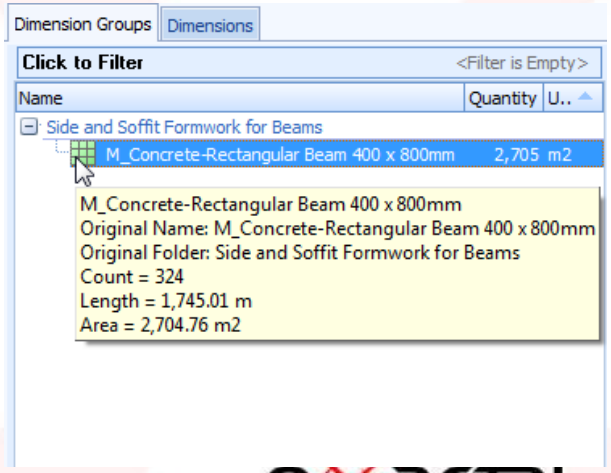
User-Defined Properties







Beam Side and Soffit Formwork derived from Beam Width, Beam Height, Slab thickness and Cut length dimensions in CostX ®

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Method 3 : Cost Code

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Cost Code Implementation

Adding the relevant cost codes as User-Defined Properties into the BIM model, CostX® can co-ordinate the Rate Libraries with model object libraries to achieve a high level of automation to the process of generating comprehensive and fully priced Bills of Quantities or Cost Estimates from BIM models.

BZ	CA	CB	CC	CD	CE
CostCode	Mark	Model	Perimeter	Phase Created	QSID
200 Shotcrete Wall				New Construction	01 SUBSTRUCTURE
200 Shotcrete Wall				New Construction	01 SUBSTRUCTURE
200 Shotcrete Wall				New Construction	01 SUBSTRUCTURE
200 Shotcrete Wall				New Construction	01 SUBSTRUCTURE
200 Shotcrete Wall				New Construction	01 SUBSTRUCTURE
200 Shotcrete Wall				New Construction	01 SUBSTRUCTURE
200 Shotcrete Wall				New Construction	01 SUBSTRUCTURE

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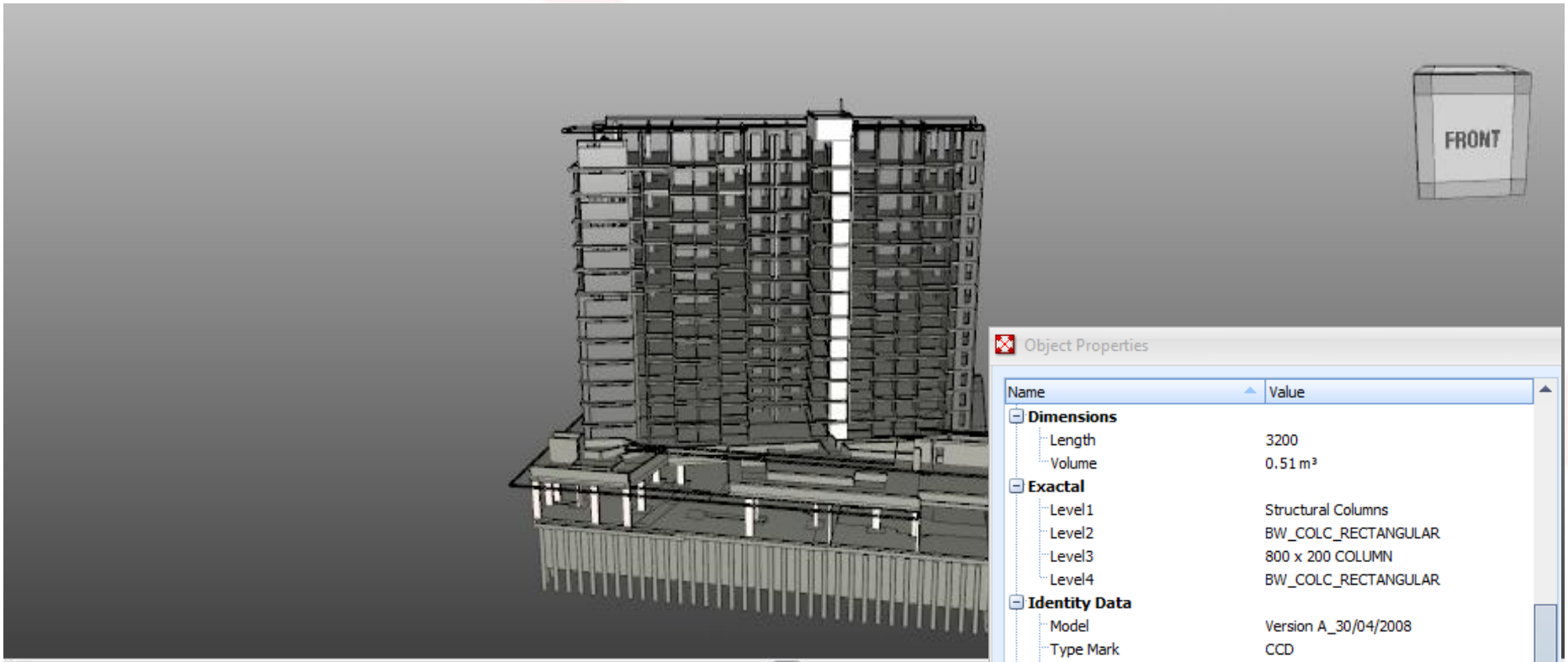
Cost Code Implementation



Schedule:

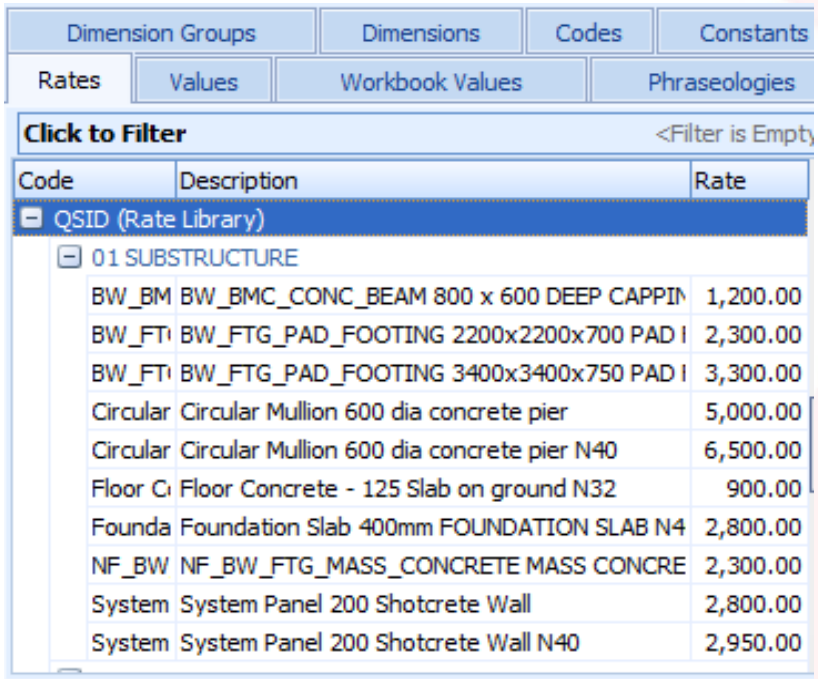
down Depth	Concrete Strength	CostCode	Cut Length	Cutoff Offset	Depth of M
	N40	800 x 200 COLUMN			
	N40	800 x 200 COLUMN			
	N40	800 x 200 COLUMN			
	N40	800 x 200 COLUMN			
	N40	800 x 200 COLUMN			

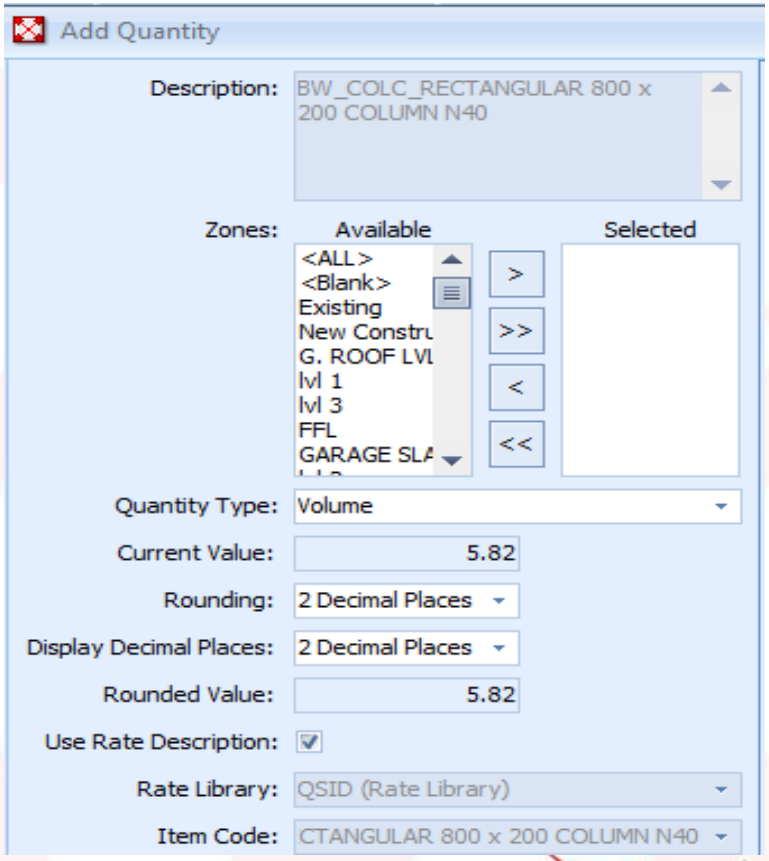
Object Properties

Name	Value
Dimensions	
Length	3200
Volume	0.51 m³
Exactal	
Level1	Structural Columns
Level2	BW_COLC_RECTANGULAR
Level3	800 x 200 COLUMN
Level4	BW_COLC_RECTANGULAR
Identity Data	
Model	Version A_30/04/2008
Type Mark	CCD
Type Name	800 x 200 COLUMN
Other	
Concrete Strength	N40
Family Name	BW_COLC_RECTANGULAR
QSID	02 COLUMNS
Reo Rate	200
Phasing	
Phase Created	New Construction
System Property	
Instance ID	99ujsjokW0abt0uw37FlSA
User Defined	
CostCode	800 x 200 COLUMN

Cost Code Implementation

Example of 3D Cost Report





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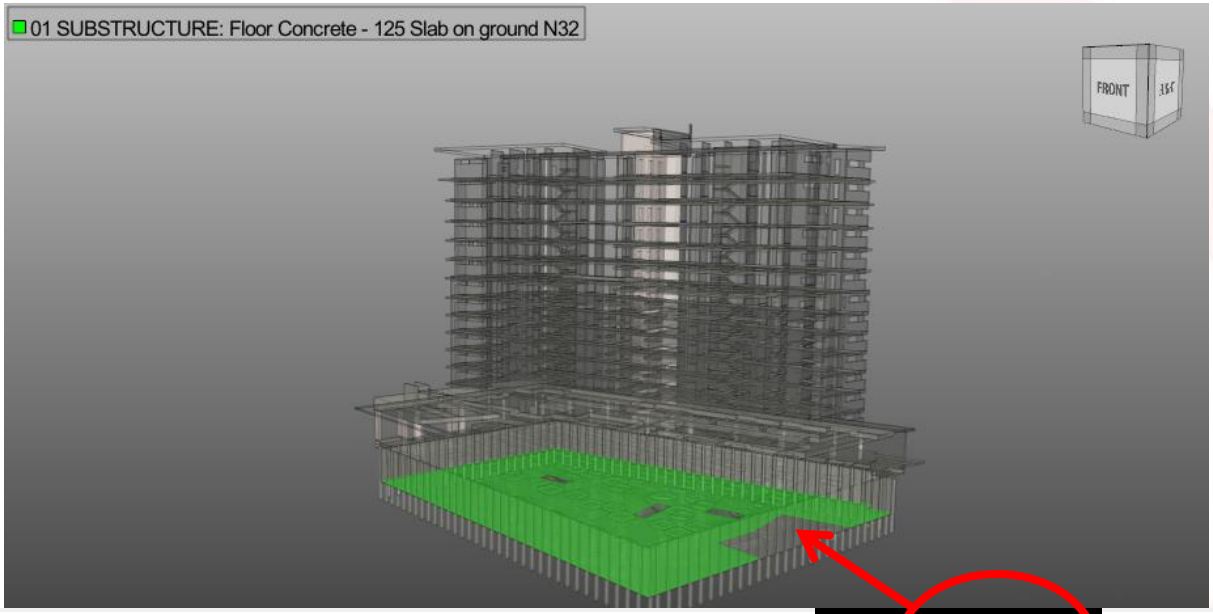
Cost Code Implementation

	A:Code	B:Description	C:Quantity	D:Unit	E:Rate	F:Subtotal
1		3D COST PLAN				
2						
3	1	01 SUBSTRUCTURE				12,225,900.00
4	2	02 COLUMNS				2,136,170.00
5	3	03 UPPER FLOORS				48,210,440.00
6	4	04 STAIRCASE				3,684,000.00
7	5	05 ROOF				5,523,100.00
8	6	06 EXTERNAL WALLS				17,214,600.00
9	7	09 INTERNAL WALLS				7,677,600.00
10					TOTAL:	96,671,810.00

Cost Geometry ®

Live links of Workbook

Live-links between drawing files and workbooks mean that change of dimension is automatically updated in the workbook. It allows QS or estimators to perceive drawing revisions and update quantities.



Floor Concrete - 125 Slab on ground N32	2,384.00	m2	900.00	2,145,600.00

5D Cost Report

	A:Code	B:Description	C:Quantity	D:Unit	E:Rate	F:Subtotal	G:Factor	H:Total
1		01 SUBSTRUCTURE				13,372,950.00		13,372,950.00
2		02 COLUMNS				2,136,170.00		2,136,170.00
3		03 UPPER FLOORS				48,210,440.00		48,210,440.00
4		04 STAIRCASE				3,684,000.00		3,684,000.00
5		05 ROOF				5,523,100.00		5,523,100.00
6		06 EXTERNAL WALLS				17,214,600.00		17,214,600.00
7		09 INTERNAL WALLS				7,677,600.00		7,677,600.00

	Code	Description	Quantity	Unit	Rate	Sub-Total	Factor	Total
		01 SUBSTRUCTURE				3,372,950.00		3,372,950.00

	A:Code	B:Description	C:Quantity	D:Unit	E:Rate	F:Subtotal	G:Factor	H:Total
1		BW_BMC_CONC_BEAM 800 x 600 DEEP CAPPING BEAM N40	217.00	m	1,200.00	260,400.00		260,400.00
2		BW_FTG_PAD_FOOTING 2200x2200x700 PAD FOOTING N40	61.00	m3	2,300.00	140,300.00		140,300.00
3		BW_FTG_PAD_FOOTING 3400x3400x750 PAD FOOTING N40	216.00	m3	3,300.00	712,800.00		712,800.00
4		Circular Mullion 600 dia concrete pier	17.00	m	5,000.00	85,000.00		85,000.00
5		Circular Mullion 600 dia concrete pier N40	964.00	m	6,500.00	6,266,000.00		6,266,000.00
6		Floor Concrete - 125 Slab on ground N32	2,384.00	m2	900.00	2,145,600.00		2,145,600.00
7		Foundation Slab 400mm FOUNDATION SLAB N40	34.00	m3	2,800.00	95,200.00		95,200.00
8		NF_BW_FTG_MASS_CONCRETE MASS CONCRETE N10	113.00	m3	2,300.00	259,900.00		259,900.00
9		Power float finish to concrete floor for carpark/driveway	2,549.00	m2	450.00	1,147,050.00		1,147,050.00
10		System Panel 200 Shotcrete Wall	13.00	m2	2,800.00	36,400.00		36,400.00
11		System Panel 200 Shotcrete Wall N40	754.00	m2	2,950.00	2,224,300.00		2,224,300.00

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5D Cost Report

3D COST PLAN

Project: Default Project
Building: QSID Cost Code Example - Copy

Details: 3D Cost Analysis
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Code	Description	Quantity	Unit	Rate	Cost Total (HKD):
01 SUBSTRUCTURE					
1.1	BW_BMC_CONC_BEAM 800 x 600 DEEP CAPPING BEAM N40	217.00	m	1,200.00	260,400.00
1.2	BW_FTG_PAD_FOOTING 2200x2200x700 PAD FOOTING N40	61.00	m3	2,300.00	140,300.00
1.3	BW_FTG_PAD_FOOTING 3400x3400x750 PAD FOOTING N40	216.00	m3	3,300.00	712,800.00
1.4	Circular Mullion 600 dia concrete pier	17.00	m	5,000.00	85,000.00
1.5	Circular Mullion 600 dia concrete pier N40	964.00	m	6,500.00	6,266,000.00
1.6	Floor Concrete - 125 Slab on ground N32	2,384.00	m2	900.00	2,145,600.00
1.7	Foundation Slab 400mm FOUNDATION SLAB N40	34.00	m3	2,800.00	95,200.00
1.8	NF_BW_FTG_MASS_CONCRETE MASS CONCRETE N10	113.00	m3	2,300.00	259,900.00
1.9	System Panel 200 Shotcrete Wall	13.00	m2	2,800.00	36,400.00
1.10	System Panel 200 Shotcrete Wall N40	754.00	m2	2,950.00	2,224,300.00

Final Words

QS in the 5D BIM Movement

- Addition of extra information into BIM models is an important technique and very significant to QS for successful implementation of BIM into their workflow.

- 5D estimating or measurement ultimately creates better prospect for QS in the construction industry:
  - Transparency of scope and cost decisions
  - Better document management & contract administration
  - Workflow and productivity benefits
  - Greater certainty of outcome
  - Savings in program time for better cost advice
  - Better scope management (ie. cost saving exercise as project cost overrun)

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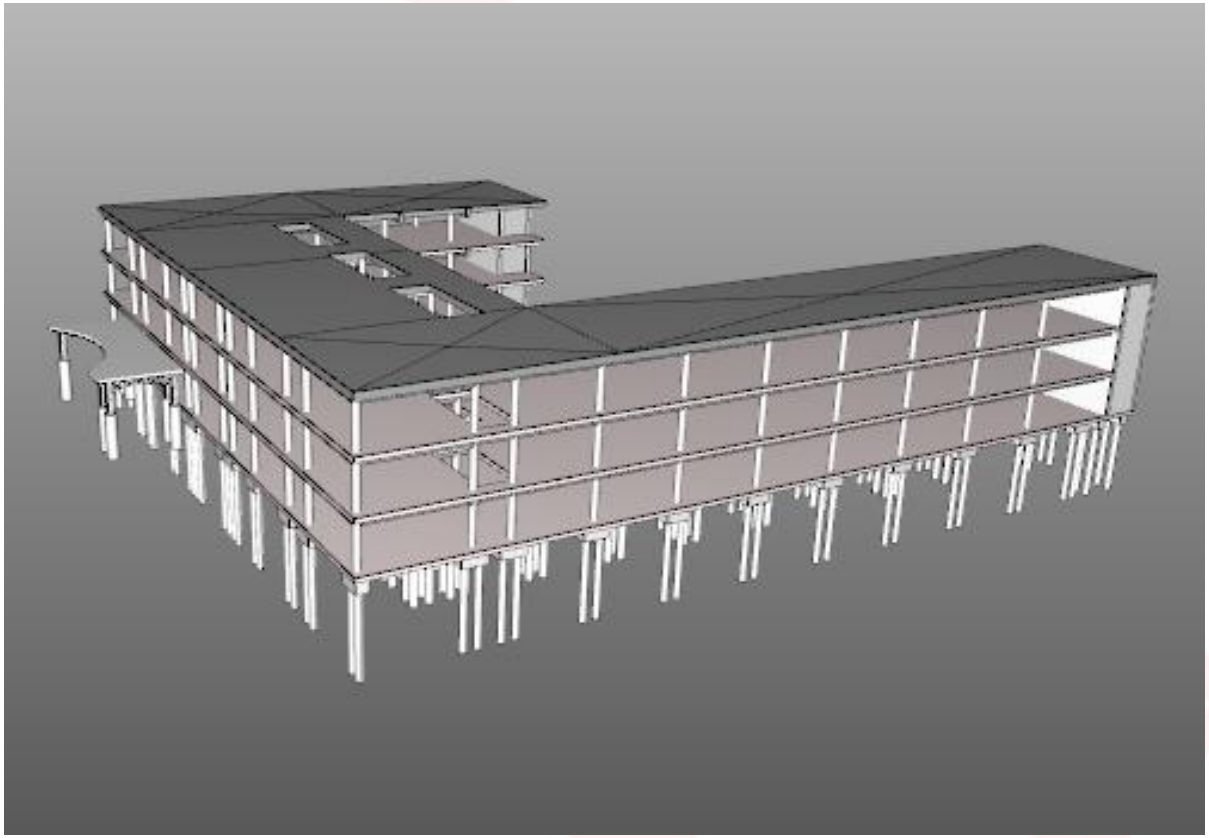
Case Study – Structural Model



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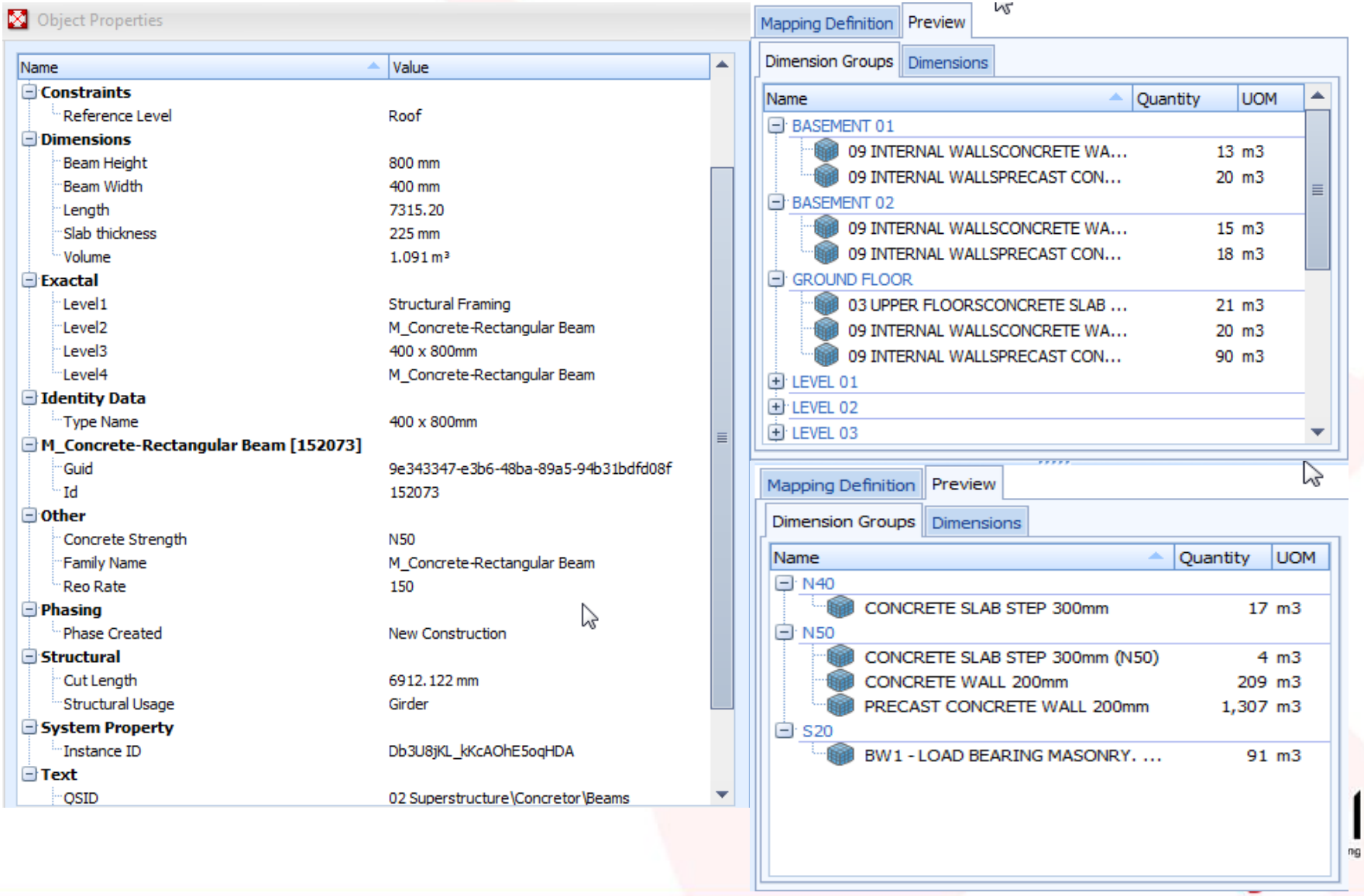
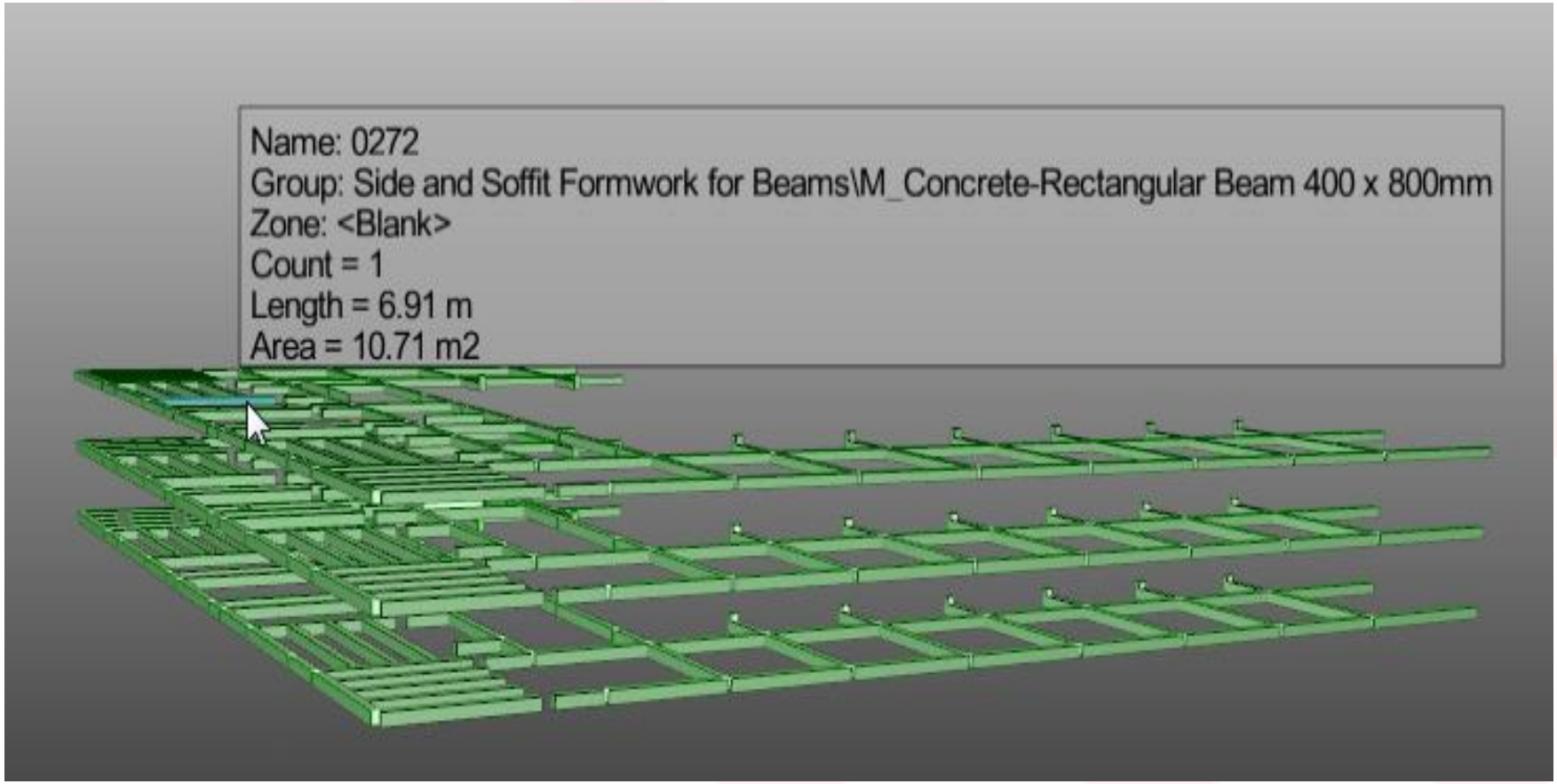
Case Study – Structural Model



Case Study – Structural Model



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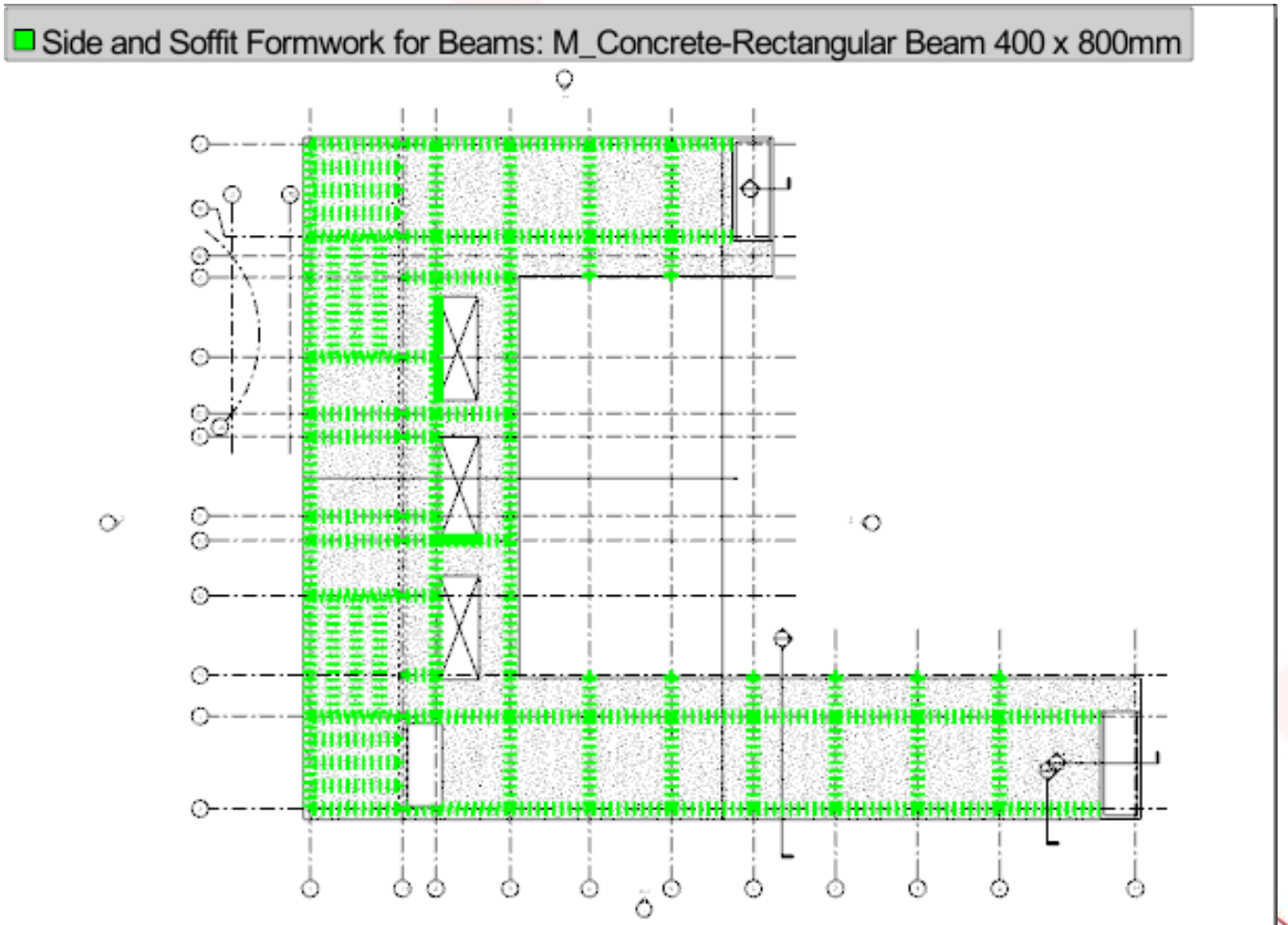
Case Study – Structural Model



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Case Study – Structural Model

	A:Code	B:Description	C:Quantity	D:Unit	E:Rate	F:Subtotal
2						
3		**BILLS OF QUANTITES**				
4						
5	Bill No. 1	PRELIMINARIES				112,000.00
6	Bill No. 2	PREAMBLES				230,000.00
7	Bill No. 3	SUBSTRUCTURE				130,000.00
8	Bill No. 4	PODIUM				500,000.00
9	Bill No. 5	SUPERSTRUCTURE				97,200.00
10	Bill No. 7	EXTERNAL WORKS				600,000.00
11	Bill No. 8	FIXTURE, FURNITURE AND EQUIPMENT				120,000.00
12	Bill No. 9	ELECTRICAL INSTALLATION				450,000.00
13	Bill No. 10	MECHANICAL VENTILATION AND AIR CONDITIONING INSTALLATION				600,000.00
14	Bill No. 11	FIRE SERVICES INSTALLATION				800,000.00
15	Bill No. 12	PLUMBING AND DRAINAGE				280,000.00
16	Bill No. 13	LIFT INSTALLATION				450,000.00
17	Bill No. 14	SITE SAFTETY AND ENVIRONMENTAL MANAGEMENT				800,000.00
18	Bill No. 15	PROVISIONAL SUMS AND ATTENDANCES				120,000.00
19	Bill No. 16	SPARE AND SPARE PARTS				500,000.00
20					**TOTAL:**	**5,789,200.00**

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- End of Presentation –

Thank you ☺