THE HONG KONG INSTITUTE OF SURVEYORS
香港測量師學會

BIM
Measurement Information Requirements

by

Quantity Surveying Division

The Hong Kong Institute of Surveyors

DRAFT

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Feedback

As Building Information Modelling (BIM) and related digital technologies are developing rapidly, it is expected that the Quantity Take-off practice may also undergo an evolutionary change. The Hong Kong Institute of Surveyors welcomes comments and proposed changes to this publication and encourages readers to notify us of any apparent inaccuracies for further improvements in the subsequent revision.

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Part A – Introduction

Section 1 – General Principles

1.1 Background

Building Information Modelling (BIM) has been implemented in Hong Kong for several years. At the early stage of development, BIM was only voluntarily adopted by some well-established developers, design consultants and contractors. Since 2019, cost estimation has been specified by the Development Bureau as one of the mandatory BIM uses in government capital works projects. According to CIC BIM Standards – General (Version 2.1 – 2021):

> *Cost Estimation / 5D modelling is a process in which BIM can be used for cost estimates throughout the life cycle of a project.*
>
> *(a) Quantity Take-off and cost estimating*
> *In the design stage, the Information Models can generate more accurate quantities for project cost budgeting, project cost control and cost evaluation on design options, etc. as far as practicable.*
> *In the tender stage, the Information Models can be used for extracting quantities in the preparation of pricing documents [and the Information Models shall form part of tender information to indicate the design intent layout and the material quantities for the tenderers' information].*
>
> *(b) 5D modelling / cash flow forecasting*
> *In the construction stage, the Information Models can be used for extracting quantities for project cost control, cost evaluation on the variation of works, cash flow forecast, spending analysis, interim payment, etc. as far as practicable. The 5D Model shall be adopted in the regular project progress meeting to indicate and compare the current cash flow status with the baseline forecast to facilitate project management.*
>
> (Note: the term information model is defined under ISO 19650-1:2018.)

In fact, **Quantity Take-off (QTO)** is the first and foremost essential task for the preparation of pre-construction cost estimates, cost plans, bills of quantities, quotations, schedule of quantities and rates, and bills of materials for ordering, programme planning, progress payment valuation, post-contract cost estimating, re-measurement of provisional quantities and variations, etc. With the advent of BIM, the traditional meaning of QTO, whereby the dimensions of work and materials are measured from the drawings one by one and further calculated to give the quantities, should be updated to mean ***extraction and generation of quantities from the BIM models for various cost management needs***. Such needs are applicable to any person (not just quantity surveyors) who is required to determine the quantities of work to be done (or already done) or materials to be ordered, and the quantities so extracted or generated must suit the established practice of classification and itemisation for cost management needs.

The quantity surveying discipline has been proactively exploring how to adopt BIM in quantity surveying practices throughout the project life cycle. Projects utilising BIM models for QTO, cost estimating and other cost management functions are growing. However, there are still many issues to be resolved to achieve a higher degree of collaboration with other disciplines. While several BIM standards have been released in the industry, these standards and most of the BIM models being produced in projects have not adequately prescribed or been modelled in such a way to enable extraction and generation of quantities according to the established practice of classification and itemisation.

The Digitalisation Sub-committee of the Quantity Surveying Division (QSD) of The Hong Kong Institute of Surveyors (HKIS), therefore, took an initiative to prepare this publication listing the QTO information requirements on model elements/objects, and QTO guidelines. It is anticipated that this publication will contribute not only to the best practice of BIM-based QTO but also facilitate the collaborative practice among stakeholders. For full automation of QTO, further standardisation or coding system have to be explored.

The persons carrying out BIM-based QTO are called "**quantity surveyors**" in this publication, irrespective of their positions or employment in their organizations.

1.2 Aim and Approaches

BIM models of inadequate quality will impair using BIM information for cost management and procurement. Benefits from efficient model-based cost advice or budget monitoring cannot be achieved.

This publication aims to give guidelines to be used by quantity surveyors to share and communicate with the designers and modellers to ensure that the information provided in BIM models can enable the extraction and generation of quantities according to the established practice of classification and itemisation in the pre- and post-contract stages.

The general principles are described in this **Part A**.

The naming of any specific software or brand name is for explaining the origin of the specific content and does not aim at promoting any proprietary product.

Part B presents the common work and trade sections, and describes under each section:

1. Basic modelling approaches: this publication does not mandate the modelling approaches*; most of the models included are taken from existing projects and the information for QTO is highlighted for illustration. Geometric modelling relationships have been suggested such that the quantities directly generated from the model can represent the quantities required for QTO with minimum adjustments. Schedulable parameters should be used as much as possible such that the model is truly parametric to avoid the occurrence of a mismatch between the geometry and the input parameter value.

* To enable smooth workflow and effective data management across the built asset life cycle, standardisation of naming and data format must be agreed upon among different parties. Full collaboration among different disciplines to explore the appropriate way is the solution for digitalised workflow.

In a BIM project, the full information required for tender pricing and construction should be given in the model, and supplementary 2D drawings of construction details and specifications should be provided for study in conjunction (except for the design or development to be further done by the contractors, fabricators and suppliers).

2. *Information requirements for QTO*: the essential information to be included in a specific model element/object. The quantity surveyors are also reminded of what is generally not included in a model element/object.

3. *QTO guidelines*: brief guidelines on how to extract the relevant dimensions or quantities in compliance with the Fifth Edition of the Hong Kong Standard Method of Measurement (HKSMM5) to compile schedules for measurement.

4. Preambles of Part B:
   a) All the information highlighted in red rectangular frames in the properties palette of model objects has to be provided for QTO;
   b) Dimensions and levels of model objects, which are required as the minimum information for construction purposes and thus for QTO, are not repeatedly mentioned again under information requirements for QTO; and
   c) All the information required for the fields in the schedules, except calculated fields, have to be provided for QTO.

Some essential scheduling, quantity extraction and generation skills for QTO are described in **Part C** for the reference of quantity surveyors.

1.3 Caveat

While BIM models can be built progressively (whether by the design consultants, contractors or their BIM consultants), the modelling should be appropriate from the very beginning to avoid abortive work. Therefore, the requirements mentioned in this publication should be observed at the very beginning.

Quantity surveyors should recognize that preliminary models received for cost estimating are mostly not completed yet. Allowances should be made for work reasonably required for the final design but not yet modelled.

The BIM models should be modelled according to the standards, such as those published by Construction Industry Council (CIC), Housing Authority (HA) or Architectural Services Department (ArchSD), prescribed by the services agreements or works contracts. The scope

and fineness of BIM models as required at different project stages are usually defined in the agreements or contracts in terms of the Level of Information Need (LOIN) as defined in the CIC BIM Standards – General (Version 2.1 – 2021), which comprises three components: Level of Graphics (LOD-G), Level of Information (LOD-I), and Documentation (DOC). LOD-G has four generic levels of graphical representation: LOD-G 100, LOD-G 200, LOD-G 300, and LOD-G 400, and LOD-I has five levels, namely LOD-I 100, LOD-I 200, LOD-I 300, LOD-I 400 and LOD-I 500.

Quantity surveyors should refer to the services agreements and works contracts and other relevant documents such as the BIM Execution Plan (BEP) to understand what level of model details could be obtained at each stage of work. It should be noted that notwithstanding the specified standards and LOIN, the fundamental principle is that the BIM models should be adequate for the intended purposes at different points in time. If they are not, the designers and the modellers should be informed of any errors or omissions, if found by the quantity surveyors, for supplement or corrections. For good BIM implementation in a project, it is necessary to involve quantity surveyors from the outset to agree on the information requirements for cost management purposes in different stages of work.

The ideal BIM model should ultimately represent the work to be done or already done, sufficiently and accurately, with no errors or omissions.

However, BIM models prepared by the design consultants or their BIM consultants may be intended for design authoring, design review and drawing generation only and, if given to the tenderers/contractors, are intended to be for reference only without any contractual implication. Care should be exercised when using such BIM models for preparing bills of quantities or schedules of quantities and rates. This situation is not ideal for the implementation of BIM in construction projects. The HKIS BIM Contract Conditions (First Edition, April 2020) has a provision to include “Design Model” as part of contract documents. The Development Bureau (DEVB) Technical Circular (Works) No. 2/2021 mentions it is the ultimate goal of DEVB to include BIM models as part of tender information for electronic tendering (e-tendering) and make them contractually binding, and Works Departments should be working towards including BIM models as part of tender information as far as practicable.

On the other hand, BIM models prepared by the contractors or their BIM consultants are not intrinsic instructions of the architects or engineers, and these models may contain fabrication details and as-built work which is not a measurable item for payment according to the methods of measurement used for the bills of quantities or schedule of quantities and rates. Care should be exercised when these BIM models are the only available models for QTO in the post-contract stage of a project.

When BIM models are built according to the agreed approaches and LOIN, and the BIM models are reviewed by model authors to remove errors or omissions, then quantity surveyors should be able to create BIM QTO or to extract information and quantities for cost management, effectively from BIM models. Having said that, the deliverables will not be generated from the click of a single button, but the whole process will be benefited from the automated collection and categorization of data, facilitating quantity surveyors to provide clients with more active cost advice against any design changes in a project.

Part B – BIM Model Information Requirements for Quantity Take-off

Section 2 – Excavation

2.1 Site and Foundation Excavation

2.1.1 Basic Modelling Approaches

If no topo surface object is available, import drawings of existing topo surface for creating a topo surface object in the model.

By using the building pad approach, quantities of excavation could be derived. Unless otherwise agreed with modellers, quantity surveyors will carry out the building pad approach as illustrated in Section 2.1.3.

2.1.2 Information Requirements for Quantity Take-off

a) Site formation and excavation requirements.

b) Foundation layout and profile.

2.1.3 Quantity Take-off Guidelines

a) Model comparing existing and new topo surfaces:

Create two topo surfaces, one is representing the profile of commencing levels and another is representing the profile of excavated levels; cut and fill volumes will be generated when the two topo surfaces are compared.

For site formation

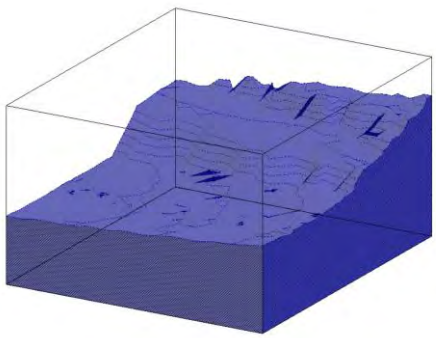


Figure 2.1.1 - Commencing levels

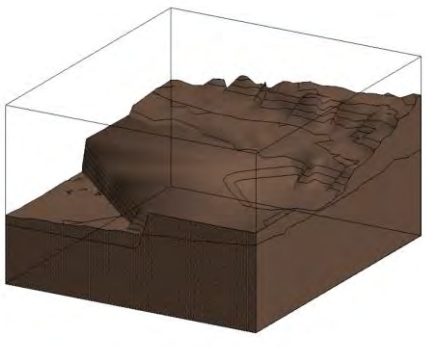
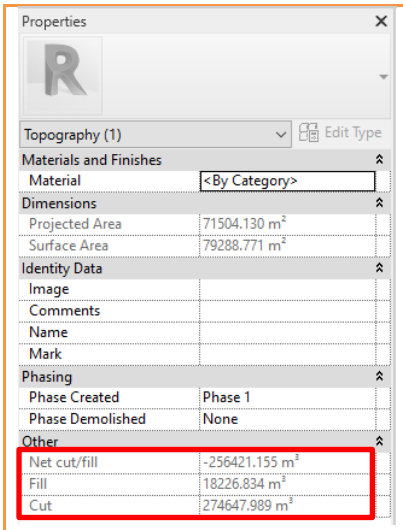


Figure 2.1.2 - Excavated levels



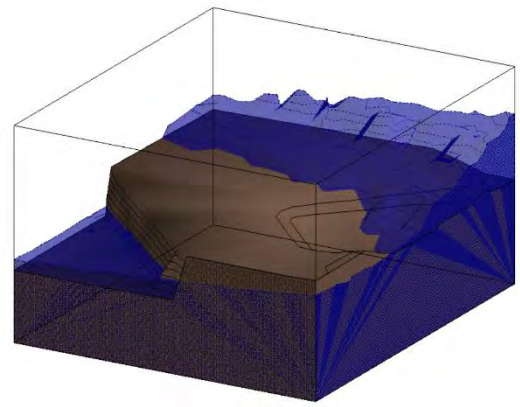
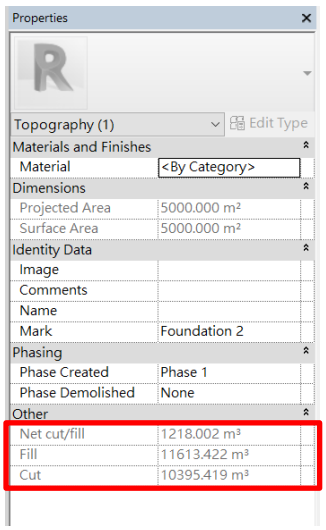
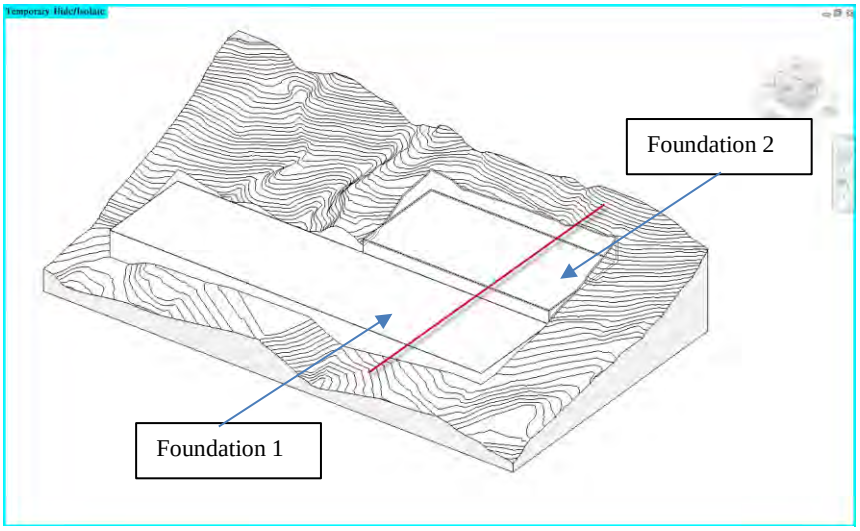


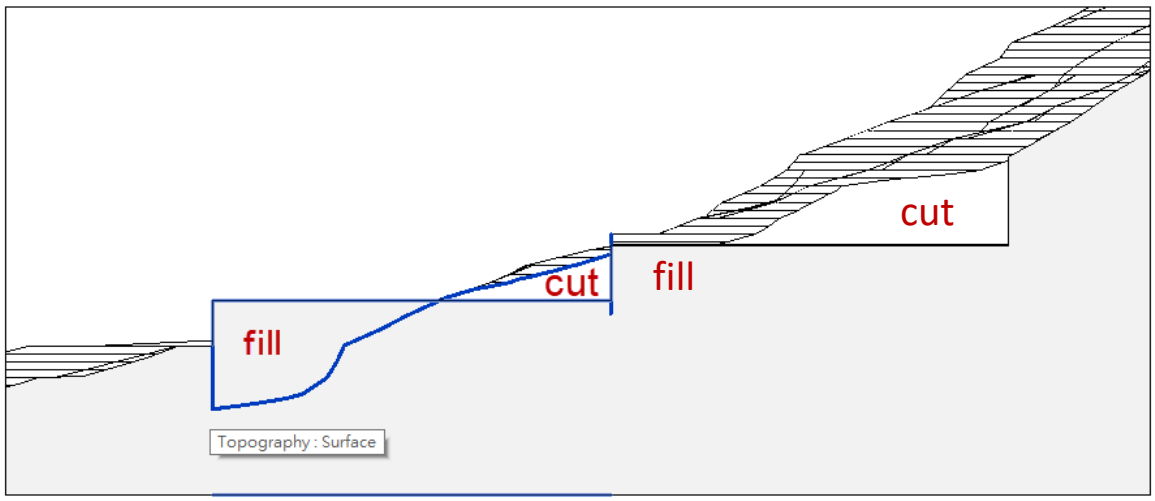
Figure 2.1.3 – Combined profile

b) Model with building pad on existing topo:

A system family for building pad or a new profile to be created in the model by sketching the boundary of the foundation / excavation layout. If different levels of foundation are encountered, separate building pads should be created.





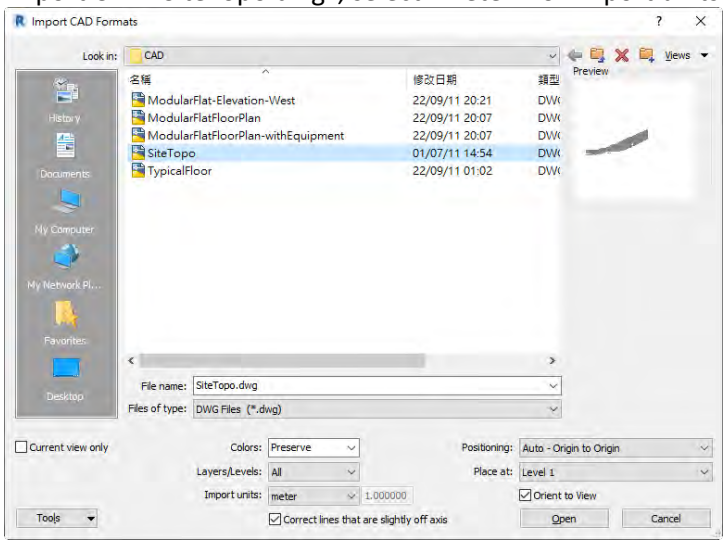


Toposurface

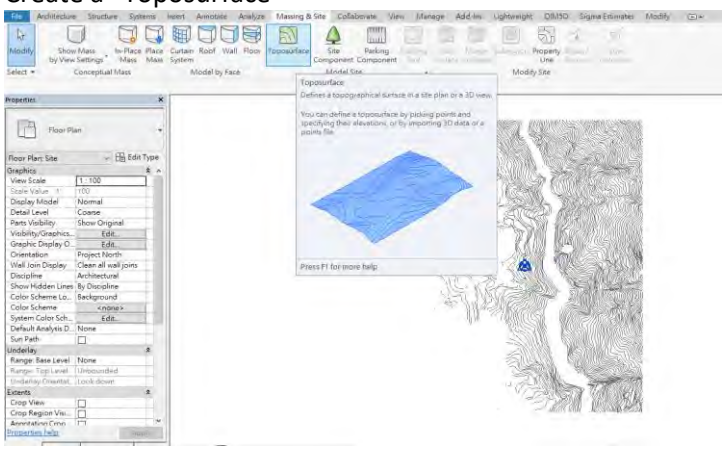
1 Create New Project

2 Open Site Floor Plan

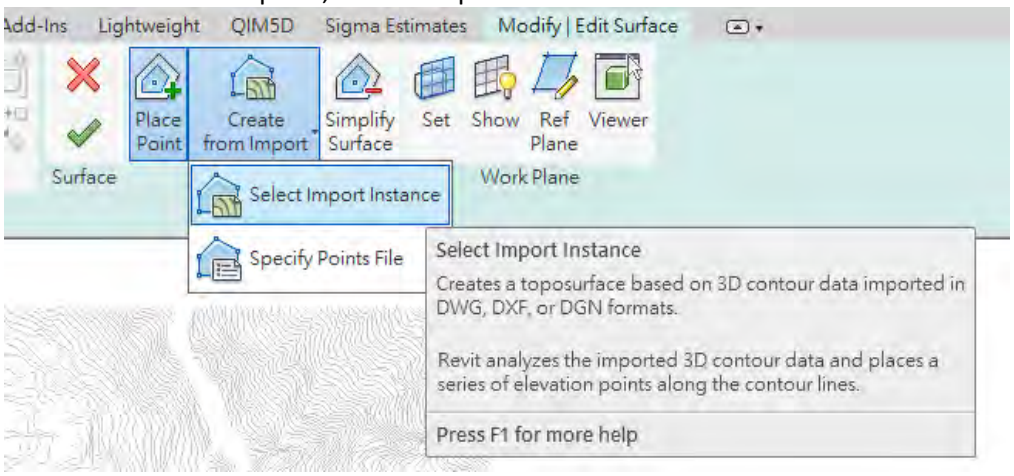
3 Import CAD “SiteTopo.dwg”, select “meter” for import units



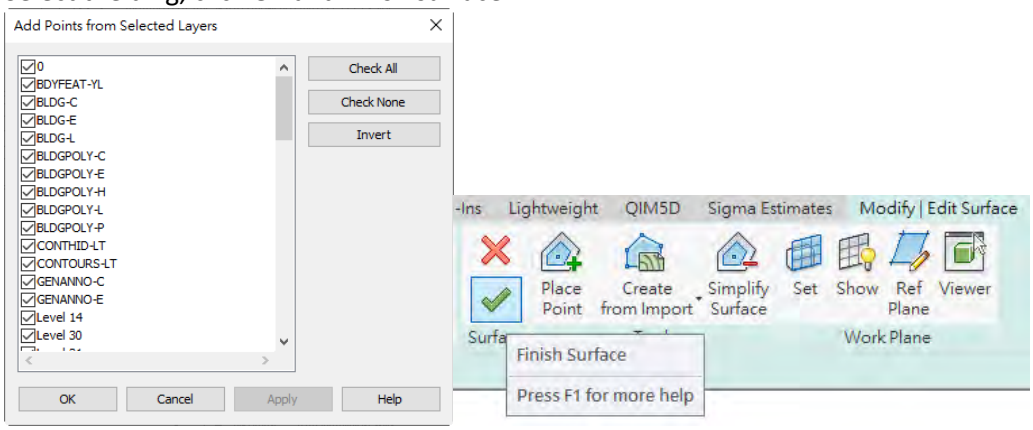
4 Create a “Toposurface”



5 Click “Create from Import”, “Select Import Instance”

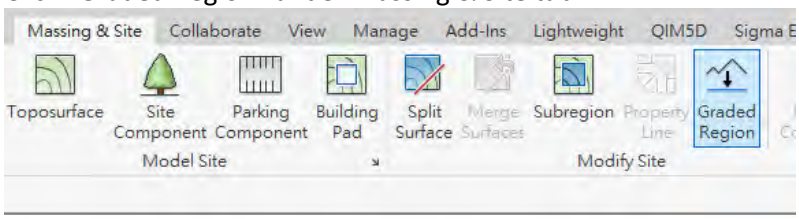


6 Select the dwg, click OK and finish surface

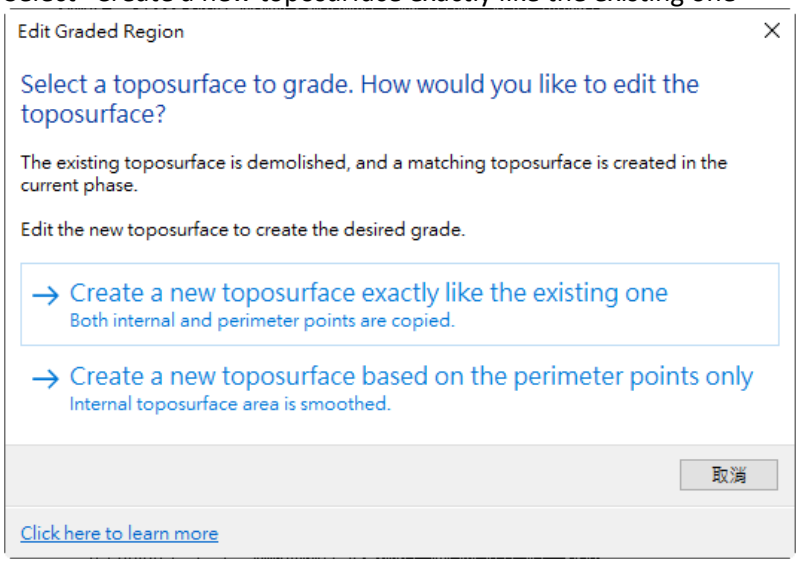


7 Open 3D view, turn to Top plan view

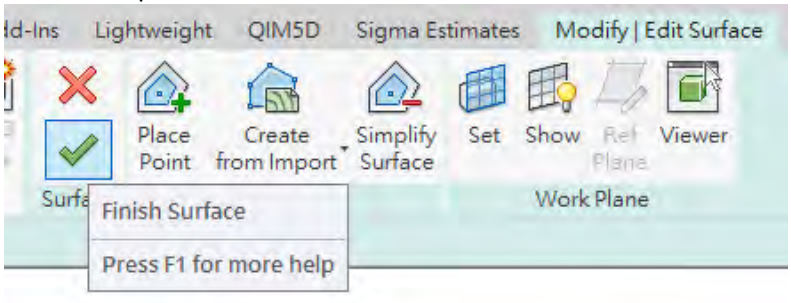
8 Click “Graded Region” under Massing & Site tab



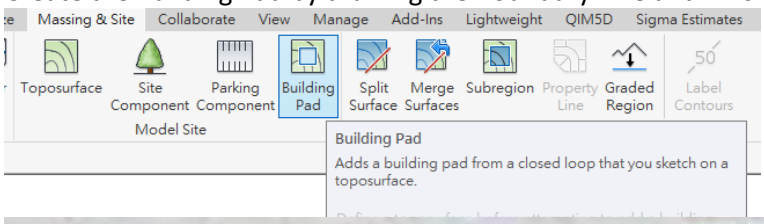
9 Select “Create a new toposurface exactly like the existing one”

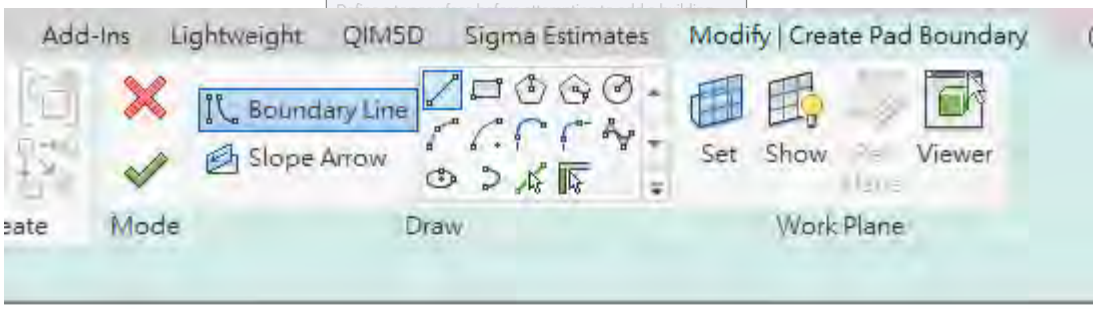


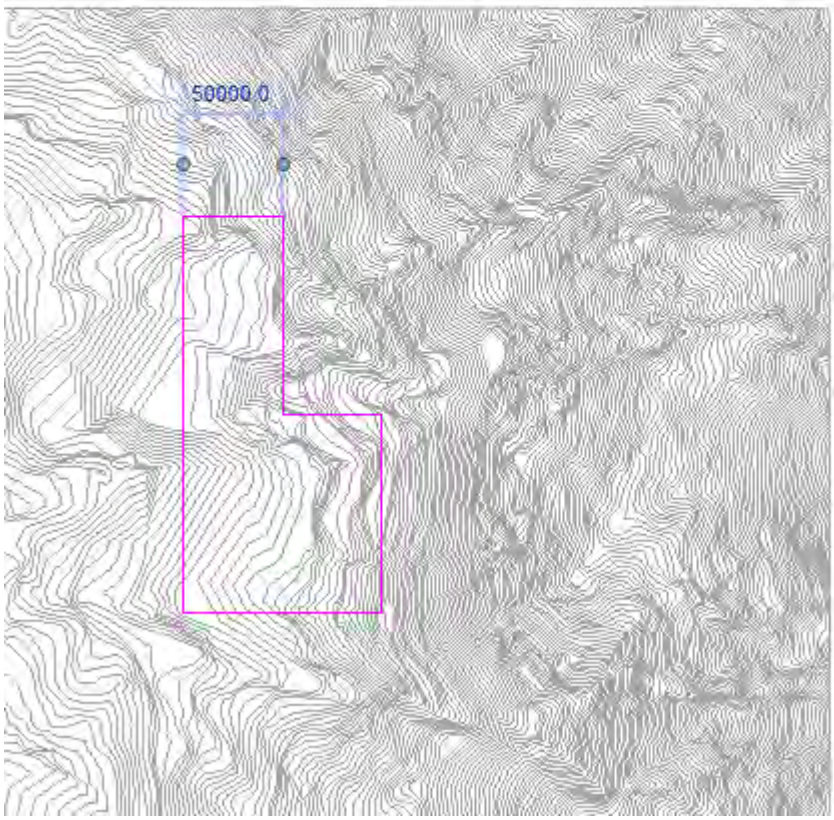
10 Click the toposurface and finish surface



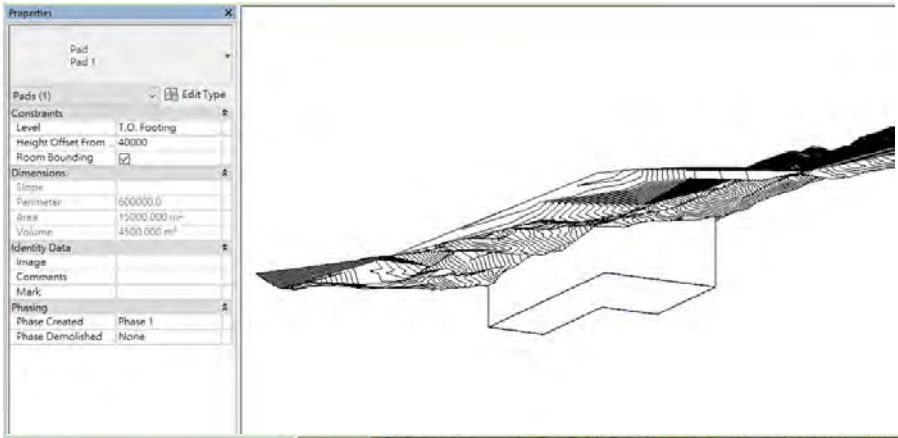
11 Create the Building Pad by drawing the Boundary Line and finish surface

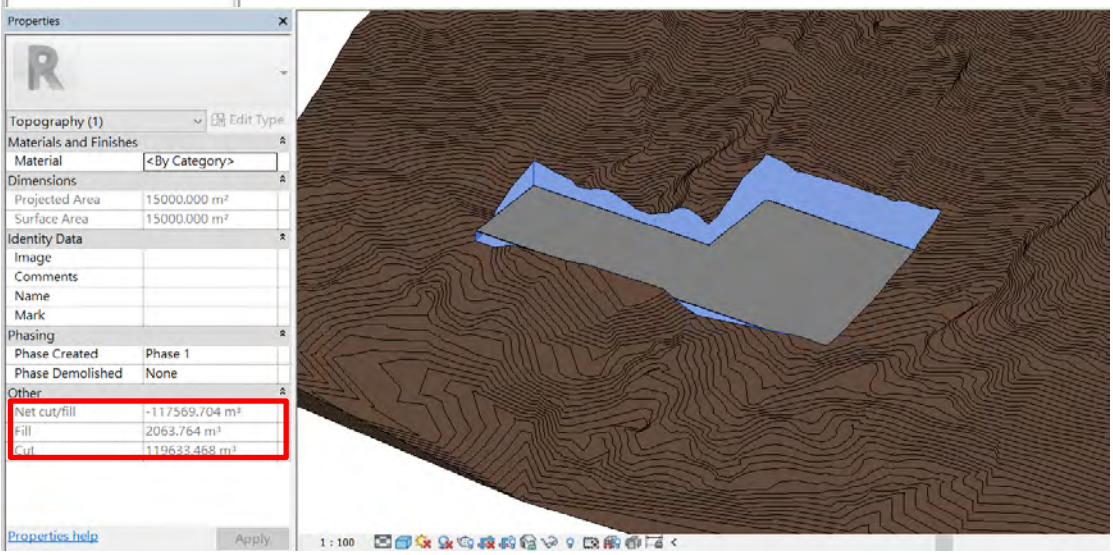




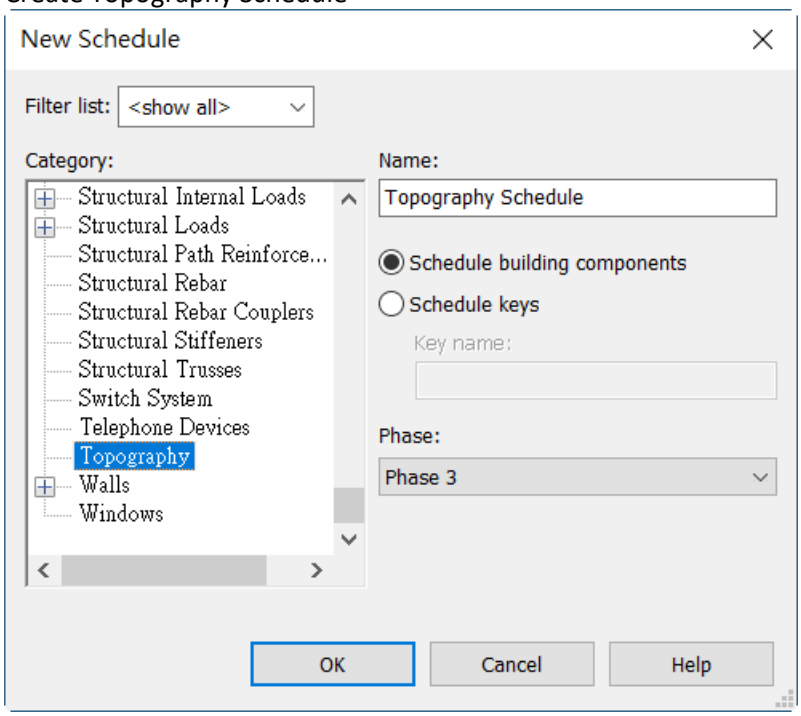


12 Offset the pad top level to 40000, where the required reduced level is 40300, with the difference 300mm is the pad thickness

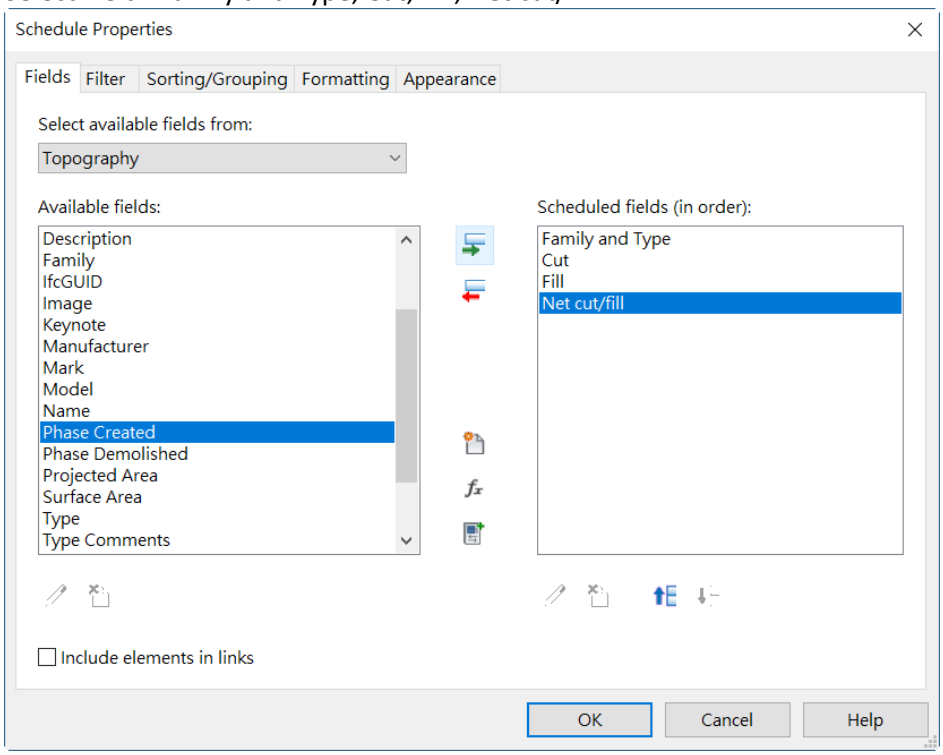




13 Create Topography Schedule



14 Select Field “Family and Type, Cut, Fill, Net cut/fill”



For measurement of volume of excavation, create a schedule as below:

<Topography Schedule>

A	B	C	D
Mark	Cut	Fill	Net cut/fill
Foundation 1	3245.36 m³	42457.79 m³	39212.43 m³
Foundation 2	10395.42 m³	11613.42 m³	1218.00 m³
Grand total: 2	13640.78 m³	54071.21 m³	40430.43 m³

Adjust for the following as necessary:

- Nil.

2.2 Excavation and lateral supports

2.2.1 Basic Modelling Approaches

Excavation and lateral support should be modelled with two major parts, one is supporting wall and the other is strutting system.

For supporting wall, such as sheet piles, soldier piles, interlocking piles, etc., the modelling approaches and information required shall refer to “Section 4.1 – Steel Sheet Piling” for details.

For strutting system, including strut, waling, king post, bracing, etc., the modelling approaches and information required shall refer to “Section 9 – Structural Steelwork” for details.

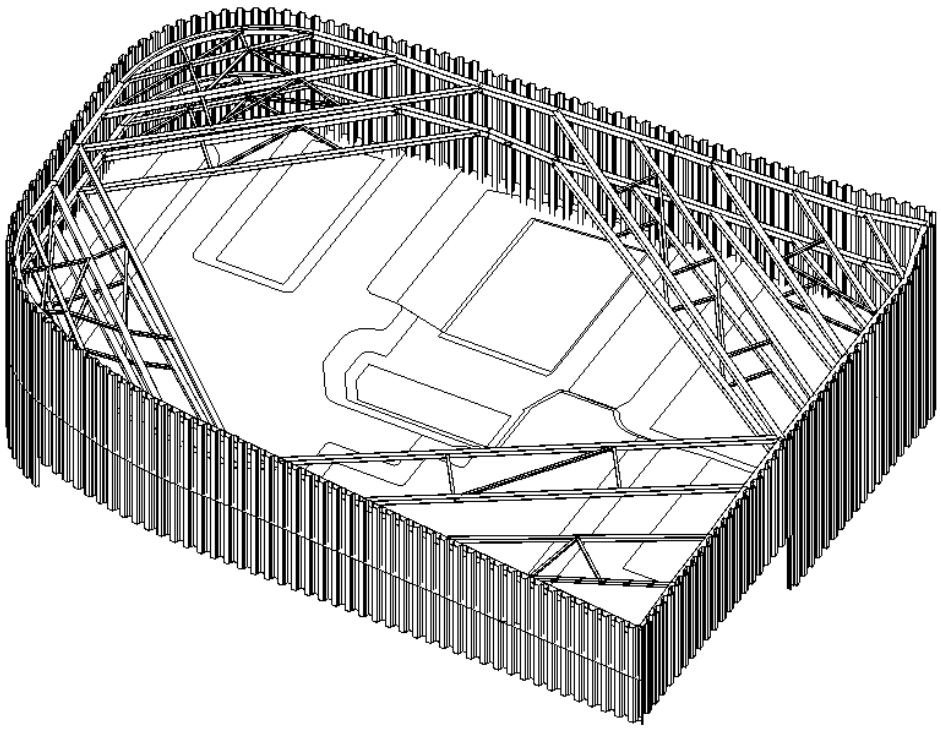


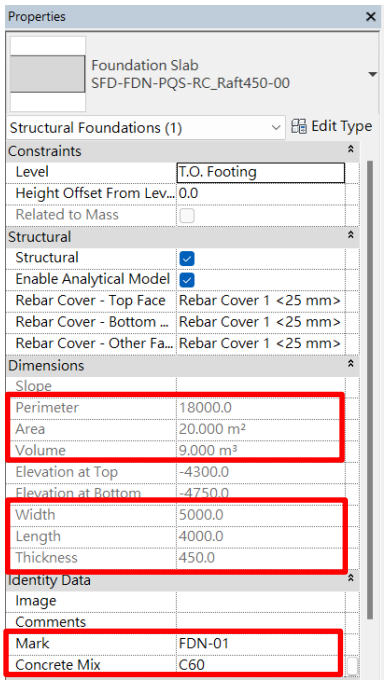
Figure 2.2.1 - 3D View of Excavation and Lateral Support (Engineer’s design)

Section 3 – Foundations

3.1 Raft Foundations

3.1.1 Basic Modelling Approaches

Based on the structural foundations template, a system family type for foundation slab is created by sketching the boundary/profile of the foundation perimeter and extruding to the required thickness. The relevant information that can be extracted from the parameters is perimeter, length, area, volume, thickness, etc. In case there is a level difference, a system family type for slab edge should be used.



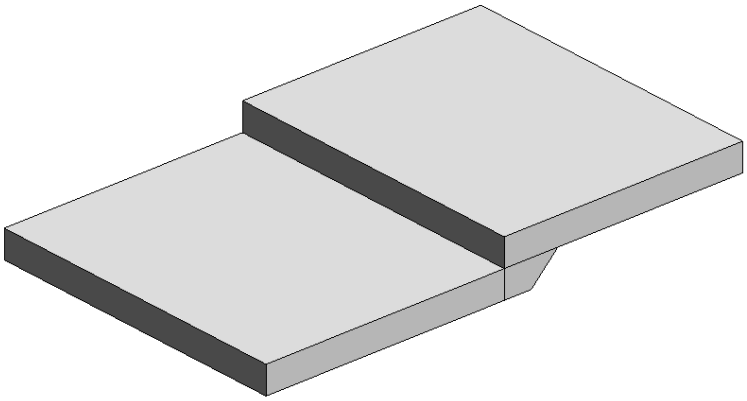


Figure 3.1.1 - 3D View of Foundation Slabs with Level Difference

3.1.2 Information Requirements for Quantity Take-off

1. Foundation marks.
2. Mix or strength of concrete.
3. Types and extent of specified admixture, e.g. waterproofing.
4. Thickness of blinding layer.
5. Formwork – left-in (if any)

This sample model has not included:

a. Reinforcement.

b. Formwork.

3.1.3 Quantity Take-off Guidelines

For measurement of foundation, create a schedule with the following fields:

<Structural Foundation Schedule>

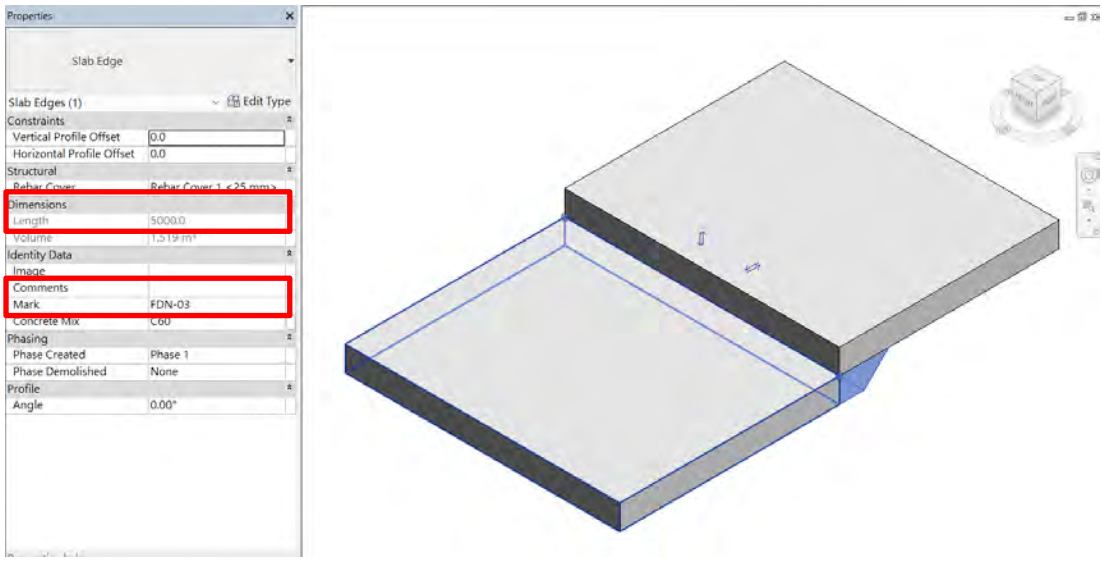
A	B	C	D	E	F	G	H	I	J	K
Family	Type	Mark	Concrete Mix	Length	Width	Thickness	Perimeter	Area	Volume	Side Fmk Area
Foundation Slab	SFD-FDN-PQS-RC_Raft450-00	FDN-01	C60	4000	5000	450	18000	20.00	9.00	8.10
Foundation Slab	SFD-FDN-PQS-RC_Raft450-00	FDN-02	C60	4000	5000	450	18000	20.00	9.00	8.10
Grand total: 2								40.00	18.00	16.20

The plan area of foundations can be used for the measurement of the blinding layer (if such object is not separately created). The perimeter and thickness of the foundation can be used to calculate the side formwork quantities.

For measurement of Side Formwork Area, create the following formula for column K in the schedule:

- Setting formula: *Perimeter * Thickness*

For measurement of slab edge, create a schedule as below:



<Slab Edge Schedule>

A	B	C	D	E
Family	Mark	Concrete Mix	Length	Volume
Slab Edge	FDN-03	C60	5000	1.52

Adjust for the following as necessary:

- Formwork at intersected areas of foundations.
- Formwork and blinding layer at steps.

Section 4 – Piling

4.1 Steel sheet piling

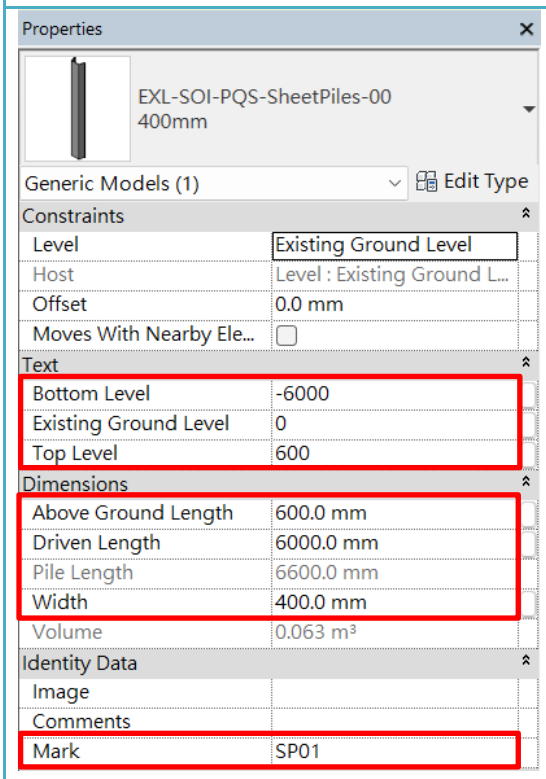
4.1.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for steel sheet piling is created by extruding the specified cross-sectional dimensions and profile. The steel sheet piling length is set as a parameter (i.e. an instance property) to enable the adjustment of individual piling depth, while its cross-sectional profile is fixed as a type property.

Where there are corner, junction, closure, taper or other special sheet piles, they should be created as separate loadable family types.

The existing ground or formation levels should be created in the model so that there are reference levels for placing the sheet piles. When precise existing ground or formation levels are unavailable, tentative levels should be given.

Depending upon the design, sheet piles may be projected above or sunken below the commencing levels. The bottom levels of individual sheet piles may vary according to design requirements or ground conditions which should be modelled individually.



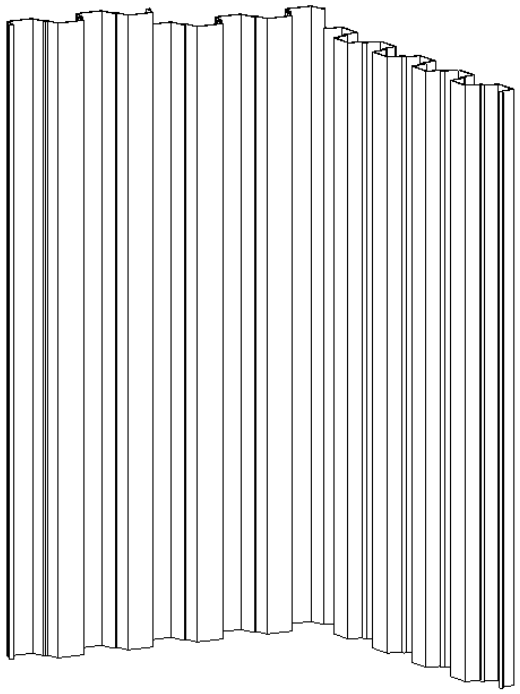


Figure 4.1.1 - 3D View of Steel Sheet Piling

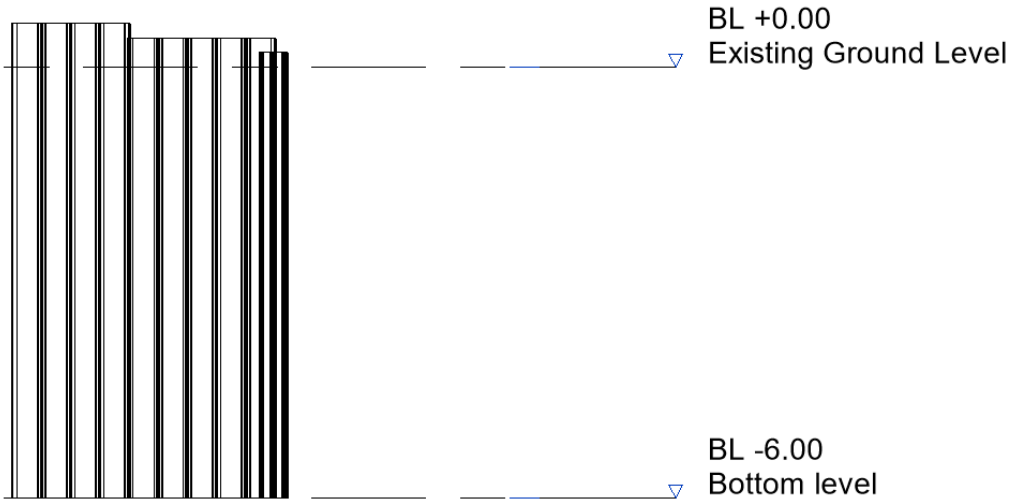


Fig 4.1.2 - Elevation View of Steel Sheet Piling

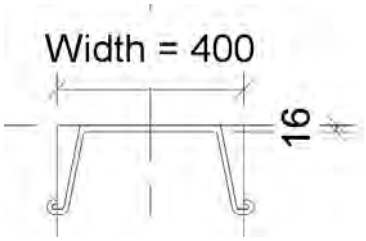


Fig 4.1.3 - Profile of Steel Sheet Piling

4.1.2 Information Requirements for Quantity Take-off

1. Sheet pile marks.
2. Cross-sectional sizes (i.e. width, height and thickness) and section modulus of sheet piles.
3. Supply (or design) lengths of sheet piles, if designed by the engineer.
4. Commencing levels (which may be existing ground or formation levels) and bottom levels of sheet piles.
5. Any cutting-off surplus lengths be indicated or specified.

This sample model has not included:

a. Initial trenching, temporary strutting, waling and other guides for driving.
b. Pre-boring for sheet piles.
c. Temporary lateral supports to sheet piles.
d. Corner, junction, closure, taper or other special sheet piles.

4.1.3 Quantity Take-off Guidelines

For measurement of steel sheet piling, create a schedule with the following fields:

<Sheet Pile Schedule>

A	B	C	D	E	F	G
Family	Mark	Width	Pile Length	Top Level	Existing Ground Level	Bottom Level
EXL-SOI-PQS-SheetPiles-00	SP10	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP11	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP12	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP13	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP14	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP15	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP16	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP17	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP18	400 mm	6200 mm	200	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP09	400 mm	6400 mm	400	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP08	400 mm	6400 mm	400	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP07	400 mm	6400 mm	400	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP06	400 mm	6400 mm	400	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP05	400 mm	6400 mm	400	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP04	400 mm	6600 mm	600	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP03	400 mm	6600 mm	600	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP02	400 mm	6600 mm	600	0	-6000
EXL-SOI-PQS-SheetPiles-00	SP01	400 mm	6600 mm	600	0	-6000

Adjust for the following as necessary:

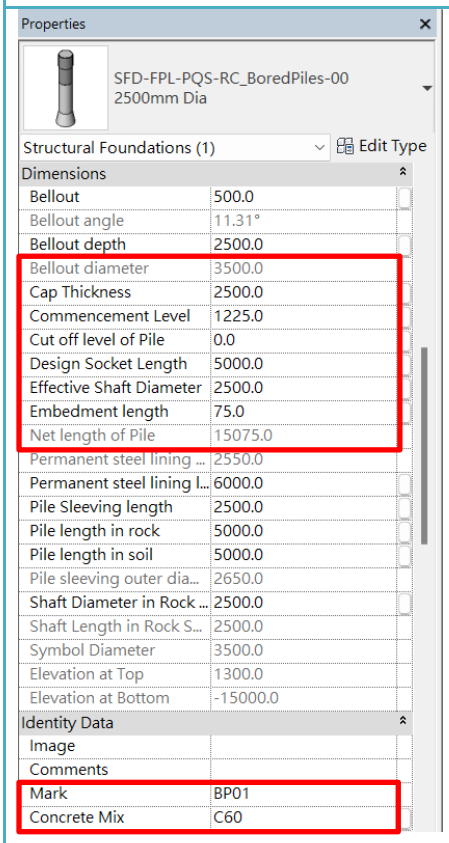
- Nil.

4.2 Bored piles

4.2.1 Basic Modelling Approaches

Based on the structural foundations template, a loadable family type for bored pile is created by extruding the specified cross-sectional dimensions and profile. The relevant bored pile dimensions are set as parameters (i.e. instance properties) to enable the adjustment of individual length, diameter, permanent steel lining, and bell-out.

The existing ground or formation levels should be created in the model so that there are reference levels for placing the bored piles. When precise existing ground or formation levels are unavailable, tentative levels should be given.



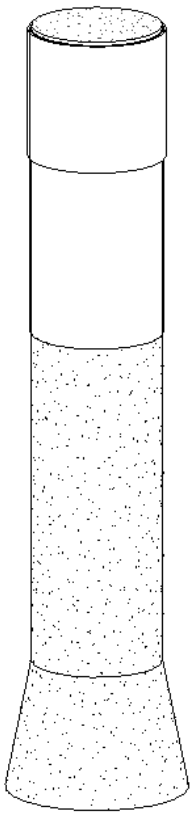


Fig 4.2.1 - 3D View of Bored Pile

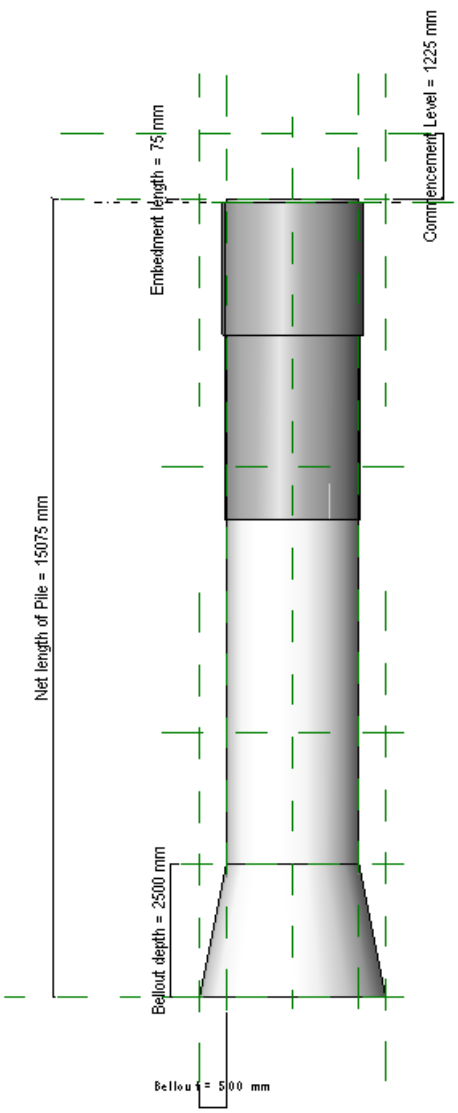


Fig 4.2.2 - Profile of design dimensions

•

4.2.2 Information Requirements for Quantity Take-off

1. Bored pile marks.
2. Nominal diameters of piles and enlarged bases.
3. Commencing levels (which may be existing ground or formation levels), cut-off levels, top level of bedrock and bottom levels of bored piles.
4. Bottom levels of specified pile sleeving and permanent linings.
5. Mix or strength of concrete filling to pile holes.
6. Socket length in bedrock.
7. Internal diameter and thickness of permanent linings.

This sample model has not included:

a. Reinforcement and couplers to piles.
b. Non-destructive integrity tests.
c. Drilling and coring tests.
d. Load tests.

4.2.3 Quantity Take-off Guidelines

For measurement of bored piles, create a schedule with the following fields:

<Bored Piles Schedule>

A	B	C	D	E	F
Family and Type	Mark	Concrete Mix	Commencement Level	Cut off level of Pile	Permanent steel lining length
SFD-FPL-PQS-RC_BoredPiles-00: 2500mm Dia	BP01	C60	1225	0	6000
SFD-FPL-PQS-RC_BoredPiles-00: 2500mm Dia	BP02	C60	1225	0	6000
SFD-FPL-PQS-RC_BoredPiles-00: 2500mm Dia	BP03	C60	1225	0	6000
SFD-FPL-PQS-RC_BoredPiles-00: 2500mm Dia	BP04	C60	1225	0	6000

G	H	I
Net length of Pile	Bellout	Volume of Piles
15075	500	74.00
15075	500	74.00
15075	500	74.00
15075	500	74.00

For measurement of Volume of Piles, create the following formula for column I in the schedule:

- Setting formula: *Net length of Pile * 3.14159 * (Pile Diameter/2)²*

Adjust for the following as necessary:

- Nil.

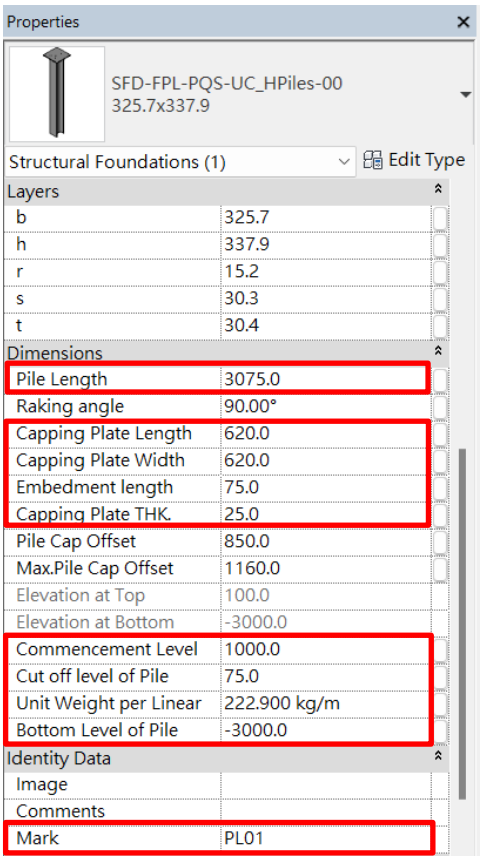
4.3 Steel H-piles

4.3.1 Basic Modelling Approaches

Based on the structural foundations template, a loadable family type for steel H-pile is created by extruding the specified cross-sectional dimensions and profile. The relevant steel H-pile dimensions are set as parameters (i.e. instance properties) to enable the adjustment of individual length, member size, raking angle, etc.

The existing ground or formation levels should be created in the model so that there are reference levels for placing the steel H-piles. When precise existing ground or formation levels are unavailable, tentative levels should be given.

The bottom levels of individual steel H-piles may vary according to design requirements or ground conditions which should be modelled individually.



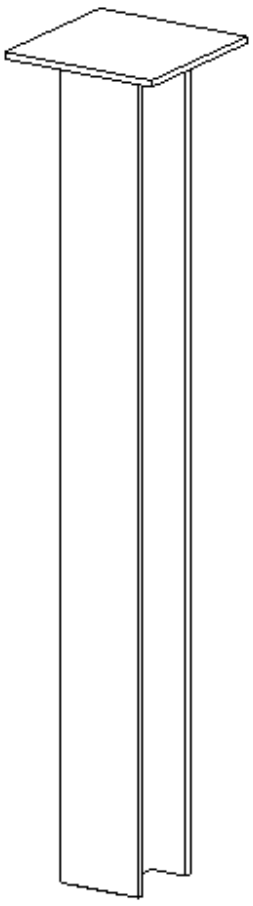


Fig 4.3.1 - 3D View of Steel H-Pile

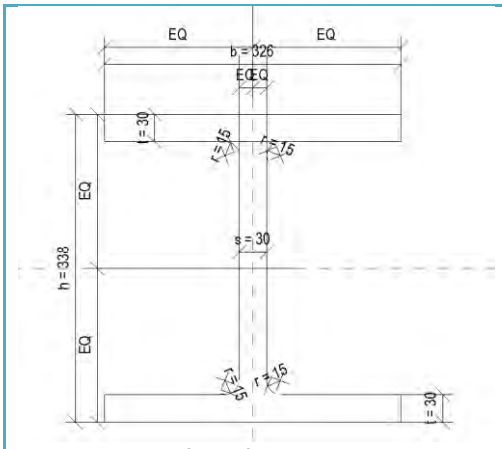


Fig 4.3.2 - Profile of Steel H-pile

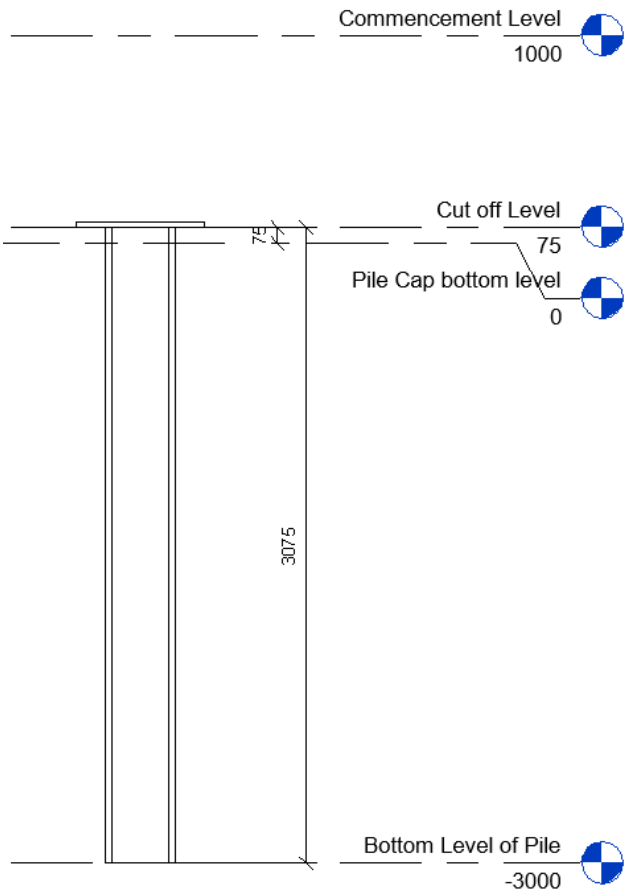


Fig 4.3.3 - Elevation view of Steel H-pile

4.3.2 Information Requirements for Quantity Take-off

1. Steel H-pile marks.
2. Cross-sectional sizes and weight per unit length.
3. Commencement levels, cut-off levels and bottom levels of steel H-piles.
4. Pile head details.

This sample model has not included:

a. Pre-boring.
b. Drilling test.
c. Load tests.

4.3.3 Quantity Take-off Guidelines

For measurement of steel H-piles, create a schedule with the following fields:

<Steel H-Piles Schedule>

A	B	C	D	E	F	G
Family	Type	Mark	Commencement Level	Cut off level of Pile	Bottom Level of Pile	Capping Plate Length
SFD-FPL-PQS-UC_HPiles-00	325.7x337.9	PL01	1000	75	-3000	620
SFD-FPL-PQS-UC_HPiles-00	325.7x337.9	PL02	1000	75	-3000	620
SFD-FPL-PQS-UC_HPiles-00	325.7x337.9	PL03	1000	75	-3000	620
SFD-FPL-PQS-UC_HPiles-00	325.7x337.9	PL04	1000	75	-3000	620
Grand total: 4						

H	I	J	K	L
Capping Plate Width	Pile Length	Embedment length	Unit Weight per Lin	Weight
620	3075	75	222.90 kg/m	685.42 kg
620	3075	75	222.90 kg/m	685.42 kg
620	3075	75	222.90 kg/m	685.42 kg
620	3075	75	222.90 kg/m	685.42 kg
				2741.67 kg

Adjust for the following as necessary:

- Nil.

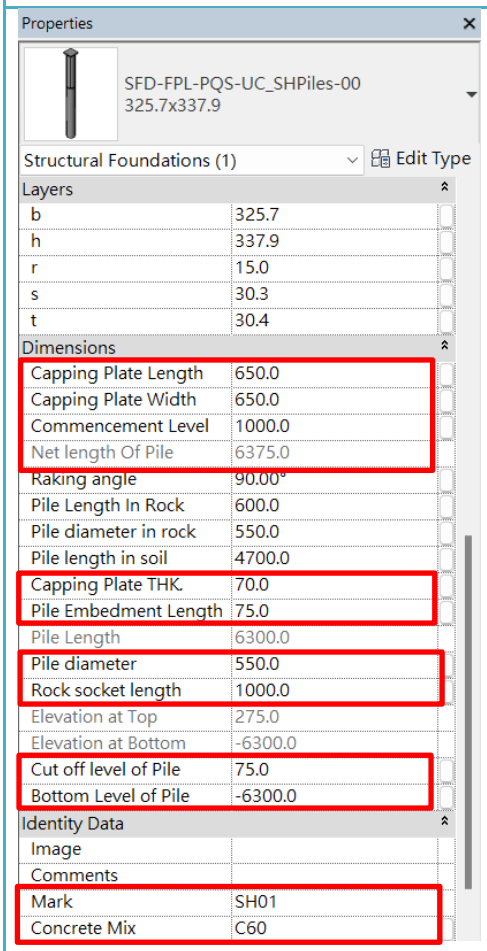
4.4 Rock-socketed steel H-piles

4.4.1 Basic Modelling Approaches

Based on the structural foundations template, a loadable family type for rock-socketed steel H-pile is created by extruding the specified cross-sectional dimensions and profile. The relevant rock-socketed steel H-pile dimensions are set as parameters (i.e. instance properties) to enable the adjustment of individual length, member size, raking angle, etc.

The existing ground or formation levels should be created in the model so that there are reference levels for placing the rock-socketed steel H-piles. When precise existing ground or formation levels are unavailable, tentative levels should be given.

The bottom levels of individual rock-socketed steel H-piles may vary according to design requirements or ground conditions which should be modelled individually.



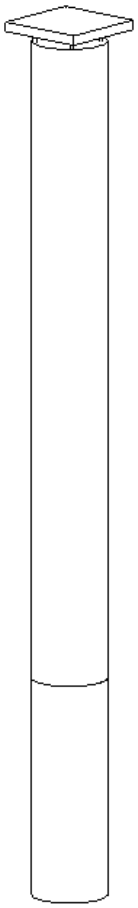


Fig 4.4.1 - 3D View of Rock-Socketed H-Pile

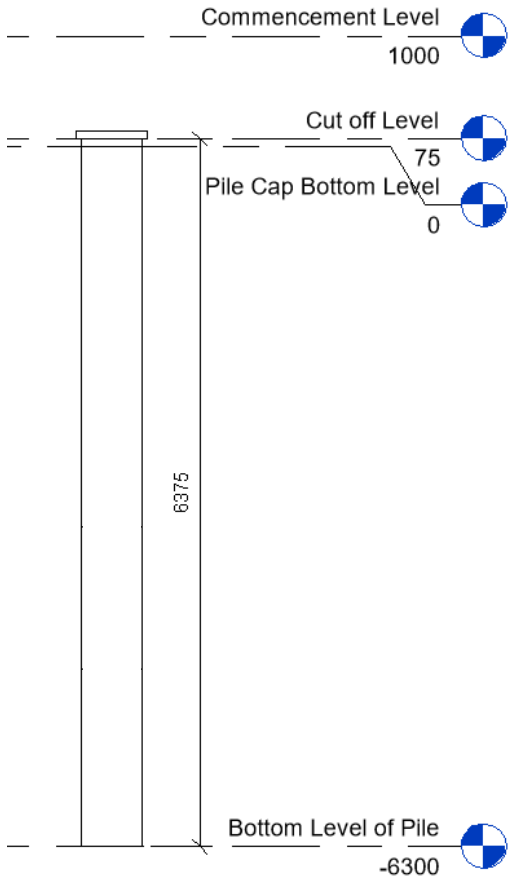


Fig. 4.4.2 - Elevation View of Rock-Socketed H-Pile

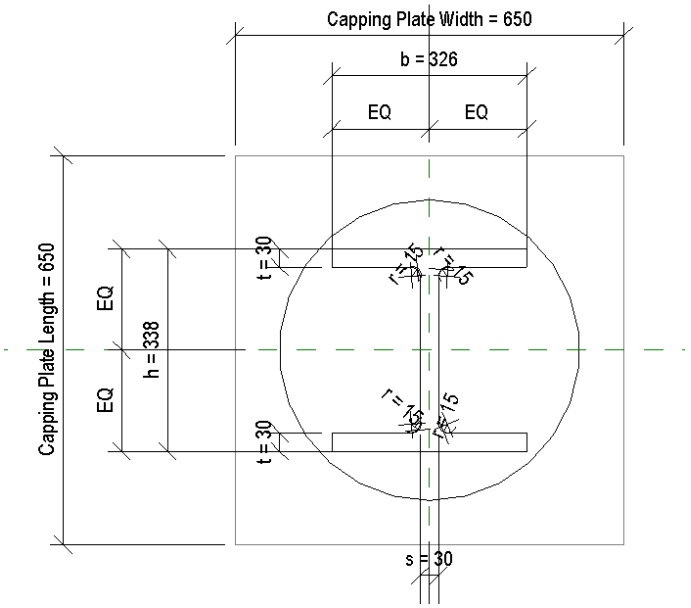


Fig. 4.4.3 - Plan View of Rock-Socketed H-Pile

4.4.2 Information Requirements for Quantity Take-off

1. Rock-socketed steel H-pile marks.
2. Nominal diameter of sockets.
3. Commencing levels (which may be existing ground or formation levels), cut-off levels, top level of bedrock and bottom levels of rock-socketed H-piles.
4. Internal diameter and thickness of permanent casings.
5. Mix or strength of concrete filling to pile holes.
6. Socket length in bedrock.
7. Pile head details.

This sample model has not included:

a. Reinforcement to piles.
b. Pre-boring and drilling tests.
c. Load tests.

4.4.3 Quantity Take-off Guidelines

For measurement of rock socketed steel H-piles, create a schedule with the following fields:

<Rock Socketed Steel H-Piles Schedule>

A	B	C	D	E	F	G	H
Family	Type	Mark	Concrete Mix	Commencement Level	Cut off level of Pile	Bottom Level of Pile	Drilling Length
SFD-FPL-PQS-UC_SHPiles-00	325.7x337.9	SH01	C60	1000	75	-6300	7300

I	J	K
Pile Embedment Length	Rock socket length	Net length Of Pile
75	1000	6375

For measurement of Drilling Length, create the following formula for column H in the schedule:

- Setting formula: *Commencement Level – Bottom Level of Pile*

Adjust for the following as necessary:

- Nil.

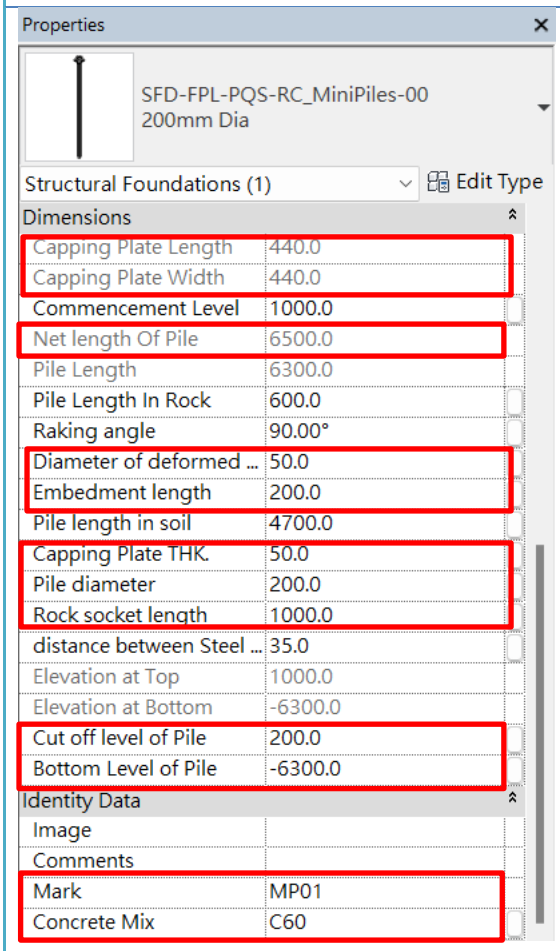
4.5 Mini-piles

4.5.1 Basic Modelling Approaches

Based on the structural foundations template, a loadable family type for the mini-pile is created by extruding the specified cross-sectional dimensions and profile. The relevant mini-pile dimensions are set as parameters (i.e. instance properties) to enable the adjustment of individual length, diameter, raking angle, etc.

The existing ground or formation levels should be created in the model so that there are reference levels for placing the mini-piles. When precise existing ground or formation levels are unavailable, tentative levels should be given.

The bottom levels of individual min-piles may vary according to design requirements or ground conditions which should be modelled individually.



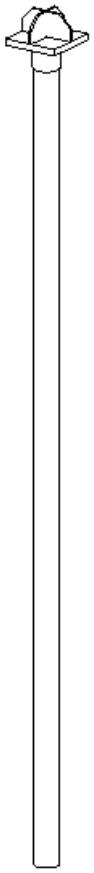


Fig. 4.5.1 - 3D View of Mini-Pile

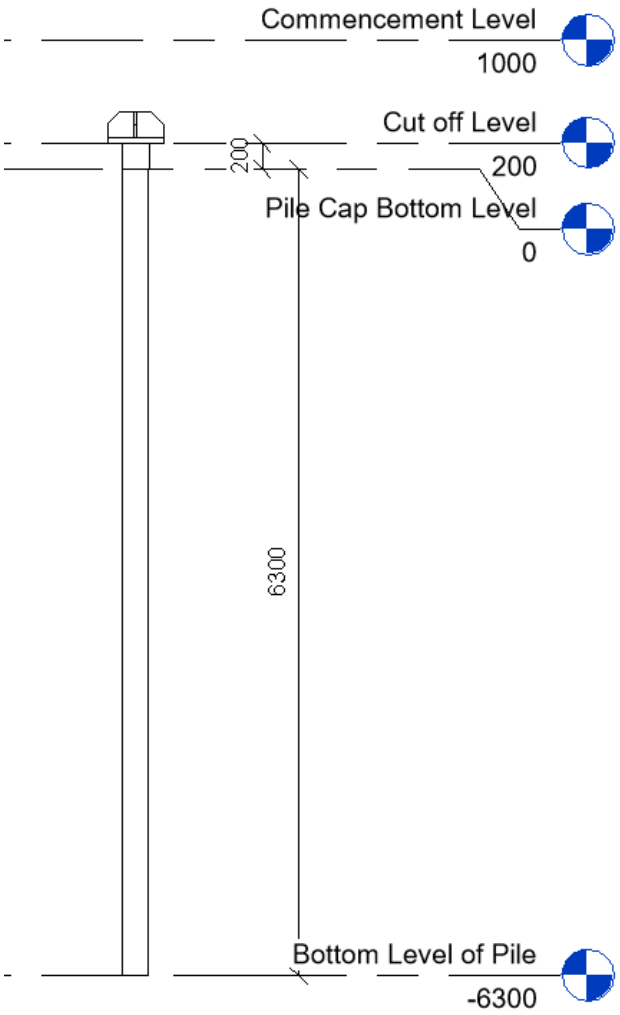


Fig. 4.5.2 - Elevation view of Mini-Pile

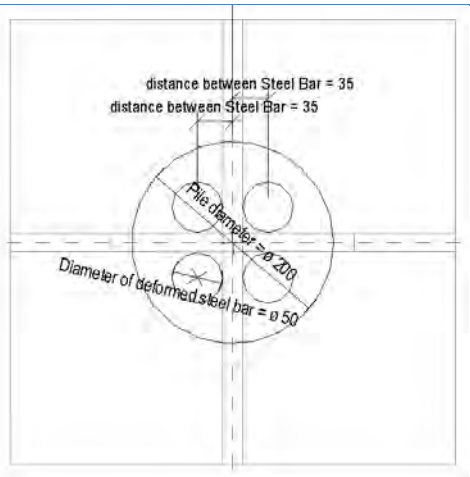


Fig. 4.5.3 - Plan View Of Mini-Pile

4.5.2 Information Requirements for Quantity Take-off

1. Mini-pile marks.
2. Nominal diameters of piles.
3. Diameter of steel bars.
4. Commencing levels (which may be existing ground or formation level), cut-off levels, top levels of bedrock and bottom levels of mini-piles.
5. Internal diameter and thickness of permanent casings.
6. Mix or strength of concrete filling to pile holes.
7. Socket length in bedrock.
8. Pile head details.

This sample model has not included:

a. Load tests.

4.5.3 Quantity Take-off Guidelines

For measurement of mini-piles, create a schedule with the following fields:

<Mini Piles Schedule>

A	B	C	D	E	F	G	H
Family	Type	Mark	Concrete Mix	Commencement Level	Cut off level of Pile	Bottom Level of Pile	Drilling Length
SFD-FPL-PQS-RC_MiniPiles-00	200mm Dia	MP01	C60	1000	200	-6300	7300

I	J	K	L	M
Embedment length	Rock socket length	Net length Of Pile	No. of Steel bars	Steel bar length
200	1000	6500	4	6500

For measurement of Drilling Length, create the following formula for column H in the schedule:

- Setting formula: *Commencement Level - Bottom Level of Pile*

Adjust for the following as necessary:

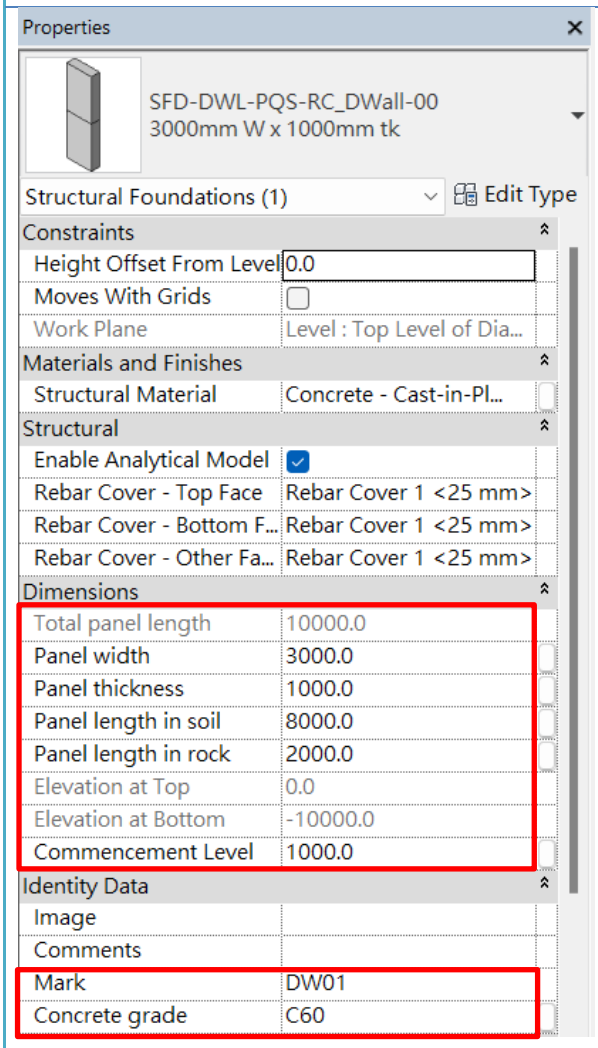
- Nil

4.6 Diaphragm walling

4.6.1 Basic Modelling Approaches

The diaphragm wall consists of two 3D segments: (1) panel length in soil and (2) panel length in rock. Based on the structural foundations template, a loadable family type for the 'panel length in soil' is created by extruding the specified cross-sectional dimensions and profile. The top level of the diaphragm wall panel is set and named as the cut-off or top level of diaphragm wall panels. The panel width, thickness and length are set as instance properties to enable the adjustment of individual dimensions where necessary. The second 3D segment (i.e. panel length in rock (bedrock)) is created in the same way as the first segment. The two segments are then locked together. Where there are corner or other non-standard panels, they should be created as separate loadable family types.

The existing ground or formation levels should be created or indicated so that there are reference levels for placing the guide walls and diaphragm wall panels. Guide walls are separately created by utilizing the system wall family. Unless otherwise designed or specified, excavating trenches for diaphragm wall panels is commenced at the bottom level of guide walls (instead of the cut-off or top levels of panels). The bottom levels of individual diaphragm wall panels in soil and rock may vary according to design requirements or ground conditions. The length of each panel may be modelled individually.



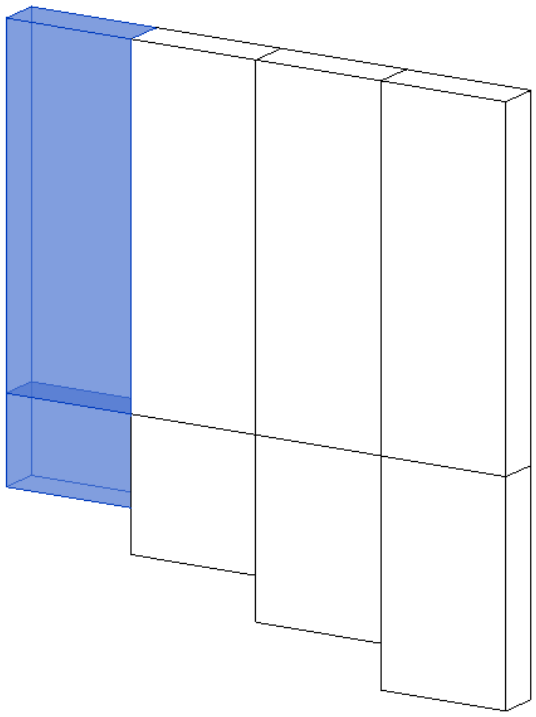


Figure 4.6.1 - 3D View of Diaphragm Wall

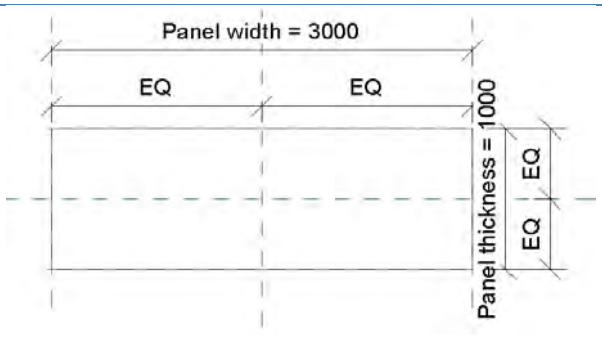


Figure 4.6.2 - Cross-Section View of Diaphragm Wall

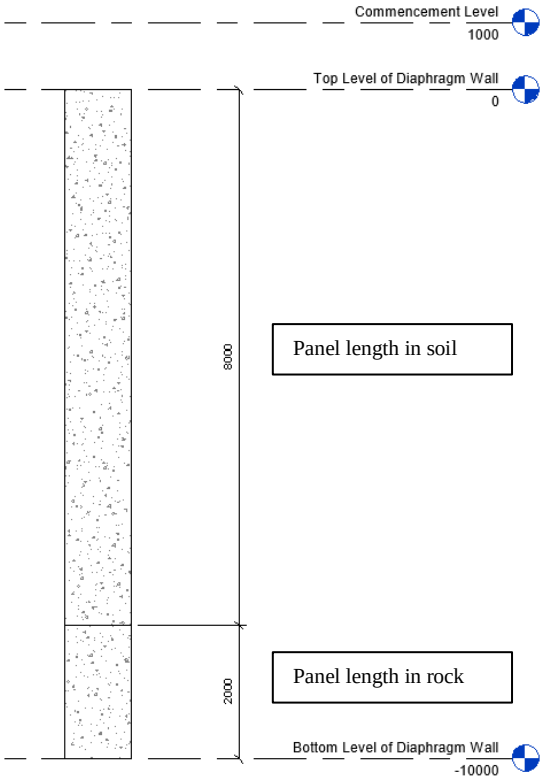


Figure 4.6.3 - Elevation of Diaphragm Wall

4.6.2 Information Requirements for Quantity Take-off

1. Diaphragm wall marks.
2. Mix or strength of concrete.
3. Commencing levels for excavation of guide walls and diaphragm walls.
4. Dimension of guide walls (if not modelled); required on one side or both sides.
5. Top of bedrock level.

This sample model has not included:

a. Guide walls.
b. Reinforcement to diaphragm walls.
c. Waterproof joints between panels.
d. Pre- and post-construction drilling tests.
e. Temporary lateral supports.

4.6.3 Quantity Take-off Guidelines

For measurement of diaphragm walling, create a schedule with the following fields:

<Diaphragm Wall Schedule>

A	B	C	D	E	F	G	H	I
Family	Type	Mark	Concrete grade	Commencement Level	Elevation at Bottom	Panel width	Panel thickness	Panel length in rock
SFD-DWL-PQS-RC_DWall-00	3000mm W x 1000mm tk	DW01	C60	1000	-10000	3000	1000	2000

J	K	L	M	N
Panel length in soil	Total panel length	Excavation Length	Concrete Volume	Excavation Quantity
8000	10000	11000	30.00	33.00

For measurement of Volume of Concrete, create the following formula for column M in the schedule:

- Setting the formula: *Panel width * Panel thickness * Panel length*

For measurement of Excavation Quantity, create the following formula for column N in the schedule:

- Setting the formula: Excavation Length * *Panel width * Panel thickness*

Adjust for the following as necessary:

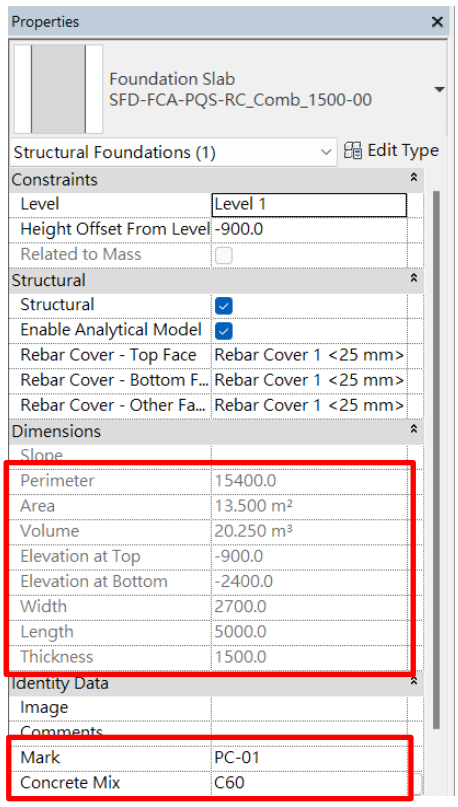
- Nil.

Section 5 – RC Substructure

5.1 Pile caps

5.1.1 Basic Modelling Approaches

Based on the structural foundations template, a system family type for pile cap is created by sketching the boundary/profile of the pile cap. The relevant information can be extracted from the parameters such as perimeter, (horizontal) area, volume, thickness (height), etc. If the pile caps are to be connected to other pile caps / footings / strap and tie beams, etc., these elements should be joined to each other and pile caps / footings shall take precedence over strap and tie beams. For the embedment of piles in the pile caps, they should be joined to each other and the piles shall take precedence over pile caps.



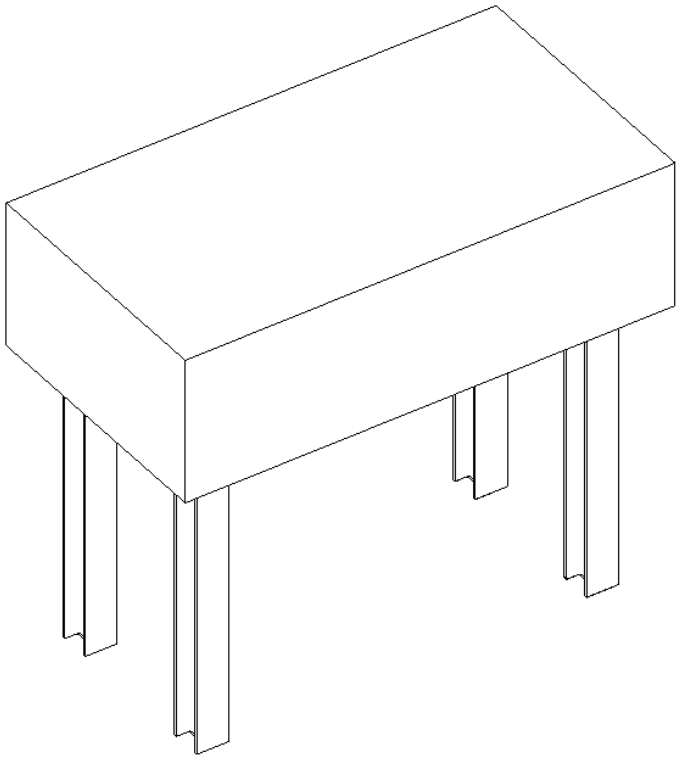


Figure 5.1.1 - 3D View of Pile Cap

5.1.2 Information Requirements for Quantity Take-off

1. Pile cap marks.
2. Mix or strength of concrete.
3. Type of specified admixtures (if any).

This sample model has not included:

a. reinforcement, and

b. formwork.

5.1.3 Quantity Take-off Guidelines

For the measurement of pile caps, create a schedule with the following fields:

<Pile Cap Schedule>

A	B	C	D	E	F	G	H	I
Family	Type	Mark	Concrete Mix	Perimeter	Thickness	Area	Volume	Pile Cap Side Fwk Area
Foundation Slab	SFD-FCA-PQS-RC_Comb_1500-00	PC-01	C60	15400	1500	13.50	20.25	23.10

For measurement of formwork to sides of pile caps, create the following formula for column I in the schedule:

- Setting formula: *Perimeter * Thickness (depth of pile cap).*

For measurement of blinding layer under pile cap:

- Include Area in the Schedule.

Adjust for the following as necessary:

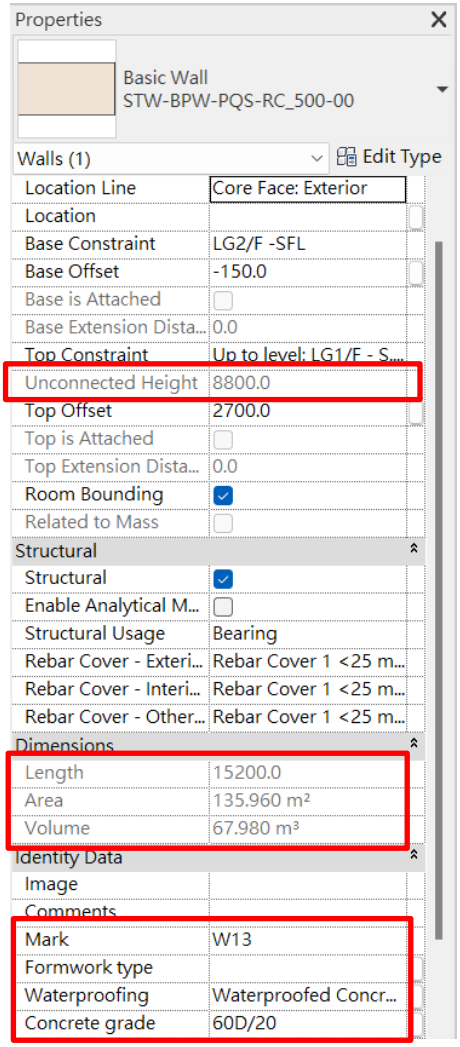
- Omit formwork at intersections between pile caps.
- Omit areas of blinding layers overlapped with piles.

5.2 Basement Perimeter Walls

5.2.1 Basic Modelling Approaches

Based on the structural walls template, a system family for basement wall is created by sketching the alignment of the wall from the base level (wall base) to the top level (wall top). The relevant information can be extracted from the parameters such as length, unconnected height (height), width (thickness), area, volume, etc. The parameter "Area" may only be useful if the wall is a straight wall, otherwise, the Area represents the largest area of wall.

The base level is where basement wall located, the top level of basement wall is attached to the top floor slabs of the basement. The geometry of basement walls is joined with horizontal elements (e.g. beam, slab, etc.), and the basement wall takes precedence.



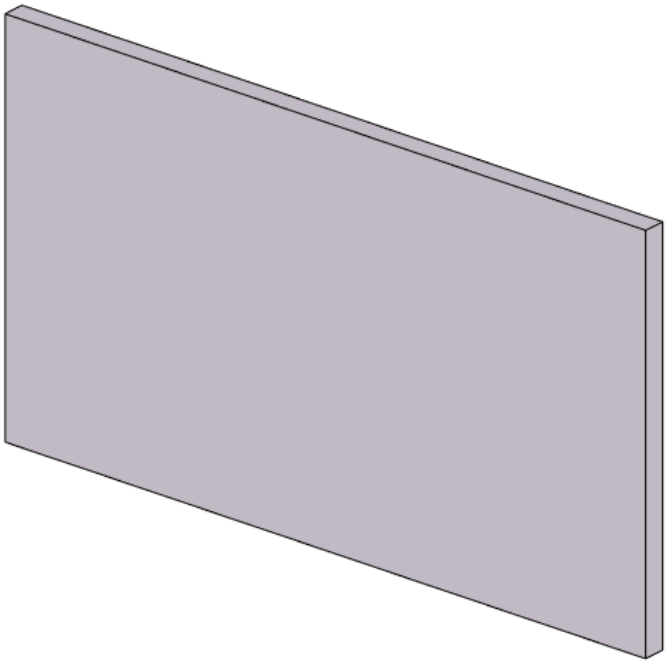


Figure 5.2.1 - 3D View of Basement Wall

5.2.2 Information Requirements for Quantity Take-off

1. Wall marks.
2. Mix or strength of concrete.
3. Wall types – structural /retaining/ vertical / sloping/ curved.
4. Formwork type - left-in (if any).

This sample model has not included:

a. reinforcement, and

b. formwork.

5.2.3 Quantity Take-off Guidelines

For measurement of basement perimeter walls, create a schedule with the following fields:

<Structural Wall Schedule>

A	B	C	D	E	F	G	H
Family	Type	Mark	Waterproofing	Concrete grade	Area	Volume	Fwk_Sides of wall
Basic Wall	STW-BPW-PQS-RC_500-00	W14	Waterproofed Concrete	60D/20	38.73	19.37	77.47
Basic Wall	STW-BPW-PQS-RC_500-00	W13	Waterproofed Concrete	60D/20	135.96	67.98	271.92
Basic Wall	STW-BPW-PQS-RC_500-00	W12	Waterproofed Concrete	60D/20	269.01	134.51	538.02

For measurement of formwork to sides of wall, create the following formula for column H in the schedule:

- Setting formula: *Area * 2, or*
- Setting formula: *[Volume/width (thickness)]*2*

Adjust for the following as necessary:

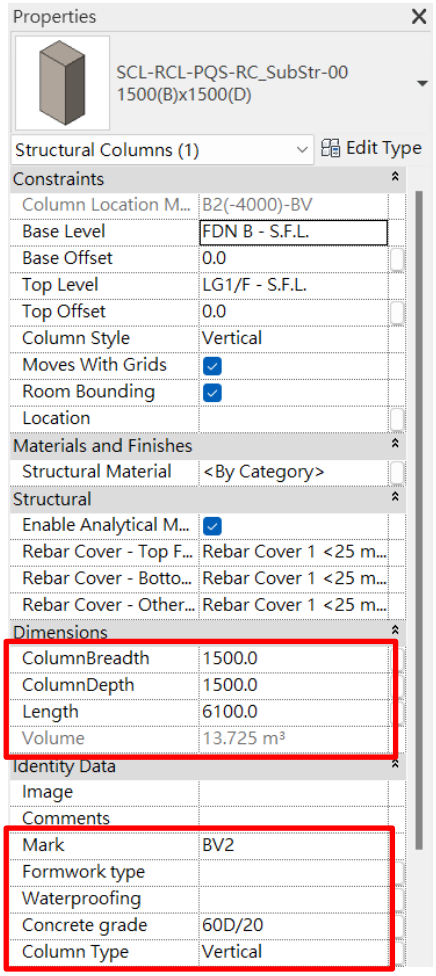
- Omit formwork at intersections of wall with slab and column as appropriate.
- Adjust for left-in formwork or one-sided formwork.

5.3 Sub-structural Columns

5.3.1 Basic Modelling Approaches

Based on the structural columns template, a loadable family type for sub-structural column is created from the base level (column base) to the top level (column top). The relevant information can be extracted from the parameters such as b (column breadth), h (column depth), length (column height), volume, etc.

The base level should be the structural top level of the footing on which the column rests. The top level would be the structural top level of the lowest floor slab above. The column geometry should take precedence over beams and slabs.



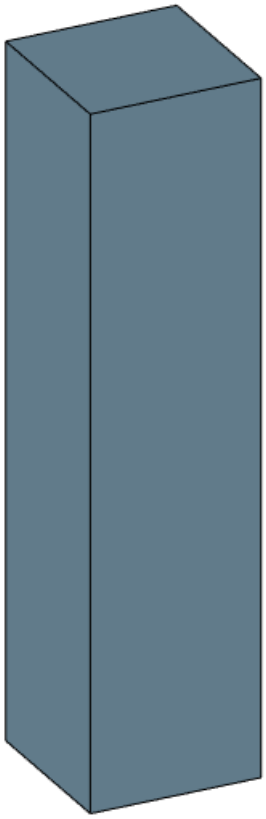


Figure 5.3.1 - 3D View of Sub-structural Column

5.3.2 Information Requirements for Quantity Take-off

1. Column marks.
2. Mix or strength of concrete.
3. Type of specified admixtures (if any).
4. Column type – vertical or inclined (or slanted).
5. Shape and cross-sectional size of Column
6. Formwork type - left-in (if any).

This sample model may not include:

a. reinforcement, and

b. formwork.

5.3.3 Quantity Take-off Guidelines

For measurement of sub-structural columns, create a schedule with the following fields:

<Structural Column Schedule>

A	B	C	D	E	F	G	H	I	J
Family	Type	Mark	Column Type	Concrete grade	Length	ColumnBreadth	ColumnDepth	Volume	Fwk_Sides of Column
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BQ4	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BR4	Vertical	60D/20	6500	1500	1500	14.63	39.00
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BS4	Vertical	60D/20	6500	1500	1500	14.63	39.00
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BT4	Vertical	60D/20	6500	1500	1500	14.63	39.00
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BU4	Vertical	60D/20	6500	1500	1500	14.63	39.00
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BV4	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BQ3	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BR3	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BS3	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BT3	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BU3	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BV3	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BR2	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BS2	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BT2	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BU2	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1500(B)x1500(D)	BV2	Vertical	60D/20	6100	1500	1500	13.73	36.60
SCL-RCL-PQS-RC_SubStr-00	1200(B)x1200(D)	BW3	Vertical	60D/20	6100	1200	1200	8.78	29.28
Grand total: 18								245.71	661.08

For measurement of formwork to sides of column, create the following formula field for column J in the schedule:

- Setting formula: *Length * (ColumnBreadth + ColumnDepth) * 2*

Note: to set *ColumnBreadth and ColumnDepth* refer to Part C

For circular column, b and h will be replaced by diameter (d) of column and the formula will be:

- *Length * π *d*

Adjust for the following as necessary:

- Omit formwork at intersections of column with slab and wall as appropriate.

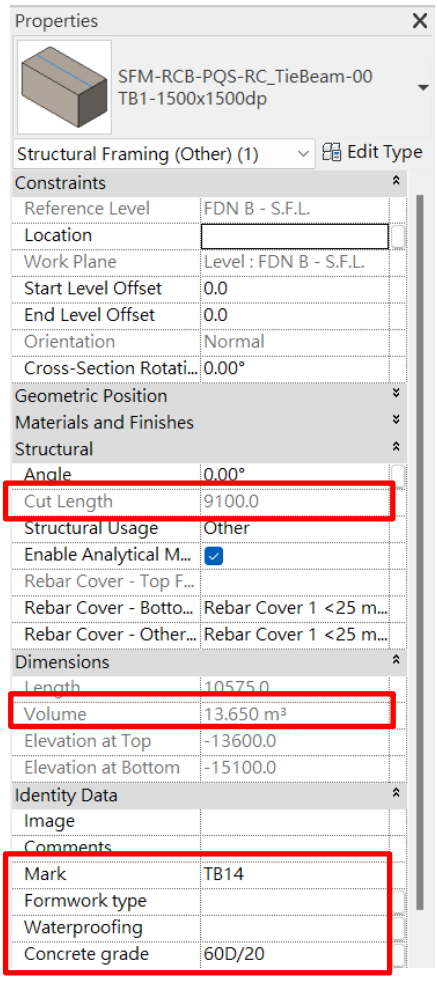
5.4 Sub-structural beams

5.4.1 Basic Modelling Approaches

Sub-structural beams can be divided into ground beams, strap beams and tie beams. All beams can be built up based on structural framing template.

Based on the structural framing template, a loadable family type for ground beams is created by sketching the alignment of beam. The relevant information can be extracted from the parameters, such as b (beam width), h (beam depth), cut length (beam length), volume, etc.

Sub-structural beams are horizontal elements and shall not cut through the vertical element like walls and columns. When the sub-structural beams joined with the ground/isolated slab or pile cap, the slab/cap takes precedence. If sub-structural beams are to be connected, they should be joined together.



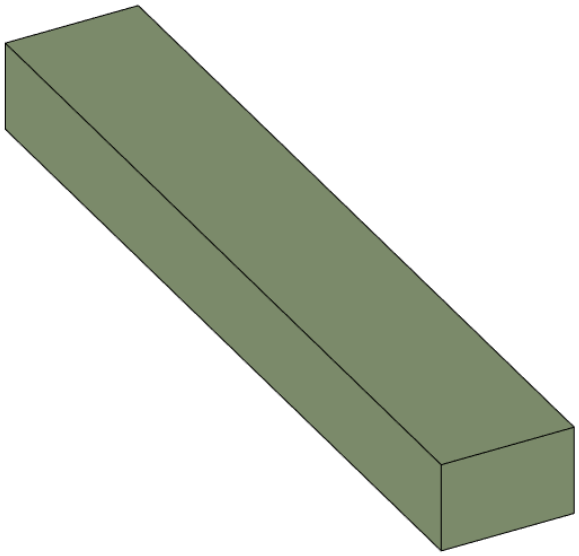


Figure 5.4.1 - 3D View of Sub-structural Beam

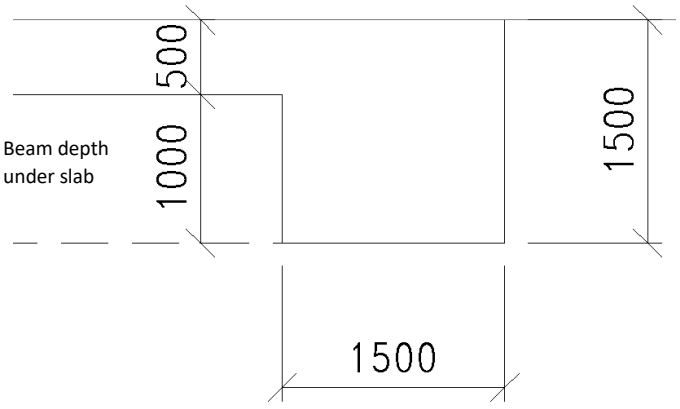


Figure 5.4.2 – Elevation of Sub-structural Beam

5.4.2 Information Requirements for Quantity Take-off

1. Beam marks.
2. Mix or strength of concrete.
3. Type of specified admixtures (if any).
4. Structural Usage - Ground Beam/Strap Beam/Tie Beam
5. Beam type – horizontal/sloping/curved/cranked/tapered.
6. Formwork type - left-in (if any).

This sample model has not included:

a. blinding layer,

b. reinforcement, and

c. formwork.

5.4.3 Quantity Take-off Guidelines

For quantity take-off of on-grade substructural beams , create a schedule with the following fields:

<Structural Framing Schedule>

A	B	C	D	E	F	G	H	I	J	K
Family	Type	Mark	Concrete grade	Cut Length	BeamWidth	BeamDepth	Beam depth under sla	Volume	Fwk_Sides of Beam	Blinding Area
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB19	60D/20	6791	1500	1500	1000	10.19	16.98	10.19
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB15	60D/20	4263	1500	1500	1000	6.07	10.66	6.07
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB01	60D/20	6100	1500	1500	1000	9.15	15.25	9.15
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB16	60D/20	4627	1500	1500	1000	6.29	11.57	6.29
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB17	60D/20	4627	1500	1500	1000	6.29	11.57	6.29
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB18	60D/20	4263	1500	1500	1000	6.07	10.66	6.07
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB02	60D/20	8450	1500	1500	1000	12.67	21.12	12.67
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB03	60D/20	8400	1500	1500	1000	12.60	21.00	12.60
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB04	60D/20	8400	1500	1500	1000	12.60	21.00	12.60
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB05	60D/20	7550	1500	1500	1000	11.33	18.88	11.33
SFM-RCB-PQS-RC_TieBeam-00	TB1-1500x1500dp	TB14	60D/20	9100	1500	1500	1000	13.65	22.75	13.65
SFM-RCB-PQS-RC_TieBeam-00	TB5-4000x1800dp	TB23	60D/20	4985	4000	1800	1300	22.92	15.45	17.63
SFM-RCB-PQS-RC_TieBeam-00	TB5-4000x1800dp	TB24	60D/20	4985	4000	1800	1300	22.92	15.45	17.63
SFM-RCB-PQS-RC_TieBeam-00	TB5-4000x1800dp	TB25	60D/20	4085	4000	1800	1300	18.24	12.66	14.03
SFM-RCB-PQS-RC_TieBeam-00	TB5-4000x1800dp	TB26	60D/20	4085	4000	1800	1300	18.24	12.66	14.03
SFM-RCB-PQS-RC_TieBeam-00	TB5-4000x1800dp	TB27	60D/20	3900	4000	1800	1300	20.28	12.09	15.60
SFM-RCB-PQS-RC_TieBeam-00	TB8-2000x1500dp	TB10	60D/20	3332	2000	1500	1000	6.66	8.33	6.66
SFM-RCB-PQS-RC_TieBeam-00	TB8-2000x1500dp	TB11	60D/20	3332	2000	1500	1000	6.66	8.33	6.66
SFM-RCB-PQS-RC_TieBeam-00	TB8-2000x1500dp	TB12	60D/20	3332	2000	1500	1000	6.66	8.33	6.66
SFM-RCB-PQS-RC_TieBeam-00	TB8-2000x1500dp	TB13	60D/20	3600	2000	1500	1000	7.20	9.00	7.20
SFM-RCB-PQS-RC_TieBeam-00	TB8-2000x1500dp (CAN)	TB06	60D/20	1241	2000	1500	1000	2.48	3.10	2.48
SFM-RCB-PQS-RC_TieBeam-00	TB8-2000x1500dp (CAN)	TB07	60D/20	1241	2000	1500	1000	2.48	3.10	2.48
SFM-RCB-PQS-RC_TieBeam-00	TB8-2000x1500dp (CAN)	TB08	60D/20	1241	2000	1500	1000	2.48	3.10	2.48
SFM-RCB-PQS-RC_TieBeam-00	TB8-2000x1500dp (CAN)	TB09	60D/20	1000	2000	1500	1000	2.00	2.50	2.00
Grand total: 24								246.15	295.55	222.47

For measurement of formwork to sides of the sample beam in Fig. 5.4.2, create the following formula for column J in the schedule with the relevant parameter:

- Setting formula: *Cut Length * (BeamDepth + BeamDepth under slab)*

For measurement of blinding layer (if required) under beams on grade, create the following formula for column K:

- Setting formula: C*ut Length * BeamWidth*

Note: Beam width and beam depth are not obtainable using Schedule by default. Define schedulable parameters to expose the b and h and embed such information in elements' instance parameters (refer to Part C for the approach).

Adjust for the following as necessary:

- Omit formwork at intersections of beam with slab, and wall respectively.

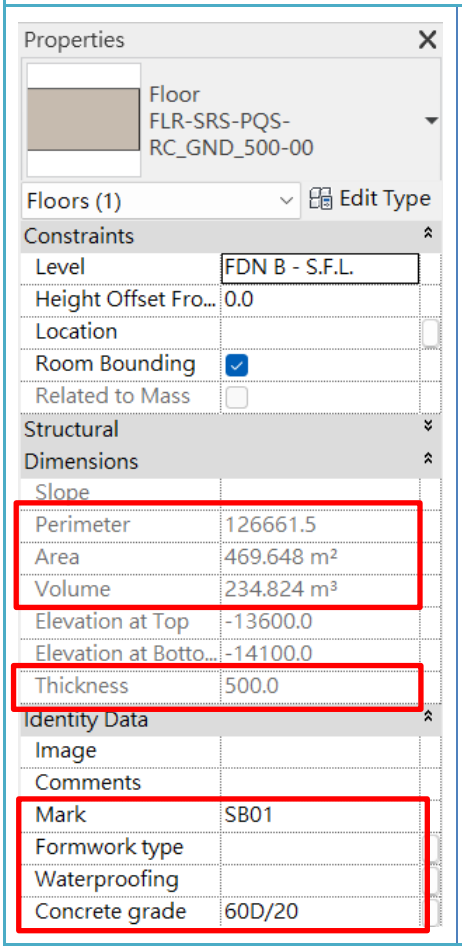
5.5 Sub-structural Floors

5.5.1 Basic Modelling Approaches

Sub-structural floors can be divided into basement slab, on-grade slab and suspended slab. All slabs can be built up based on structural floors template.

Based on the structural floors template, a system family for sub-structural floor is created by sketching the boundary of the floor. Relevant information such as perimeter, thickness, area, volume, etc. can be extracted from the parameters.

Sub-structural floor is defined as horizontal element. The geometry of floor is joined over/across beams and joined to vertical elements (e.g. structural columns and walls) where the floors are bounded by vertical elements.



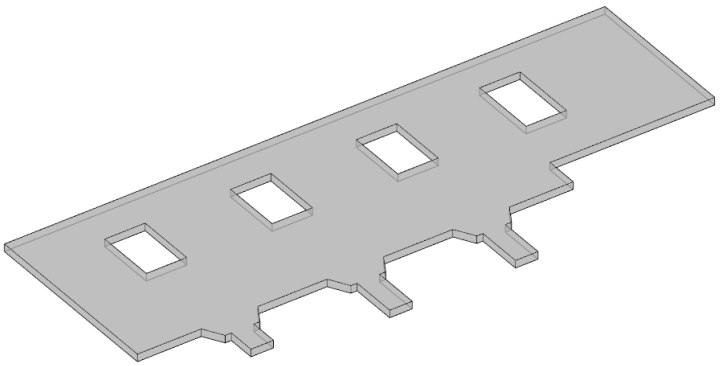


Figure 5.5.1 - 3D View of Sub-structural Floor

5.5.2 Information Requirements for Quantity Take-off

1. Slab marks (if required).
2. Mix or strength of concrete.
3. Type of specified admixtures (if any).
4. Slab type – suspended/ on-grade/ ground slab.

This sample model has not included:

a. blinding layer (except for suspended slab),

b. hardcore bed and building paper,

c. reinforcement, and

d. formwork.

5.5.3 Quantity Take-off Guidelines

For measurement of sub-structural floors, create a schedule with the following fields:

<Floor Schedule>

A	B	C	D	E	F	G	H	I	J
Family	Type	Mark	Concrete grade	Perimeter	Thickness	Area	Volume	Fwk_Sides of Slab	Blinding Area
Floor	FLR-SRS-PQS-RC_GND_500-00	SB01	60D/20	126662	500	469.65	234.82	63.33	469.65
Floor	FLR-SRS-PQS-RC_GND_500-00	SB02	60D/20	142696	500	435.36	217.68	71.35	435.36
Grand total: 2							452.50	134.68	905.01

For measurement of formwork to sides of slab, create the following formula for column I in the schedule:

- Setting formula: *Thickness * Perimeter*

For measurement of blinding layer (if required) under on-grade slab, use the *Area* field.

Adjust for the following as necessary:

- Omit formwork at intersections of slab with sub-structural wall, beam, column and pile cap as appropriate.

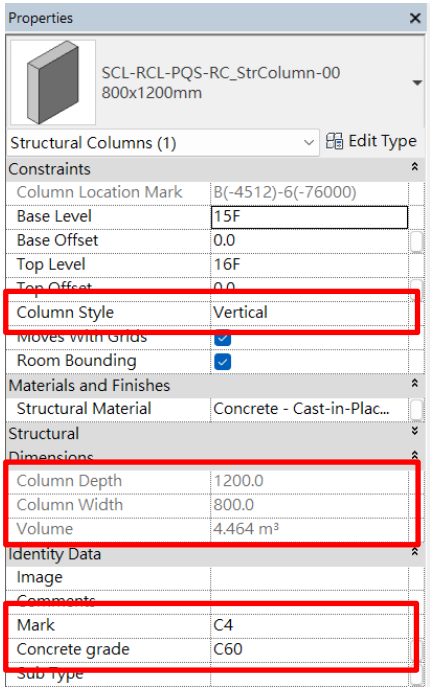
Section 6 – RC Superstructure

6.1 Structural columns

6.1.1 Basic Modelling Approaches

Based on the structural columns template, a loadable family type for structural columns is created from the base level (column base) to the top level (column top). The relevant information can be extracted from the parameters such as b (column width), h (column depth), length (column height), volume, etc.

The base level is where structural columns are located, and the top level of structural columns is attached to the top surface of the structural slab at the upper floor level. The geometry of structural columns is joined with horizontal elements (e.g. beams, slabs, etc.) and the structural columns take precedence. In the case of transfer slabs and beams over supporting columns, columns will be attached to the bottom surface of transfer slabs and beams at the upper floor level.



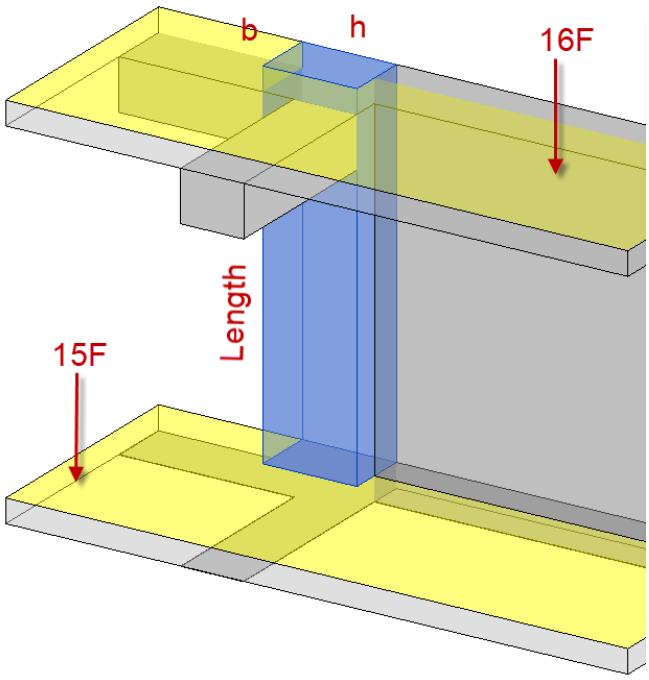


Figure 6.1.1 - 3D View of Structural Column

6.1.2 Information Requirements for Quantity Take-off

1. Column marks.
2. Mix or strength of concrete.
3. Column type – structural / vertical / sloping.
4. Shape of column - rectangular or circular.
5. Type of specified admixtures (if any).

This sample model has not included:

a. reinforcement, and

b. formwork.

6.1.3 Quantity Take-off Guidelines

For measurement of structural columns, create a schedule with the following fields:

<Structural Column Schedule>

A	B	C	D	E	F	G	H	I
Family	Type	Mark	Concrete grade	Column Depth	Column Width	Length	Volume	Fwk_Sides of Column
SCL-RCL-PQS-RC_StrColumn-00	800x1200mm	C1	C60	1200	800	4650	4.46	18.60
SCL-RCL-PQS-RC_StrColumn-00	800x1200mm	C2	C60	1200	800	4650	4.46	18.60
SCL-RCL-PQS-RC_StrColumn-00	800x1200mm	C3	C60	1200	800	4650	4.46	18.60
SCL-RCL-PQS-RC_StrColumn-00	800x1200mm	C4	C60	1200	800	4650	4.46	18.60
SCL-RCL-PQS-RC_StrColumn-00	800x1200mm	C5	C60	1200	800	4650	4.46	18.60
SCL-RCL-PQS-RC_StrColumn-00	800x1200mm	C6	C60	1200	800	4650	4.46	18.60
SCL-RCL-PQS-RC_StrColumn-00	800x1200mm	C7	C60	1200	800	4650	4.46	18.60
SCL-RCL-PQS-RC_StrColumn-00	800x1200mm	C8	C60	1200	800	4650	4.46	18.60
Grand total: 8							35.71	148.80

For measurement of formwork to sides of column, create the following formula for column I in the schedule:

- Setting formula: *Length * (Column Width + Column Depth) * 2*

Note: refer to Part C on how to set *Column Width* and *Column Depth*;

For circular column, Column Width and Column Depth will be replaced by the diameter of the column and the formula will be:

- *Length * π * diameter*

Adjust for the following as necessary:

- Omit formwork at intersections of column with slab, beam and wall respectively.

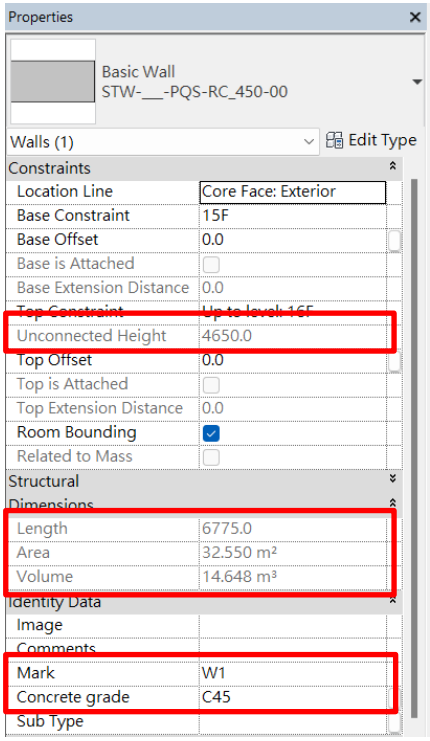
6.2 Structural Walls

6.2.1 Basic Modelling Approaches

Based on the structural walls template, a system family for structural walls is created by sketching the alignment of the wall from the base level (wall base) to the top level (wall top) of the upper floor slab. The relevant information can be extracted from the parameters such as length, unconnected height (height), width (thickness), area, volume, etc.

The base level is where structural walls are located, and the top level of structural walls is attached to the top surface of the structural slab at the upper floor level. The geometry of structural walls is joined with the horizontal elements (e.g. beam, slab, etc.), and the structural walls take precedence.

In the case of transfer slabs and beams over supporting walls, walls will be attached to the bottom surface of transfer slabs and beams at the upper floor level.



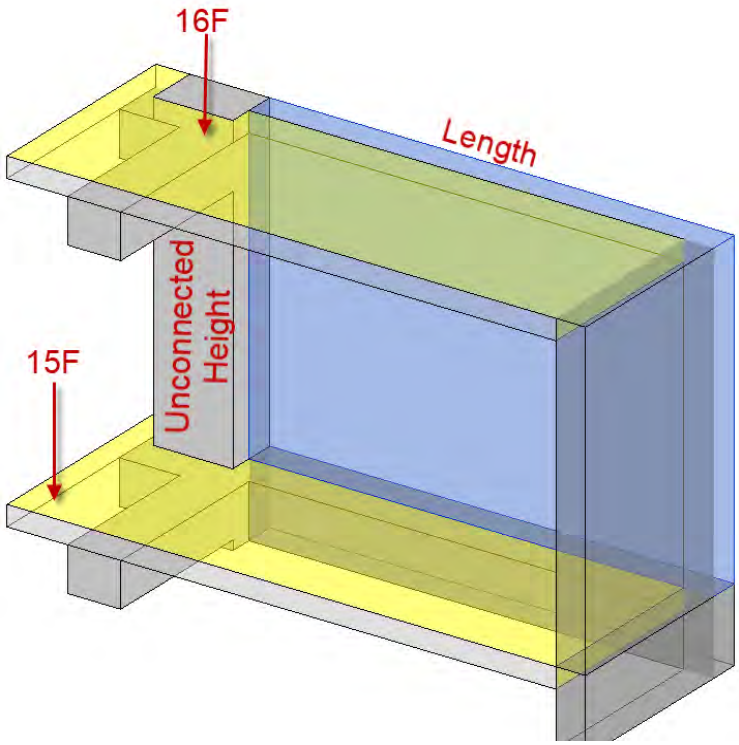


Figure 6.2.1 - 3D View of Structural Wall

6.2.2 Information Requirements for Quantity Take-off

1. Wall marks.
2. Mix or strength of concrete.
3. Wall types – structural /retaining/ vertical / sloping/ curved.
4. Type of specified admixtures (if any).

This sample model has not included:

a. reinforcement, and

b. formwork.

6.2.3 Quantity Take-off Guidelines

For measurement of structural walls, create a schedule with the following fields:

<Wall Schedule>

A	B	C	D	E	F	G	H	I
Family	Type	Mark	Concrete grade	Width	Length	Area	Volume	Fwk_Both sides of Wall
Basic Wall	STW-___-PQS-RC_450-00	W1	C45	450	6775	32.55	14.65	65.10
Basic Wall	STW-___-PQS-RC_450-00	W2	C45	450	6350	29.53	13.29	59.06
Basic Wall	STW-___-PQS-RC_450-00	W3	C45	450	6775	30.46	13.71	60.92
Basic Wall	STW-___-PQS-RC_450-00	W4	C45	450	6775	32.55	14.65	65.10
Basic Wall	STW-___-PQS-RC_450-00	W5	C45	450	6350	29.53	13.29	59.06
Basic Wall	STW-___-PQS-RC_450-00	W6	C45	450	6775	30.46	13.71	60.92
Grand total: 6							83.28	370.14

The parameter “Area” of wall is representing the larger side surface of the wall. For measurement of formwork to sides of wall, create the following formula for the column I in the schedule:

- For stand-alone walls and walls connected perpendicularly: *Area * 2 or [Volume / Width (thickness)]*2*
- For walls connected at an acute angle or obtuse angle: *[Volume / Width (thickness)]*2 or (Length * Unconnected Height) *2*

Adjust for the following as necessary:

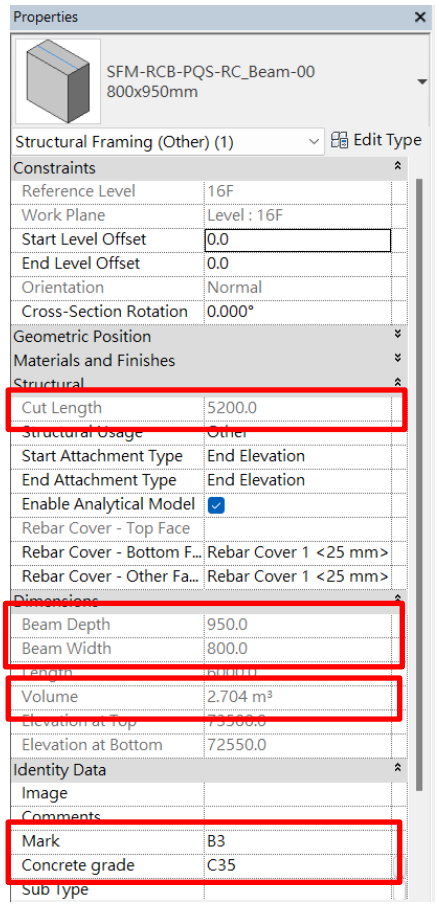
- Omit formwork at intersections of the wall with slab, beam and column respectively.

6.3 Beams

6.3.1 Basic Modelling Approaches

Based on the structural framings template, a loadable family type for beams is created by sketching the alignment of the beam. The relevant information can be extracted from the parameters, such as b (beam width), h (beam depth), cut length (beam length), volume, etc.

A beam is defined as a horizontal element. The beams will not cut the vertical elements. The geometry of beams is joined with the slabs where the slabs take precedence. If beams are to be connected, they should be joined together.



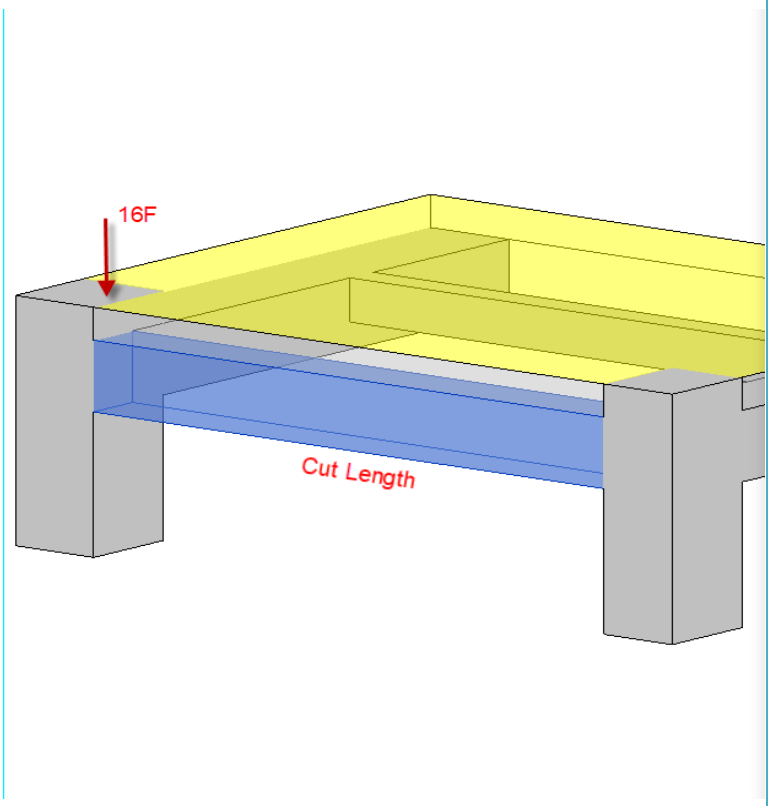


Figure 6.3.1 – 3D View of Beam

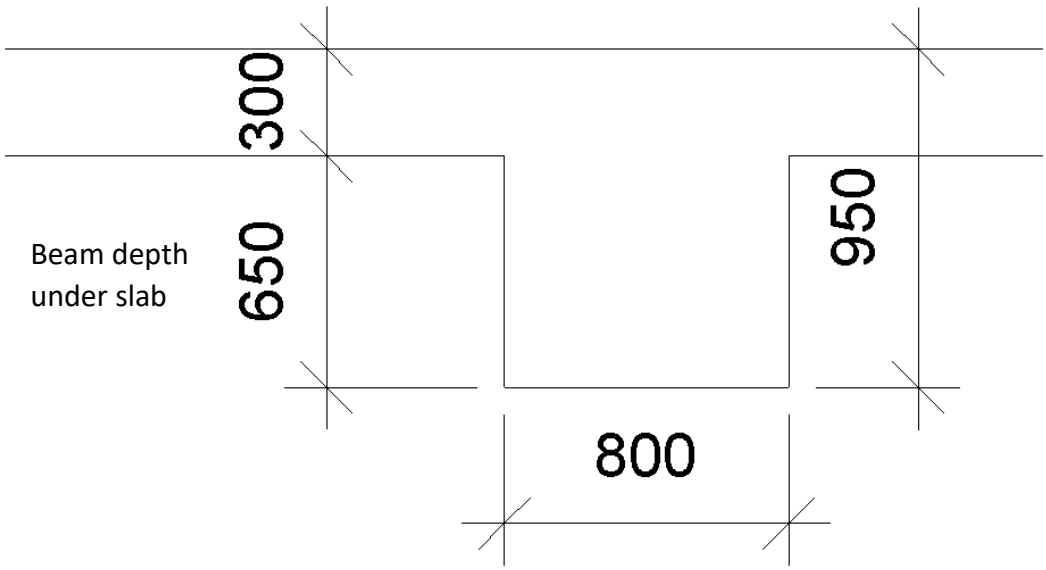
6.3.2 Information Requirements for Quantity Take-off
1. Beam marks. 2. Mix or strength of concrete. 3. Beam types – horizontal / sloping / curved / cranked / tapered / upstand/ transfer beam/ tie beam 4. Type of specified admixtures (if any).
This sample model has not included: a. reinforcement, and b. formwork

6.3.3 Quantity Take-off Guidelines

For measurement of beams, create a schedule with the following fields:

<Structural Framing Schedule>

A	B	C	D	E	F	G	H	I	J
Family	Type	Mark	Concrete grade	Cut Length	Beam Width	Beam Depth	Beam depth under slab	Volume	Fwk_Sides & Soffit
SFM-RCB-PQS-RC_Beam-00	800x950mm	B1	C35	4800	800	950	650	2.50	10.08
SFM-RCB-PQS-RC_Beam-00	800x950mm	B2	C35	4800	800	950	650	2.50	10.08
SFM-RCB-PQS-RC_Beam-00	800x950mm	B3	C35	5200	800	950	650	2.70	10.92
SFM-RCB-PQS-RC_Beam-00	800x1550mm	B4	C35	5200	800	1550	1250	5.20	17.16
SFM-RCB-PQS-RC_Beam-00	300x700mm	B5	C35	5200	300	700	400	0.62	5.72
SFM-RCB-PQS-RC_Beam-00	800x950mm	B6	C35	4800	800	950	650	2.50	10.08
SFM-RCB-PQS-RC_Beam-00	800x950mm	B7	C35	4800	800	950	650	2.50	10.08
SFM-RCB-PQS-RC_Beam-00	800x950mm	B8	C35	5200	800	950	650	2.70	10.92
SFM-RCB-PQS-RC_Beam-00	800x1550mm	B9	C35	5200	800	1550	1250	5.20	17.16
SFM-RCB-PQS-RC_Beam-00	300x700mm	B10	C35	5200	300	700	400	0.62	5.72
Grand total: 10								27.04	107.92



For measurement of formwork to sides and soffits of the sample beam, create the following formula for column J in the schedule:

- Setting formula: *Cut Length * ((Beam Depth – thickness of slab) * 2 + Beam Width);*

  in the example above, the additional field "Beam depth under slab" is added with a formula set as: Beam Depth - thickness of slab (check manually)

Note: refer to Part C on how to set *Beam Width* and *Beam Depth* as shared parameters.

Adjust for the following as necessary:

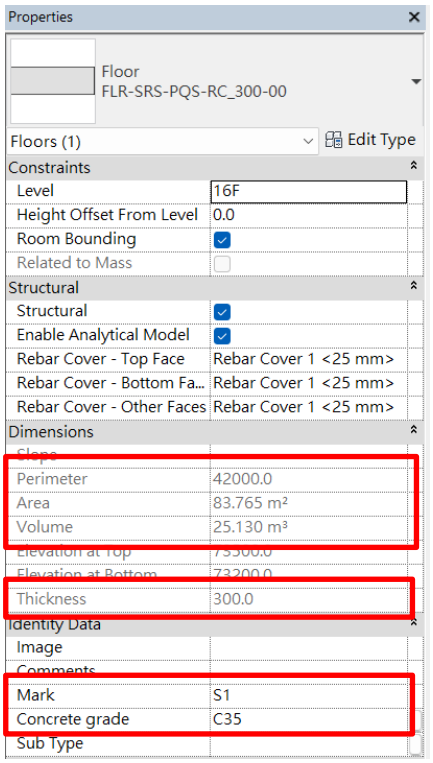
- Omit formwork at intersections of the beam with slab and wall respectively.

6.4 Slabs

6.4.1 Basic Modelling Approaches

Based on the structural floors template, a system family type for slab is created by sketching the boundary of the floor perimeter. The relevant information can be extracted from the parameters, such as perimeter, thickness, area, volume, etc.

A slab is defined as a horizontal element. The geometry of slabs is joined over/across beams and joined to vertical elements (e.g. structural columns and walls) where the slabs are bounded by vertical elements.



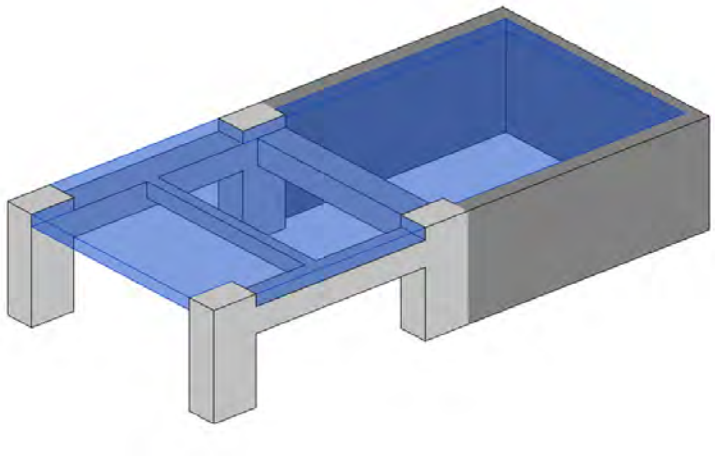


Figure 6.4.1 – 3D View of Slabs

6.4.2 Information Requirements for Quantity Take-off

1. Slab marks.
2. Mix or strength of concrete.
3. Slab type –suspended/ sloping/ curved.
4. Type of specified admixtures (if any).

This sample model has not included:

a. reinforcement, and

b. formwork.

6.4.3 Quantity Take-off Guidelines

For measurement of slabs, create a schedule with the following fields:

<Floor Schedule>

A	B	C	D	E	F	G	H	I	J
Family	Type	Mark	Concrete grade	Thickness	Perimeter	Area	Volume	Fwk_Soffit of Slab	Fwk_Sides of Slab
Floor	FLR-SRS-PQS-RC_300-00	S1	C35	300	42000	83.77	25.13	83.77	12.60
Floor	FLR-SRS-PQS-RC_300-00	S2	C35	300	42000	83.77	25.13	83.77	12.60
Grand total: 2							50.26	167.53	25.20

For measurement of formwork to soffits of slabs, create the following formula for column I in the schedule:

- Setting formula = *Area*

For measurement of formwork to sides of slab, create the following formula for column J in the schedule:

- Setting formula: *Thickness * Perimeter*
- Unit in m2; width n.e. 300mm and width >300mm measured separately.

Adjust for the following as necessary:

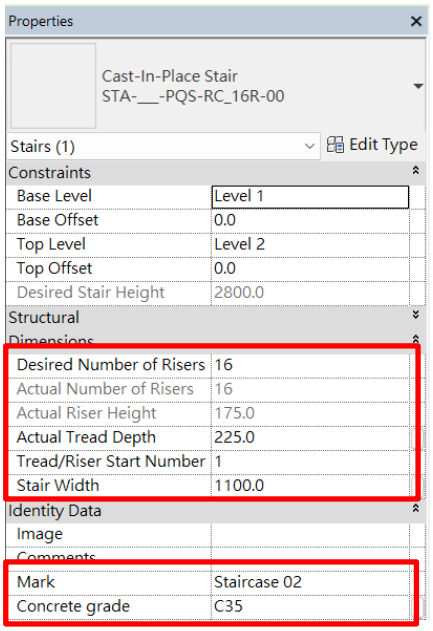
- Omit concrete volume at junctions in case the beam has a higher concrete grade than the slab.
- Omit formwork at intersections of the slab with column, wall and beam respectively.
- Add edge and break for slab if required.

6.5 Staircases

6.5.1 Basic Modelling Approaches

Based on the stairs template, a system family type for staircases is created by sketching the alignment of the stair from the base level (stair base) to the top level (stair top). The relevant information can be extracted from the parameters such as the actual number of risers, actual run width, etc.

Create In-place models to complete the connection between structural elements.



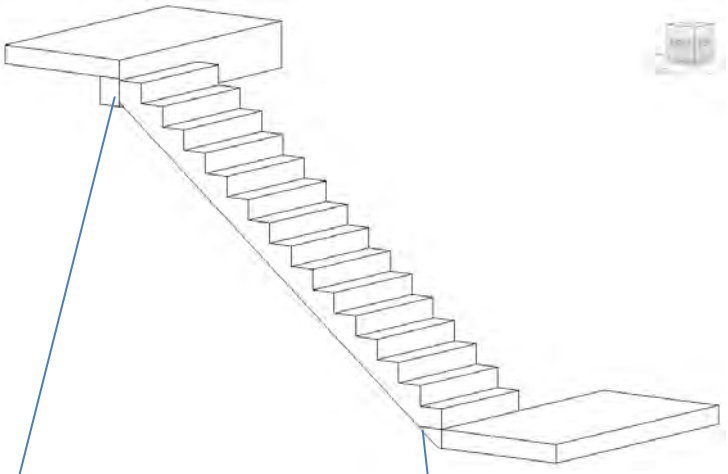
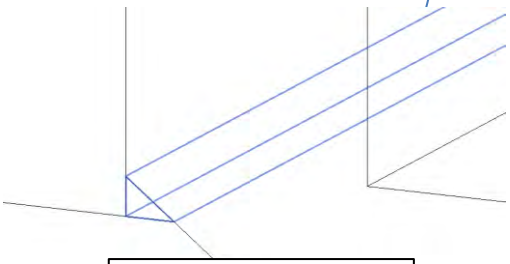
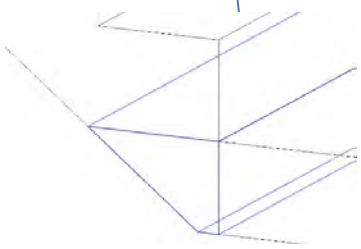


Figure 6.5.1 – 3D View of Staircase



Stair Connection 01



Stair Connection 02

6.5.2 Information Requirements for Quantity Take-off

1. Staircase marks.
2. Mix or strength of concrete.

This sample model has not included:

a. reinforcement, and

b. formwork.

6.5.3 Quantity Take-off Guidelines

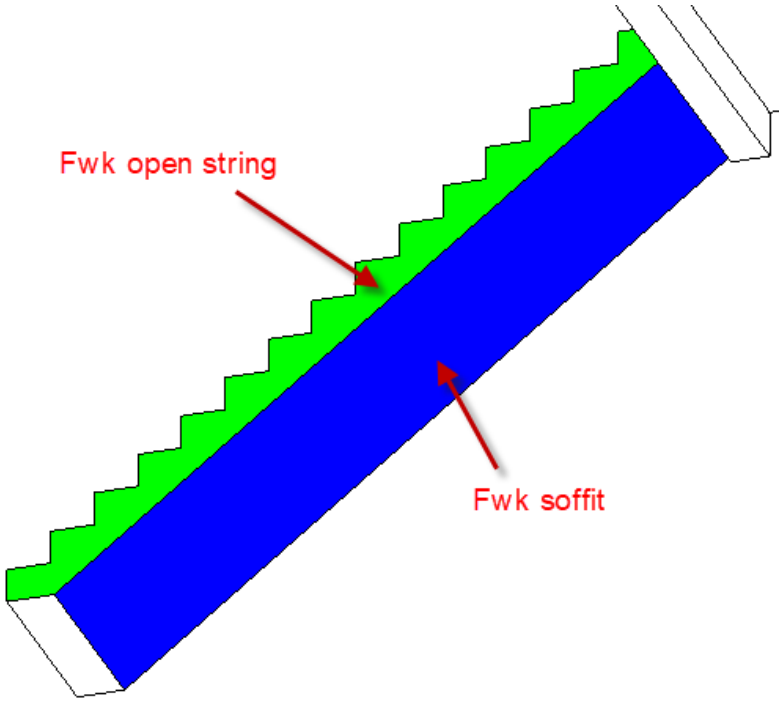
For measurement of concrete staircases, create a material take-off schedule with the following fields:

<Stairs Conc. Volume>				
A	B	C	D	E
Family	Type	Mark	Concrete grade	Material: Volume
Cast-In-Place Stair	STA-___-PQS-RC_16R-00	Staircase 02	C35	1.00

For measurement of the in-place model of stair connections, create a schedule as follows:

<Stair Connection Schedule>	
A	B
Family	Volume
Stair connection 01	0.001
Stair connection 02	0.025

For measurement of formwork to open strings of stairs & soffits of Stairs, use the “Paint” function. Please note that open strings of stairs are measured in m^2; width n.e. 300mm and width >300mm measured separately.



For measurement of formwork to open strings of stairs & soffits of Stairs, create a material take-off schedule with the following fields (refer to Part C for how to create material name):

<Stairs Material Takeoff>

A	B	C	D	E
Family	Type	Mark	Material: Name	Material: Area
Cast-In-Place Stair	STA-___-PQS-RC_16R-00	Staircase 01	Fwk open string	0.91
Cast-In-Place Stair	STA-___-PQS-RC_16R-00	Staircase 01	Fwk soffit	4.36

For measurement of formwork to risers of stairs, create a schedule with the following fields:

<Stair - Formwork Schedule>

A	B	C	D	E	F	G
Family	Type	Mark	Maximum Riser Height	Actual Number of Risers	Stair Width	Fwk_Riser of Stair
Cast-In-Place Stair	STA-___-PQS-RC_16R-00	Staircase 02	175	16	1100	2.89

For measurement of formwork to risers of stairs, create the following formula for column G in the schedule:

- Setting formula: *Actual Number of Risers - 1 * Stair Width * Actual Riser Height*
- Unit in m2; width n.e. 300mm and width >300mm measured separately

Note: refer to Part C on how to set Stair Width as a shared parameter.

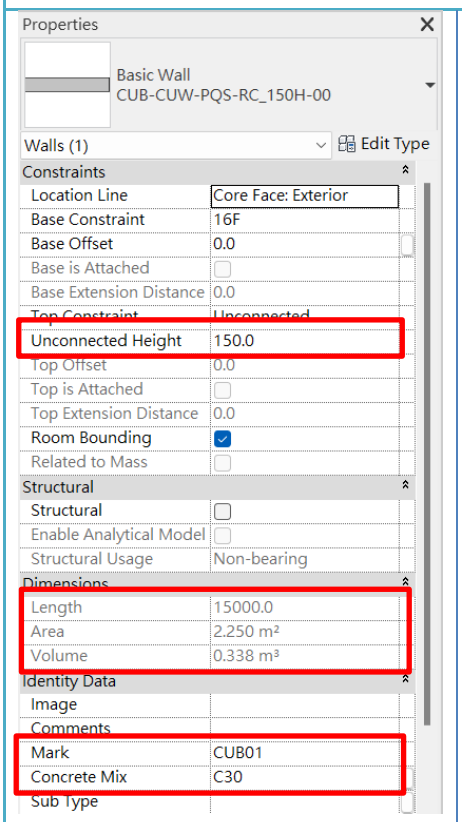
Adjust for the following as necessary:

- Nil

6.6 Curbs

6.6.1 Basic Modelling Approaches

Based on the walls template, a system family type for curb is created by sketching the alignment of the curb from the base level (curb base) to the required height. The relevant information can be extracted from the parameters such as length, unconnected height (height), width, area, volume, etc.



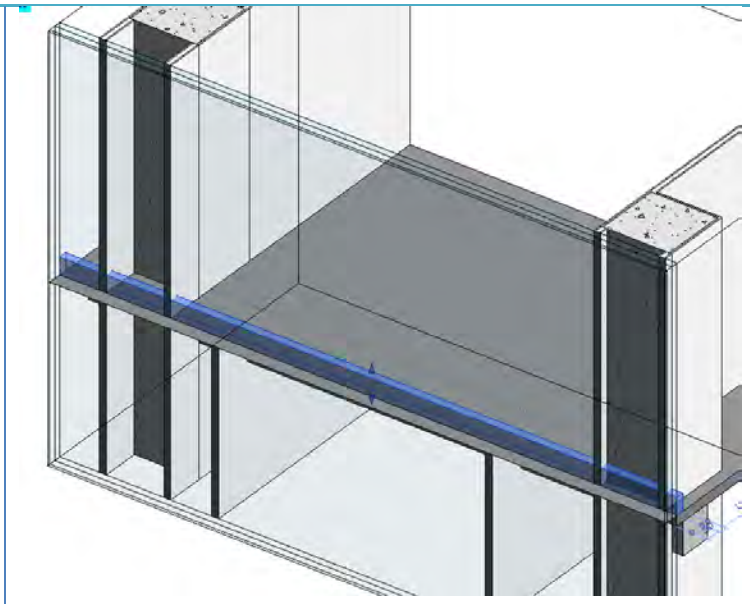


Figure 6.6.1 – 3D View of Curb

6.6.2 Information Requirements for Quantity Take-off

1. Curb marks
2. Mix or strength of concrete.

This sample model has not included:

a. Reinforcement, and

b. Formwork.

6.6.3 Quantity Take-off Guidelines

For measurement of curbs, create a schedule with the following fields:

<Curb Schedule>

A	B	C	D	E
Family	Type	Mark	Concrete Mix	Volume
Basic Wall	CUB-CUW-PQS-RC_150H-00	CUB03	C30	0.06
Basic Wall	CUB-CUW-PQS-RC_150H-00	CUB02	C30	0.17
Basic Wall	CUB-CUW-PQS-RC_150H-00	CUB01	C30	0.34
Grand total: 3				0.56

<Curb - Formwork - Sides of curbs>

A	B	C	D	E	F	G
Family	Type	Mark	Unconnected Height	Length	Area	Formwork - Sides of curbs
Basic Wall	CUB-CUW-PQS-RC_150H-00	CUB03	150	2500	0.38	0.75
Basic Wall	CUB-CUW-PQS-RC_150H-00	CUB02	150	7600	1.14	2.28
Basic Wall	CUB-CUW-PQS-RC_150H-00	CUB01	150	15000	2.25	4.50
Grand total: 3						7.53

For measurement of formwork to sides of curbs, create the following formula for column G in the schedule:

- Setting formula: *Length * Unconnected Height* 2 or Area * 2*
- Unit in m2; width n.e. 300mm and width >300mm measured separately

Adjust for the following as necessary:

- Nil

6.7 Lintels (normally this will not be modelled)

6.7.1 Basic Modelling Approaches

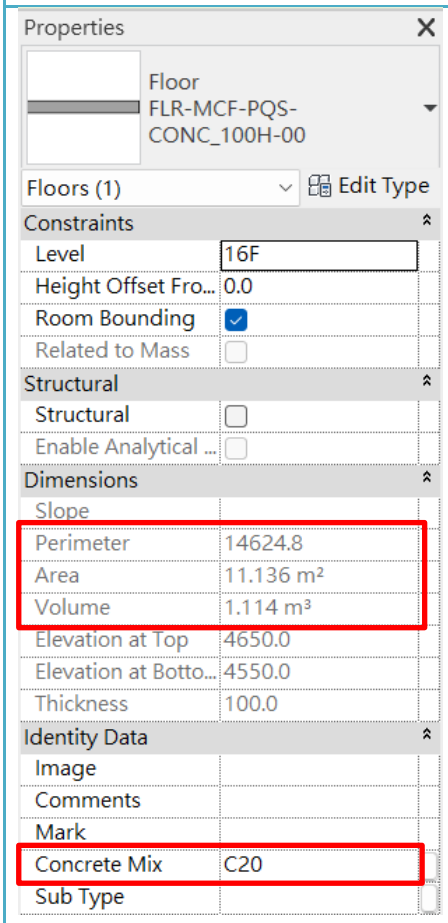
Based on the walls template, a system family type for lintel is created by sketching the alignment of lintel from the base level to top level.

For detailed illustration, refer to 8.1

6.8 Mass concrete filling (Sundry Concrete)

6.8.1 Basic Modelling Approaches

Based on the floors template, a system family type for floors is created as mass concrete filling by sketching the boundary of the mass concrete filling (e.g. sundry concrete) perimeter. The relevant information can be extracted from the parameters, such as perimeter, thickness, area, volume, etc.



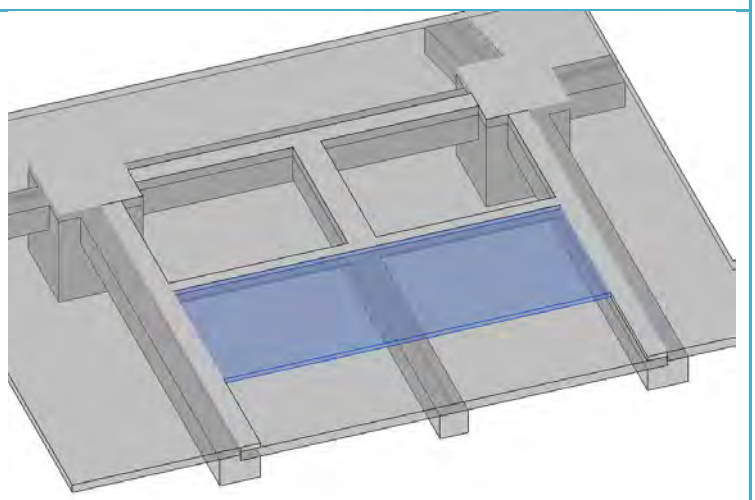


Figure 6.8.1 – 3D View of Mass Concrete Filling

6.8.2 Information Requirements for Quantity Take-off

1. Mix or strength of concrete.

This sample model has not included:

a. formwork.

6.8.3 Quantity Take-off Guidelines

For measurement of mass concrete filling, create a schedule with the following fields:

<Mass Concrete Filling Schedule>

A	B	C	D	E	F	G
Family	Type	Concrete Mix	Thickness	Perimeter	Volume	Fwk_Sides of Mass conc. fill
Floor	FLR-MCF-PQS-CONC_100H-00	C20	100	14625	1.11	1.46

For measurement of formwork to sides of mass conc. fill, create the following formula for column G in the schedule:

- Setting formula : *Thickness * Perimeter*
- Unit in m2; width n.e. 300mm and width >300mm measured separately

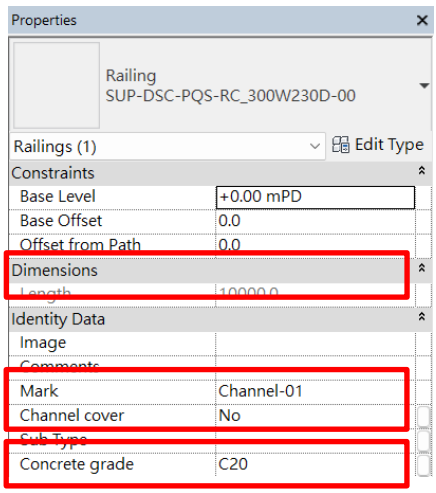
Adjust for the following as necessary:

- Nil

6.9 Surface water channels

6.9.1 Basic Modelling Approaches

Based on the railings template, a system family type for railings is created as surface water channels by sketching the alignment of the surface channel, with *Edit Profile* for the shape. *(This sample model is just one of the different modelling approaches for surface water channels).* The reason to create the object by railings is that it could be easier to draw the channel alignment which can be straight or curved. The relevant information can be extracted from the parameters, such as length, etc.



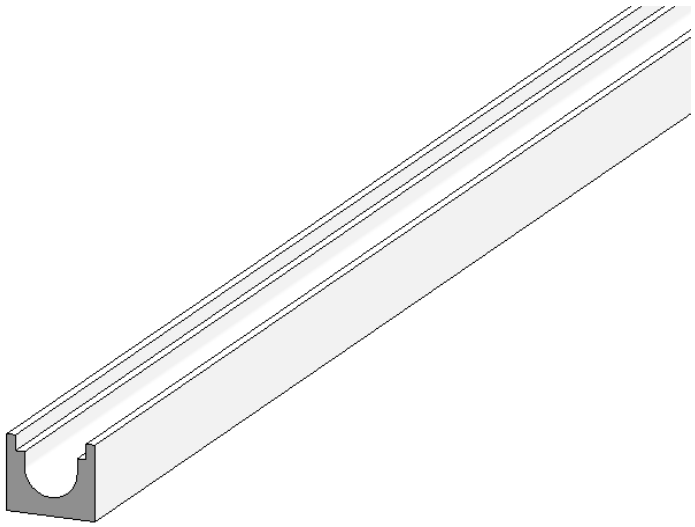


Figure 6.9.1 – 3D View of Surface Water Channel

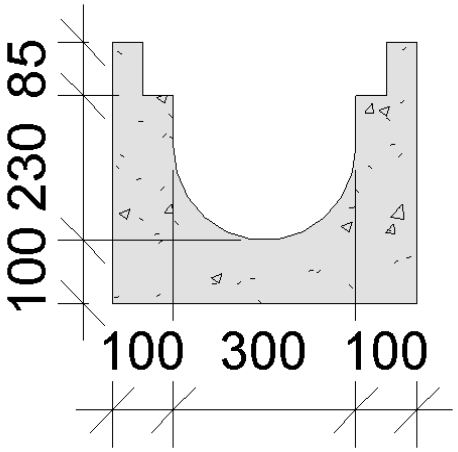


Figure 6.9.2 – Cross-Sectional Profile of Surface Water Channel

6.9.2 Information Requirements for Quantity Take-off

1. Surface water channel marks.
2. Shape, width and average depth.
3. Mix or strength of concrete.
4. Cover details, if any.
5. Curved.

6.9.3 Quantity Take-off Guidelines

For measurement of surface water channel, create a schedule with the following fields:

<Surface Water Channel Schedule>

A	B	C	D	E
Type	Mark	Concrete grade	Channel cover	Length
SUP-DSC-PQS-RC_300W230D-00	Channel-01	C20	No	10000
SUP-DSC-PQS-RC_300W230D-00	Channel-02	C20	No	7854
SUP-DSC-PQS-RC_300W230D-00	Channel-03	C20	No	5000
Grand total: 3				22854

Note: In creating the relevant schedule, the family name “railing” is obsolete as what we want is “surface water channel” in this case. As such, the title should be amended from “Railing Schedule” to “Surface Water Channel Schedule”.

Adjust for the following as necessary:

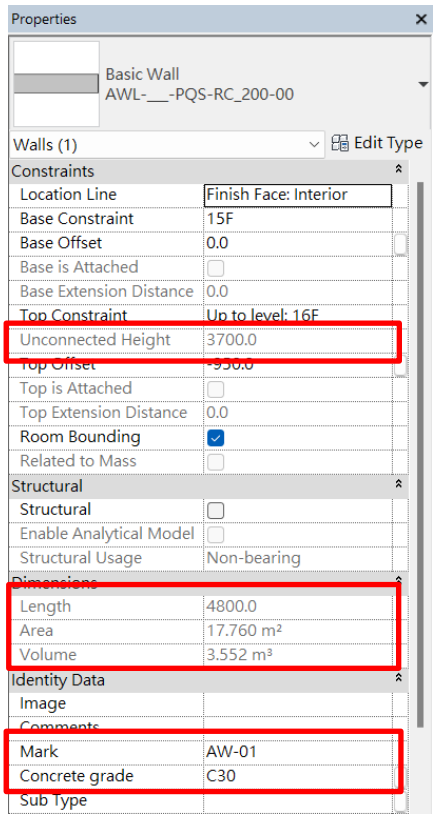
- Nil

6.10 Non-structural Walls

6.10.1 Basic Modelling Approaches

Based on the walls template, a system family type for non-structural walls is created by sketching the alignment of the wall from the base level (wall base) to the top level (wall top). The relevant information can be extracted from the parameters such as length, unconnected height (height), width (thickness), area, volume, etc.

The base level is where non-structural walls are located, and the top level of non-structural walls is attached to the bottom surface of structural floor slabs/ beams at the upper floor level. The geometry of non-structural walls is joined with the horizontal elements (e.g. beam, slab, etc.), and the horizontal elements take precedence.



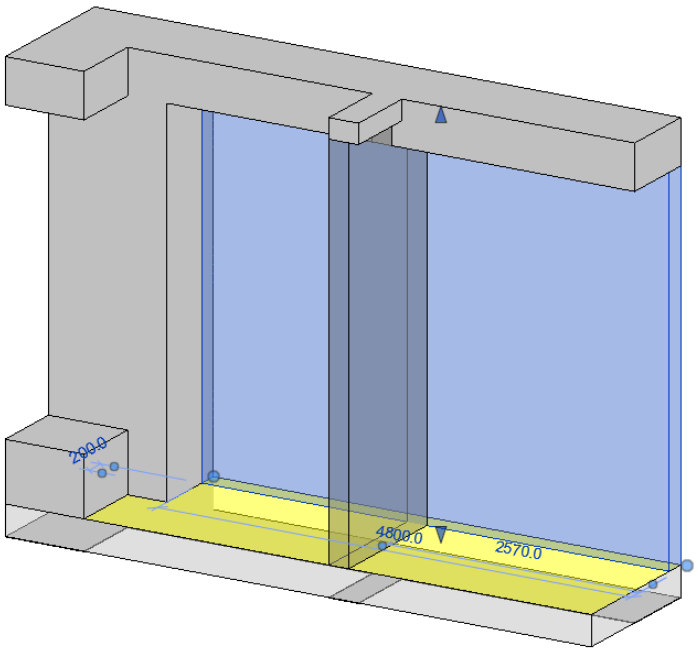


Figure 6.10.1: 3D View of Non-structural Walls

6.10.2 Information Requirements for Quantity Take-off

1. Wall marks.
2. Mix or strength of concrete.
3. Wall types – Non-structural.

This sample model has not included:

a. reinforcement, and

b. formwork.

6.10.3 Quantity Take-off Guidelines

For measurement of non-structural walls, create a schedule with the following fields:

<Wall Schedule>

A	B	C	D	E	F	G	H	I
Family	Type	Mark	Concrete grade	Width	Length	Area	Volume	Fwk_Both sides of Wall
Basic Wall	AWL-___-PQS-RC_200-00	AW-01	C30	200	4800	17.76	3.55	35.52
Basic Wall	AWL-___-PQS-RC_200-00	AW-02	C30	200	3300	12.10	2.42	24.19
Basic Wall	AWL-___-PQS-RC_200-00	AW-03	C30	200	3720	16.41	3.28	32.82
Basic Wall	AWL-___-PQS-RC_200-00	AW-04	C30	200	2600	9.25	1.85	18.50
Grand total: 4							11.10	111.03

The parameter “Area” of wall is representing the larger side surface of wall. For measurement of formwork to sides of wall, create the following formula for the column I in the schedule :

- For stand-alone walls and walls connected perpendicularly: *Area * 2 or [Volume / Width (thickness)]*2*
- For walls connected at an acute angle or obtuse angle: *[Volume / Width (thickness)]*2 or (Length * Unconnected Height) *2*

For measurement of formwork to the edge of walls (if required), create the following formula in the schedule:

- Setting formula in schedule: *Unconnected Height * Width* (unit = m^2), where
- Unconnected Height *is the height* (for *a* simple straight wall)
- Formwork with width n.e. 300mm and width >300mm are measured separately.

Adjust for the following as necessary:

- Nil

Section 7 – Precast Concrete

7.1 Facade Panels

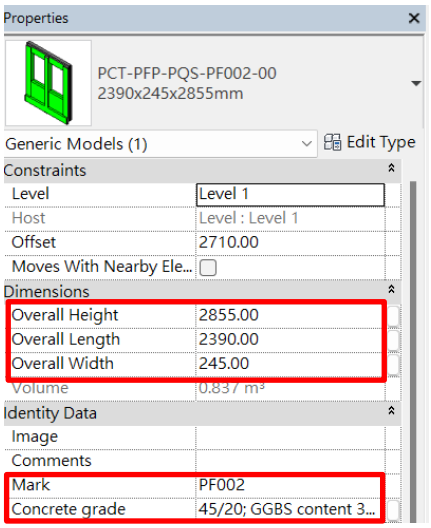
7.1.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for precast facade panels is created and the object is placed in the designed location.

For modelling of surface finishes, refer to Section 20.1.1 for details. Precast concrete elements may not be all pre-finished.

For modelling built-in fixtures and fittings, refer to relevant sections for details.

Dimensions stated in the Type Name shall be the overall dimensions of the element.



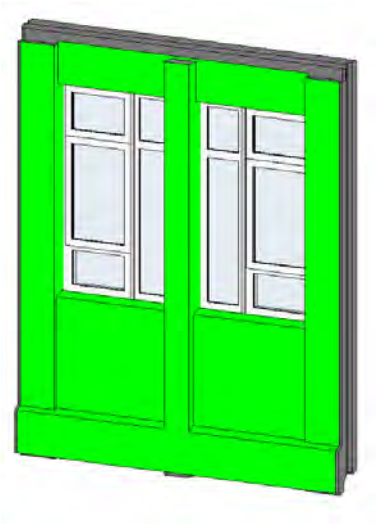


Figure 7.1.1 - 3D View of Facade Panel

7.1.2 Information Requirements for Quantity Take-off

1. Facade panel type marks.
2. Overall size including thickness.
3. Mix or strength of concrete.
4. Surface finishes.
5. Any built-in fixtures and fittings including windows and building services, etc.
6. Any cast-in accessories.

This sample model has not included:

a. Reinforcement details.

b. Structural connection methods.

c. Joint details.

7.1.3 Quantity Take-off Guidelines

For measurement of precast facade panels, create a schedule with the following fields:

<Precast Facade Schedule>

A	B	C	D	E	F
Family	Type	Mark	Level	Concrete grade	Count
PCT-PFP-PQS-PF002-00	2390x245x2855mm	PF002	Level 1	45/20; GGBS content 35%	1

The precast façade panel is deemed to have included, apart from others, surface finishes and built-in fittings and fixtures.

Note:

If want to measure built-in fixtures and fittings separately, refer to the relevant sections for details.

If want to measure surface finishes separately, refer to Section 20.1.3 for details.

Adjust for the following as necessary:

- Nil

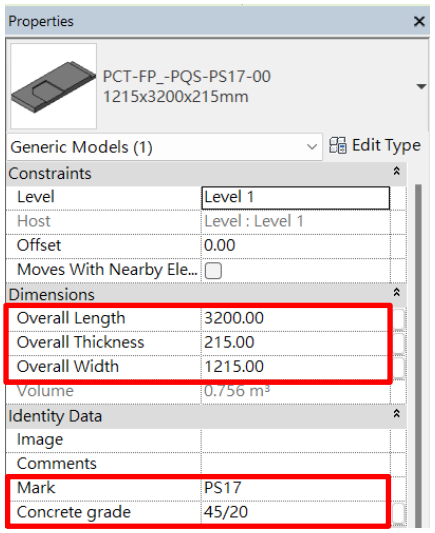
7.2 Precast Slabs

7.2.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for precast slab is created and the object is placed in the designed location.

For modelling of surface finishes, refer to Section 20.1.1 for details.

Dimensions stated in the Type Name shall be the overall dimensions of the element.



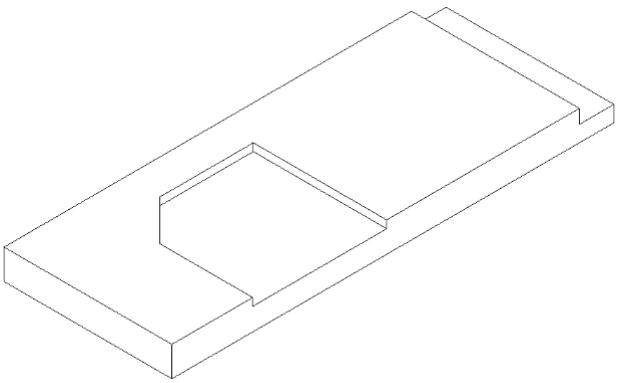


Figure 7.2.1 - 3D View of Precast Slab

7.2.2 Information Requirements for Quantity Take-off

1. Precast slab marks.
2. Overall size including thickness.
3. Mix or strength of concrete.
4. Any cast-in accessories.

This sample model has not included:

a. Reinforcement details.

b. Surface finishes.

c. Structural connection methods.

d. Joint details.

7.2.3 Quantity Take-off Guidelines

For measurement of precast slabs, create a schedule with the following fields:

<Precast Slab Schedule>

A	B	C	D	E
Family	Type	Mark	Concrete grade	Count
PCT-FP_-PQS-PS17-00	1215x3200x215mm	PS17	45/20	1

Note:

If want to measure surface finishes separately, refer to Section 20.1.3 for details.

Adjust for the following as necessary:

- Nil

7.3 Precast Staircases

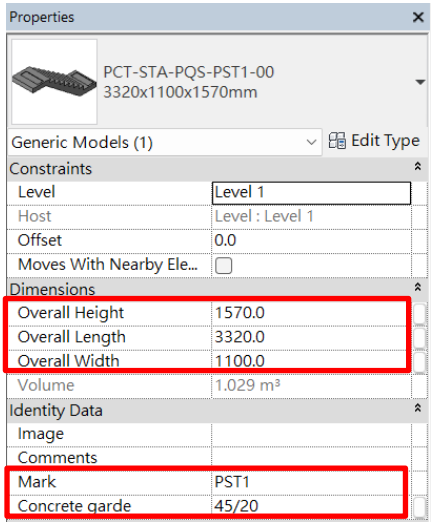
7.3.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for precast staircase is created and the object is placed in the designed location.

For modelling of surface finishes, refer to Section 20.1.1 for details.

For modelling of tactile, refer to Section 20.3.1 for details.

Dimensions stated in the Type Name shall be the overall dimensions of the element.



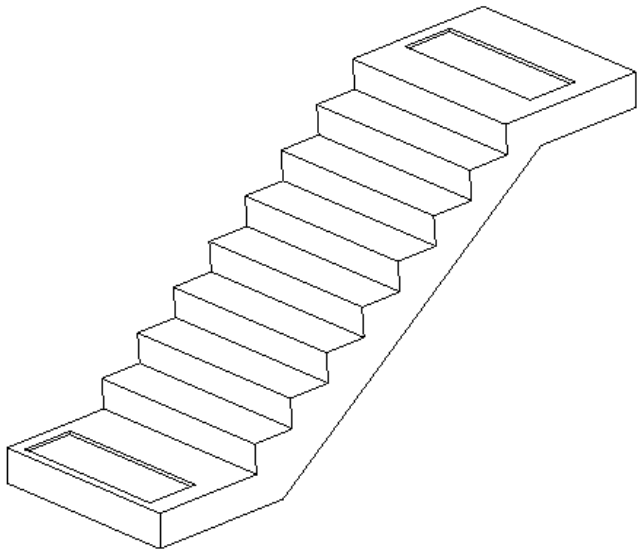


Figure 7.3.1 - 3D View of Precast Staircase

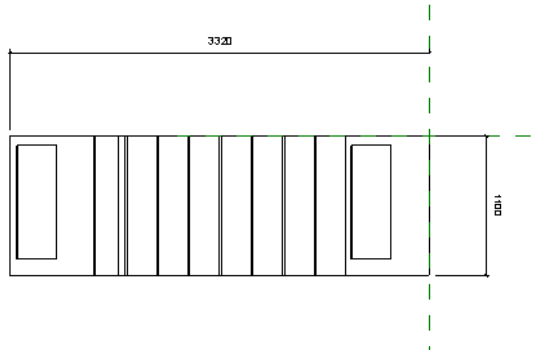


Figure 7.3.2 - Plan View of Precast Staircase

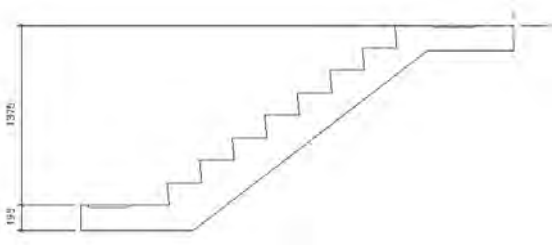


Figure 7.3.3 - Sectional View of Precast Staircase

7.3.2 Information Requirements for Quantity Take-off

1. Precast staircase marks.
2. Overall size.
3. Mix or strength of concrete.
4. Surface finishes.
5. Any cast-in accessories.

This sample model has not included:

a. Reinforcement details.

b. Structural connection methods.

c. Joint details.

7.3.3 Quantity Take-off Guidelines

For measurement of precast staircase, create a schedule with the following fields:

<Precast Staircase Schedule>

A	B	C	D	E
Family	Type	Mark	Concrete garde	Count
PCT-STA-PQS-PST1-00	3320x1100x1570mm	PST1	45/20	1

The precast staircase item is deemed to include, apart from others, surface finishes and tactile.

Note:

If want to measure surface finishes separately, refer to Section 20.1.3 for details.

If want to measure tactile separately, refer to Section 20.3.3 for details.

Adjust for the following as necessary:

- Nil

7.4 Volumetric precast concrete units

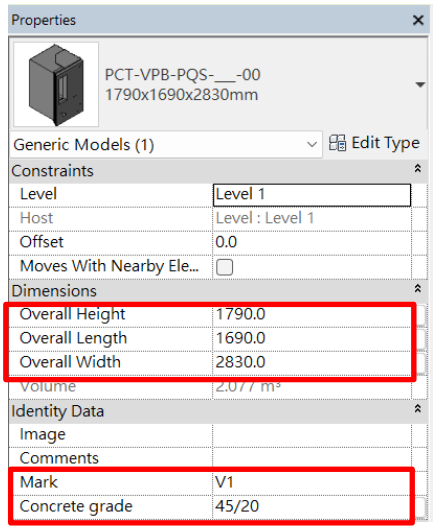
7.4.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for volumetric precast concrete unit is created and the object is placed in the designed location.

For modelling of surface finishes, refer to Section 20.1.1 for details.

For modelling of built-in fixtures and fittings, refer to relevant sections for details.

Dimensions stated in the Type Name shall be the overall dimensions of the element.



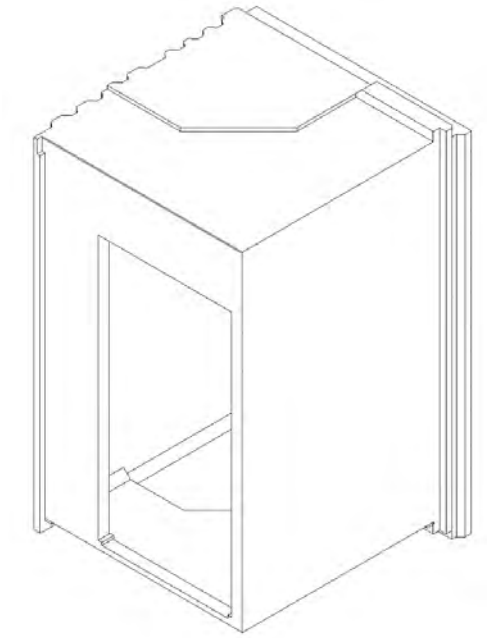


Figure 7.4.1 - 3D View of Volumetric Precast Concrete Unit

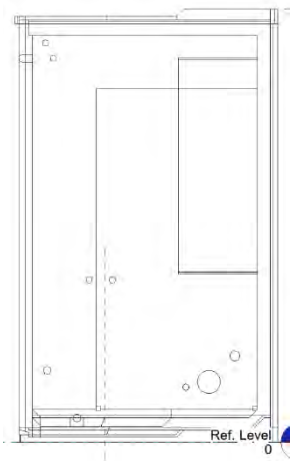


Figure 7.4.2 - Elevation View of Volumetric Precast Concrete Unit

7.4.2 Information Requirements for Quantity Take-off

1. Volumetric precast concrete unit mark.
2. Overall size.
3. Mix or strength of concrete.
4. Surface finishes.
5. Any built-in fixtures and fittings including doors, windows, sanitary fittings and building services, etc.
6. Any cast-in accessories.

This sample model has not included:

a. Reinforcement details.

b. Structural connection methods.

c. Joint details.

7.4.3 Quantity Take-off Guidelines

For measurement of volumetric precast concrete units, create a schedule with the following fields:

<Volumetric precast concrete units Schedule>

A	B	C	D	E
Family	Type (Overall size)	Mark	Concrete grade	Count
PCT-VPB-PQS-___-00	1790x1690x2830mm	V1	45/20	1

The volumetric precast concrete unit is deemed to include, apart from others, surface finishes and built-in fixtures and fittings.

Note:

If want to measure surface finishes separately, refer to Section 20.1.3 for details.

If want to measure built-in fixtures and fittings separately, refer to the relevant sections for details.

Adjust for the following as necessary:

- Nil

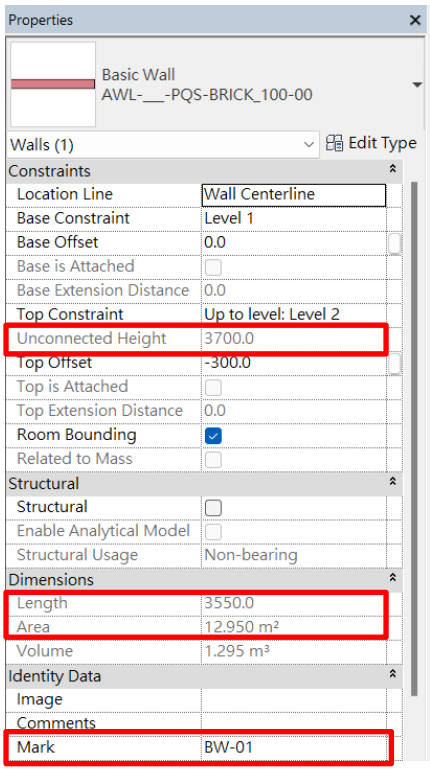
Section 8 – Masonry

8.1 Brickwork and Blockwork

8.1.1 Basic Modelling Approaches

Based on the walls template, a system family type for brick wall/ block wall/ panel wall is created by sketching the alignment of the wall from the base level (wall base) to the top level (wall top). The relevant information can be extracted from the parameters such as length, unconnected height (height), width (thickness), area, etc.

The top of the brick wall/ block wall/ panel wall is below the horizontal elements (e.g. beam, slab, etc.).



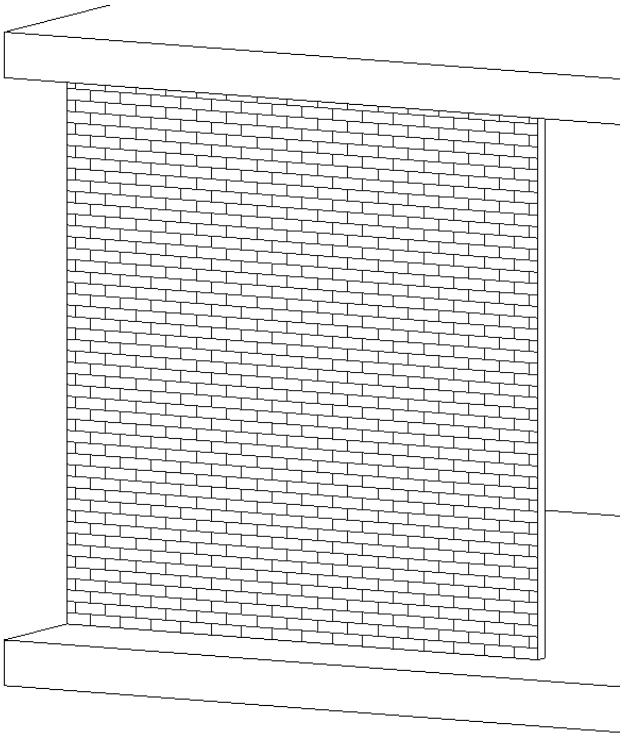
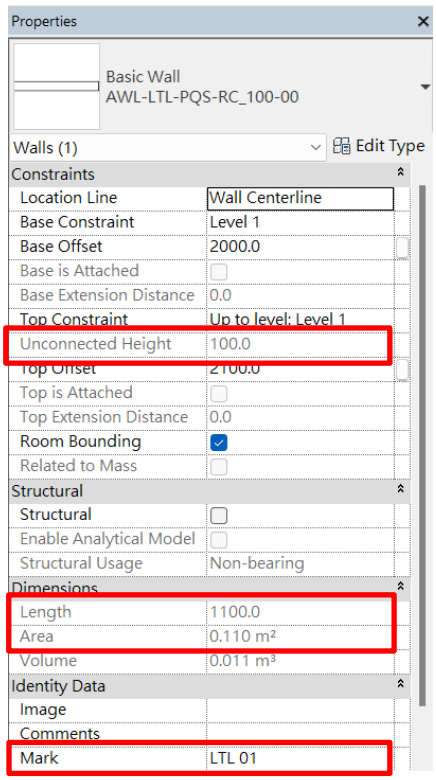


Figure 8.1.1 - 3D View of Brick/Block Wall

Lintel, if created, would be within brick/ block walls (overlapped), on top of the door opening. If lintel is modelled, information on the details for respective openings or locations shall be provided.



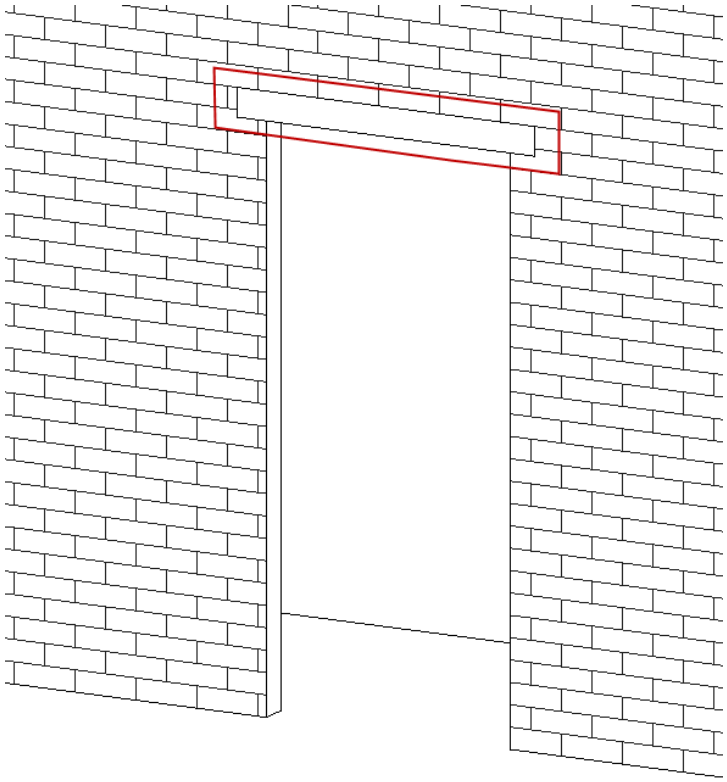


Figure 8.1.2 - Lintel on Top of Door Opening

8.1.2 Information Requirements for Quantity Take-off

- Type, kind and quality of materials.
- Wall thicknesses.
- FRP and insulation properties.
- Damp-proof course (if any).
- Reinforcement (if any).
- Stiffener for wall height exceeding 3.5m.
- Lintel, with overall size, concrete mix and reinforcement details (if any).

8.1.3 Quantity Take-off Guidelines

For measurement of masonry, create a schedule with the following fields:

<Blockwall Schedule>

A	B	C	D	E	F
Family	Type	Mark	Length	Unconnected Height	Area
Basic Wall	AWL-___-PQS-BRICK_100-00	BW-01	3550	3700	12.95
Basic Wall	AWL-___-PQS-BRICK_100-00	BW-02	6200	3700	20.96
Grand total: 2					33.91

For measurement of Lintel, create a schedule with the following fields:

<Lintel Schedule>

A	B	C	D	E	F
Family	Type	Mark	Length	Unconnected Height	Count
Basic Wall	AWL-LTL-PQS-RC_100-00	LTL 01	1100	100	1

Adjust for the following as necessary:

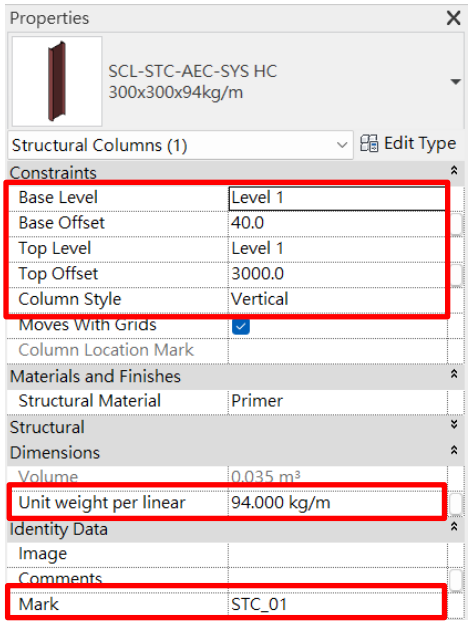
- Nil

Section 9 – Structural Steelwork

9.1 Steel Columns

9.1.1 Basic Modelling Approaches

Based on the structural columns template, a loadable family type for steel columns is created from the base level (column base) to the top level (column top). The relevant information can be extracted from the parameters, such as length, unit weight per linear, etc.



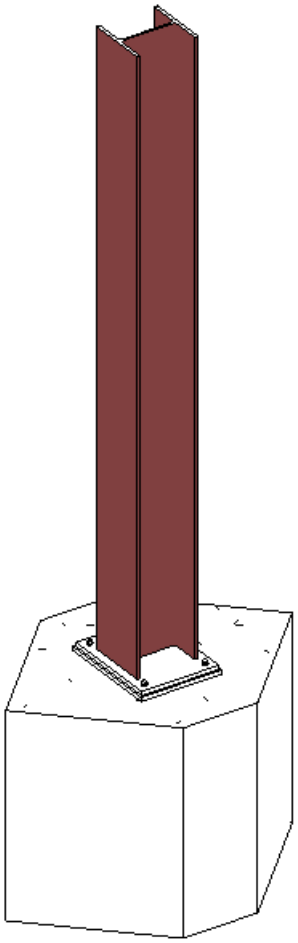


Figure 9.1.1 - 3D View of Steel Column

9.1.2 Information Requirements for Quantity Take-off

1. Steel column marks.
2. Cross-sectional sizes and weight per unit length.
3. Type and grade of materials.
4. Surface treatments and finishes.

9.1.3 Quantity Take-off Guidelines

For measurement of steel columns, create a schedule with the following fields:

<Structural Column Schedule>

A	B	C	D	E	F
Family	Type	Mark	Length	Unit weight per linear	Weight
SCL-STC-AEC-SYS HC	300x300x94kg/m	STC_01	2960	94.00 kg/m	278.24 kg
SCL-STC-AEC-SYS HC	300x300x94kg/m	STC_02	2960	94.00 kg/m	278.24 kg
SCL-STC-AEC-SYS HC	300x300x94kg/m	STC_03	2960	94.00 kg/m	278.24 kg
SCL-STC-AEC-SYS HC	300x300x94kg/m	STC_04	2960	94.00 kg/m	278.24 kg
Grand total: 4			11840		1112.96 kg

For measurement of Weight, set a formula for column F in the schedule:

- Setting formula: *Length * kg/m*

For measurement of painting, create a material take-off schedule with the following fields:

<Structural Column Material Takeoff>

A	B	C	D	E	F
Family	Type	Mark	Length	Material Name	Material: Area
SCL-STC-AEC-SYS HC	300x300x94kg/m	STC_01	2960	Primer	5.20
SCL-STC-AEC-SYS HC	300x300x94kg/m	STC_02	2960	Primer	5.20
SCL-STC-AEC-SYS HC	300x300x94kg/m	STC_03	2960	Primer	5.20
SCL-STC-AEC-SYS HC	300x300x94kg/m	STC_04	2960	Primer	5.20
Grand total: 4					20.81

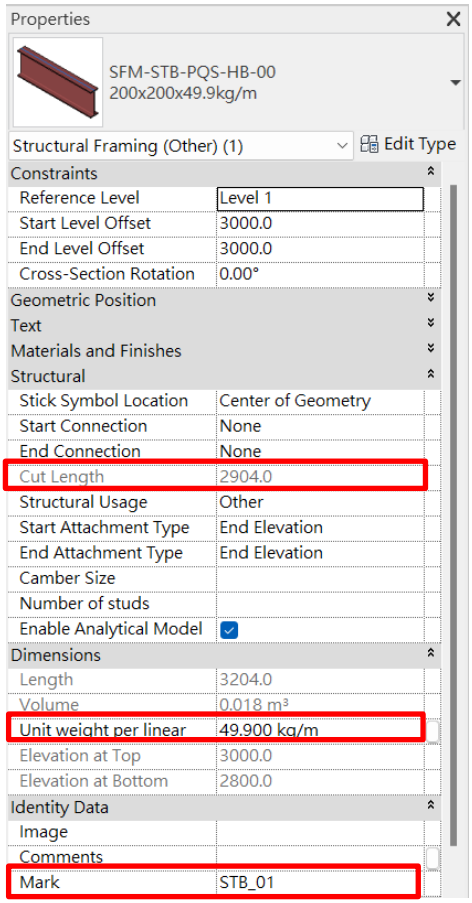
Adjust for the following as necessary:

- Nil

9.2 Steel Beams

9.2.1 Basic Modelling Approaches

Based on the structural framing template, a loadable family type for steel beams is created by sketching the alignment of the beam. The relevant information can be extracted from the parameters, such as cut length (beam length), volume, etc.



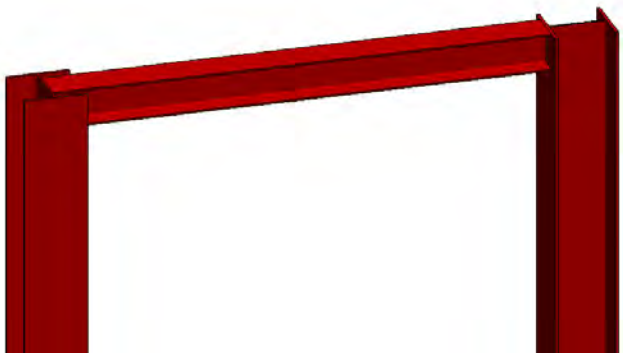


Figure 9.2.1 - 3D View of Steel Beam

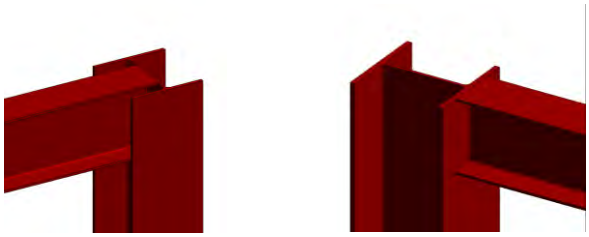


Figure 9.2.2 – Connection details of Steel Beam

9.2.2 Information Requirements for Quantity Take-off

1. Steel beam marks.
2. Cross-sectional sizes and weight per unit length.
3. Type and grade of materials.
4. Surface treatments and finishes.

9.2.3 Quantity Take-off Guidelines

For measurement of steel beams, create a schedule with the following fields:

<Structural Framing Schedule>

A	B	C	D	E	F
Family	Type	Mark	Cut Length	Unit weight per linear	Weight
SFM-STB-PQS-HB-00	200x200x49.9kg/m	STB_01	2904	49.90 kg/m	144.91 kg
SFM-STB-PQS-HB-00	200x200x49.9kg/m	STB_02	2904	49.90 kg/m	144.91 kg
SFM-STB-PQS-HB-00	200x200x49.9kg/m	STB_04	3000	49.90 kg/m	149.70 kg
SFM-STB-PQS-HB-00	200x200x49.9kg/m	STB_03	3000	49.90 kg/m	149.70 kg
Grand total: 4			11808		589.22 kg

For measurement of weight, set a formula for column F in the schedule:

- Setting formula: *Cut Length * kg/m*

For measurement of Painting, create a material take-off schedule with the following fields:

<Structural Framing Material Takeoff>

A	B	C	D	E	F
Family	Type	Mark	Cut Length	Material Name	Material: Area
SFM-STB-PQS-HB-00	200x200x49.9kg/m	STB_01	2904	Primer	3.37
SFM-STB-PQS-HB-00	200x200x49.9kg/m	STB_02	2904	Primer	3.37
SFM-STB-PQS-HB-00	200x200x49.9kg/m	STB_04	3000	Primer	3.49
SFM-STB-PQS-HB-00	200x200x49.9kg/m	STB_03	3000	Primer	3.49
Grand total: 4					13.72

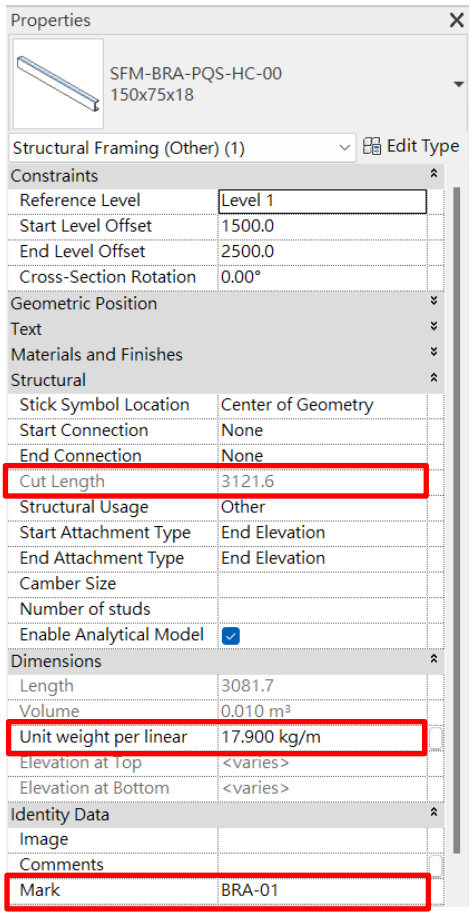
Adjust for the following as necessary:

- Nil

9.3 Steel bracings

9.3.1 Basic Modelling Approaches

Based on the structural framing template, a loadable family type for steel bracing is created by sketching the alignment of the beam. The relevant information can be extracted from the parameters, such as cut length (beam length), volume, etc.



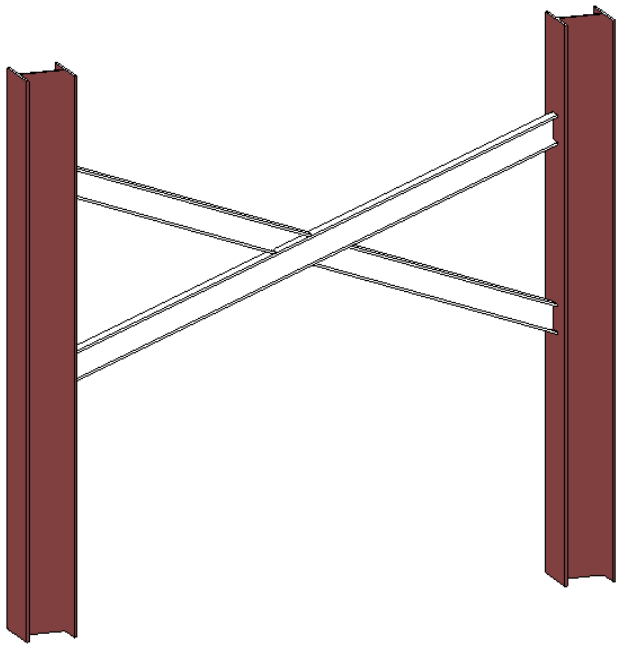


Figure 9.3.1 - 3D View of Steel Bracing

9.3.2 Information Requirements for Quantity Take-off

1. Steel bracing marks.
2. Cross-sectional sizes and weight per unit length.
3. Type and grade of materials.
4. Surface treatments and finishes.

9.3.3 Quantity Take-off Guidelines

For measurement of steel bracings, create a schedule with the following fields:

<Structural Bracing Schedule>

A	B	C	D	E	F
Family	Type	Mark	Cut Length	Unit weight per linear	Weight
SFM-BRA-PQS-HC-00	150x75x18	BRA-02	1530	17.90 kg/m	27.38 kg
SFM-BRA-PQS-HC-00	150x75x18	BRA-01	3122	17.90 kg/m	55.88 kg
SFM-BRA-PQS-HC-00	150x75x18	BRA-03	1540	17.90 kg/m	27.57 kg
Grand total: 3			6192		110.83 kg

For measurement of Weight, set a formula for column F in the schedule:

- Setting formula: *Cut Length * kg/m*

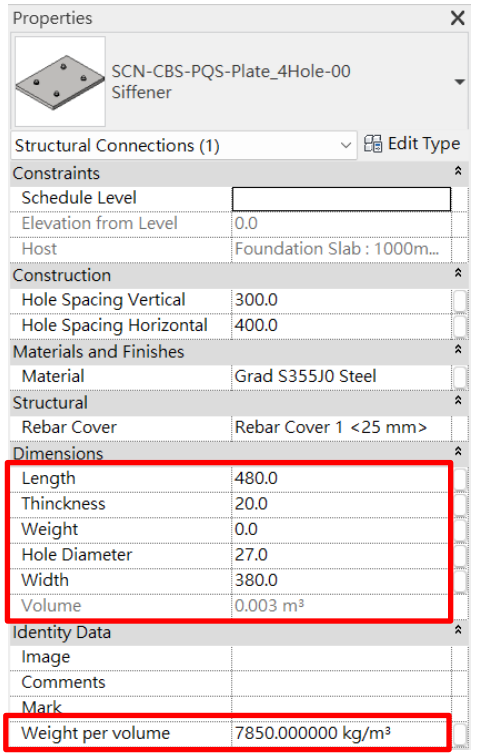
Adjust for the following as necessary:

- Nil

9.4 Connections to Framed Members

9.4.1 Basic Modelling Approaches

Based on the structural connections template, a loadable family type of connections plate is created by sketching the profile of the steel plates/ stiffeners or brackets etc. The relevant information can be extracted from the parameters, such as thickness, volume, etc.



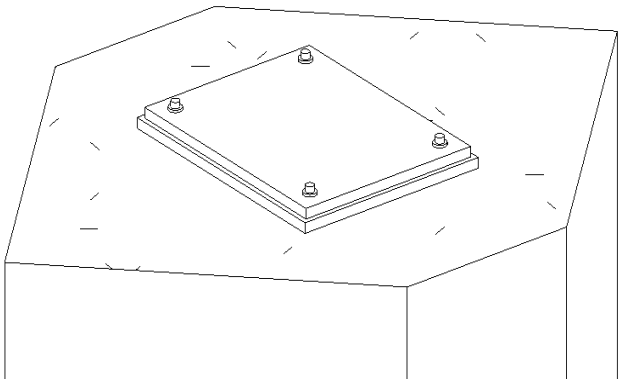


Figure 9.4.1 - 3D View of Connection Detail

9.4.2 Information Requirements for Quantity Take-off

1. Thickness and weight per volume.
2. Type and grade of materials.
3. Surface treatments and finishes.

9.4.3 Quantity Take-off Guidelines

For measurement of connections to framed members, create a schedule with the following fields:

<Structural Connection Schedule>

A	B	C	D	E	F	G	H
Family	Type	Length	Width	Thinckness	Volume	Weight per volume	Weight
SCN-CBS-PQS-Plate_4Hole-00	Siffener	480	380	20	0.003 m³	7850.00 kg/m³	25.81 kg
SCN-CBS-PQS-Plate_4Hole-00	plate	500	400	20	0.004 m³	7850.00 kg/m³	31.04 kg
SCN-CBS-PQS-Plate_4Hole-00	Siffener	480	380	20	0.003 m³	7850.00 kg/m³	25.81 kg
SCN-CBS-PQS-Plate_4Hole-00	plate	500	400	20	0.004 m³	7850.00 kg/m³	31.04 kg
SCN-CBS-PQS-Plate_4Hole-00	Siffener	480	380	20	0.003 m³	7850.00 kg/m³	25.81 kg
SCN-CBS-PQS-Plate_4Hole-00	plate	500	400	20	0.004 m³	7850.00 kg/m³	31.04 kg
SCN-CBS-PQS-Plate_4Hole-00	Siffener	480	380	20	0.003 m³	7850.00 kg/m³	25.81 kg
SCN-CBS-PQS-Plate_4Hole-00	plate	500	400	20	0.004 m³	7850.00 kg/m³	31.04 kg
Grand total: 8					0.029 m³		227.41 kg

For measurement of weight, set a formula for column H in the schedule:

- Setting formula: *Volume * Weight per Volume*

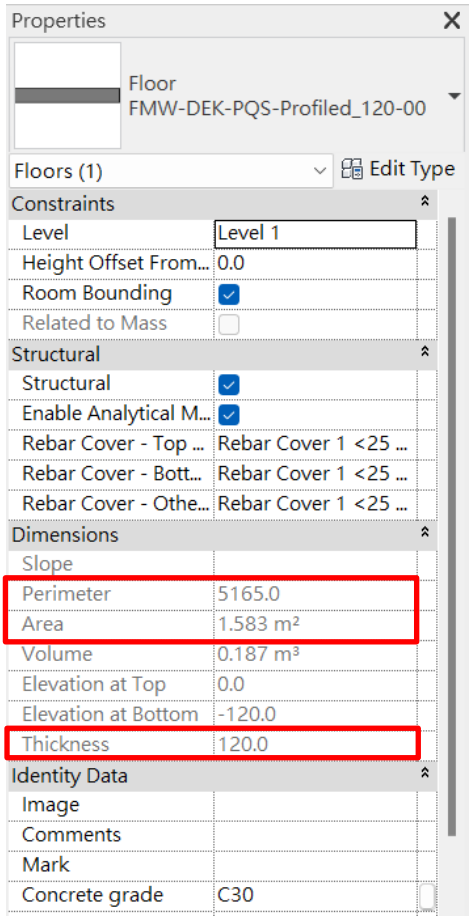
Adjust for the following as necessary:

- Nil

9.5 Metal profiled sheet decking

9.5.1 Basic Modelling Approaches

Based on the structural floors template, a system family type for metal profiled sheet decking is created by sketching the profile of the metal deck. The relevant information can be extracted from the parameters, such as thickness, area, etc.



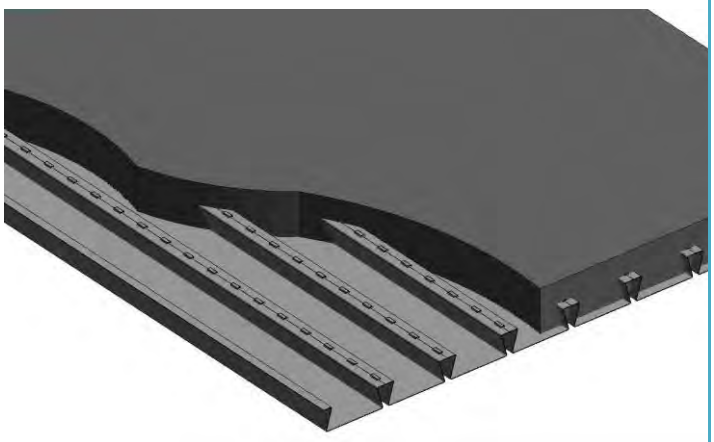


Figure 9.5.1 - 3D View of Metal Profiled Sheet Decking

9.5.2 Information Requirements for Quantity Take-off

1. Kind, quality, profile, thickness and finish of decking materials.
2. Method of fixings.
3. Horizontal / sloping / curved.

9.5.3 Quantity Take-off Guidelines

For measurement of metal profiled sheet decking, create a schedule with the following fields:

<Metal Profiled Sheet Decking Schedule>

A	B	C	D
Family	Type	Thickness	Area
Floor	FMW-DEK-PQS-Profiled_120-00	120	1.58

Adjust for the following as necessary:

- No deductions is made for voids not greater than 1.00m².

Section 10 Waterproofing

10.1 Waterproofing

10.1.1 Basic Modelling Approaches

Waterproofing includes roofing, tanking and damp-proofing, and related works. There can be three modelling approaches for waterproofing as follows:

1) Create Rooms;

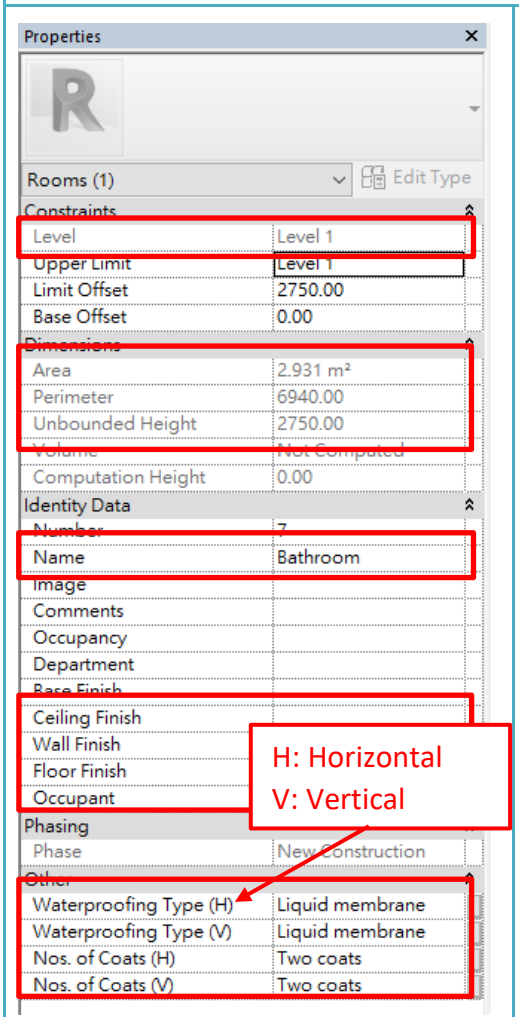
2) Apply Paint; or

3) Create separate layers by floor and wall as waterproofing layers.

For modelling of waterproofing adopting the above approaches, refer to Section 20.1.1 for details.

1) Create Rooms

Example of waterproofing modelled by Rooms:



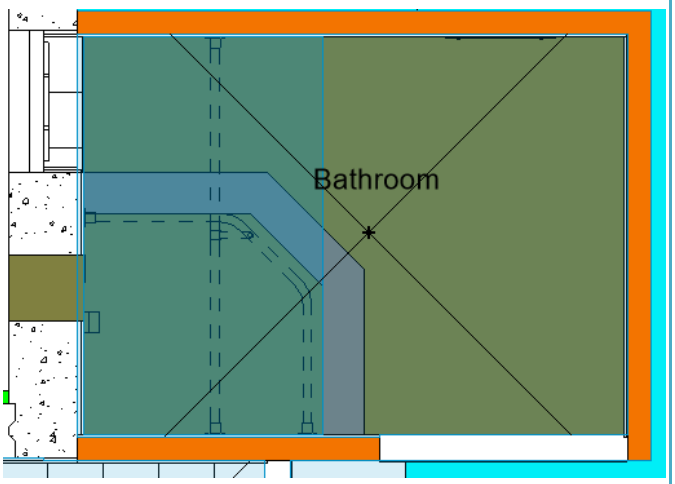
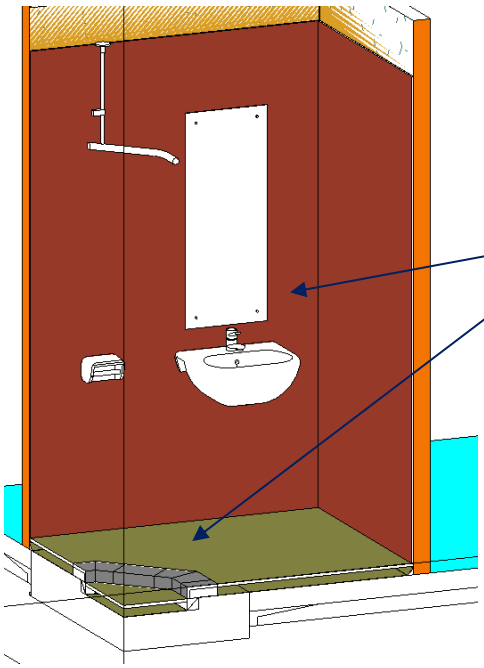


Figure 10.1.1 - Plan View of Bathroom with Rooms

2) Apply Paint

Example of waterproofing by applying “Paint”:



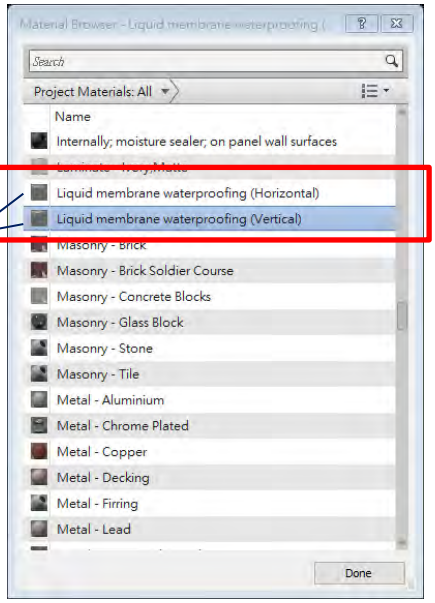
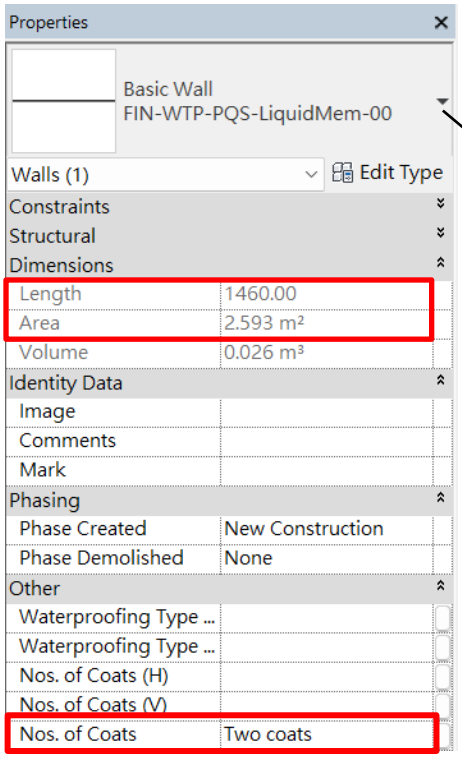


Figure 10.1.2 - 3D View of Area Applying “Paint” for Waterproofing Layer

3) Create Separate Layers by Floor and Wall as Waterproofing Layers

Example of waterproofing modelled by separate layers of walls and floors:



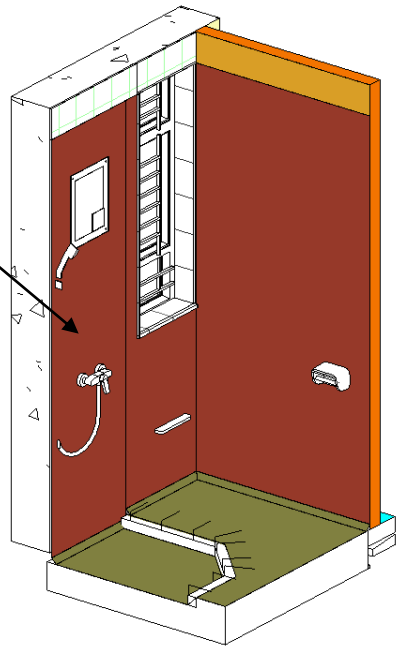


Figure 10.1.3 - 3D View of Waterproofing on Walls

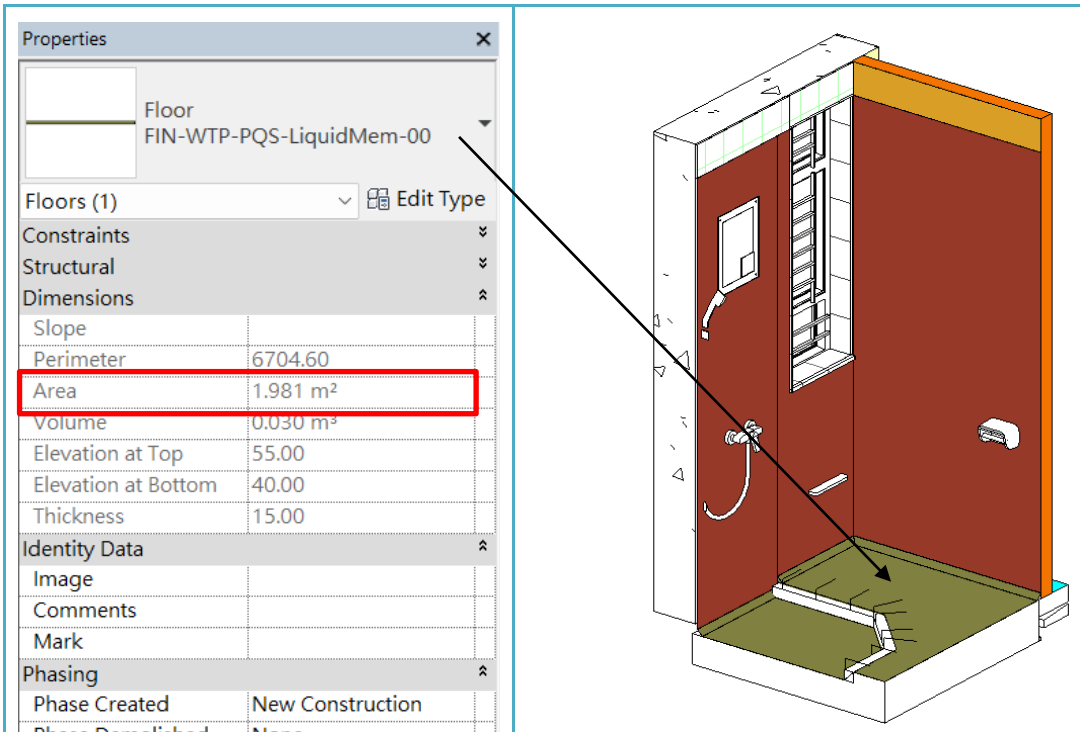


Figure 10.1.4 - 3D View of Waterproofing on Floors

10.1.2 Information Requirements for Quantity Take-off

1. Waterproofing type/ marks. (if any)
2. Number of coats or layers.
3. Sloping or laid to fall (Sloping means > 15°from horizontal).
4. Curved

This sample model has not included:

a. Kind and quality of waterproofing materials.

b. Thickness.

10.1.3 Quantity Take-off Guidelines

For measurement of waterproofing, create relevant material take-off schedules or schedules depending on the modelling approach.

1) Create Rooms

For measurement of waterproofing by Rooms, create a schedule with the following fields, details referring to Section 20.1.3.

<Waterproofing Schedule - Horizontal by Rooms>

A	B	C	D	E
Name	Waterproofing Type (H)	No. of Coats (H)	Area	Count
Bathroom	Liquid membrane	Two coats	2.93	1

Example of Waterproofing Schedule – Horizontal by Rooms

<Waterproofing Schedule - Vertical by Rooms>

A	B	C	D	E	F	G
Name	Waterproofing Type (V)	No. of Coats (V)	Perimeter	Height	Wall Area (Perimeter x Height)	Count
Bathroom	Liquid membrane	Two coats	6940.00	2330.00	16.17	1

Example of Waterproofing Schedule – Vertical by Rooms

2) Apply Paint

For measurement of waterproofing by applying “Paint” with split function, create a material take-off schedule to include “Material: Area”, details referring to Section 20.1.3.

<Waterproofing Schedule by Paint>

A	B	C	D
Material: Name	Waterproofing Type	No. of Coats	Material: Area
Liquid membrane waterproofing (Horizontal)	Liquid membrane	Two coats	1.98
Liquid membrane waterproofing (Horizontal)	Liquid membrane	Two coats	0.68
Liquid membrane waterproofing (Horizontal): 2			2.66
Liquid membrane waterproofing (Vertical)	Liquid membrane	Two coats	3.32
Liquid membrane waterproofing (Vertical)	Liquid membrane	Two coats	2.71
Liquid membrane waterproofing (Vertical)	Liquid membrane	Two coats	2.59
Liquid membrane waterproofing (Vertical)	Liquid membrane	Two coats	4.55
Liquid membrane waterproofing (Vertical): 4			13.18

Example of Waterproofing – Schedule by Applying Paint

3) Create Separate Layers by Floor and Wall as Waterproofing Layers

For measurement of waterproofing layers modelled by floor and wall, create material take-off schedules to include the following fields, details referring to Section 20.1.3.

<Waterproofing - Horizontal Schedule>

A	B	C	D	E	F
Family	Type	No. of Coats	Material: Name	Material: Area	Sloping
Floor	FIN-WTP-PQS-LiquidMem-00	Two coats	Liquid membrane waterproofing (Horizontal)	1.98	☐
Floor	FIN-WTP-PQS-LiquidMem-00	Two coats	Liquid membrane waterproofing (Horizontal)	0.68	☐
Grand total: 2				2.66	

Example of Waterproofing – Horizontal Schedule (created by “Floor”)

<Waterproofing - Vertical Schedule>

A	B	C	D	E
Family	Type	No. of Coats	Material: Name	Material: Area
Basic Wall	FIN-WTP-PQS-LiquidMem-00	Two coats	Liquid membrane waterproofing (Vertical)	3.32
Basic Wall	FIN-WTP-PQS-LiquidMem-00	Two coats	Liquid membrane waterproofing (Vertical)	2.71
Basic Wall	FIN-WTP-PQS-LiquidMem-00	Two coats	Liquid membrane waterproofing (Vertical)	2.59
Basic Wall	FIN-WTP-PQS-LiquidMem-00	Two coats	Liquid membrane waterproofing (Vertical)	4.55
Grand total: 4				13.18

Example of Waterproofing – Vertical Schedule (created by “Wall”)

Adjust for the following as necessary:

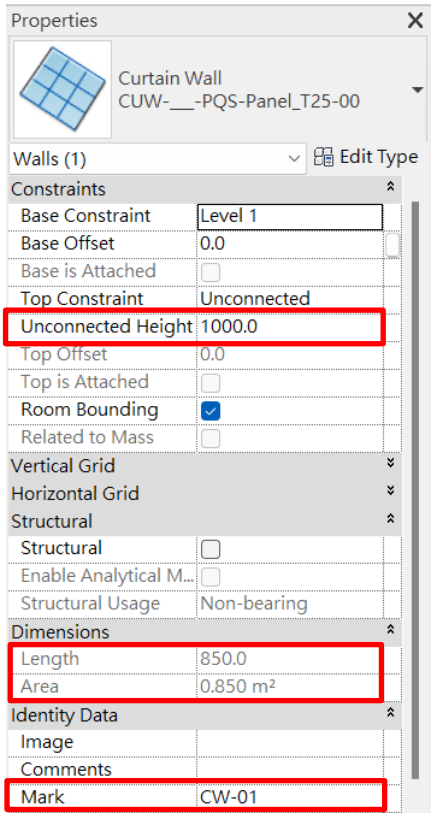
- Doors and windows (for the approach adopting “Rooms”: the quantities given are based on the overall dimensions without deduction of openings).
- Voids and openings if required.
- Steps, channels and recesses if required.
- Beware of measurement on area is that “in contact with base”.

Section 11 - Curtain and Glass Walling, Claddings and Coverings

11.1 Curtain walling

11.1.1 Basic Modelling Approaches

Based on the walls template, a ssystem family type for curtain wall is created by sketching the alignment of the curtain wall from the base level (curtain wall base) to the top level (curtain wall top). The relevant information can be extracted from the parameters, such as length, unconnected height (height), area, etc.



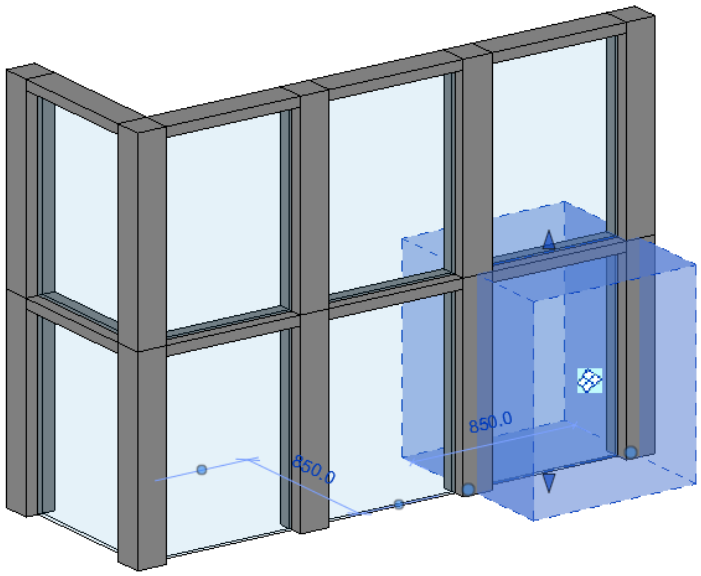
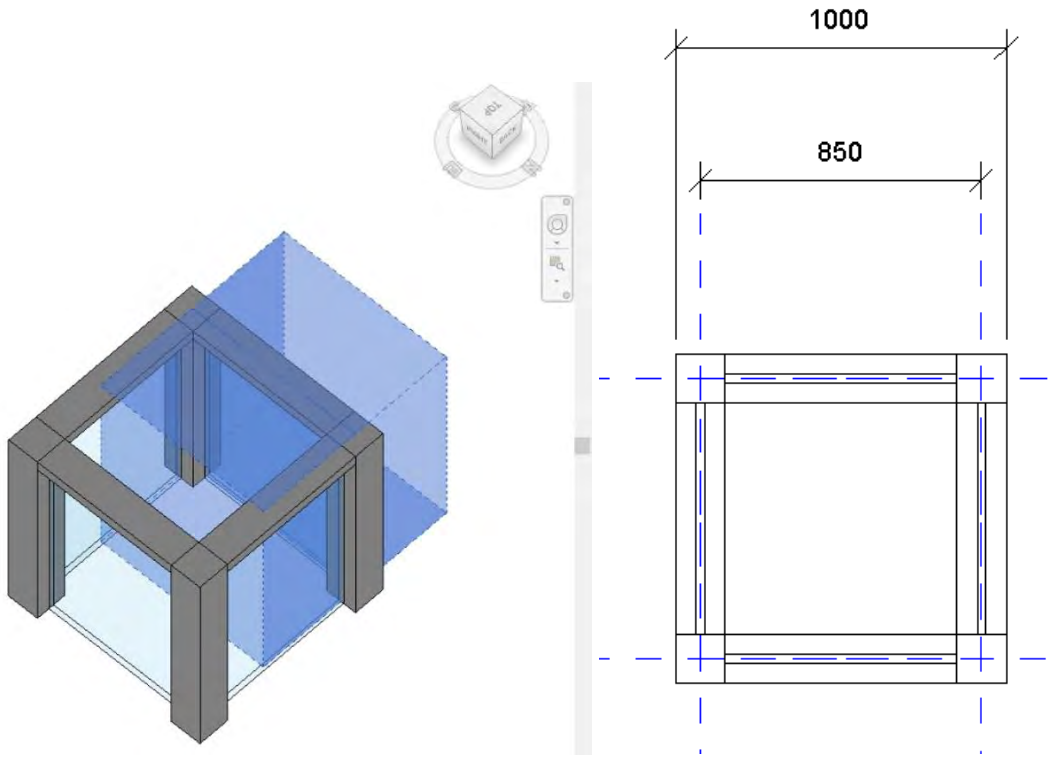


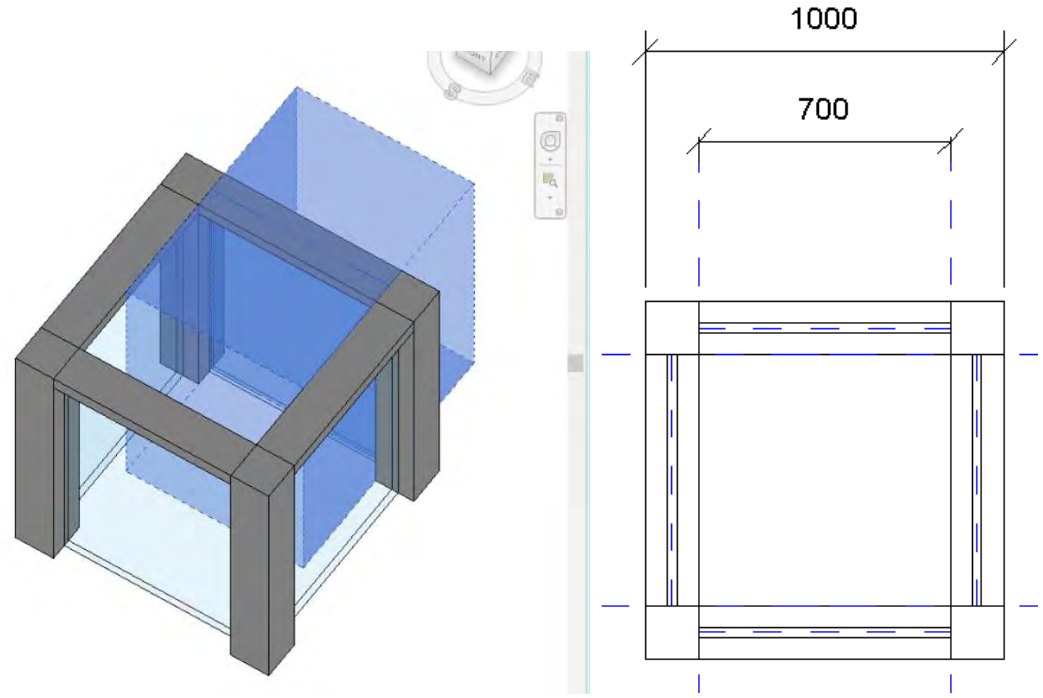
Figure 11.1.1 - 3D View of Curtain Walling

Length is determined by the profile setting.

Example 1 shows the profile cut at centre of mullion:



Example 2 shows the profile at internal side of mullion:



11.1.2 Information Requirements for Quantity Take-off

1. Curtain walling marks.
2. Overall size of curtain walling panel.
3. Material, quality and surface finish of framing members
4. Type and thickness of vision and spandrel glass panels.
5. Positions - vertical / horizontal / sloping > 15º from horizontal / curved.
6. Opening types – openable windows / glazed doors / louvres / protective bearers / others

11.1.3 Quantity Take-off Guidelines

For measurement of the area of curtain wall, create a schedule with the following fields:

<Curtain Wall Schedule>

A	B	C	D	E	F
Family	Type	Mark	Length	Unconnected Height	Area
Curtain Wall	CUW-___-PQS-Panel_T25-00	CW-01	850	1000	0.85
Curtain Wall	CUW-___-PQS-Panel_T25-00	CW-02	850	1000	0.85
Curtain Wall	CUW-___-PQS-Panel_T25-00	CW-03	850	1000	0.85
Curtain Wall	CUW-___-PQS-Panel_T25-00	CW-04	850	1000	0.85
Curtain Wall	CUW-___-PQS-Panel_T25-00	CW-05	850	1000	0.85
Curtain Wall	CUW-___-PQS-Panel_T25-00	CW-06	850	1000	0.85
Curtain Wall	CUW-___-PQS-Panel_T25-00	CW-07	850	1000	0.85
Curtain Wall	CUW-___-PQS-Panel_T25-00	CW-08	850	1000	0.85
Grand total: 8					6.80

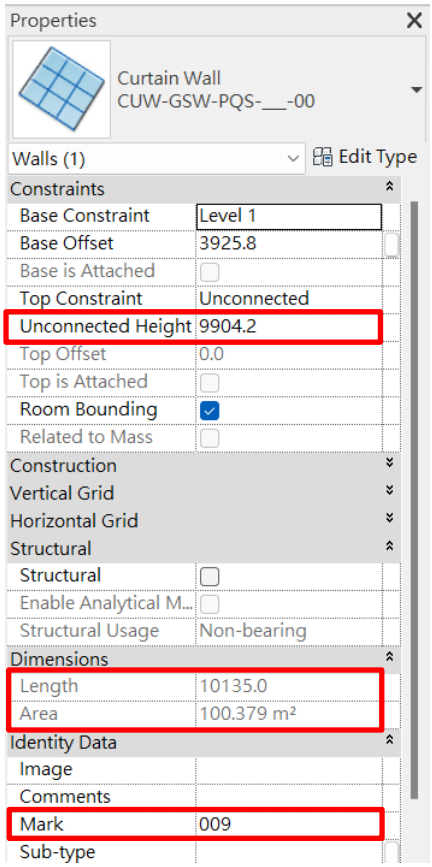
Adjust for the following as necessary:

- Length, depending on whether the profile setting matches the method of measurement.

11.2 Glass walling

11.2.1 Basic Modelling Approaches

Based on the walls template, a system family for glass wall is created by sketching the alignment of the glass wall from the base level (glass wall base) to the top level (glass wall top). The individual glass panel is created by placing the curtain panels in the designed location. The relevant information can be extracted from the parameters, such as length, width, unconnected height (height), area, etc.



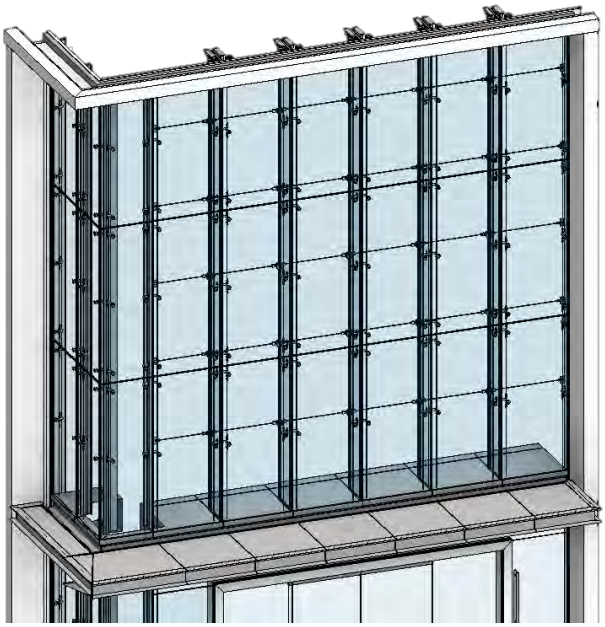


Figure 11.2.1 3D View of Glass Walling

11.2.2 Information Requirements for Quantity Take-off

1. Glass walling marks.
2. Material, quality and surface finish of framing members.
3. Type and thickness of glass panels.
4. Positions – vertical / horizontal / sloping > 15º from horizontal / curved.
5. Opening types – openable windows / glazed doors / louvres / protective bearers / other openings

11.2.3 Quantity Take-off Guidelines

For measurement of area of glass walling, create a schedule with the following fields:

<Glass Wall Schedule>

A	B	C	D	E	F
Family	Type	Mark	Length	Unconnected Height	Area
Curtain Wall	CUW-GSW-PQS-___-00	009	10135	9904	100.38
Curtain Wall	CUW-GSW-PQS-___-00	010	2623	9904	25.98
Grand total: 2					126.36

Note: In creating the relevant schedule, the family name “curtain wall” is obsolete as what we want is “glass wall” in this case. As such, the title should be amended from “Curtain Wall Schedule” to “Glass Wall Schedule”.

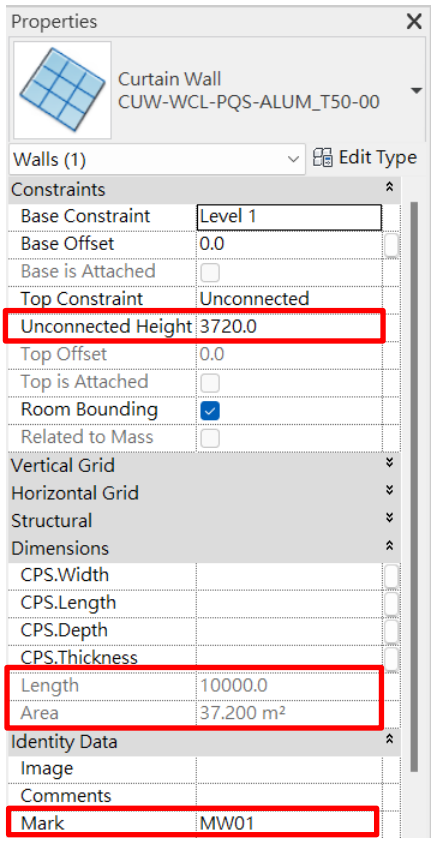
Adjust for the following as necessary:

- Length, depending on whether the profile setting matches the method of measurement.

11.3 Wall claddings

11.3.1 Basic Modelling Approaches

Based on the walls template, a system family for wall cladding is created by sketching the alignment of the wall cladding from the base level (wall cladding base) to the top level (wall cladding top). Individual wall cladding panel is created and the object is placed in the designed location. The relevant information can be extracted from the parameters, such as length, width, unconnected height (height), area, etc.



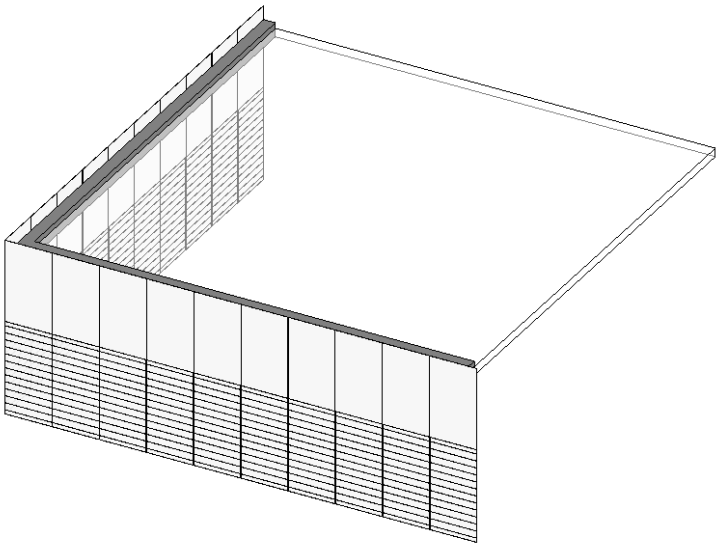


Figure 11.3.1 3D View of Wall Cladding

11.3.2 Information Requirements for Quantity Take-off

1. Wall cladding marks.
2. Dimensional descriptions of claddings.
3. Material, kind, quality and surface finish of claddings, and backings (if any).
4. Positions – vertical / horizontal / sloping > 15º from horizontal / curved.
5. Types of openings – openable windows / glazed doors / louvres / ventilators / protective bearers / other openings.

11.3.3 Quantity Take-off Guidelines

For measurement of area of wall claddings, create a schedule with the following fields:

<Wall Cladding Schedule>

A	B	C	D	E	F
Family	Type	Mark	Length	Unconnected Height	Area
Curtain Wall	CUW-WCL-PQS-ALUM_T50-00	MW01	10000	3720	37.20
Curtain Wall	CUW-WCL-PQS-ALUM_T50-00	MW01	10000	3720	37.20
Grand total: 2					74.40

Note: In creating the relevant schedule, the family name “curtain wall” is obsolete as what we want is “cladding” in this case. As such, the title should be amended from “Curtain Wall Schedule” to “Wall Cladding Schedule”.

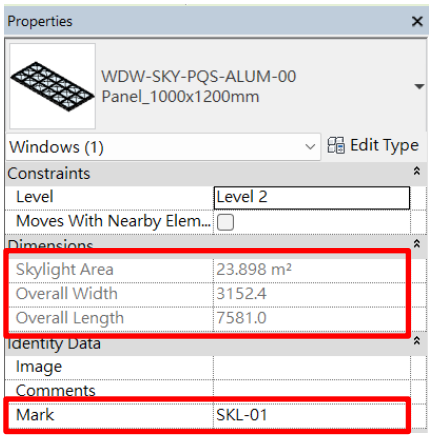
Adjust for the following as necessary:

- Length, depending on whether the profile setting matches the method of measurement.

11.4 Skylights

11.4.1 Basic Modelling Approaches

Based on the windows template, a loadable family type for skylight is created and the object is placed in the designed location (host). It is suggested to adopt parametric modelling such that the shape of the model geometry will be changed accordingly upon the dimension value being modified. This could avoid inconsistency between geometry and non-geometrical information. The relevant information, therefore, can be extracted from the parameters, such as area, number of skylights panel etc.



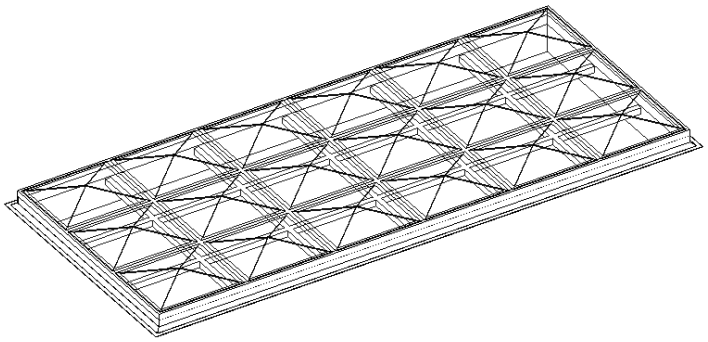


Figure 11. 4.1 - 3D View of Skylight

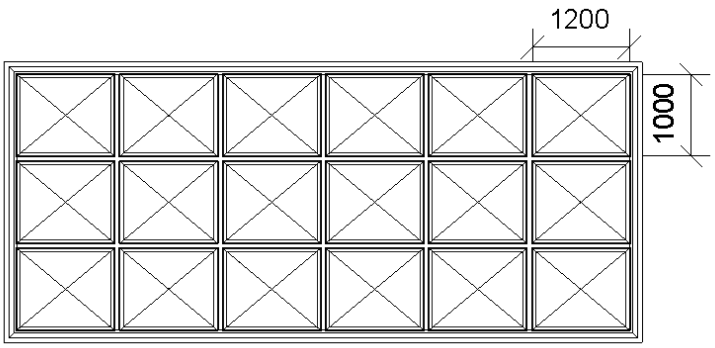


Figure 11.4.2 - Plan View of Skylight

11.4.2 Information Requirements for Quantity Take-off

1. Skylight marks.
2. Overall size.
3. Type and thickness of glass panels.
4. Material, quality and surface finish of framing members, and the structural glazing system.
5. Horizontal, sloping,

This sample model has not included:

a. Fixing details to host.

11.4.3 Quantity Take-off Guidelines

For measurement of skylights, create a schedule with the following field:

<Skylight Schedule>

A	B	C	D	E	F
Family	Type	Mark	Overall Length	Overall Width	Skylight Area
WDW-SKY-PQS-ALUM-00	Panel_1000x1200mm	SKL-01	7581	3152	23.90

Note: In creating the relevant schedule, the family name “window” is obsolete as what we want is “skylight” in this case. As such, the title should be amended from “Window Schedule” to “Skylight Schedule”.

Adjust for the following as necessary:

- Nil

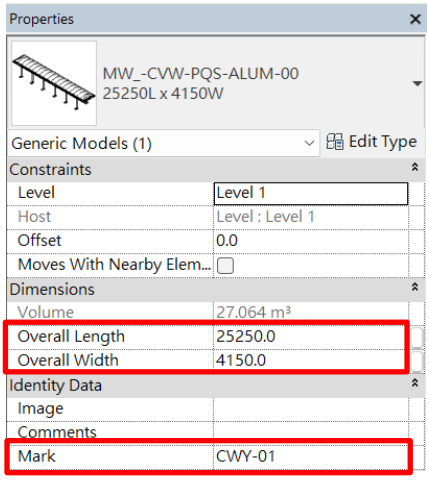
11.5 Glazed covered walkways

11.5.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for covered walkway is created and the object is placed in the designed location.

It is suggested to adopt parametric modelling such that the shape of the model geometry will be changed accordingly upon the dimension value being modified. This could avoid inconsistency between geometry and non-geometrical information.

The relevant information, therefore, can be extracted from the parameters, such as length, count etc.



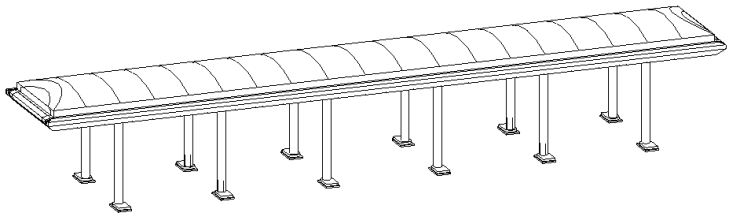


Figure 11.5.1 - 3D View of Glazed Covered Walkway

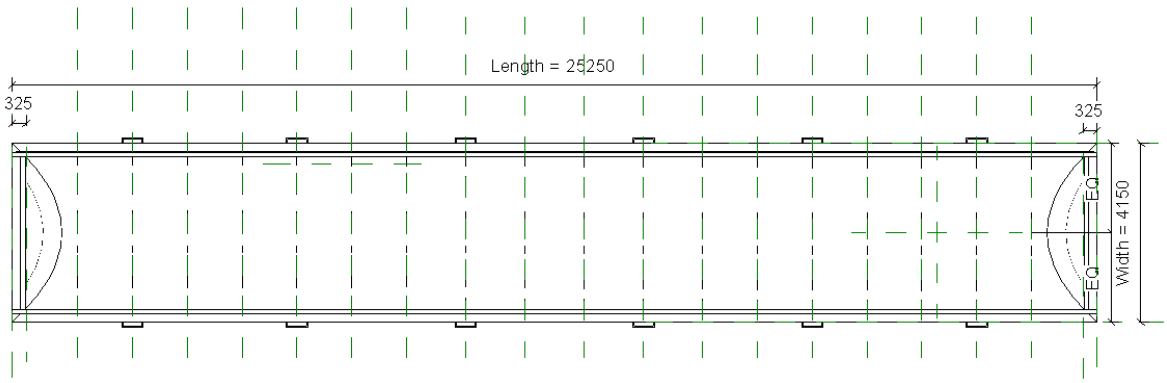


Figure 11.5.2 - Plan View of Glazed Covered Walkway

11.5.2 Information Requirements for Quantity Take-off

1. Overall size.
2. Covered walkway marks.
3. Material, quality and surface finish of framing members, and the structural glazing system.
4. Type and thickness of glass/polycarbonate panels; flat or curved.

This sample model has not included:

a. Foundation details of supports.

11.5.3 Quantity Take-off Guidelines

For measurement of glazed covered walkways, create a schedule with the following fields:

<Covered Walkway Schedule>

A	B	C	D	E	F
Family	Type	Mark	Overall Length	Overall Width	Count
MW_-CVW-PQS-ALUM-00	25250L x 4150W	CWY-01	25250	4150	1

Adjust for the following as necessary:

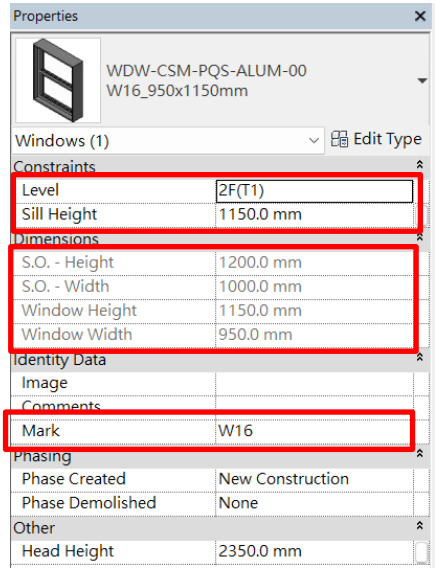
- Nil

Section 12 - Windows, Louvres and Shop Fronts

12.1 Windows

12.1.1 Basic Modelling Approaches

Based on the windows template, a loadable family type for window is created and the object is placed in the designed location (host). The relevant information can be extracted from the parameters, such as height and width etc.



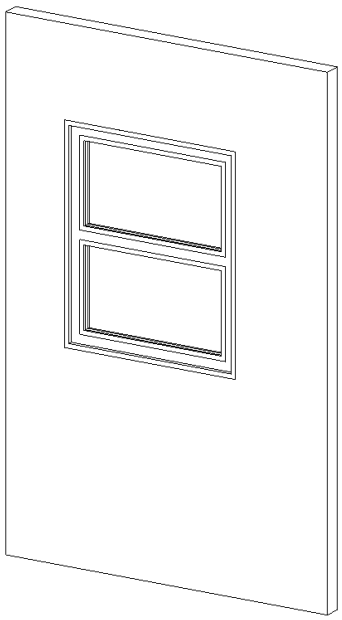


Figure 12.1.1 - 3D View of Window

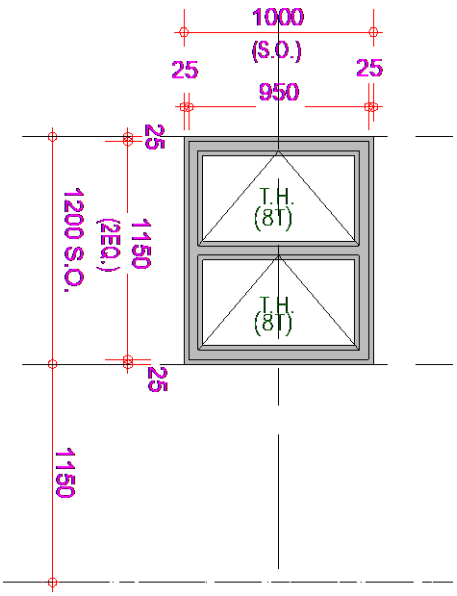


Figure 12.1.2 - Elevation View of Window

12.1.2 Information Requirements for Quantity Take-off

1. Window marks.
2. Structural opening size
3. Overall size.
4. Material, quality and surface finish of framing members.
5. Type and thickness of glass panels.
6. Any specified fire resistance rating.

12.1.3 Quantity Take-off Guidelines

For the measurement of windows, create a schedule with the following fields:

<Window Schedule>

A	B	C	D	E	F	G
Level	Family	Type	Mark	Width	Height	Count
2F(T1)	WDW-CSM-PQS-ALUM-00	W16_950x1150mm	W16	1000 mm	1200 mm	1

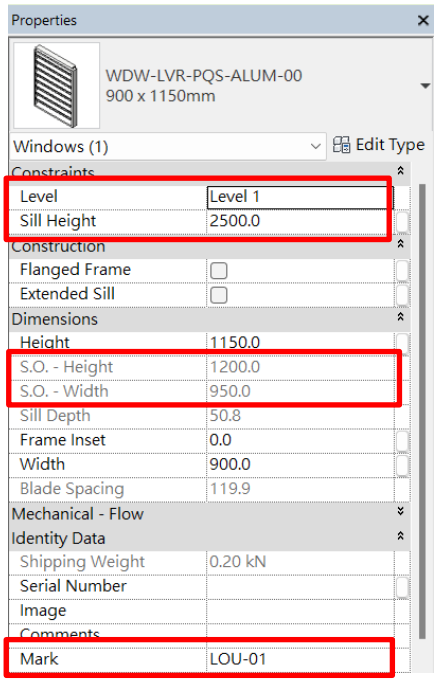
Adjust for the following as necessary:

- Nil

12.2 Louvres

12.2.1 Basic Modelling Approaches

Based on the windows template, a loadable family type for louvre is created and the object is placed in the designed location. The relevant information can be extracted from the parameters, such as width, height, sill depth, etc.



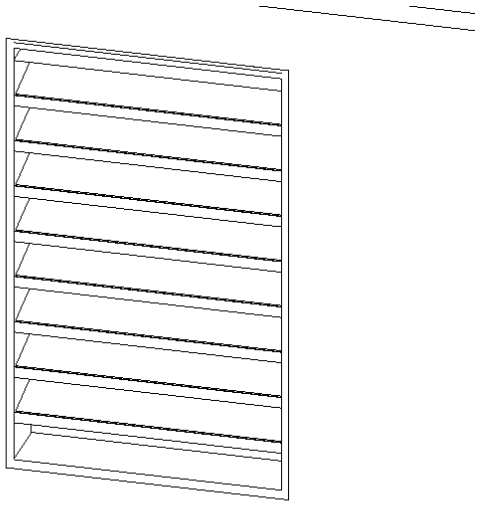


Figure 12.2.1 - 3D View of Louvre (external side)

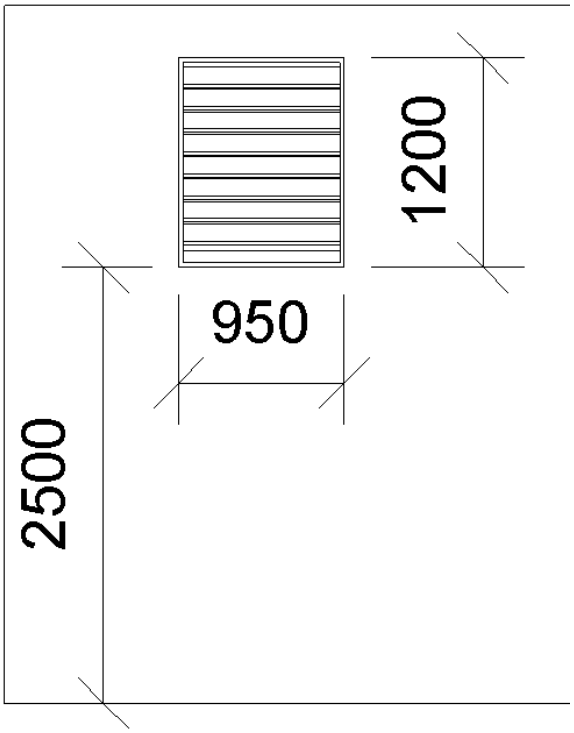


Figure 12.2.2 - Elevation View of Louvre

12.3.2 Information Requirements for Quantity Take-off

1. Louvre marks.
2. Structural opening size.
3. Overall size.
4. Type of louvre, e.g. weatherproof type.
5. Material, quality and surface finish of framing and blading members.
6. Fixed or adjustable.

12.2.3 Quantity Take-off Guidelines

For measurement of louvres, create a schedule with the following fields:

<Louvre Schedule>

A	B	C	D	E	F
Family	Type	Mark	Width	Height	Count
WDW-LVR-PQS-ALUM-00	900 x 1150mm	LOU-01	900	1150	1

For measurement of the paint/ finishes around the sides of opening, the Paint function should be used

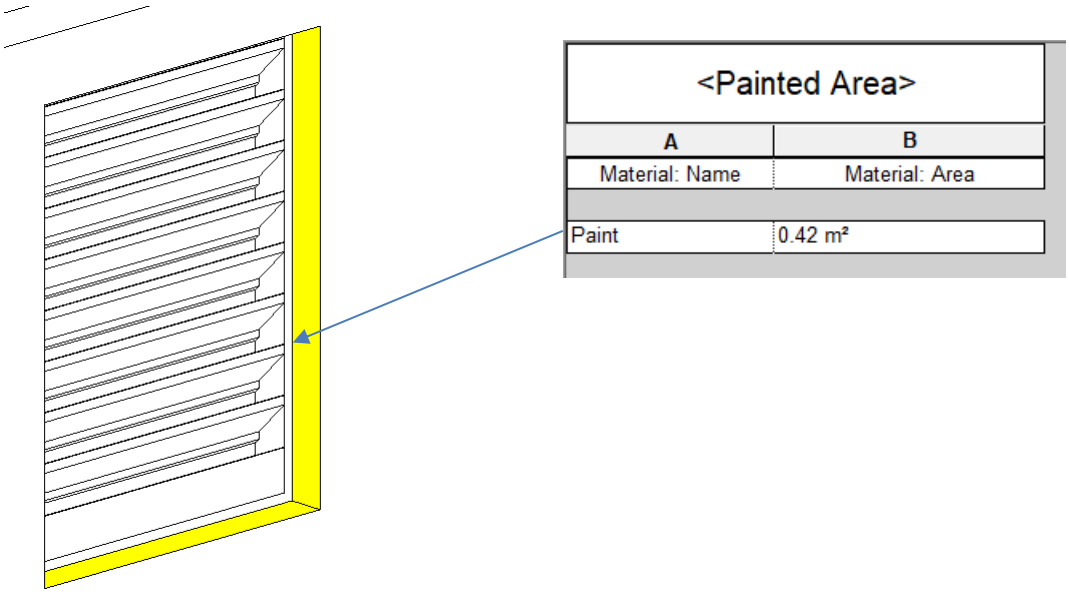


Figure 12.2.3 - 3D View of Louvre (internal side)

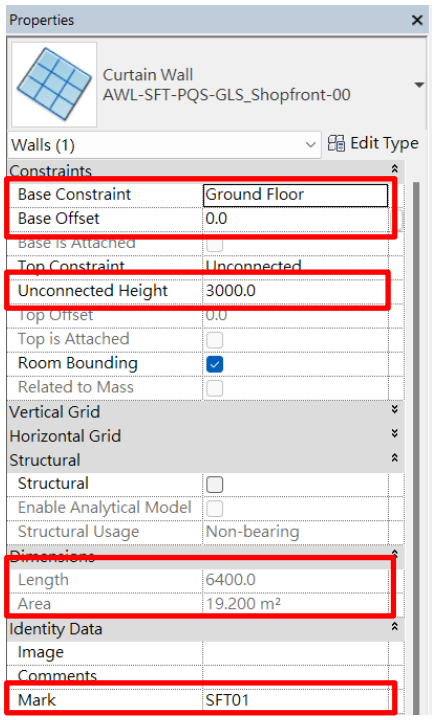
Adjust for the following as necessary:

- Nil

12.3 Shop fronts

12.3.1 Basic Modelling Approaches

Based on the curtain panels template, a loadable family type for shop front is created and the object is placed in the designed location. The relevant information can be extracted from the parameters, such as panel width, panel height, area, etc.



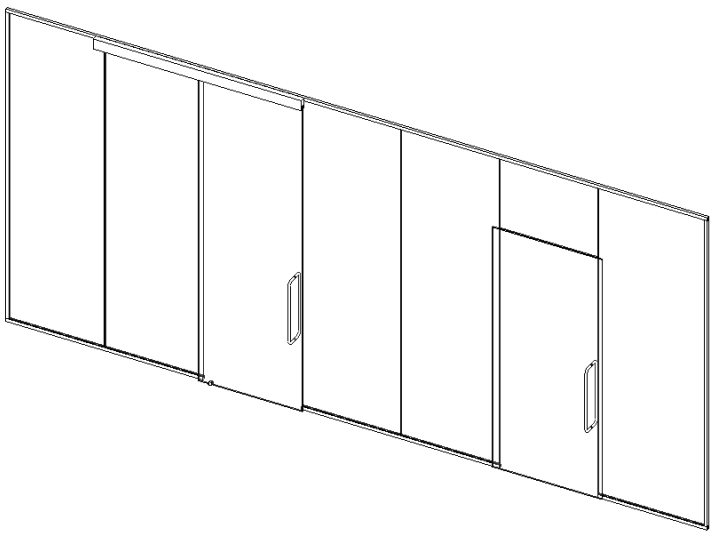


Figure 12.3.1 - 3D View of Shop Front

12.3.2 Information Requirements for Quantity Take-off

7. Shop front marks.
8. Overall size.
9. Material, quality and surface finish of framing members.
10. Type and thickness of glass panels.
11. Any glazed doors or other openings.
12. Any sloping/curved surfaces.

12.3.3 Quantity Take-off Guidelines

For measurement of shop fronts, create a schedule with the following fields:

<Shop Front Schedule>

A	B	C	D	E	F
Family	Type	Mark	Length	Unconnected Height	Area
Curtain Wall	AWL-SFT-PQS-GLS_Shopfront-00	SFT01	6400	3000	19.20

Adjust for the following as necessary:

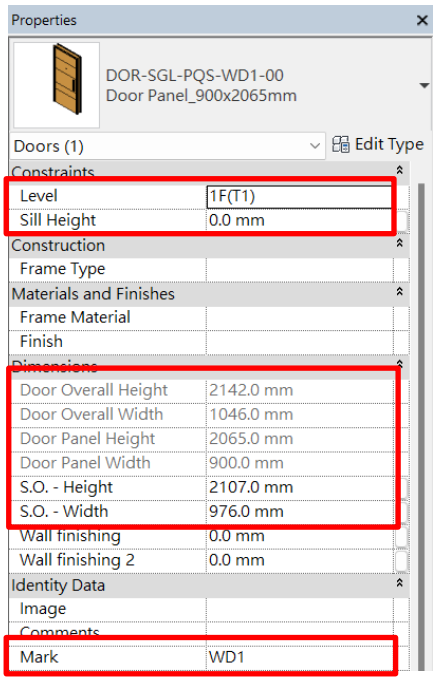
- Extra over shop front for glazed door

Section 13 - Doors, Gates, Shutters and Ironmongery

13.1 Timber Doors

13.1.1 Basic Modelling Approaches

Based on the doors template, a loadable family type for timber door is created and the object is placed in the designed location (host).



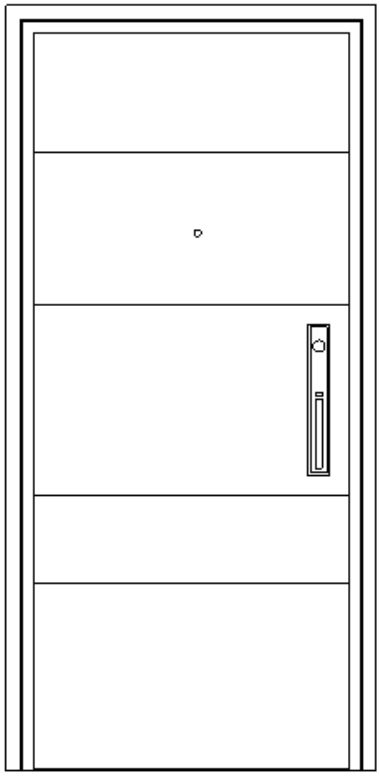


Figure 13.1.1 - Front Elevation of Timber Door

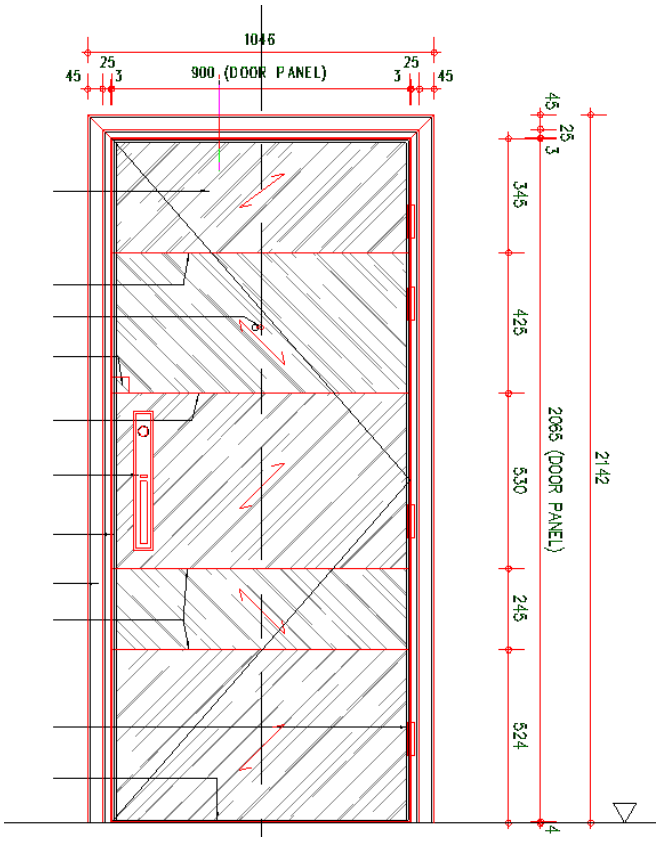


Figure 13.1.2 - Door Details

13.1.2 Information Requirements for Quantity Take-off

1. Timber door marks.
2. Structural opening size.
3. Overall size, and door panel size.
4. Thickness, construction and surface finish of doors.
5. Glazed panels and louvres (if any).
6. Cross-sectional size of frames/linings and architraves.
7. Door types – single-leaf/ double-leaf/ swinging /sliding /folding.
8. Fire resistance rating and sound reduction rating.
9. Ironmongery schedule, and the ironmongery mark.

13.1.3 Quantity Take-off Guidelines

For measurement of timber doors, create a schedule with the following fields:

<Door Schedule>

A	B	C	D	E	F	G
Family	Type	Mark	Door Overall Width	Door Overall Height	S.O. - Width	S.O. - Height
DOR-SGL-PQS-WD1-00	Door Panel_900x2065mm	WD1	1046 mm	2142 mm	976 mm	2107 mm

H	I	J	K
Door Panel Width	Door Panel Height	Fire Rating	Count
900 mm	2065 mm	60mins	1

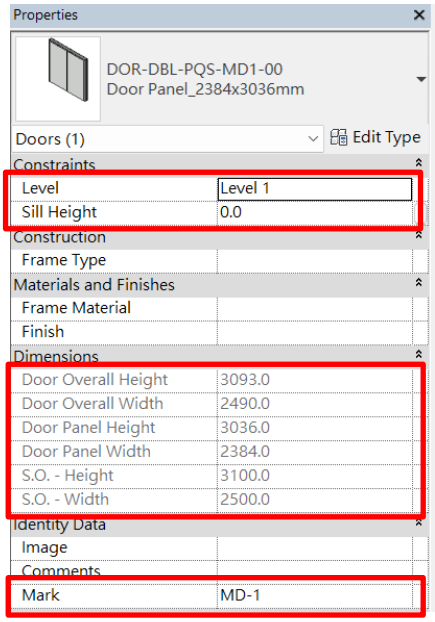
Adjust for the following as necessary:

- Nil

13.2 Metal Doors

13.2.1 Basic Modelling Approaches

Based on the doors template, a loadable family type for metal door is created and the object is placed in the designed location (host).



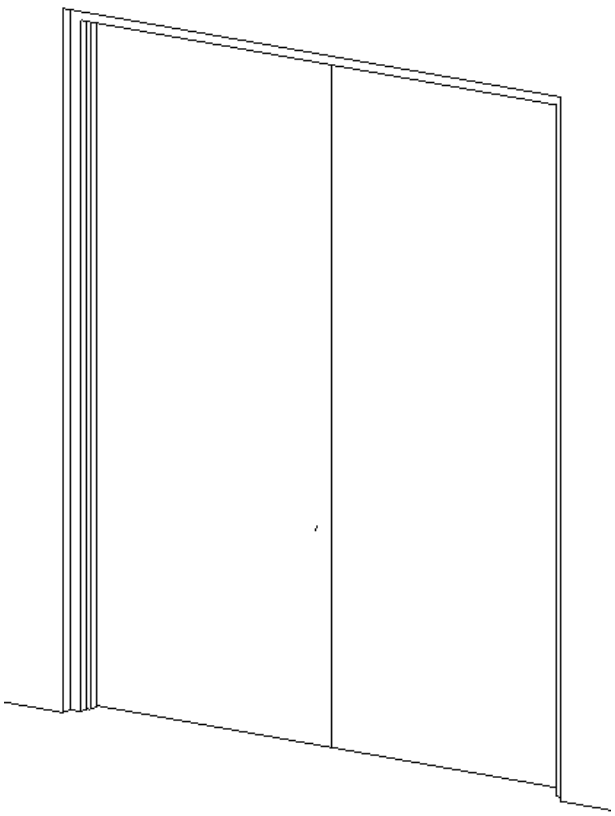


Figure 13.2.1 - 3D View of Metal Door

13.2.2 Information Requirements for Quantity Take-off

1. Metal door marks.
2. Overall size, and door panel size.
3. Material, thickness, construction and surface finish of doors.
4. Any glazed panels and louvres.
5. Cross-sectional sizes of frames/linings and architraves.
6. Door types – single-leaf/ double-leaf/ swinging/ sliding/ folding.
7. Fire resistance rating and sound reduction rating.
8. Ironmongery schedule, and the ironmongery mark

13.2.3 Quantity Take-off Guidelines

For measurement of metal doors, create a schedule with the following fields:

<Door Schedule>

A	B	C	D	E	F	G
Family	Type	Mark	S.O. - Width	S.O. - Height	Door Overall Width	Door Overall Height
DOR-DBL-PQS-MD1-00	Door Panel_2384x3036mm	MD-1	2500	3100	2490	3093

H	I	J	K
Door Panel Width	Door Panel Height	Fire Rating	Count
2384	3036	up to 240 minutes	1

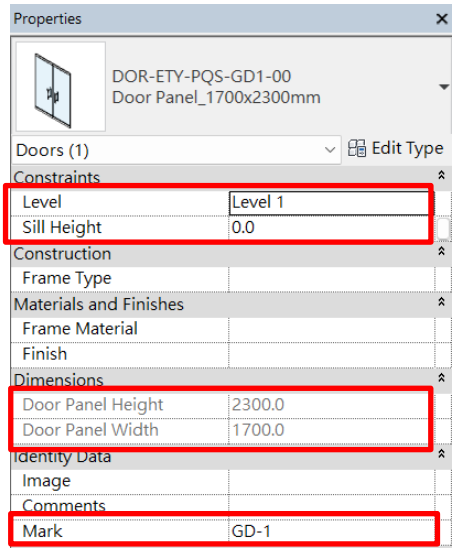
Adjust for the following as necessary:

- Nil

13.3 Glazed doors

13.3.1 Basic Modelling Approaches

Based on the doors template, a loadable family type for glazed door is created and the object is placed in the designed location (host).



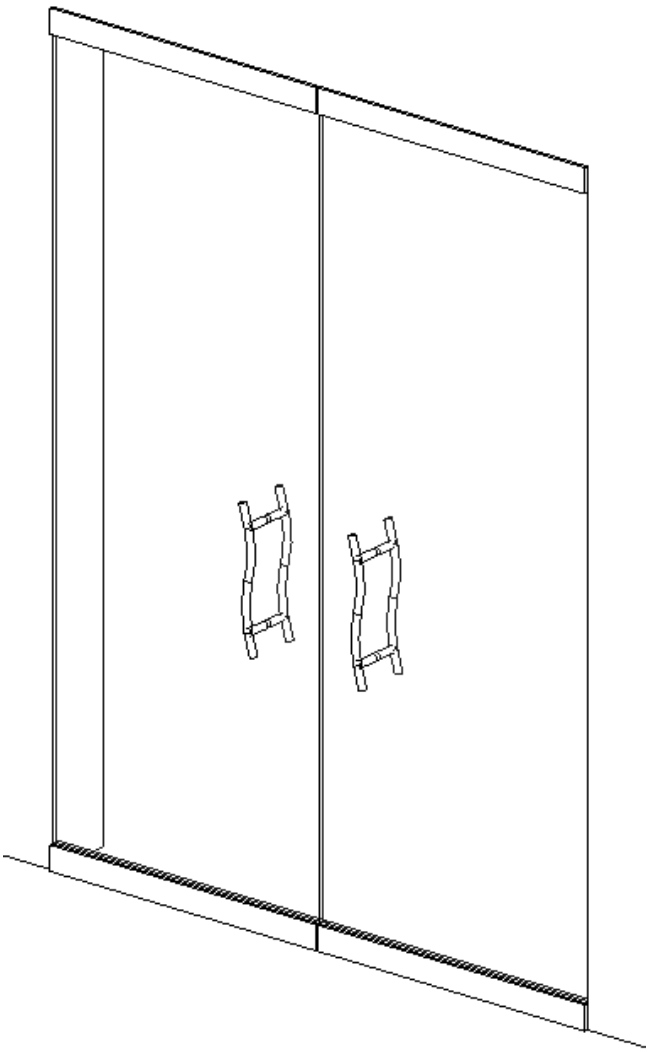


Figure 13.3.1 - 3D View of Glazed Door

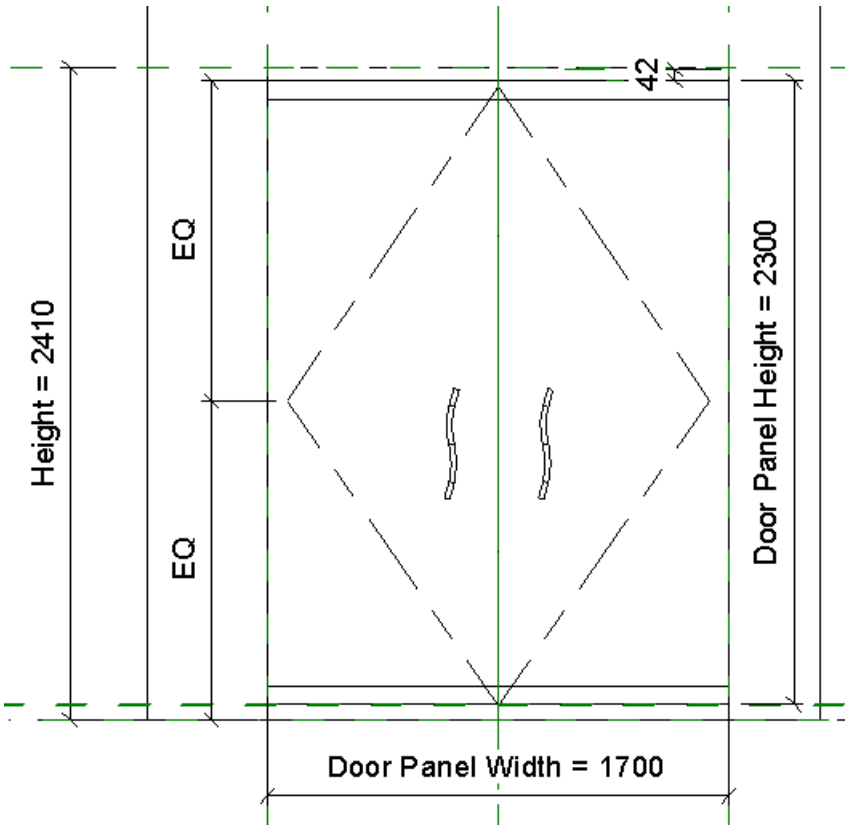


Figure 13.3.2 - Elevation View of Glazed Door

13.3.2 Information Requirements for Quantity Take-off

1. Glazed door marks.
2. Overall size, and door panel size.
3. Type and thickness of glass door panels.
4. Material, quality and surface finish of door frames (if any)
5. Door types – single-leaf/ double-leaf/ swinging/ sliding/ folding.
6. Fire resistance rating.
7. Ironmongery schedule, and the ironmongery mark

13.3.3 Quantity Take-off Guidelines

For measurement of glazed doors, create a schedule with the following fields:

<Door Schedule>

A	B	C	D	E	F
Family	Type	Mark	Door Panel Width	Door Panel Height	Count
DOR-ETY-PQS-GD1-00	Door Panel_1700x2300mm	GD-1	1700	2300	1

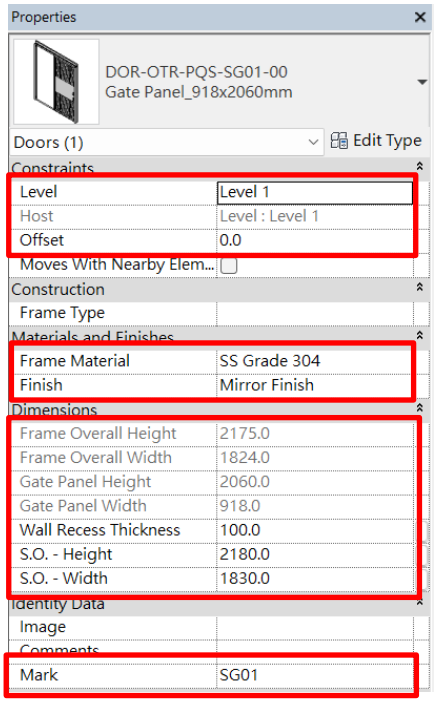
Adjust for the following as necessary:

- Nil

13.4 Gates

13.4.1 Basic Modelling Approaches

Based on the doors template, a loadable family type for gate is created and the object is placed in the designed location (host).



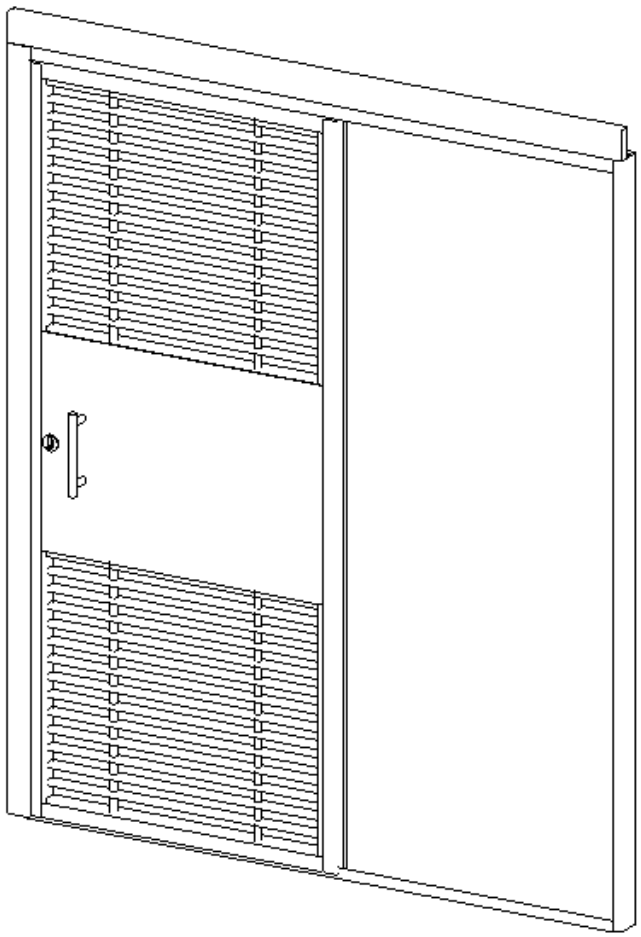


Figure 13.4.1 - 3D View of Grate

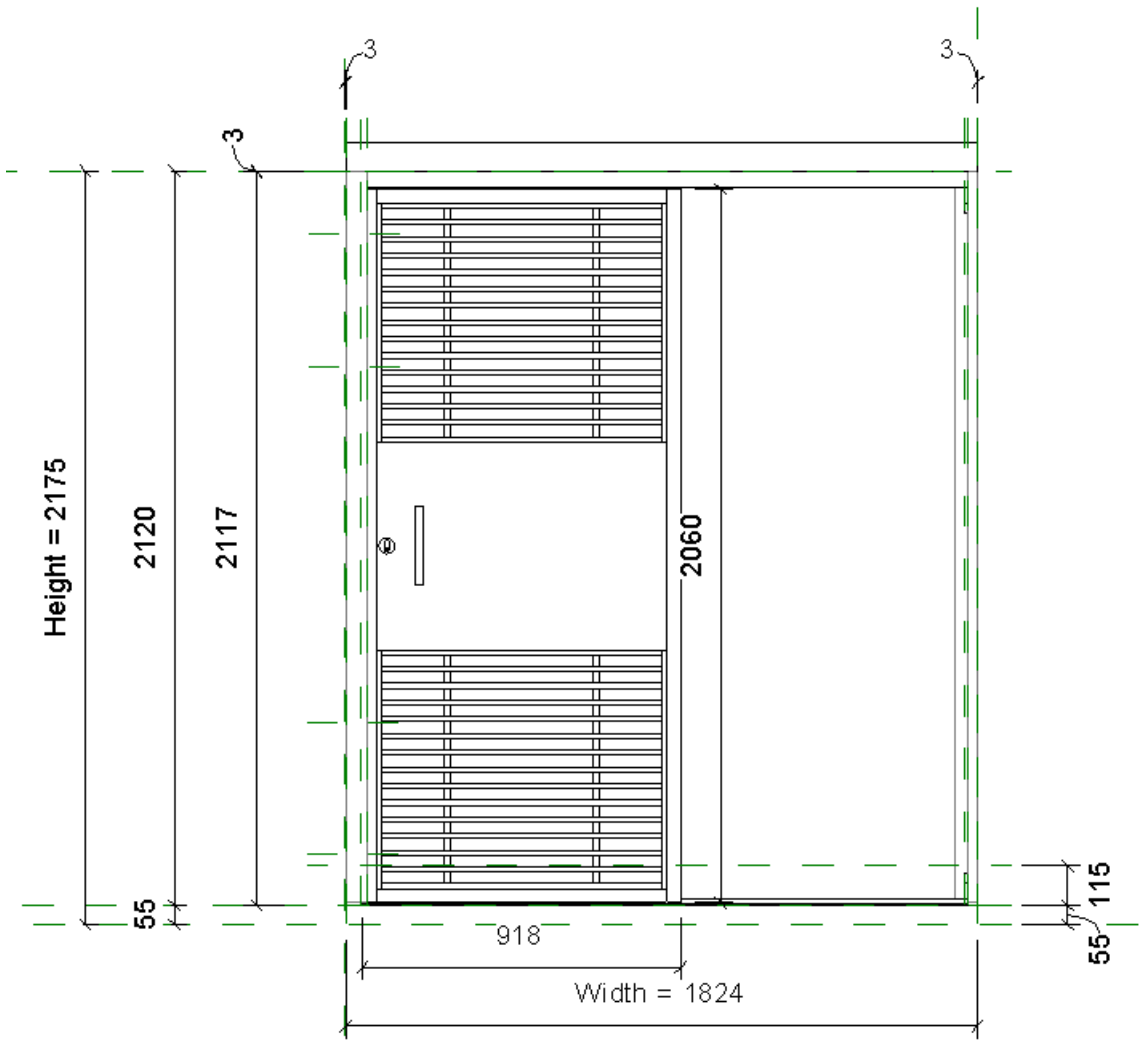


Figure 13.4.2 - Elevation of Gate

13.4.2 Information Requirements for Quantity Take-off

1. Gate marks.
2. Overall size and gate panel size.
3. Material, quality, construction and surface finish of gate and frames.
4. Manually operated or electrically operated.
5. Gate type – sliding/swing/folding.

13.4.3 Quantity Take-off Guidelines

For measurement of gate, create a schedule with the following fields:

<Metal Gate Schedule>

A	B	C	D	E	F	G
Family	Type	Mark	S.O. - Width	S.O. - Height	Frame Overall Width	Frame Overall Height
DOR-OTR-PQS-SG01-00	Gate Panel_918x2060mm	SG01	1830	2180	1824	2175

H	I	J	K	L
Gate Panel Width	Gate Panel Height	Frame Material	Finish	Count
918	2060	SS Grade 304	Mirror Finish	1

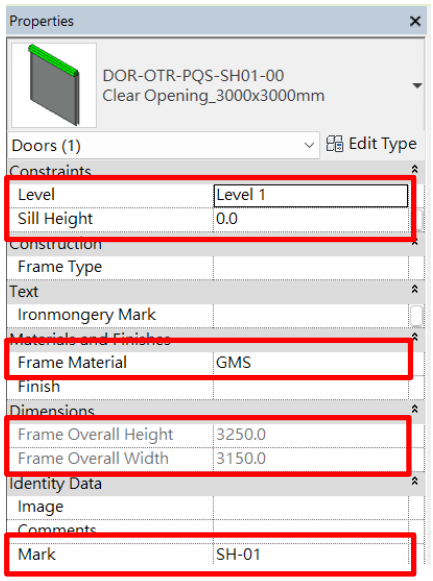
Adjust for the following as necessary:

- Nil

13.5 Rolling shutters

13.5.1 Basic Modelling Approaches

Based on the doors template, a loadable family type for rolling shutters is created and the object is placed in the designed location.



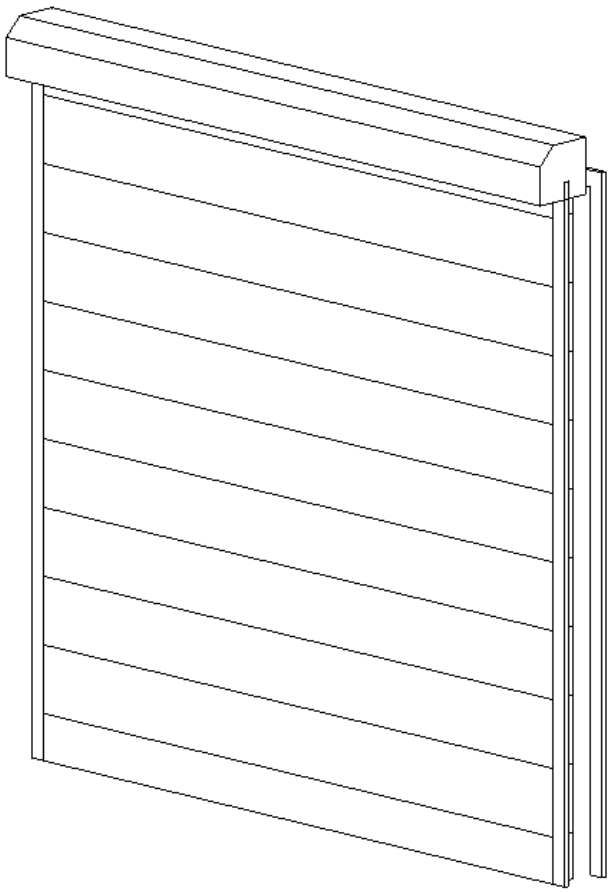


Figure 13.5.1 - 3D View of Rolling Shutter

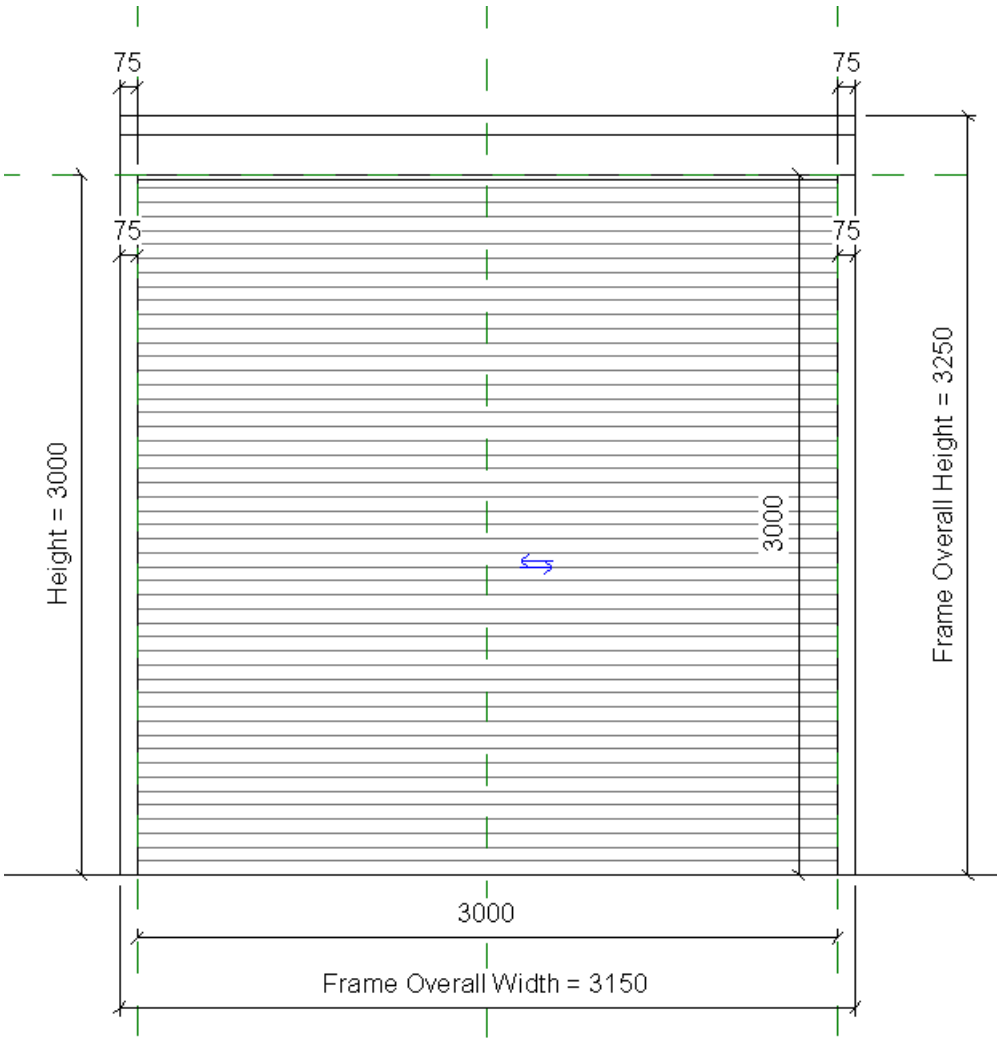


Figure 13.5.2 – Elevation of Rolling Shutter

13.5.2 Information Requirements for Quantity Take-off

1. Rolling shutter marks.
2. Overall size and the shutter size.
3. Material, quality, construction and surface finish of shutter.
4. Horizontal or vertical.
5. Manually operated or electrically operated.
6. Fire resistance rating.
7. Access/pass doors (if any).

13.5.3 Quantity Take-off Guidelines

For measurement of rolling shutter, create a schedule with the following fields:

<Rolling Shutter Schedule>

A	B	C	D	E	F	G
Family	Type	Mark	Frame Overall Width	Frame Overall Height	Frame Material	Count
DOR-OTR-PQS-SH01-00	Clear Opening_3000x3000mm	SH-01	3150	3250	GMS	1

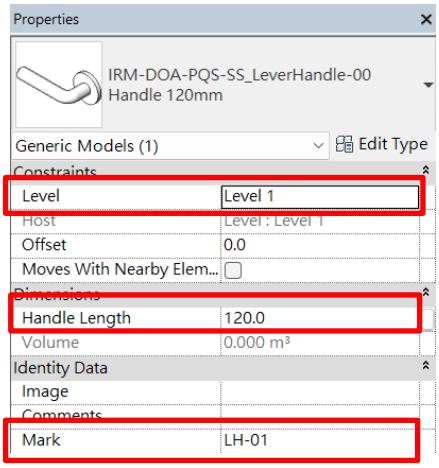
Adjust for the following as necessary:

- Nil

13.6 Ironmongery

13.6.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for ironmongery is created and the object is placed in the desired location.



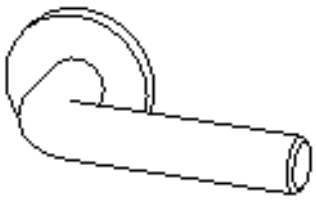


Figure 13.6.1 - 3D View of Handle

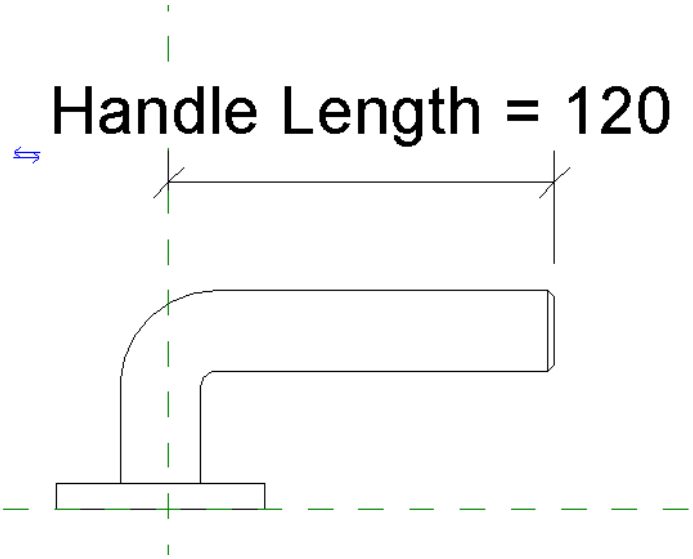


Figure 13.6.2 - Plan View of Handle

13.6.2 Information Requirements for Quantity Take-off

1. Ironmongery marks.
2. Material and quality of materials.
3. Surface finish.
4. Size.
5. Brand and model number (if available).
6. Fixing background: timber/ metal/ glass/ others (include door mark).

13.6.3 Quantity Take-off Guidelines

For measurement of ironmongery, create a schedule with the following fields:

<Ironmongery Schedule>

A	B	C	D
Family	Type	Mark	Count
IRM-DOA-PQS-ALU_DoorCloser-00	Heavy Duty 200mm	DC-01	1
IRM-DOA-PQS-SS_PullHandle-00	Handle 150mm	PH-01	1
IRM-DOA-PQS-SS_StapleLock-00	300mm	SL-01	1
IRM-DOA-PQS-SS_LeverHandle-00	Handle 120mm	LH-01	1
IRM-DOA-PQS-ALU_DoorGuard-00	100mm	DG-01	1

Adjust for the following as necessary:

- Nil

Section 14 - Partitions and Linings

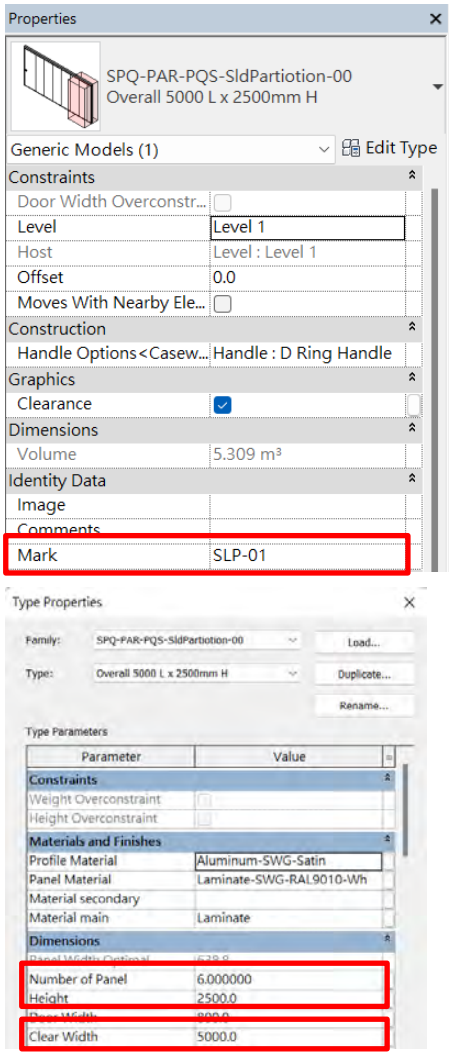
14.1 Sliding and folding partitions

14.1.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for sliding and folding partitions is created and the object is placed in the designed location.

It is suggested to adopt parametric modelling such that the configuration of the model geometry will be changed accordingly upon the dimension values are modified. This could avoid inconsistency between geometry and non-geometrical information.

The relevant information, therefore, can be extracted from the parameters, such as length (clear width), height etc.



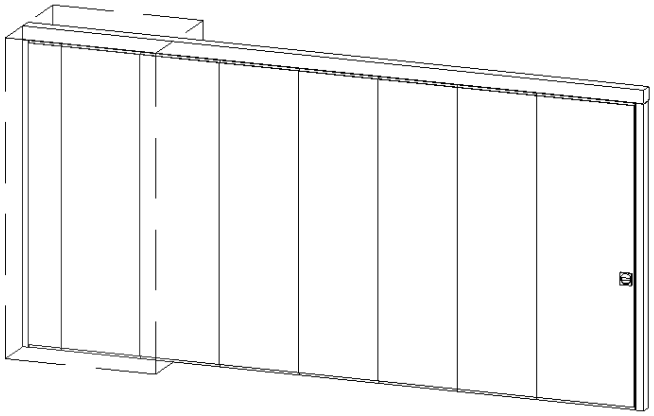


Figure 14.1.1 - 3D View of Sliding and Folding Partitions

14.1.2 Information Requirements for Quantity Take-off

1. Sliding and folding partition marks (or location identification).
2. Overall size.
3. Number, material, quality, construction and surface finish of panels.
4. Access door and pocket enclosure (if any).
5. Required suspension system, guide rails, floor guides and other accessories and fixings.
6. Manually operated or electrically operated.
7. Fire resistance rating and sound reduction rating.
8. Overall height including open framing or unfinished partitioning above ceilings.

14.1.3 Quantity Take-off Guidelines

For measurement of sliding and folding partitions, create a schedule with the following fields:

<Sliding and Folding Partition Schedule>

A	B	C	D	E	F
Family	Type	Mark	Clear Width	Height	Count
SPQ-PAR-PQS-SldPartiotion-00	Overall 5000 L x 2500mm H	SLP-01	5000	2500	1

Adjust for the following as necessary:

- Nil

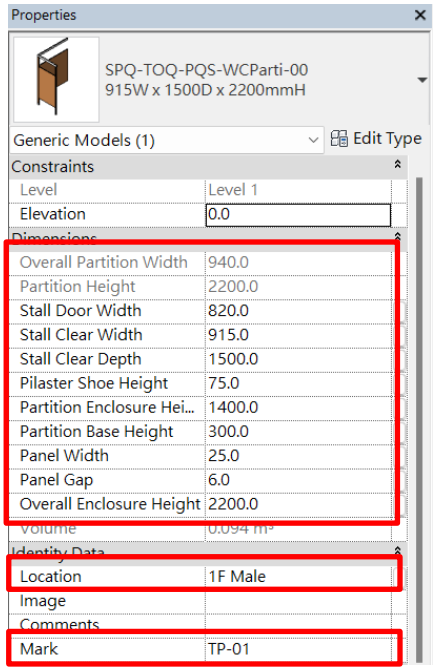
14.2 Toilet and shower cubicle partitions

14.2.1 Basic Modelling Approaches

Based on the specialty equipment template, a loadable family type for toilet and shower cubicles is created and the object is placed in the designed location.

It is suggested to adopt parametric modelling such that the configuration of the model geometry will be changed accordingly upon the dimension values are modified. This could avoid inconsistency between geometry and non-geometrical information.

The relevant information, therefore, can be extracted from the parameters, such as overall size, number of bays, etc.



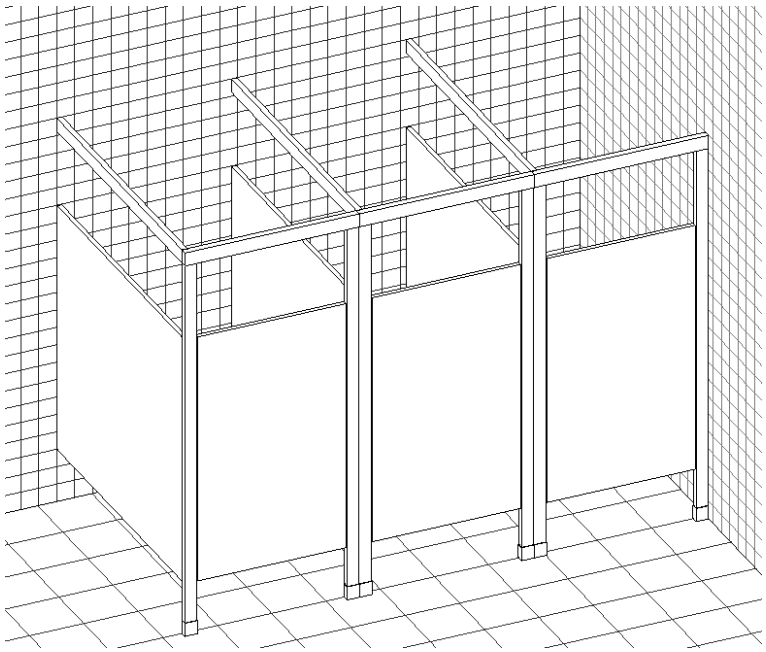


Figure 14.2.1 - 3D View of Toilet and Shower Cubicle Partitions

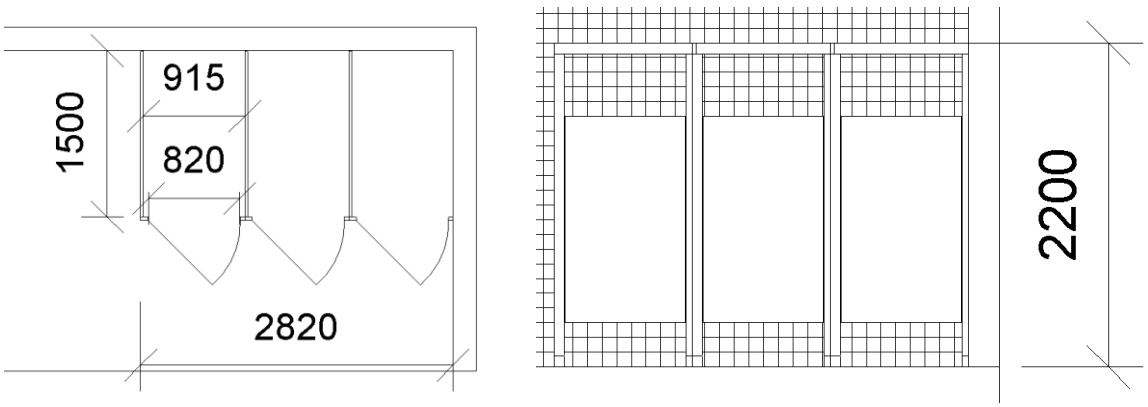


Figure 14.2.2 – Plan and Elevation View of Toilet and Shower Cubicle Partitions

14.2.2 Information Requirements for Quantity Take-off

1. Toilet/shower cubicle marks (or location identification).
2. Cubicle partitions or back wall panels.
3. Overall size.
4. Material, quality, height, thickness and surface finish of cubicle or back wall panels and door.
5. Number of bays or access panels.
6. Required accessories like locks, coat hooks, door stoppers and other fixings.
7. Required recessed/ corner unit.

14.2.3 Quantity Take-off Guidelines

For measurement of toilet and shower cubicle partitions, create a schedule with the following fields:

<Toilet Partition Schedule>

A	B	C	D	E	F	G
Family	Type	Mark	Location	Overall Partition Width	Partition Height	Set
SPQ-TOQ-PQS-WCParti-00	915W x 1500D x 2200mmH	TP-01	1F Male	2820	2200	1
SPQ-TOQ-PQS-WCParti-00	915W x 1500D x 2200mmH	TP-02	2F Female	3760	2200	1

Adjust for the following as necessary:

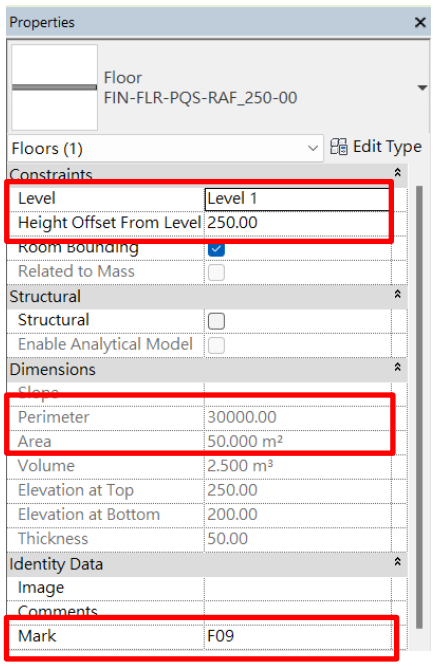
- Nil

Section 15 – Raised Access Floors

15.1 Raised access floors

15.1.1 Basic Modelling Approaches

Based on the floors template, a system family type for raised access floor is created by sketching the boundary of the floor perimeter. The relevant information can be extracted from the parameters, such as perimeter, overall thickness, area, etc.



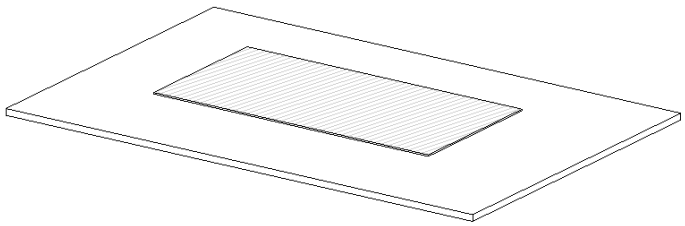


Figure 15.1.1 3D View of Raised access floors

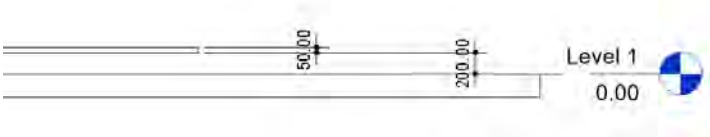


Figure 15.1.2 Elevation View of Raised access floors

15.1.2 Information Requirements for Quantity Take-off

1. Material of raised access floors (e.g. wood, mineral and steel).
2. Thickness and modular size of panels.
3. Cover/ top finish of panels.
4. Height of cavity from the top surface of subfloor to the underside of panels.

15.1.3 Quantity Take-off Guidelines

For measurement of raised access floors, create a schedule with the following fields:

<Floor Schedule>

A	B	C	D	E	F	G	H
Family	Type	Mark	Level	Perimeter	Thickness	Height of Cavity	Area
Floor	FIN-FLR-PQS-RAF_250-00	F09	Level 1	30000.00	50.00	200.00	50.00 m²

Adjust for the following as necessary:

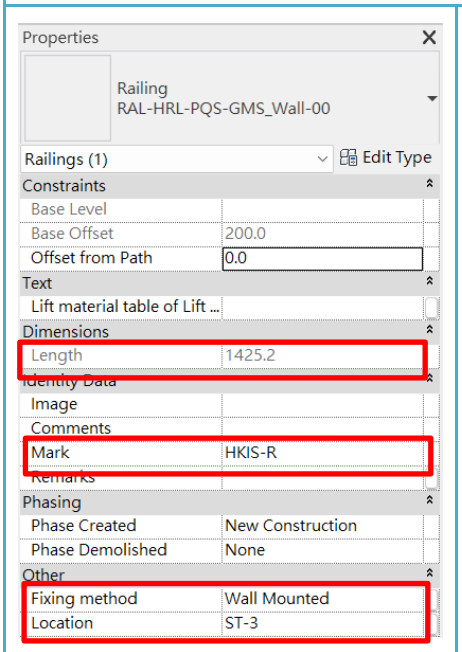
- Nil

Section 16 – Handrails, Balustrades, Ladders and Stairs

16.1 Handrails

16.1.1 Basic Modelling Approaches

Handrail is automatically generated when a stair is created or it can be placed on existing stair object. Based on the railings template, a system family type for handrail is created by sketching the alignment of the handrail. The relevant information can be extracted from the parameter, such as length.



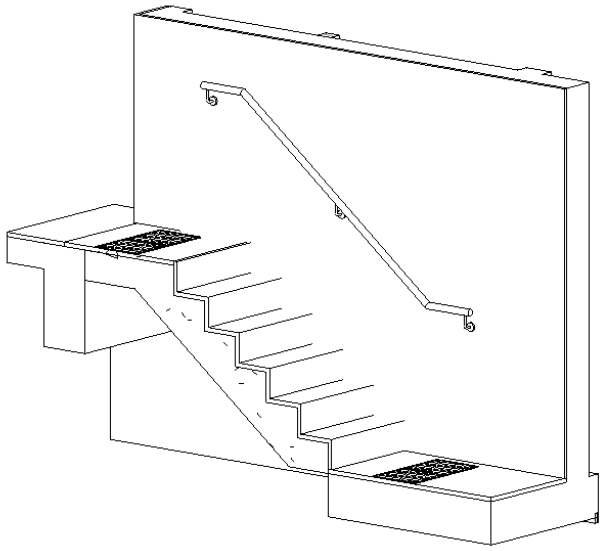


Figure 16.1.1 3D View of Handrail and Stair

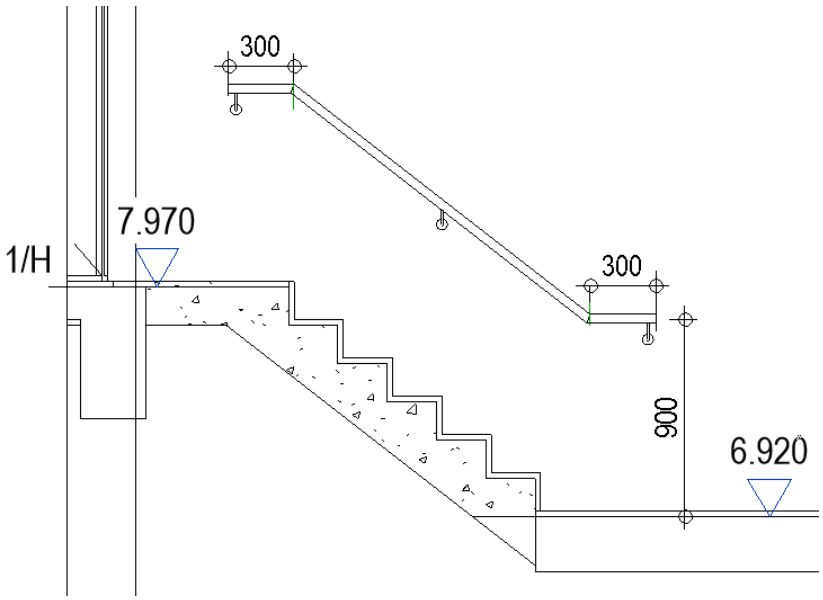


Figure 16.1.2 Section of Handrail and Stair

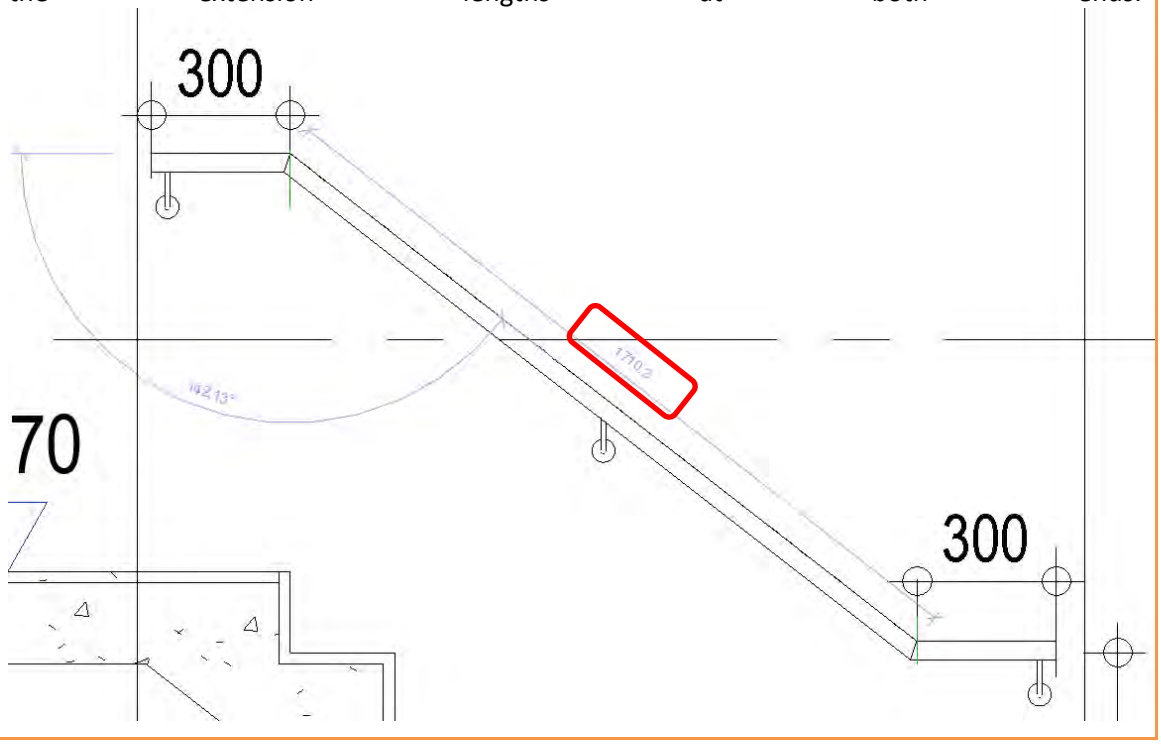
16.1.2 Information Requirements for Quantity Take-off

1. Staircase marks (or location reference).
2. Material, size and surface finish of handrail.
3. Fixing method.
4. Secondary handrails (if any).

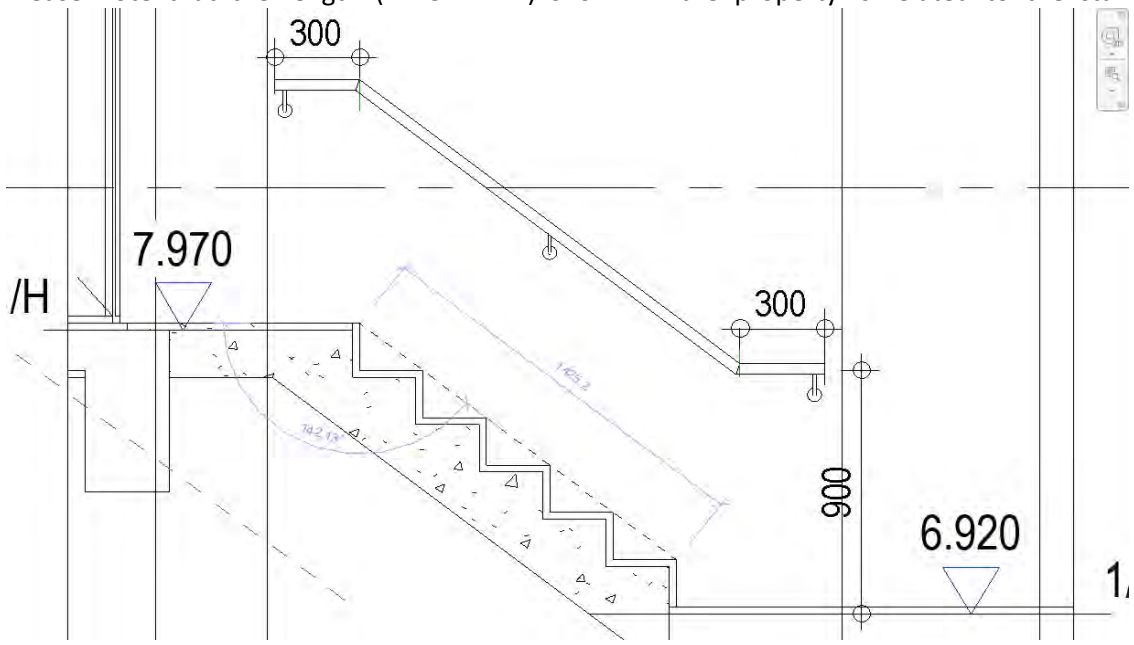
16.1.3 Quantity Take-off Guidelines

For the measurement of handrails, please note the adjustments to be done below:

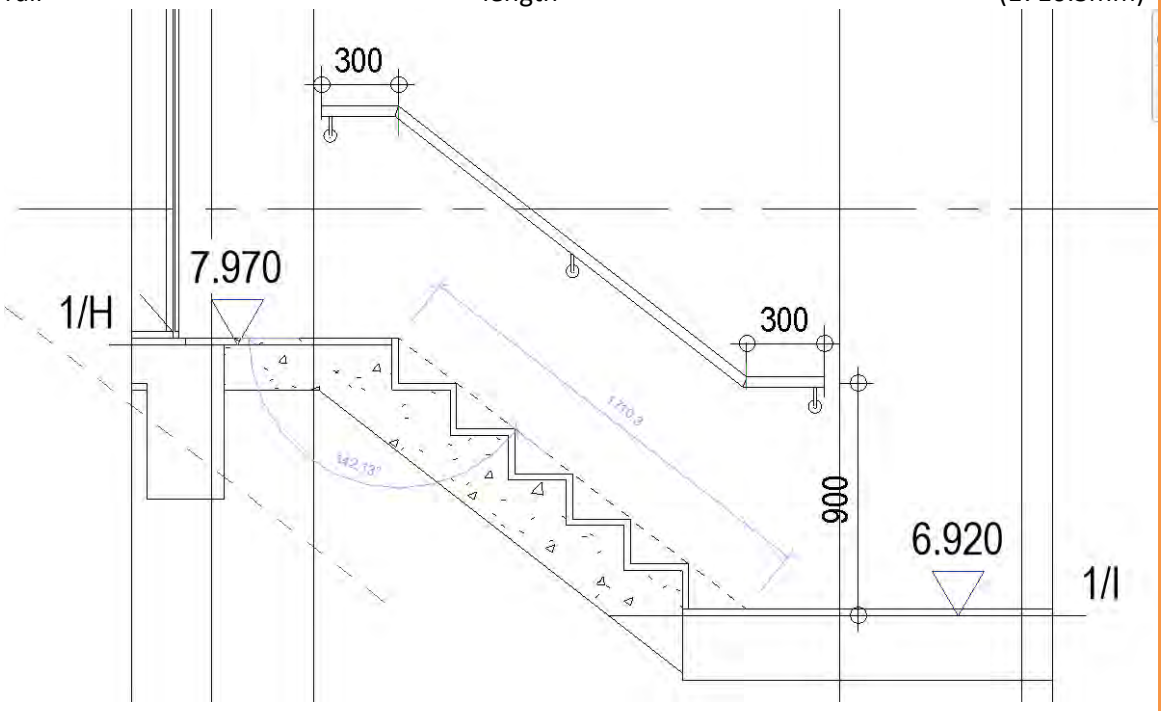
- Railing extensions may not be modelled and therefore not be included in the "Length" of the model. The Length shown in the property cannot be adopted, for example, the Length in the schedule below is not the required length for measurement:
- Adjustment of extension lengths, lateral offset in the intermediate connection, beginning and end are required.
- Measurement from the model is required. The actual length of rail should be 1710.3mm, plus the extension lengths at both ends.



- Please note that the length (1425.2 mm) shown in the property is related to the stair.



- If we extend the length of the flight to the landing, the length becomes the same as the actual rail length (1710.3mm)



For measurement of handrails, create a schedule with the following fields:

<Railing Schedule>

A	B	C	D	E	F	G	H	I	J
Family	Type	Description	Fixing method	Location	Mark	Length	Measured length	Extended length at both	Total Length
Railing	RAL-HRL-PQS-GMS_Wall-00	40x2mm thk GMS tubular	Wall Mounted	ST-3	HKIS-R	1425	1710	600	2310

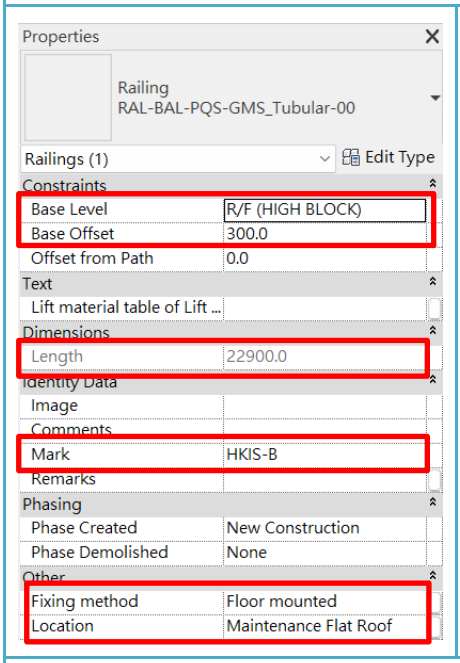
Where Total Length = Measured Length (of rail) + Extended length at both ends.

Column J = Column H + Column I

16.2 Balustrades

16.2.1 Basic Modelling Approaches

Based on the railings template, a system family type for balustrades is created by sketching the alignment of the balustrade. The relevant information can be extracted from the parameter, such as length.



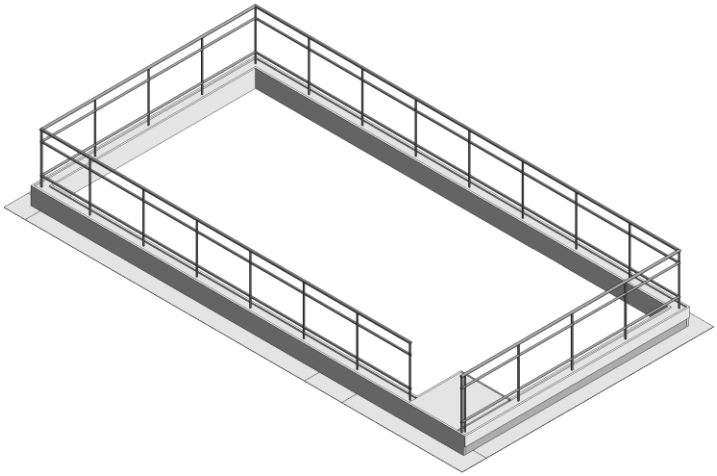


Figure 16.2.1 3D View of Balustrade

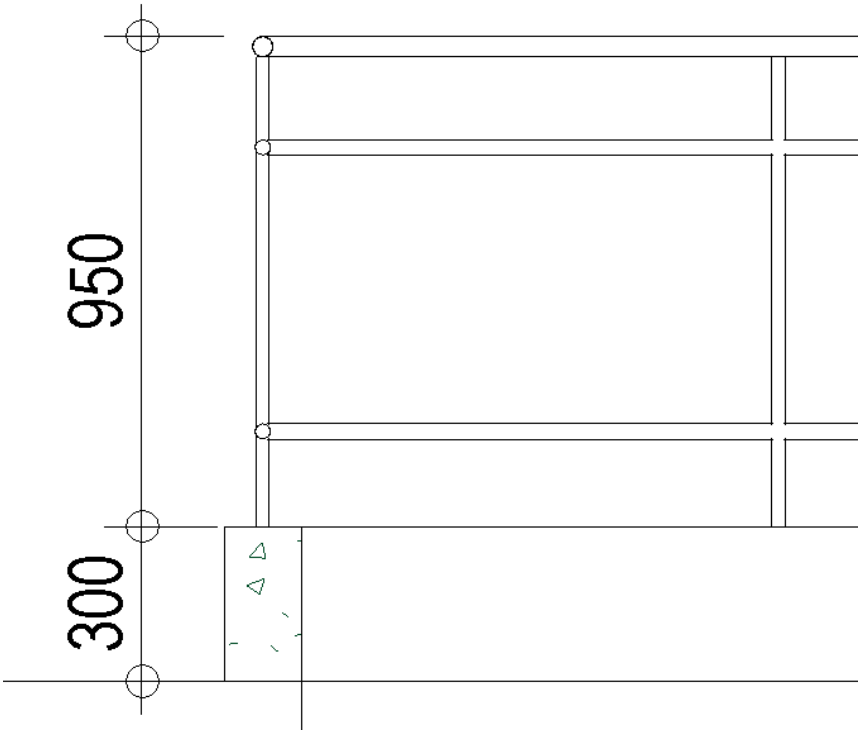


Figure 16.2.2 Section of Balustrade

16.2.2 Information Requirements for Quantity Take-off

1. Balustrade marks (or location reference).
2. Material, size and surface finish of handrail.
3. Fixing method.
4. Secondary handrails (if any).

16.2.3 Quantity Take-off Guidelines

For measurement of balustrades, create a schedule with the following fields:

<Balustrades Schedule>

A	B	C	D	E	F	G	H	I
Family	Type	Description	Fixing method	Base Level	Location	Mark	Railing Height	Length
Railing	RAL-BAL-PQS-GMS_Tubular-00	40x2mm thk GMS tubular	Floor mounted	R/F (HIGH BLOCK)	Maintenance Flat Roof	HKIS-B	950	22900

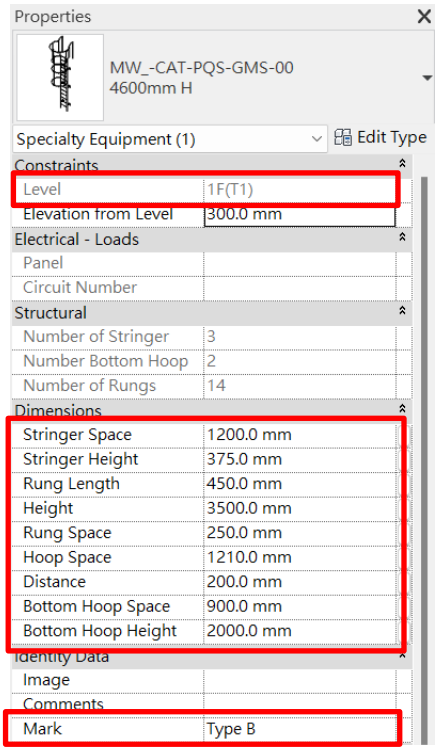
Adjust for the following as necessary:

- Nil

16.3 Cat Ladders

16.3.1 Basic Modelling Approaches

Based on the Specialty Equipment template, a loadable family type for cat ladder is created and the object is placed in the designed location.



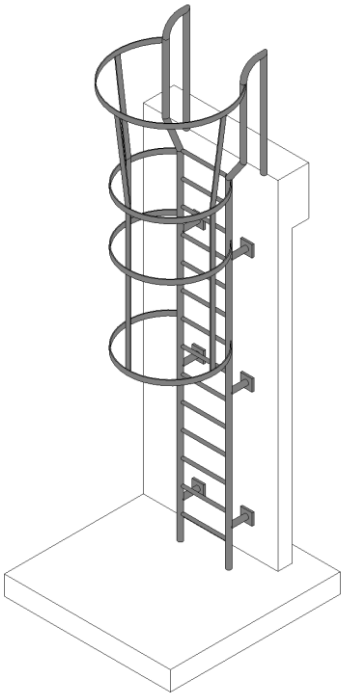


Figure 16.3.1 3D View of Cat Ladder

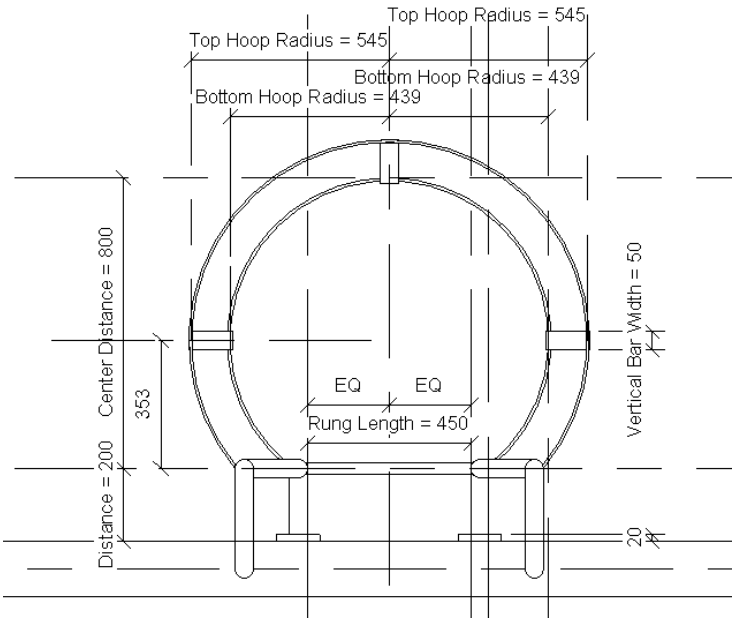


Figure 16.3.2 Plan View of Cat Ladder

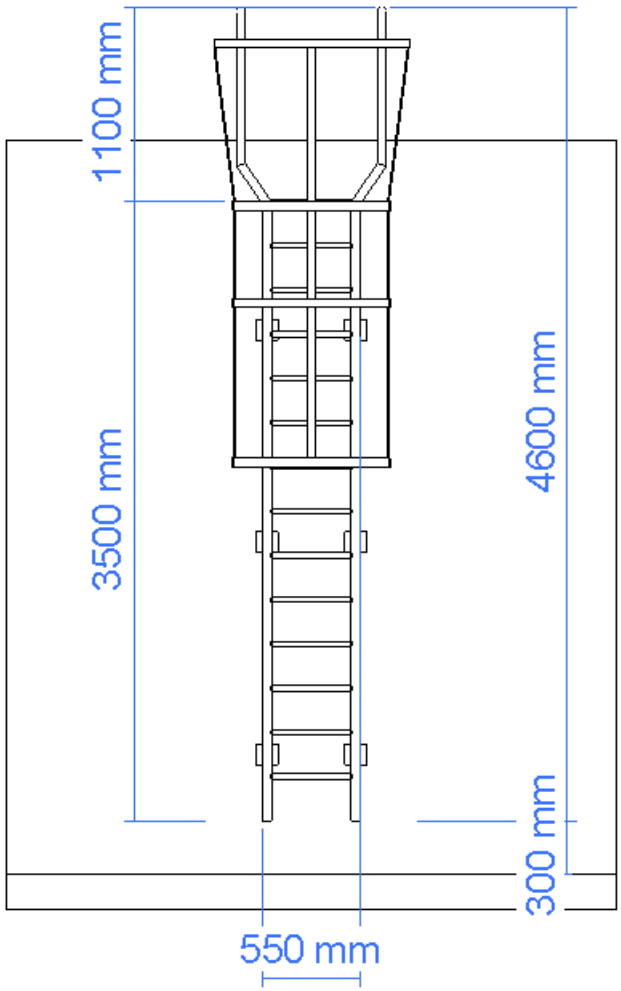


Figure 16.3.3 Elevation of Cat Ladder

16.3.2 Information Requirements for Quantity Take-off

1. Cat ladder marks (or location reference).
2. Material, size and surface finish of components of cat ladders.
3. Width and height of cat ladders.
4. Fixing method.
5. Any openable gates, hoop guards, lockable access doors, and rest platforms, with details.

16.3.3 Quantity Take-off Guidelines

For the measurement of cat ladders, create a schedule with the following fields:

<Cat Ladder Schedule>

A	B	C	D	E	F
Family	Type	Mark	Description	Level	Count
MW_-CAT-PQS-GMS-00	4600mm H	Type B	GMS cat ladder w/ hoop guards	1F(T1)	1

Adjust for the following as necessary:

- Nil

16.4 Stairs

16.4.1 Basic Modelling Approaches

Based on the stairs template, a system family type for assembled stair is created by sketching the alignment of the stair from the base level (stair base) to the top level (stair top). The relevant information can be extracted from the parameters such as the actual number of risers, actual riser height, actual tread depth, etc.

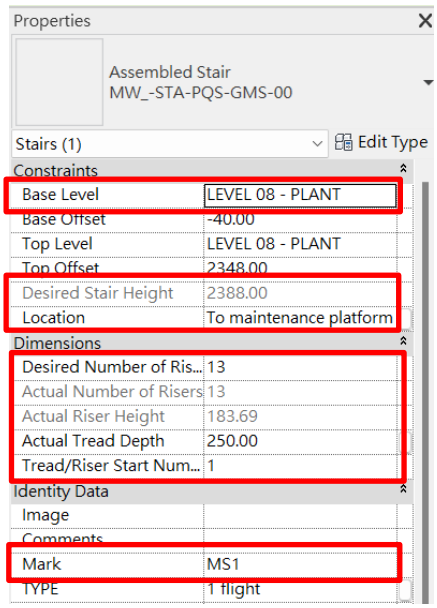


Figure 16.4.1 3D View of Metal Stair

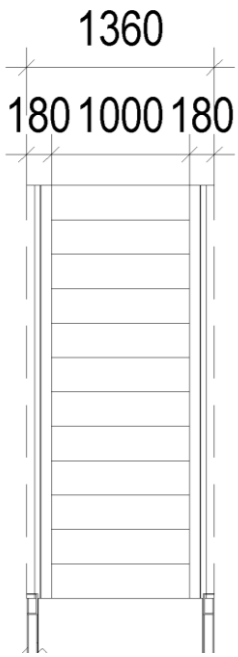


Figure 16.4.2 Plan View of Metal Stair

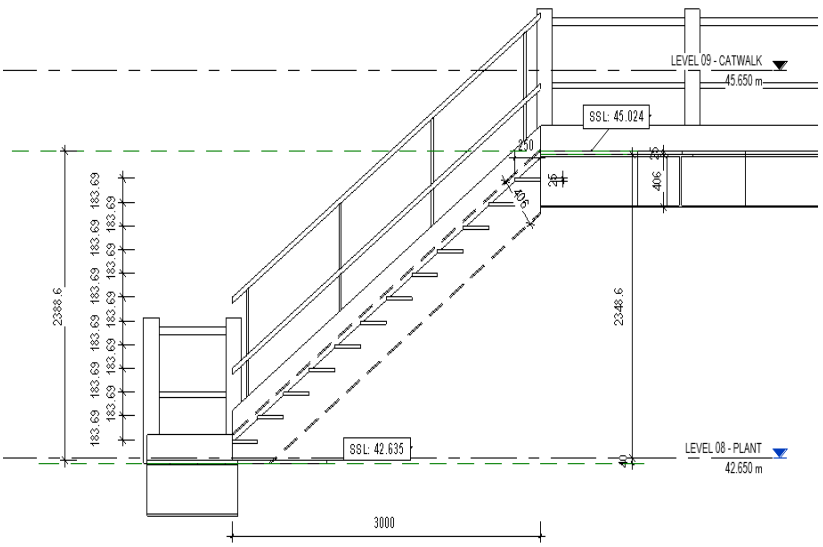


Figure 16.4.3 Section View of Metal Stair

16.4.2 Information Requirements for Quantity Take-off

1. Metal stair marks (or location reference).
2. Material, number and surface finish of treads, risers, strings, balustrades (measured separately) and supporting members.
3. Dimensions of stairs and members.
4. Fixing method.
5. Number of flights between landings and floors.
6. Fire resistance rating (if required).

16.4.3 Quantity Take-off Guidelines

For the measurement of metal stairs, create a schedule with the following fields:

<Metal Stair Schedule>

A	B	C	D	E	F	G	H	I
Family	Type	Base Level	Top Level	Location	Description	Mark	Number of Risers	Count
Assembled Stair	MW_-STA-PQS-GMS-00	LEVEL 08 - PLANT	LEVEL 08 - PLANT	To maintenance platform	1360mm wide GMS stair	MS1	13	1
Grand total: 1								

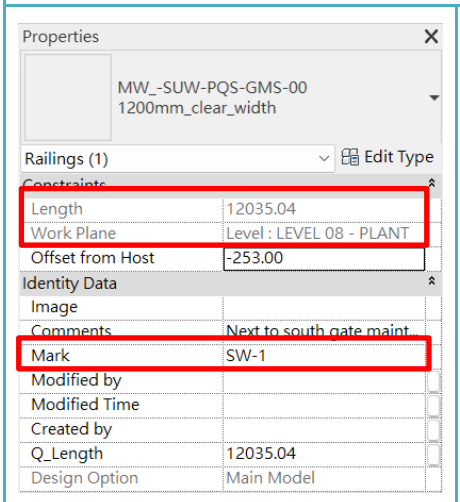
Adjust for the following as necessary:

- Nil.

16.5 Suspended walkways

16.5.1 Basic Modelling Approaches

Based on the railings template, a loadable family type for suspended walkway is created and the object is placed in the designed location.



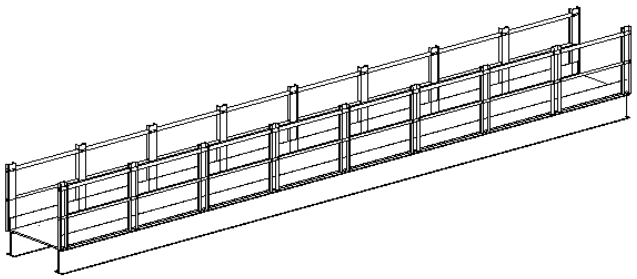


Figure 16.5.1 3D View of Suspended Walkway

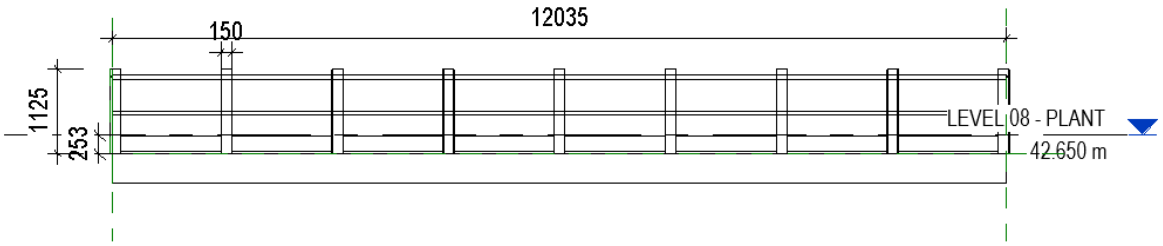


Figure 16.5.2 Elevation of Suspended Walkway

16.5.2 Information Requirements for Quantity Take-off

1. Walkway marks (or location reference).
2. Material, size and surface finish of members of walkway.
3. Width of walkways.
4. Fixing method.
5. Fire resistance rating (if required).

16.5.3 Quantity Take-off Guidelines

For measurement of suspended walkways, create a schedule with the following fields:

<Supsended walkway Schedule>

A	B	C	D	E	F
Family	Type	Location	Mark	Length	Count
MW_-SUW-PQS-GMS-00	1200mm_clear_width	Next to south gate maintenance platform	SW-1	12035	1

Adjust for the following as necessary:

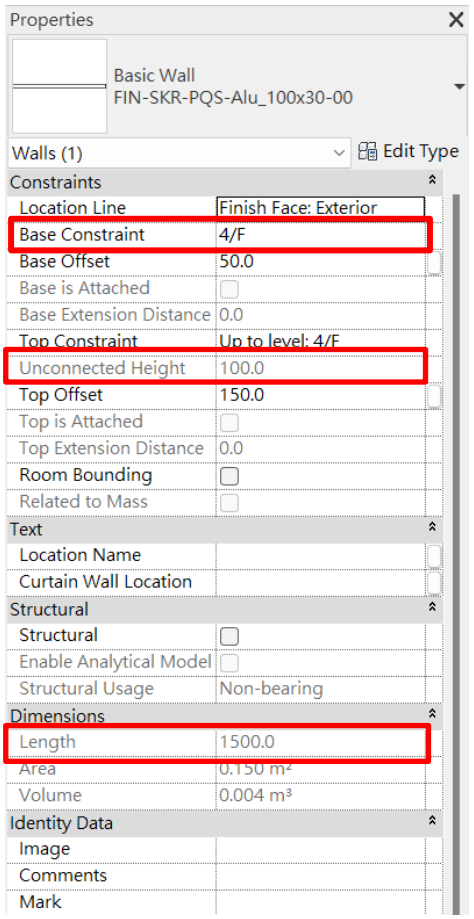
- Nil

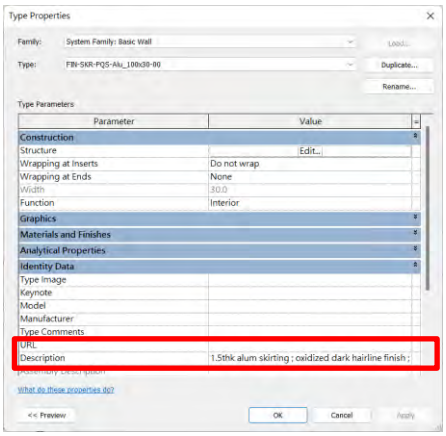
Section 17 - Metalwork

17.1 Skirtings

17.1.1 Basic Modelling Approaches

Based on the walls template, a system family type for skirting is created by sketching the alignment of the skirtings from the base level (wall base) with base offset for the floor finishes and defining the unconnected height (skirting height). The relevant information can be extracted from the parameters such as length, unconnected height (skirting height), width (thickness), etc.





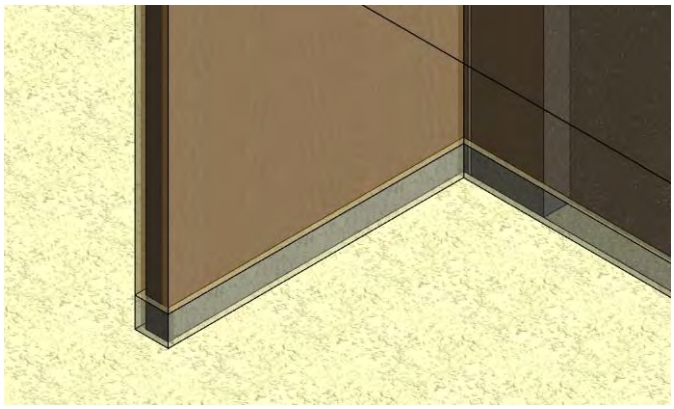


Figure 17.1.1 3D View of Metal Skirtings

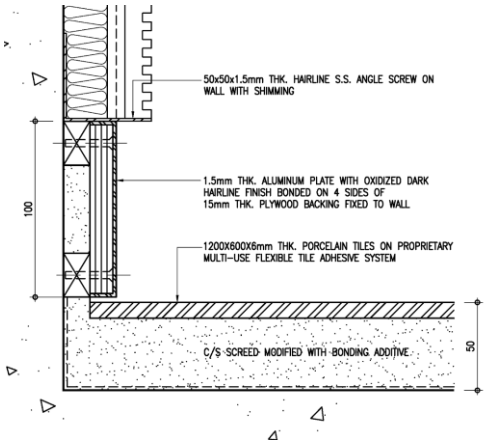


Figure 17.1.2 Detail of Metal Skirtings

17.1.2 Information Requirements for Quantity Take-off

1. Material and surface finish of skirtings.
2. Overall height and thickness.

17.1.3 Quantity Take-off Guidelines

For measurement of skirting, create a schedule with the following fields:

<Skirting Schedule>

A	B	C	D	E
Type	Description	Base Constraint	Unconnected Height	Length
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	0.85 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	3.15 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	3.16 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	3.11 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	1.48 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	2.21 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	1.50 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	0.82 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	1.48 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	0.99 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	0.99 m
FIN-SKR-PQS-Alu_100x30-00	1.5thk alum skirting ; oxidized dark hairline finish ; 15thk plywood backing	4/F	100	0.97 m
Grand total: 12				20.71 m

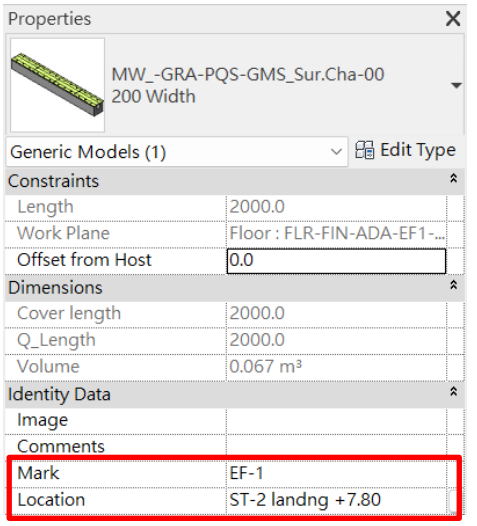
Adjust for the following as necessary:

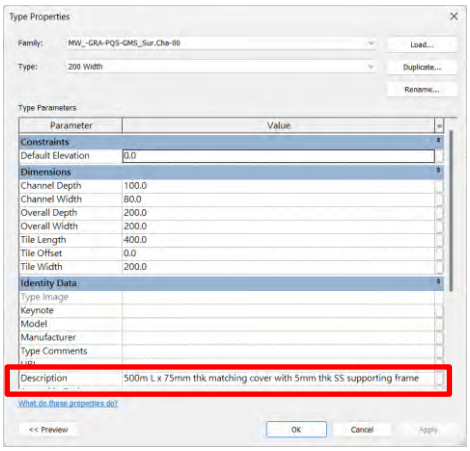
- Nil

17.2 Gratings and frames to floor channels

17.2.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for grating is created and the object is placed in the designed location.





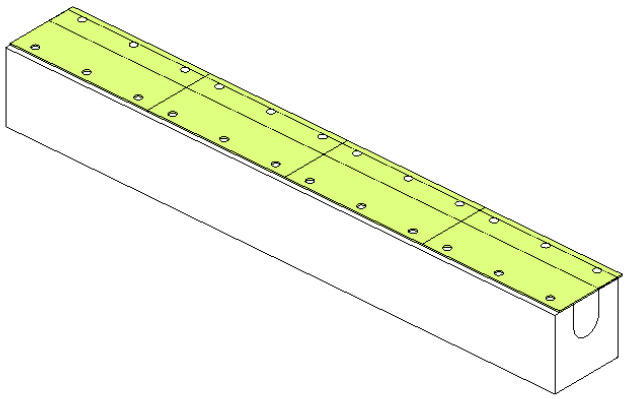


Figure 17.2.1 3D View of Gratings

17.2.2 Information Requirements for Quantity Take-off

1. Material of gratings and support channels.
2. Location reference.
3. Mark.
4. Overall size and thickness of gratings, and dimensions of support channels.
5. Size of slots/holes and spacing.

17.2.3 Quantity Take-off Guidelines

For measurement of gratings and frame, create a schedule with the following fields:

<Channel Cover Schedule>

A	B	C	D	E	F
Family	Type	Description	Location	Mark	Length
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	G/F ST-2	EF-1	3.39 m
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	G/F ST-4	EF-1	8.20 m
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	G/F ST-4	EF-1	1.60 m
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	G/F admission lobby	EF-1	3.40 m
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	G/F admission lobby	EF-1	1.23 m
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	ST-2 landing +13.00	EF-1	1.94 m
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	ST-2 landng +7.80	EF-1	2.00 m
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	G/F ST-3	EF-1	2.12 m
MW_-GRA-PQS-GMS_Sur.Cha-00	200 Width	500m L x 75mm thk matching cover with 5mm thk SS supporting frame	G/F ST-3	EF-1	1.64 m
Grand total: 9					25.54 m

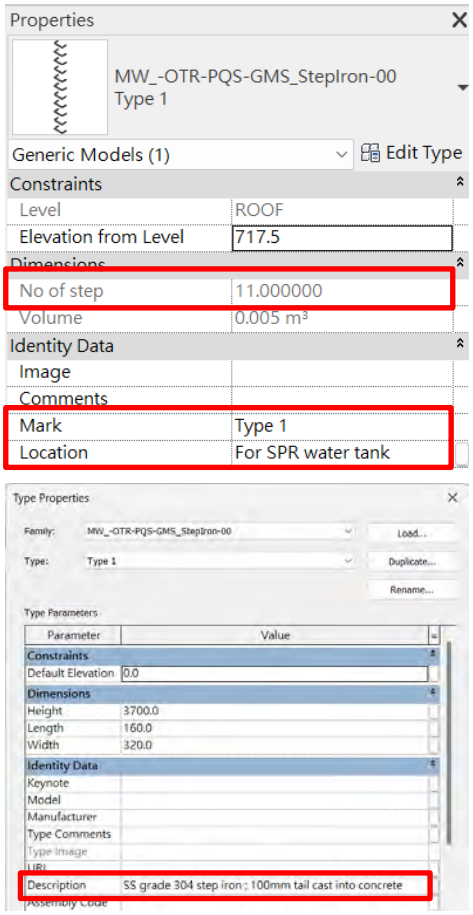
Adjust for the following as necessary:

- Nil.

17.3 Step irons

17.3.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for step iron is created and the object is placed in the designed location.



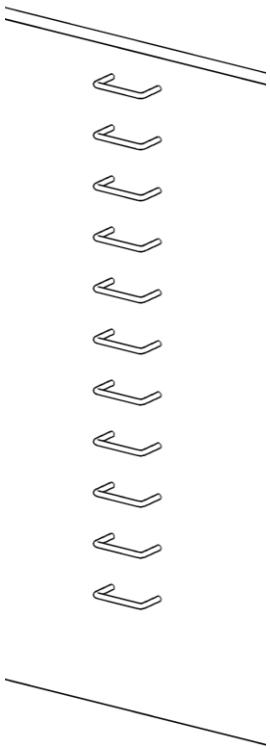


Figure 17.3.1 3D View of Step Irons

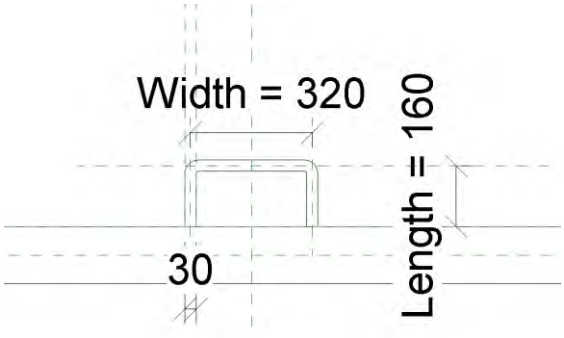


Figure 17.3.2 Plan View of Step Iron

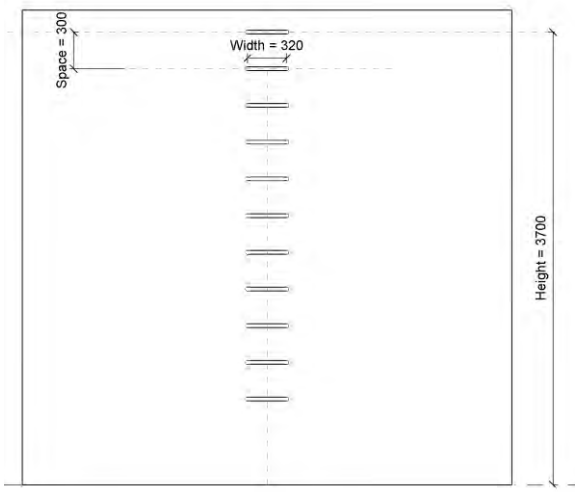


Figure 17.3.3 Front Elevation of Step Irons

17.3.2 Information Requirements for Quantity Take-off

1. Step iron type marks (if any) and location.
2. Material and surface finish of step irons.
3. Overall size and thickness.
4. Fixing method.

17.3.3 Quantity Take-off Guidelines

For measurement of step iron, create a schedule with the following fields:

<Step Iron Schedule>

A	B	C	D	E	F	G
Family	Type	Description	Level	Count	Location	No of step
MW_-OTR-PQS-GMS_StepIron-00	Type 1	SS grade 304 step iron ; 100mm tail cast into concrete	ROOF	1	For SPR water tank	11
MW_-OTR-PQS-GMS_StepIron-00	Type 1	SS grade 304 step iron ; 100mm tail cast into concrete	ROOF	1	For FS water tank	11
Grand total: 2				2		22

Notes:

a) Step irons are only measured independently where they are not specified and included as part of another object of other section, e.g. manhole.

b) With sufficient reference marks and location reference, the number of step irons in individual locations can be extracted; or designers/modellers provide a schedule on the same.

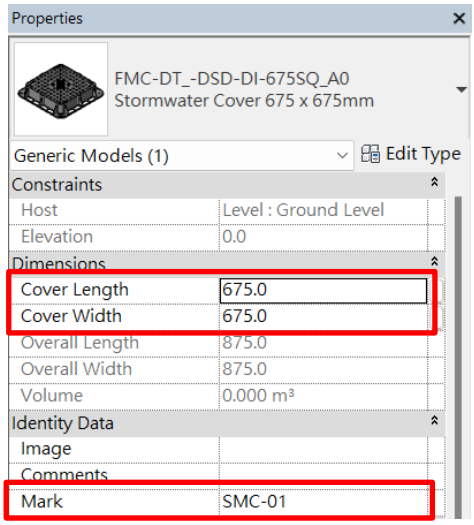
Adjust for the following as necessary:

- Nil.

17.4 Manhole covers and frames

17.4.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for manhole cover is created and the object is placed in the designed location.



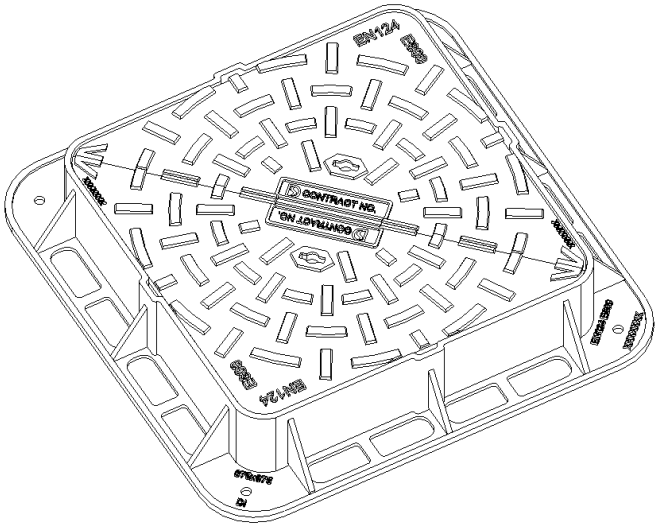
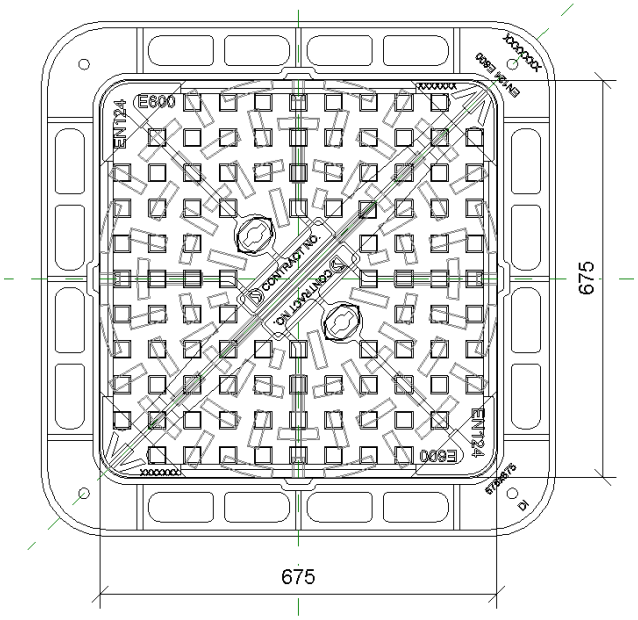


Figure 17.4.1 3D View of Manhole Cover



17.4.2 Information Requirements for Quantity Take-off

1. Material of manhole covers and frames.
2. Opening size.
3. Surface finish. (Matching cover with finish shall be measured separately, if any)
4. Manhole types: light duty/ medium duty/ heavy duty/ single seal/ double seal/ recessed pattern.

17.4.3 Quantity Take-off Guidelines

For measurement of manhole cover, create a schedule with the following fields:

<Manhole Cover Schedule>

A	B	C	D	E	F
Family	Type	Cover Length	Cover Width	Mark	Count
FMC-DT_-DSD-DI-675SQ_A0	Stormwater Cover 675 x 675mm	675	675	SMC-01	1

Note:

a) Manhole covers and frames are only measured independently where they are not specified and included as part of another object of other section, e.g. manhole.

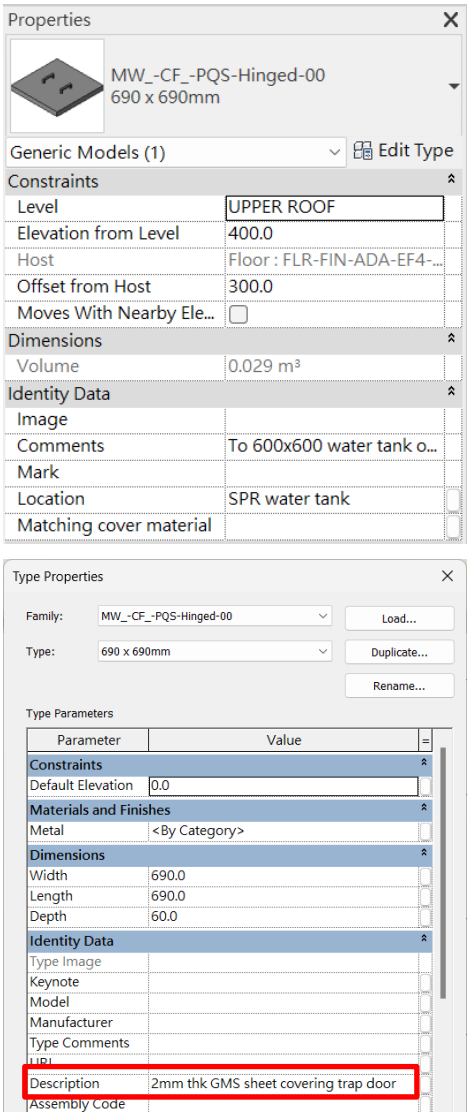
Adjust for the following as necessary:

- Nil.

17.5 Hinged covers and frames

17.5.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for hinged cover is created and the object is placed in the designed location.



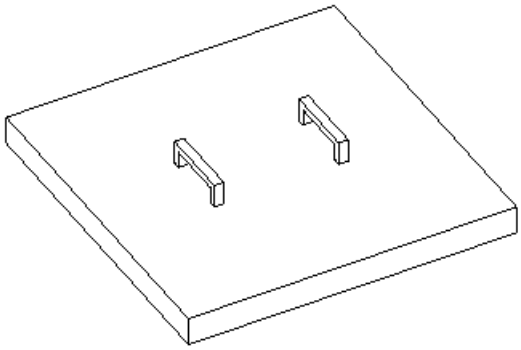


Figure 17.5.1 3D View of Hinged Cover

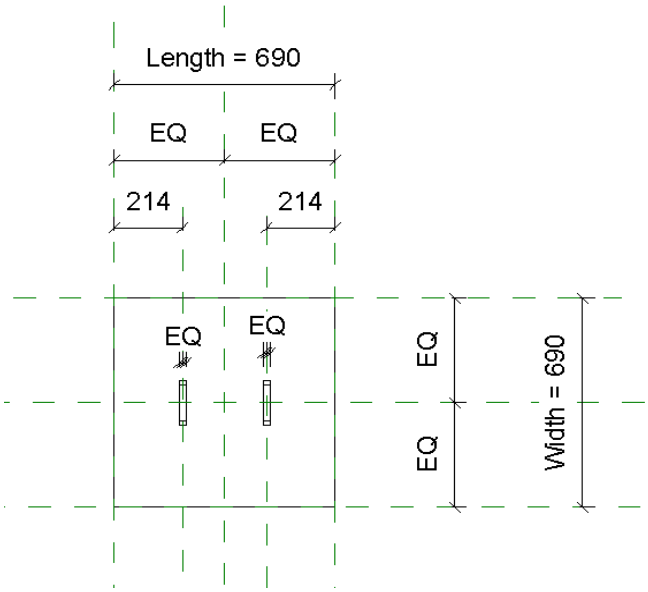


Figure 17.5.2 Plan View of Hinged Cover

17.5.2 Information Requirements for Quantity Take-off

1. Location reference, water tank marks or the like.
2. Material and surface finish of hinged covers and frames.
3. Opening size.
4. Hardware like hinges, lock plates and padlock (if any).

17.5.3 Quantity Take-off Guidelines

For measurement of hinged cover, create a schedule with the following fields:

<Hinged Covers and Frames to Water Tanks Schedule>

A	B	C	D	E
Family	Type	Description	Location	Count
MW_-CF_-PQS-Hinged-00	690 x 690mm	2mm thk GMS sheet covering trap door	SPR water tank	1
MW_-CF_-PQS-Hinged-00	690 x 690mm	2mm thk GMS sheet covering trap door	FS water tank	1
Grand total: 2				2

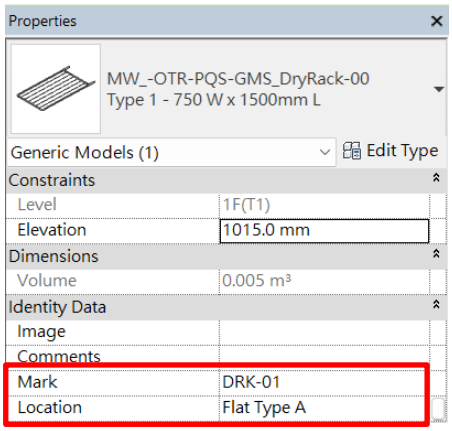
Adjust for the following as necessary:

- Nil

17.6 Drying racks

17.6.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for drying rack is created and the object is placed in the designed location.



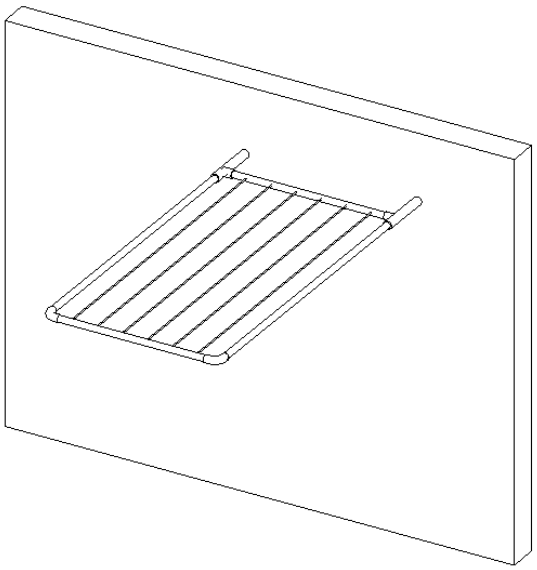


Figure 17.6.1 3D View of Drying Rack

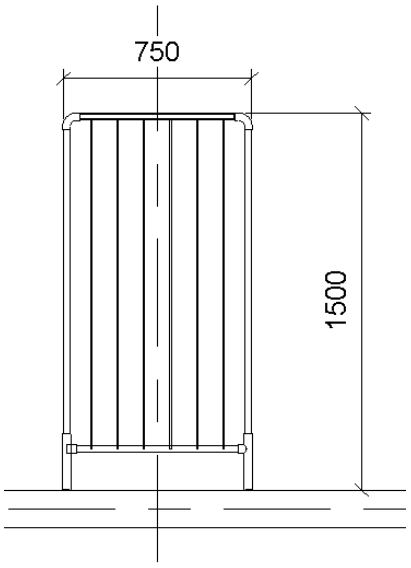


Figure 17.6.2 Plan View of Drying Rack

17.6.2 Information Requirements for Quantity Take-off

1. Overall size.
2. Material and surface finish of members of drying rack.
3. Canvas cover (if any).
4. Fixing method.

17.6.3 Quantity Take-off Guidelines

For measurement of drying rack, create a schedule with the following fields:

<Drying Rack Schedule>

A	B	C	D	E
Family	Type	Mark	Location	Count
MW_-OTR-PQS-GMS_DryRack-00	Type 1 - 750 W x 1500mm L	DRK-01	Flat Type A	1

Adjust for the following as necessary:

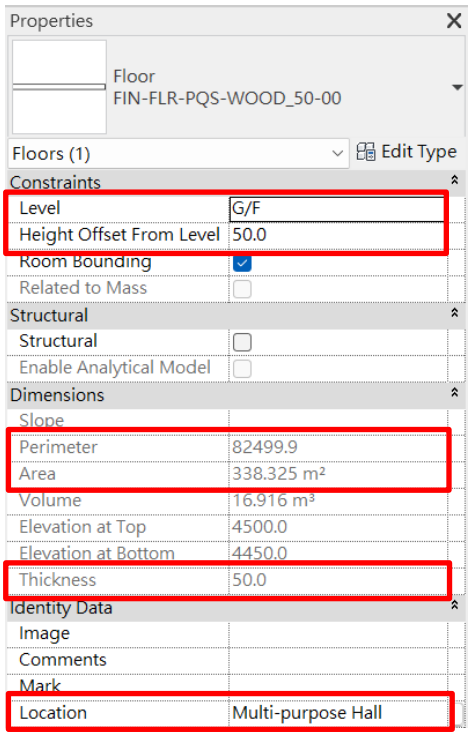
- Nil

Section 18 - Joinery

18.1 Wood flooring

18.1.1 Basic Modelling Approaches

Based on the architectural floors template, a system family type for wood flooring is created by sketching the boundary of the wood flooring perimeter. Set the height offset from level equal to the thickness of floor finishes. The relevant information can be extracted from the parameters, such as perimeter, thickness, area, etc.



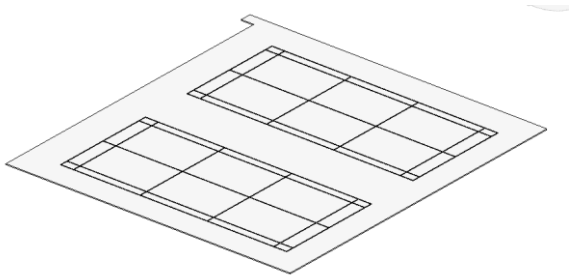


Figure 18.1.1 3D View of Wood Flooring

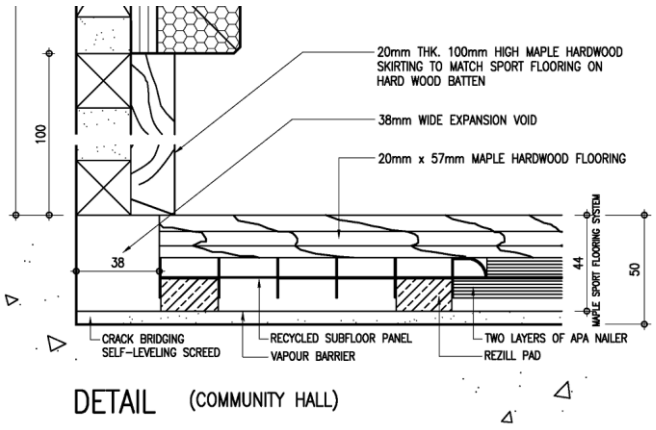


Figure 18.1.2 Details of Wood Flooring

18.1.2 Information Requirements for Quantity Take-off

1. Location reference.
2. Material and size of materials.
3. Pattern and surface finish.
4. Moisture resisting membrane, underlay and sub-floor system.
5. Method of jointing and bedding material.

18.1.3 Quantity Take-off Guidelines

For measurement of wood flooring, create a schedule with the following fields:

<Wood flooring schedule>

A	B	C	D	E
Family	Type	Level	Location	Material: Name
Floor	FIN-FLR-PQS-WOOD_50-00	G/F	Multi-purpose Hall	F1 - Hard wood flooring (double battern with extra underlay) and non-slip coating and line markng on waterproof and self-leveling cement sand screeding
Floor	FIN-FLR-PQS-WOOD_50-00	G/F	Stage	F1 - Hard wood flooring (double battern with extra underlay) and non-slip coating and line markng on waterproof and self-leveling cement sand screeding
Floor	FIN-FLR-PQS-WOOD_50-00	G/F	Stage	F1 - Hard wood flooring (double battern with extra underlay) and non-slip coating and line markng on waterproof and self-leveling cement sand screeding
Floor	FIN-FLR-PQS-WOOD_50-00	G/F	Stage	F1 - Hard wood flooring (double battern with extra underlay) and non-slip coating and line markng on waterproof and self-leveling cement sand screeding
Grand total: 4				

F	G
Default Thickness	Material: Area
50	338.325 m²
50	131.892 m²
50	82.880 m²
50	5.750 m²
	558.848 m²

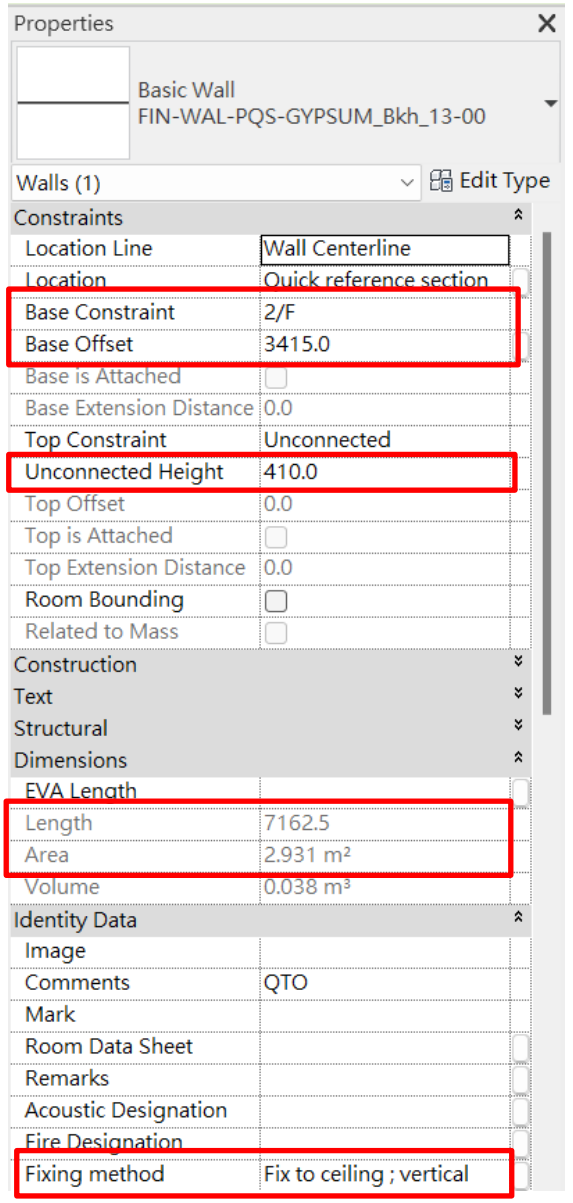
Adjust for the following as necessary:

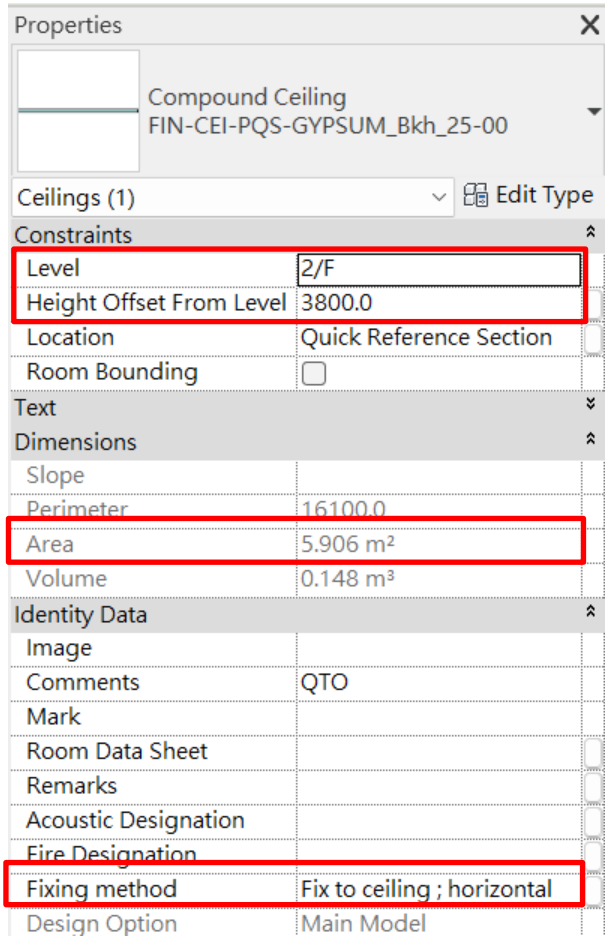
- Nil

18.2 Wood boarding, panelling and casings

18.2.1 Basic Modelling Approaches

Based on the architectural walls template, a system family type for bulkhead to ceiling is created by sketching the alignment of the bulkhead (vertical) and based on the ceilings template, a system family type for compound ceiling is created by sketching the alignment of the boundary of the bulkhead (horizontal). The relevant information can be extracted from the parameters such as length, unconnected height (bulkhead height), width (bulkhead thickness), area, etc.





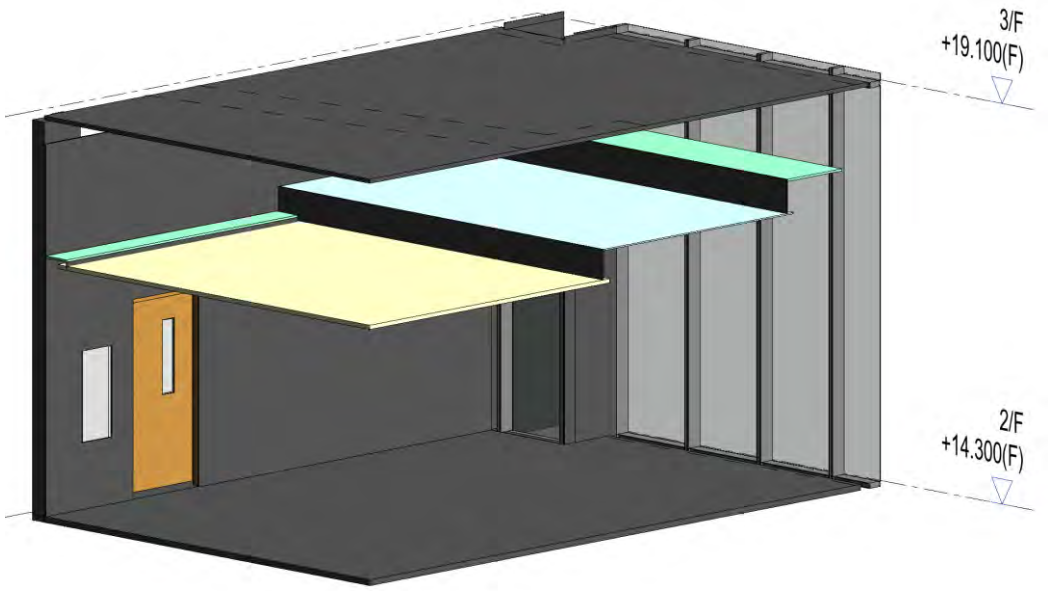


Figure 18.2.1 3D View of Bulkheads to ceiling

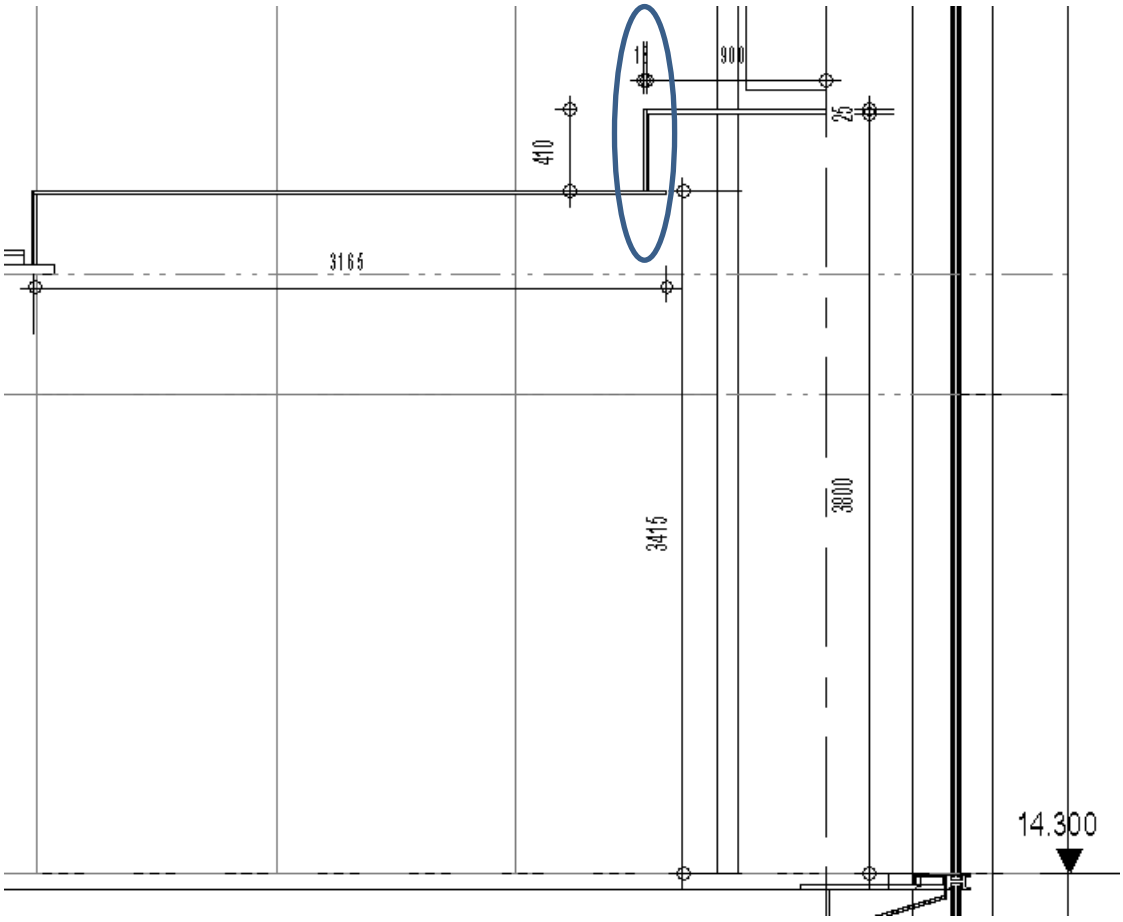


Figure 18.2.2 Section of Bulkheads to ceiling

18.2.2 Information Requirements for Quantity Take-off

1. Location reference (fix to walls and columns, ceilings and sides and soffits of beams, pipe and service ducts or other).
2. Material and thickness of material.
3. Surface finish.
4. Material, size and spacing of members of framing support.
5. Sloping / vertical / curved.

18.2.3 Quantity Take-off Guidelines

For measurement of bulkhead, create wall and ceiling schedules with the following fields:

<Bulkhead Schedule - vertical>

A	B	C	D	E	F	G
Family	Type	Base Constraint	Fixing method	Length	Unconnected Height	Area
Basic Wall	FIN-WAL-PQS-GYPSUM_Bkh_13-00	2/F	Fix to ceiling ; vertical	7.162	410	2.93
Basic Wall	FIN-WAL-PQS-GYPSUM_Bkh_13-00	2/F	Fix to ceiling ; vertical	7.162	365	2.61
Basic Wall	FIN-WAL-PQS-GYPSUM_Bkh_13-00	2/F	Fix to ceiling ; vertical	10.912	50	0.55
Grand total: 3						6.09

<Bulkhead Schedule - horizontal>

A	B	C	D	E	F	G	H
Family	Type	Material: Name	Level	Fixing method	Height Offset From Level	Count	Material: Area
Compound Ceiling	FIN-CEI-PQS-GYPSUM_Bkh_25-00	C01 - 4 coats of VOC free + anti-mould emulsion paint with skim coat on sealess perforated gypsum board ceiling	2/F	Fix to ceiling ; horizontal	3200	1	4.500
Compound Ceiling	FIN-CEI-PQS-GYPSUM_Bkh_25-00	C01 - 4 coats of VOC free + anti-mould emulsion paint with skim coat on sealess perforated gypsum board ceiling	2/F	Fix to ceiling ; horizontal	2650	1	4.107
Compound Ceiling	FIN-CEI-PQS-GYPSUM_Bkh_25-00	C01 - 4 coats of VOC free + anti-mould emulsion paint with skim coat on sealess perforated gypsum board ceiling	2/F	Fix to ceiling ; horizontal	2850	1	1.538
Compound Ceiling	FIN-CEI-PQS-GYPSUM_Bkh_25-00	C01 - 4 coats of VOC free + anti-mould emulsion paint with skim coat on sealess perforated gypsum board ceiling	2/F	Fix to ceiling ; horizontal	3100	1	27.925
Compound Ceiling	FIN-CEI-PQS-GYPSUM_Bkh_25-00	C01 - 4 coats of VOC free + anti-mould emulsion paint with skim coat on sealess perforated gypsum board ceiling	2/F	Fix to ceiling ; horizontal	3800	1	5.906
Compound Ceiling	FIN-CEI-PQS-GYPSUM_Bkh_25-00	C01 - 4 coats of VOC free + anti-mould emulsion paint with skim coat on sealess perforated gypsum board ceiling	2/F	Fix to ceiling ; horizontal	3950	1	19.205
Compound Ceiling	FIN-CEI-PQS-GYPSUM_Bkh_25-00	C01 - 4 coats of VOC free + anti-mould emulsion paint with skim coat on sealess perforated gypsum board ceiling	2/F	Fix to ceiling ; horizontal	2400	1	4.752
Compound Ceiling	FIN-CEI-PQS-GYPSUM_Bkh_25-00	C01 - 4 coats of VOC free + anti-mould emulsion paint with skim coat on sealess perforated gypsum board ceiling	2/F	Fix to ceiling ; horizontal	1800	1	10.566
Grand total: 8							78.498

Adjust for the following as necessary:

- Nil

Section 19 - Furniture, Fittings and Equipment

19.1 Furniture

19.1.1 Basic Modelling Approaches

Based on the furniture template, a loadable family type for furniture is created and the object is placed in the designed location.

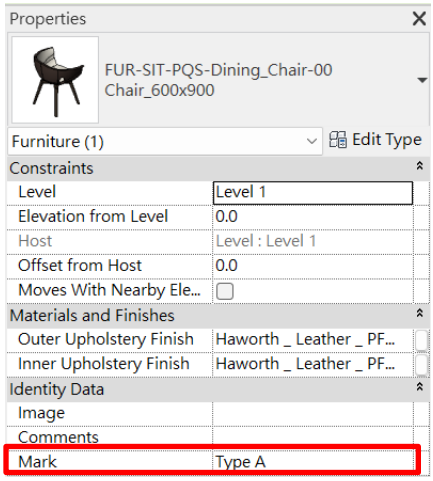


Figure 19.1.1 - 3D View of Fixtures and Furnishings

19.1.2 Information Requirements for Quantity Take-off

1. Furniture reference mark.
2. Overall size.
3. Type and quality of materials.
4. Surface finish.

19.1.3 Quantity Take-off Guidelines

For the measurement of furniture, create a schedule with the following fields:

<Furniture Schedule>

A	B	C	D
Family	Type	Mark	Count
FUR-SIT-PQS-Dining_Chair-00	Chair_600x900	Type A	1

Adjust for the following as necessary:

- Nil

19.2 Bathroom fittings

19.2.1 Basic Modelling Approaches

Based on the plumbing fixtures template, a loadable family type for bathroom fitting is created and the object is placed in the designed location.

The below illustration is based on a specific family, modeller can create similar with relevant parameters.

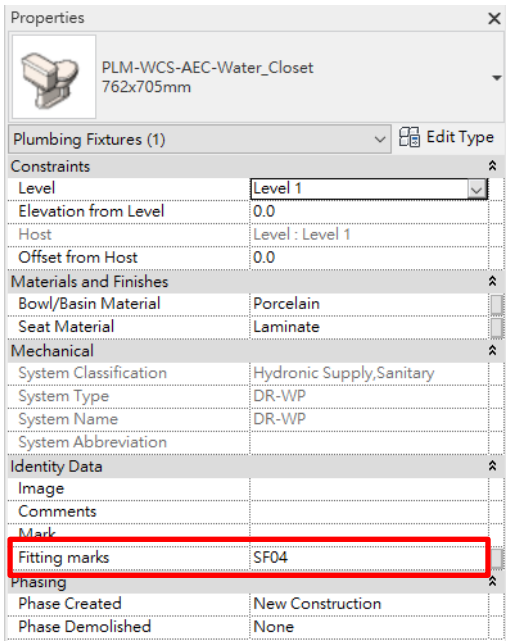


Figure 19.2.1 - 3D View of Water Closet

19.2.2 Information Requirements for Quantity Take-off

1. Fitting mark.
2. Type, size and surface finish of fittings.
3. Specification reference (if any).
4. Method of fixing.

19.2.3 Quantity Take-off Guidelines

For the measurement of bathroom fitting, create a schedule with the following fields:

<Plumbing Fixture Schedule>

A	B	C	D	E
Family	Type	Fitting marks	Material	Count
PLM-WCS-AEC-Water_Closet	762x705 mm	SF04	Porcelain	1

Adjust for the following as necessary:

- Nil

Section 20 - Surface Finishes/ Painting Works

20.1 Finishes

20.1.1 Basic Modelling Approaches

(A) Internal Finishes

Internal finishes include plastering, stone, tiling, painting, etc. There can be three modelling approaches for internal finishes as follows:

1) Create Rooms;

2) Apply Paint; or

3) Create separate layers by floor or wall as internal finishes layers.

1) Create Rooms

Based on the room template, a system family type for room is created by placing the room object within the room-bounding elements, including walls, columns, floors, roofs, ceilings, curtain systems, etc. The space bounded by these elements is defined as room-boundary. To further subdivide space where no room-bounding elements exist, a room separation line shall be added. It can compute the perimeter, area and volume.

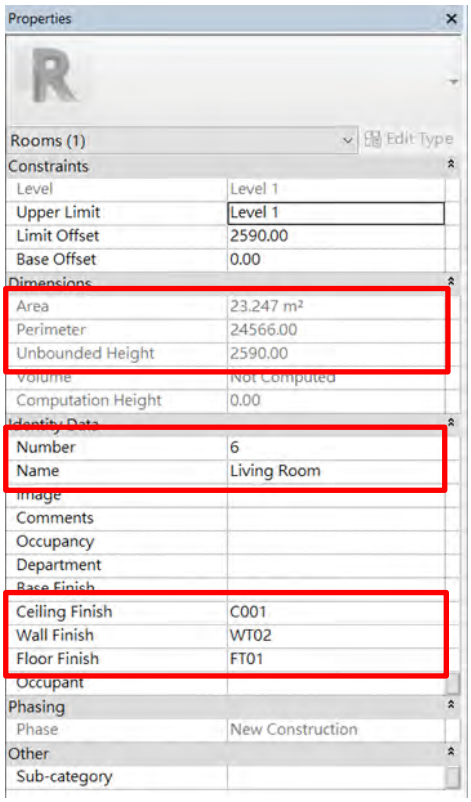


Figure 20.1.1 - Properties of Rooms

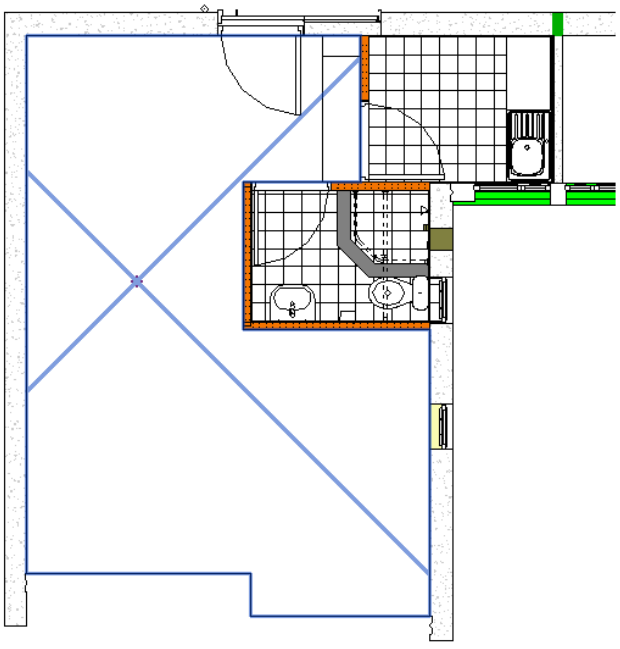


Figure 20.1.2 - Plan View of model (assigned Room)

20.1.1 Basic Modelling Approaches (Cont'd)

(A) Internal Finishes (Cont'd)

2) Apply Paint

A material parameter can be created by applying a Material to the face of an element with "Paint" functions. The Paint tool is applied to the whole surface of the selected face of the element or family. For applying different materials to the same surface, the "Split" function can be applied to divide the surface into different regions. The finishing areas with Paint applied can only be extracted by material take-off schedule.

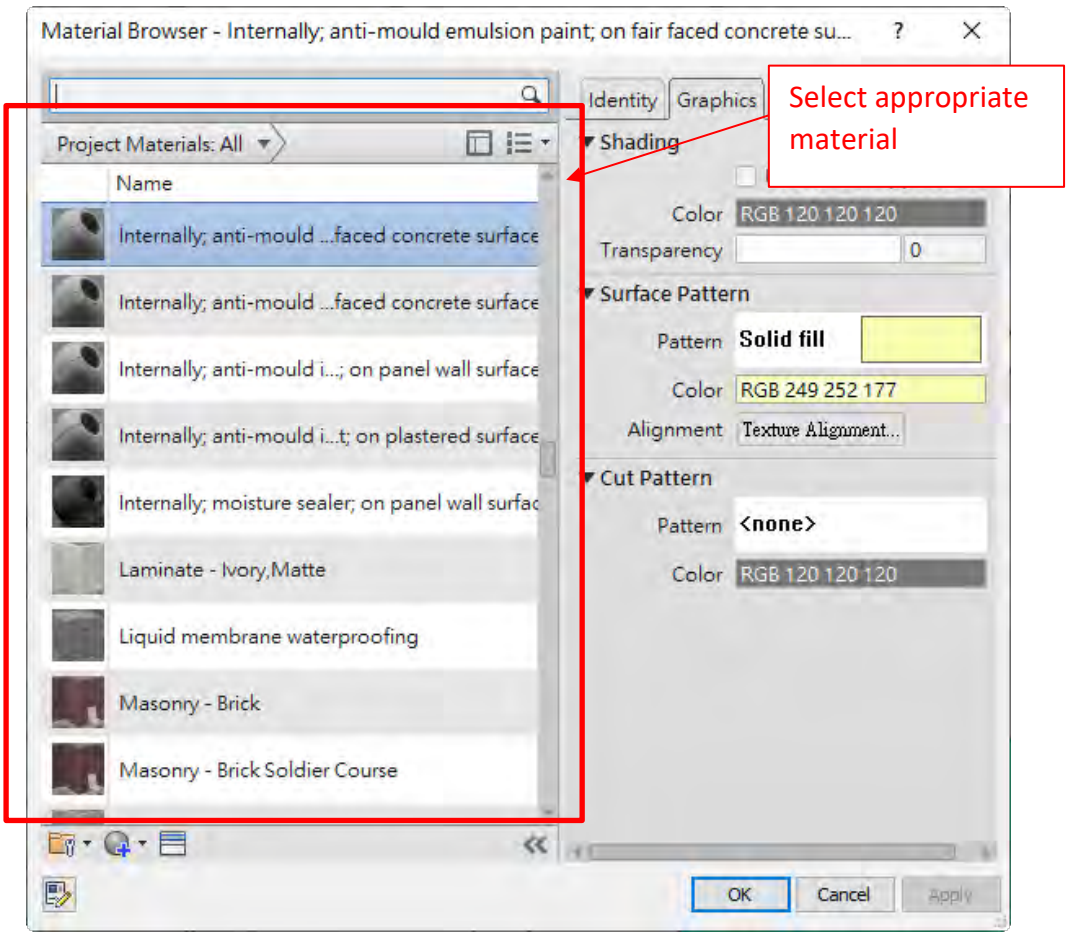


Figure 20.1.3 - Select Material for "Paint"

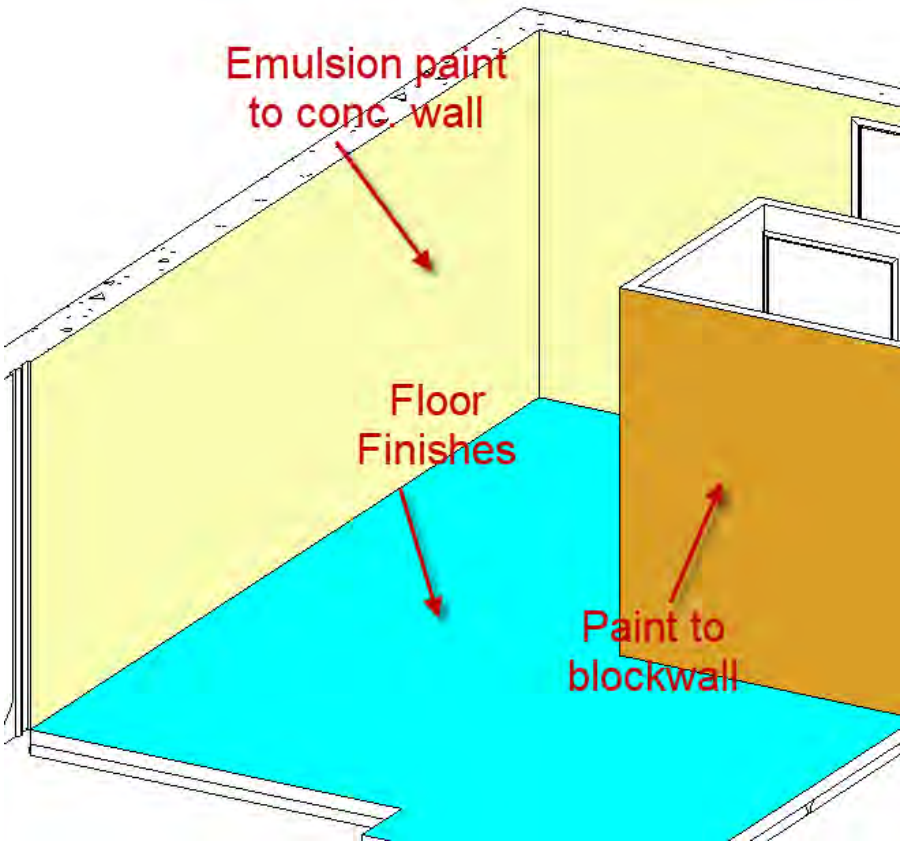


Figure 20.1.4 - 3D View of Finishing Works with Paint Applied

20.1.1 Basic Modelling Approaches

(A) Internal Finishes (Cont'd)

3) Create separate layers by floor and wall as internal finishes layers

Finishes layer can be created by an additional layer of floor and/or wall to the designed surfaces. The relevant information can be extracted from the parameters.

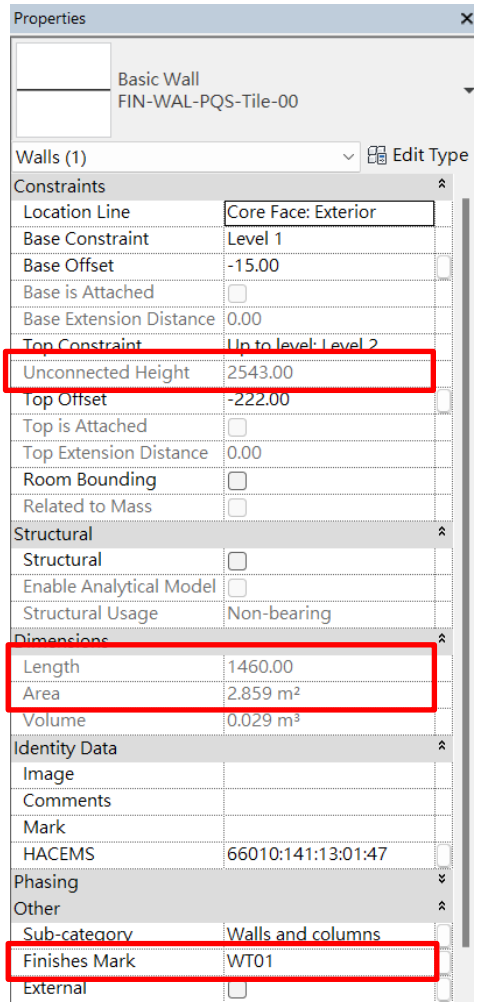


Figure 20.1.5 - Properties of Wall Finishes

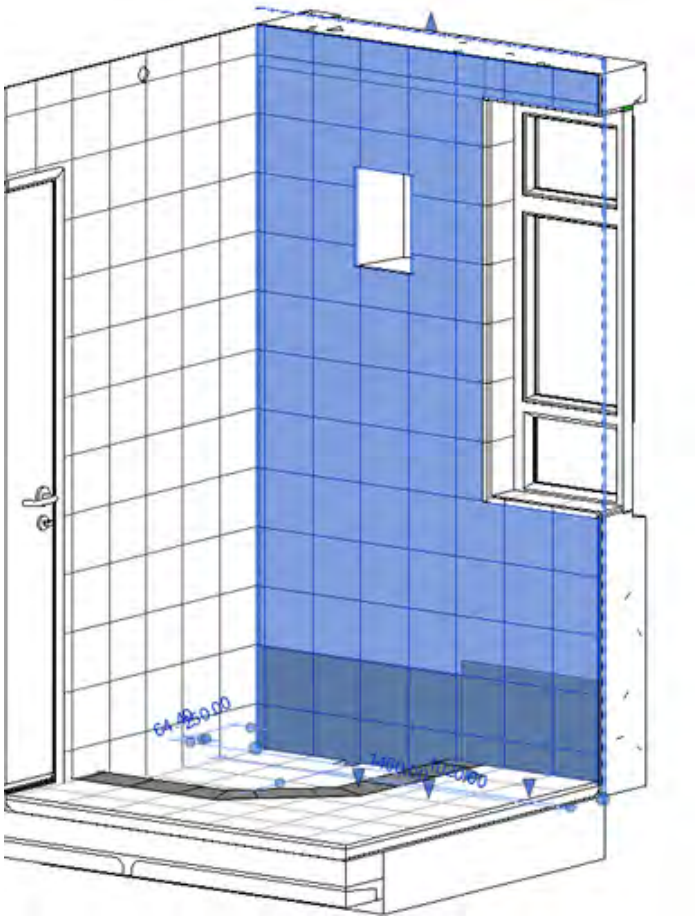


Figure 20.1.6 - 3D View of Bathroom modelled with Wall Finishes

(B) External Finishes

External finishes include plastering, stone, tiling, painting, etc. There can be two modelling approaches for external finishes as follows:

1) Apply Paint; or

2) Create separate layers by floor or wall as external finishes layers.

The steps described in 20.1.1(A) above can be followed for these two approaches.

20.1.2 Information Requirements for Quantity Take-off

(A) Finishes (e.g. cement sand screeds, granolithic, plaster and gypsum boards; exclude those types of finishes stated in (B) & (C) below)

1. Finishes type/ mark.
2. Composition and mix of materials (if appropriate).
3. Thickness, number of coats and surface finish (if appropriate).
4. Works laid in complicated colours and/or patterns.
5. Method of bedding/ fixing and supporting frames (if any).
6. Fire/sound reduction rating (if required).

(B) Finishes (Stone facing, tiling, rubber/ plastic sheet, carpet, etc.)

1. Finishes type/mark.
2. Thickness, size and shape of units.
3. Method of bedding/fixing and jointing.
4. Admixtures e.g. bonding agents, waterproofing agents etc. (if required).
5. Surface treatments e.g. wax polishing, sealing coats etc. (if required).
6. Horizontal/sloping (>15° from horizontal) / curved work.
7. Works laid in complicated colours and/or patterns.

(C) Painting

1. Finishes type/mark.
2. Number of priming or sealing coats.
3. Number of undercoats and finishing coats.

20.1.3 Quantity Take-off Guidelines

(A) Create Rooms

For measurement of finishes by Rooms, create schedules with the following fields:

- "Area" for floor and ceiling finishes.
  (Note: Beware of the areas measured by creating "Rooms" are the overall bounded areas without deduction of any void and opening.)
- "Perimeter" for skirting.
- "Unbounded Height".
- Create parameter "Wall Area" with formula "*Perimeter x Unbounded Height*" (Note: Beware of the "unbounded height", check and make any adjustment as necessary.)

<Room Schedule - Floor finish>

A	B	C
Floor Finish	Name	Area
FT01		
FT01	Living Room	23.25
FT01	Kitchen	3.39
		26.64
FT02		
FT02	Bathroom	2.93
		2.93

Example of Room Schedule for Floor Finishes

<Room Schedule - Wall Finishes>

A	B	C	D	E
Wall Finish	Name	Perimeter	Unbounded Height	Wall Area
WT01				
WT01	Bathroom	6940.00	2590.00	17.97
WT01				17.97
WT02				
WT02	Living Room	24566.00	2590.00	63.63
WT02				63.63
WT03				
WT03	Kitchen	7417.23	2590.00	19.21
WT03				19.21

Example of Room Schedule for Wall Finishes

(B) Apply Paint

For measurement of finishes by applying Paint, create a material take-off schedule with the following fields:

<Floor Finishes Material Takeoff>

A	B	C	D
Family	Material: Name	Finishes Mark	Material: Area
Floor	Floor tiling 200x200x7	FT01	3.39
Floor	Floor tiling 200x200x7	FT01	23.25
Grand total: 2			26.64

Example of Material Take-off Schedule for Painting for Floor Finishes

<Wall Finishes Material Takeoff>

A	B	C	D
Family	Material: Name	Finishes Mark	Material: Area
Basic Wall	Wall tiling 200x200x7	WT01	3.59
Basic Wall	Wall tiling 200x200x7	WT01	4.91
Basic Wall	Wall tiling 200x200x7	WT01	2.86
Basic Wall	Wall tiling 200x200x7	WT01	3.01
Grand total: 4			14.37

Example of Material Take-off Schedule for Painting for Wall Finishes

(C) Create separate layers by floor and wall as internal/external finishing layers

For measurement of finishes modelled by floor and/or wall, create relevant schedules with the following fields:

(i) Floor Schedules (for finishes created by floor)
- Area

(ii) Wall Schedules (for finishes created by wall)
- Unconnected height
- Length
- Create parameter "Wall Area" with the formula "*Length x Unconnected height*".

<Floor Tile Schedule>

A	B	C	D
Family	Type	Finishes Mark	Area
FIN-FLR-PQS-Tile-00			
Floor	FIN-FLR-PQS-Tile-00	FT01	3.39
Floor	FIN-FLR-PQS-Tile-00	FT01	23.25
Grand total: 2			26.64

Example of Floor Schedule for Floor Tile

<Wall Tile Schedule>

A	B	C	D	E	F
Family	Type	Finishes Mark	Length	Unconnected Height	Area
Basic Wall	FIN-WAL-PQS-Tile-00	WT01	1460	2462	3.59
Basic Wall	FIN-WAL-PQS-Tile-00	WT01	2000	2462	4.91
Basic Wall	FIN-WAL-PQS-Tile-00	WT01	1460	2543	2.86
Basic Wall	FIN-WAL-PQS-Tile-00	WT01	1980	2462	3.01
Grand total: 4					14.37

Example of Wall Schedule for Wall Tile

Adjust for the following as necessary:

- Doors, windows and beams (for modelling approach adopting “Rooms”).
- Voids and openings if required.
- Beware that the measurement should be based on the “net area to be covered (i.e. the net background)”, while the models may give the quantities of area along the centre line or the front face.”

20.2 Roof Tile Finishes

20.2.1 Basic Modelling Approaches

In response to the different approaches of providing roof tile finishes information in models, there can be two modelling approaches which include:

1) Apply Paint; or

2) Create a relevant layer by floor as roof tile finishes.

The details of the two approaches can refer to 20.1.1(A).

Example of roof tile modelled by a separate layer of floor:

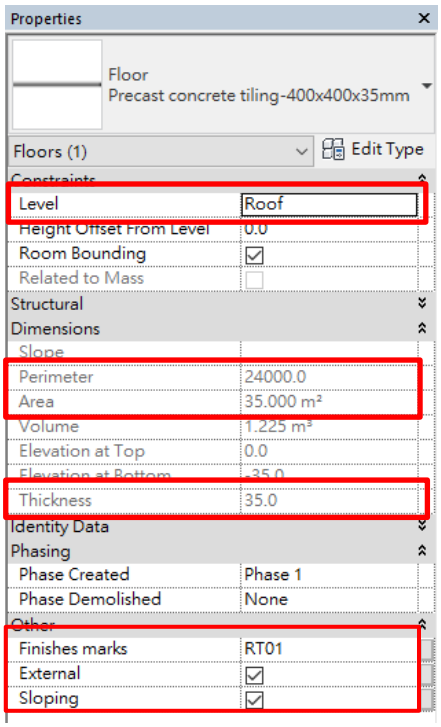


Figure 20.2.1 - Properties of Roof Tile

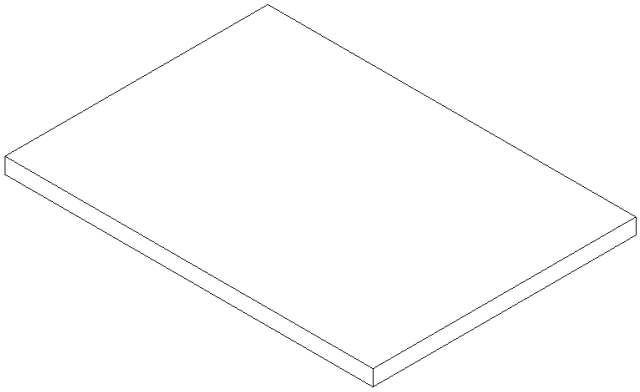


Figure 20.2.2 - 3D View of Roof Tile

20.2.2 Information Requirements for Quantity Take-off

1. Finishing marks.
2. Type, thickness, size and shape of tiles.
3. Method of fixing including any batten system.
4. Horizontal /sloping (> 15° from horizontal) / curved work.
5. Works laid in complicated colours and/or patterns.

20.2.3 Quantity Take-off Guidelines

For measurement of roof tile finishes, create a relevant material take-off schedule depending on the modelling approaches.

1) Paint

To measure roof tile by applying "Paint", create a material take-off schedule to include the following fields, details referring to 20.1.3.

<Roof Tile - Material Takeoff Schedule>

A	B	C	D	E	F
Family	Material: Name	Finishes Marks	Sloping	External	Material: Area
Floor	Precast Concrete Tiles-400x400x35mm	RT01	☑	☑	35.00
Floor	Precast Concrete Tiles-400x400x35mm	RT01	☑	☑	35.00
Grand total: 2					70.00

Example of Roof Tile Material Take-off Schedule (created by "Paint")

2) Create Separate Layers by Floor

For measurement of roof tile modelled by floor, create a schedule with the following fields, details referring to Section 20.1.3.

<Roof Tile Schedule>

A	B	C	D	E	F
Family	Type	Finishes Marks	Sloping	External	Area
Floor	FIN-ROF-PQS-PCTiling-00	RT01	☑	☑	35.00
Floor	FIN-ROF-PQS-PCTiling-00	RT01	☑	☑	35.00
RT01: 2					70.00

Example of Roof Tile Schedule (created by "Floor")

Adjust for the following as necessary:

- Voids and openings if required.
- Beware of measurement on "net area to be covered (i.e. the net background)".

20.3 Tactile

20.3.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for tactile is created and the object is placed in the designed location. Only volume, however, can be extracted from generic model objects.

Another option for modelling tactile is to create a separate layer by floor, details referring to Section 20.1.1(A).

For tactile modelling by generic model, shared parameters “Tactile Length” and “Tactile Width” should be created for tactile size.

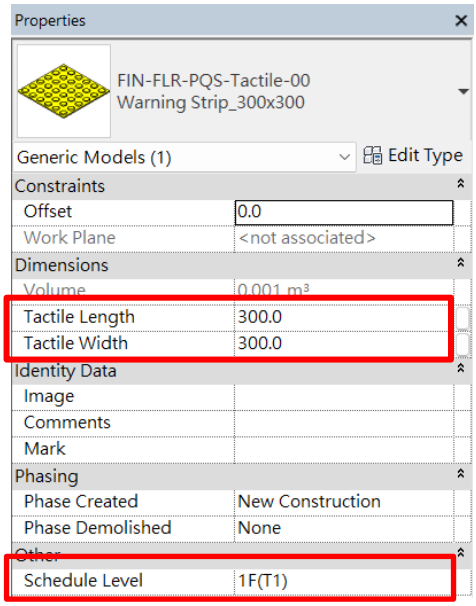


Figure 20.3.1 - Properties and Type Properties of Tactile

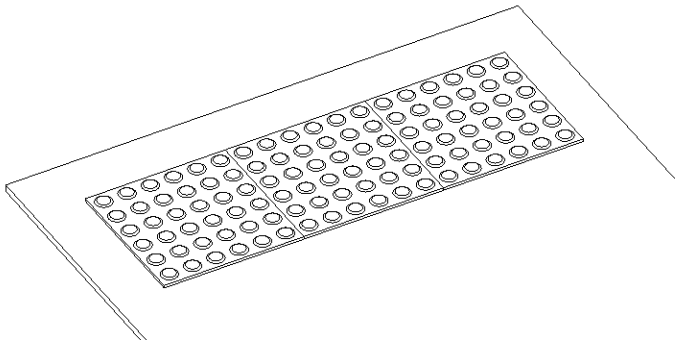


Figure 20.3.2 - 3D View of Tactile

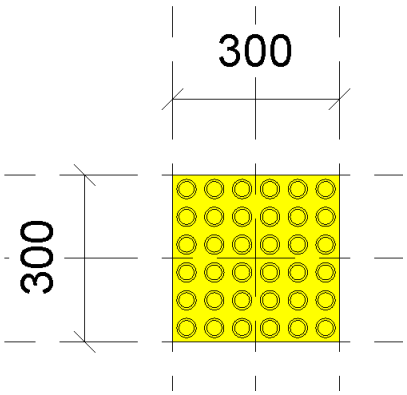


Figure 20.3.3 - Plan View of Tactile

20.3.2 Information Requirements for Quantity Take-off

1. Type of materials.
2. Size and method of fixing.
3. Tactile types: warning (or stop) / direction (or go) / turning (or positional).

20.3.3 Quantity Take-off Guidelines

For measurement of tactile, create a schedule with the following fields:

- "Tile Length"
- "Tile Width"
- Create the parameter "Tile Area" with the formula "Tile Length x Tile Width".

<Tactile Schedule>

A	B	C	D	E	F
Family	Type	Count	Tactile Length	Tactile Width	Tile Area
FIN-FLR-PQS-Tactile-00	Warning Strip_300x300	1	300	300	0.09
FIN-FLR-PQS-Tactile-00	Warning Strip_300x300	1	300	300	0.09
FIN-FLR-PQS-Tactile-00	Warning Strip_300x300	1	300	300	0.09
Grand total: 3		3			0.27

Example of Tactile Schedule

Adjust for the following as necessary:

- Nil

Section 21 – Painting

21.1 Painting

21.1.1 Basic Modelling Approaches

The model information requirements for painting are similar to other types of finishes. Similarly, the approach for extracting quantities for painting is the same as that for measuring finishes.

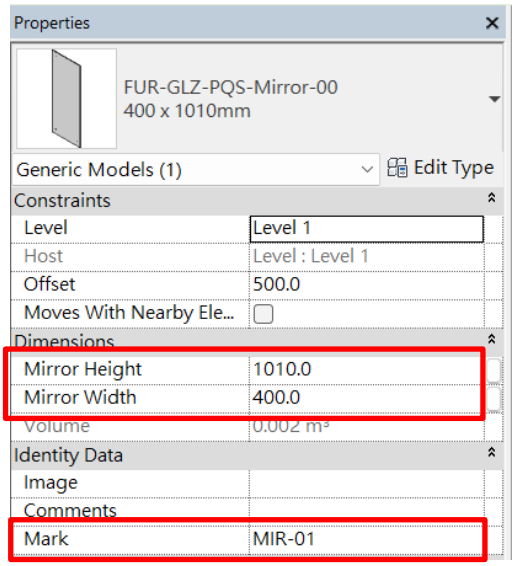
The basic modelling approaches, the information requirements for quantity take-off and the quantity take-off guidelines are not repeated here.

Section 22 - Glazing

22.1 Mirror

22.1.1 Basic Modelling Approaches

Based on the generic models template, a loadable family type for mirror is created and the object is placed in the designed location.



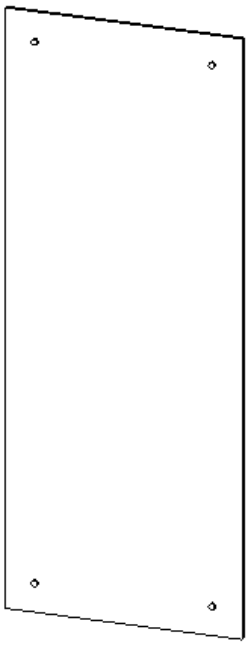


Figure 22.1.1 - 3D View of Mirror

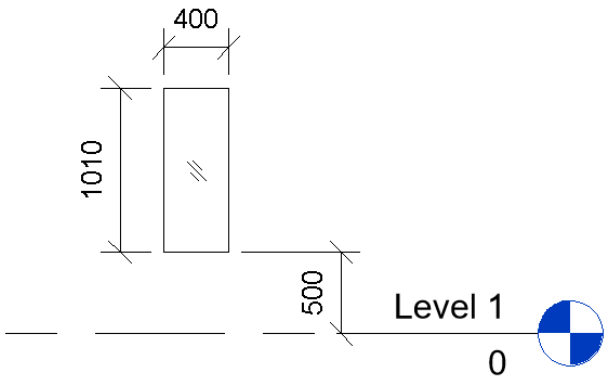


Figure 22.1.2 - Front Elevation of Mirror

22.1.2 Information Requirements for Quantity Take-off

1. Mirror marks or location.
2. Overall size of mirror.
3. Type, quality and thickness of glass.
4. Any bevelled edge, backings and edge frames.
5. Framing support details.

22.1.3 Quantity Take-off Guidelines

For measurement of mirror, create a schedule with the following fields:

<Mirror Schedule>

A	B	C	D	E	F
Family	Type	Mark	Mirror Width	Mirror Height	Count
FUR-GLZ-PQS-Mirror-00	400 x 1010mm	MIR-01	400	1010	1

Adjust for the following as necessary:

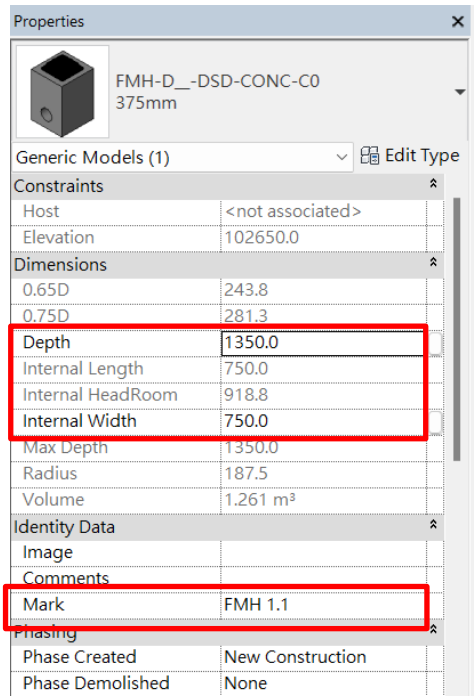
- Nil

Section 23 - Drainage Below Ground

23.1 Manholes

23.1.1 Basic Modelling Approaches

Based on the generic model template, a loadable family type for manhole is created and the object is placed in the desired location. It is suggested to adopt parametric modelling such that the configuration of the model geometry will be changed accordingly upon the dimension values are modified. This could avoid inconsistency between geometry and non-geometrical information. The relevant information can be extracted from the parameters such as the cover level, invert level, internal length/ width, depth to invert, etc.



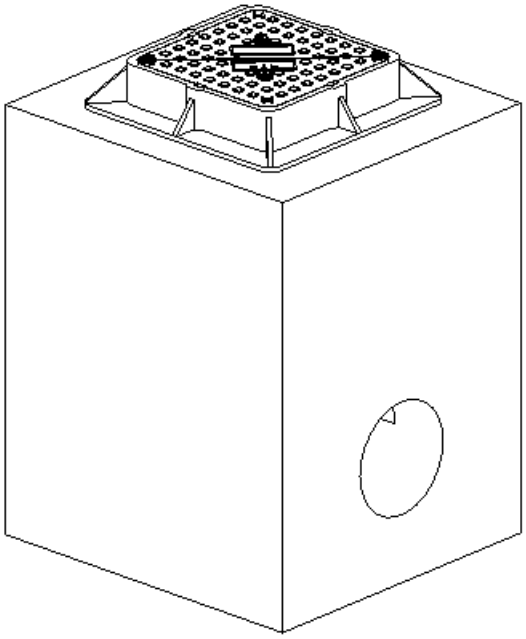


Figure 23.1.1 - 3D View of Manhole

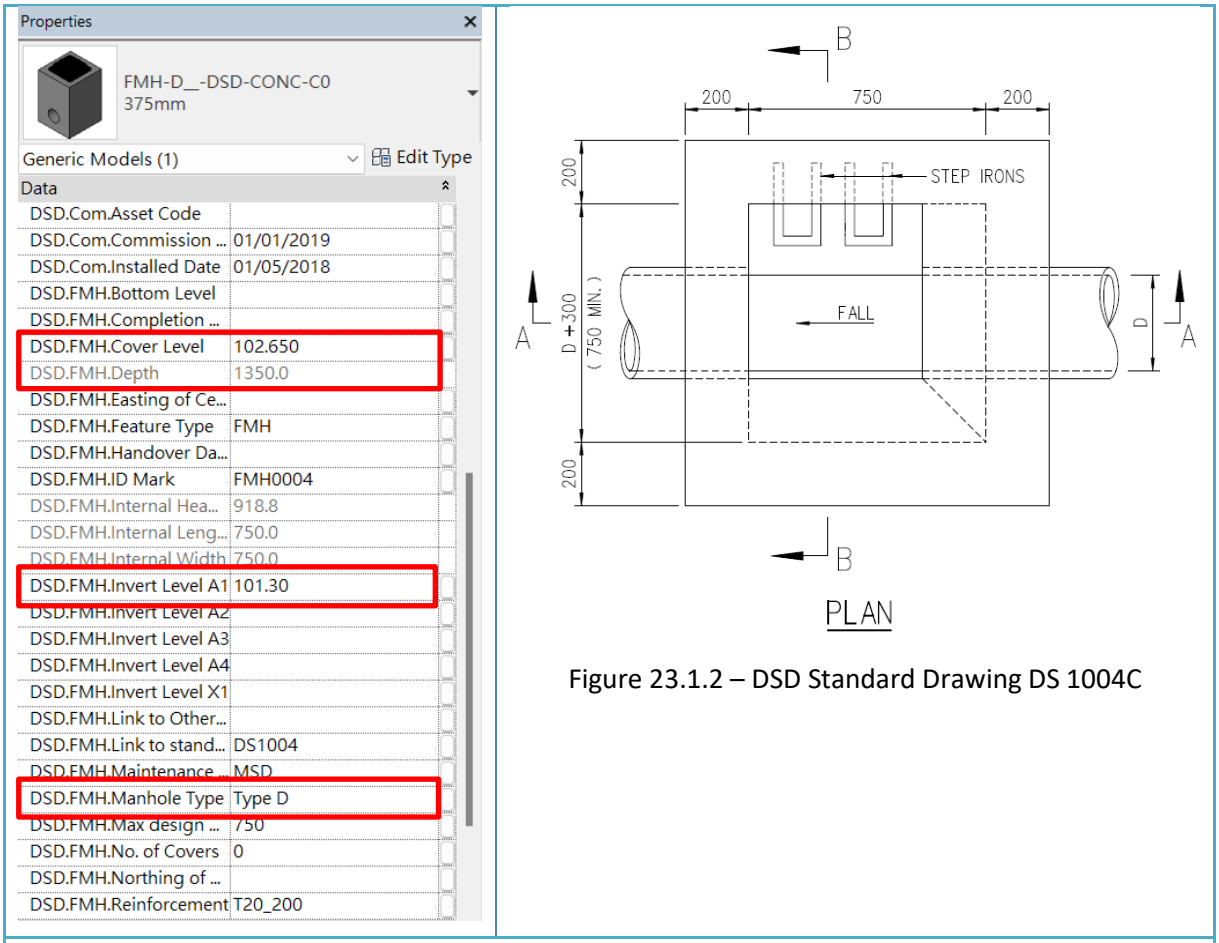


Figure 23.1.2 – DSD Standard Drawing DS 1004C

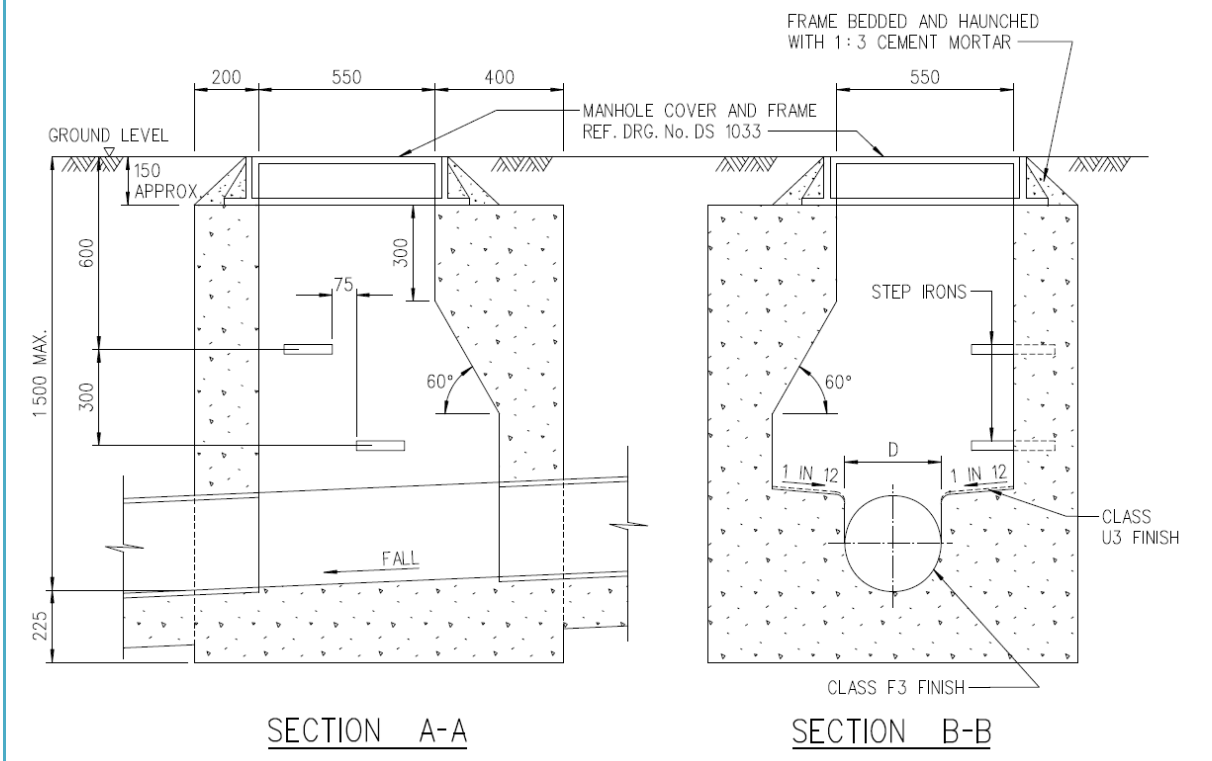


Figure 23.1.3 - Section

23.1.2 Information Requirements for Quantity Take-off

1. Manhole marks.
2. Cover Level.
3. Inverted level of manhole.
4. Internal sizes.
5. Construction details of base slab, wall and cover slab.
6. Sizes of main and branch channels.
7. Internal finishes.
8. Manhole covers and frames
9. Accessories like backdrops, step irons, access ladders etc. (if any)

23.1.3 Quantity Take-off Guidelines

For the measurement of manholes, create a schedule with the following fields:

<Manhole Schedule>

A	B	C	D	E	F	G
Family	Type	DSD.FMH.Manhole	Mark	DSD.FMH.Internal Length	DSD.FMH.Internal Width	DSD.FMH.Cover Level
FMH-D__-DSD-CONC-C0	375mm	Type D	FMH 1.1	750	750	102.650
FMH-D__-DSD-CONC-C0	375mm	Type D	FMH 1.2	750	750	102.650
FMH-D__-DSD-CONC-C0	375mm	Type D	FMH 1.3	750	750	102.650
FMH-D__-DSD-CONC-C0	375mm	Type D	FMH 1.4	750	750	102.650

H	I	J
DSD.FMH.Invert Level	DSD.FMH.Depth	Count
101.30	1350	1
101.22	1430	1
101.18	1470	1
101.11	1500	1

Measurement of similar items such as drain pit, gully, sump pit, grease traps, and petrol interceptor can be done by creating similar schedules.

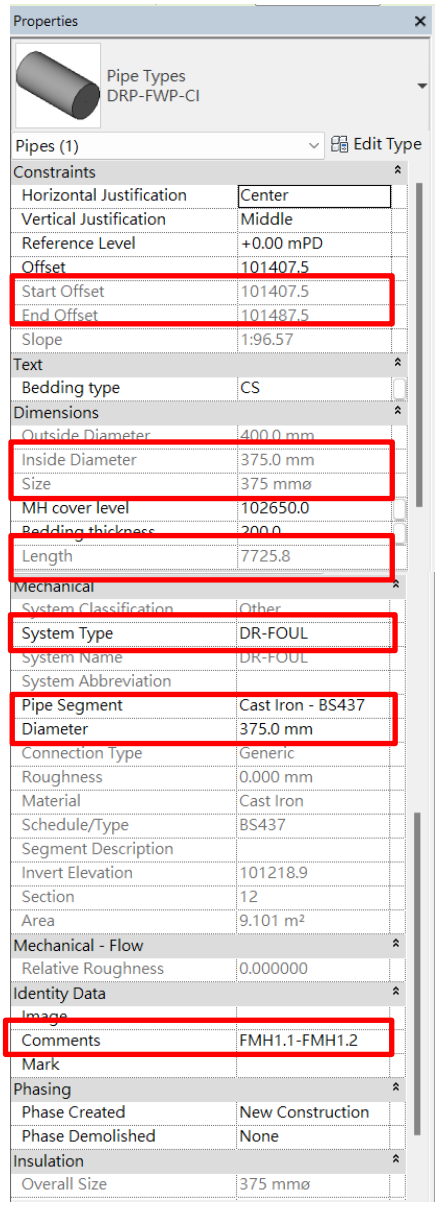
Adjust for the following as necessary:

- Nil

23.2 Drain pipes

23.2.1 Basic Modelling Approaches

Based on the pipes template, a system family type for pipe is created by sketching the alignment of the drain pipe. The relevant information can be extracted from the parameters such as system type, material, size, length, etc.



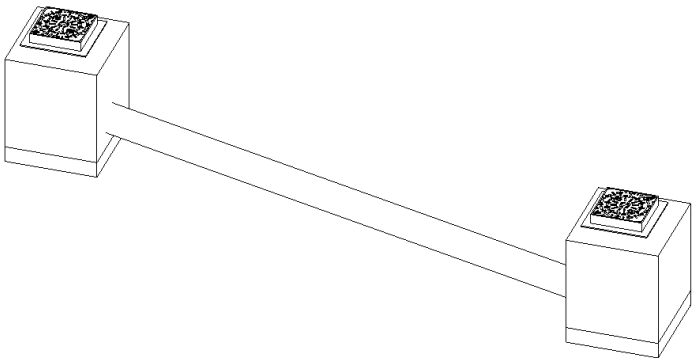


Figure 23.2.1 - 3D View of Drain Pipe

Start and End Offset shall align with the manholes schedule.

However, Revit defaults the pipe level (the vertical justification) at the centreline of the pipe, while the invert level is the level of the internal bottom of a pipe. Therefore, half of the internal diameter should be added to the default pipe level to give the invert level. For the above example, the Invert level of FMH1.1 (i.e. the start end) at 101407.5 minus half of the internal pipe diameter at 187.5 (=375/2), the adjusted start invert level is 101220. For the other end at FMH1.2, the adjusted end invert level is 101300.

23.2.2 Information Requirements for Quantity Take-off

1. Commencement level for drain pipe excavation (for pipes in soil only).
2. Invert levels of drain pipe at both ends.
3. Nominal diameter of drain pipe.
4. Pipe types: - cast iron/ vitrified clay/ precast concrete/ ductile iron/ polyvinyl chloride/ concrete porous/ unglazed clayware/ perforated plastic/ other pipes.
5. Bedding type: - bed/ bed and haunch/ bed and surround (for pipes in soil only).
6. Bedding dimensions.
7. Wrapping or lining to pipe (if any).
8. Painting to pipes (not for pipes in soil).
9. Pipe accessories.
10. Connecting to which manholes.
11. Method of jointing.

23.2.3 Quantity Take-off Guidelines

For the measurement of drain pipes, create a schedule with the following fields:

<Pipe Schedule>

A	B	C	D	E	F	G	H
Comments	Type	System Type	Material	Size	Bedding type	Bedding thickness	Length
FMH1.1-FMH1.2	PP_-___-PQS-CI_FWP-00	DR-FOUL	Cast Iron	375 mmø	CS	200	7726
FMH1.2-FMH1.3	PP_-___-PQS-CI_FWP-00	DR-FOUL	Cast Iron	375 mmø	CS	200	4380
FMH1.3-FMH1.4	PP_-___-PQS-CI_FWP-00	DR-FOUL	Cast Iron	375 mmø	CS	200	6900

- Pipes are measured along the centre lines of pipes over all bends, junctions and other pipe fittings. There is an alternative rule in HKSMM5 that all pipe fittings are enumerated, and pipework is measured along the centre lines of pipes only (i.e. not measured through pipe fittings).
- There is another alternative rule in HKSMM5 that drain pipes laid to or fixed to different backgrounds are not measured separately, and can be grouped together.

Adjust for the following as necessary:

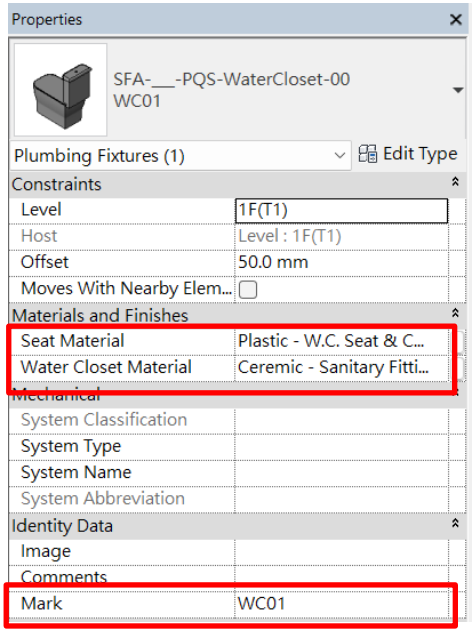
- Under HKSMM5, the length of pipes entering manholes are measured to the inside surfaces of manholes. A special preamble is required for measuring drain pipes up to the external wall of manholes if this is the modelling practice of the project.

Section 24 - Water Supply Systems and Disposal System

24.1 Sanitary fittings and ancillaries

24.1.1 Basic Modelling Approaches

Based on the plumbing fixtures template, a loadable family type for sanitary fitting is created and the object is placed in the designed location.



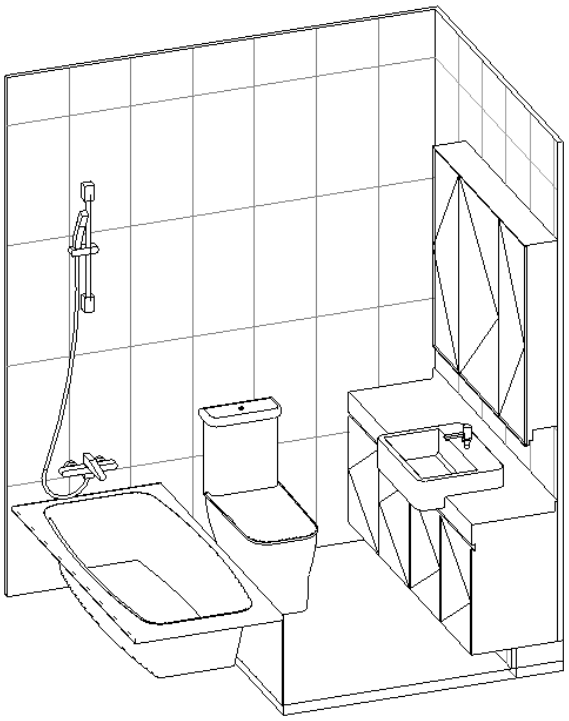


Figure 24.1.1 - 3D View of Sanitary Fittings

24.1.2 Information Requirements for Quantity Take-off

1. Type, size, surface finish and capacity of sanitary fittings.
2. Type marks or specification references.

24.1.3 Quantity Take-off Guidelines

For measurement of sanitary fitting, create a schedule with the following fields:

<Sanitary Fittings Schedule>

A	B	C	D
Family	Type	Mark	Count
SFA-___-PQS-Bathtub-00	BT_Type A	Type A	1
SFA-___-PQS-ShowerMixer-00	SM03	Type 03	1
SFA-___-PQS-WaterCloset-00	WC01	Type 01	1

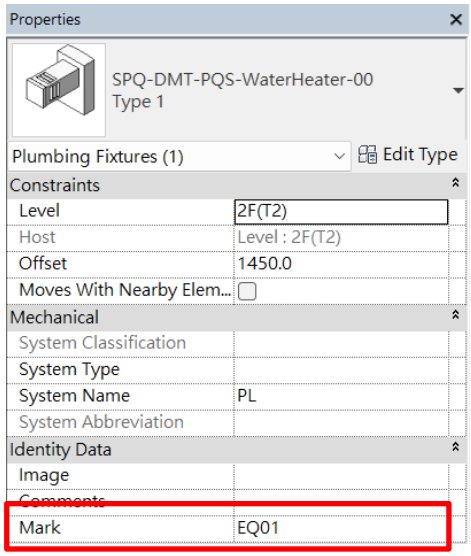
Adjust for the following as necessary:

- Nil

24.2 Equipment

24.2.1 Basic Modelling Approaches

Based on the plumbing fixtures template, a loadable family type for equipment is created and the object is placed in the designed location.



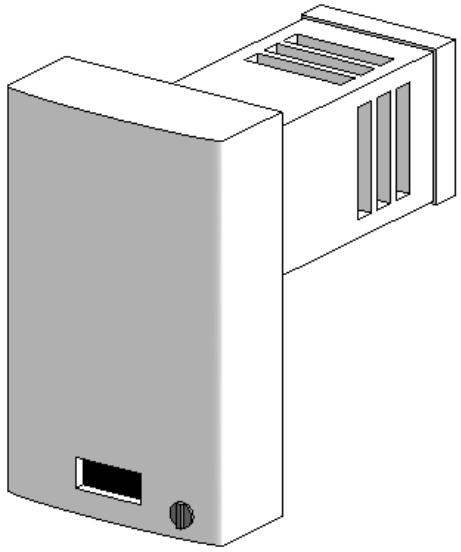


Figure 24.2.1 - 3D View of Gas Water Heater

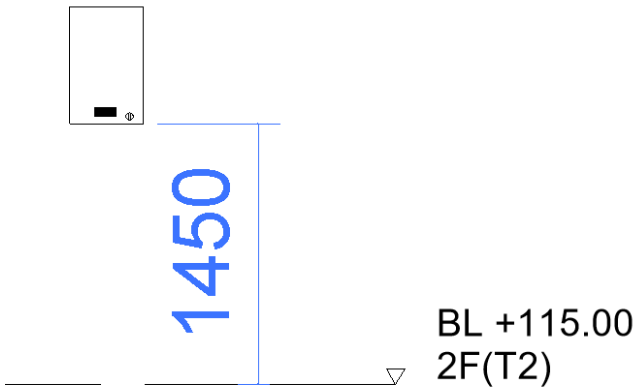


Figure 24.2.2 - Front Elevation of Gas Water Heater

24.2.2 Information Requirements for Quantity Take-off

1. Type, size, surface finish and capacity of equipment.
2. Type marks and specification references.
3. Fixing method including any backing and support.
4. Thermal insulation to equipment (if any).
5. Sound insulation to equipment (if any).

24.2.3 Quantity Take-off Guidelines

For measurement of Equipment, create a plumbing fixture schedule with the following fields:

<Equipment Schedule>

A	B	C	D
Family	Type	Mark	Count
SPQ-DMT-PQS-WaterHeater-00	Type 1	EQ01	1

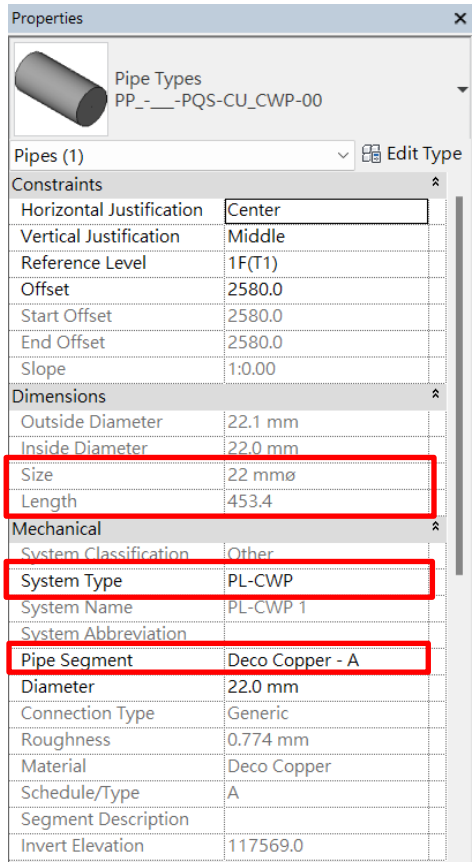
Adjust for the following as necessary:

- Nil

24.3 Water supply pipework

24.3.1 Basic Modelling Approaches

Based on the pipes template, a system family type for pipe is created by sketching the alignment of the pipeline. The relevant information can be extracted from the parameters such as system type, material, size, length, etc.



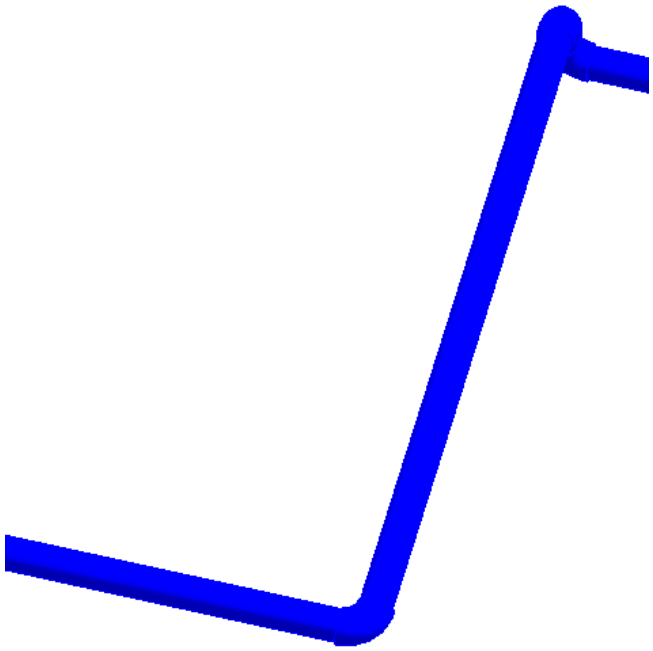


Figure 24.3.1 - 3D View of Pipework

24.3.2 Information Requirements for Quantity Take-off

1. System type.
2. Nominal diameter and material of pipe.
3. Any wrapping or insulation to pipe.
4. Painting to pipe.

24.3.3 Quantity Take-off Guidelines

For measurement of pipes, create a pipe schedule with the following fields:

- Sorting by type & size

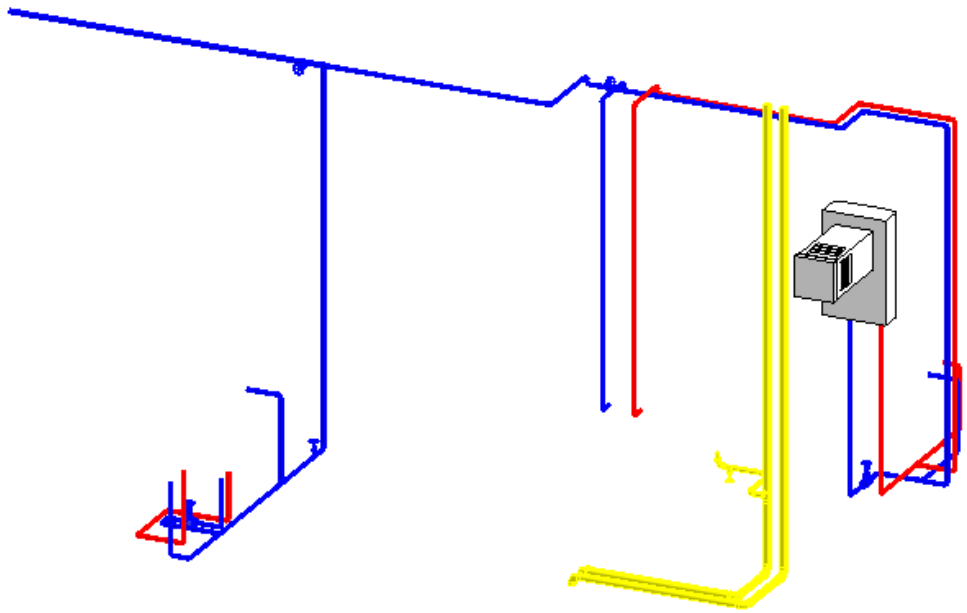


Figure 24.3.2 - 3D View of Pipework

<Pipe Schedule>

A	B	C	D	E	F
Type	System Type	Material	Size	Count	Length
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	35	17343
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	28 mmø	2	1903
PP_-___-PQS-CU_HWP-00	PL-HWP	Deco Copper	22 mmø	19	10779
PP_-___-PQS-PVC_FWP-00	PL-FWP	Plastic (3)	20 mmø	5	506
PP_-___-PQS-PVC_FWP-00	PL-FWP	Plastic (3)	32 mmø	9	8239

Also, can itemize each object to have a summary schedule as below:

<Pipe Schedule>

A	B	C	D	E	F
Type	System Type	Material	Size	Count	Length
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	453
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	249
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	442
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	2333
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	1387
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	408
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	330
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	53
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	789
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	82
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	431
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	194
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	506
PP_-___-PQS-CU_CWP-00	PL-CWP	Deco Copper	22 mmø	1	72

*The above image only shown part of the schedule

It should be noted that:

- As an alternative rule in HKSMM5, pipework fixed to different backgrounds is not measured separately, and can be grouped together.

For pipework diameter > 110mm

- The HKSMM5 stipulates that pipework is measured along the centre lines of pipes over all bends, junctions and other pipe fittings. Pipe fittings > 110mm nominal diameter are enumerated as extra over pipework.
- There is an alternative rule in HKSMM5 that all pipe fittings > 110mm nominal diameter are enumerated (instead of as extra over) for water supply systems, and pipework is measured along the centre lines of pipes only (i.e. not measured through pipe fittings).

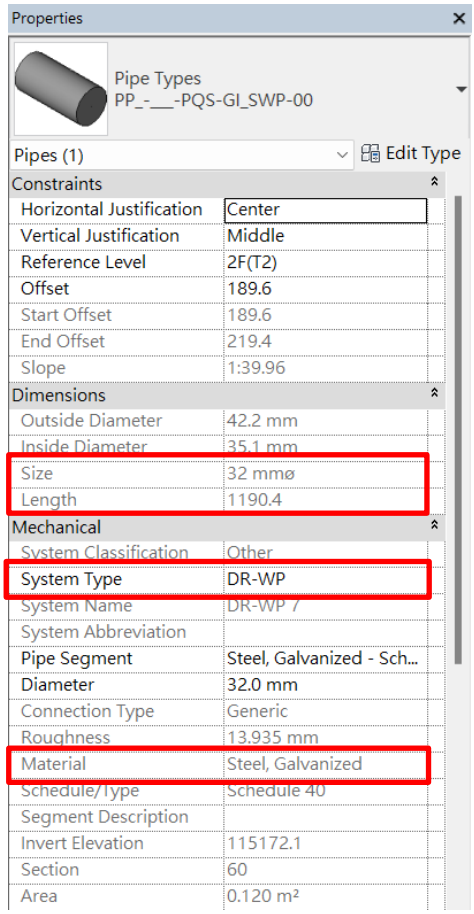
For pipework diameter <= 110mm

- For projects with full BIM information for pipework and fittings, the pipe lengths generated by Revit are the net lengths with gaps at fittings while HKSMM5 measures the pipe lengths through the fittings without deducting the gaps. Therefore, the Revit quantities for pipework <= 110mm nominal diameter have to be adjusted to suit (e.g. adding the length of gaps x number of fittings by type).
- As an alternative, for measurement of pipework of size <= 110mm nominal diameter, a special preamble should be given to measuring pipework along the centre lines of pipes only (i.e. not measured through pipe fittings), and all pipe fittings are enumerated.

24.4 Above ground drain pipework

24.4.1 Basic Modelling Approaches

Based on the pipes template, a system family type for pipe is created by sketching the alignment of the drain pipe. The relevant information can be extracted from the parameters such as system type, material, size, length, etc.



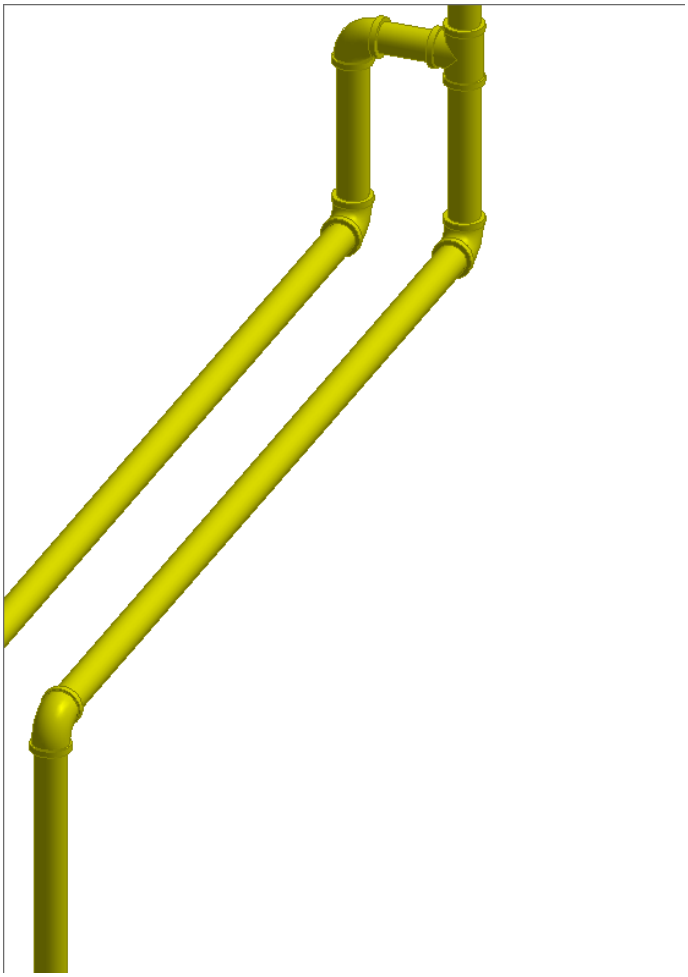


Figure 24.4.1 - 3D View of Drain Pipework

24.4.2 Information Requirements for Quantity Take-off

1. System type.
2. Nominal diameter and material of drainpipe.
3. Painting to drainpipe.

24.4.3 Quantity Take-off Guidelines

For measurement of drainpipes, create a pipe schedule with the following fields:

- Sorting by system type, type & size

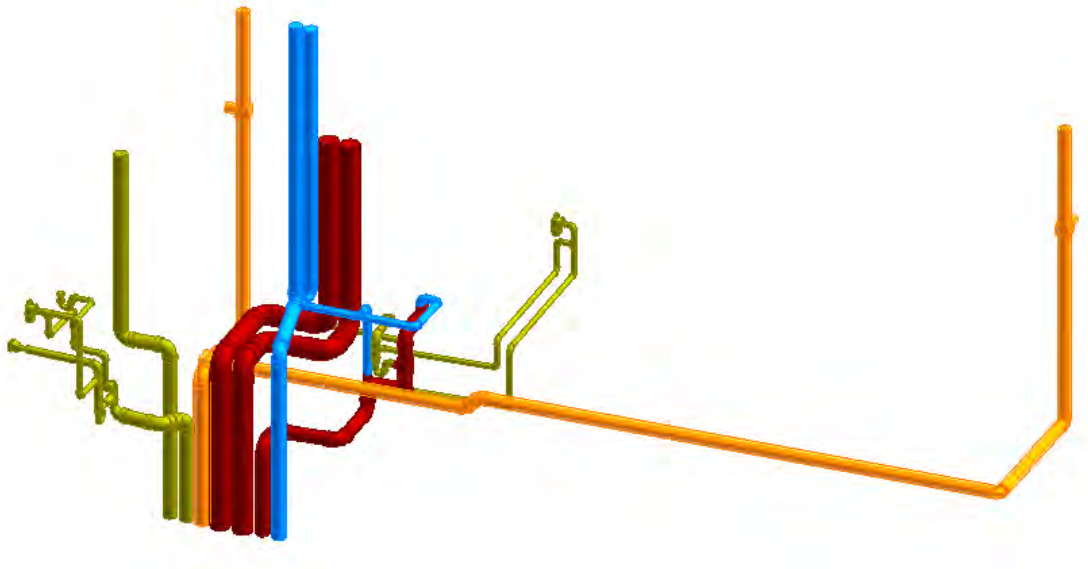


Figure 24.4.2 - 3D View of Drain Pipework

<Pipe Schedule>

A	B	C	D	E	F
Type	System Type	Material	Size	Count	Length
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	32 mmø	2	218
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	10	13619
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	80 mmø	3	1330
PP_-___-PQS-PVC_SWP-00	DR-SWP	Plastic	100 mmø	9	1714
PP_-___-PQS-PVC_SWP-00	DR-SWP	Plastic	150 mmø	9	6858
PP_-___-PQS-PVC_VP-00	DR-VP	Plastic	50 mmø	8	1866
PP_-___-PQS-PVC_VP-00	DR-VP	Plastic	100 mmø	4	7059
PP_-___-PQS-GI_SWP-00	DR-WP	Steel, Galvanized	32 mmø	15	5790
PP_-___-PQS-GI_SWP-00	DR-WP	Steel, Galvanized	40 mmø	15	3303
PP_-___-PQS-GI_SWP-00	DR-WP	Steel, Galvanized	50 mmø	8	1179
PP_-___-PQS-PVC_WP-00	DR-WP	Plastic	40 mmø	1	9
PP_-___-PQS-PVC_WP-00	DR-WP	Plastic	50 mmø	1	11
PP_-___-PQS-PVC_WP-00	DR-WP	Plastic	100 mmø	6	4258

Also, can itemize each object to have a detailed summary in the schedule:

<Pipe Schedule>

A	B	C	D	E	F
Type	System Type	Material	Size	Count	Length
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	32 mmø	1	97
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	32 mmø	1	122
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	1880
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	881
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	1691
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	883
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	1239
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	470
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	4542
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	1943
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	37
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	50 mmø	1	52
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	80 mmø	1	1275
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	80 mmø	1	16
PP_-___-PQS-PVC_CDP-00	DR-CDP	Plastic	80 mmø	1	40

*The above image only shown part of the schedule

It should be noted that:

- As an alternative rule in HKSMM5, drainpipe fixed to different backgrounds is not measured separately, and all pipe fittings are enumerated.

For pipework diameter > 110mm

- The HKSMM5 stipulates that the drainpipe is measured along the centre lines of pipes over all bends, junctions and other pipe fittings. Pipe fittings > 110mm nominal diameter are enumerated as extra over pipework.
- There is an alternative rule in HKSMM5 that for above ground disposal systems all pipe fittings > 110mm nominal diameter are enumerated (instead of as extra over), and drainpipe is measured along the centre lines of pipes only (i.e. not measured through pipe fittings).

For pipework diameter <= 110mm

- For projects with full BIM information for pipework and fittings, the pipe lengths generated by Revit are the net lengths with gaps at fittings while HKSMM5 measures the pipe lengths through the fittings without deducting the gaps. Therefore, the Revit quantities for pipework <= 110mm nominal diameter have to be adjusted to suit (e.g. adding the length of gaps x number of fittings by type).
- As an alternative, for measurement of pipework of size <= 110mm nominal diameter, a special preamble should be given to measuring pipework along the centre lines of pipes only (i.e. not measured through pipe fittings), and all pipe fittings are enumerated.
- Lengths of pipes are the actual inclined length (with slope), not the horizontal length (as measured on plan)

24.5 Pipe Fittings

24.5.1 Basic Modelling Approaches

Based on the pipe fittings template, a loadable family type for pipe fitting is created automatically by joining two pipes. The relevant information can be extracted from the parameters such as system type, material, size, etc.

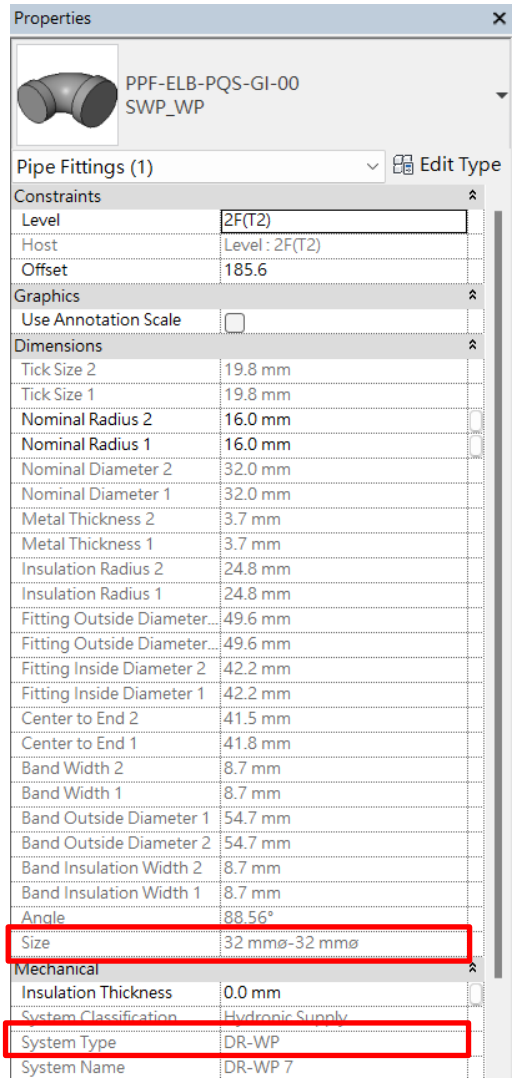


Figure 24.5.1 - 3D View of Bend

24.5.2 Information Requirements for Quantity Take-off

1. System type.
2. Nominal diameter and material of pipe fitting.
3. Painting to pipe fitting.

24.5.3 Quantity Take-off Guidelines

For measurement of pipe fittings, create a pipe fitting schedule with the following fields:

- Sorting by system type, type & size

<Pipe Fitting Schedule>

A	B	C	D	E
Family	Type	System Type	Size	Count
PPF-BND-PQS-PVC-00	CDP	DR-CDP	50 mmø-50 mmø	6
PPF-BND-PQS-PVC-00	CDP	DR-CDP	80 mmø-80 mmø	1
PPF-BND-PQS-PVC-00	SWP_SWP	DR-SWP	100 mmø-100 mmø	5
PPF-BND-PQS-PVC-00	SWP_SWP	DR-SWP	150 mmø-150 mmø	7
PPF-BND-PQS-PVC-00	VP	DR-VP	50 mmø-50 mmø	5
PPF-BND-PQS-PVC-00	VP	DR-VP	100 mmø-50 mmø	1
PPF-BND-PQS-PVC-00	VP	DR-VP	100 mmø-100 mmø	2
PPF-BND-PQS-PVC-00	SWP_WP	DR-WP	100 mmø-50 mmø	1
PPF-BND-PQS-PVC-00	SWP_WP	DR-WP	100 mmø-100 mmø	4
PPF-ELB-PQS-GI-00	SWP_WP	DR-WP	32 mmø-32 mmø	10
PPF-ELB-PQS-GI-00	SWP_WP	DR-WP	40 mmø-40 mmø	11
PPF-ELB-PQS-GI-00	SWP_WP	DR-WP	50 mmø-50 mmø	2
PPF-RDC-PQS-PVC-00	CDP	DR-CDP	80 mmø-50 mmø	1
PPF-TEE-PQS-GI-00	SWP_WP	DR-WP	32 mmø-32 mmø-32 mmø	1
PPF-TEE-PQS-GI-00	SWP_WP	DR-WP	40 mmø-32 mmø-32 mmø	1
PPF-TEE-PQS-GI-00	SWP_WP	DR-WP	40 mmø-40 mmø-32 mmø	1
PPF-TEE-PQS-GI-00	SWP_WP	DR-WP	40 mmø-40 mmø-40 mmø	1
PPF-TEE-PQS-GI-00	SWP_WP	DR-WP	50 mmø-40 mmø-50 mmø	1
PPF-TEE-PQS-GI-00	SWP_WP	DR-WP	50 mmø-50 mmø-32 mmø	1
PPF-TEE-PQS-GI-00	SWP_WP	DR-WP	50 mmø-50 mmø-40 mmø	1
PPF-TEE-PQS-PVC-00	CDP	DR-CDP	50 mmø-50 mmø-32 mmø	2
PPF-TEE-PQS-PVC-00	CDP	DR-CDP	80 mmø-80 mmø-50 mmø	1
PPF-TEE-PQS-PVC-00	SWP_SWP	DR-SWP	100 mmø-32 mmø-100 mmø	1
PPF-TEE-PQS-PVC-00	SWP_SWP	DR-SWP	100 mmø-50 mmø-100 mmø	1
PPF-TEE-PQS-PVC-00	SWP_SWP	DR-SWP	100 mmø-100 mmø-50 mmø	1
PPF-TEE-PQS-PVC-00	VP	DR-SWP	100 mmø-100 mmø-50 mmø	1
PPF-TEE-PQS-PVC-00	VP	DR-VP	50 mmø-50 mmø-50 mmø	1

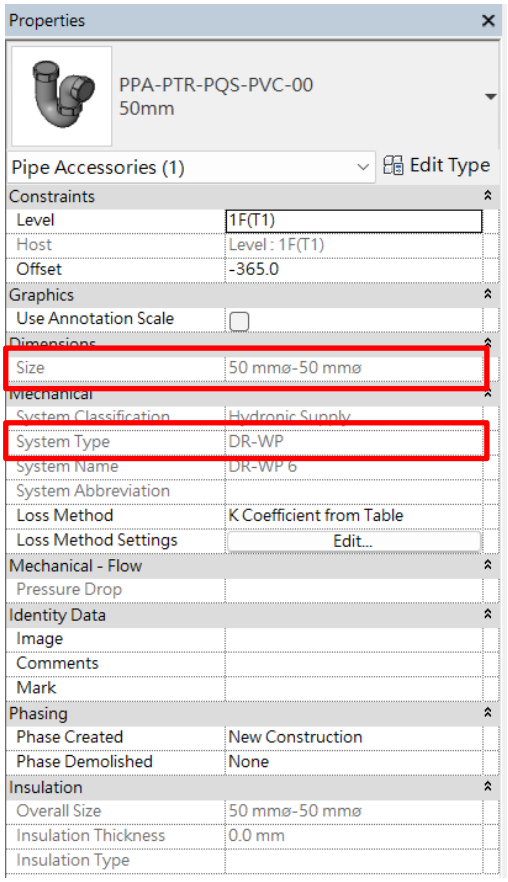
It should be noted that:

- There is an alternative rule in HKSMM5 that for above ground water supply and disposal systems all pipe fittings > 110mm nominal diameter are enumerated (instead of as extra over), and drainpipe is measured along the centre lines of pipes only (i.e. not measured through pipe fittings).
- For projects with full BIM information for pipework and fittings, suggest adding a special preamble for measuring all sizes of pipework along the centre lines of pipes only (i.e. not measured through pipe fittings), and all pipe fittings are enumerated.
- Refer to sections 24.3.3 and 24.4.3 above.

24.6 Pipe accessories

24.6.1 Basic Modelling Approaches

Based on the pipe accessories template, a loadable family type for accessories is created by joining to existing pipework. The relevant information can be extracted from the parameters such as system type, size, etc.



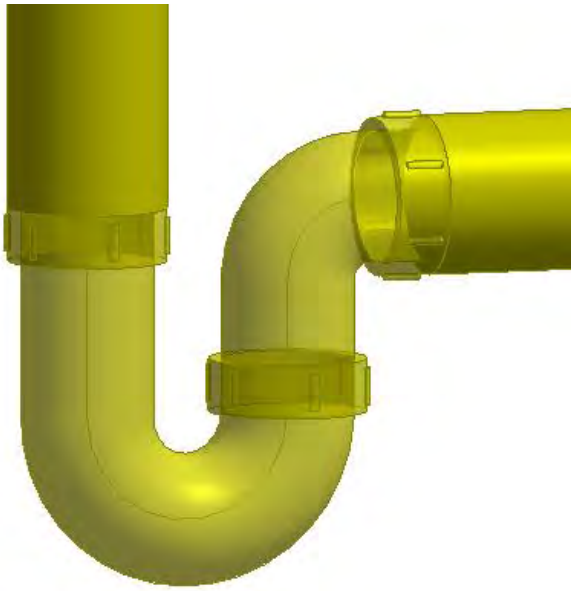


Figure 24.6.1 - 3D View of P Trap

24.6.2 Information Requirements for Quantity Take-off

1. System type in the type name.
2. Nominal size and material of pipe accessories.
3. Painting to pipe accessories.

24.6.3 Quantity Take-off Guidelines

For measurement of pipe accessories, create a pipe accessory schedule with the following fields:

- Sorting by system type, type & size

<Pipe Accessory Schedule>

A	B	C	D	E
Family	Type	System Type	Size	Count
PPA-ABT-PQS-PVC-00	32mm	DR-WP	32 mmø-32 mmø	1
PPA-ABT-PQS-PVC-00	40mm	DR-WP	40 mmø-40 mmø	1
PPA-DBB-PQS-PVC-00	40mm	DR-WP	40 mmø-32 mmø-32 mmø	1
PPA-MPT-PQS-PVC-00	32mm	DR-WP	32 mmø-32 mmø	1
PPA-PTR-PQS-PVC-00	50mm	DR-WP	50 mmø-50 mmø	2
PPA-VFD-PQS-PVC-00	50mm	DR-WP	50 mmø	2
Grand total: 8				

Adjust for the following as necessary:

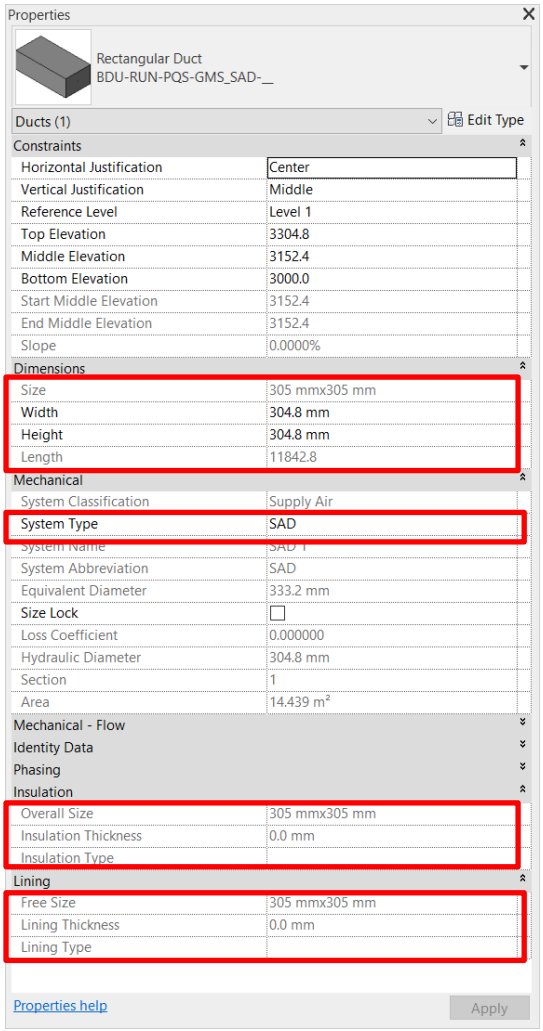
- Nil

Section 25 – Mechanical Systems

25.1 Ductwork

25.1.1 Basic Modelling Approaches

Based on the ducts template, a system family type for duct is created by sketching the alignment of the ductwork. The relevant information can be extracted from the parameters such as system type, material, size, length, etc.



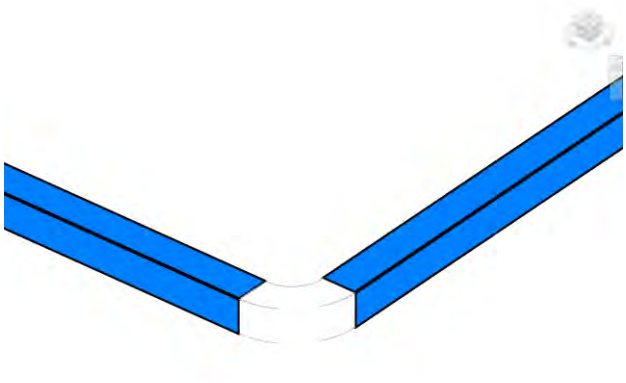


Figure 25.1.1 - 3D View of Ductwork

25.1.2 Information Requirements for Quantity Take-off

1. System type.
2. Kind and quality of material.
3. Size and thickness of material.
4. Wrapping & insulation/lining to ductwork (if any).
5. Painting to ductwork.

25.1.3 Quantity Take-off Guidelines

For measurement of ductwork, create a schedule with the following fields:

<Duct Schedule>

A	B	C	D	E	F	G	H
Family	Type	Width	Height	System Abbreviatio	System Classification	System Name	Length
Rectangular Duct	BDU-RUN-PQS-GMS_EAD-__	305 mm	305 mm	EAD	Exhaust Air	EAD 1	3995
Rectangular Duct	BDU-RUN-PQS-GMS_EAD-__	305 mm	305 mm	EAD	Exhaust Air	EAD 1	4495
Rectangular Duct	BDU-RUN-PQS-GMS_EAD-__	305 mm	305 mm	EAD	Exhaust Air	EAD 1	647
Rectangular Duct	BDU-RUN-PQS-GMS_SAD-__	305 mm	305 mm	SAD	Supply Air	SAD 1	11843
Rectangular Duct	BDU-RUN-PQS-GMS_SAD-__	305 mm	305 mm	SAD	Supply Air	SAD 1	13362
Rectangular Duct	BDU-RUN-PQS-GMS_SAD-__	305 mm	305 mm	SAD	Supply Air	SAD 1	2031

- In HKSMM5, the rates for mechanical systems cover setting and fixing in position on any background.
- Ductwork rectangular in section is measured the nett area of sheet material fabricated over all in-line fittings, short running, and branches, but not through in-line equipment. Where an in-line reduction in size occurs at a reducer or tee etc., the largest size shall be measured for the full length of the fitting.
- Ductwork circular or oval in section is measured along the centre lines of the duct and in-line fittings but not through in-line equipment**.** In-line fittings are measured extra over the circular or oval ducts.
- For projects with full BIM information for ductwork and fittings, suggest adding a special preamble for measuring all ductwork along the centre lines of ducts but not through in-line fittings; and all in-line fittings are enumerated.

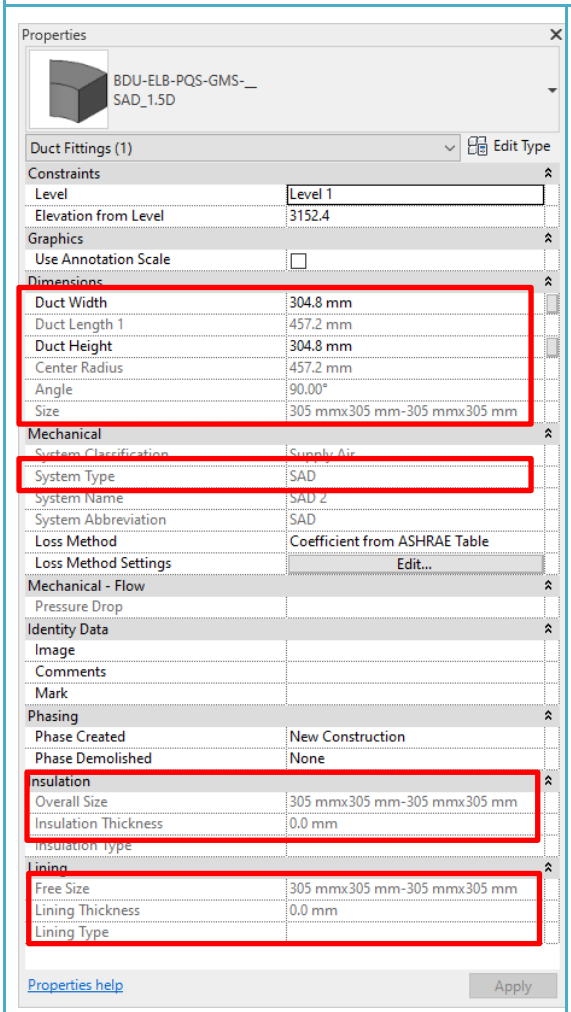
Adjust for the following as necessary:

- Nil.

25.2 Ductwork fittings

25.2.1 Basic Modelling Approaches

Based on the duct fittings template, a loadable family type for duct fitting is created by connecting two ducts. The relevant information can be extracted from the parameters such as system type, material, size, etc.



Shared Parameters, for the Duct Width, Height, Angle, and Center Radius of the duct fittings, shall be created for scheduling.

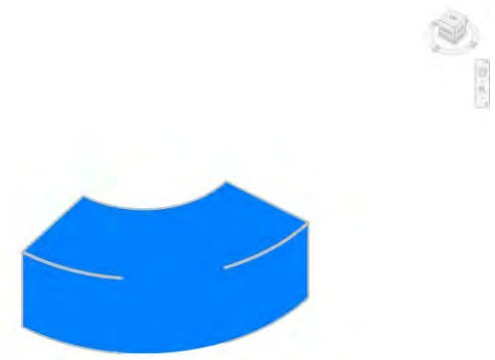


Figure 25.2.1 - 3D View of Duct Fitting

25.2.2 Information Requirements for Quantity Take-off

1. System type
2. Cross-sectional dimensions and material of duct fitting.
3. Wrapping & Insulation/Lining to duct fitting (if any).
4. Painting to duct fitting.

25.2.3 Quantity Take-off Guidelines

For measurement of rectangular ductwork fittings, create a schedule with the following fields:

<Duct Fitting Schedule>

A	B	C	D	E	F	G	H	I	J
Family	Type	System Abbreviation	Bend_Angle	Radius_Multiplier	Duct_Height	Duct_Width	Count	Duct Fitting Length	Duct Fitting Area
BDU-ELB-PQS-GMS-__	1.5W Radius	EAD	90.00°	1.5	305	305	1	718 mm	0.875 m²
BDU-ELB-PQS-GMS-__	1.5W Radius	EAD	90.00°	1.5	305	305	1	718 mm	0.875 m²

P.S. Centre Radius multiplier is given in the type name, being 1.5 times of duct width (W).

"Duct Length" from default parameters shall not be used to calculate the actual length of duct.

Based on HKSMM5, rectangular ductwork is measured the nett area of sheet material fabricated over all in-line fittings, short running and branches. For calculating nett area of sheet material of this fitting:

Duct Fitting Length (along centre line) = 2π*(1.5*Duct_Width)*(Bend_Angle/360°)

Duct Fitting Nett Area = 2*(Duct_Height + Duct_Width)*Duct Fitting Length

For measurement of circular or oval ductwork fittings, create a schedule with the following fields:

<Round Duct Fitting Schedule>

A	B	C	D	E	F	G	H
Family	Type	System Abbreviation	Bend_Angle	Radius_Multiplier	Duct_Diameter	Count	Duct Fitting Length
BDU-REL-PQS-GMS-__	1.5 D	SAD	90.00°	1.5	305	1	718 mm

P.S. Centre Radius multiplier is given in type name, being 1.5 times of duct diameter.

"Duct Length" from default parameters shall not be used to calculate the actual length of duct.

Based on HKSMM5, circular ductwork is measured along the centre lines of ducts and in-line fittings with extra overs in-line fittings being enumerated. For calculating the length of fitting,

Duct Fitting Length = 2π*(1.5*Duct_Diameter)*(Bend_Angle/360°)

It is suggested that:

- For projects with full BIM information for ductwork and fittings, add a special preamble for measuring all ductwork along the centre lines of ducts (i.e. not measured through in-line fittings), and all in-line fittings are enumerated.

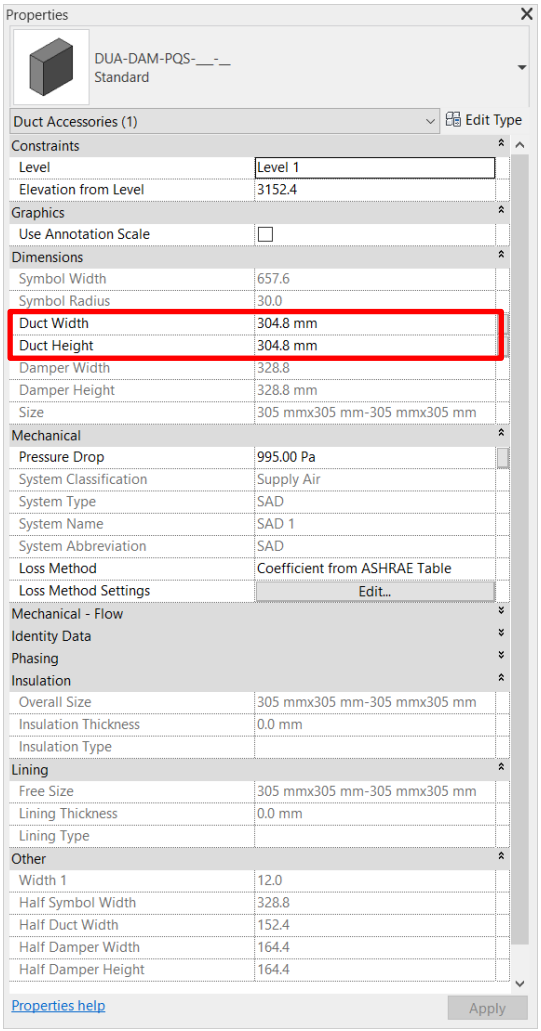
Adjust for the following as necessary:

- Nil.

25.3 Ductwork ancillaries

25.3.1 Basic Modelling Approaches

Based on the duct accessories template, a loadable family type for duct ancillary is created and put in the designed location. The relevant information can be extracted from the parameters such as system type, material, size, etc.



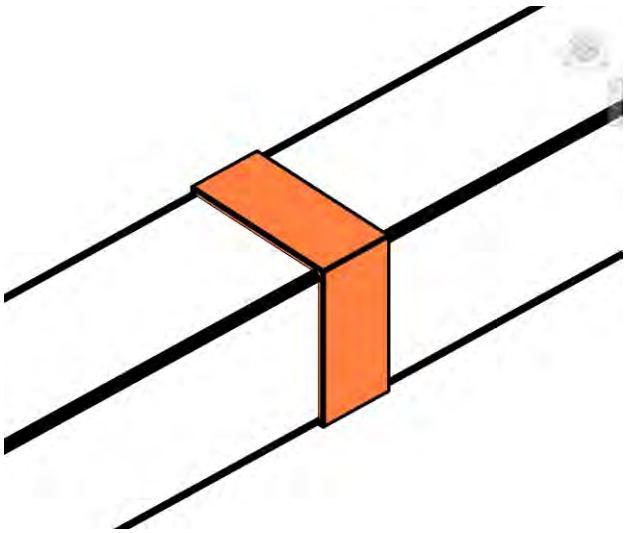


Figure 25.3.1 - 3D View of a Duct Damper

25.3.2 Information Requirements for Quantity Take-off

1. System type.
2. Cross-sectional dimensions and material of duct ancillary.
3. Wrapping & Insulation/Lining to duct fitting (if any).
4. Painting to duct ancillary.

25.3.3 Quantity Take-off Guidelines

For measurement of ductwork ancillaries, create a schedule with the following fields:

<Duct Ancillary Schedule>

A	B	C	D
Family	Type	System Abbreviation	Count
DUA-DAM-PQS-___-__	Standard	SAD	1

Adjust for the following as necessary:

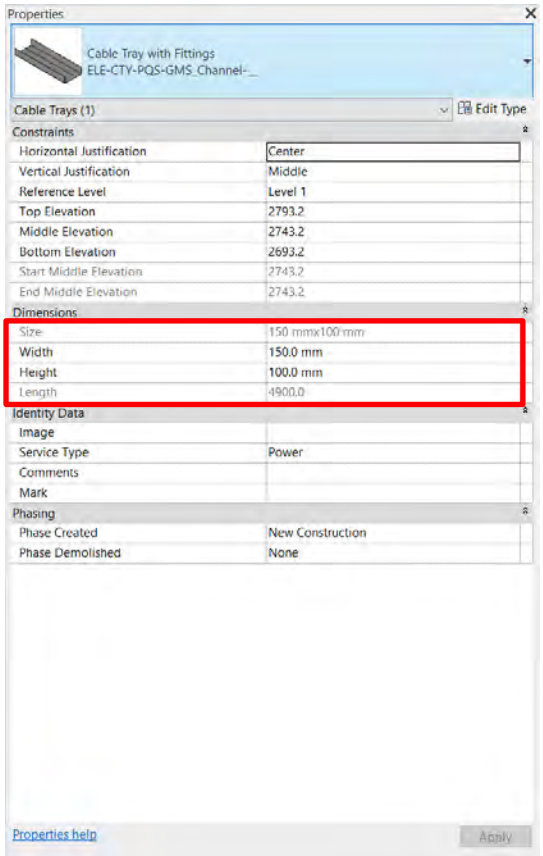
- Nil.

Section 26 – Electrical Systems

26.1 Cable Tray

26.1.1 Basic Modelling Approaches

Based on the cable trays template, a system family type for the cable tray is created by sketching the alignment of the cable tray. The relevant information can be extracted from the parameters such as material, size, length, etc.



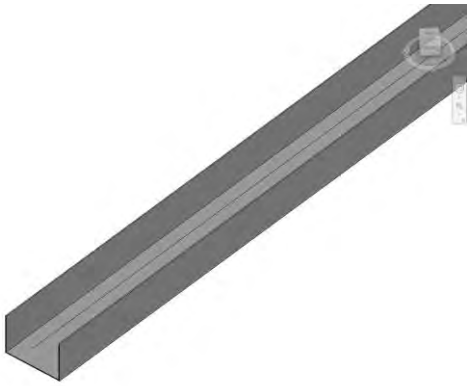


Figure 26.1.1 - 3D View of Cable Tray

26.1.2 Information Requirements for Quantity Take-off

1. Cross-sectional dimensions of cable tray.
2. Type and material of cable tray.
3. Painting to cable tray (if any).

26.1.3 Quantity Take-off Guidelines

For the measurement of cable tray, create a schedule with the following fields:

<Cable Tray Schedule>

A	B	C	D	E
Family	Type	Width	Height	Length
Cable Tray with Fittings	ELE-CTY-PQS-GMS_Channel-__	150 mm	100 mm	4900
Cable Tray with Fittings	ELE-CTY-PQS-GMS_Channel-__	150 mm	100 mm	7400
Cable Tray with Fittings	ELE-CTY-PQS-GMS_Channel-__	150 mm	100 mm	9000
Cable Tray with Fittings	ELE-CTY-PQS-GMS_Channel-__	150 mm	100 mm	10500
Cable Tray with Fittings	ELE-CTY-PQS-GMS_Channel-__	150 mm	100 mm	7585
Cable Tray with Fittings	ELE-CTY-PQS-GMS_Channel-__	150 mm	100 mm	13318
Cable Tray with Fittings	ELE-CTY-PQS-GMS_Channel-__	150 mm	100 mm	14740

- According to HKSMM5, trays and ladders are measured over all fittings, short lengths, and branches.
- For projects with full BIM information for trays and tray fittings, suggest adding a special preamble for measuring all trays along the centre lines of the trays but not measured through tray fittings; and all tray fittings are enumerated.

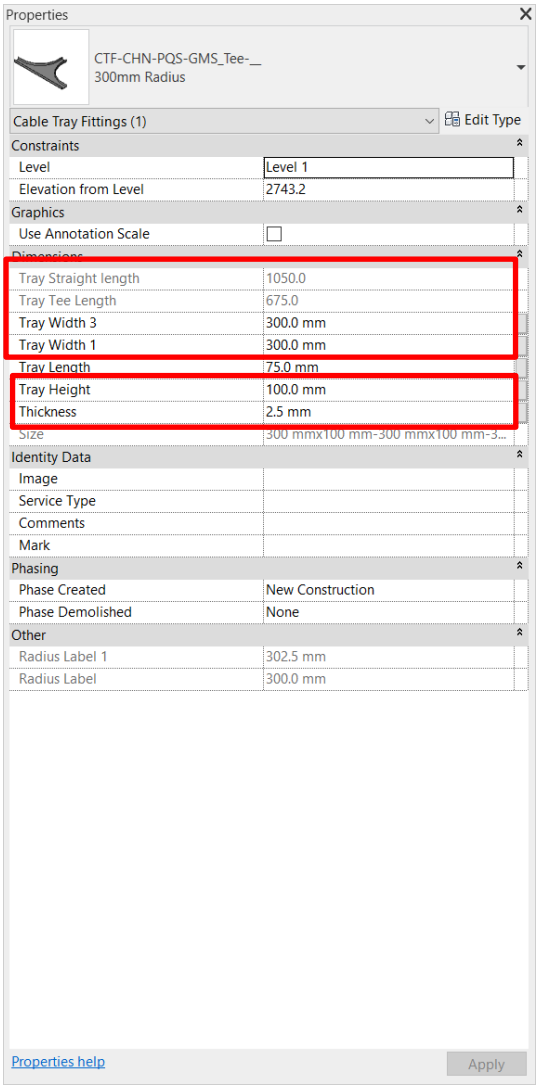
Adjust for the following as necessary:

- Nil.

26.2 Tray Fittings

26.2.1 Basic Modelling Approaches

Based on the tray fittings template, a loadable family type for tray fitting is created by connecting two cable trays. The relevant information can be extracted from the parameters such as material, size, etc.



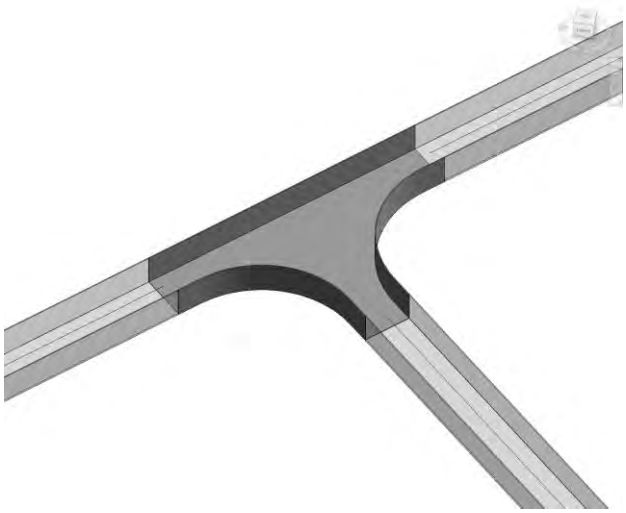


Figure 25.2.1 - 3D View of Cable Tray Fitting

26.2.2 Information Requirements for Quantity Take-off

1. Cross-sectional dimensions of tray fitting.
2. Material of tray fitting.
3. Painting to tray fitting (if any).

26.2.3 Quantity Take-off Guidelines

For measurement of tray fitting, create a schedule as below:

<Cable Tray Fitting Schedule>

A	B	C	D	E	F	G	H	I
Family	Type	Size	Count	Tee Straight Length	Tee-out length	Bend Radius (Cente	Fitting Bend Angle	Fitting Length
CTF-CHN-PQS-GMS_Bend-__	300mmx100mm	300 mmx100 mm-300 mmx100 mm	1			450	90.00°	707
CTF-CHN-PQS-GMS_Bend-__	300mmx100mm	300 mmx100 mm-300 mmx100 mm	1			450	90.00°	707
CTF-CHN-PQS-GMS_Bend-__	300mmx100mm	300 mmx100 mm-300 mmx100 mm	1			450	90.00°	707
CTF-CHN-PQS-GMS_Bend-__	300mmx100mm	300 mmx100 mm-300 mmx100 mm	1			450	90.00°	707
CTF-CHN-PQS-GMS_Bend-__	300mmx100mm	300 mmx100 mm-300 mmx100 mm	1			450	90.00°	707
CTF-CHN-PQS-GMS_Bend-__	300mmx100mm	300 mmx100 mm-300 mmx100 mm	1			450	90.00°	707
CTF-CHN-PQS-GMS_Bend-__	300mmx100mm(600R)	300 mmx100 mm-300 mmx100 mm	1			750	90.00°	1178
CTF-CHN-PQS-GMS_Tee-__	300mm Radius	300 mmx100 mm-300 mmx100 mm-300 mmx100 mm	1	1050	675			
CTF-CHN-PQS-GMS_Tee-__	300mm Radius	300 mmx100 mm-300 mmx100 mm-300 mmx100 mm	1	1050	675			
CTF-CHN-PQS-GMS_Tee-__	300mm Radius	300 mmx100 mm-300 mmx100 mm-300 mmx100 mm	1	1050	675			
CTF-CHN-PQS-GMS_Tee-__	300mm Radius	300 mmx100 mm-300 mmx100 mm-300 mmx100 mm	1	1050	675			

Note: "Tray Length" from default parameters shall not be used to calculate the actual length of tray.

For Bends,

Fitting Length (along centre line) = 2π*(Bend Radius(Centerline))*(Fitting Bend Angle/360^{o})

For Tees,

See "Tee Straight Length" and "Tee-out length

- According to HKSMM5, trays are measured over all fittings, short lengths and branches.
- For tray fittings > 200mm high or wide, the fittings are measured as extra over of the trays.
- For projects with full BIM information for trays and tray fittings, suggest adding a special preamble for measuring all trays along the centre lines of the trays but not measured through tray fittings; and all tray fittings are enumerated.

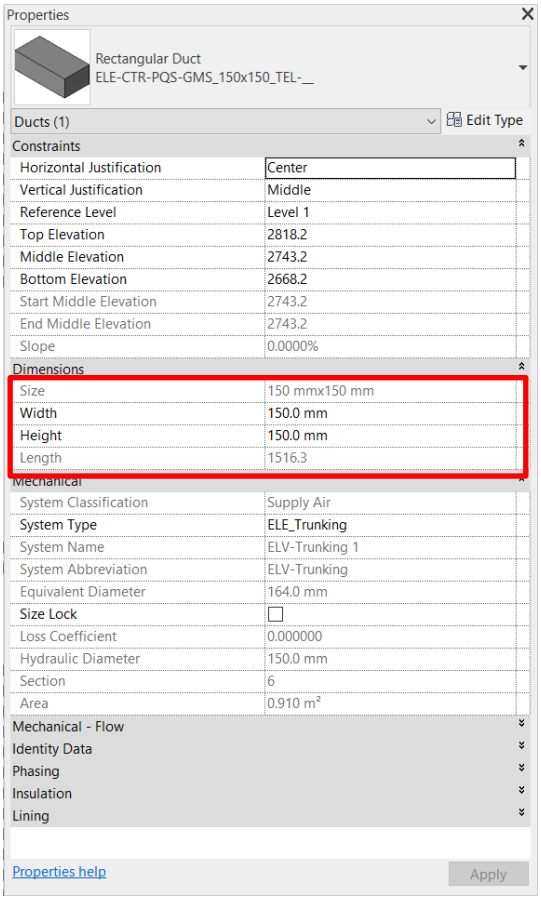
Adjust for the following as necessary:

- Nil.

26.3 Trunking

25.3.1 Basic Modelling Approaches

Based on the ducts template, a system family type for trunking is created. The relevant information can be extracted from the parameters such as type, material, size, length etc.



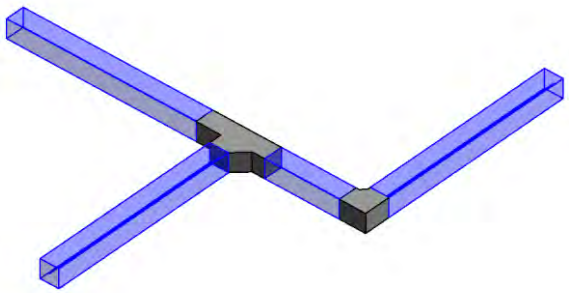


Figure 25.3.1 - 3D View of Cable Trunking

25.3.2 Information Requirements for Quantity Take-off

1. Type, material, and size of trunking.
2. Number and size of compartment.
3. Type of covers.
4. Painting to cable trunking (if any).

25.3.3 Quantity Take-off Guidelines

For the measurement of trunking, create a schedule with the following fields:

<Cable Trunking Schedule>

A	B	C	D	E
Family	Type	System Abbreviation	System Name	Length
Rectangular Duct	ELE-CTR-PQS-GMS_150x150_TEL-__	ELV-Trunking	ELV-Trunking 1	1565
Rectangular Duct	ELE-CTR-PQS-GMS_150x150_TEL-__	ELV-Trunking	ELV-Trunking 1	1525
Rectangular Duct	ELE-CTR-PQS-GMS_150x150_TEL-__	ELV-Trunking	ELV-Trunking 1	1516
Rectangular Duct	ELE-CTR-PQS-GMS_150x150_TEL-__	ELV-Trunking	ELV-Trunking 1	598

- According to HKSMM5, trunkings are measured over all trunking fittings, short lengths and branches.

- For projects with full BIM information for trunking and trunking fittings, suggest adding a special preamble for measuring all trunkings along the centre lines of the trunkings but not measured through trunking fitting; and all trunking fittings are enumerated.

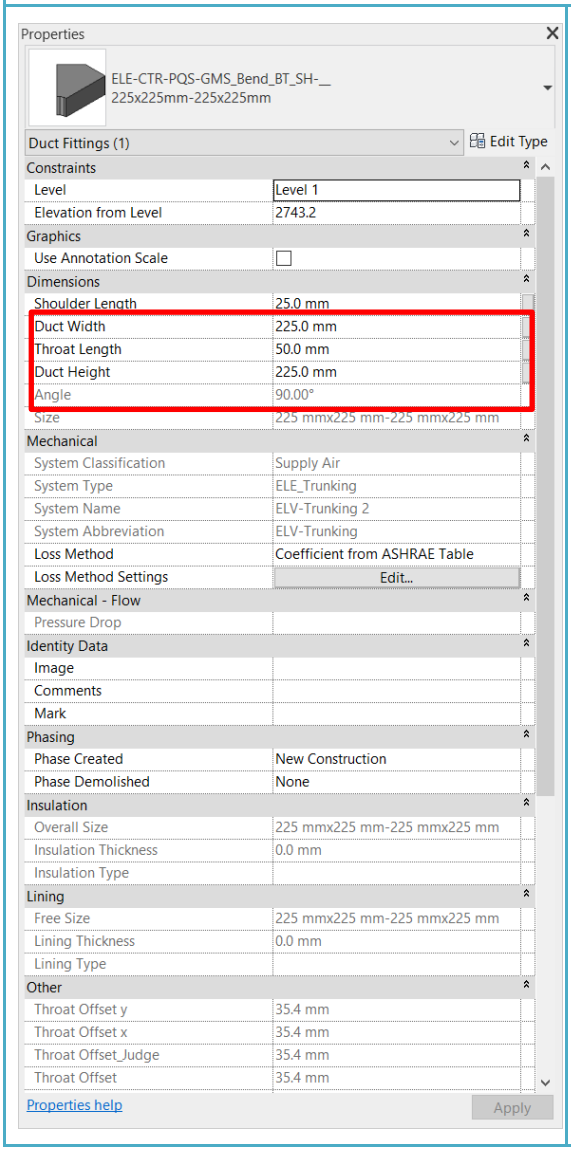
Adjust for the following as necessary:

- Nil.

26.4 Trunking fittings

26.4.1 Basic Modelling Approaches

Based on the duct fittings template, a loadable family type for trunking fitting is created by connecting two trunkings. The relevant information can be extracted from the parameters such as material, size, etc.



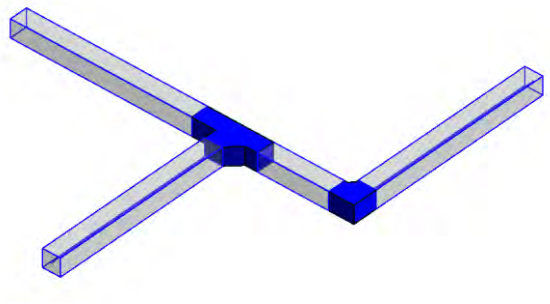


Figure 26.4.1 - 3D View of cable trunking fitting

26.4.2 Information Requirements for Quantity Take-off

1. Cross-sectional dimensions of trunking fitting.
2. Material of trunking fitting.
3. Painting to cable trunking (if any).

26.4.3 Quantity Take-off Guidelines

For the measurement of trunking fitting, create a schedule with the following fields:

<Cable Trunking Fitting Schedule>

A	B	C	D	E
Family	Type	System Abbreviation	System Name	Count
ELE-CTR-PQS-GMS_Bend_BT_SH-__	225x225mm-225x225mm	ELV-Trunking	ELV-Trunking 2	1
M_Rectangular Tee	Standard	ELV-Trunking	ELV-Trunking 2	1

- According to HKSMM5, trunkings are measured over all fittings, short lengths and branches.
- For trunking fittings > 200mm high or wide, the fittings are measured as extra over of the trunkings.
- For projects with full BIM information for trunkings and tray fittings, suggest adding a special preamble for measuring all trunkings along the centre lines of the trunkings (i.e. not measured through trunking fittings), and all trunking fittings are enumerated.

Adjust for the following as necessary:

- Nil.

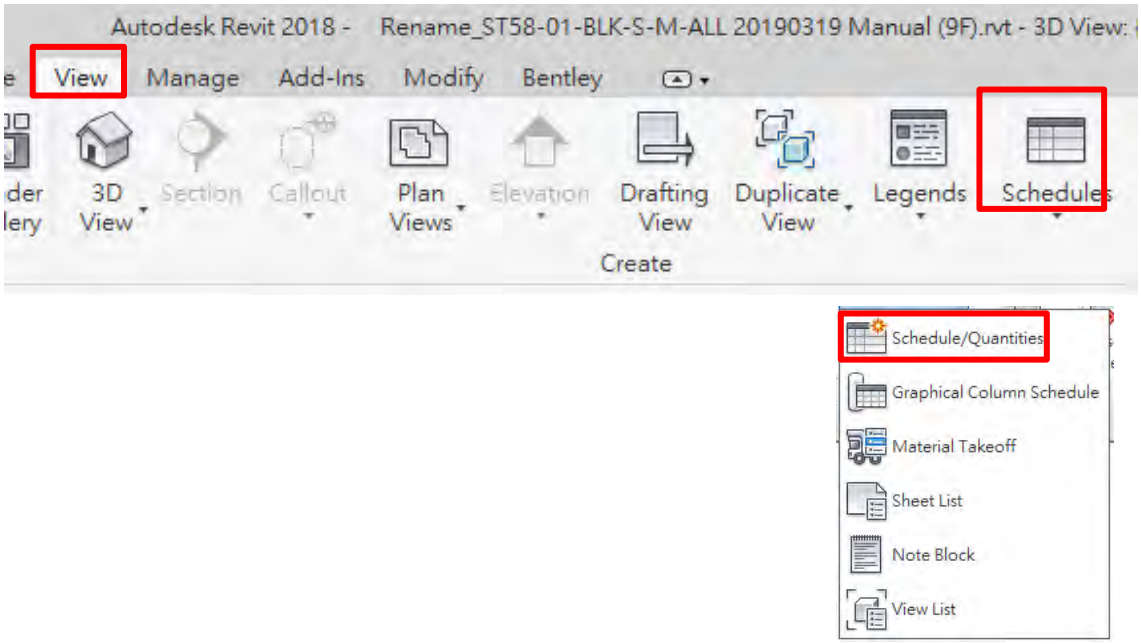
Part C – Essential Skills on Creating Schedules, Quantity Extraction and Generation from BIM Models

Section 27 Schedules and Material Take-off Schedules

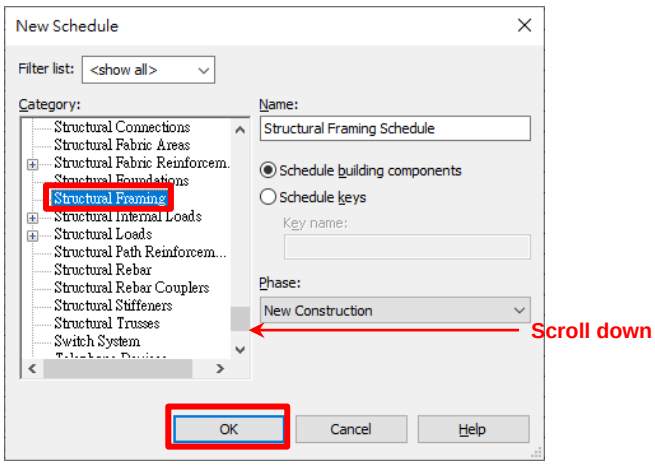
In Revit, Schedules / Material Take-off Schedules are used for extracting information and dimensions / quantities of model elements. Whilst only Material Take-off Schedules can extract the material quantities of the elements, e.g. the area applying the "**Paint**" function.

27.1 Create schedules

1. Click "**View**" > "**Schedules**" > "**Schedules/Quantities**".



2. Select the required category of the new schedule, e.g. Select "**Structural Framing**".



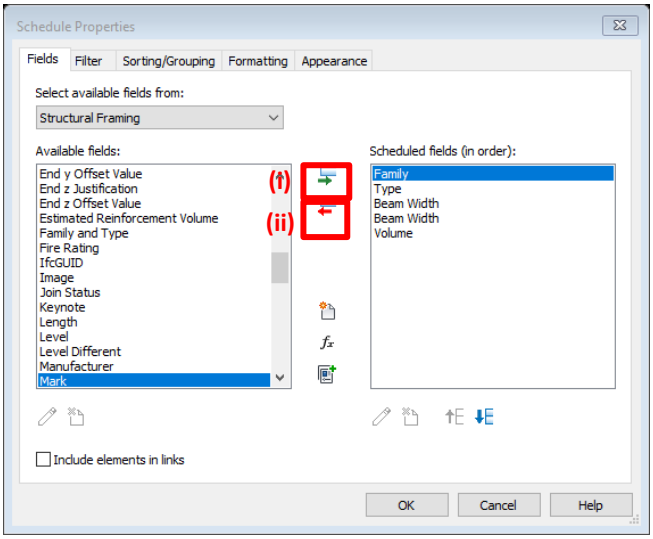
27.1 Create schedules (Cont'd)

3. Select available fields to be included in the schedule

A. Add / Remove parameters

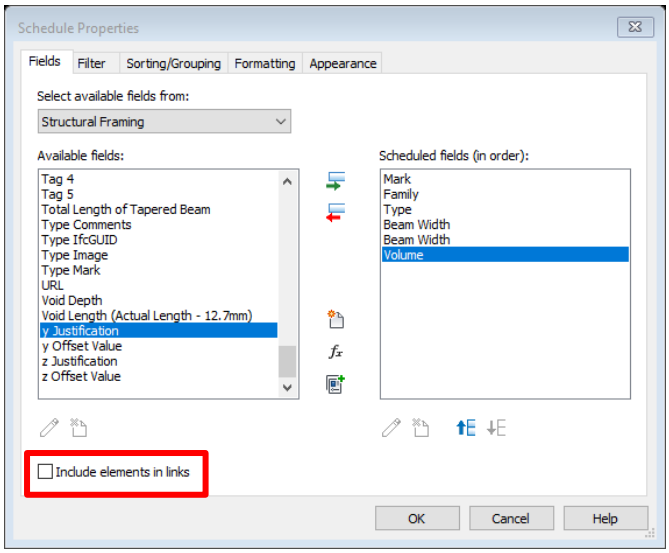
a. Add the required parameters: Double click the required parameter in "**Available fields**" column or click the required parameter in "**Available fields**" column and then click the button.

b. Remove unwanted parameters: Double click the unwanted parameter in "**Schedule fields**" column, e.g. "Volume" or select the unwanted parameter in "**Scheduled fields**" column and then click the button.



B. Include elements in linked files

If there are linked files in the model, select "**Include elements in links**" to include the elements from the linked files in the schedule.



27.1 Create schedules (Cont'd)

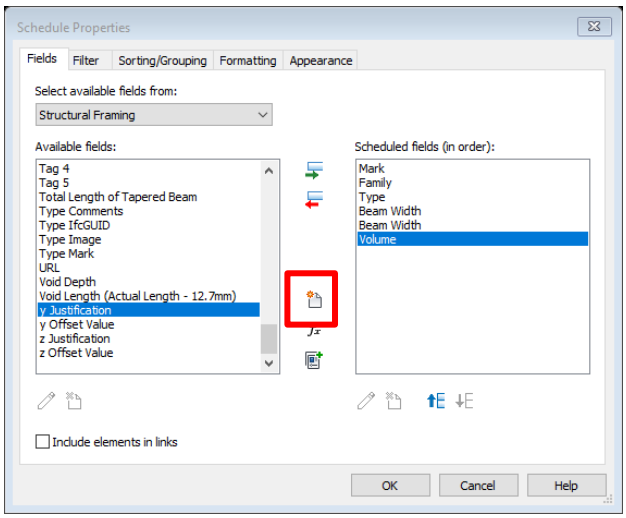
3. Select available fields to be included in the schedule (Cont'd)

C. Create a new parameter

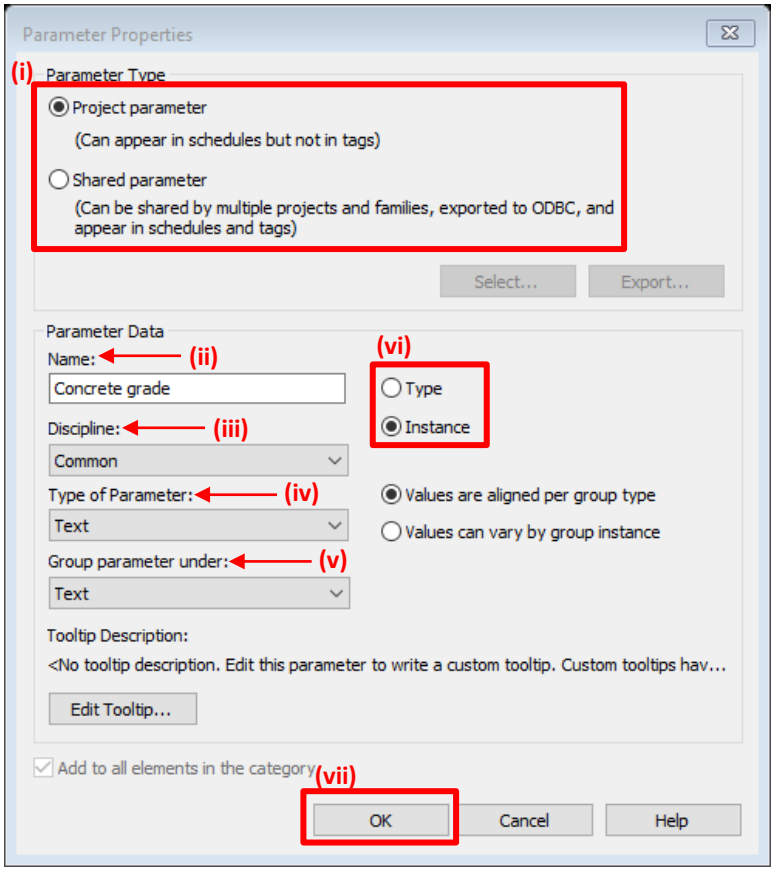
For a parameter that cannot be found in the "**Available fields**" column, it can be created in the schedule.

e.g. Add "**Concrete grade**" to the schedule.

a. Click the "**New parameter**" button  .



b. Complete the information for the new parameter



27.1 Create schedules (Cont'd)

3. Select available fields to be included in the schedule (Cont'd)

C. Create a new parameter (Cont'd)

b. Complete the information for the new parameter (Cont'd)

(i) Select the parameter type (project parameter or shared parameter).

Note: Project parameters are specific to a single project file and are used for scheduling, sorting, and filtering in a project, but cannot be tagged. Shared parameters can be used in multiple families or projects, and can be tagged and scheduled.

(ii) Input the name of parameter.

(iii) Select the discipline of parameter to be assigned.

(iv) Select the type of parameter.

Note: The type of parameter is chosen based on the selected discipline. For example, "Text" is for data information.

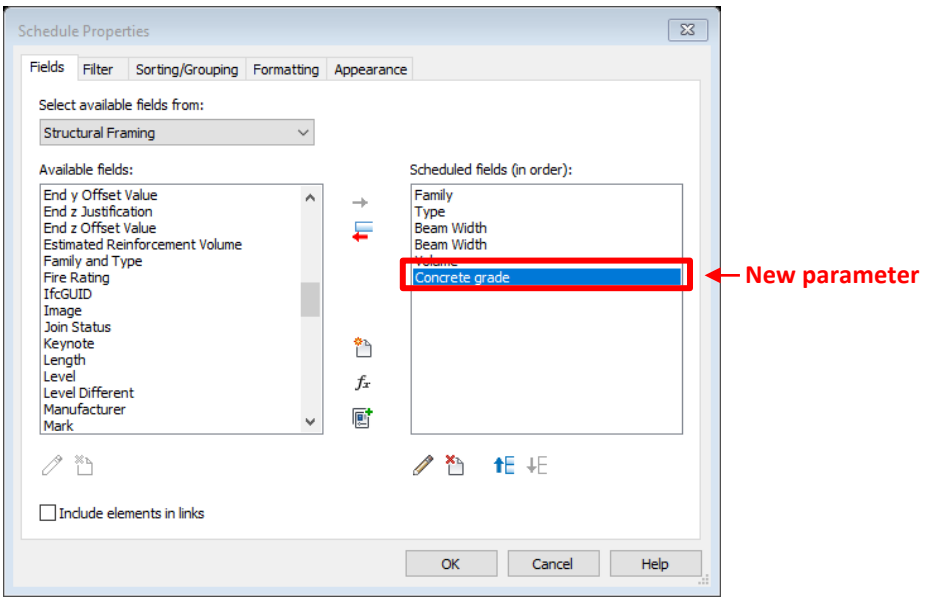
(v) Select the parameter to be grouped.

(vi) Select the type of properties.

Note: Type property is a value same to all elements in a family. Changing the value of a type property affects all current and future instances of that family type.

Instance properties can be assigned to all elements of a particular family type, and the values of instance properties may vary. Changing the value of an instance property affects the selected element only.

(vii) Click the **OK** button OK to confirm. The new parameter will appear in the scheduled fields.



27.1 Create schedules (Cont'd)

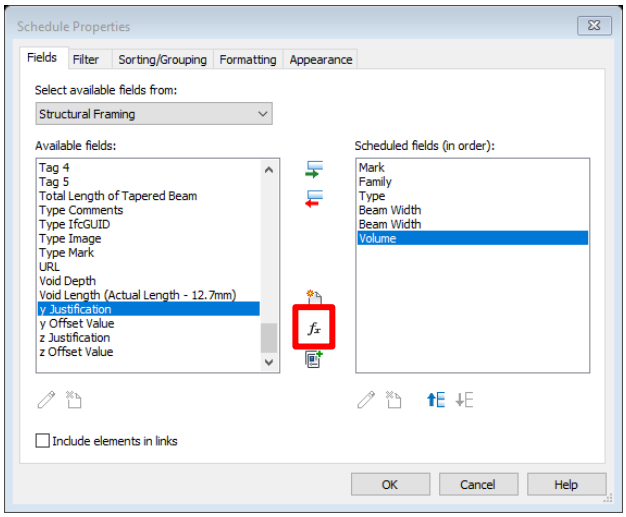
3. Select available fields to be included in the schedule (Cont'd)

D. Create calculated value

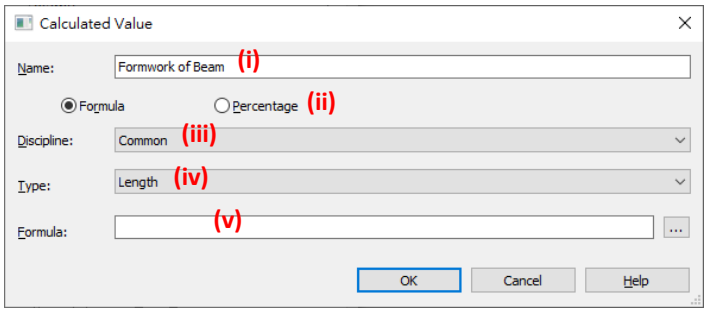
In the schedule, parameters can be created with setting formula. To set up the formula, required parameters have to be selected to the "**Scheduled fields**" column.

e.g. Create "**Formwork of Beam**" by setting formula "**Cut Length * (Beam Width + Beam Depth * 2 - [q Slab Thickness (1)] - [q Slab Thickness (2)])**".

a. Click "**Add calculated parameter**"  .



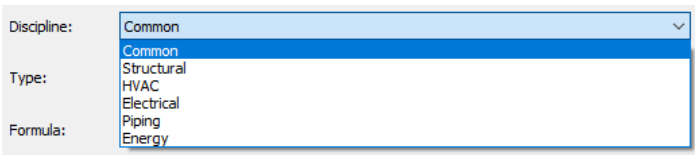
b. Complete the information of "**Calculated Value**".



(i) Input the new name of the parameter, e.g. "**Formwork of Beam**".

(ii) Click **Formula**  .

(iii) Choose the suitable discipline, e.g. Select "**Common**".



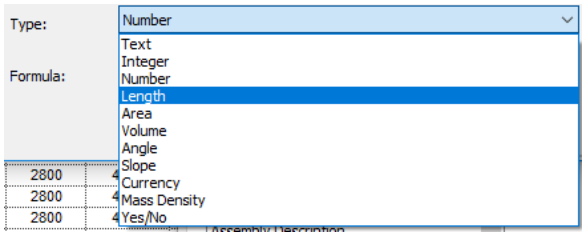
27.1 Create schedules (Cont'd)

3. Select available fields to be included in the schedule (Cont'd)

D. Create calculated value (Cont'd)

b. Complete the information of "**Calculated Value**" (Cont'd)

(iv) Choose the suitable type, e.g. Select "**Length**".

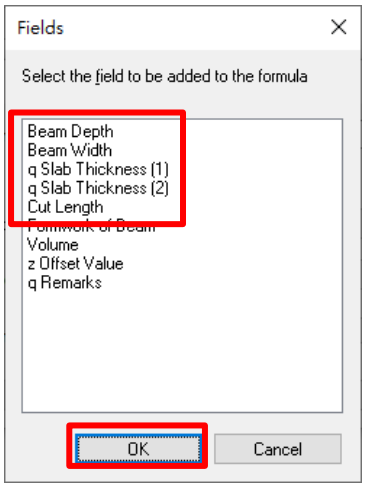


(v) Input Formula.

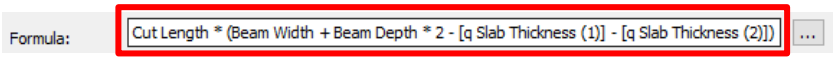
- Click the button ... .

- Select the required fields for formula set up. Only the fields added to the scheduled fields can be selected for creating formula.

  e.g. Select "**Beam Depth**", "**Beam Width**", "**q Slab Thickness (1)**", "**q Slab Thickness (2)**" and "**Cut Length**".



- Add corresponding **symbol(s)** e.g. "*****", "**+**", "**-**", to the appropriated positions.



- Once the formula set-up is completed, click "**OK**" of the Calculated Value.

27.1 Create schedules (Cont'd)

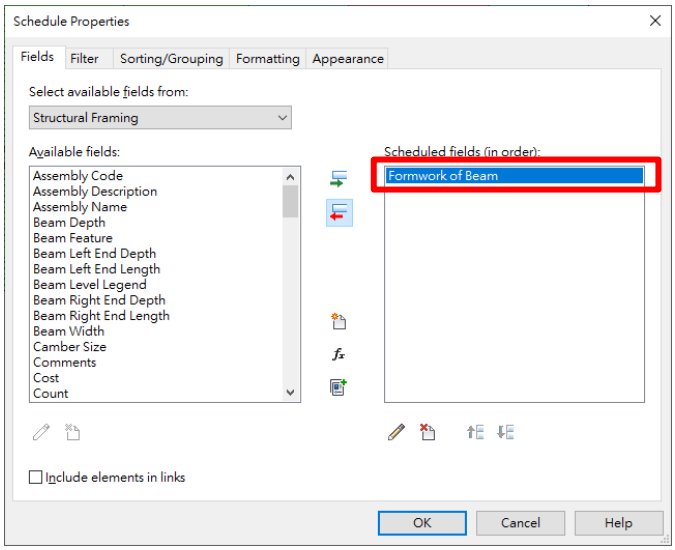
3. Select available fields to be included in the schedule (Cont'd)

D. Create calculated value (Cont'd)

b. Complete the information of "**Calculated Value**" (Cont'd)

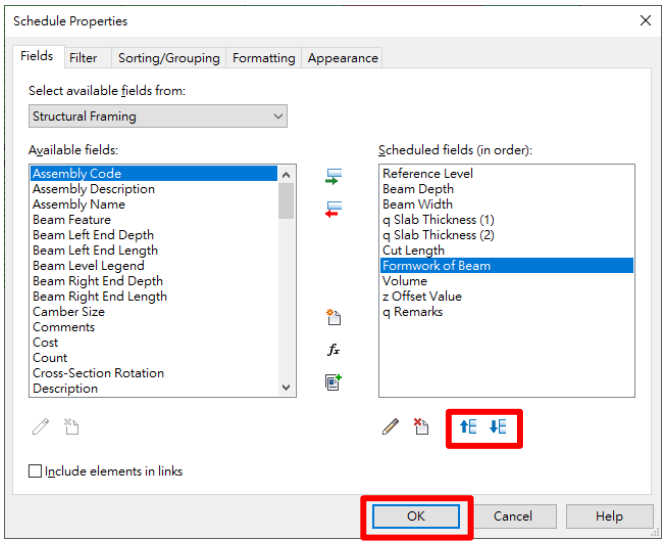
(v) Input Formula (Cont'd)

- The new parameter "**Formwork of Beam**" is created and shown in the scheduled fields.



E. Change order of selected fields

The order of parameters shown in the schedule is based on the order in the scheduled fields. To change the order of selected fields, it can use "⬆" and "⬇" for movement. e.g. select "**Formwork to Beam**" and move it above "**Volume**".



F. To complete the selection of fields, click "**OK**".

27.1 Create schedules (Cont'd)

4. The new schedule, e.g. "**Structural Framing Schedule**" is created.

<Structural Framing Schedule>

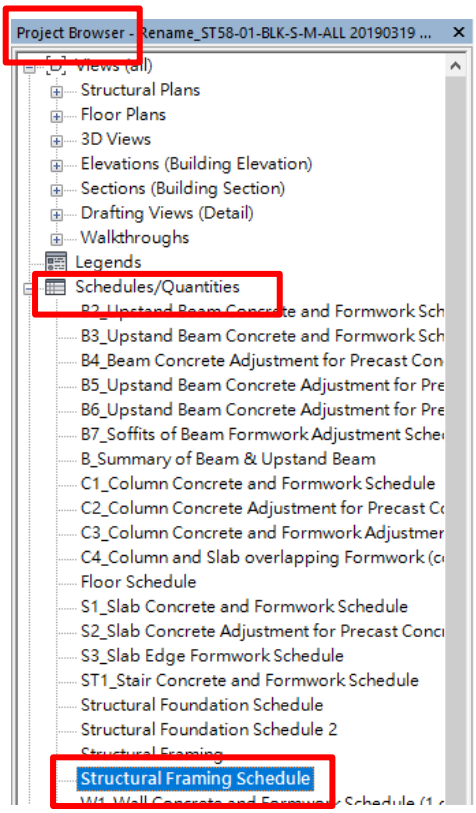
A	B	C	D	E	F	G	H
Reference Level	Beam Depth	Beam Width	q Slab Thickness (1)	q Slab Thickness (2)	Cut Length	Formwork of Beam (m2)	Volume (m3)
9/F_Typ. 1	400.00	300.00	160.00	160.00	1615.00	1.260	0.194
9/F_Typ. 1	400.00	300.00	160.00	160.00	1615.00	1.260	0.194
9/F_Typ. 1	400.00	250.00	160.00	160.00	1615.00	1.179	0.162
9/F_Typ. 1	400.00	300.00	160.00	0.00	500.00	0.470	0.060
9/F_Typ. 1	400.00	300.00	160.00	0.00	500.00	0.470	0.060
9/F_Typ. 1	500.00	300.00	350.00	0.00	1850.00	1.758	0.278
9/F_Typ. 1	400.00	200.00	350.00	0.00	700.00	0.455	0.056
9/F_Typ. 1	400.00	250.00	160.00	160.00	1615.00	1.179	0.162
9/F_Typ. 1	400.00	250.00	160.00	160.00	1615.00	1.179	0.162
9/F_Typ. 1	350.00	200.00	350.00	0.00	4730.00	2.602	0.331
9/F_Typ. 1	350.00	200.00	350.00	0.00	5600.00	3.080	0.392
9/F_Typ. 1	350.00	200.00	0.00	0.00	2365.00	2.129	0.166
9/F_Typ. 1	350.00	200.00	0.00	0.00	2365.00	2.129	0.166
9/F_Typ. 1	500.00	250.00	350.00	200.00	2600.00	1.820	0.325
9/F_Typ. 1	500.00	400.00	350.00	0.00	1530.00	1.607	0.306
9/F_Typ. 1	400.00	250.00	350.00	0.00	800.00	0.560	0.080
9/F_Typ. 1	500.00	400.00	350.00	0.00	2855.00	2.998	0.571
9/F_Typ. 1	400.00	250.00	160.00	160.00	1615.00	1.179	0.162
9/F_Typ. 1	400.00	300.00	350.00	0.00	700.00	0.525	0.084
9/F_Typ. 1	400.00	250.00	350.00	0.00	800.00	0.560	0.080
9/F_Typ. 1: 20						28.395	3.987

5. Rename schedules

The original naming of schedules is based on its category. After a schedule is created, the name of schedule can be changed for specific usage.

A. Select the new created schedule in the Project Browser.

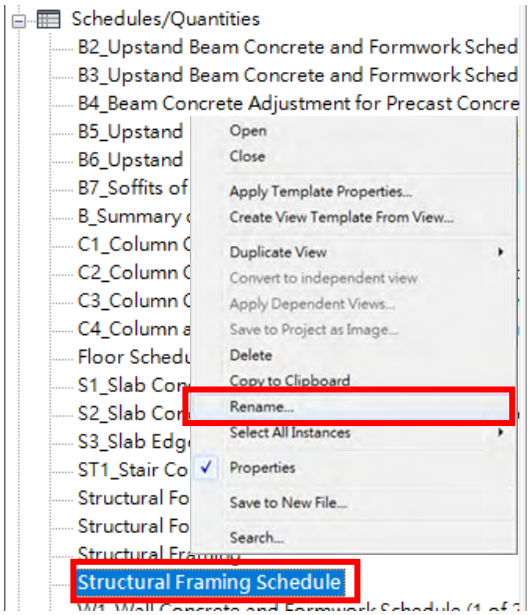
- "**Project Browser**" > "**Schedules/Quantities**" > "**Structural Framing Schedule**".



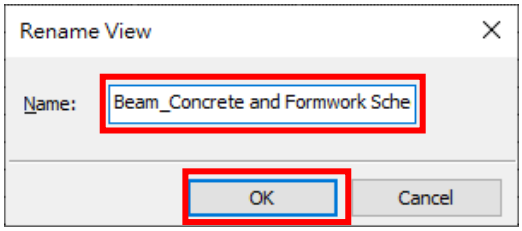
27.1 Create schedules (Cont'd)

5. Rename schedules (Cont'd)

B. Click the rename button by right click mouse and select "**Rename…**".



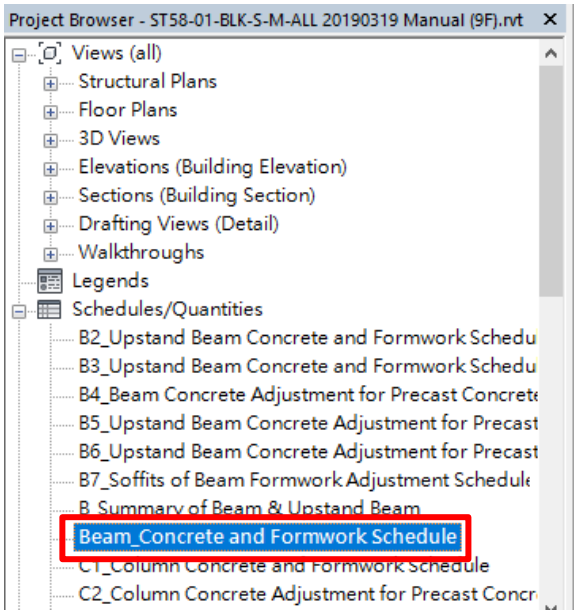
C. **Rename** the schedule (e.g. rename to "**Beam_Concrete and Formwork Schedule**") > "**OK**".



27.1 Create schedules (Cont'd)

5. Rename schedules (Cont'd)

The schedule is renamed to "**Beam_Concrete and Formwork Schedule**".

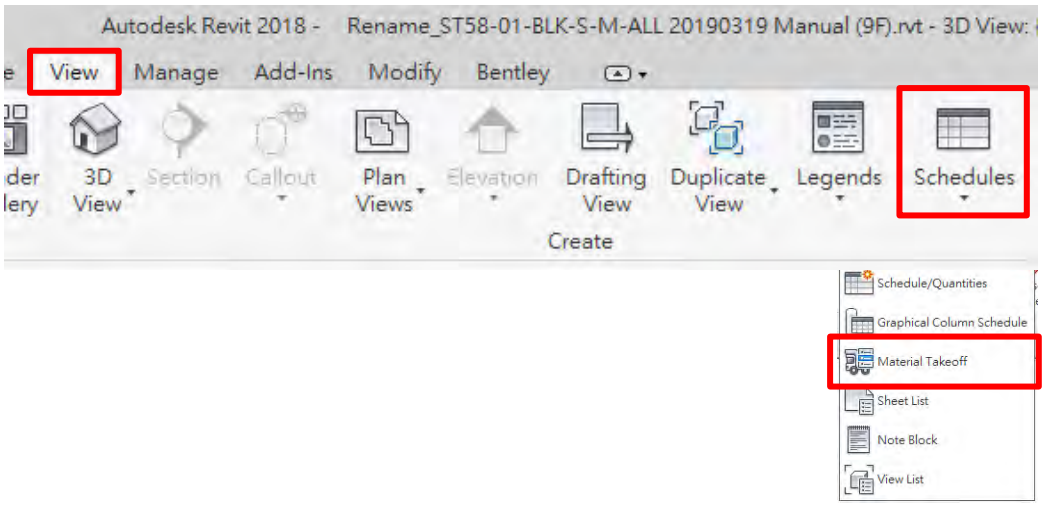


<Beam_Concrete and Formwork Schedule>

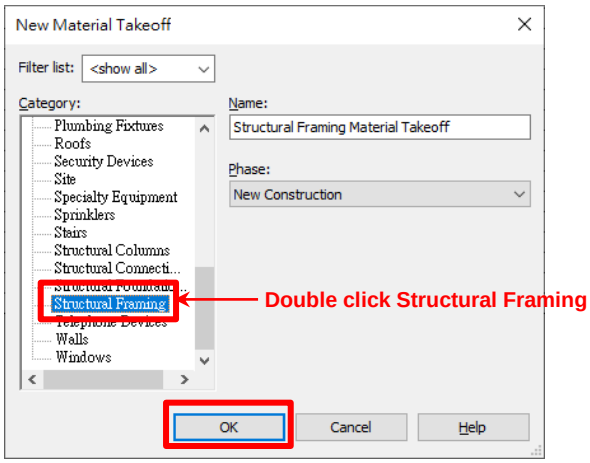
A	B	C	D	E	F	G	H
Reference Level	Beam Depth	Beam Width	q Slab Thickness (1)	q Slab Thickness (2)	Cut Length	Formwork of Beam (m2)	Volume (m3)
9/F_Typ. 1	400.00	300.00	160.00	160.00	1615.00	1.260	0.194
9/F_Typ. 1	400.00	300.00	160.00	160.00	1615.00	1.260	0.194
9/F_Typ. 1	400.00	250.00	160.00	160.00	1615.00	1.179	0.162
9/F_Typ. 1	400.00	300.00	160.00	0.00	500.00	0.470	0.060
9/F_Typ. 1	400.00	300.00	160.00	0.00	500.00	0.470	0.060
9/F_Typ. 1	500.00	300.00	350.00	0.00	1850.00	1.758	0.278
9/F_Typ. 1	400.00	200.00	350.00	0.00	700.00	0.455	0.056
9/F_Typ. 1	400.00	250.00	160.00	160.00	1615.00	1.179	0.162
9/F_Typ. 1	400.00	250.00	160.00	160.00	1615.00	1.179	0.162
9/F_Typ. 1	350.00	200.00	350.00	0.00	4730.00	2.602	0.331
9/F_Typ. 1	350.00	200.00	350.00	0.00	5600.00	3.080	0.392
9/F_Typ. 1	350.00	200.00	0.00	0.00	2365.00	2.129	0.166
9/F_Typ. 1	350.00	200.00	0.00	0.00	2365.00	2.129	0.166
9/F_Typ. 1	500.00	250.00	350.00	200.00	2600.00	1.820	0.325
9/F_Typ. 1	500.00	400.00	350.00	0.00	1530.00	1.607	0.306
9/F_Typ. 1	400.00	250.00	350.00	0.00	800.00	0.560	0.080
9/F_Typ. 1	500.00	400.00	350.00	0.00	2855.00	2.998	0.571
9/F_Typ. 1	400.00	250.00	160.00	160.00	1615.00	1.179	0.162
9/F_Typ. 1	400.00	300.00	350.00	0.00	700.00	0.525	0.084
9/F_Typ. 1	400.00	250.00	350.00	0.00	800.00	0.560	0.080
9/F_Typ. 1: 20						28.395	3.987

27.2 Create material take-off schedules

1. Click “**View**” > “**Schedules**” > “**Material Take-off**”.



2. Select the required category of the new Material Take-off, e.g. Select “**Structural Framing**”.

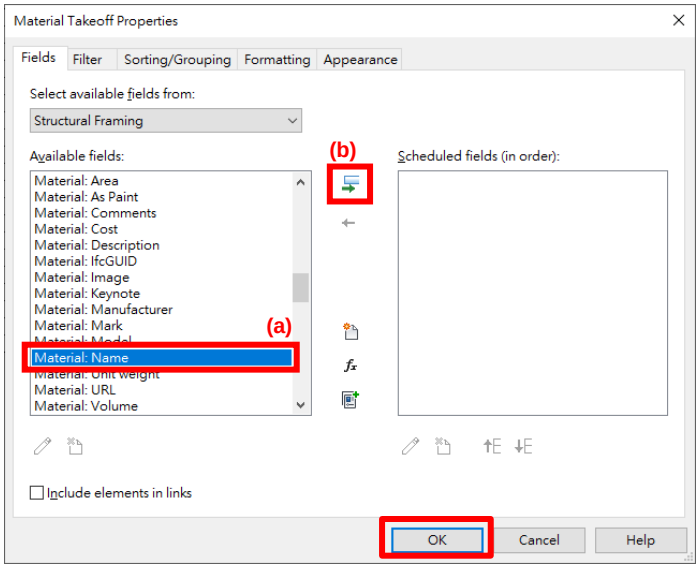


27.2 Create material take-off schedules (Cont'd)

3. Select available fields to be included in the Material Take-off Schedule.

   Add the required parameters from "**Available fields**" column to "**Scheduled fields**" column. At least one material field must be selected to Material Take-off Schedule. e.g. Material: Name / Material: Area.

   Double click the selected parameter in the "**Available fields**" column, or click the selected parameter in the "**Available fields**" column and click the botton.



   Details on selecting available fields, adding new parameters and Calculated Value with formula refer to Step 3 of Section 27.1 Create Schedules.

   After added / created the required parameters, click "**OK**".

4. The new Material Take-off Schedule is created.

<Structural Framing Material Takeoff>

A	B	C	D	E
Family	Type	Mark	Material: Name	Material: Area
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB40	Concrete - C40	5.235 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB40	Formwork	19.440 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB40	Blinding Layer	4.735 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB43	Concrete - C40	4.679 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB43	Formwork	14.715 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB43	Blinding Layer	3.679 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB49	Concrete - C40	3.425 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB49	Formwork	9.700 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB49	Blinding Layer	2.425 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB56	Concrete - C40	3.425 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB56	Formwork	9.700 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB56	Blinding Layer	2.425 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB4	Concrete - C40	1.830 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB4	Formwork	5.820 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB4	Blinding Layer	1.330 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB6	Concrete - C40	1.452 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB6	Formwork	4.310 m²
HD_Concrete - Rectangular Beam V04 TOS83	B1000x500	TB6	Blinding Layer	0.952 m²

5. Rename Material Take-off Schedules.

   The Material Take-off Schedule can be renamed for specific usage. Details refer to Step 5 of Section 27.1 Create Schedules.

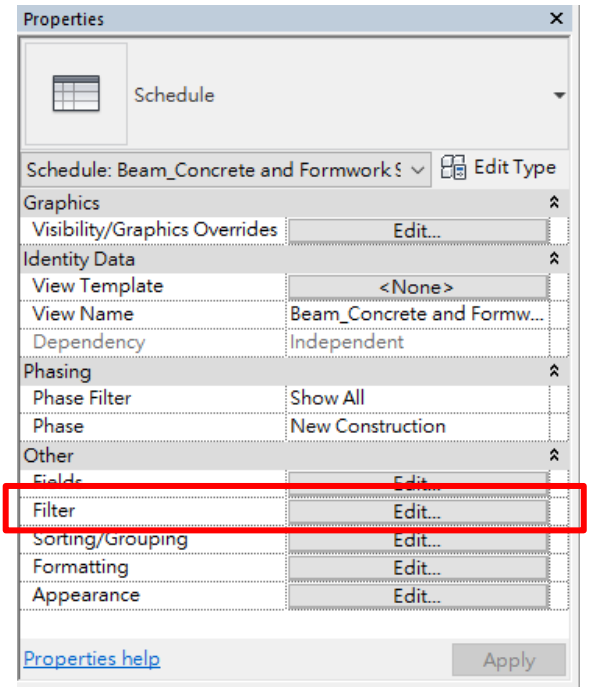
27.3 Functions of schedules / material take-off schedules

1. Use "Filter" of Schedules

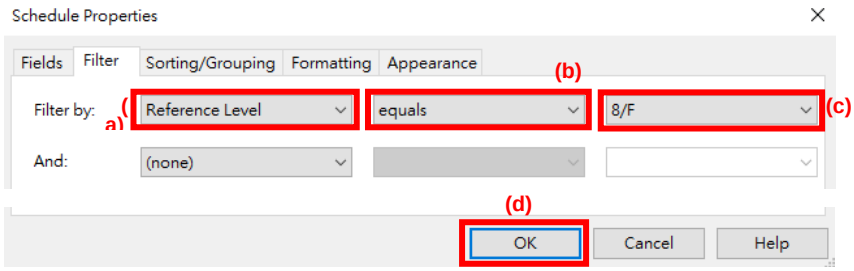
Filter can be used to sort out the elements with specific parameters / requirements.

A. Select the desired schedule in project browser and open the schedule.

B. Click the "**Edit**" button under **Filter** in the Properties of Schedule.



C. Set the filter requirements for parameters in the schedule.



a. Filter by "**Reference Level**".
b. Select "**equals**".
c. Select "**8/F**".
d. "**OK**".

27.3 Functions of schedules / material take-off schedules (Cont'd)

1. Use "Filter" of Schedules (Cont'd)

C. Set the filter requirements for parameters in the schedule (Cont'd)

The schedule is filtered by "**Reference Level – 8/F**".

<Beam_Concrete and Formwork Schedule>

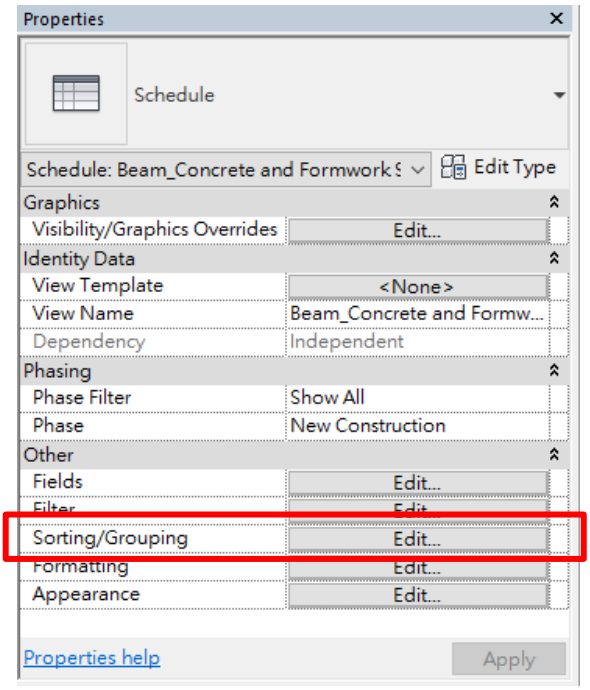
A	B	C	D	E	F	G	H
Reference Level	Beam Depth	Beam Width	q Slab Thickness (1)	q Slab Thickness (2)	Cut Length	Formwork of Beam (m2)	Volume (m3)
8/F	400.00	300.00			1615.00		0.194
8/F	400.00	300.00			1615.00		0.194
8/F	130.00	250.00			515.00		0.171
8/F	130.00	250.00			515.00		0.171
8/F	130.00	250.00			515.00		0.171
8/F	120.00	250.00			500.00		0.153
8/F	130.00	250.00			515.00		0.171
8/F	120.00	250.00			500.00		0.153
8/F	400.00	250.00			1615.00		0.162
8/F	400.00	250.00			1850.00		0.185
8/F	400.00	250.00			1850.00		0.185
8/F	400.00	250.00			1850.00		0.185
8/F	400.00	250.00			1850.00		0.185
8/F	400.00	300.00			500.00		0.060
8/F	400.00	300.00			500.00		0.060

2. Use "Sorting/Grouping" of Schedules

Sorting/Grouping can be used to sort/group the elements by the selected parameters.

A. Select the desired schedule in project browser and open the schedule.

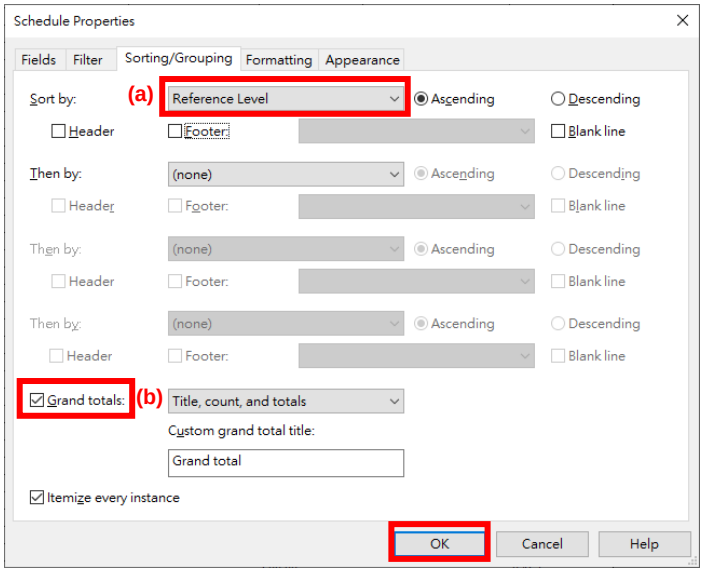
B. Click the "**Edit**" button under **Sorting/Grouping** in the Properties of Schedule.



27.3 Functions of schedules / material take-off schedules (Cont'd)

2. Use "Sorting/Grouping" of Schedules (Cont'd)

C. Select a field for sorting/grouping (e.g. sort by "**Reference Level**" and calculate the total no. of elements).



a. Sort by: "**Reference Level**" *(for sorting)*.

b. Tick "**Grand totals:**" *(for grouping)* > "**OK**".

D. The schedule is sorted by "**Reference Level**" and the total number of elements is showed at the bottom.

<Beam_Concrete and Formwork Schedule>

A	B	C	D	E	F	G	H
Reference Level	Beam Depth	Beam Width	q Slab Thickness (1)	q Slab Thickness (2)	Cut Length	Formwork of Beam (m2)	Volume (m3)
8/F	400.00	300.00			1615.00		0.194
8/F	400.00	300.00			1615.00		0.194
8/F	1330.00	250.00			515.00		0.171
8/F	1330.00	250.00			515.00		0.171
8/F	400.00	250.00			2015.00		0.232
8/F	400.00	250.00			2015.00		0.232
8/F	400.00	250.00			2015.00		0.232
8/F	400.00	250.00			2015.00		0.232
Grand total: 76						0.000	17.453

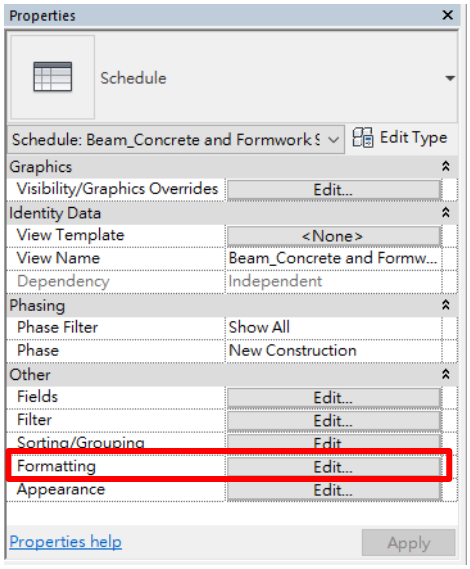
27.3 Functions of schedules / material take-off schedules (Cont'd)

3. Use "Formatting" of Schedules

Formatting can be used to set specific format / setting to the schedule.

A. Select the desired schedule in project browser and open the schedule.

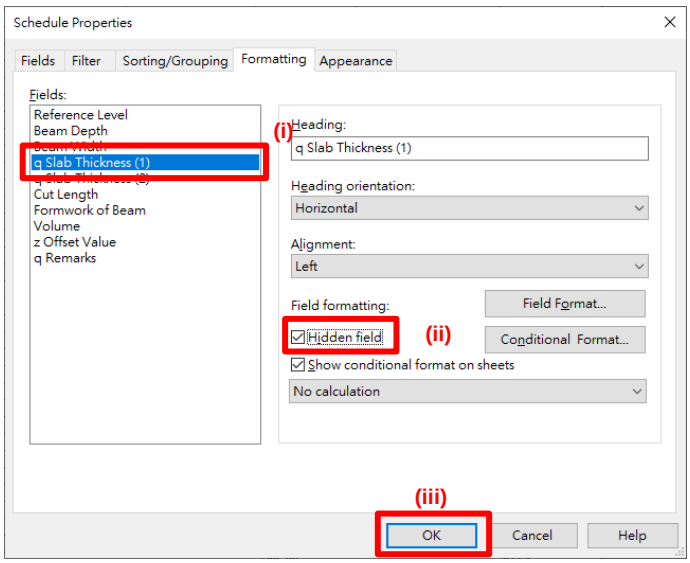
B. Click the "**Edit**" button under **Formatting** in the Properties of Schedule.



C. Format the schedules

a. Hide unwanted field

(e.g. fields used for creating formula only).



(i) Select the **unwanted field** (e.g. "**q Slab Thickness (1)**").

(ii) Tick the box "**Hidden field**".

(iii) "**OK**".

27.3 Functions of schedules / material take-off schedules (Cont'd)

3. Use “Formatting” of Schedules (Cont’d)

C. Format the schedules (Cont’d)

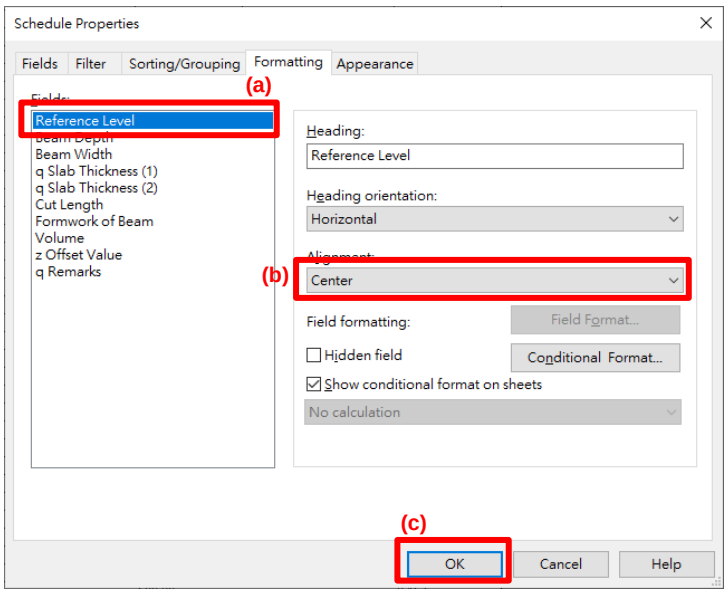
a. Hide unwanted field (Cont’d)

The selected field “**q Slab Thickness (1)**” will not show in the schedule.

<Beam_Concrete and Formwork Schedule>

A	B	C	D	E	F	G
Reference Level	Beam Depth	Beam Width	q Slab Thickness (2)	Cut Length	Formwork of Beam (m2)	Volume (m3)
8/F	400.00	300.00		1615.00		0.194
8/F	400.00	300.00		1615.00		0.194
8/F	1330.00	250.00		515.00		0.171
8/F	1330.00	250.00		515.00		0.171
8/F	1330.00	250.00		515.00		0.171
8/F	1220.00	250.00		500.00		0.153
8/F	1330.00	250.00		515.00		0.171
8/F	1220.00	250.00		500.00		0.153

b. Align the field to center



(i) Select the **field(s)** to be aligned (e.g. “**Reference Level**”).

(ii) Select “**Center**” under Alignment.

(iii) “**OK**”.

The “**Reference Level**” is aligned to “center”.

<Beam_Concrete and Formwork Schedule>

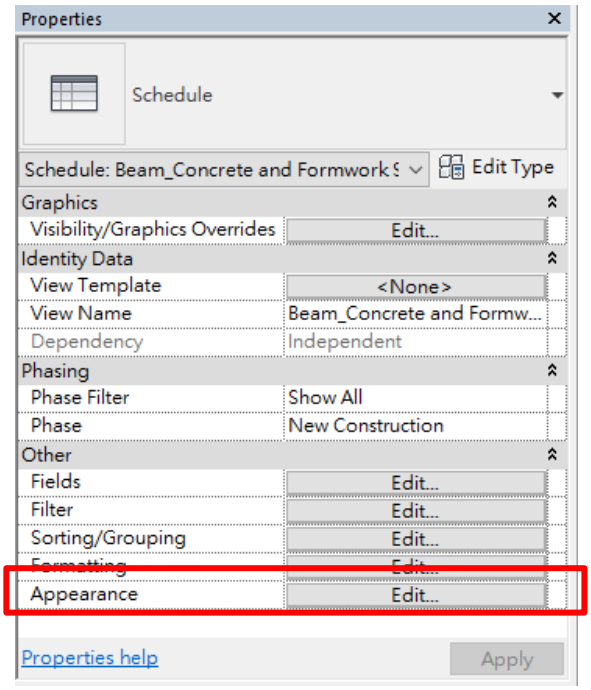
A	B	C	D	E	F	G
Reference Level	Beam Depth	Beam Width	q Slab Thickness (2)	Cut Length	Formwork of Beam (m2)	Volume (m3)
8/F	00.00	300.00		1615.00		0.194
8/F	00.00	300.00		1615.00		0.194
8/F	330.00	250.00		515.00		0.171
8/F	330.00	250.00		515.00		0.171
8/F	330.00	250.00		515.00		0.171
8/F	220.00	250.00		500.00		0.153
8/F	330.00	250.00		515.00		0.171
8/F	220.00	250.00		500.00		0.153

27.3 Functions of schedules / material take-off schedules (Cont’d)

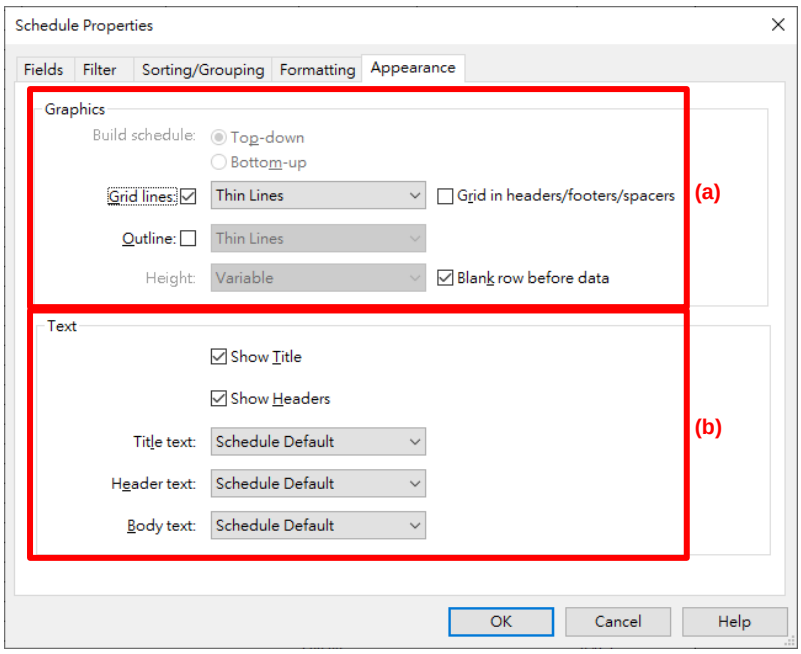
4. Use “Appearance” of Schedules

A. Select the desired schedule in project browser and open the schedule.

B. Click the "**Edit**" button under **Appearance** in the Properties of Schedule.



C. Select appropriated appearance for the Schedules / Material Take-off Schedules.



(i) Select the style of grid line / outline.

(ii) Select the text style for the title, header and body.

27.4 Add data information in the schedule

1. Add parameters to Individual Element

Once the information of parameters is added in the schedule, the relevant fields shown in the Properties will be updated, e.g. add "**Conc grade 60/20**" for beam mark B8-01.

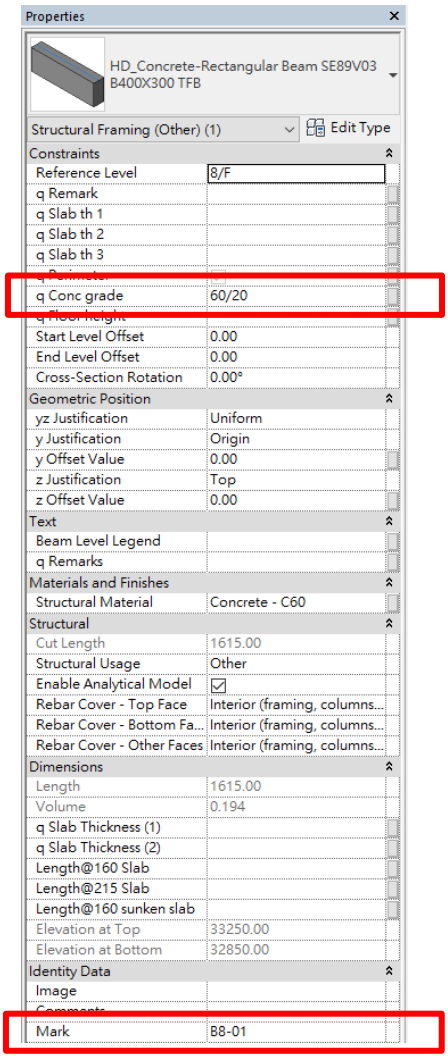
A. Click the beam Mark B8-01 in schedule.

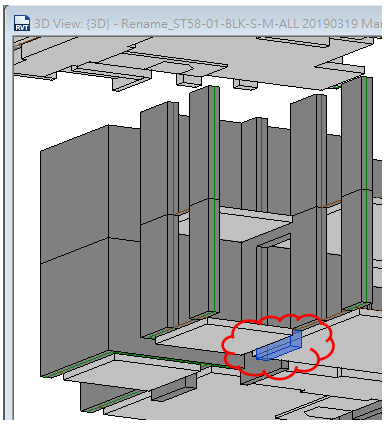
B. **Type** "**60/20**" under parameter "**q Conc grade**".

<Beam_Concrete and Formwork Schedule>

A	B	C	D	E	F	G	H	I	J
Reference Level	Beam Depth	Beam Width	q Slab Thickness (1)	q Slab Thickness (2)	Cut Length	Formwork of Beam (m2)	Volume (m3)	q Conc grade	Mark
8/F	400.00	300.00			1615.00		0.194	(b) 60/20	B8-01 (a)
8/F	400.00	300.00			1615.00		0.194		
8/F	1330.00	250.00			515.00		0.171		B8-03
8/F	1330.00	250.00			515.00		0.171		B8-04
8/F	1330.00	250.00			515.00		0.171		B8-05
8/F	1220.00	250.00			500.00		0.153		B8-06
8/F	1330.00	250.00			515.00		0.171		B8-07
8/F	1220.00	250.00			500.00		0.153		B8-08

The information of the parameter is updated to the Properties automatically. Such kind of adding information in models by QS should be done in the models for QTO only.

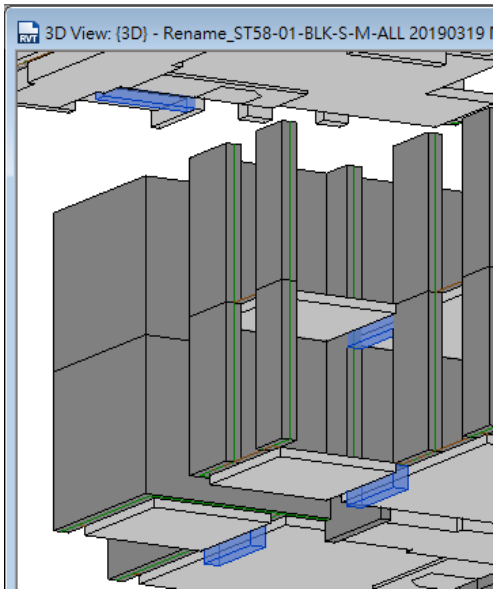




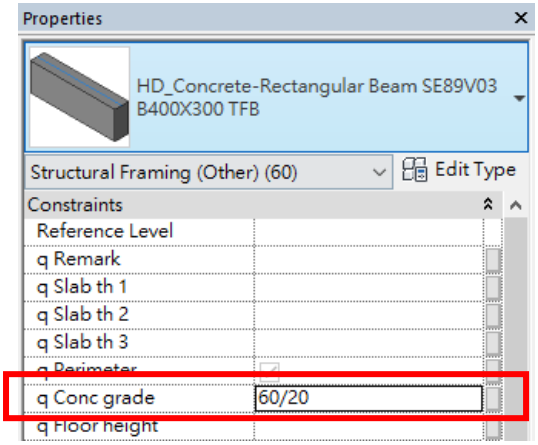
27.4 Add data information in the schedule (Cont'd)

2. Add parameters to a Group of Element / Category

A. Select a beam and use short cut key "**SA**" to select all instance of beam.



B. Add Concrete grade "**60/20**" under parameter "**q Conc grade**" in the Properties.



The information under parameter "**q Conc grade**" will be updated automatically in the existing schedule.

<Beam_Concrete and Formwork Schedule>

A	B	C	D	E	F	G	H	I	J
Reference Level	Beam Depth	Beam Width	q Slab Thickness (1)	q Slab Thickness (2)	Cut Length	Formwork of Beam (m2)	Volume (m3	q Conc grade	Mark
8/F	400.00	300.00			1615.00		0.194	60/20	B-01
8/F	400.00	300.00			1615.00		0.194	60/20	B-02
8/F	1330.00	250.00			515.00		0.171	60/20	B-03
8/F	1330.00	250.00			515.00		0.171	60/20	B-04
8/F	1330.00	250.00			515.00		0.171	60/20	B-05
8/F	1220.00	250.00			500.00		0.153	60/20	B-06
8/F	1330.00	250.00			515.00		0.171	60/20	B-07
8/F	1220.00	250.00			500.00		0.153	60/20	B-08

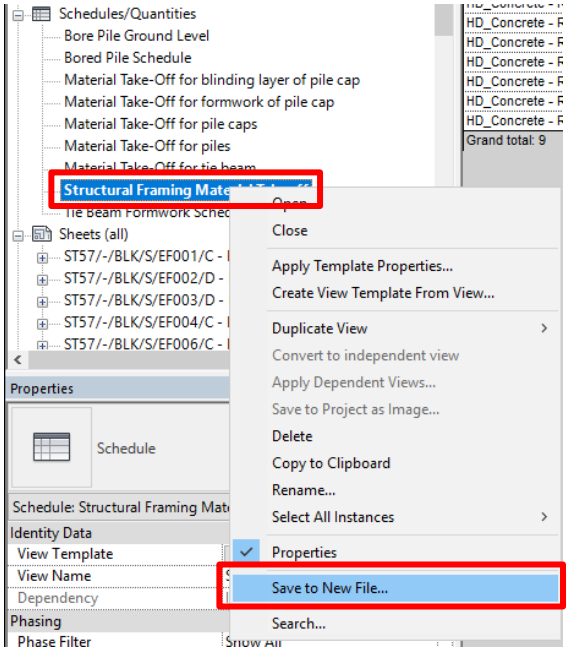
27.5 Generate schedule templates

Once the schedules are created and developed, they can be saved as **template and copy** to other projects.

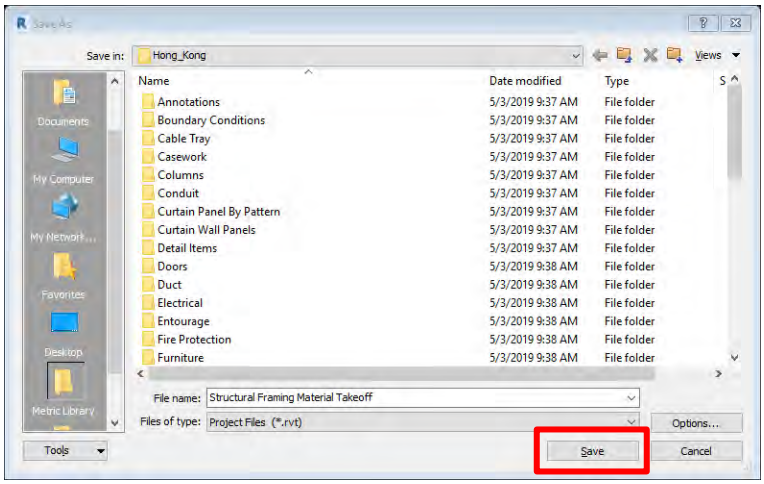
1. Select the **desired schedules** in existing project.

   > "**Project Browser**" > "**Schedules/Quantities**" > Desired Schedule (e.g. "**Structural Framing Material Take-off Schedule**").

2. Save the schedule by right click mouse and select "**Save to New File…**".



3. Select the **desired location** to save.

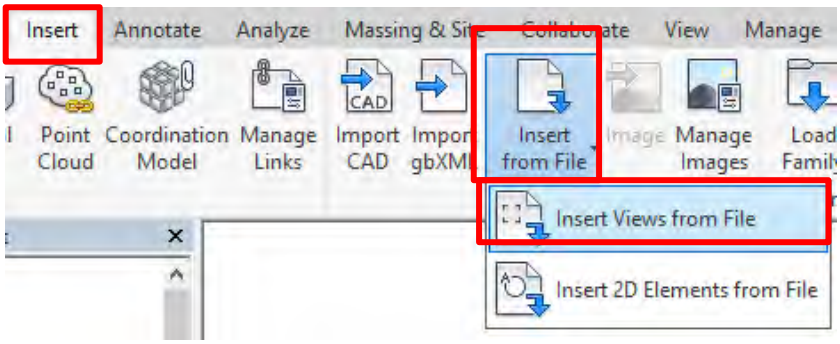


27.6 Copy schedules

There are three options in copying schedules from template or project. Once the schedules / schedule templates are copied to the new project, the information shown in the schedule will be updated automatically based on the new project.

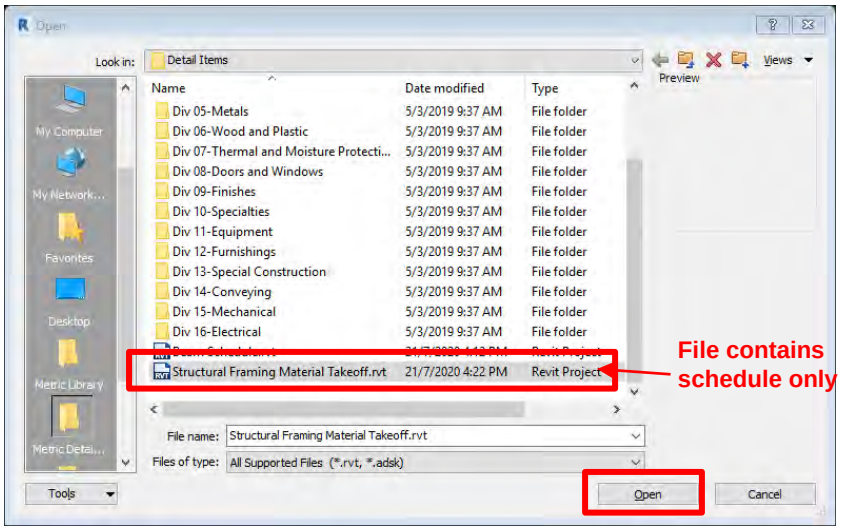
1. Insert schedules from template (Option 1)

A. "**Insert**" > "**Insert from File**" > "**Insert Views from File**".



B. Select the schedule template.

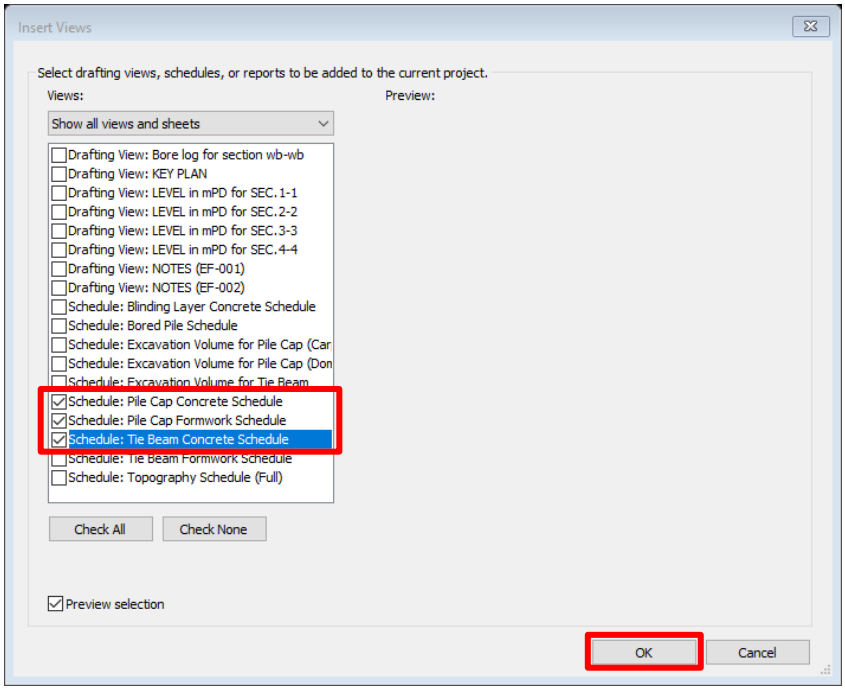
Select the **saved template** > "**Open**".



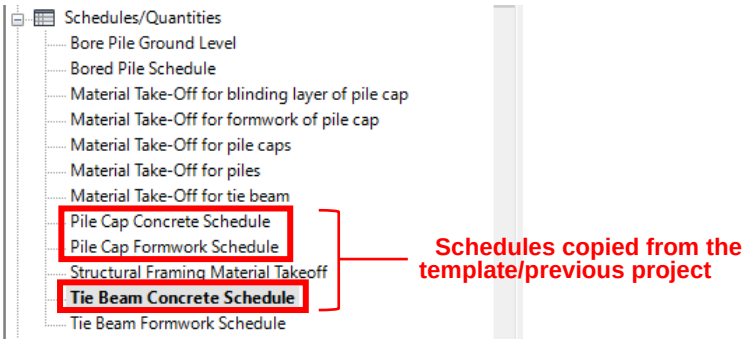
27.6 Copy schedules (Cont'd)

1. <u>Insert schedules from template (Option 1)</u> (Cont'd)

C. **Select and tick the previous schedules** to copy to the new project > "**OK**".



The selected schedules have been copied to the new project.



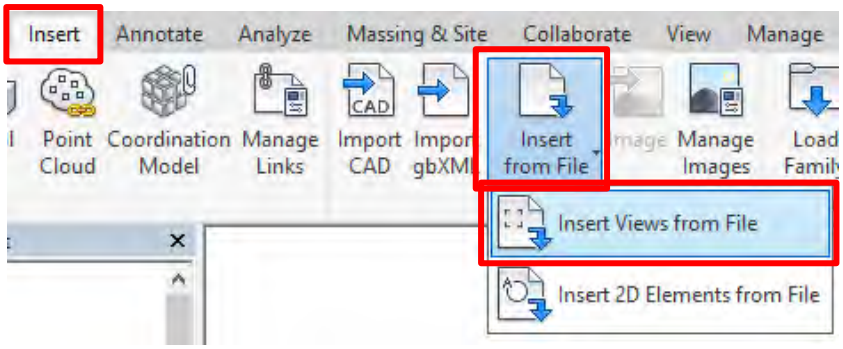
<Tie Beam Concrete Schedule>

A	B	C	D	E	F	G	H	I	J	K
Family	Type	Mark	Reference Level	Reference Level El	Cut Length	Length	Beam Depth	Beam Width	Volume	Volume (LxWxH)
HD_Concrete - Rectangular Beam V	B2000X1200 C	TB1	Cap Bottom Level	1800	5327	6177	2000	1200	12.785	12.785 m³
HD_Concrete - Rectangular Beam V	B2000X1200 C	TB2	Cap Bottom Level	1800	5330	6180	2000	1200	12.792	12.792 m³
HD_Concrete - Rectangular Beam V	B2000X1200 C	TB3	Cap Bottom Level	1800	5330	6180	2000	1200	12.792	12.792 m³
HD_Concrete - Rectangular Beam V	B2000X1200 C	TB4	Cap Bottom Level	1800	5330	6180	2000	1200	9.511 m³	12.792 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB5	Cap Bottom Level	1800	1721	2600	2000	1500	4.207 m³	5.163 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB6	Cap Bottom Level	1800	3550	3550	2000	1500	10.650	10.650 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB7	Cap Bottom Level	1800	5125	3925	2000	1500	15.375	15.375 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB8	Cap Bottom Level	1800	2325	3525	2000	1500	6.975 m³	6.975 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB9	Cap Bottom Level	1800	5895	5441	2000	1500	17.685	17.685 m³
Grand total: 9									102.773	107.010 m³

27.6 Copy schedules (Cont'd)

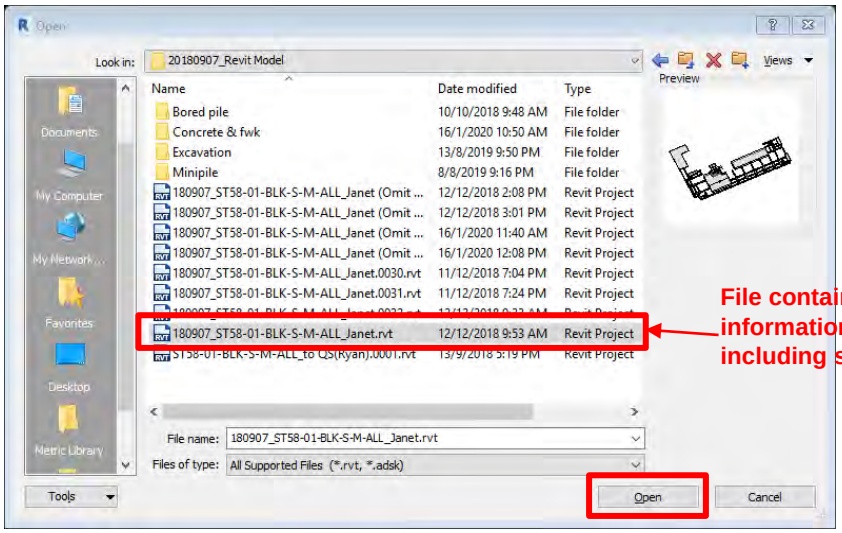
2. Insert schedules from previous project (Option 2)

A. "**Insert**" > "**Insert from File**" > "**Insert Views from File**".



B. Select the previous project.

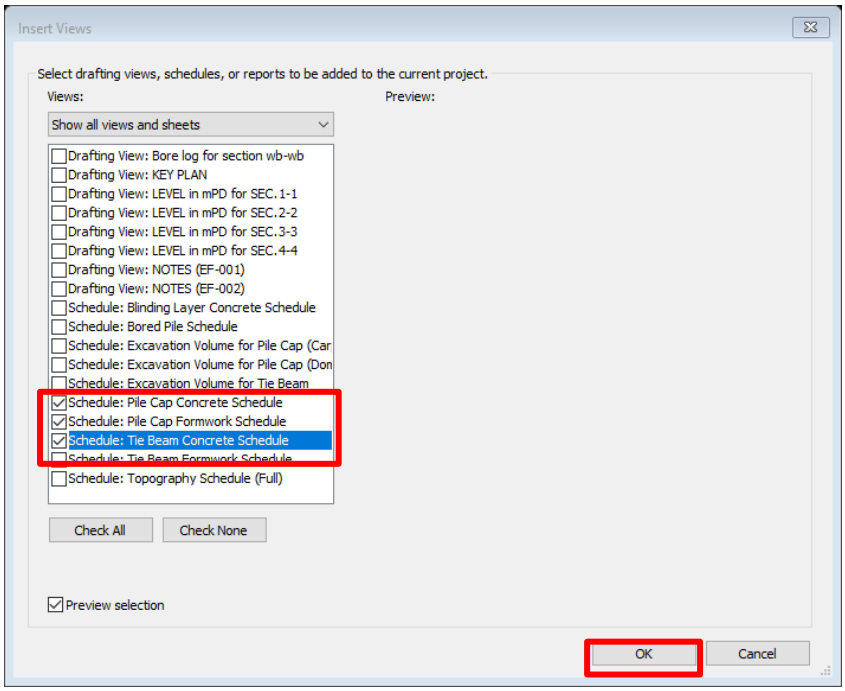
Select the **saved previous project** > "**Open**".



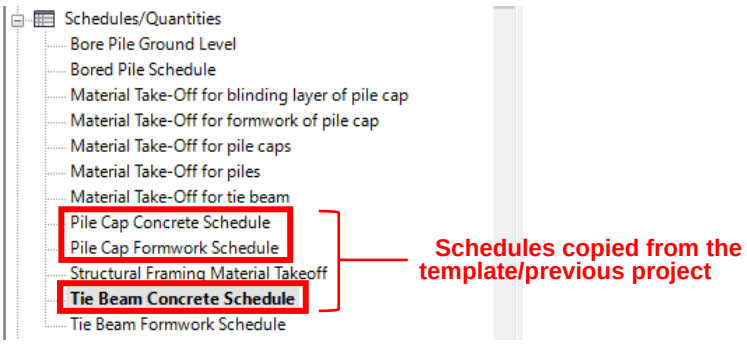
27.6 Copy schedules (Cont'd)

2. <u>Insert schedules from previous project (Option 2)</u> (Cont'd)

C. **Select and tick the previous schedules** to copy to the new project > "**OK**".



The selected schedules have been copied to the new project.



<Tie Beam Concrete Schedule>

A	B	C	D	E	F	G	H	I	J	K
Family	Type	Mark	Reference Level	Reference Level El	Cut Length	Length	Beam Depth	Beam Width	Volume	Volume (LxWxH)
HD_Concrete - Rectangular Beam V	B2000X1200 C	TB1	Cap Bottom Level	1800	5327	6177	2000	1200	12.785	12.785 m³
HD_Concrete - Rectangular Beam V	B2000X1200 C	TB2	Cap Bottom Level	1800	5330	6180	2000	1200	12.792	12.792 m³
HD_Concrete - Rectangular Beam V	B2000X1200 C	TB3	Cap Bottom Level	1800	5330	6180	2000	1200	12.792	12.792 m³
HD_Concrete - Rectangular Beam V	B2000X1200 C	TB4	Cap Bottom Level	1800	5330	6180	2000	1200	9.511 m³	12.792 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB5	Cap Bottom Level	1800	1721	2600	2000	1500	4.207 m³	5.163 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB6	Cap Bottom Level	1800	3550	3550	2000	1500	10.650	10.650 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB7	Cap Bottom Level	1800	5125	3925	2000	1500	15.375	15.375 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB8	Cap Bottom Level	1800	2325	3525	2000	1500	6.975 m³	6.975 m³
HD_Concrete - Rectangular Beam V	B2000X1500 C	TB9	Cap Bottom Level	1800	5895	5441	2000	1500	17.685	17.685 m³
Grand total: 9									102.773	107.010 m³

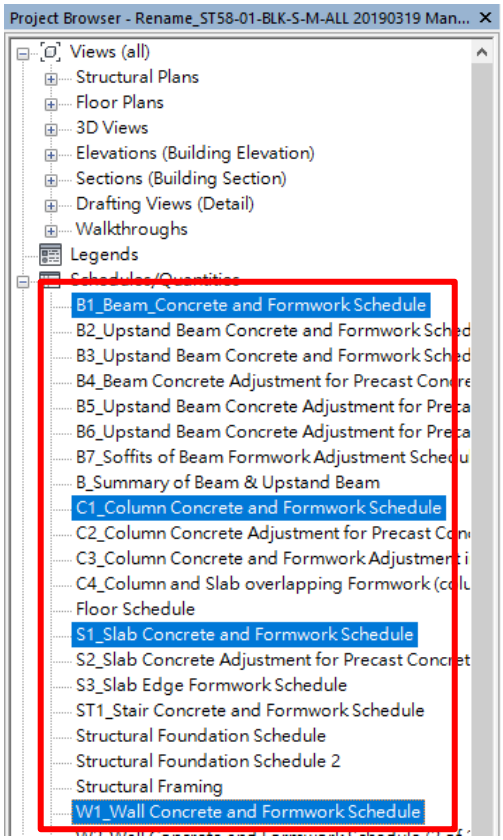
27.6 Copy schedules (Cont'd)

3. <u>Copy schedules from previous project (Option 3)</u>

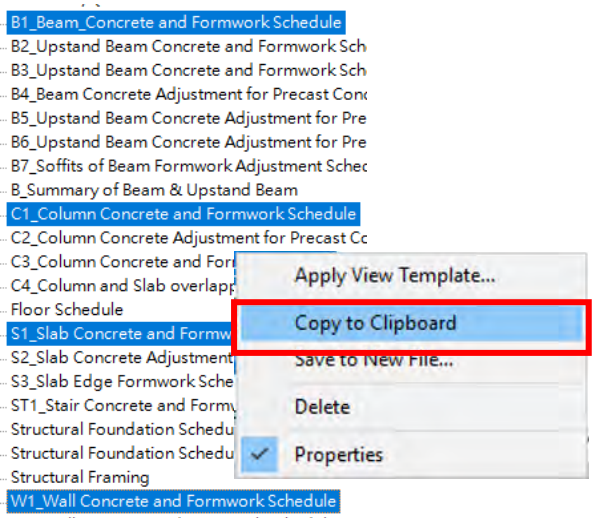
A. **Open** the previous project.

B. Select the required schedule(s) in Project Browser.

e.g. Select schedules named "**B1_Beam_Concrete and Formwork Schedule**, **C1_Column Concrete and Formwork Schedule**, **S1_Slab Concrete and Formwork Schedule** and **W1_Wall Concrete and Formwork Schedule**".



C. Right click mouse and select "**Copy to Clipboard**".

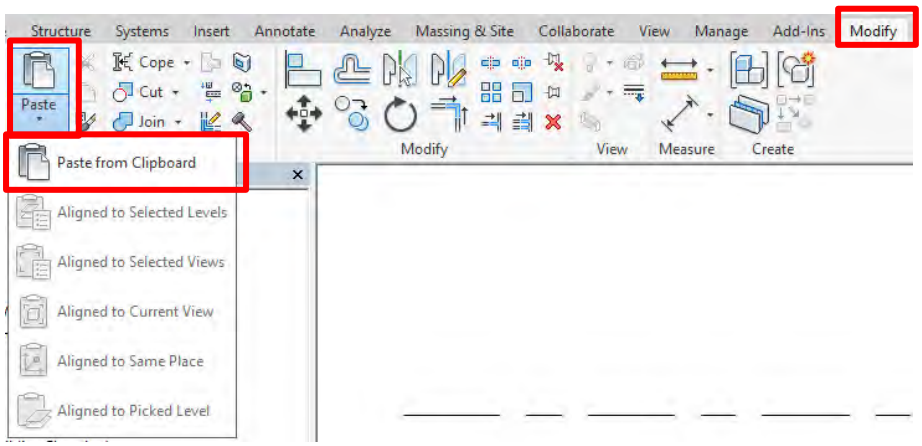


27.6 Copy schedules (Cont'd)

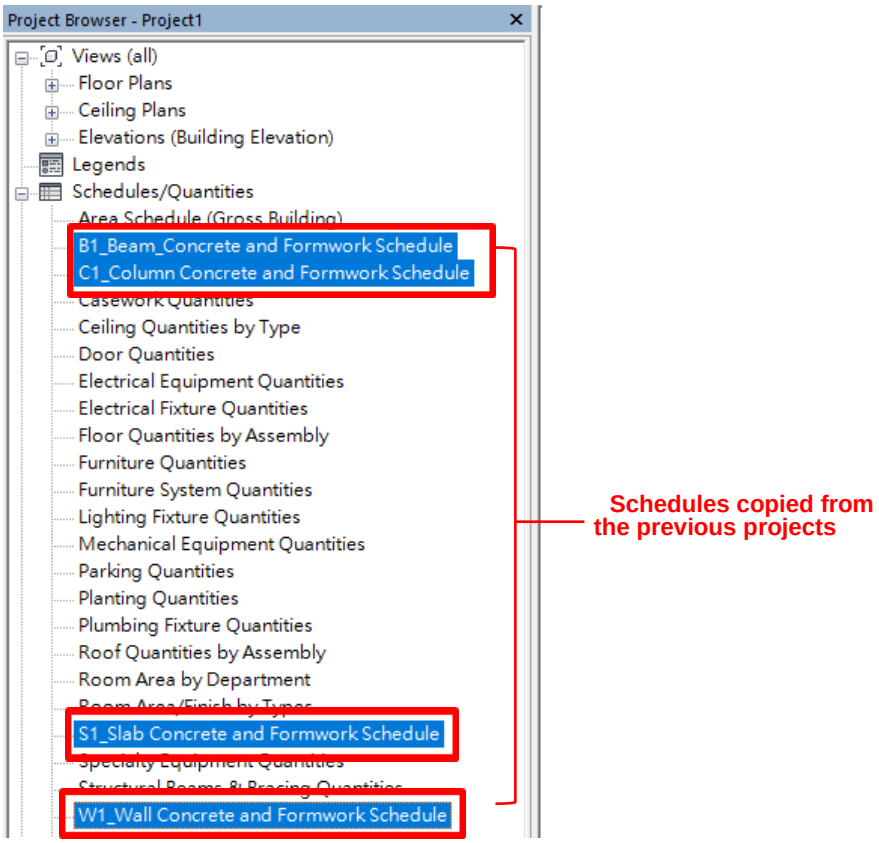
3. Copy schedules from previous project (Option 3) (Cont'd)

D. **Open** the new project.

E. Paste the copied schedules by "**Modify**" > "**Paste**" > Select "**Paste from Clipboard**".



The schedules have been copied to the new project.



27.7 Export data information from Revit

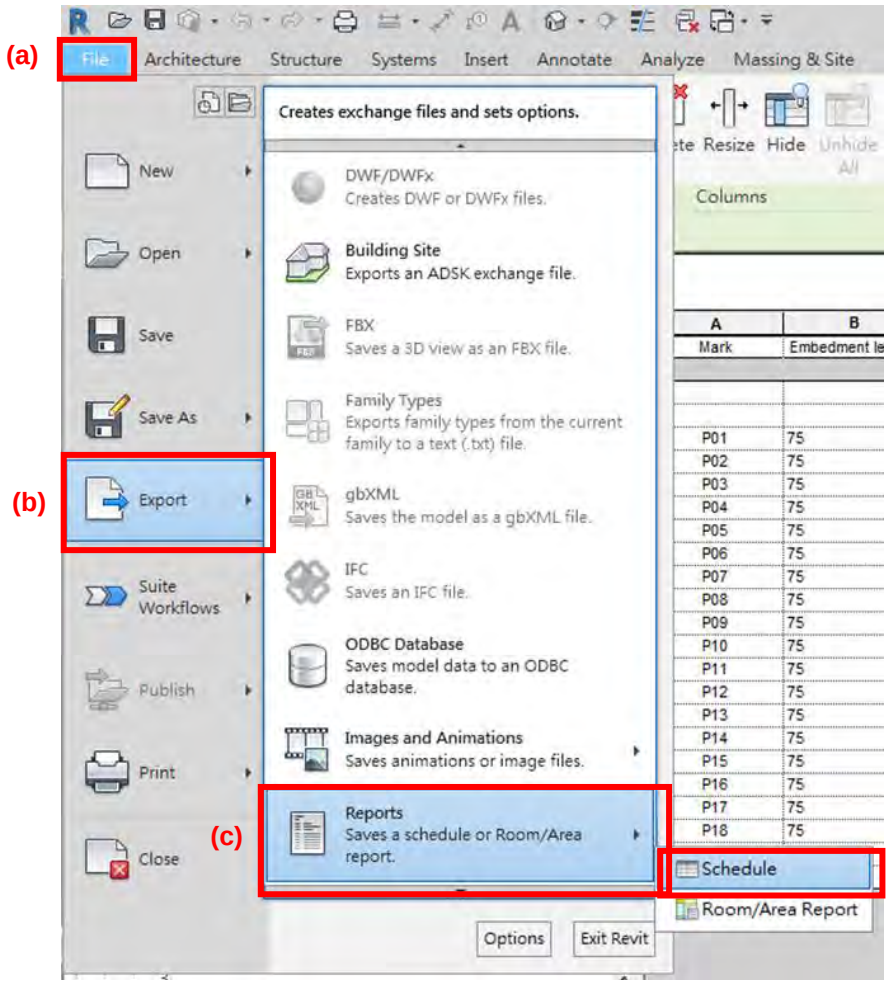
There are two common approaches to extract the data information from Revit to other file types for further processing. The first one is to export the Revit schedules as a CSV file, or a text file and then copy to Excel, and the other one is using a plug-in, such as Dynamo.

1. Export to Excel file

Once the schedules / material take-off schedules are created in Revit, the information in schedules / material Take-off schedules can be **exported as a CSV# file and opened in Excel or as a text file and copied to Excel** for further manipulation. However, all formula created in the schedule cannot be transferred to Excel and all information is displayed as a text only.

(P.S.: Revit 2022 supports exporting information in schedules as CSV files)

A. Export the schedule.



(a) Click File at the top-left corner to open the application menu.

(b) Select Export "**Export**" button.

(c) Select Reports Saves a schedule or Room/Area report. "**Reports**" in ribbon.

(d) Select Schedule "**Schedule**".

27.7 Export data information from Revit (Cont'd)

1. Export to Excel file (Cont'd)

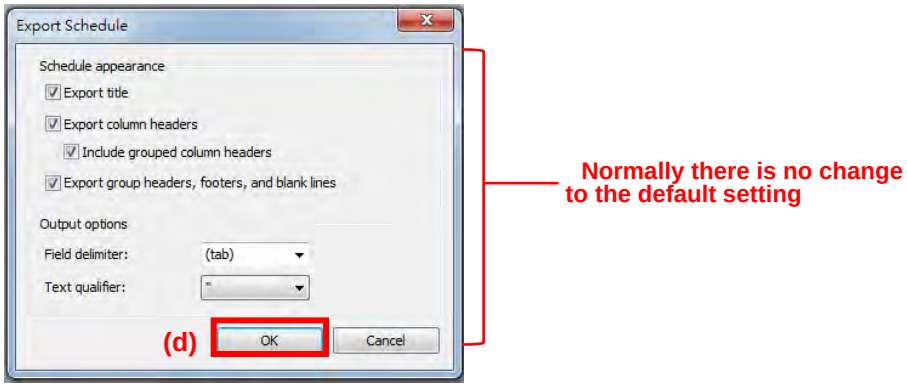
B. Save the schedule as .txt file.

(a) Select the **desired folder**.

(b) Add the file name. The file only can be saved as "txt" format.

(c) Click "**Save**" button.

(d) Another window of "**Export Schedule**" will pop up and click "**OK**".



27.7 Export data information from Revit (Cont'd)

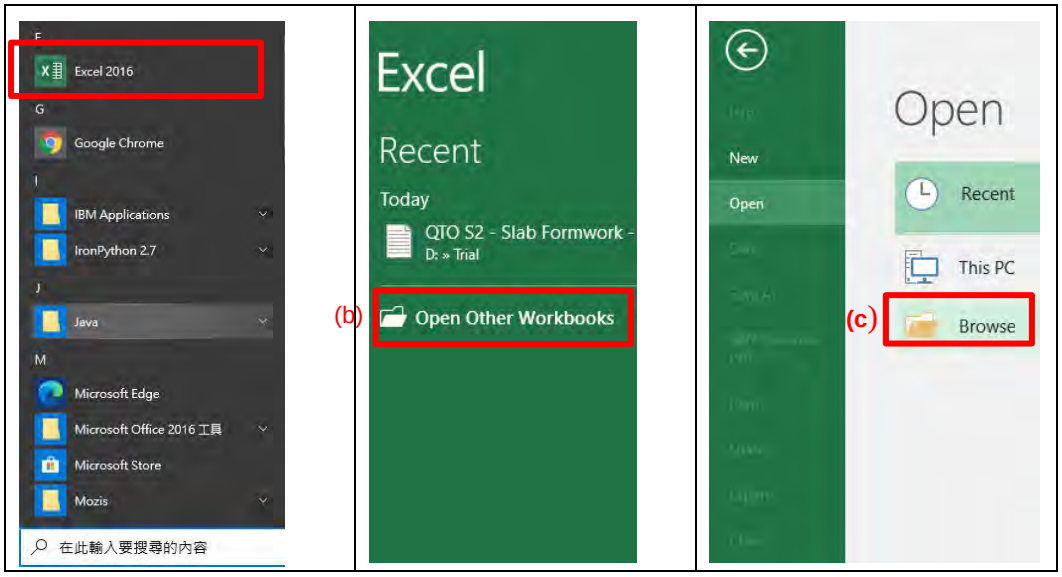
1. Export to Excel file (Cont'd)

C. Use Excel to open the .txt file.

(a) Open a new **Excel file**.

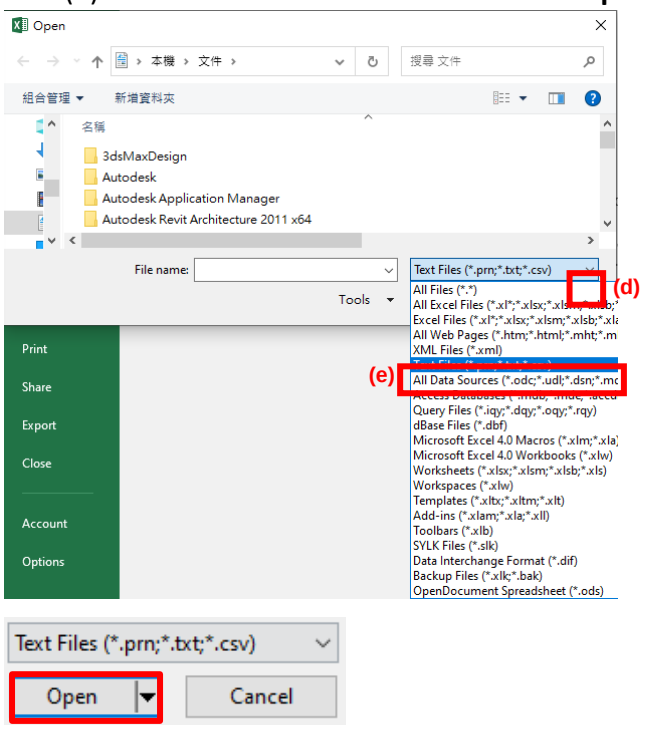
(b) Select "**Open Other Workbooks**".

(c) Select "**Browse**".



(d) Click **arrow at right bottom corner** of the Excel window.

(e) Select Text Files (*.prn;*.txt;*.csv) and "**Open**".

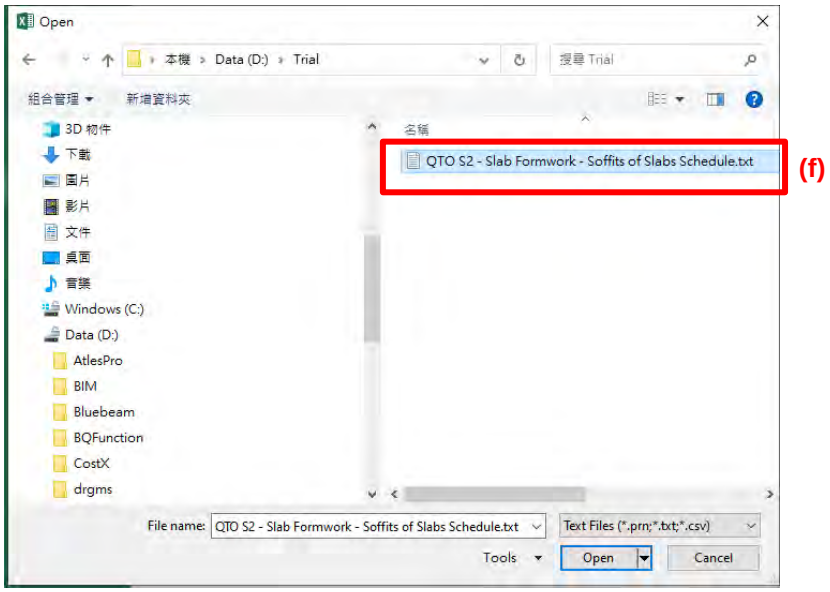


27.7 Export data information from Revit (Cont'd)

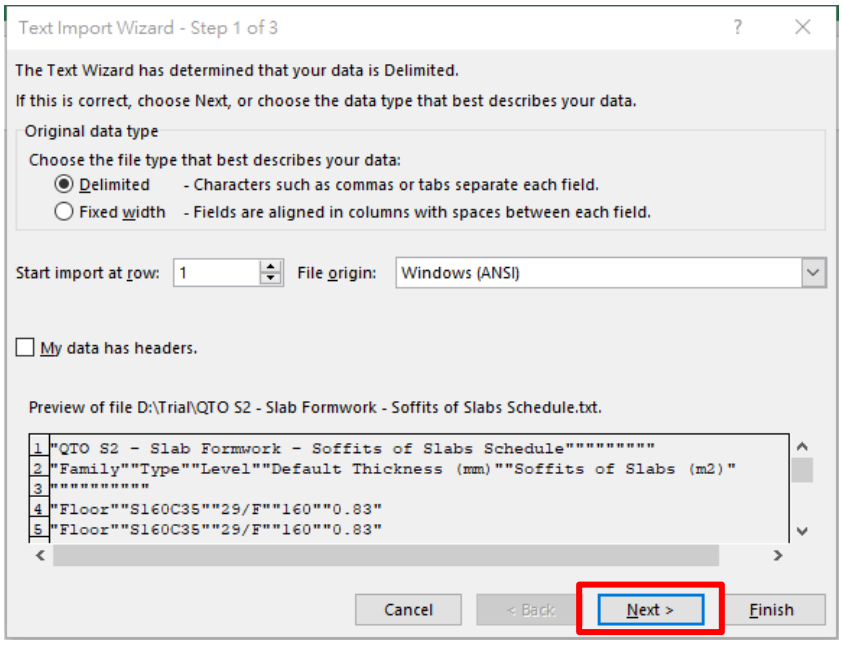
1. Export to Excel file (Cont'd)

C. Use Excel to open the .txt file. (Cont'd)

(f) Select the saved "**.txt**" **file** for the Revit schedule.



(g) A window of "**Text Import Wizard – Step 1 of 3**" will pop up. It can use the default setting and click Next > button to next step.

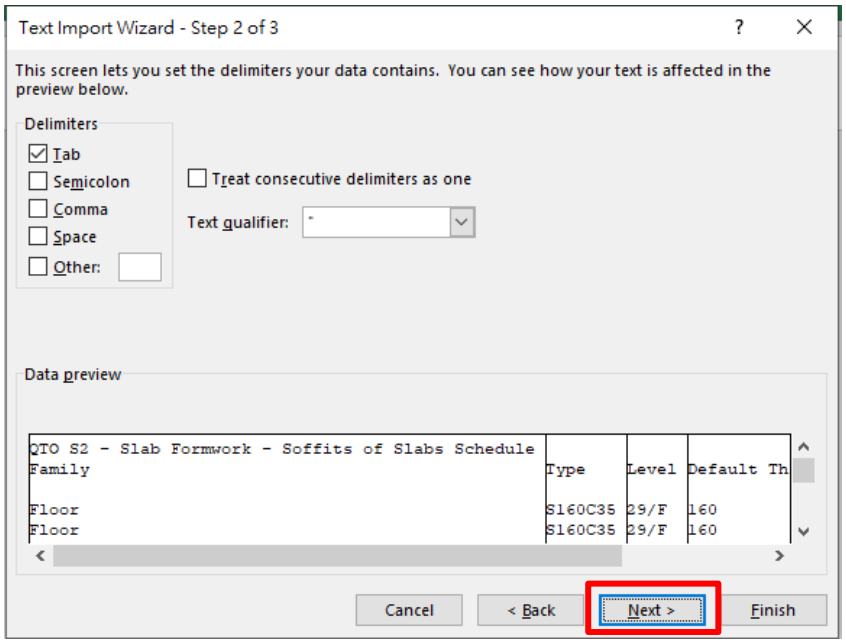


27.7 Export data information from Revit (Cont'd)

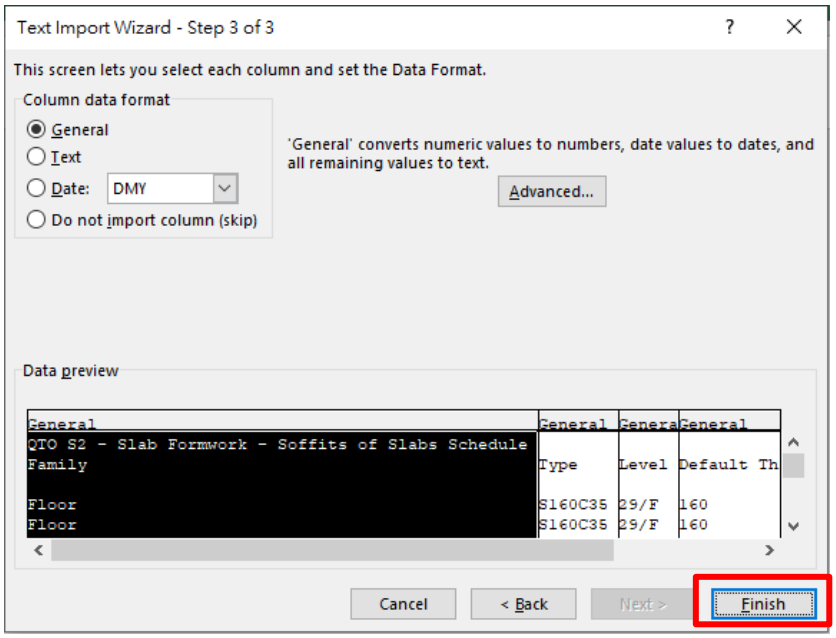
1. Export to Excel file (Cont'd)

C. Use Excel to open the .txt file. (Cont'd)

(h) A window of " **Text Import Wizard – Step 2 of 3**" will pop up. It can use the default setting and click Next > button to next step.



(i) A window of " **Text Import Wizard – Step 3 of 3**" will pop up. It can use the default setting and click Finish button to finish the step.

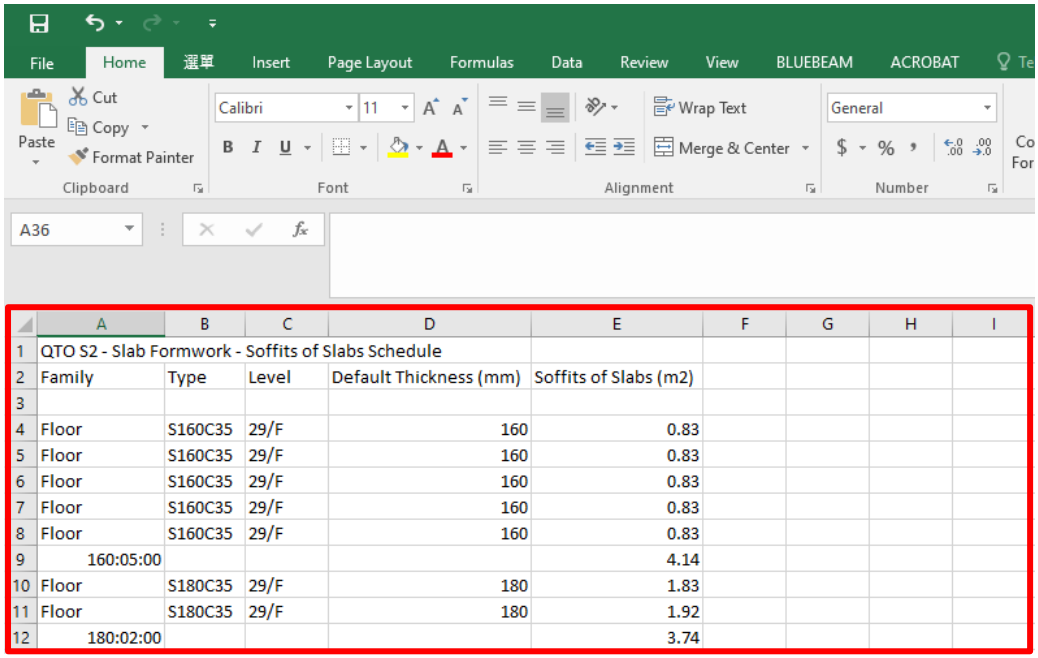


27.7 Export data information from Revit (Cont'd)

1. Export to Excel file (Cont'd)

C. Use Excel to open the .txt file (Cont'd)

The file of Revit schedule in "**.txt format**" is transferred to Excel.



	A	B	C	D	E	F	G	H	I
1	QTO S2 - Slab Formwork - Soffits of Slabs Schedule								
2	Family	Type	Level	Default Thickness (mm)	Soffits of Slabs (m2)				
3									
4	Floor	S160C35	29/F	160	0.83				
5	Floor	S160C35	29/F	160	0.83				
6	Floor	S160C35	29/F	160	0.83				
7	Floor	S160C35	29/F	160	0.83				
8	Floor	S160C35	29/F	160	0.83				
9	160:05:00				4.14				
10	Floor	S180C35	29/F	180	1.83				
11	Floor	S180C35	29/F	180	1.92				
12	180:02:00				3.74				

Note: All information transferred to Excel is a text only. The formula created in Revit Schedule cannot be transferred to Excel. Moreover, there is no linkage between the information transferred to Excel and the original Revit Schedule.

2. Dynamo

Dynamo is a plug-in and an open source visual programming language for Autodesk Revit. It is a program created by code block, nodes and Python. Dynamo can be used for analyzing complex geometries, automating repetitive processes and exporting data to Excel files and other file-types.

For BIM QTO, quantity surveyors can extract data from BIM models to Excel files by Dynamo. Once the Dynamo scrips are created, they can be saved as templates and applied to another project. Updates on the dynamo scrips may be required to suit individual project needs.

An introduction of the operation of using Dynamo for extracting information from Revit models is provided in the following section - Section 28.

Section 28 Introduction of Dynamo

28.1 Dynamo in Revit

Dynamo is a Visual Programming add-on native in Revit. It was engineered for building designer to automate the design process in a parametric way. Unlike the traditional add-on/plug-in development, Dynamo provides an intuitive interface for ordinary user to automate their process while still retains its potential to high-level programming using IronPython. The essential features are:

1. Nodes

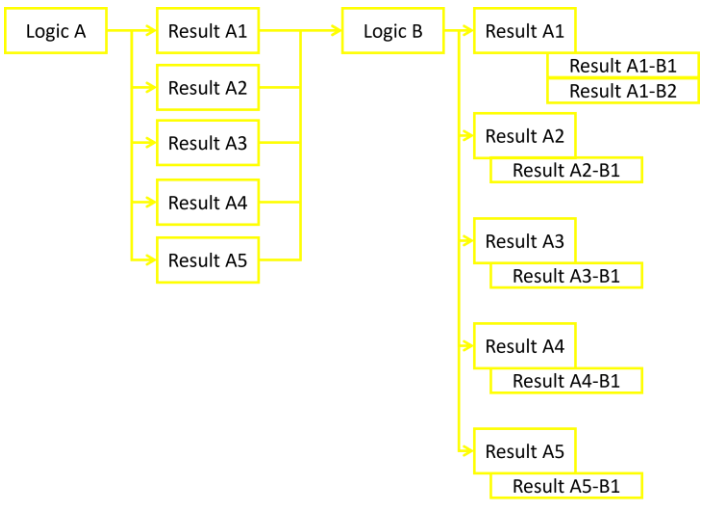
   Nodes are pre-defined set of programming script. There are different types of nodes, e.g. Built-in Node, Custom Node, Node from Packages.

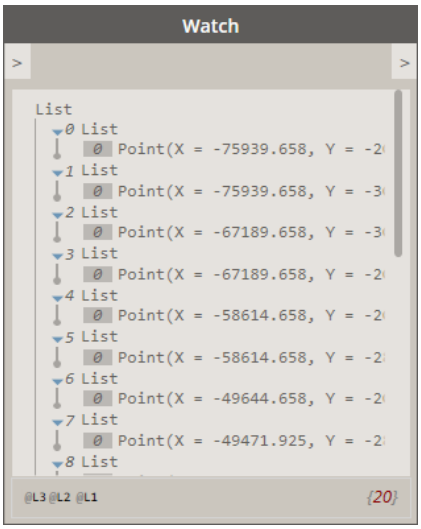
   A. *Built-in Node* refers to those came out-of-box with Dynamo and Revit.
   B. *Custom Node* are built by users. It can be built by grouping Built-in Nodes, using code block, or using IronPython at its core.
   C. *Packages* are set of custom nodes prepared by Dynamo experts around the globe and shared on online community.

   By connecting various nodes to create complex algorithm, data are being extracted, calculated, interpolated and re-structured to users' requirements. Nodes usually are self-explanatory and further supplemented with explanatory note. The Node approach save users from programming syntax and thus having a mild learning curve.

2. List

   Another fundamental concept of Dynamo is List management. All data are organized in list. With tiers of list, data are grouped and chained for processing.

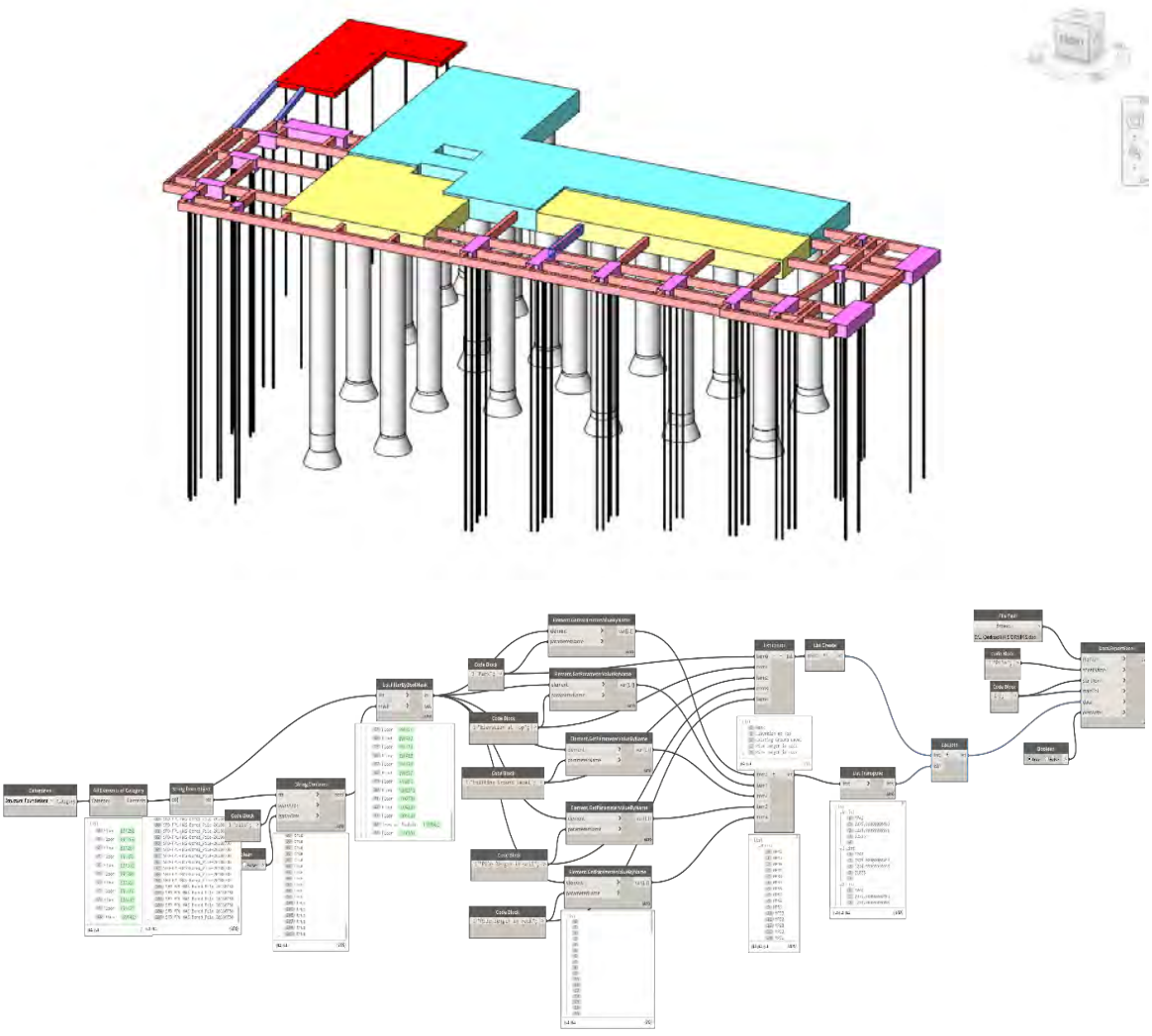




Users can specify the target tier of list for the function to act on. With combination of different tiers, users can perform a function on all data in one list against data in another, thus vice versa.

28.2 Extract model data to Excel

1. The Overview

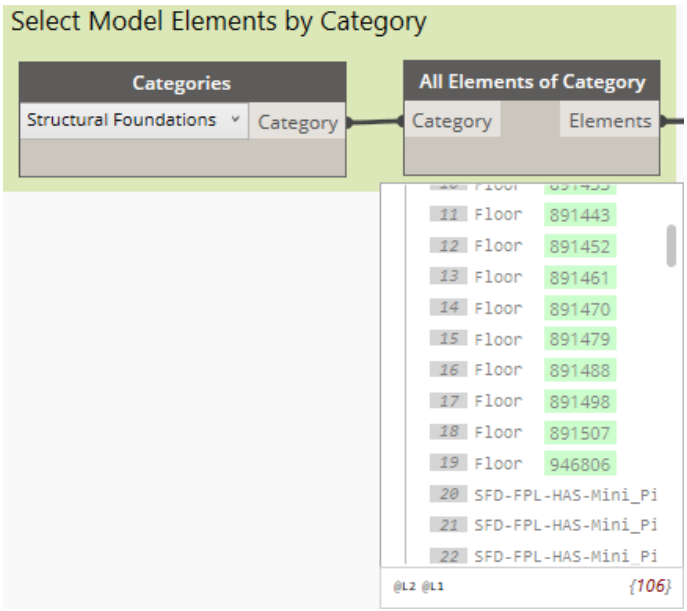


2. Procedure

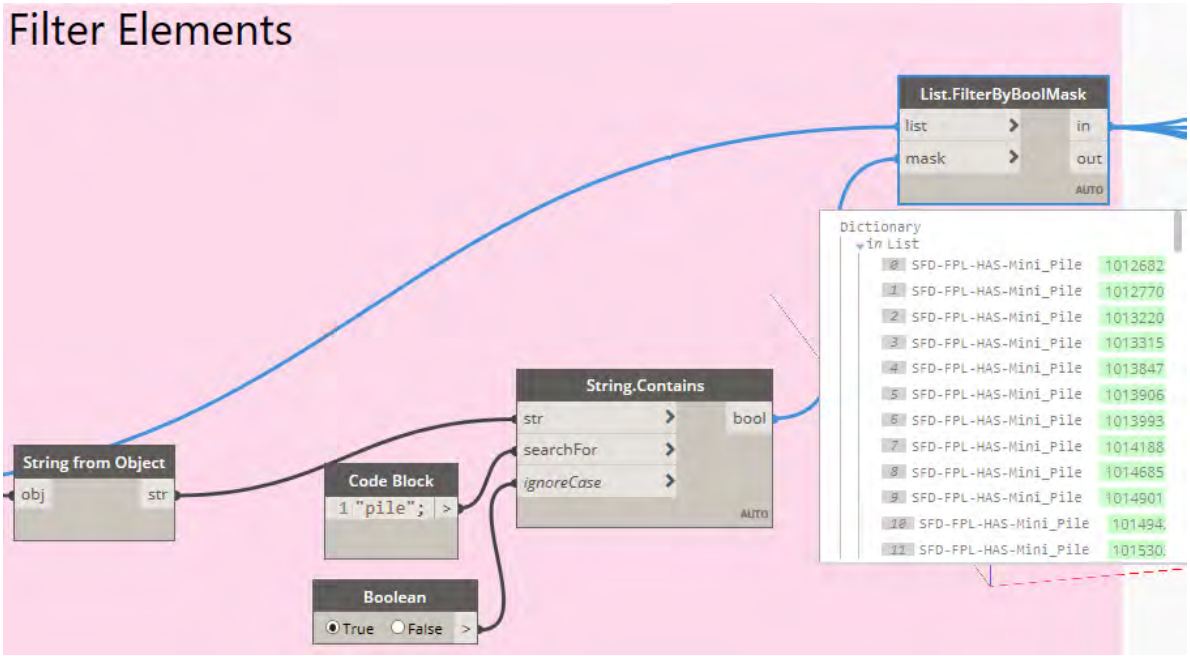
A. Select Models elements by its Categories. For Piles in the sample RVT file, piles are drawn in Structural Foundation Category.

28.2 Extract model data to Excel (cont'd)

2. Procedure (cont'd)



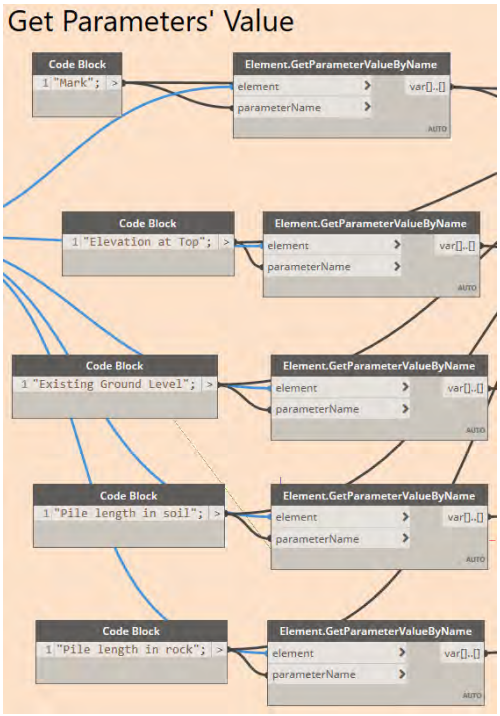
B. The result returned from the selection nodes contains elements other than piles. It is essential to filter out un-intended elements before moving onto the next stethe ps.



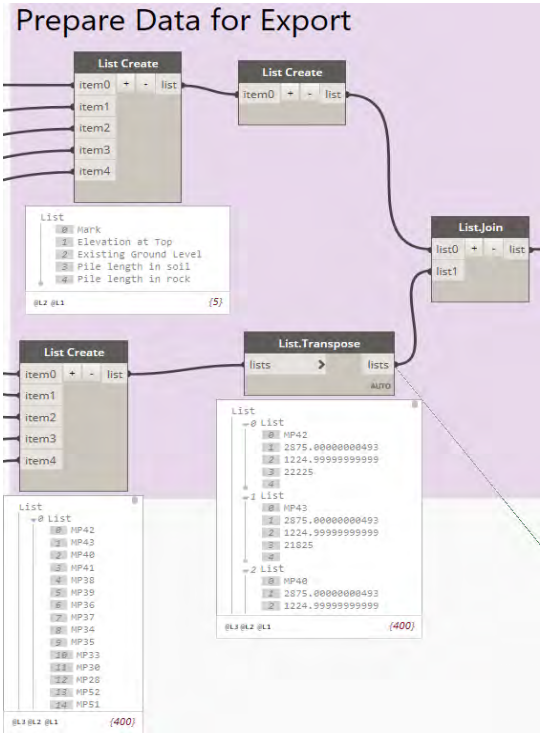
C. After the filtering process, the element list on hand is a clean list of pile elements. Then, information stored in different parameters can be located and extracted. Parameter names must be exacted and are case sencase-sensitive

28.2 Extract model data to Excel (cont'd)

2. Procedure (cont'd)



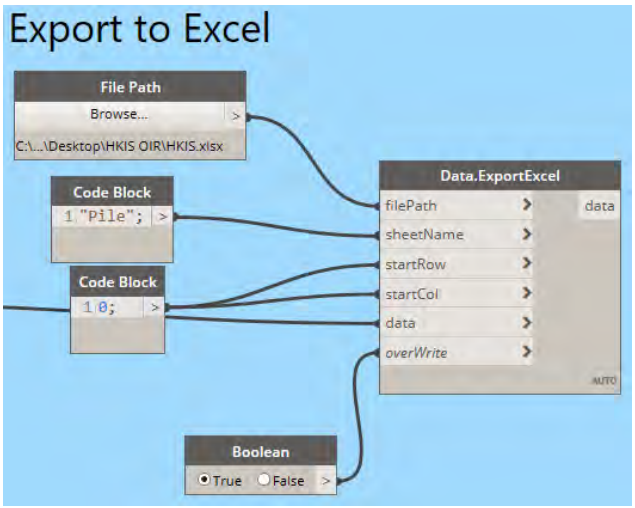
D. Each Get Parameter node will return a list of values based on the list of elements inputted. Multiple lists must be merged into one list for exporting to Excel. Dynamo plots data in each list to Excel in a horizontal manner. To get data presented in the comma fashion, we need to transpose the list before exporting.



28.2 Extract model data to Excel (cont'd)

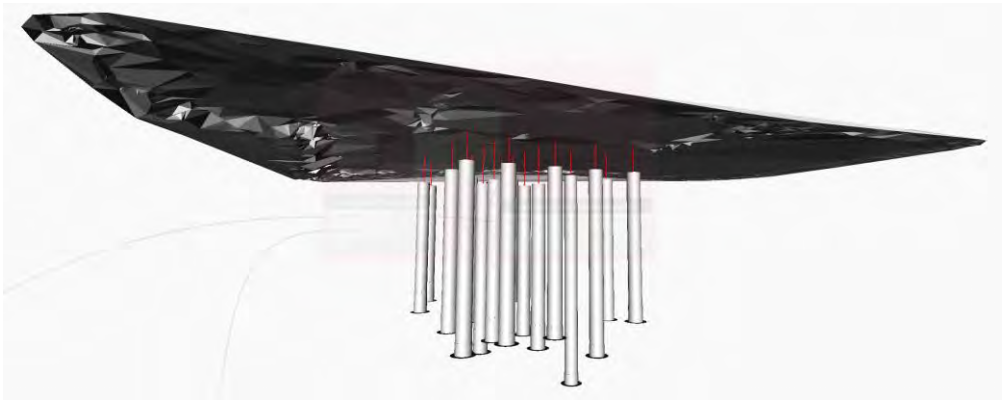
2. Procedure (cont'd)

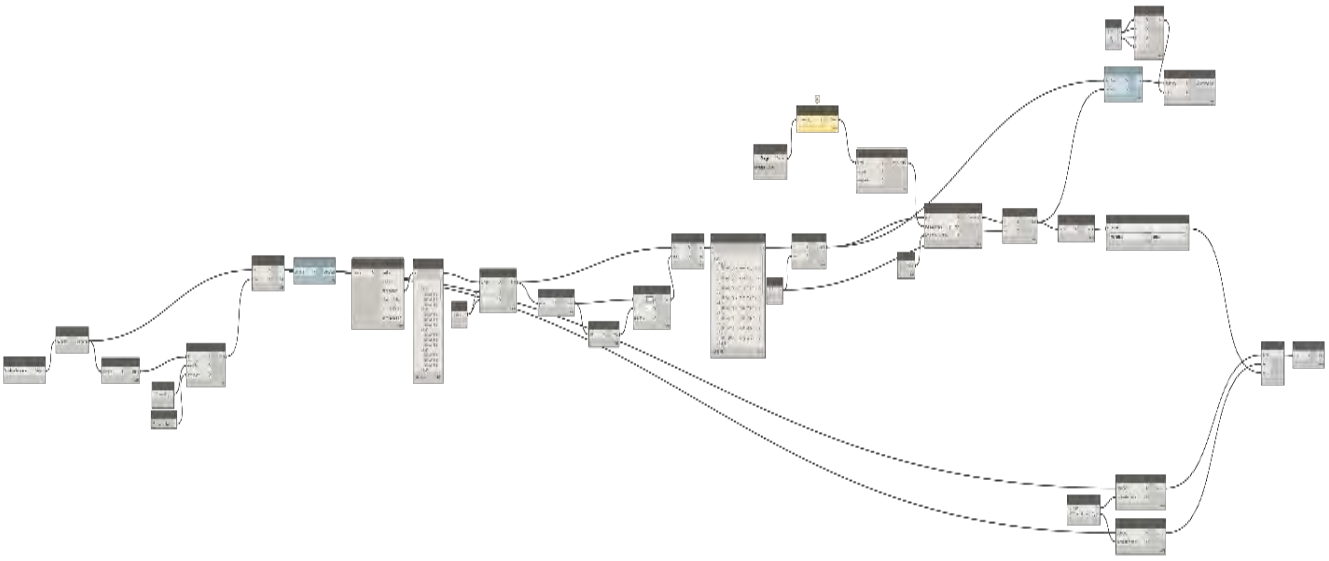
E. Finally, the data are directed into the export to Excel node.



28.3 Calculate Data from Geometry

1. The Overview

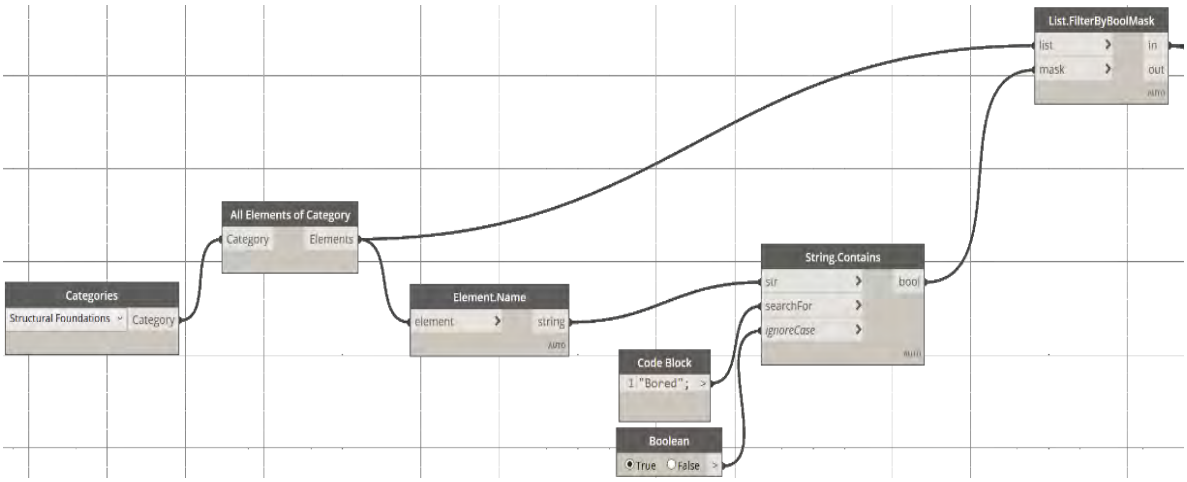




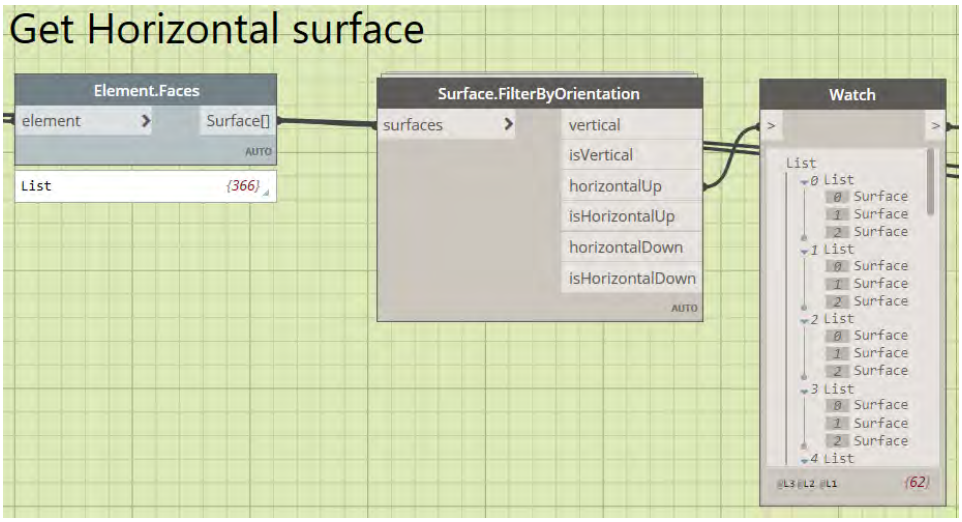
28.3 Calculate data from geometry (cont'd)

2. Procedure

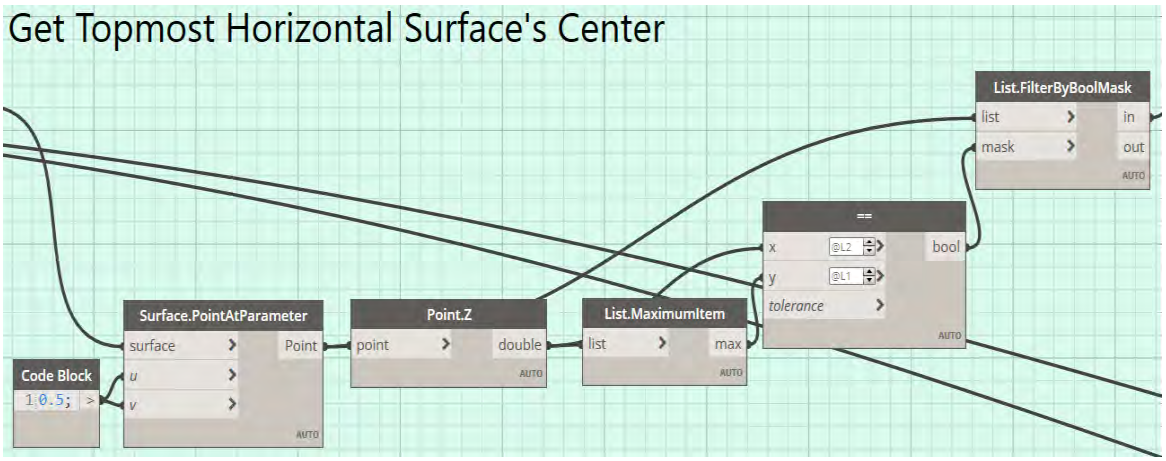
A. Select and filter piles



B. Get all horizontal surface surfacess' geometry



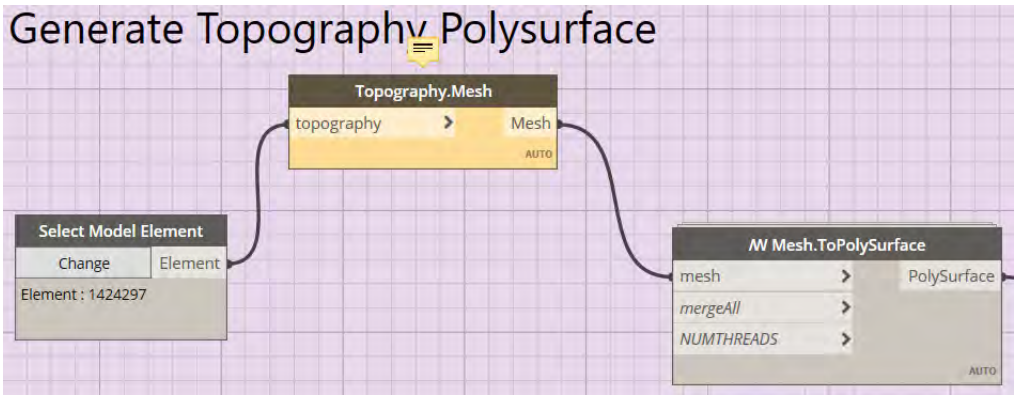
C. Filter the center topmost surface of piles



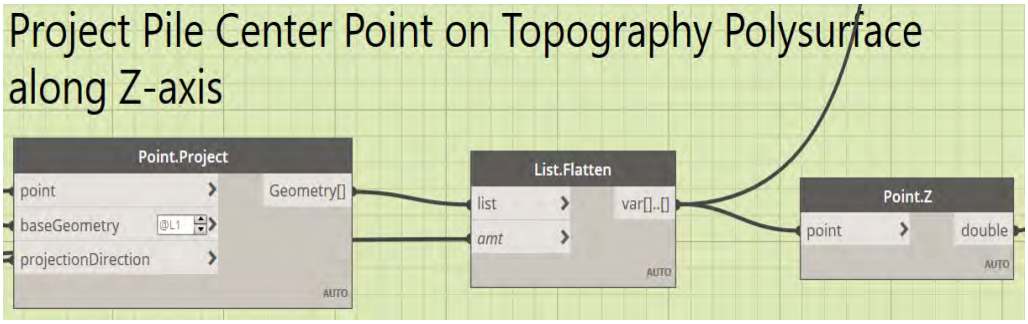
28.3 Calculate data from geometry (cont'd)

2. Procedure (cont'd)

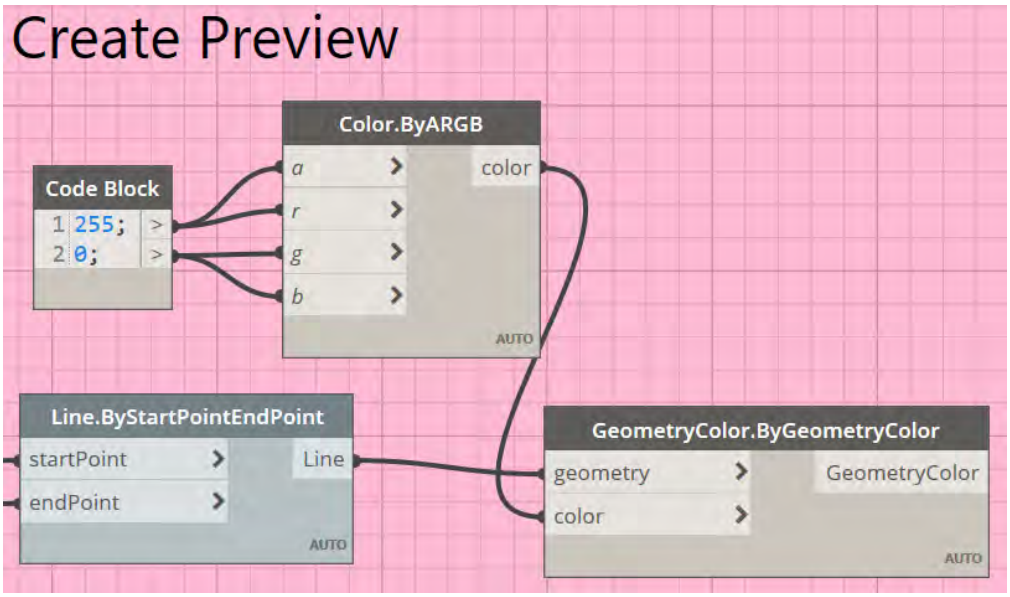
D. Generate Topography PolySurface



E. Project all centre onto the Topography to get the existing ground level of each pile



F. Generate a line connecting the Center Point and Projected Point. The line is painted in RED.



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