NCID

Advanced
Construction
Information
Development Ltd.
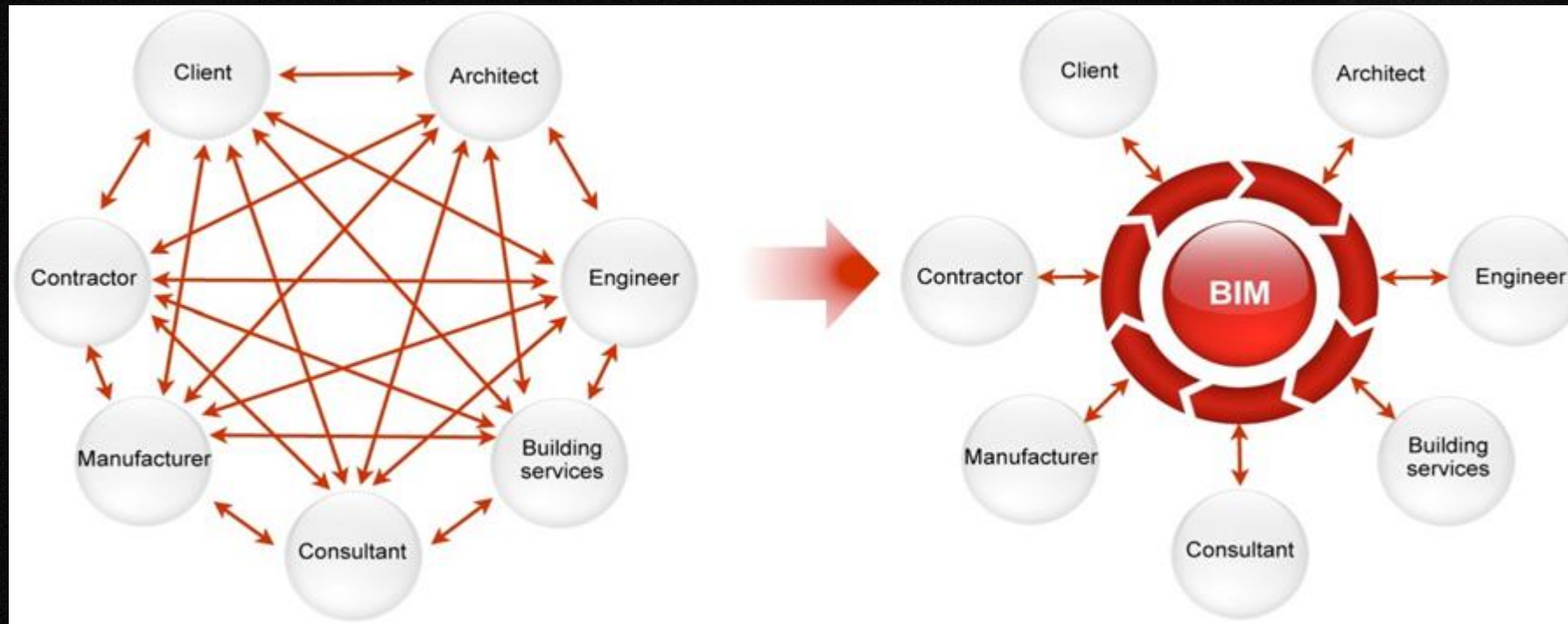
BIM MEP Model Audit

Good Industry Practice

Current Industry Workflow   vs   BIM workflow

- Cross communication channels
- Different versions sent to different teams
- Duplicate designs
- Duplicate and overlapping data creating confusion across consultants
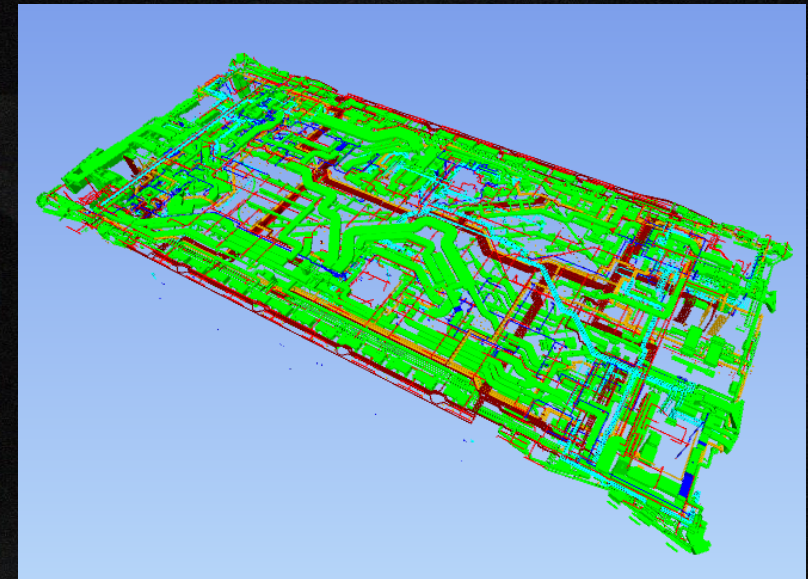
- Centralised model and information
- Live updates
- Parametric data to aid future phases
- Better coordination and collaboration
- Shared risk

MEP Checklist

- Model Segregation
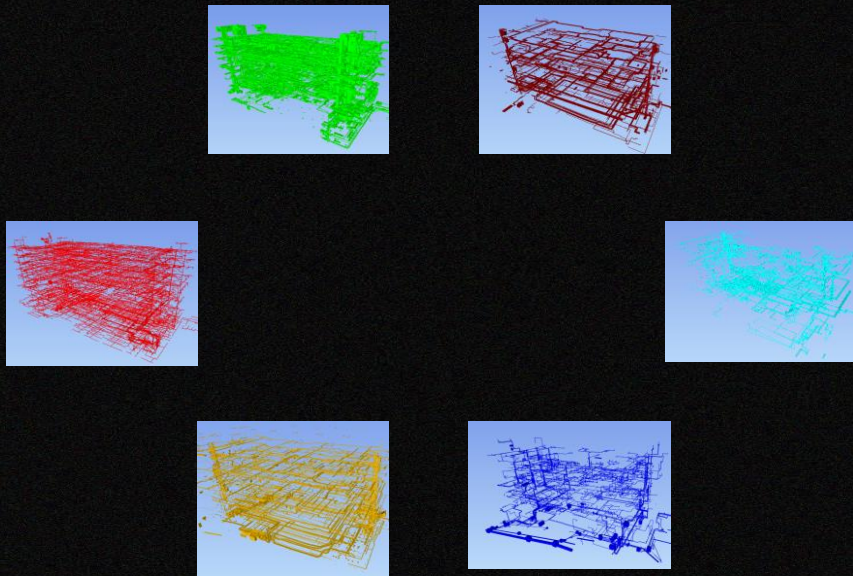
Independent models for each discipline

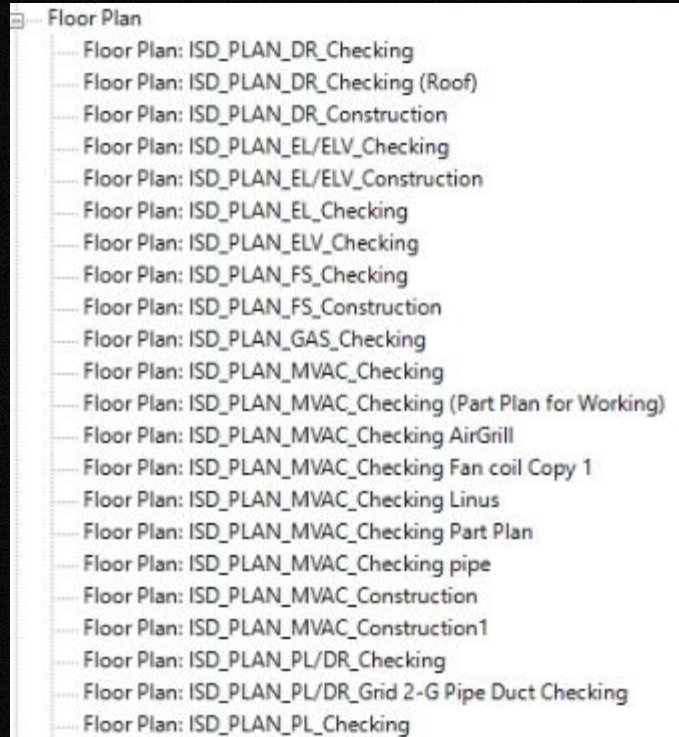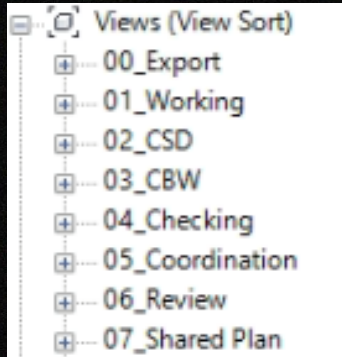Combined disciplines models for each floor

MEP Checklist

- File Naming

[Discipline]:

ACO	–	Acoustic Engineering
ARC	–	Architecture
BIM	–	Building Information Modelling
BEL	–	Electrical Engineering
BFS	–	Fire Services Engineering
BLT	–	Lighting Design
BME	–	Mechanical Services Engineering
BDR	–	Drainage Engineering
BPL	–	Plumbing Engineering
BTG	–	Town Gas
CIV	–	Civil Engineering
ELV	–	Extra Low Voltage System Engineering

MEP Checklist

- View Preparation

Views (View Sort)
- 00_Export
- 01_Working
- 02_CSD
- 03_CBW
- 04_Checking
- 05_Coordination
- 06_Review
- 07_Shared Plan

Floor Plan
- Floor Plan: ISD_PLAN_DR_Checking
- Floor Plan: ISD_PLAN_DR_Checking (Roof)
- Floor Plan: ISD_PLAN_DR_Construction
- Floor Plan: ISD_PLAN_EL/ELV_Checking
- Floor Plan: ISD_PLAN_EL/ELV_Construction
- Floor Plan: ISD_PLAN_EL_Checking
- Floor Plan: ISD_PLAN_ELV_Checking
- Floor Plan: ISD_PLAN_FS_Checking
- Floor Plan: ISD_PLAN_FS_Construction
- Floor Plan: ISD_PLAN_GAS_Checking
- Floor Plan: ISD_PLAN_MVAC_Checking
- Floor Plan: ISD_PLAN_MVAC_Checking (Part Plan for Working)
- Floor Plan: ISD_PLAN_MVAC_Checking AirGrill
- Floor Plan: ISD_PLAN_MVAC_Checking Fan coil Copy 1
- Floor Plan: ISD_PLAN_MVAC_Checking Linus
- Floor Plan: ISD_PLAN_MVAC_Checking Part Plan
- Floor Plan: ISD_PLAN_MVAC_Checking pipe
- Floor Plan: ISD_PLAN_MVAC_Construction
- Floor Plan: ISD_PLAN_MVAC_Construction1
- Floor Plan: ISD_PLAN_PL/DR_Checking
- Floor Plan: ISD_PLAN_PL/DR_Grid 2-G Pipe Duct Checking
- Floor Plan: ISD_PLAN_PL_Checking

MEP Checklist

- View Template
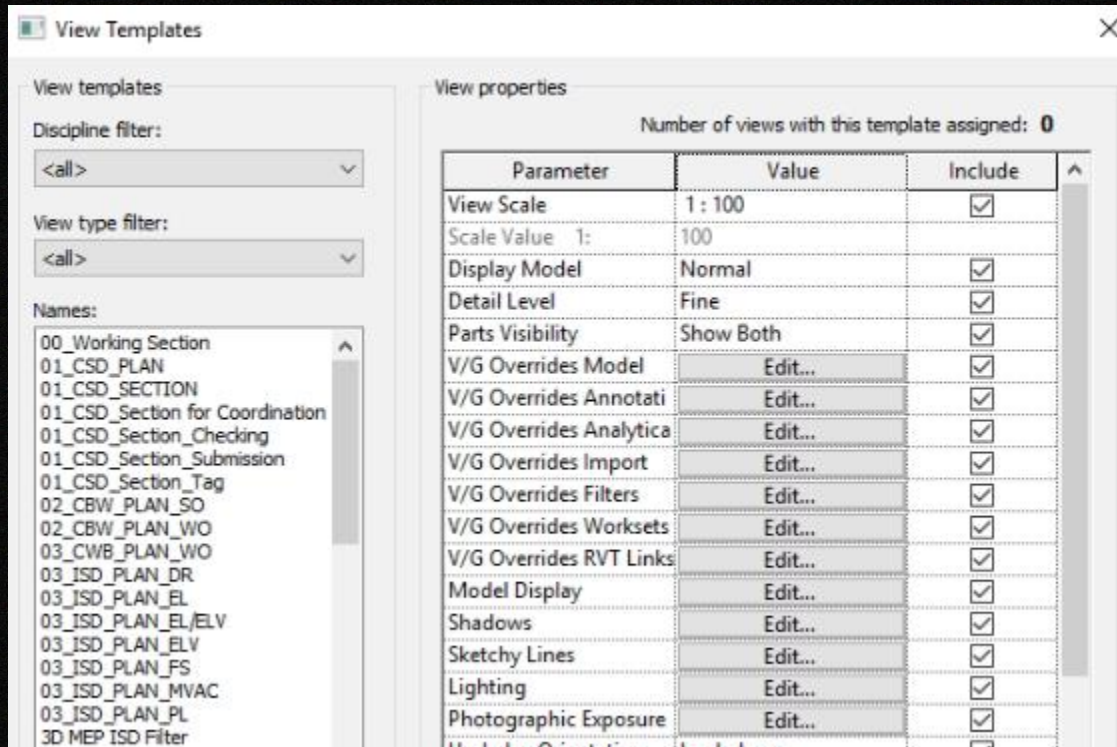
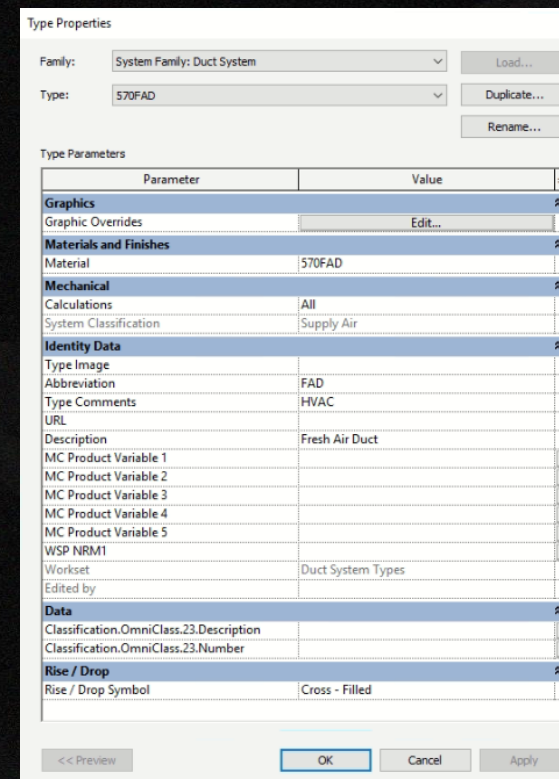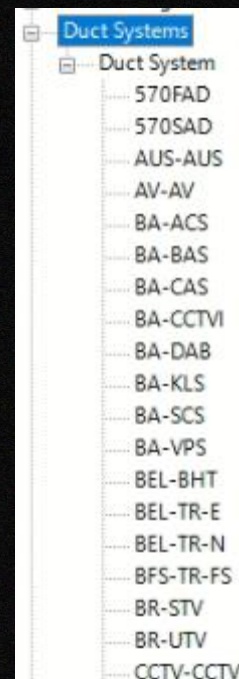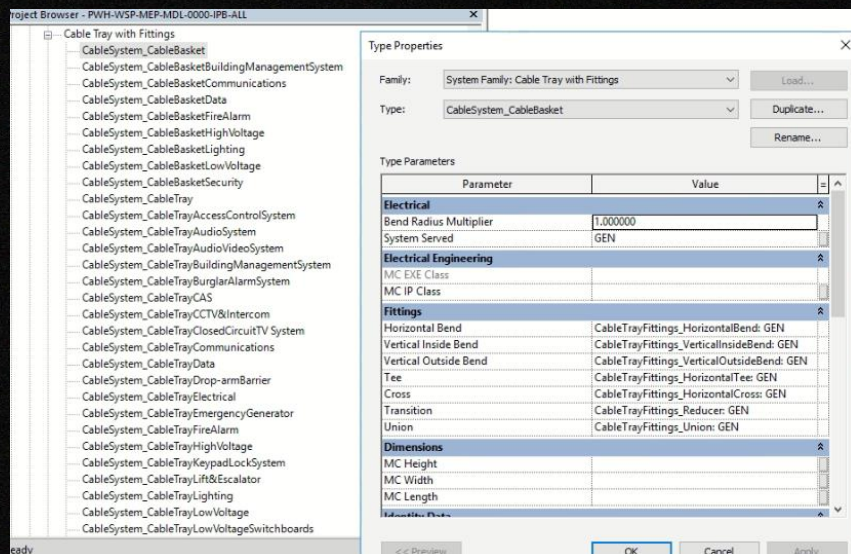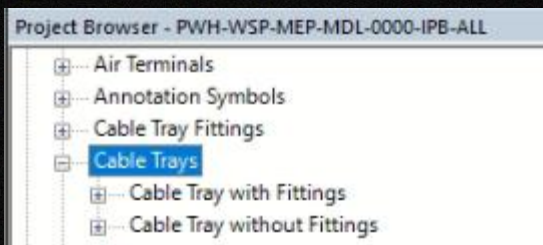# MEP Checklist

- View Set

MEP Checklist

- Families
  - System Family
    - System Type
      - Pipe
      - Duct
      - Cable Tray
    - Type
      - Pipe
      - Duct

MEP Checklist

MEP Checklist

MEP Checklist

STANDARD APPROACH OF MODELLING (SAM)

DM-P 02 Pipe

Discipline	Plumbing and Water Services
	Air Conditioning and Mechanical Ventilation
	Fire Services and Pump
	Utility Services
	Drainage and Sewage Services
	Depend on the function and system of the pipework
Family	System Family
Category	Piping System
Workset	External Envelop – for External Pipework
Naming Convention	(Functional_Type)-HAB

Functional Type (System)	Short form	Description
	FRWP	Fresh Water Pipe
	FLWP	Flushing Water Pipe
	HWP	Hot Water Pipe
	IRWP	Irrigation Water Pipe
	RWP	Rain Water Pipe

Modelling

- In Revit, Pipe, Piping System and Pipe Type are defined as System Families, while Pipe Fittings and Pipe Accessories are Loadable Families.
- Most of the parameters and functions for system family cannot be edited or modified by users, except by below settings.
- Before starting the plumbing project, Piping System and Pipe Type should be well established.
- Piping System indicates the function of the complete pipework.
- Pipe Type indicates the material of the pipe.

- Create Piping System

Rename Piping Systems according to **Piping System (System Classification) Table**

Set Rise/ Drop Sybmol

Rise / Drop	
Two Line Drop Symbol	Yin Yang
Two Line Rise Symbol	Outline
Single Line Drop Symbol	Bend - ¼ Circle
Single Line Rise Symbol	Yin Yang - Filled
Single Line Tee Up Symbol	None
Single Line Tee Down Symbol	None
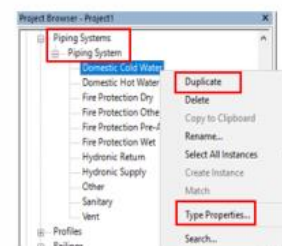
a. In Project Browser ➤ Piping System.
b. Duplicate suitable Pipe system to create a new Piping System.
c. Establish Type Properties (Fluid Types, Calculations, Abbreviation, Rise/Drop Symbol).

Establish your own abbreviations for Piping System by Abbreviation for Drawing Production (After all systems have been modelled and before producing drawing)

Identity Data	
Type Image	
Abbreviation	Fresh
Type Comments	

Different sub-category piping system contain unique settings in Revit. Duplicate and edit suitable Pipe system (Sub-Category) according to Piping System (Sub-Category) Table.

Piping System (Sub-Category) Table

Sub-category	Functional type (System)	Functional Type (short form)
Domestic Cold Water	Fresh Water Pipe	FRWP
Sanitary	Flushing Water Pipe	FLWP
Domestic Hot Water	Hot Water Pipe	HWP
Other	Irrigation Water Pipe	IRWP
Other	Rain Water Pipe	RWP

MEP Checklist

MEP Checklist

MEP Checklist

- Discipline Color Legend
  - Filter
  - Line Pattern

- System Color Legend

7 Model Audit Checklist

7.3 Standard Check

7.3.6 View and Sheet Set up

- EMSD has published BIM-AM Standards and Guidelines on 2017.
- There is a list of indication on MEP system color legend.

Building Information Modelling for Asset Management (BIM-AM) Standards and Guidelines

Version 2.0

2019

機電工程署 EMSD
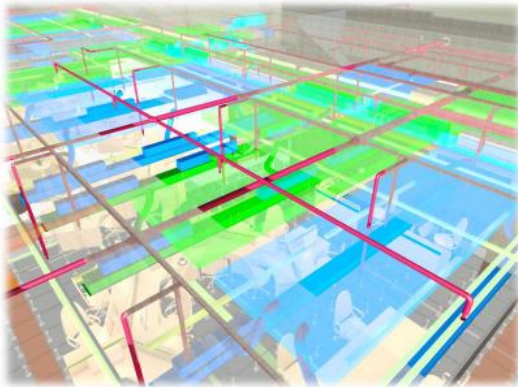
3.6.4. E&M Systems Colour Coding

The colour coding shall be assigned for the system types below by configuration of corresponding "Filters" under "Visibility/Graphics Override". For system types not listed below, consultants or contractors are advised to propose new colour coding for new system types with substantiation, where deemed necessary.

System Type	Color Palette	RGB Code
Primary Air Duct		0,255,255
Exhaust Air Duct		0, 255, 0
Fresh Air Duct		0, 0, 255
Supply Air Duct		255, 0, 0
Return Air Duct		255, 0, 255
Transfer Air Duct		0, 128, 255
Smoke Extraction Duct		128, 128, 0
Make Up Air Duct		192, 192, 192
Staircase Pressurization Duct		192, 192, 192
Condensate Drain Pipe		255, 128, 0
Chilled Water Return Pipe		0, 255, 0
Chilled Water Supply Pipe		0, 0, 255
Condening Water Supply Pipe		0, 128, 64
Condening Water Return Pipe		0, 128, 255
Chemical Dosing Pipe		192, 192, 192
Make-up Water Pipe		192, 192, 192
Heating Hot Water Supply Pipe		128, 0, 0
Heating Hot Water Return Pipe		255, 128, 64
Waste Pipe		128, 128, 0
Soil and Waste Pipe		128, 0, 0
Vent Pipe		0, 128, 255
Rain Water Pipe		0, 255, 255
Pumped Soil & Waste Pipe		64, 0, 0
Pumped Waste Pipe		64, 64, 0
Pumped Rainwater Pipe		0, 128, 128
Cleaning Water Pipe		0, 0, 255

31

MEP Checklist

- Drawing Reference

Workset	8F		AI			Revision	Drawing Name	CAD	
550 MVAC	MVAC		AI-114	2502303A-AC-212		B	HVAC SERVICES - LAYOUT PLAN 8/F	MEP-SP07-HVCE-AC-8F(20180410)	
520 DRN	DR		AI-140	2502303A-DR-212		B	DRAINAGE LAYOUT PLAN FOR EIGHTH FLOOR	2502303A-DR-212 (8F)	
610 EL	EL CABLE CONTAINMENT		AI-140	2502303A-EL-412		C	CABLE CONTAINMENT LAYOUT PLAN FOR EIGHTH FLOOR	Cable Containment Layout_20180417	GBP08 8F Cable Containment
610 EL	EL INTERIOR DESIGN LIGHTING		AI-114	2502303A-EL-212-1	2502303A-EL-212-2	-	INTERIOR DESIGN LIGHTING LAYOUT PLAN FOR EIGHTH FLOOR	-	
610 EL	EL INTERIOR DESIGN POWER		AI-114	2502303A-EL-312-1		-	INTERIOR DESIGN POWER LAYOUT PLAN FOR EIGHTH FLOOR	ID Power layout_P5_8F - Small power	
610 EL	EL POWER		AI-114	2502303A-EL-312		C	POWER LAYOUT PLAN FOR EIGHTH FLOOR	Power Layout_20180404	
610 EL	EL POWER		AI-114	2502303A-EL-312-2A	~ 2502303A-EL-312-2D	-	POWER LAYOUT PLAN FOR KITCHEN EQUIPMENT AT EIGHTH FLOOR	Kitchen Power Layout_20180205	
610 ELV	ELV & CABLE CONTAINMENT		AI-114	2502303A-ELV-212		C	ELV & CABLE CONTAINMENT LAYOUT PLAN FOR EIGHTH FLOOR	2502303A-ELV-212(L8)	
610 ELV	ELV SECURITY SYSTEM		AI-114	2502303A-SEC-212		A	SECURITY SYSTEM LAYOUT PLAN FOR EIGHTH FLOOR	2502303A-SEC-212(L8)	
580 FS	FS		AI-114	2502303A-FS-212		C	FIRE SERVICE LAYOUT PLAN FOR SEVENTH FLOOR	20180403 KLD-481-8C-01_05 (P5 FS layout)(1)	
580 FS	AUTOMATIC FIRE DETECTION & FIRE ALARM SYSTEM		AI-114	2502303A-FS-412		A	AUTOMATIC FIRE DETECTION & FIRE ALARM SYSTEM LAYOUT PLAN FOR EIGHTH FLOOR	20180403 KLD-481-8F-01_05 (P5 AFA layout)(2)	
530 PLM	PL		AI-140	2502303A-PL-211		B	PLUMBING LAYOUT PLAN FOR EIGHTH FLOOR	2502303A-PL-212 (8F)	

MEP Checklist

- CAD Import Standard
    - "Link CAD" or "Import CAD" ?
    - Workset
    - CAD Template

HVCE-ImportCAD-ElevationTemplate	3/19/2018 5:37 PM	DWG File
HVCE-ImportCAD-Template Ceiling	9/11/2018 9:35 AM	DWG File
HVCE-ImportCAD-Template	5/7/2019 5:37 PM	DWG File
HVCE-ImportCAD-Template_LB	1/16/2019 4:43 PM	DWG File

MEP Checklist

- Drawing Preparation
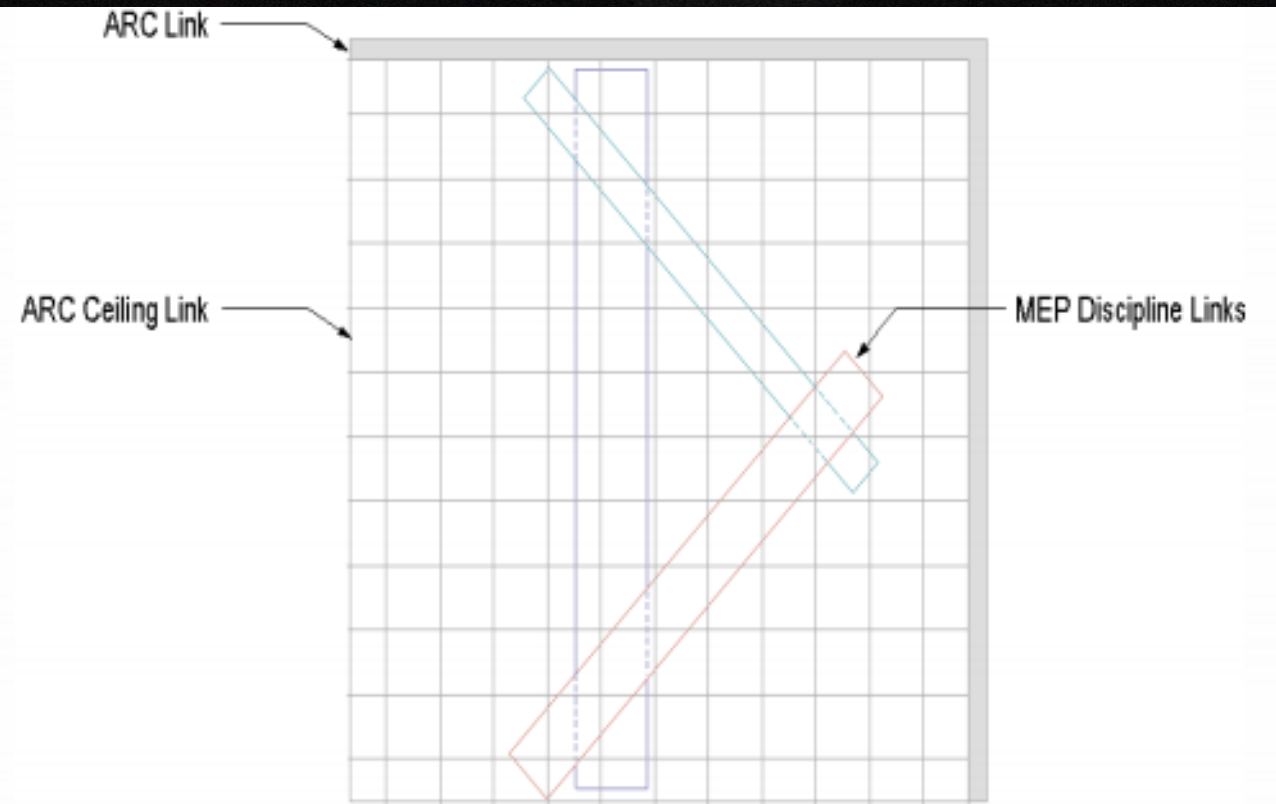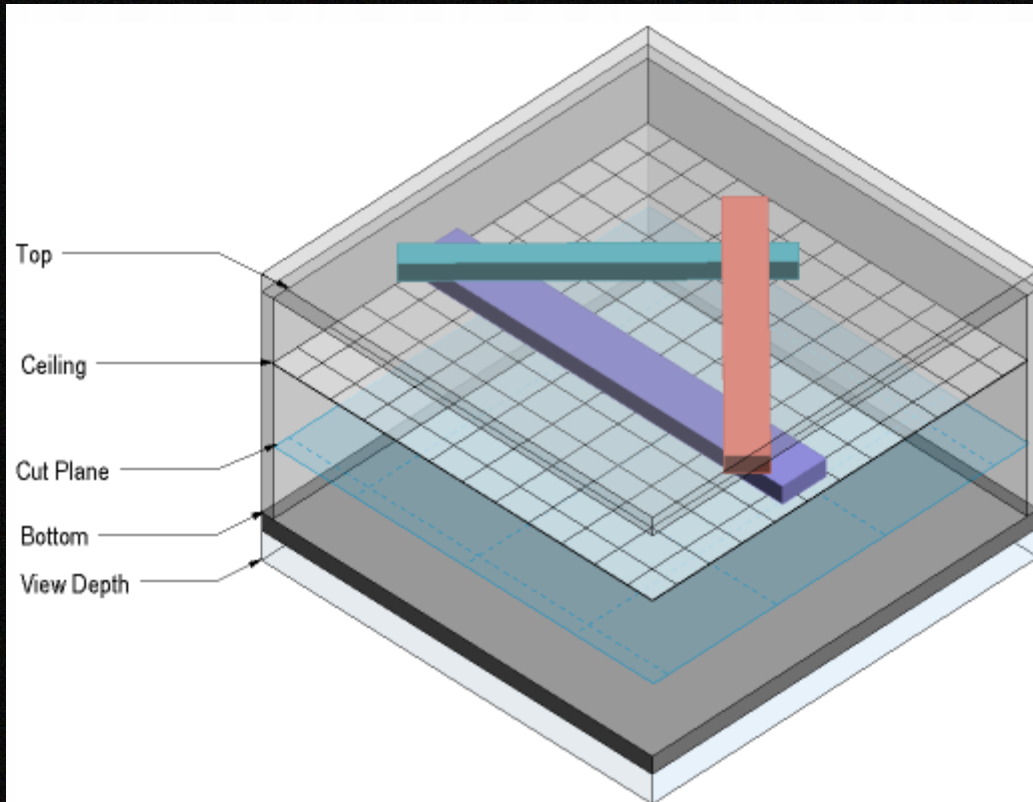
MEP Checklist

- Drawing Preparation - CSD
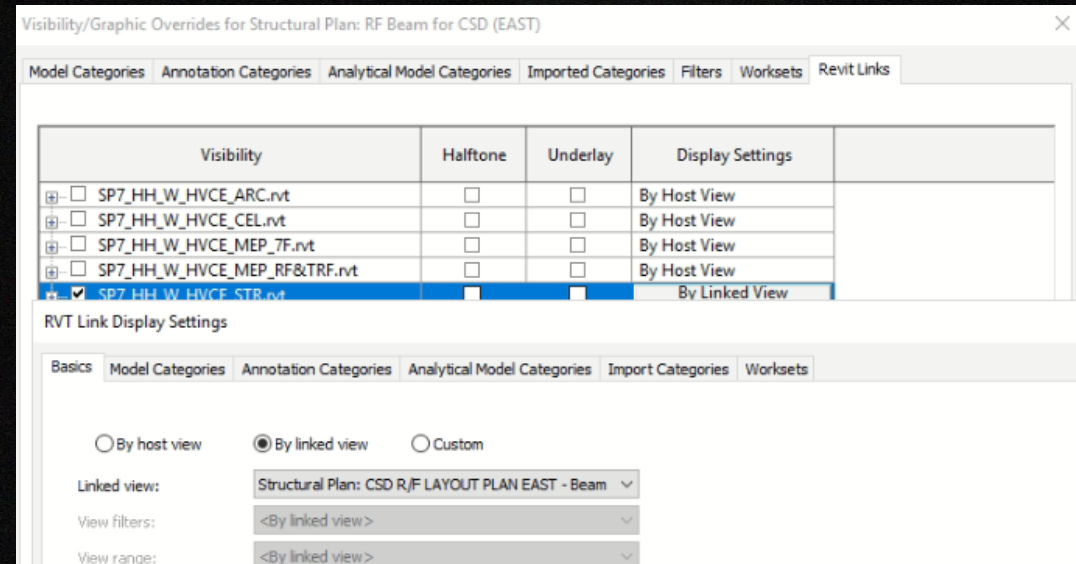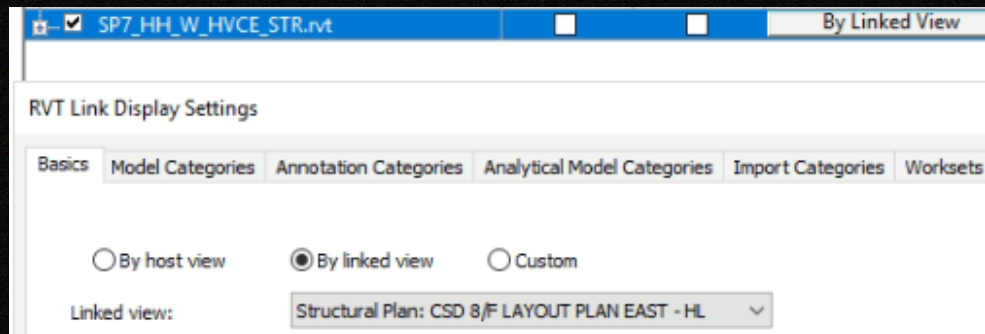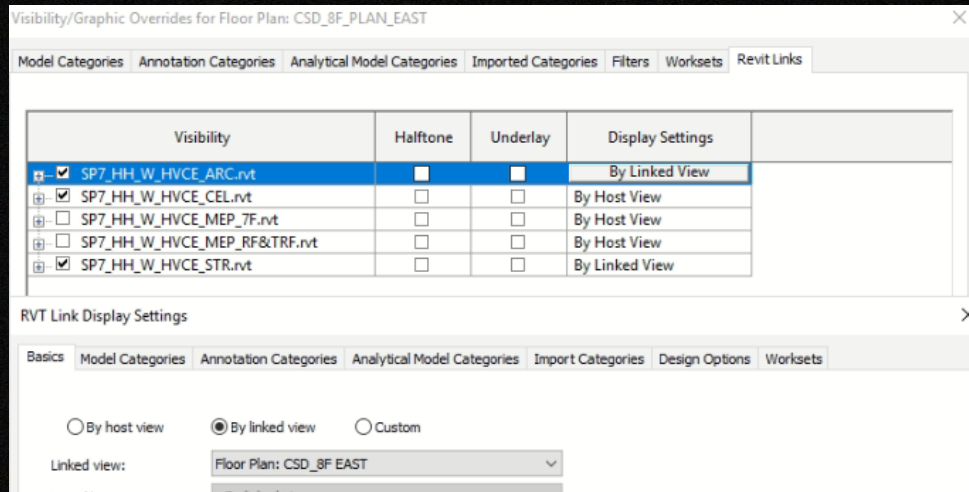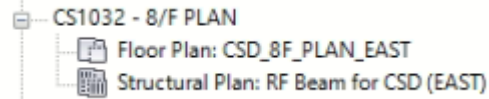
MEP Checklist

- Drawing Preparation – CBWD

Slab Opening & Beam Opening

Wall Opening

MEP Checklist

- Drawing Preparation

SECTION 6
6 MEP-SP07-HVCE-CS1017
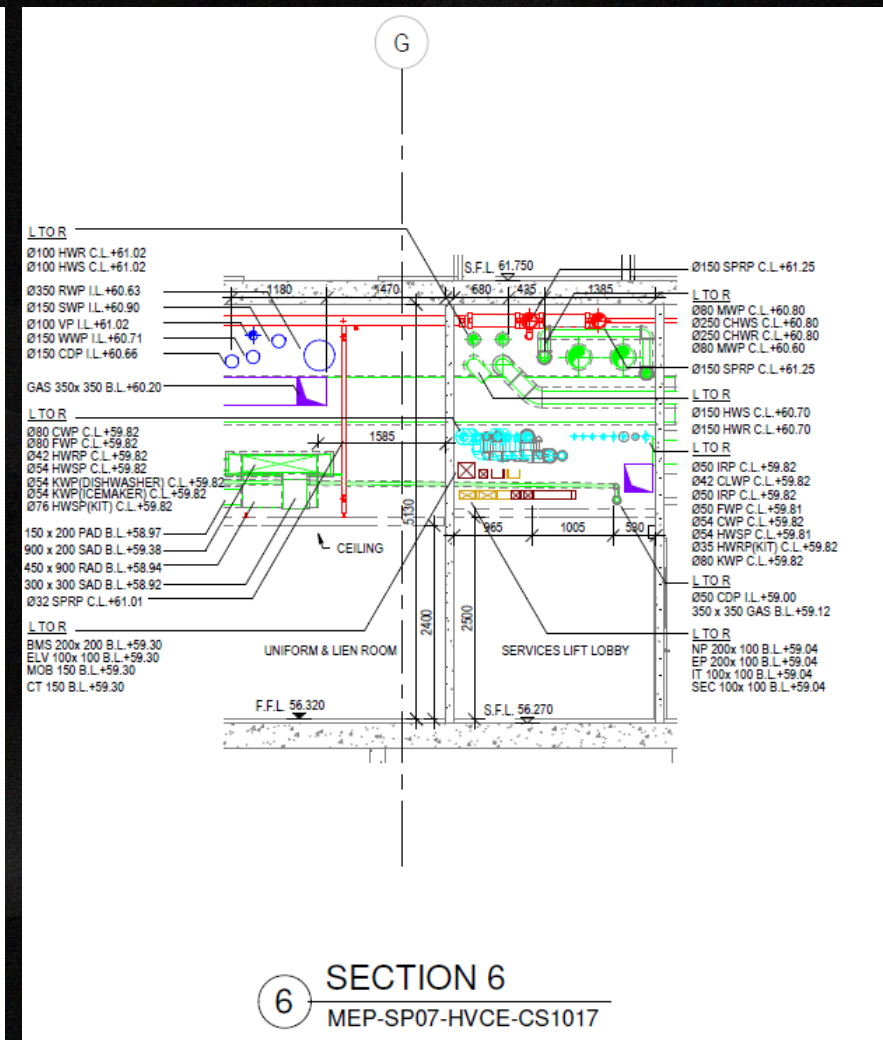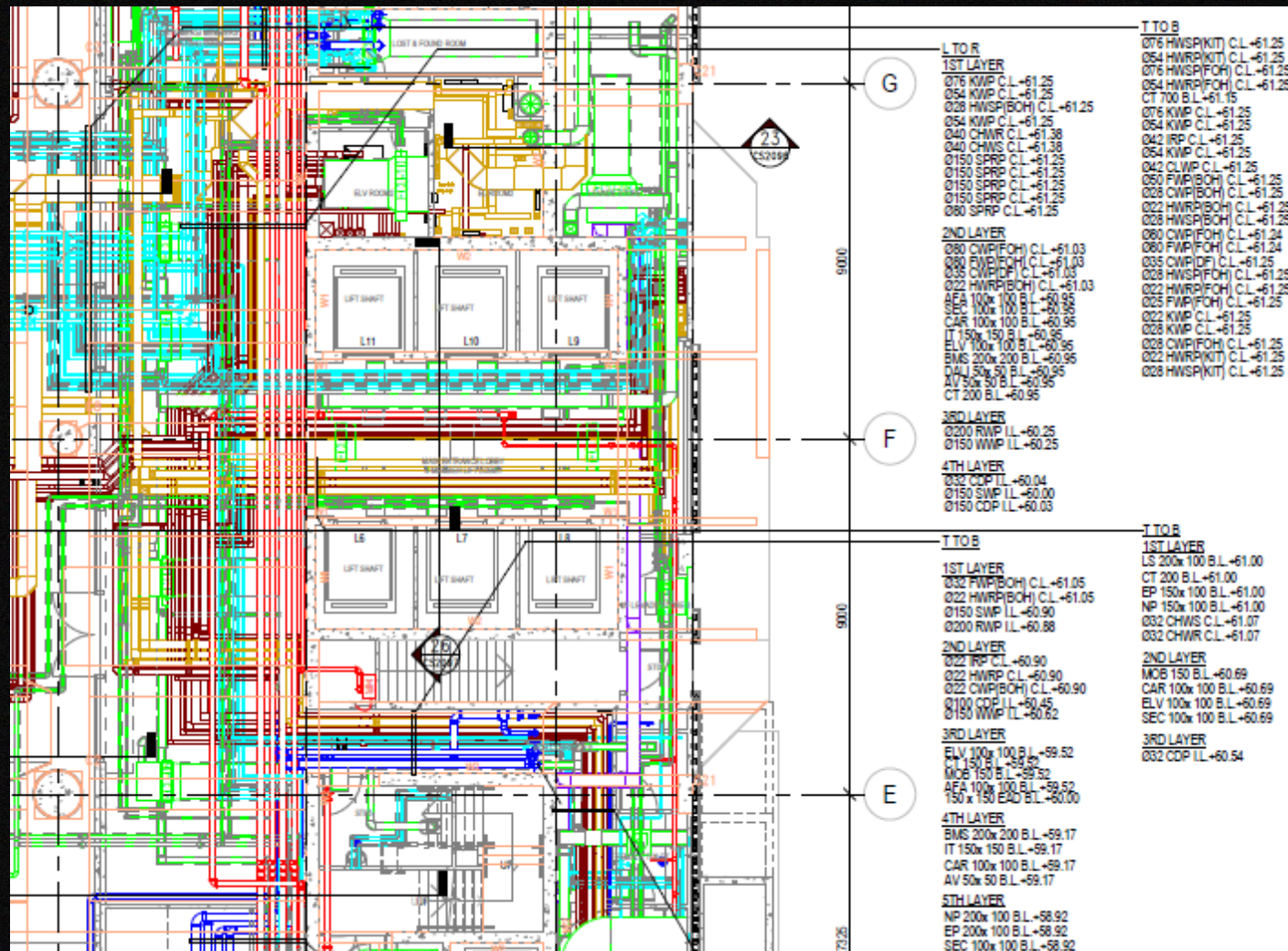
MEP Checklist

- Drawing Preparation

- As Revit cannot recognize the finishing floor level (FFL), therefore, all MEP routing should be modelled based on the Datum (0 mPD) level as Reference Level.
- Preparing for Combined Builder's Work Drawing (CBWD), opening families should be modelled basked on the Datum (0 mPD) level.
- Absolute level can be retrieved for construction.

SECTION 41
MEP-SP07-HVCE-CB1046
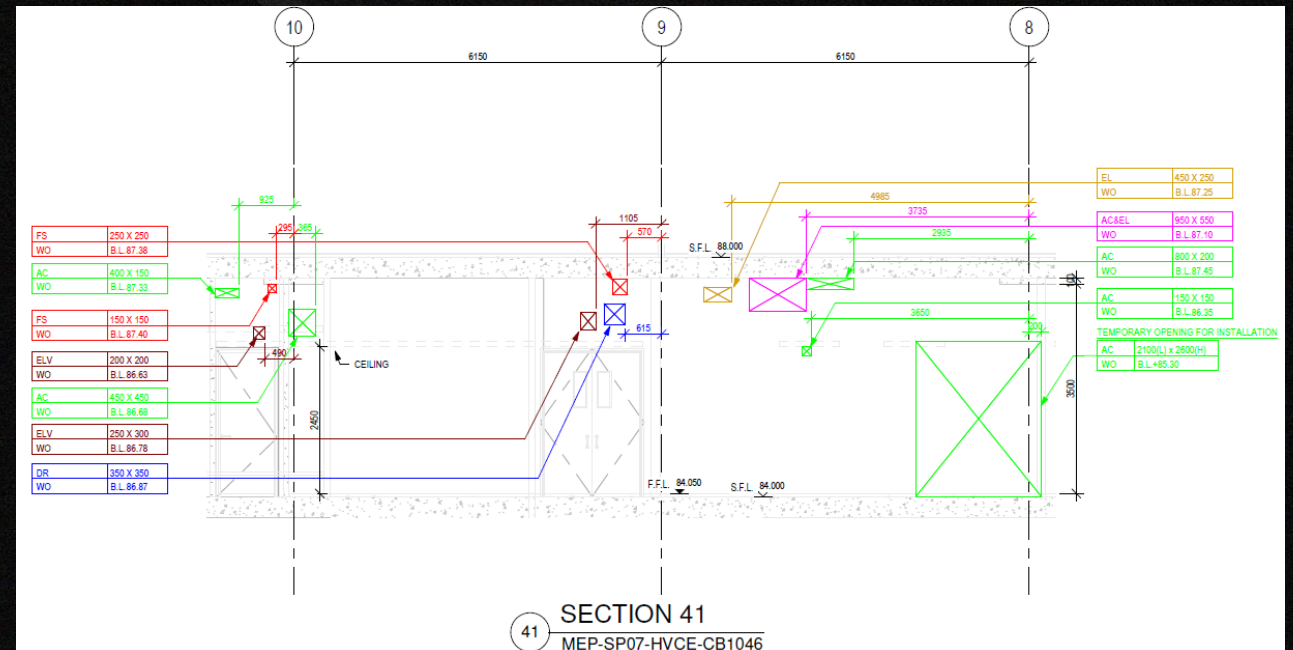
MEP Checklist

Are the review warning in the project under 50?
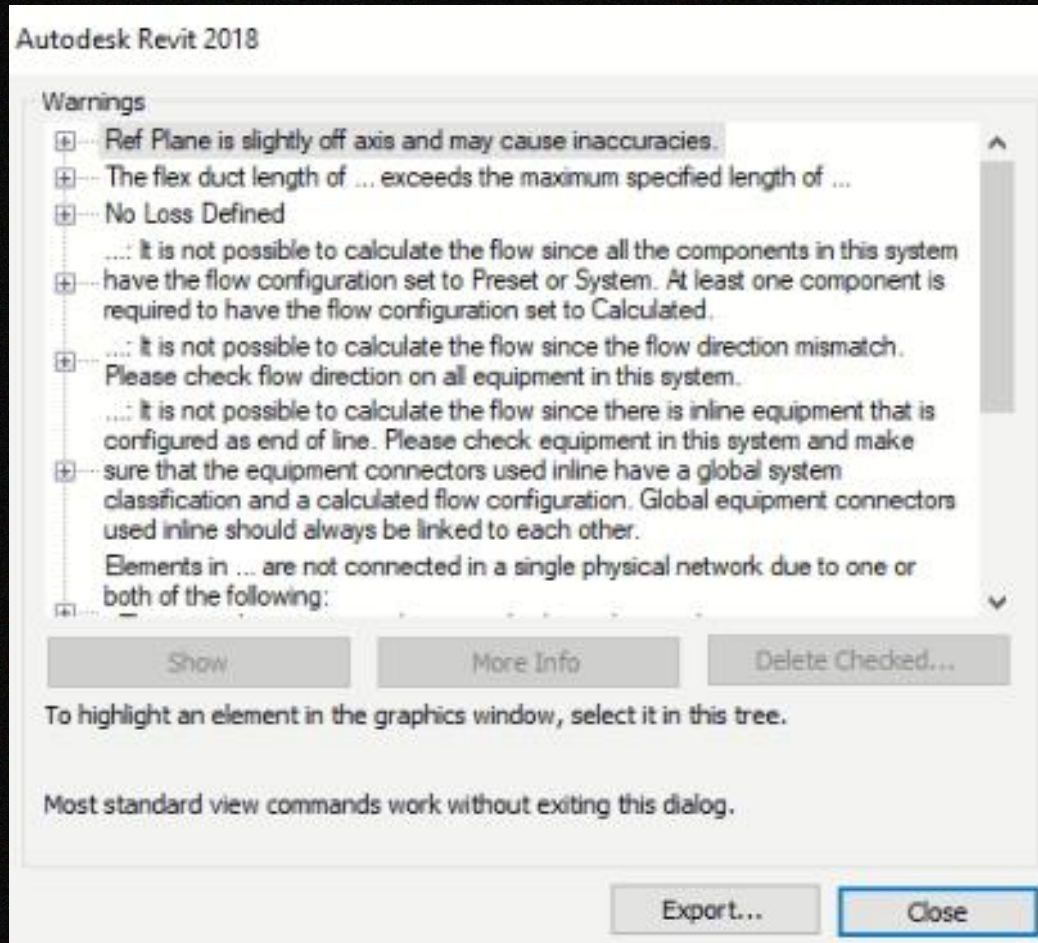
THANK YOU !
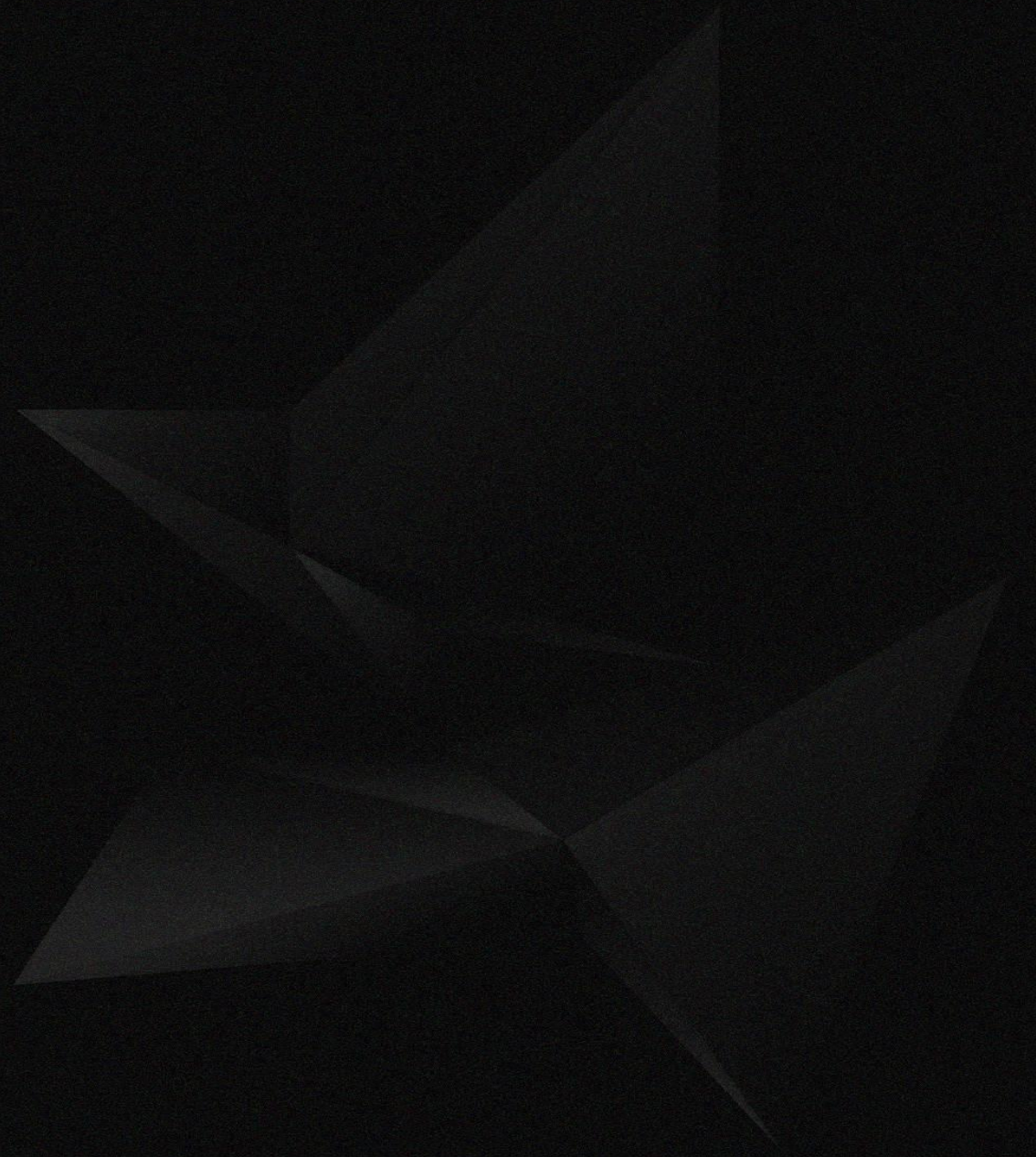
1. BIM Modelling Standard

Internal standard
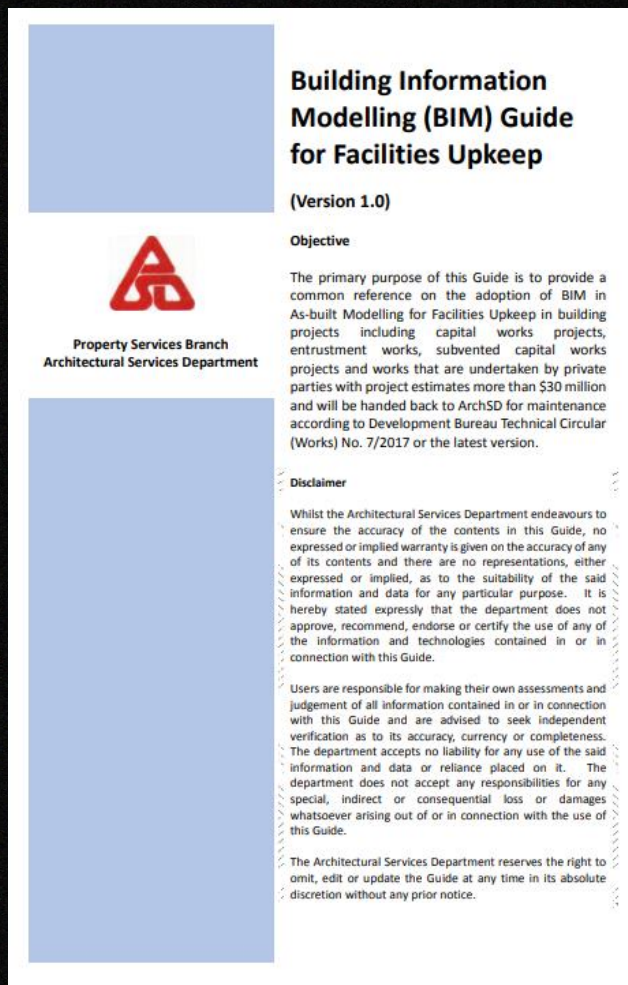
ASD BIM Guide for Facilities Upkeep
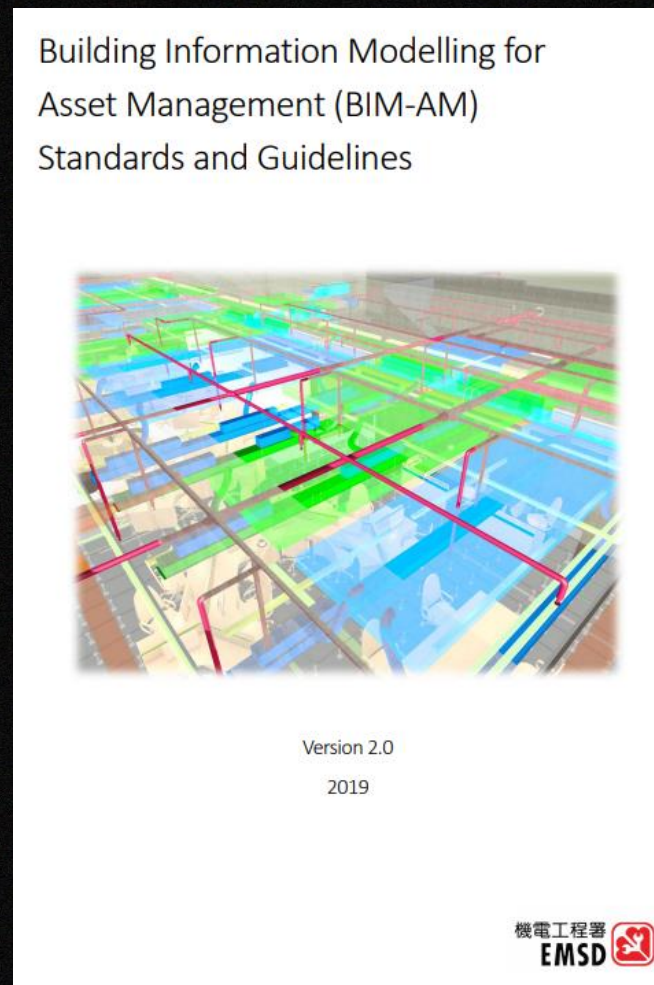
EMSD for BIM - AM
Standard and Guideline
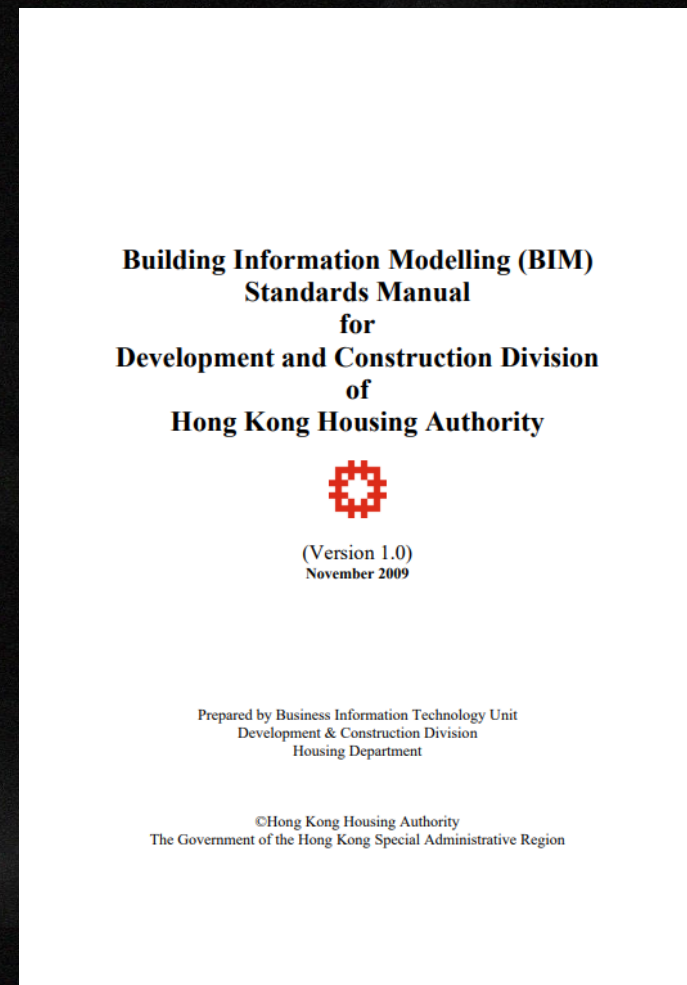
BIM Standards Manual for Development
and Construction Division of HKHA

6. Model Audit Procedure

At the beginning of the project, check the model have to be checked … the following are the items that we need to concern… *We need to check the model at least twice to make sure the model is comply with standard.

Project information loaded, Project organization, file size

Families Naming follow FLIP guideline

Gridline, Reference level setting up, share coordinate

Setting of drawing production

Wall joint Connection, slab, beam connection

See whether the model can meet the requirement of LOD or not

Information

Naming Convention

Project Setting

View and Sheet Setup

Detail of ARC, STR and MEP Model

Respect LOD Agreed

Model Audit Checking

5. Model Audit Procedure

5.4 Navisworks checking

Navisworks is a tool for checking the model. The "Clash Detection" function in Naviswork can assist user to implement interference check. Not only interference check, BIM Manager and BIM Discipline can also override the color of model to implement visual check. For example, we can override ARC model is blue in color and STR model in yellow is color, using the "Enable Section" to cut the section of model. It is easier for them to discover the problem that no related to clash.
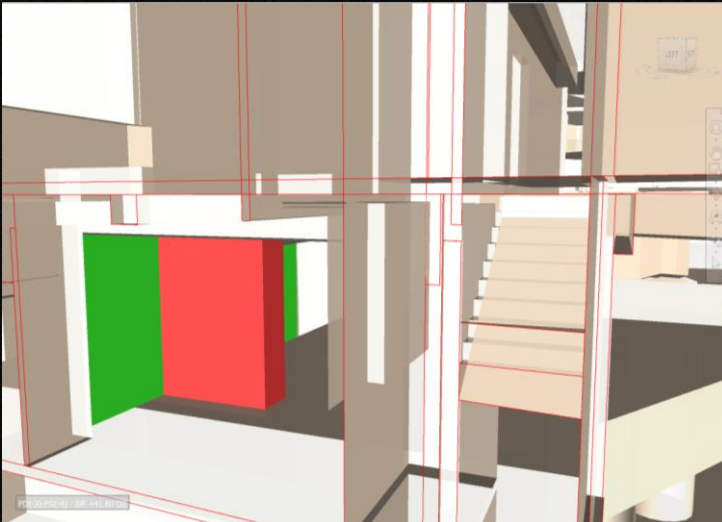
Example of interference check
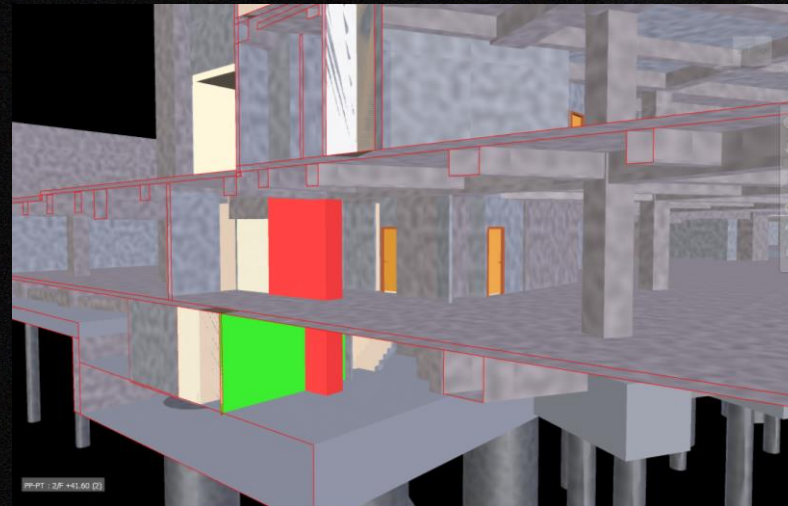
Example of interference check
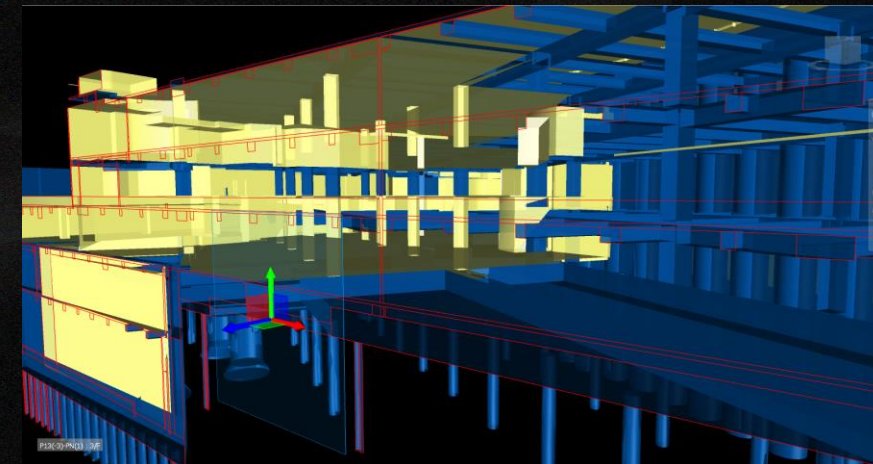
Visual Check

5. Model Audit Procedure

5.5 Clash Detection, Prioritization, Visualization and Elimination

Clash detection in Naviswork can only implement detection and reporting. It is suggested to use C-DRIVE (Programming by A.C.I.D) to implement Clash Detection. For C-DRIVE, C means clash, D means Detection, R means Reporting, I means PrIoritization, V means Visualization and E means Elimination.
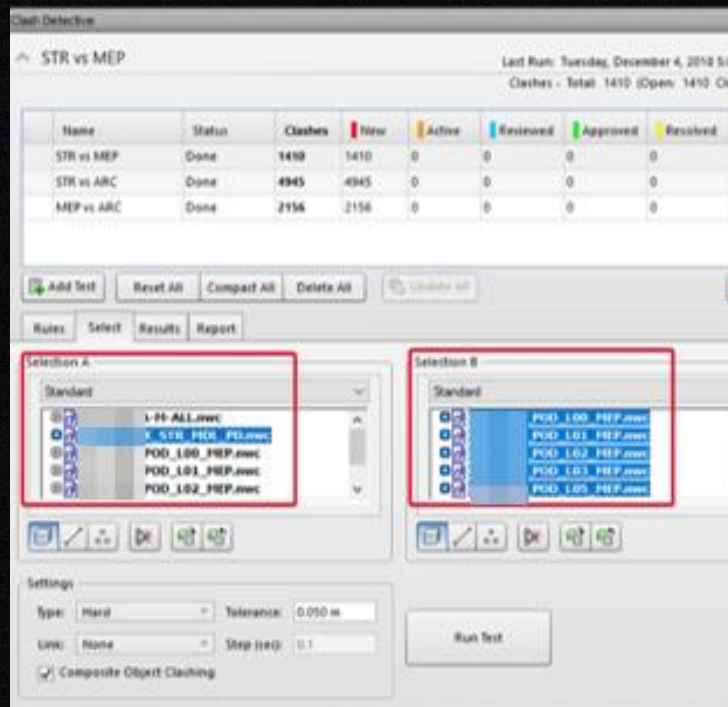
Cross Discipline Clash Detection
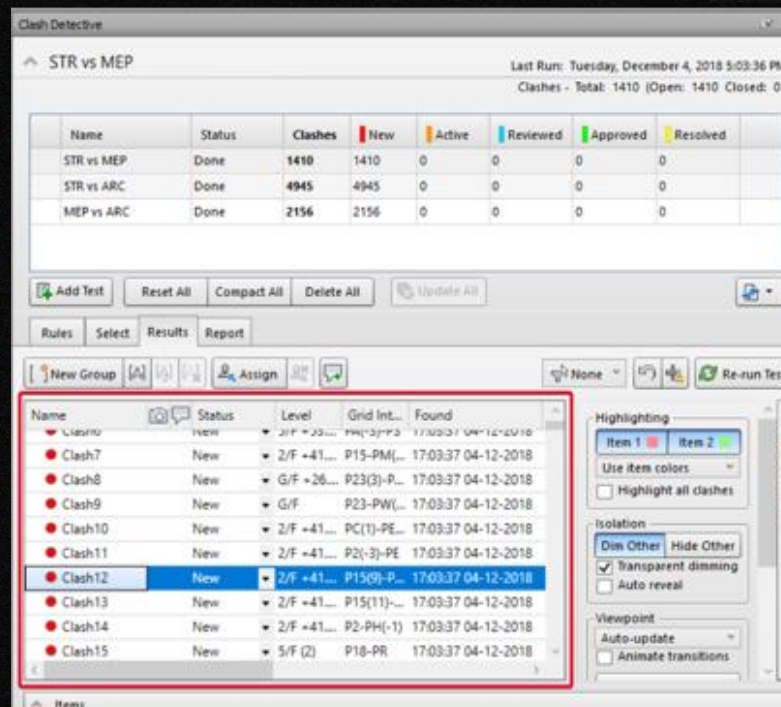
Reporting by Naviswork

Prioritization by using scoring

5. Model Audit Procedure

5.5 Clash Detection, Prioritization, Visualization and Elimination

Clash Marker generated in BIM Model which contained the information of location of clash, clash number, clash with higher score (Major clash). User can visual check the clash on floor plan, part plan, 3D model in sheet. The schedule can show the information of clash marker. For elimination, discipline coordinator can changed the color of clash marker from red (New clash) to green (Resolved clash).
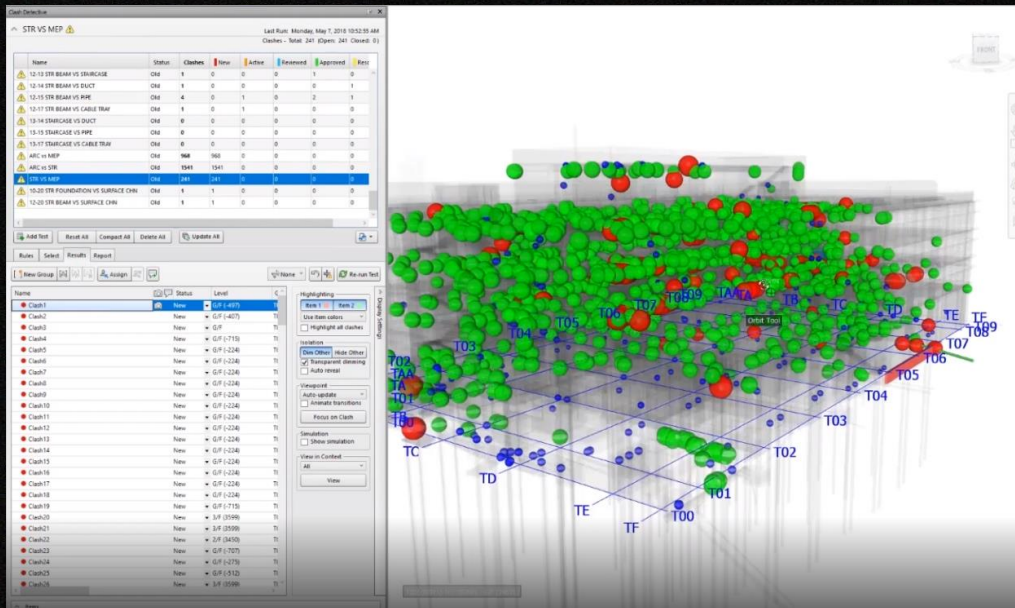
Visualization
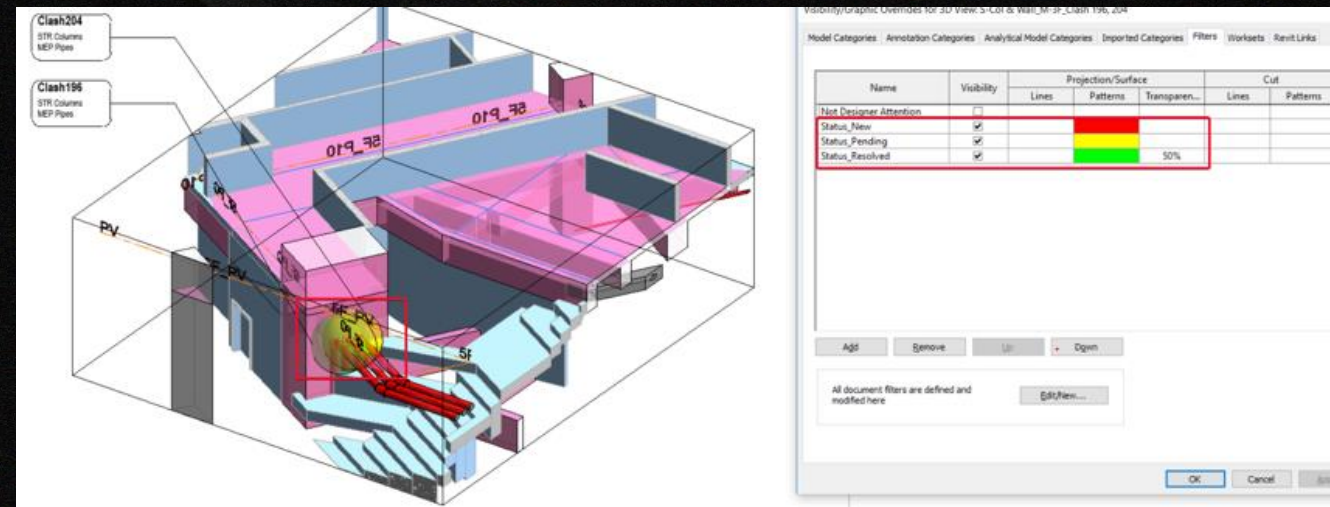
Elimination

6. System Audit

Five checking should be performed by each discipline before issue:

6.1 Fundamental Checking

Checks	Definition	Responsible	Software	Frequency
Visual check	Ensure there are no unintended model components and the design intent has been followed.	Discipline BIM Coordinator	Revit / Naviswork/ Fuzor/ A360	Weekly or before WIP exchange and end of each workstage
Interference check, Clash detection	Detect problems in the model where two building components are clashing including soft and hard.	Discipline BIM Coordinator	Revit / Naviswork/ Fuzor	Weekly or before WIP exchange and end of each workstage
Standards check	Ensure that the project BIM standards have been followed (e.g. fonts, dimensions, line styles, levels, file and object naming, classification, room numbering.	Discipline BIM Coordinator	Revit	Weekly or before WIP exchange and end of each workstage
Model data check	Process used to ensure that the project data set has no undefined, incorrectly defined or duplicated elements and the reporting process on non-compliant elements and corrective action plans.	Discipline BIM Coordinator	Revit	Weekly or before WIP exchange and end of each workstage
Model Audit	**See Appendix F "BIM Model Audit Checklist"**	**BIM Manager**	**Revit / Naviswork/ Fuzor**	Bi-weekly

7. Model Audit Checklist

7.1 Visual Check

Visual check the model to ensure that there are no unintended model components and the design intent has been followed. For example, structural column clashes with escalator, this is obvious to discover when BIM Manager and discipline coordinator visual check the model. It is suggested that to visual check the model by using Autodesk Navisworks Manage and Fuzor.
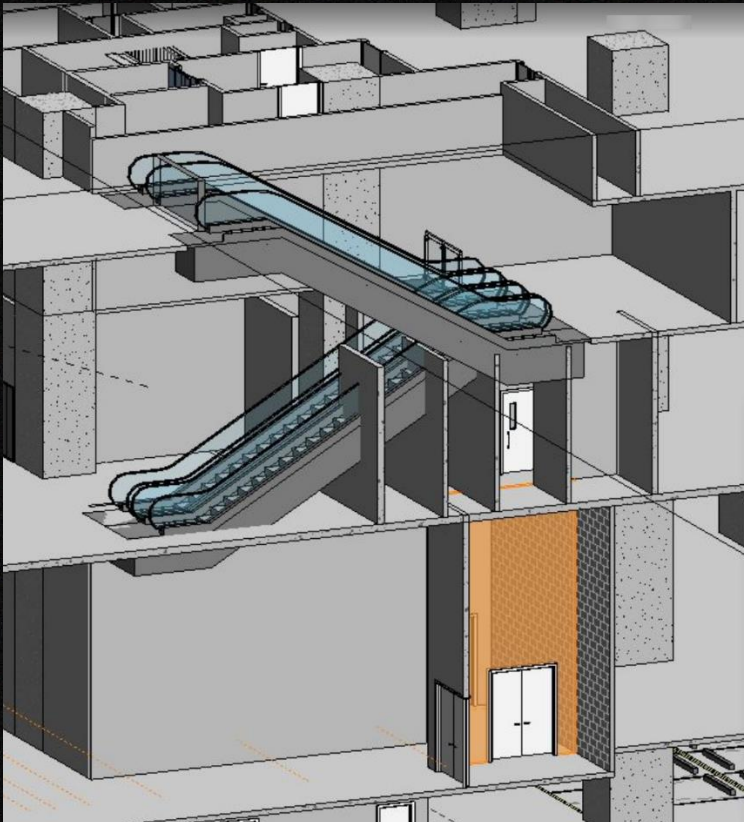
7 Model Audit Checklist

7.2 Interference Check

Interference Check is used to detect problems in the model where two building components are clashing including soft and hard. For interference check, clash detection will be run with using Autodesk Navisworks Manage software throughout with a concentration on resolving clashes prior to submission of the models.
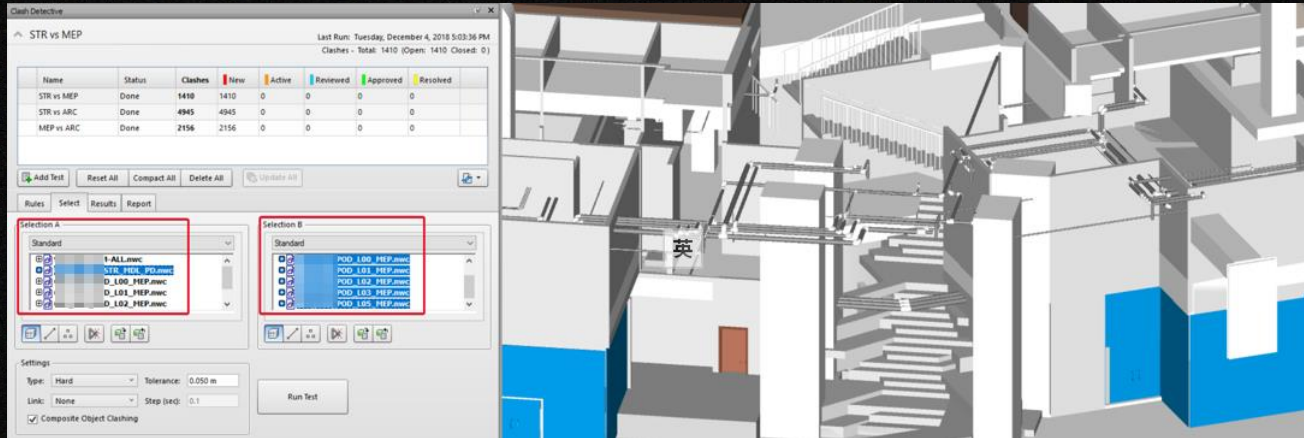
Cross Discipline Clash Detection in Navisworks
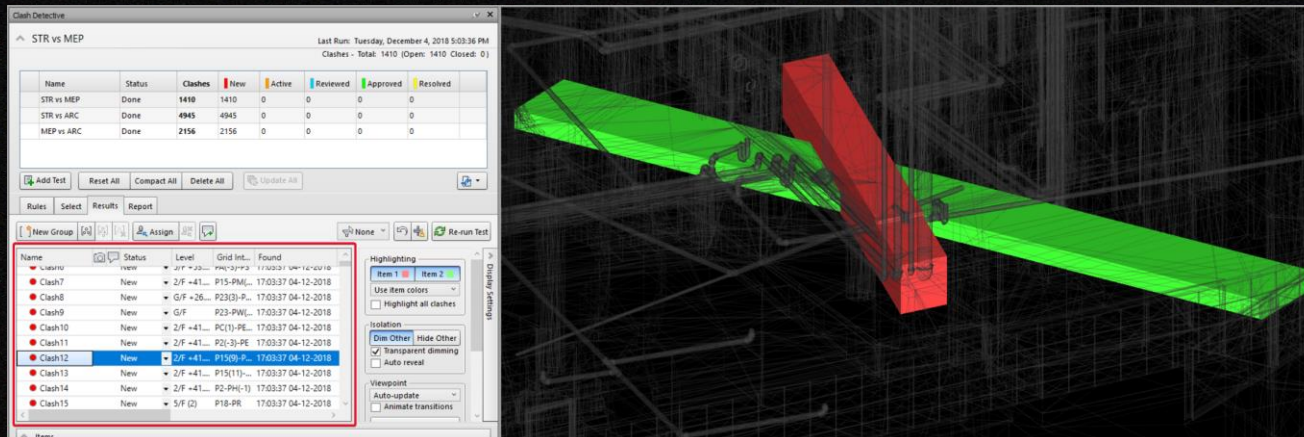
Clash result in Navisworks

7 Model Audit Checklist

7.4 Data/ Information integrity Check

•Describe the QC validation process used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements and the reporting process on noncompliant elements and corrective action plans .

•Data/ Information integrity check define some optional item shall match Information / manual for Facilities Up keeping.

•Clients' BIM Standard/ Requirements
•Government BIM Standards

8. Drawing Production Capability and Standard

8.1 Statutory Compliance

1. A combined model should be divided by different discipline

2. Drawing can be generated from BIM model. Drawing Generation from 3D model is mandatory.

Design Process → Deliverable

BIM Uses

Annex 1

1. Works Departments shall adopt the stipulated mandatory BIM uses in respective stages of a project. Works Departments may adopt the optional BIM uses when necessary.

	BIM Use	Investigation, Feasibility and Planning	Design	Construction
1	Design Authoring	O	M	M
2	Design Reviews	O	M	M
3	Existing Conditions Modelling	O	M	M
4	Site Analysis	O	M	
5	3D Coordination		M	M
6	Cost Estimation	O	M^a	M^b
7	Engineering Analysis		O	O
8	Facility Energy Analysis		O	O
9	Sustainability Evaluation	O	O	O
10	Space Programming	O	M^c	
11	Phase Planning (4D Modelling)		M^d	M
12	Digital Fabrication		O	M^e
13	Site Utilization Planning			M^f
14	3D Control and Planning			O
15	As-Built Modelling			M
16	Project Systems Analysis			O
17	Maintenance Scheduling			M^g
18	Space Management and Tracking			O
19	Asset Management			O
20	Drawing Generation (Drawing Production)		M	M

Legend:
M – Mandatory BIM Use for the mentioned stage, including that carried forward from previous stage.
O – Optional BIM Use

DEVB TC(W) No. 18/2018   *Page 7 of 11*

Design Presentation
Architectural Design
Structural Design
MEP Design
Landscape Design
Civil Design…

Statutory Submission – Legal
General Building Plan
Curtain Wall Submission,
Demolition Plan,
Site Formation Plan, Structural Submission,
Drainage Submission, Utility Submission…

Construction – Contractual
Tender Drawing, Construction Drawing,
Shop Drawings,
Combined Services Drawings (CSD),
Combined Builder's Work Drawings (CBWD),
As-built Drawings…

12. Update and Change Management

12.3 Record Comparison

In Design stage, we used CAD drawing to mark up when design changes.

In BIM workflow, we can use A360 to collaborate with each other and version control can help the parties to identify the model version and its information.

In Construction stage, contractor and sub contractor used site sketch to do collaboration.

In BIM workflow, we can use BIM Collab and BIM Track to do collaboration that can control the version and review mark up.