Multi disciplinary project collaboration using BIM

# Block MD1, Yong Loo Lin School of Medicine, NUS

# Yong Loo Lin School of Medicine at NUS

- **Introduction**
  - MD-1 is the third part of a three-building project which will provide significant expansion and modernization to National University of Singapore's School of Medicine. The first part of this project, the MD-2 Vivarium, is complete and operating. MD-6, a laboratory and teaching facility and a centerpiece of the Yong Loo Lin project is currently under construction. Upon final completion and occupation of MD-2, the existing Vivarium at MD-1 will be demolished, making available the MD-1 site as the third building in the project.
- **Project Goals**
  - The MD-1 project is the third phase of an ambitious, national program which seeks to upgrade Singapore's capabilities as a center of advanced medical education and medical research. This building has medical education, research and additional campus amenities as its centerpiece.
  - The intention is to provide a "World-Class Medical School" project that follows the high standards set by NUS in the design and construction of both MD2 and MD6.

# Project team

- CPG
  - Lim Choon Keang (PD)
  - Kuan Chee Yung (QP)
  - Kong Kin Chong (Architect)
  - Manon S. Koestoer (Architect)
  - Zheng Xuhui (Architect)
  - Sng Seok Hiang (Technical)
  - Leck Mong Nguang (CAD)
  - Renator Ibanez (CAD)
  - Ricardo Mayacyac (CAD)
  - Alimatu Sadiah (Revit Archi)
  - Starscky Zotomayor (Revit Archi)
  - Alan Belda (Revit Archi & Struct)
  - Chitra Devi Ramiah (Revit Archi)
  - Pa Pa Mon (Revit Archi)
  - Hew Foo Loong (Engineer Mech)
  - Jeffrey Ng (Engineer Mech)
  - Angelia Goh (Engineer Elec)
  - Pansy Peh (Revit ME)
  - Doris Tan (Revit ME)
  - Lee Shi Min Ivy (Revit ME)
  - Jasy Goh (Revit ME)
  - Wint Shwe Yi Tun (Revit ME)
  - Salimah Binte Mahadi (Revit ME)
  - Saw Thant Lwin Tun (Revit ME)
- RMJM-Hillier
  - Steve Fischwick (Principal)
  - Warren Kim (Architect)
  - Kevin Hamlett (Architect)
  - Phil Gray (Architect)
  - Kosior Winslow (Technical Director)
  - Erica Nobori (Architect)
  - Park Sang Hwan (Architect)
  - Chung Sang Hyun (Architect)

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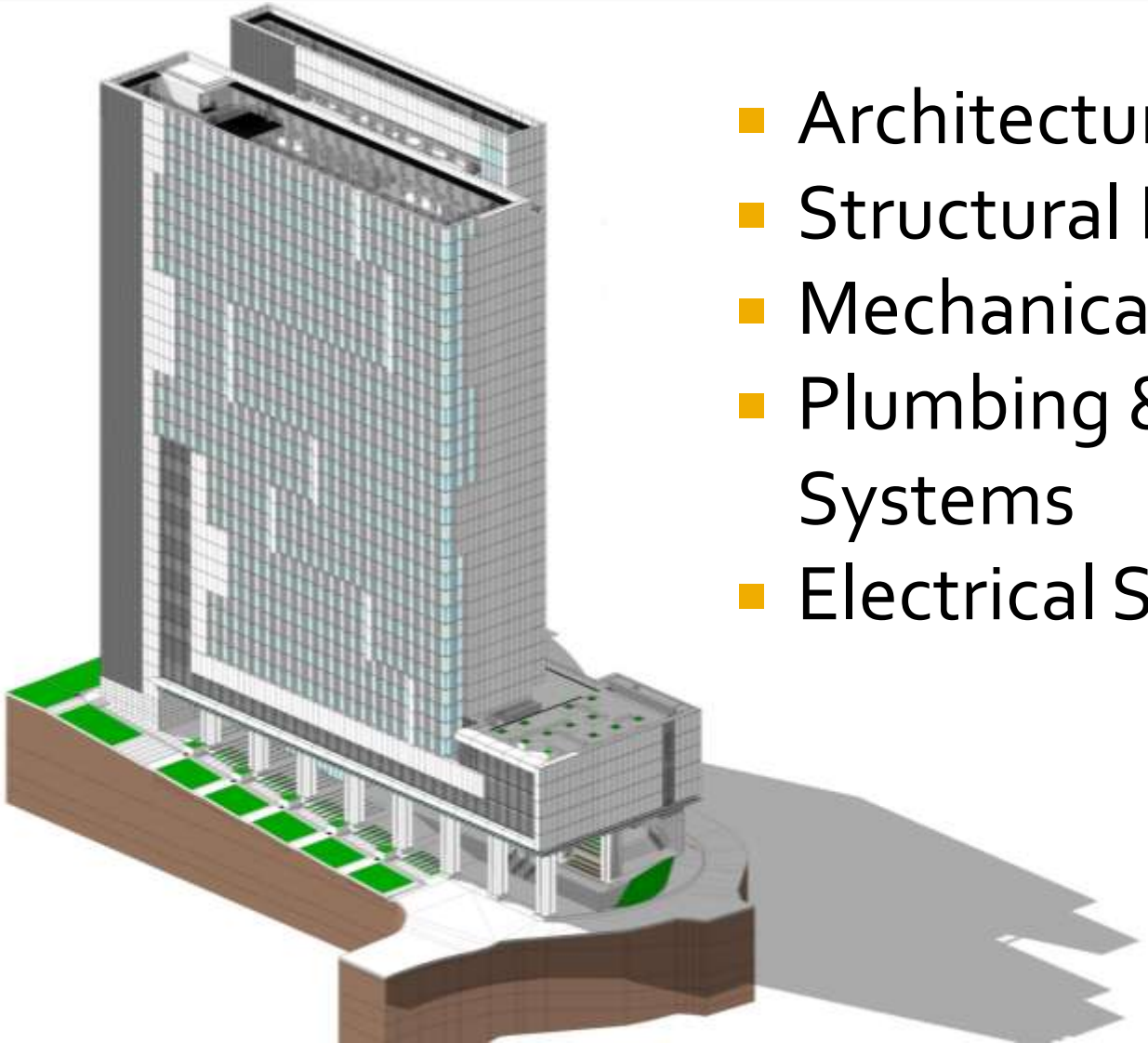
# Disciplines Involved



- Architecture
- Structural Framing
- Mechanical Systems
- Plumbing & Sanitary Systems
- Electrical Systems

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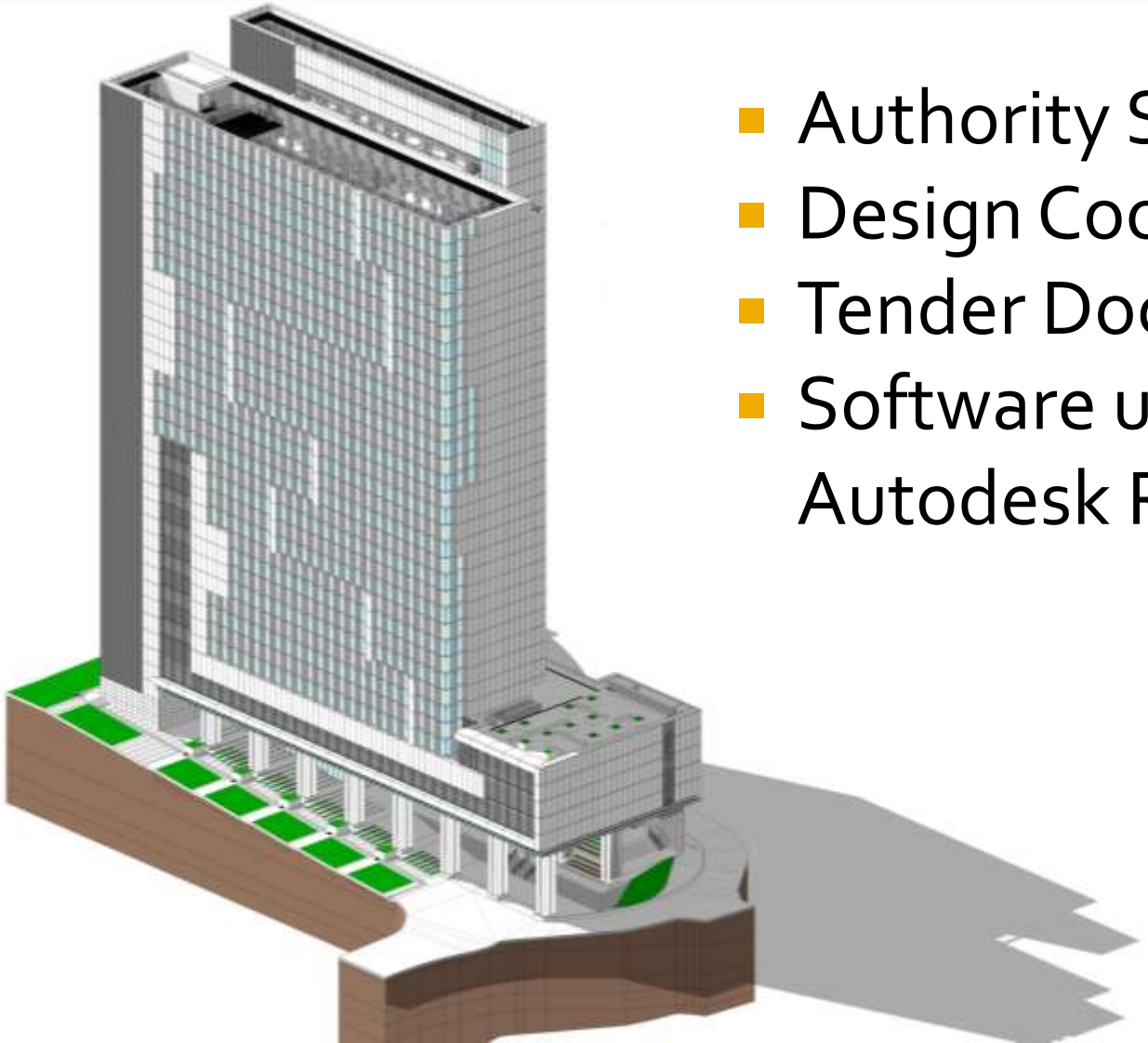
# BIM is used for



- Authority Submission
- Design Coordination
- Tender Documentation
- Software used:
  Autodesk Revit 2010

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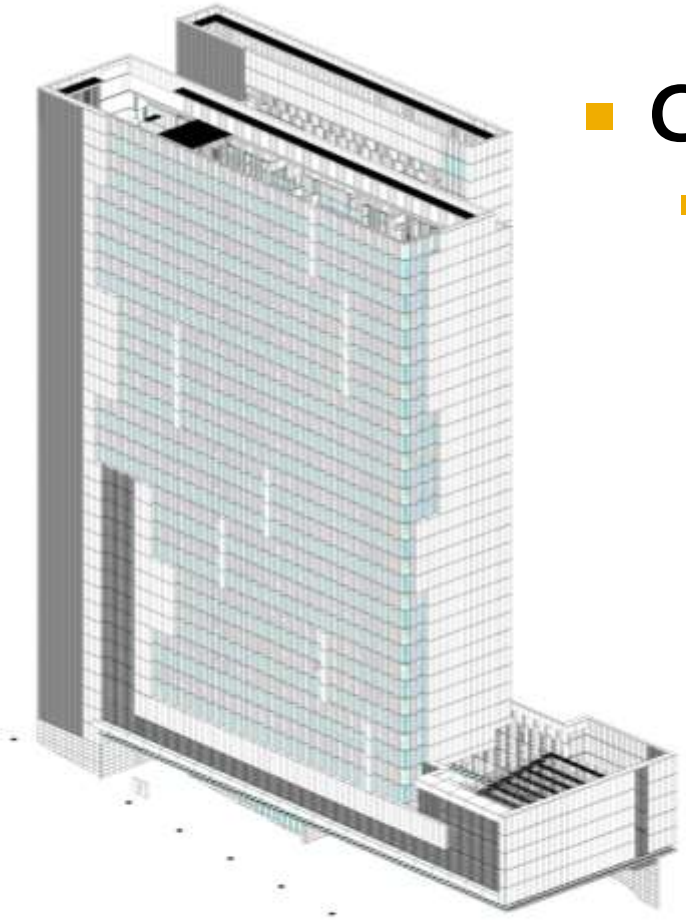
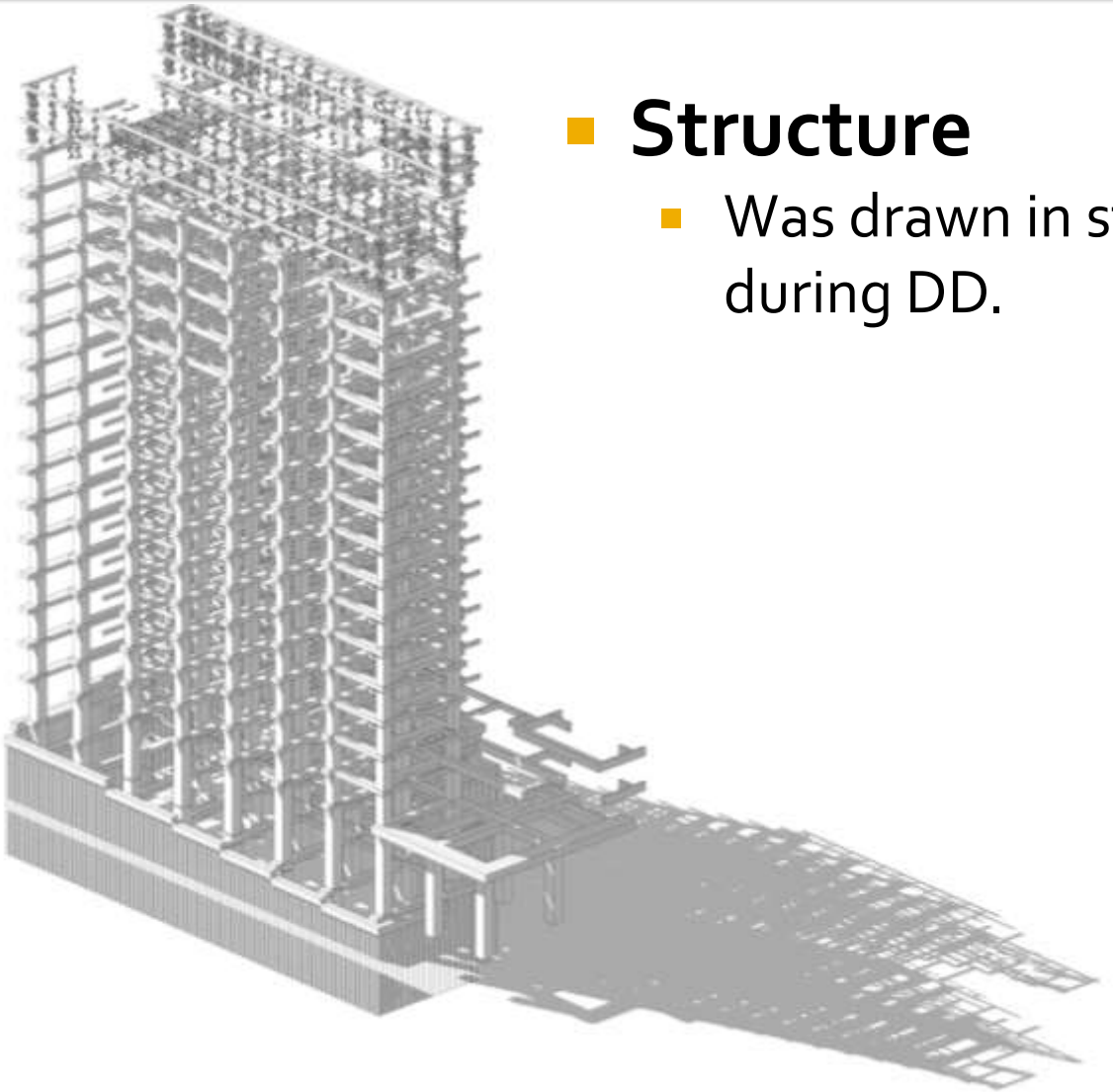
# Layers *Façade*



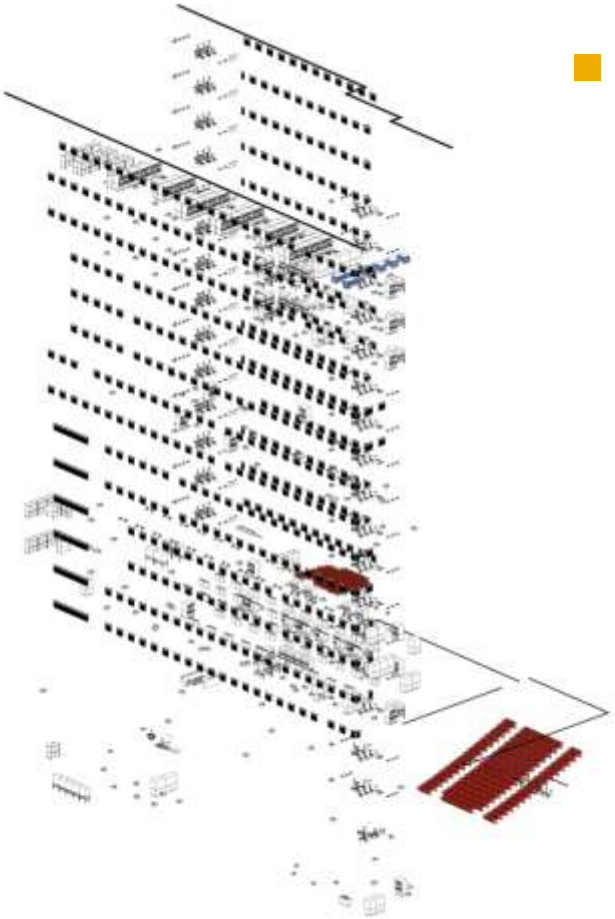
- **Curtain wall**
  - Curtain wall drawing was developed in CAD during SD. Translated to Revit after DD drawing is finalized.

# Layers *Structural*



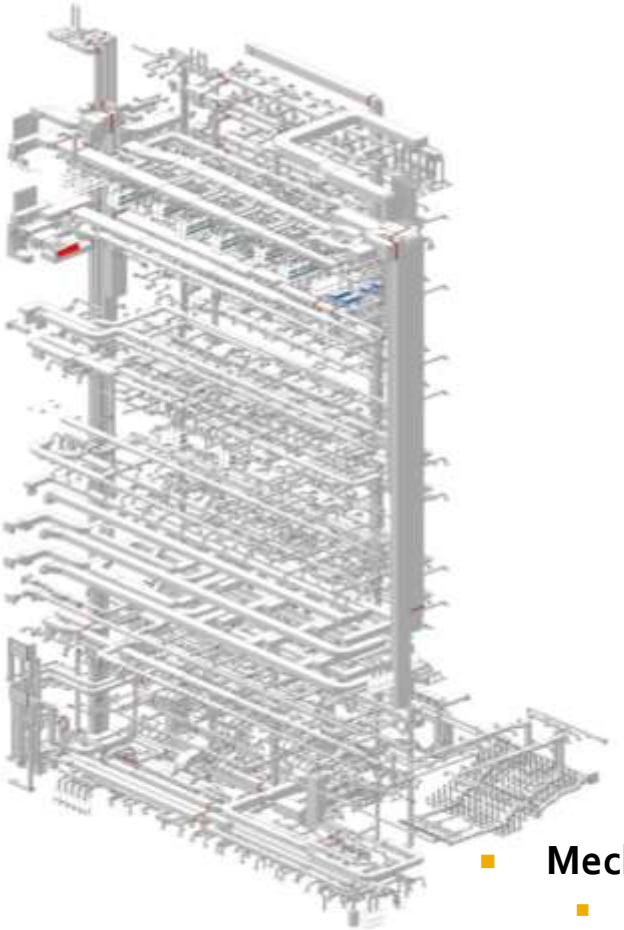
- **Structure**
  - Was drawn in structural module during DD.

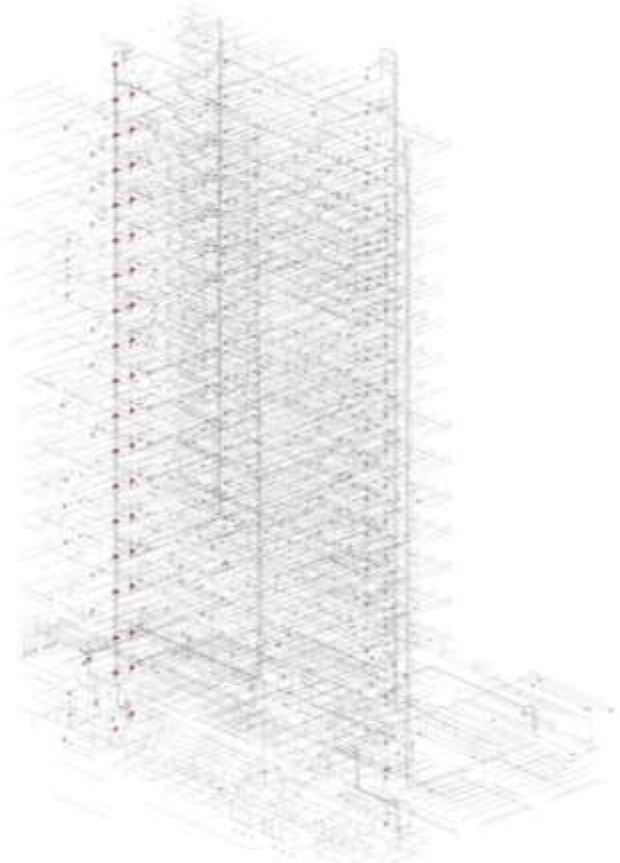
# Layers *Furnitures*



- **Furnitures**
  - Fixed furniture such as lab benches, fume hoods that is connected to mechanical, plumbing, sanitary

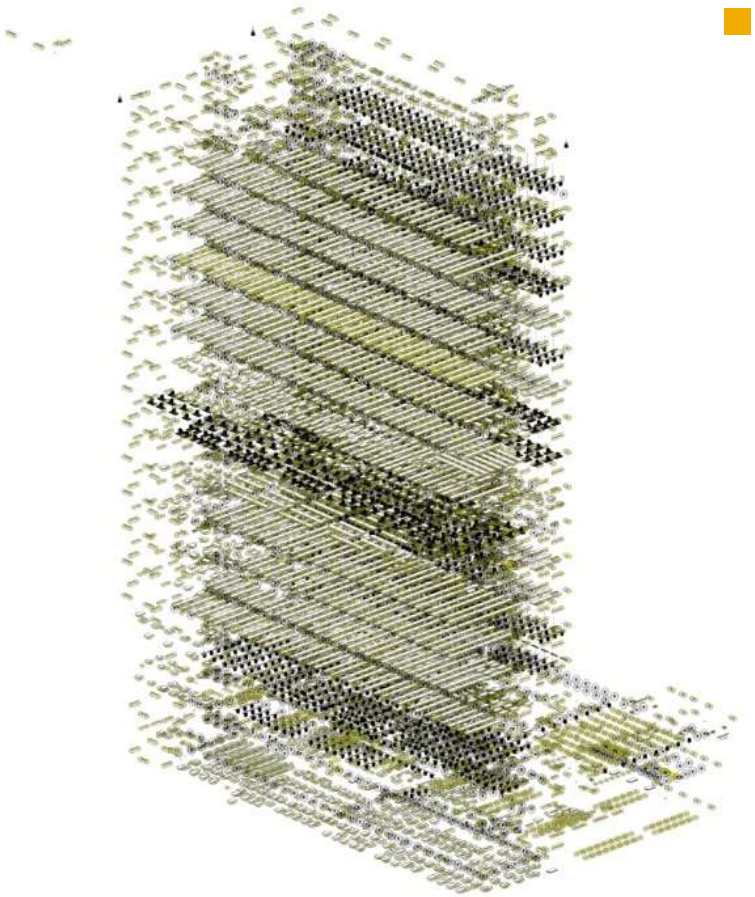
# Layers *Mechanical (ACMV, P&S)*





- **Mechanical**
  - All mechanical system drawn in 3D.
  - Preliminary coordination done in 2D. The systems were drawn in 3D once prelim coordination was done.
  - Clash detection with structural system and with other services are done carried out.

# Layers *Structural – electrical*



- **Electrical**
  - Coordination is done through coordination meetings involving users.
  - With considerations on location of lab equipment.

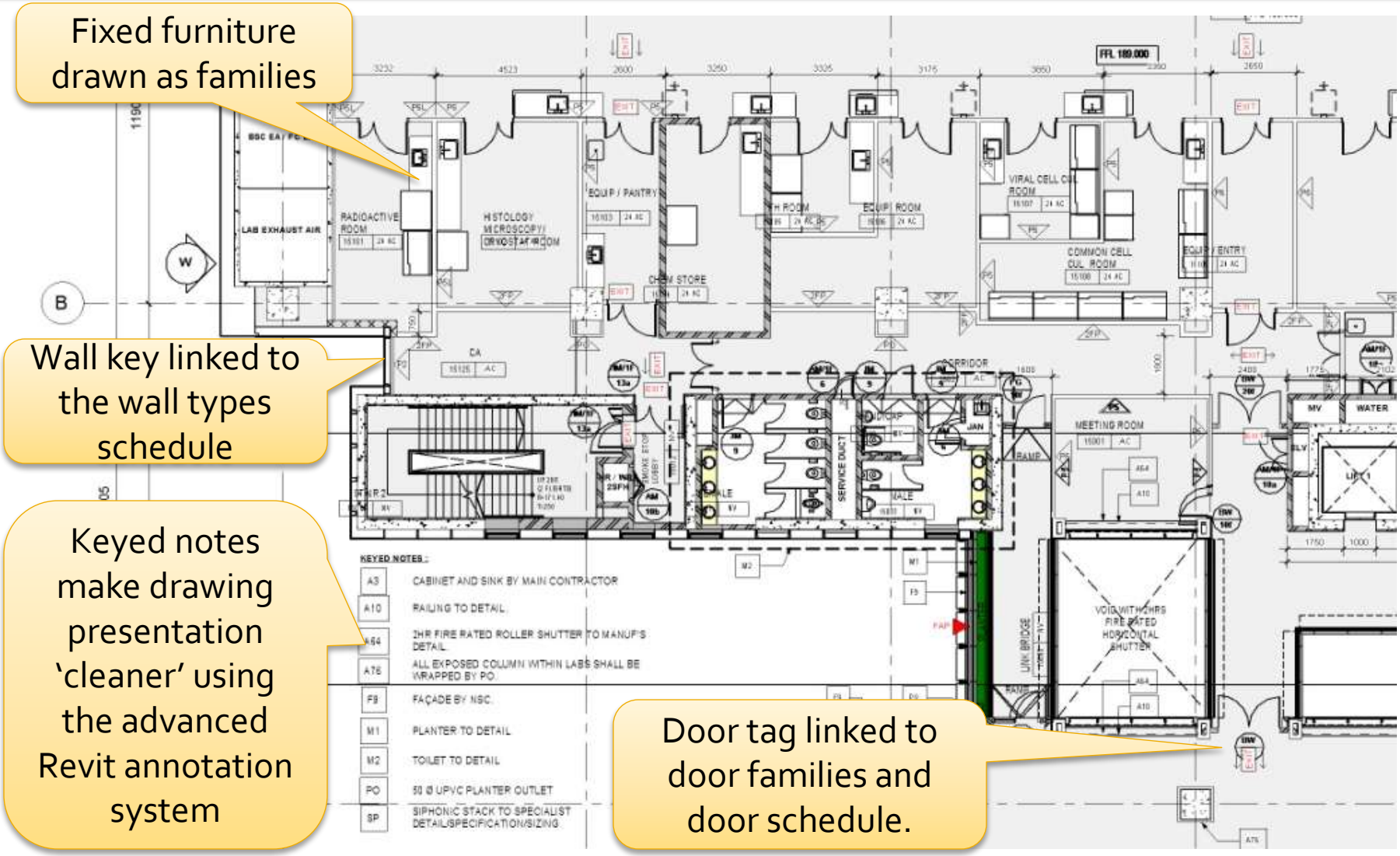
# Features *families & tagging*

Fixed furniture drawn as families

Wall key linked to the wall types schedule

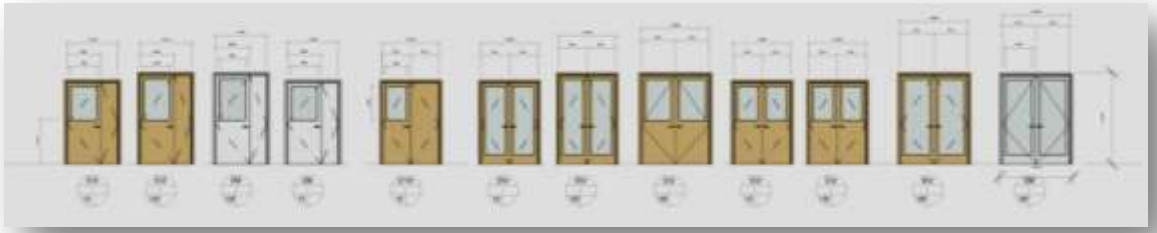
Keyed notes make drawing presentation 'cleaner' using the advanced Revit annotation system

Door tag linked to door families and door schedule.



- Schedules are generated instantly when the correct parameters set up in the families

# Features *Schedule generation*



Door Schedule

| Description | Mark | Type Mark | Fire Rating | Family and Type | Level | Count |
|---|---|---|---|---|---|---|
| | 29 | - | | mD1-Folding door panel: mD1-Folding door panel | Level 1 | 1 |
| | | HO/T | | Dbl Glass (allan): Dbl Glass (allan) | Level 1 | 1 |
| | 22 | S49 | | MD-1 double Louvre (1): 2000 x 2150mm | Level 2 | 1 |
| AM | 4 | - | | Md1-single hvac door: 400 x 2165 | Level 2 | 1 |
| AM | 4f | - | | Md1-single hvac door: 400 x 2365 | Level 2 | 1 |
| AM | 6 | - | | Md1-single hvac door: 600 x 2167 | Level 2 | 1 |
| AM | 6f | - | | Md1-single hvac door: 600 x 2365 | Level 2 | 1 |
| AM | 8 | - | | Md1-single hvac door: 800 x 2166 | Level 2 | 1 |
| AM | 8f | - | | Md1-single hvac door: 800 x 2365 | Level 2 | 1 |
| AM | 9 | - | | Md1-single hvac door: 900 x 2165 | Level 2 | 1 |
| AM | 13 | - | | MD1- double door(Un-even)(M) panel: 1350 X 2165-- | Level 1 | 1 |
| AM | 13f | - | | MD1- double door(Un-even)(M) panel: 1350 X 2365-- | Level 1 | 1 |
| AM | 10a | - | | MD1- double-swing (M) panel door: 1000 x 2165 | Level 2 | 1 |
| AM | 10b | - | - | Md1-accordion panel door: 1000x2165 | Level 2 | 1 |
| AM | 15f | - | | MD1- double door panel: 1500 X 2365 | Level 1 | 1 |
| AM | 15 | - | | MD1- double door panel: 1500 X 1265 | Level 1 | 1 |
| AM | 10af | - | | MD1- double-swing (M) panel door: 1000 x 2365 | Level 2 | 1 |
| AM | 9f | - | | Md1-single hvac door: 900 x 2365 | Level 2 | 1 |
| AM | 20f | - | | MD1- double door panel: 2000 X 2365 | Level 1 | 1 |
| AM | 18f | - | | MD1- double door panel: 1800 X 2365 | Level 1 | 1 |
| AM | 18 | - | | MD1- double door panel: 1800 X 2165 | Level 1 | 1 |

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# Lessons Learnt

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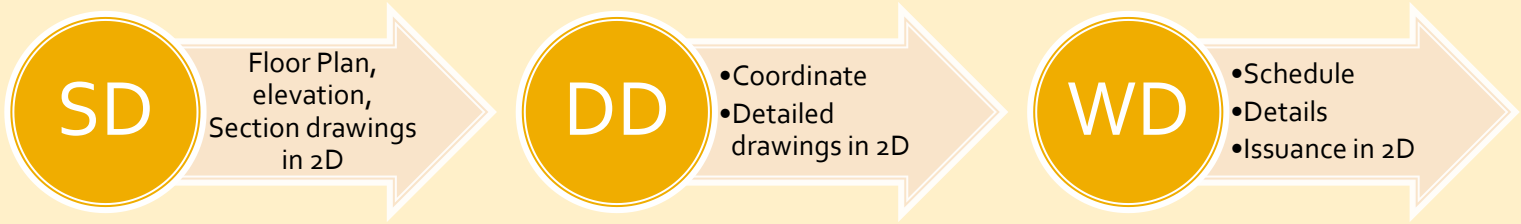
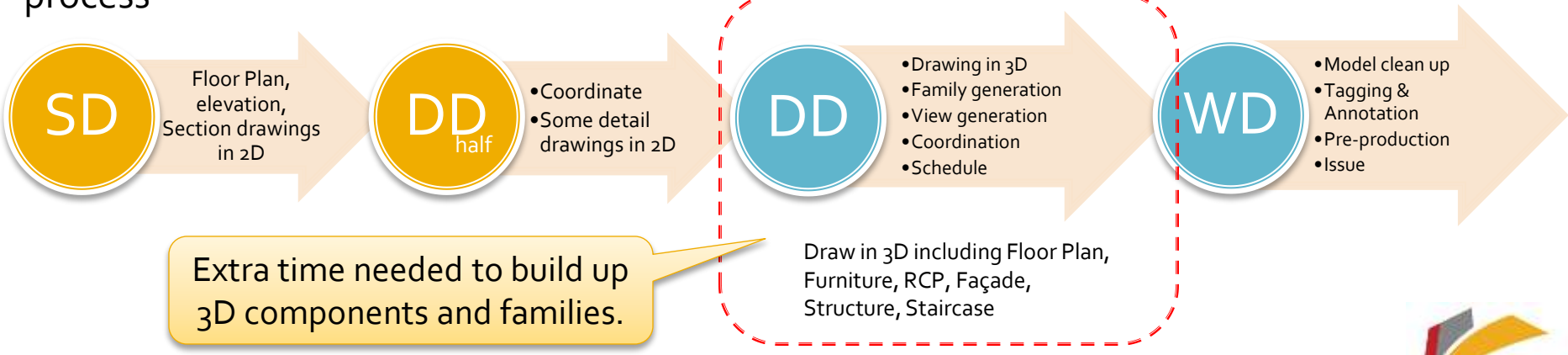
- More time is required by consultants because...
- Design is more developed.
- More coordination is done in virtual world, not in real world, reducing waste

## Time line

Old school: Drawing is more straightforward




New school: Not so straightforward since coordination and production combined in single process

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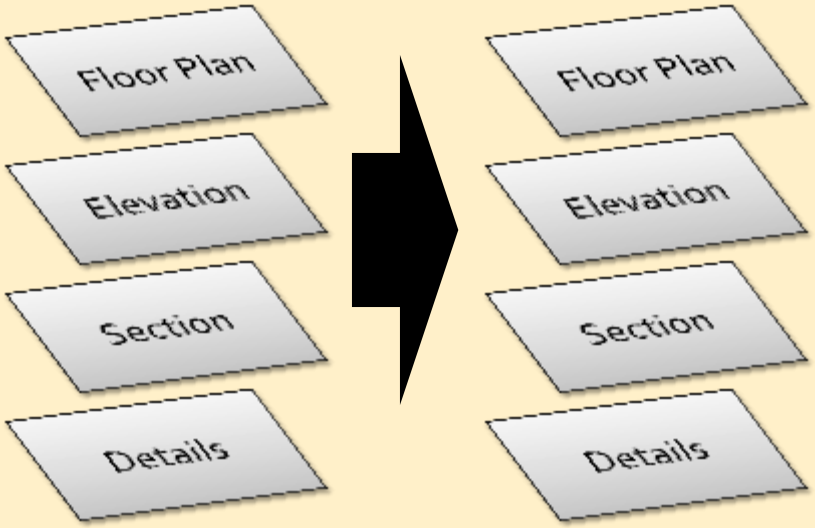
# Lessons Learnt

- Time to generate 3D

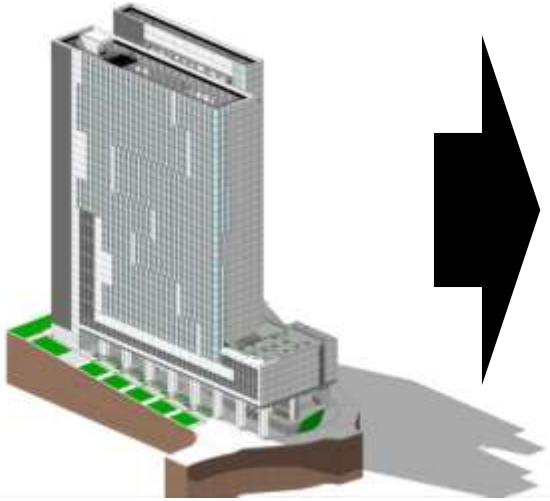
Old school: Drawing in 2D is the final representation of what will be produced

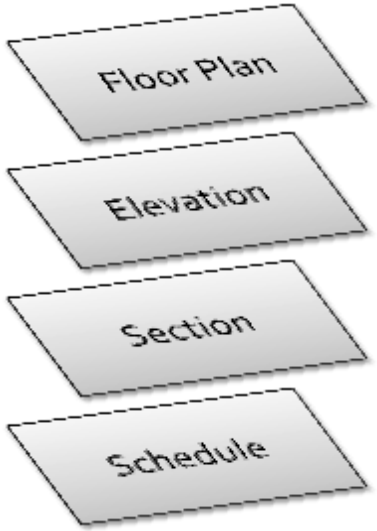



Draw

Issue

New school: Make elements in 3D to generate 2D drawing







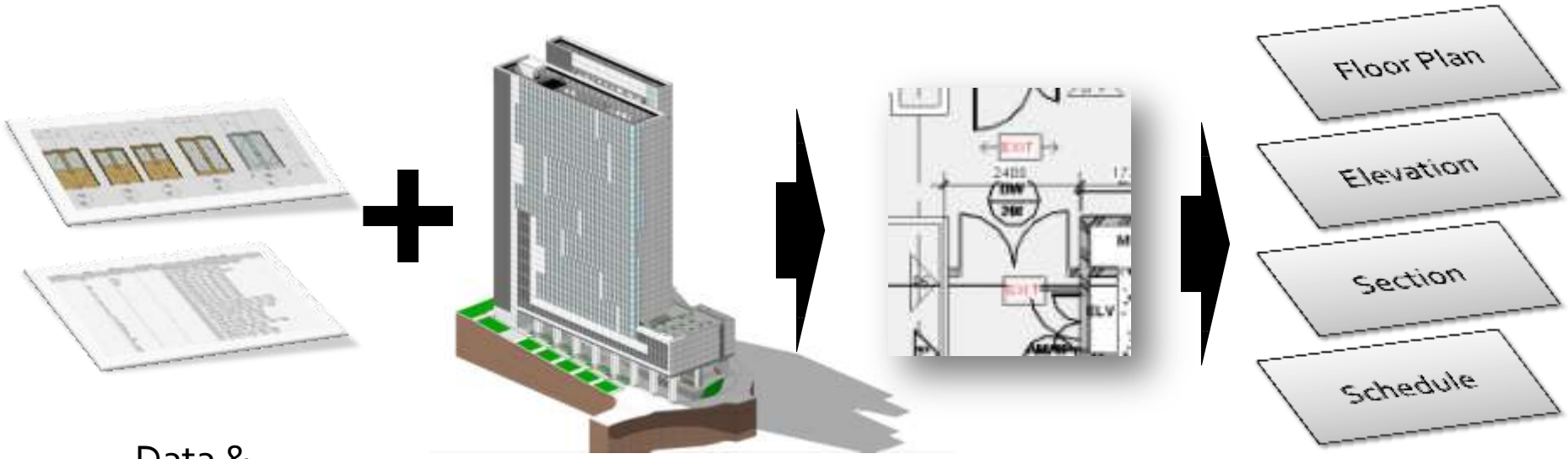
Still in 2D

# Lessons Learnt

- It is better to start building BIM after the concept design is confirmed, so that the developing of the 'families' can be more streamlined towards the production of the final deliverables.
- Families contribute towards quantity take off.
- Details is recommended to be in 2D to reduce the 'load' of the BIM model

- Components

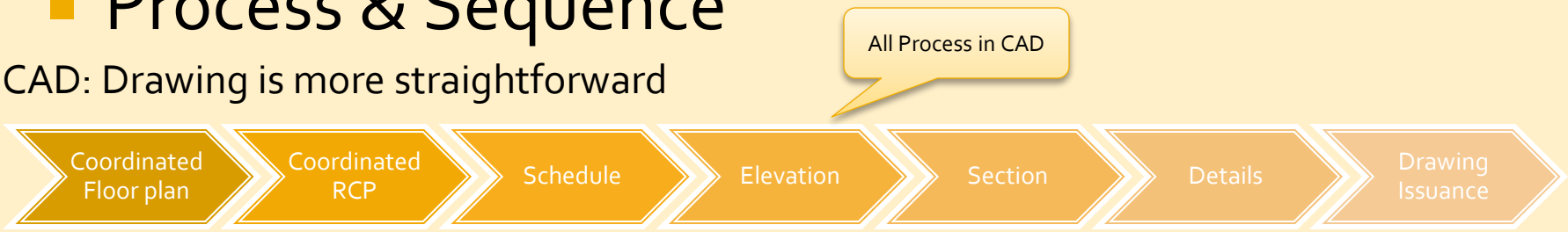
New school: More process to reach final product



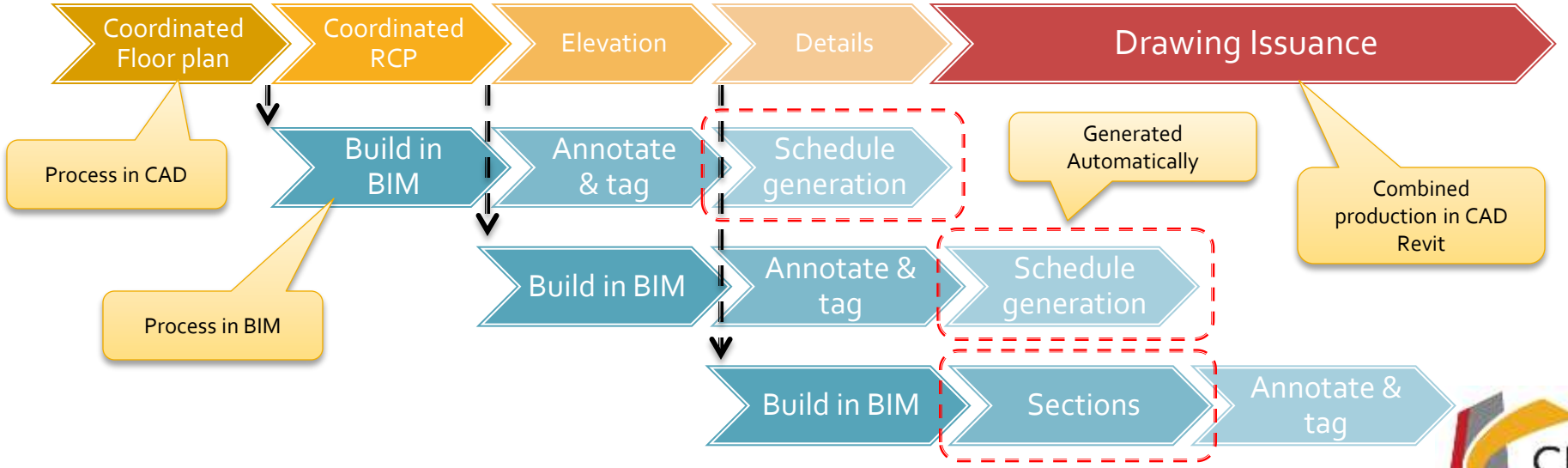
# Lessons Learnt

- Process & Sequence

CAD: Drawing is more straightforward




BIM: Process requires both BIM and CAD collaboration



# Lessons Learnt

- It is important to create families such that the correct tags are set consistently throughout the same group.
- Once Families setup correctly, plans are updated automatically.
- Once this one the following process will be streamlined

- Plan from the end in mind

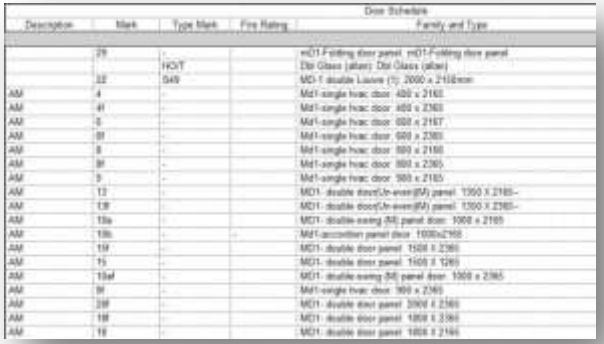
Begin

Door schedule

Door family

Door tag

End

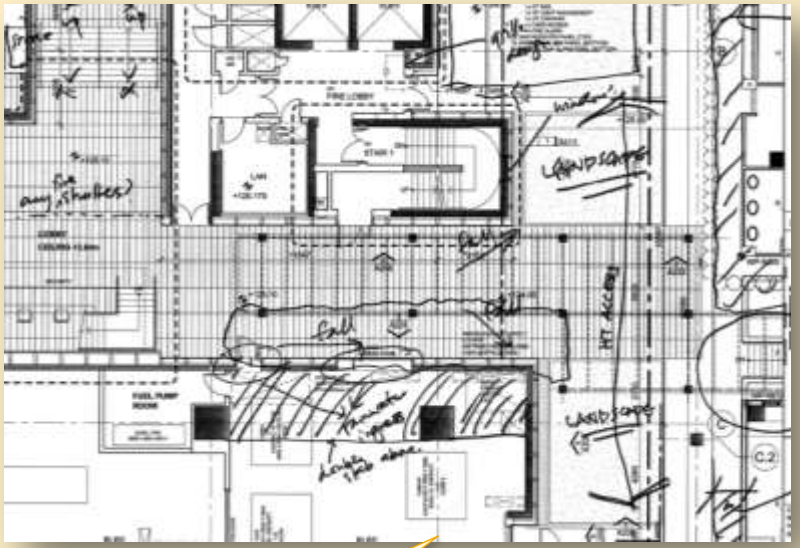


# Lessons Learnt

- Red line markups was conducted, but was found not effective since updating and generating view for printing takes time and preparation.
- Picking up changes is also not as straightforward as 3D CAD
- Some PCs are not powerful enough to generate view fast for checking using review software
- In the future online checking shall be implemented with upgraded hardware

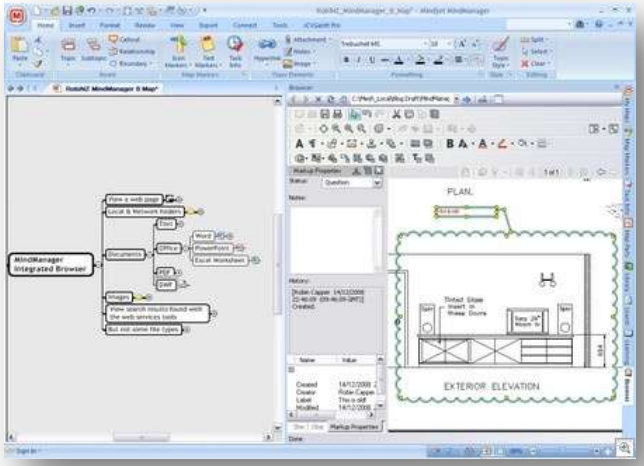
## Drawing Checking

### Old school (CAD)

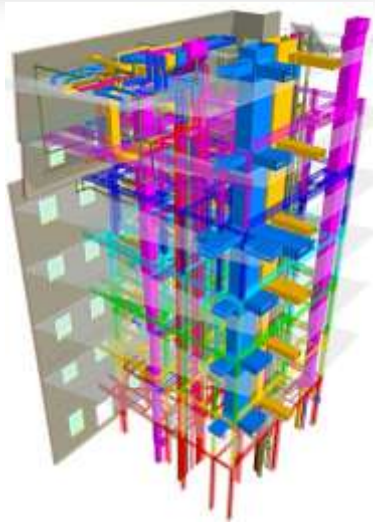


Red lines mark ups

### New school (BIM)



Online markup

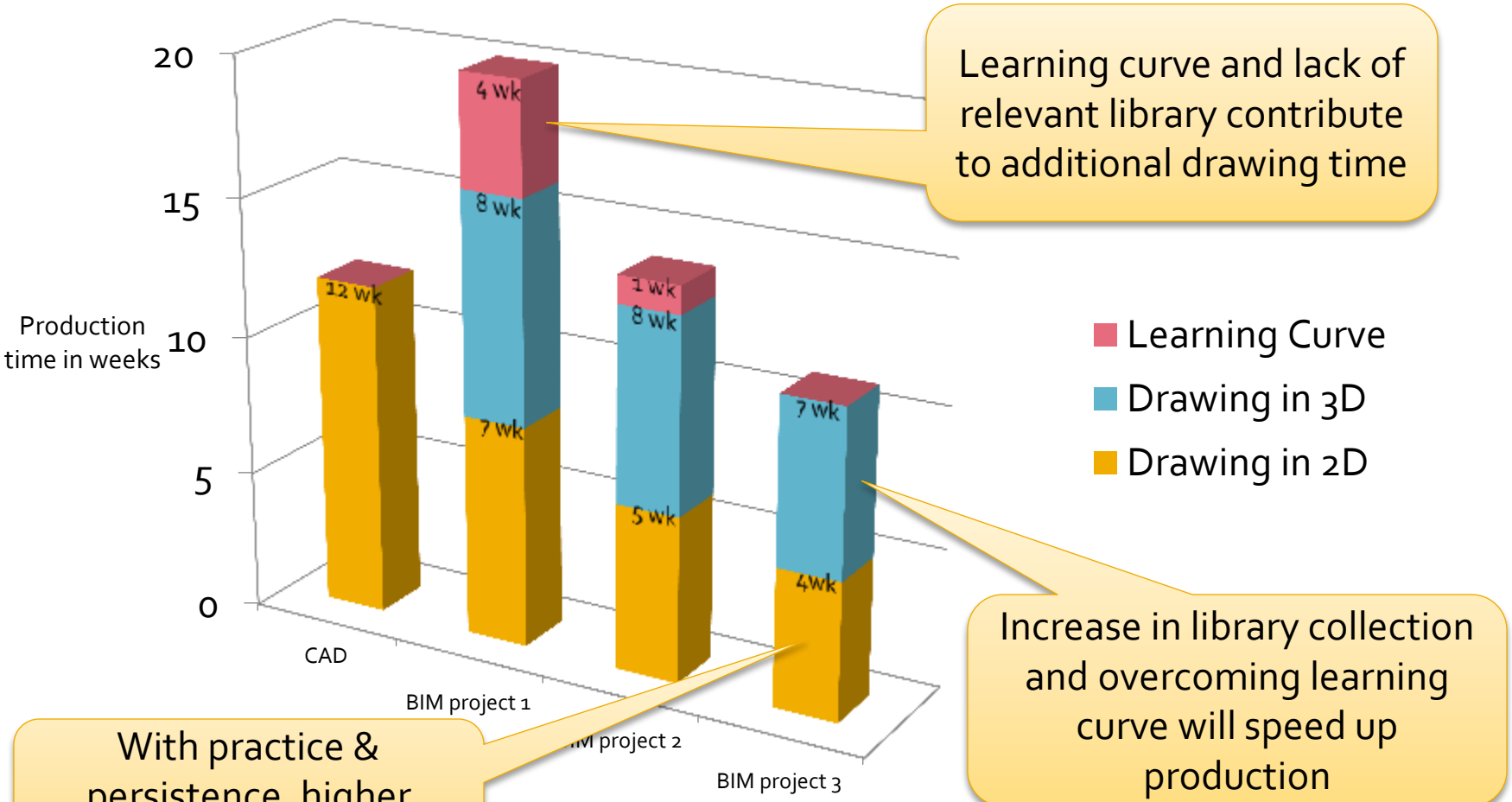


Online clash detection

# Benefits

Expected improvement for subsequent projects

# Production time



# What we like about BIM

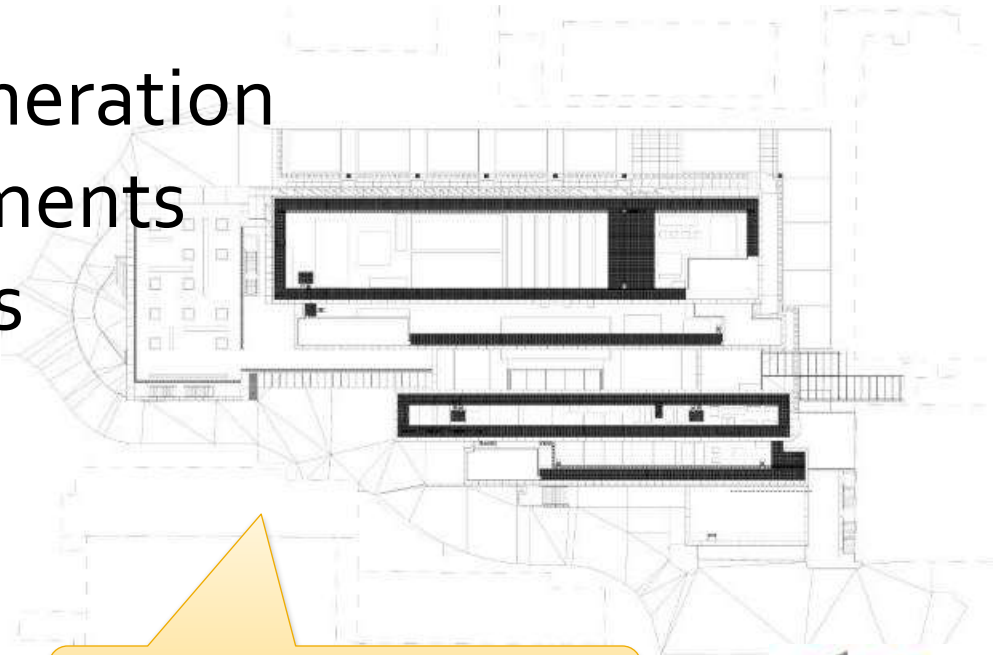
- 3D Visualisation of design and components
- Changes are made to a central 3D model, minimising risk of discrepancies between plan, section and elevation, as they are from the same model
- Instant generation of new sections and elevations Odd corners
- Tagging is automated with family & schedule generation

# What we like about BIM

- Keyed notes system is systematic and drawing improve readability
- Multi-disciplinary collaboration in 3D, reducing risk in differences in interpretation
- Intelligent properties and components allow extraction of information for more accurate cost estimation

# Still Exploring

- Line weight control
- Hatching
- Depth of view
- Site plan contour generation
- Showing hidden elements
- Schemes and options



Contour generated as folded planes

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# Still Exploring

- Streamlined process between BIM and energy modeling (currently a separate process is needed)

- Improved collaboration and ‘shopdrawing’ submission and approval process with contractors

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# Further Potentials

For downstream work flow

# Potential Benefits

- Better procurement process through more accurate and automated quantity take off
- 3D Coordination by builders, instead of 2D, paper-based coordination
- Building component manufacturers (e.g. curtain wall) using BIM model as reference or input
- Faster and more accurate model building if equipment and component manufacturers publish BIM library parts

# Potential Benefits

- Move away from on-site, in-situ, error-prone processes towards factory, automated, high-quality processes
- Improved As-Built Documentation provided constant update to BIM model is done (e.g. BIM base model used for progressive 'shop drawing' preparation and coordination)
- BIM Model become a base for Facilities Management System, improving management and operation of facilities

# Potentials Issues

- Earlier collaboration between different discipline is important, because clashes with show up
- Between different companies, it is important to agree on the extent of sharing of model information
- If different modeling software is used between companies, it is important to determine the medium for exchange

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# Potentials Issues

- Document Ownership – Who owns the multi-disciplinary, multi-party BIM model?
- Document Accuracy – Who is responsible if accuracy in the model led to construction errors?
- Who pays for them – The BIM models may be quite basic or very detailed. Who decides how much detail is needed, and who pays for them? If the BIM model is to benefit FM, again, who pays for it? To who?

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# Thank you..

Any questions?