Impact of BIM in building practices

David Fung

Senior Associate, BIM Division Head; Aedas

Registered Architect, HKIA, AIAB

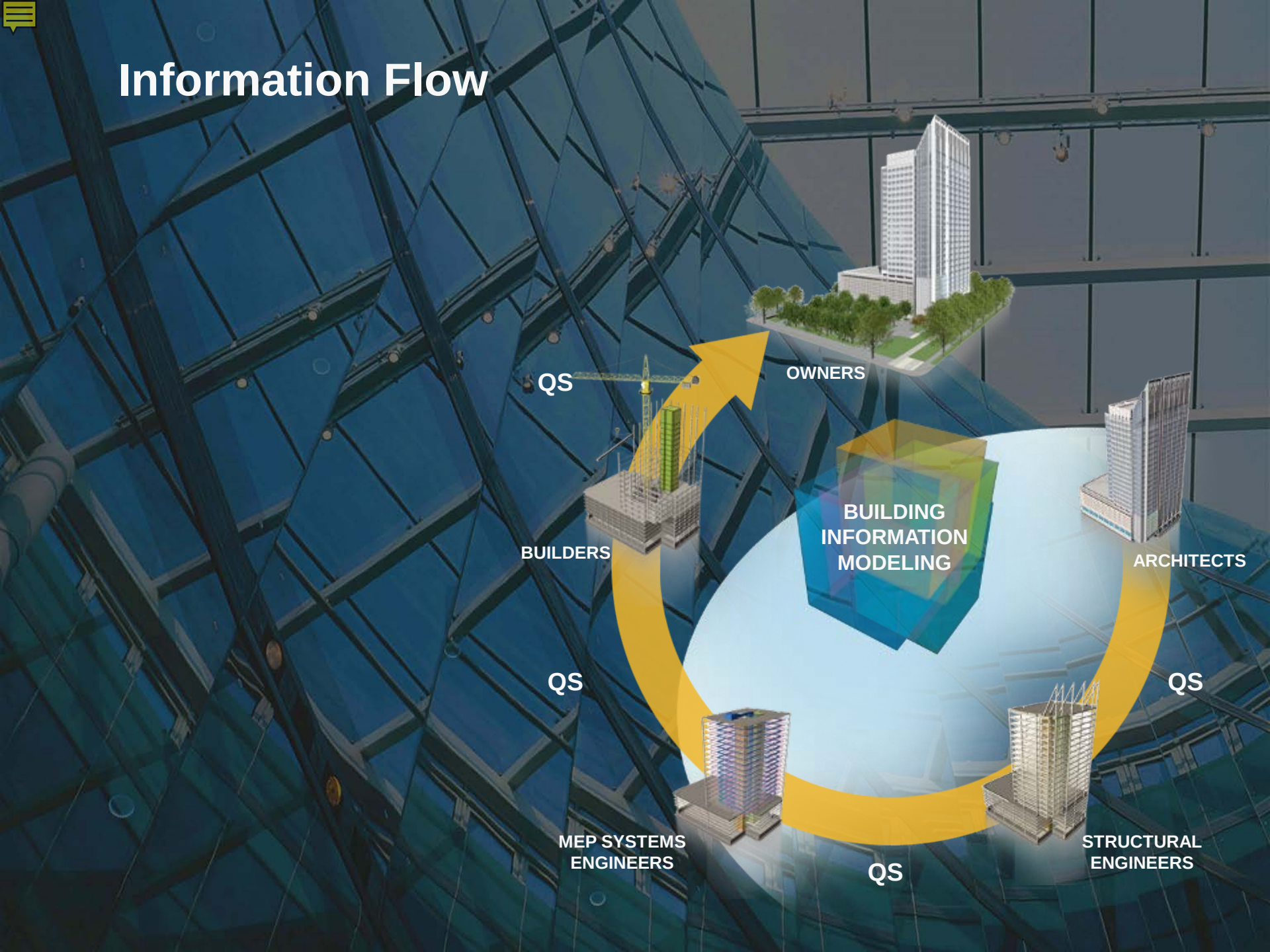
AIA Hong Kong

A Chapter of The American Institute of Architects

Use of Building Information Modeling (BIM)

1. Design visualization
2. Drawing Productions
3. Services Co-ordination and Clash detection with other disciplines
4. Quantity taking and preparation of Tender Document
5. Automated Statutory Submission
6. Scientific analysis of different environmental aspects
7. Complex Geometry
8. Supply Chain Integration with manufacturing and production

Information Flow



TEAM – Project groups

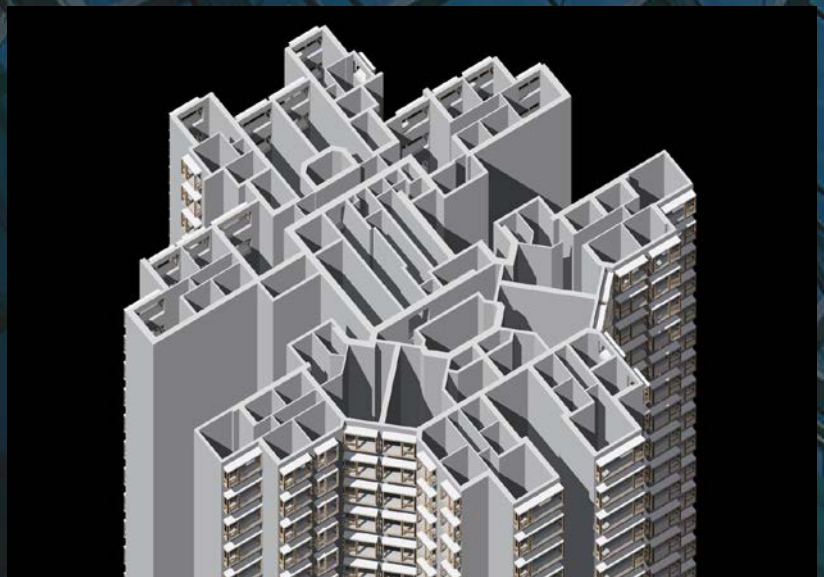
use of passive environmental controls, setting a precedent in Pakistan.

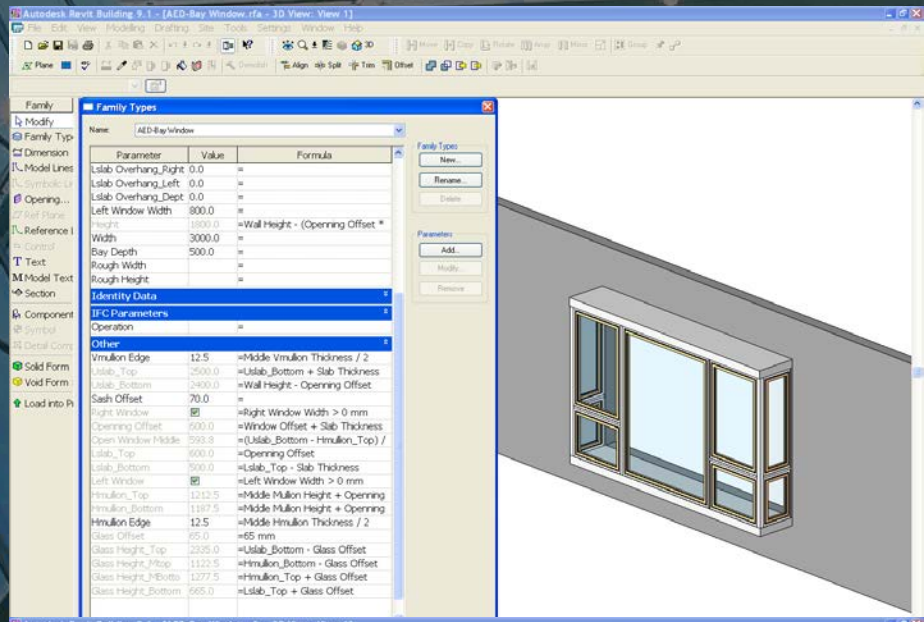
Our London and Manchester offices have collaborated with our specialist Advanced Modelling Group, using Ecotect analysis to interpret the climatic performance.

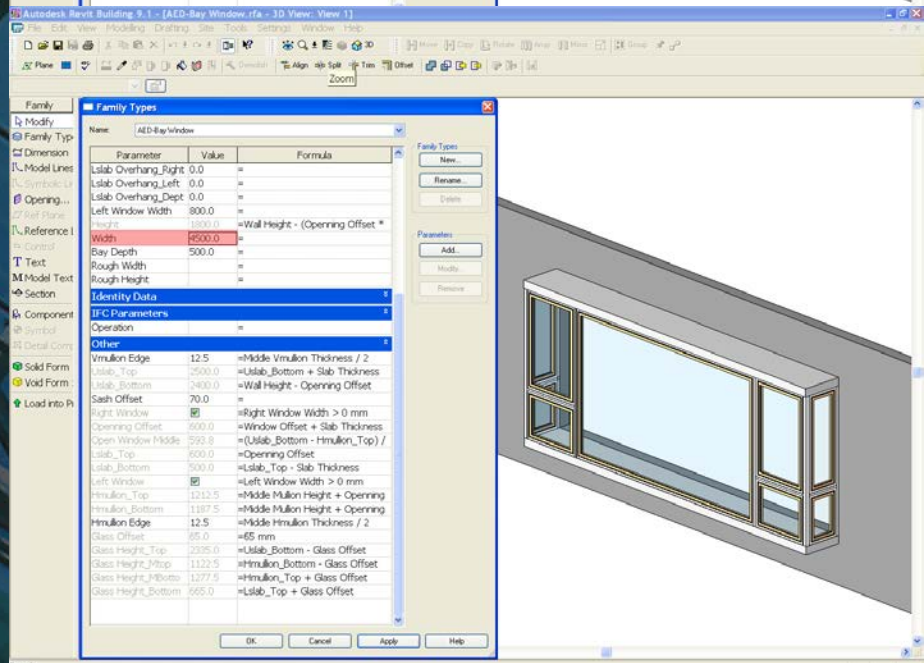
TEAM – Single Building, by elements

In-House Design & Production Team Structure

- Professional Designers
  - Know what to design professional
  - Know what to communicate!
- Family Man
  - Champion of System
  - Parametric Modeling
  - Mathematical Sense!!!
- Technicians
  – Competent BIM operators



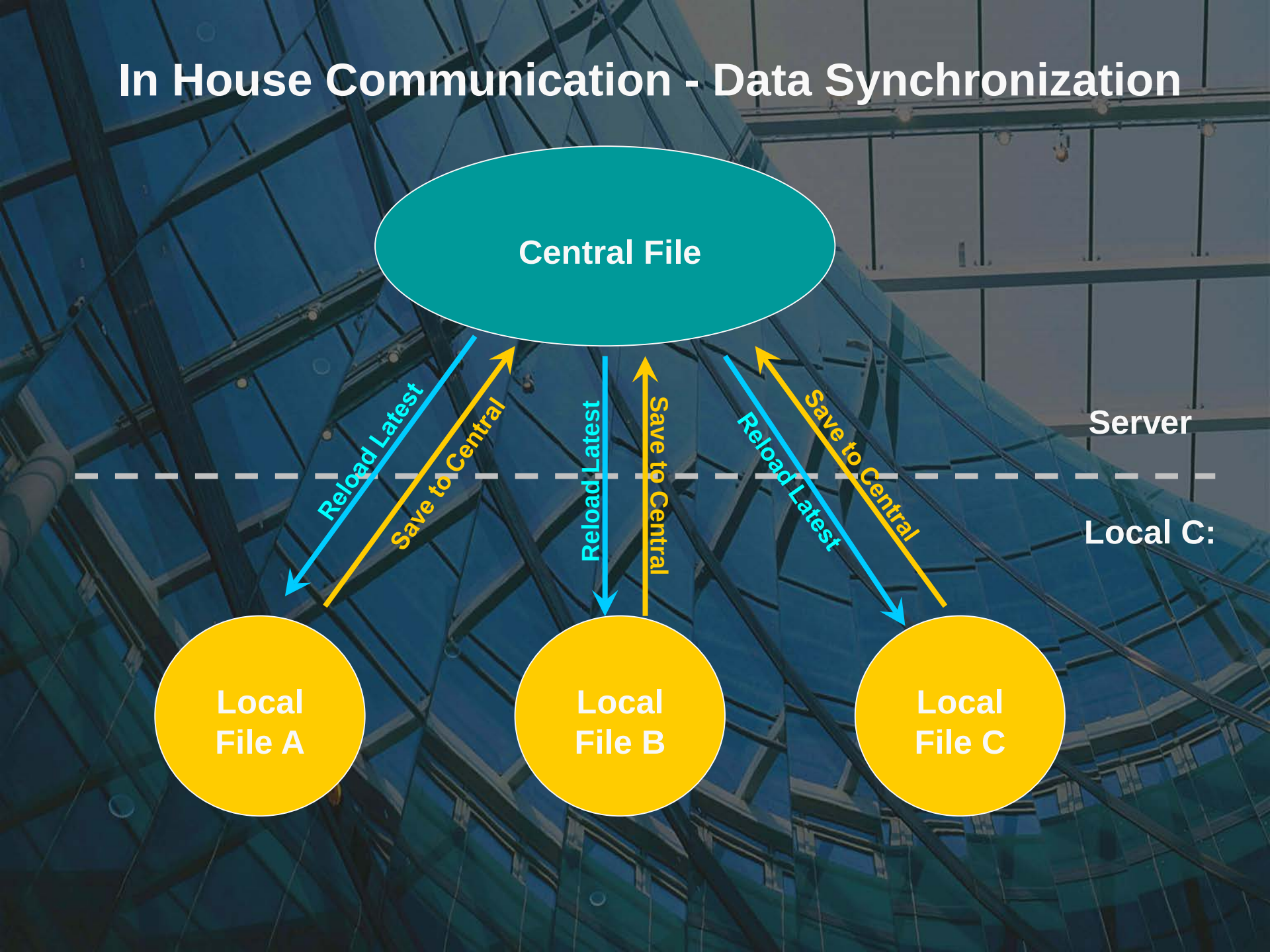


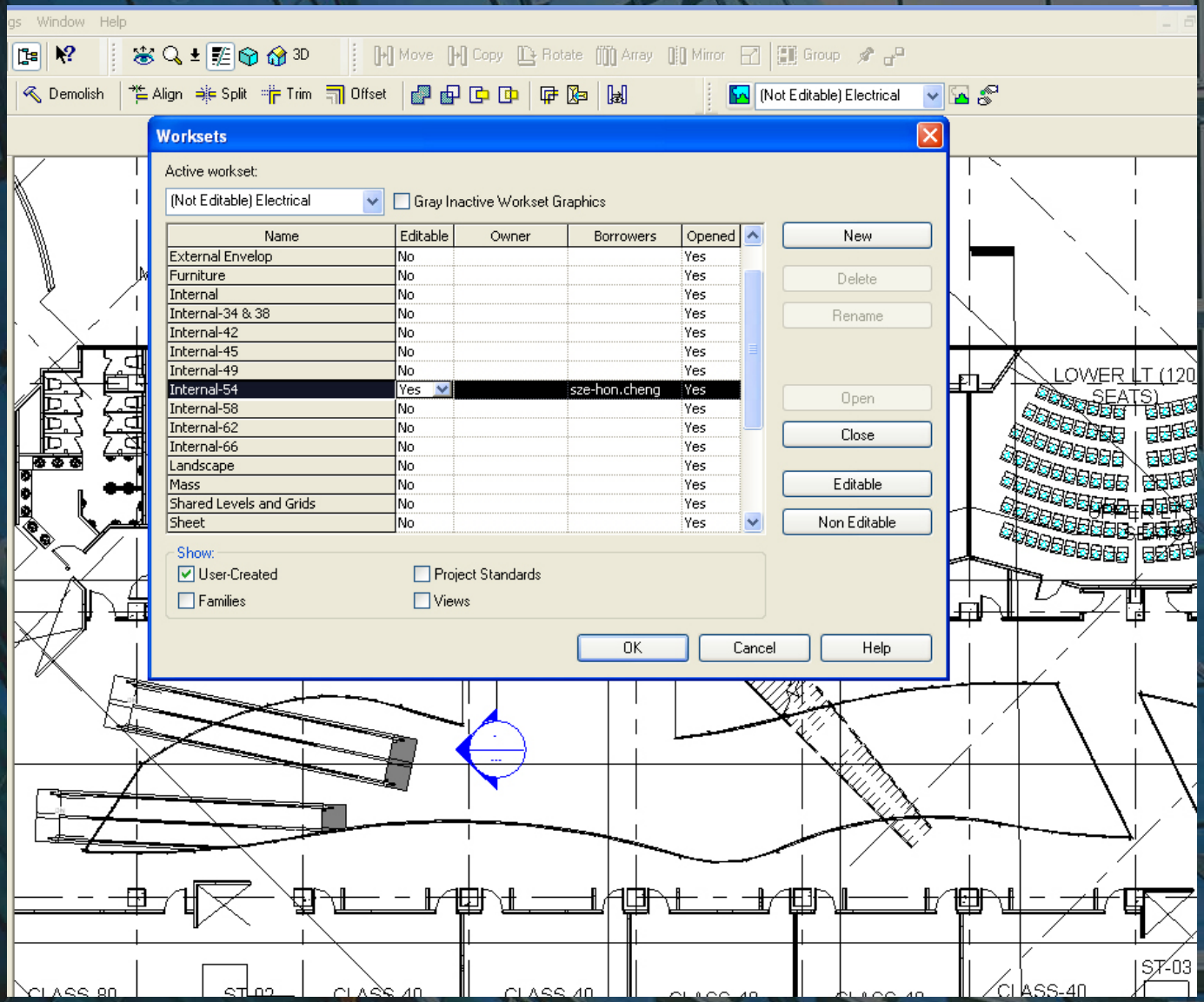


In-House Design & Production Team Structure

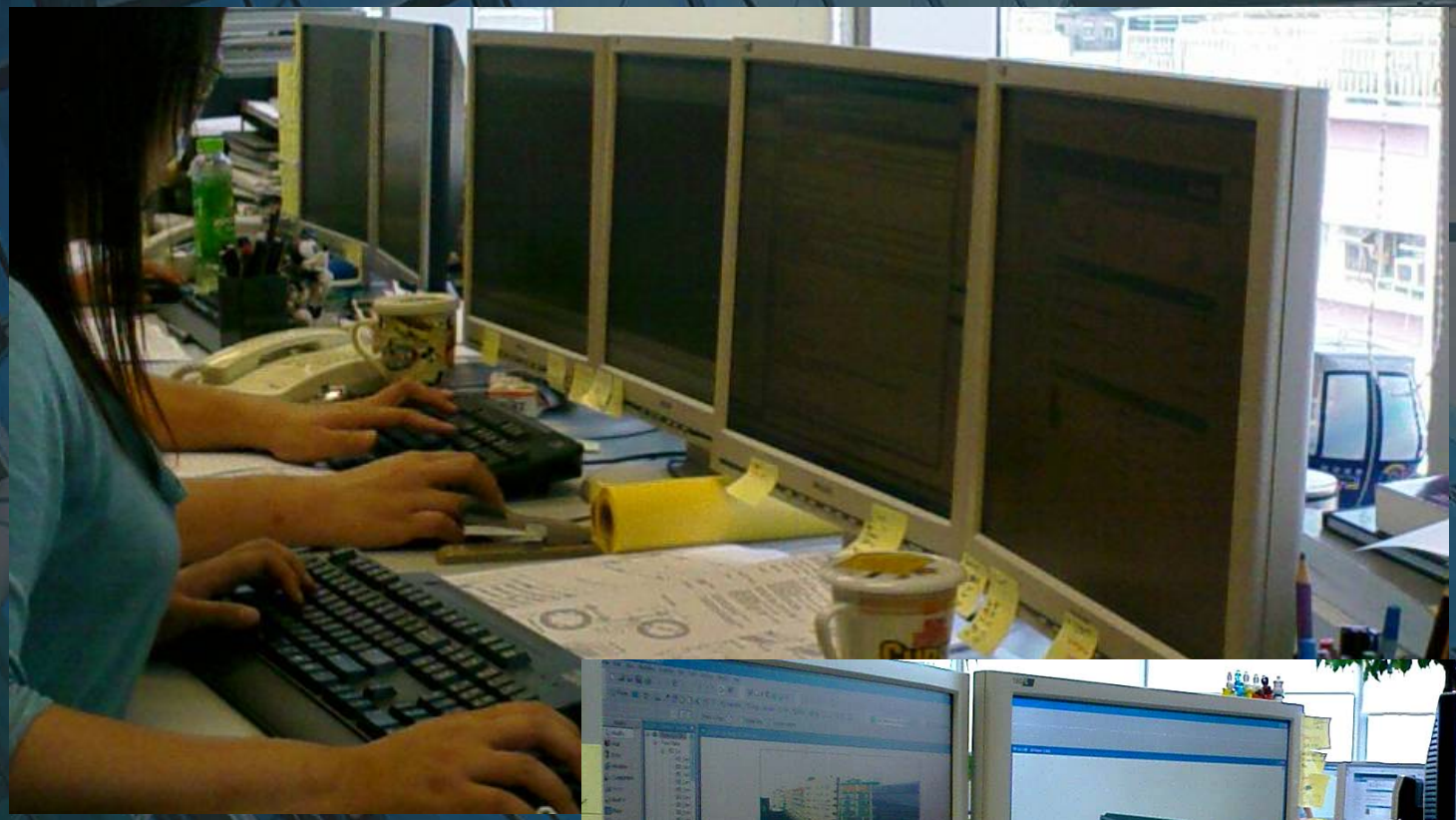
- Same Reference System
- Same Co-ordinates, same Height
- Complex model broken into pieces
- Fast network
- Physical Communication
- Same BIM Project Standard - naming

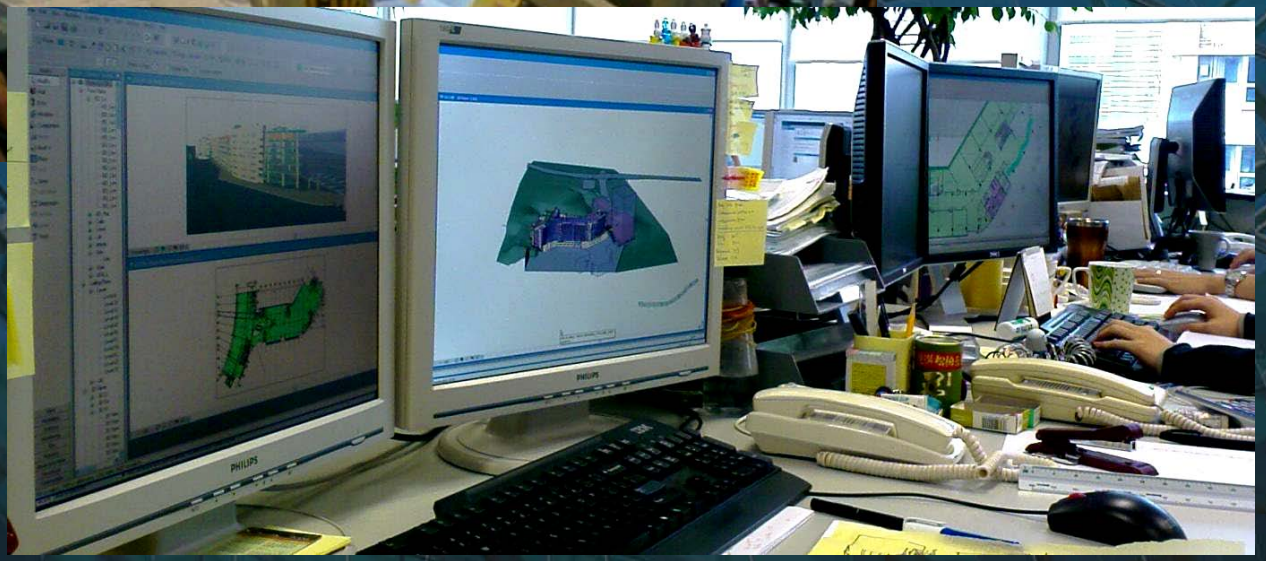
In House Communication - Data Synchronization



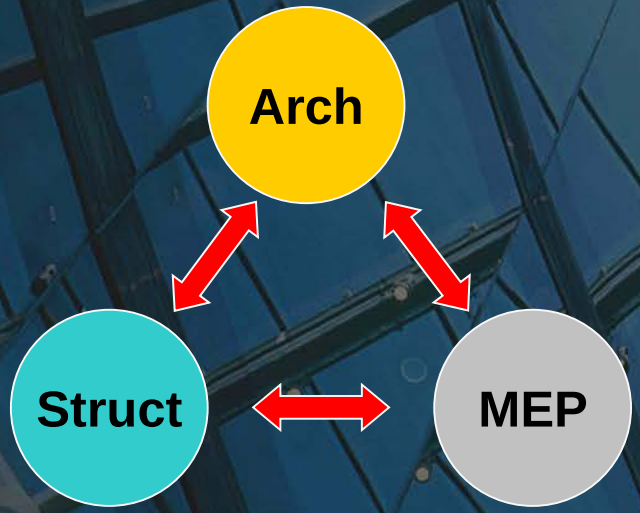

Window Help
3D
Move Copy Rotate Array Mirror Group
Demolish Align Split Trim Offset
(Not Editable) Electrical
Worksets
Active workset:
(Not Editable) Electrical
Gray Inactive Workset Graphics
Name Editable Owner Borrowers Opened
External Envelop No Yes
Furniture No Yes
Internal No Yes
Internal-34 & 38 No Yes
Internal-42 No Yes
Internal-45 No Yes
Internal-49 No Yes
Internal-54 Yes sze-hon.cheng Yes
Internal-58 No Yes
Internal-62 No Yes
Internal-66 No Yes
Landscape No Yes
Mass No Yes
Shared Levels and Grids No Yes
Sheet No Yes
New
Delete
Rename
Open
Close
Editable
Non Editable
Show:
User-Created
Project Standards
Families
Views
OK
Cancel
Help
LOWER LT (120 SEATS)
CLASS-40
ST-03

In-House Design & Production Team Structure

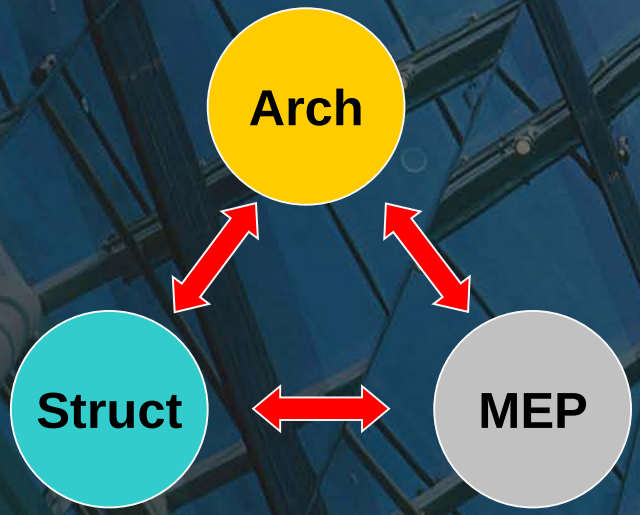




Full BIM Project Team Structure



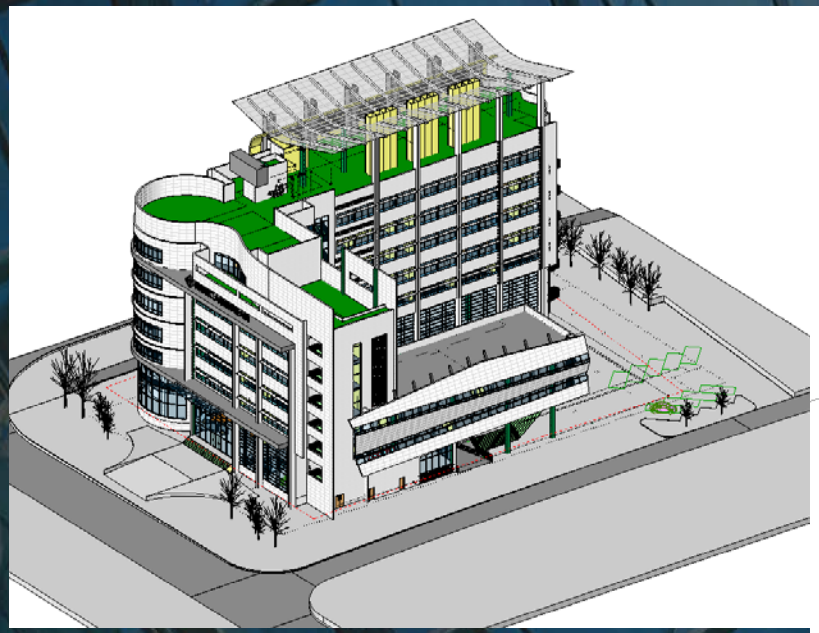
Full BIM Project Team Structure

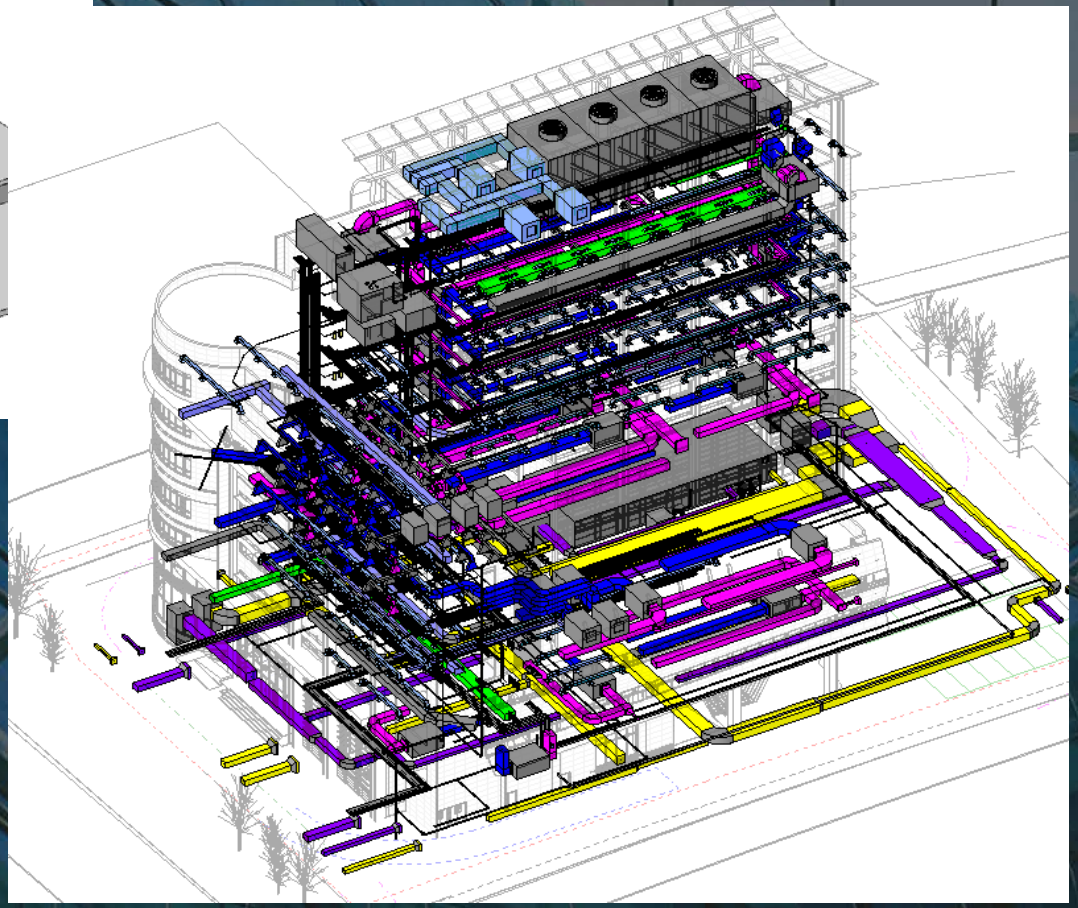


Best Practice: Office with All Disciplines

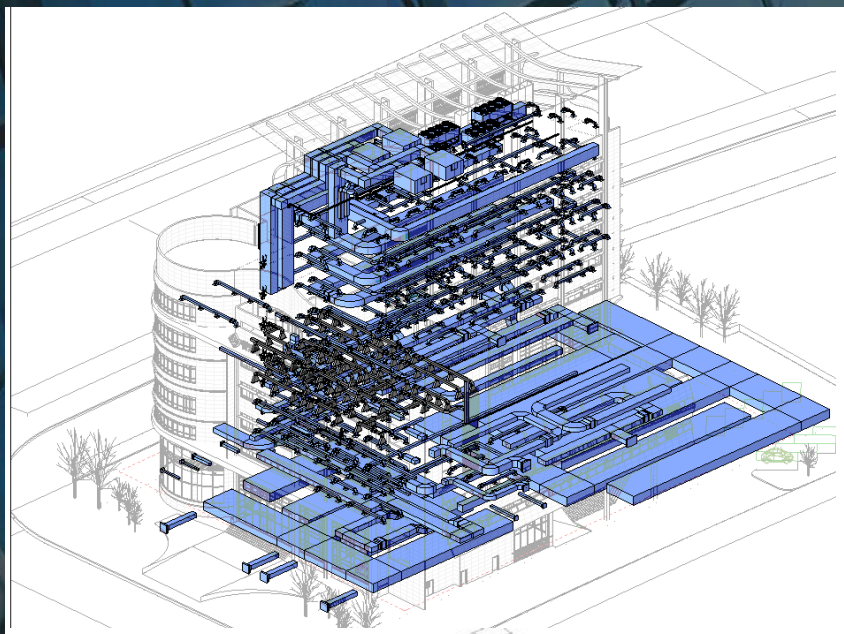
Second Best: Efficient Communication

BIM Project Team Structure

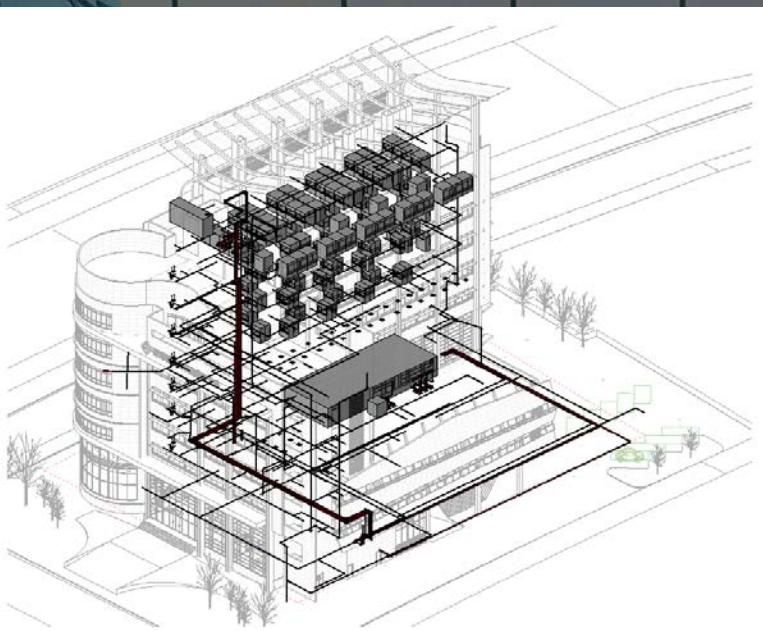


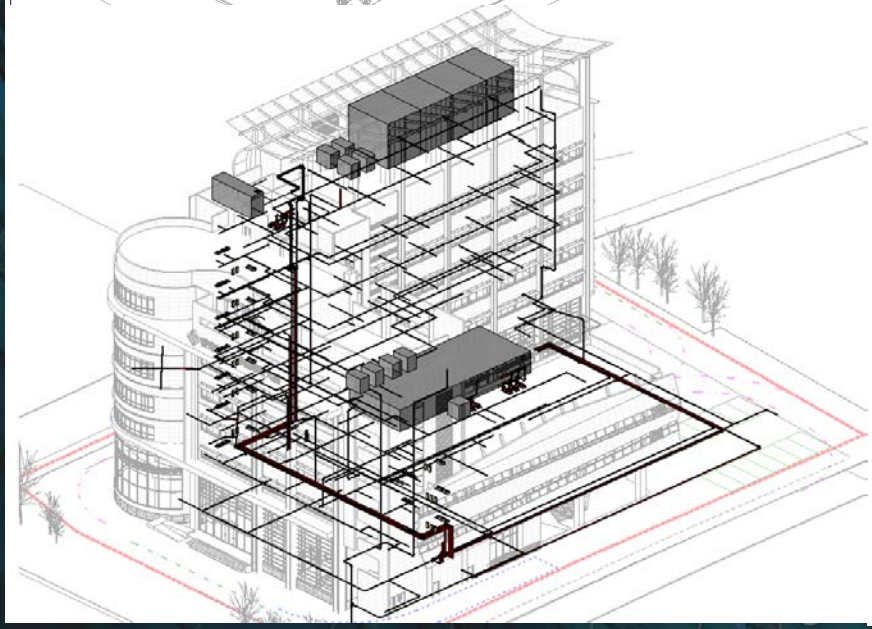


HVAC Installation

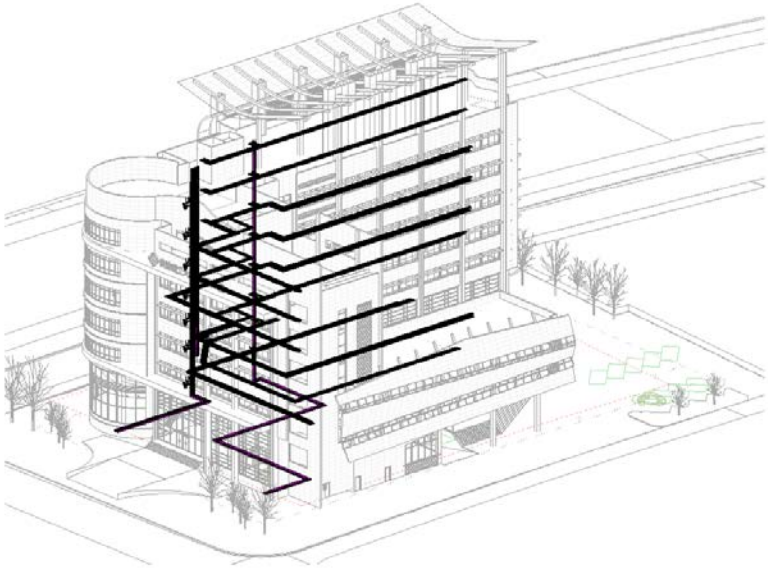


Fire Services Installation



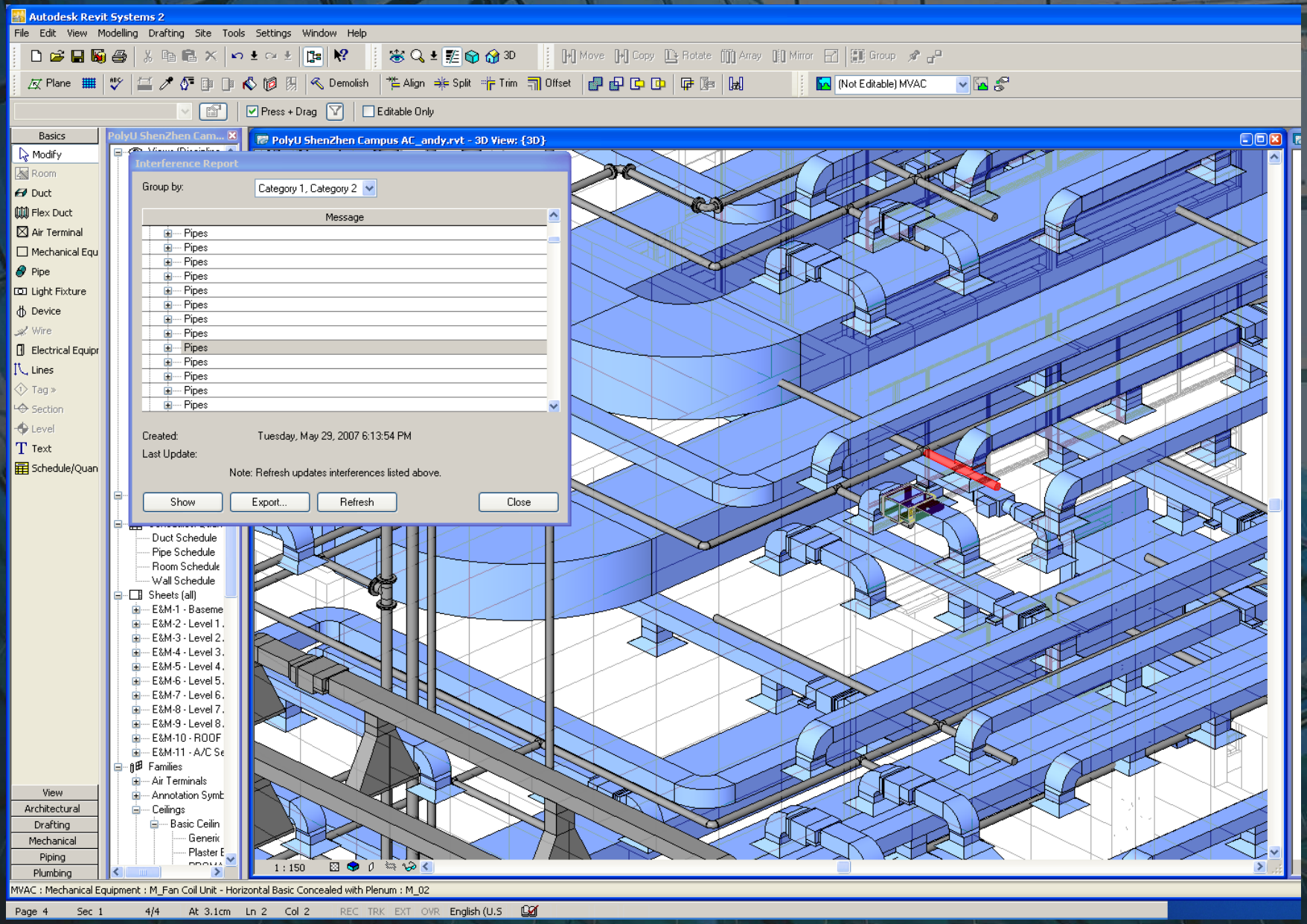


P/D Installation

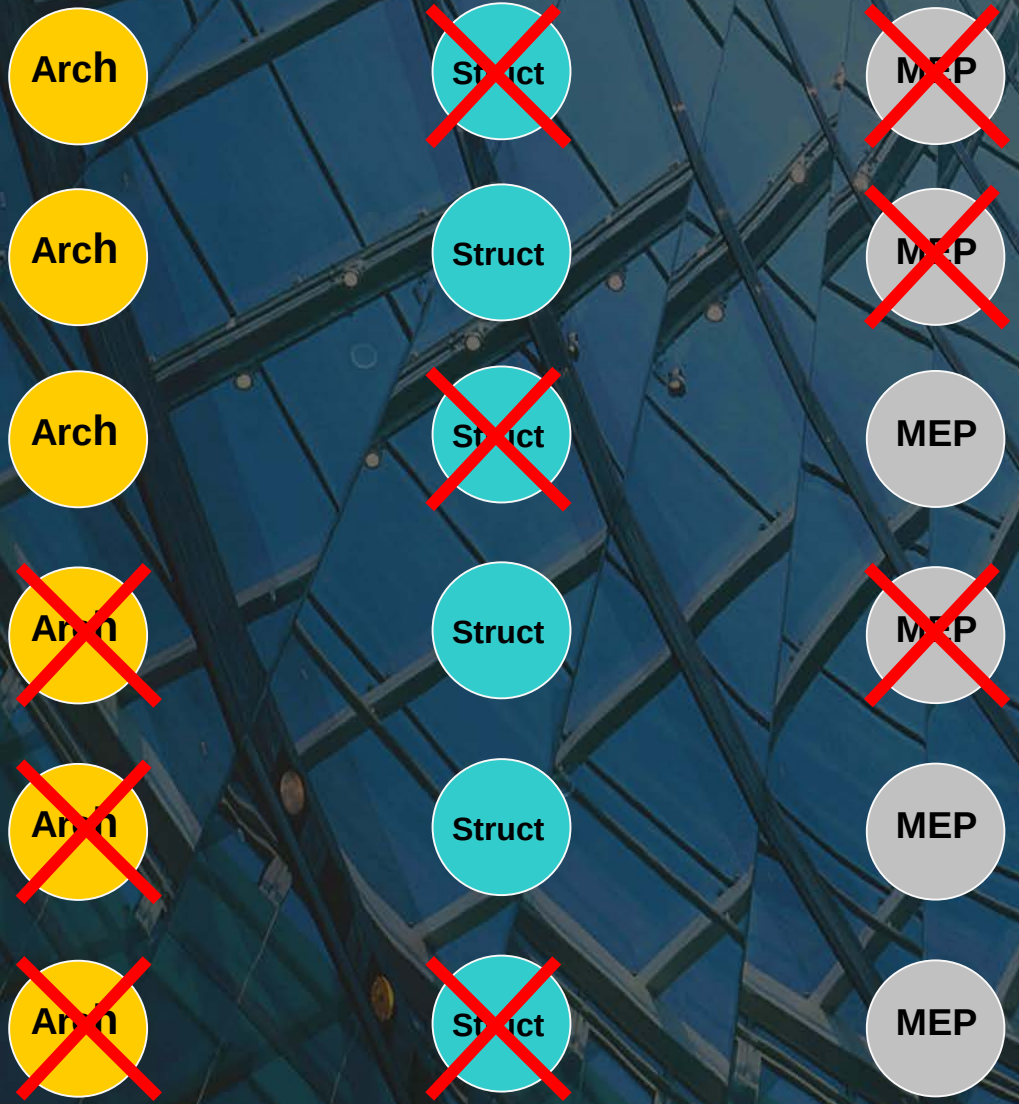


Electricity Installation

Clash Analysis



Partial BIM Project Team Structure



Most Common, Efficient

Very Efficient

Good, Arch has to build Structure

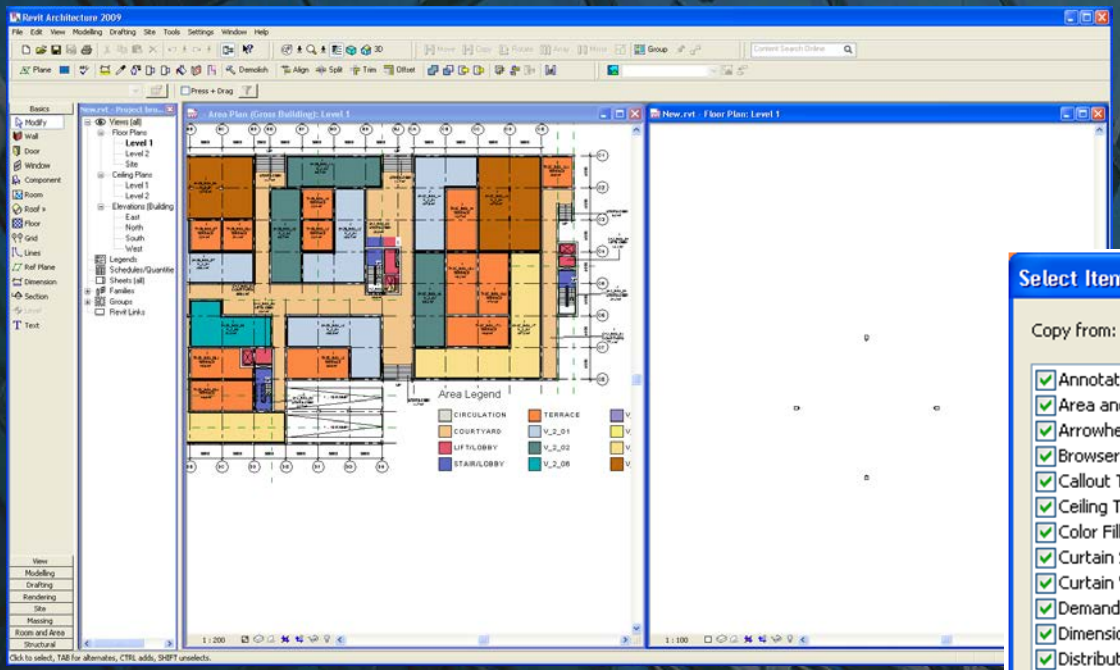
Very Efficient for Structure

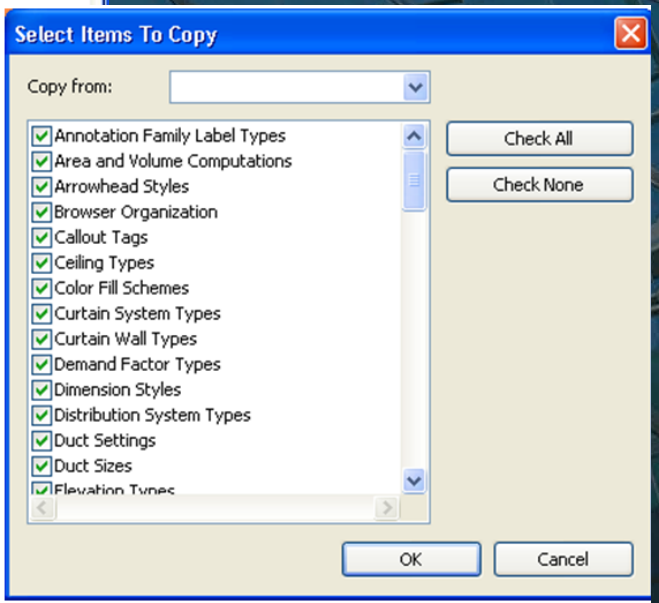
??????

NEVER HAPPEN!!!

Partial BIM Project Team Structure

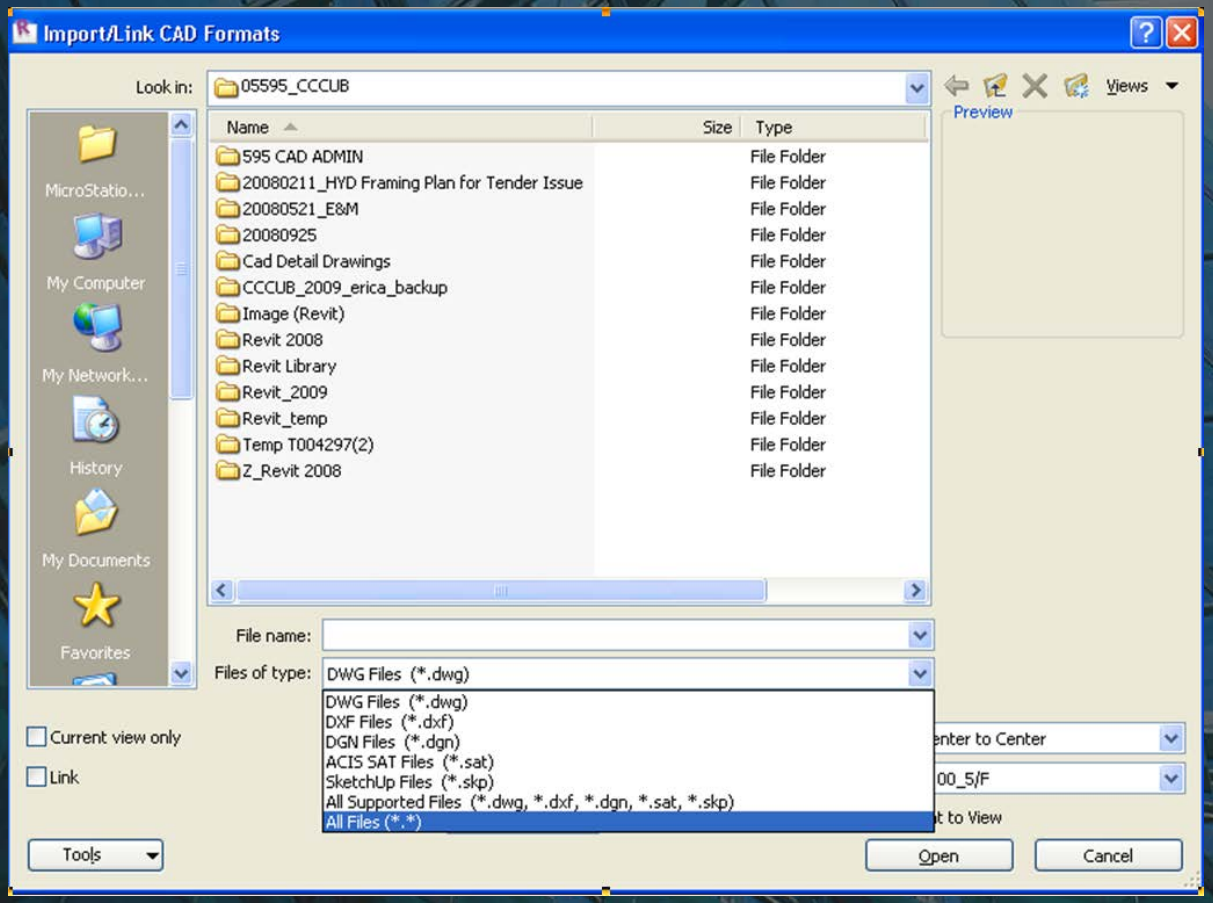
- Communication
  - Email (?) / FTP
  - Time Lag
  - Same Co-ordinate, Height
  - Different Project Standard





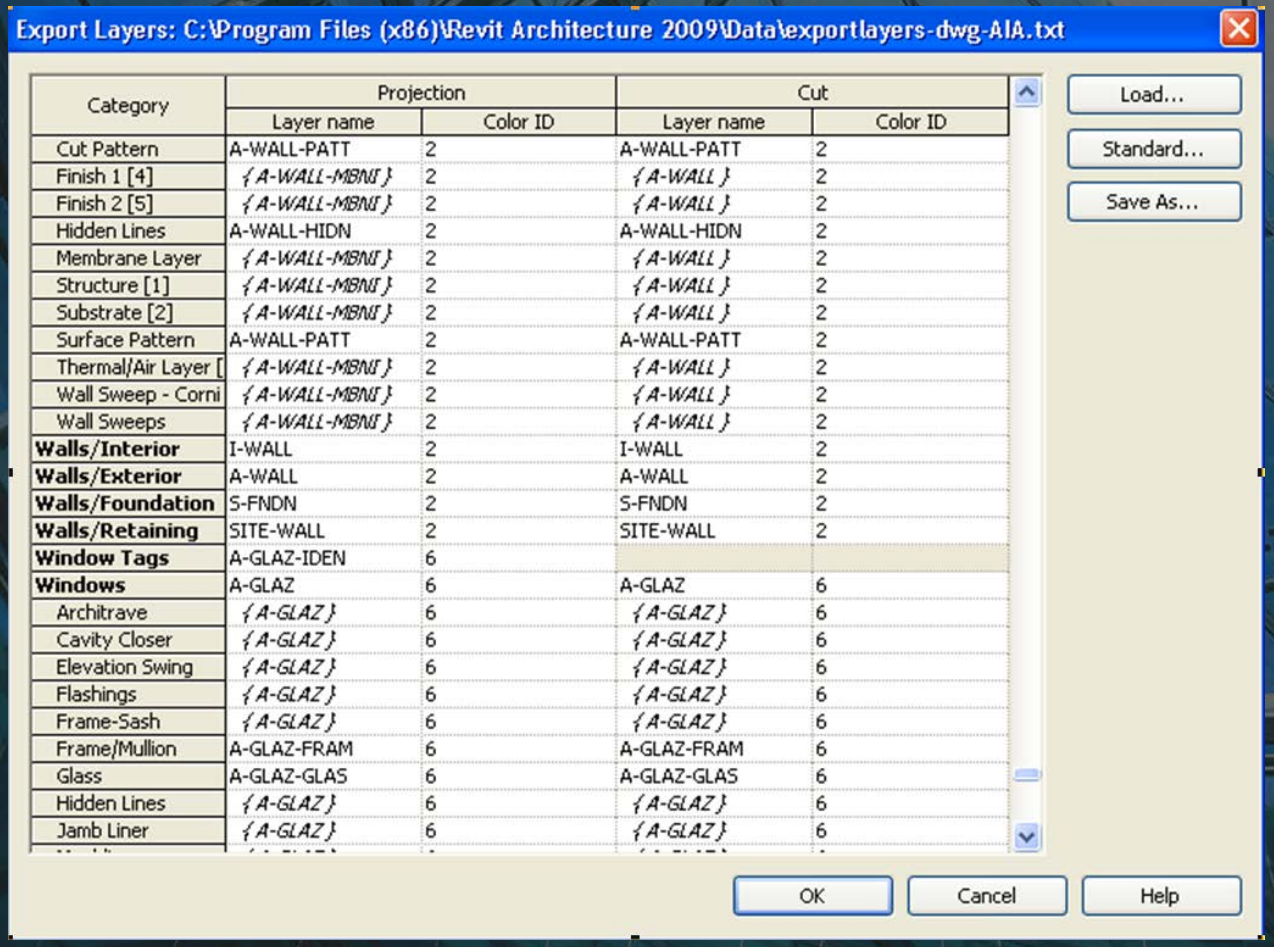
Partial BIM Project Team Structure

- Filing Conversion
  - Receive information – Rebuild from traditional 2D to 3D presentation



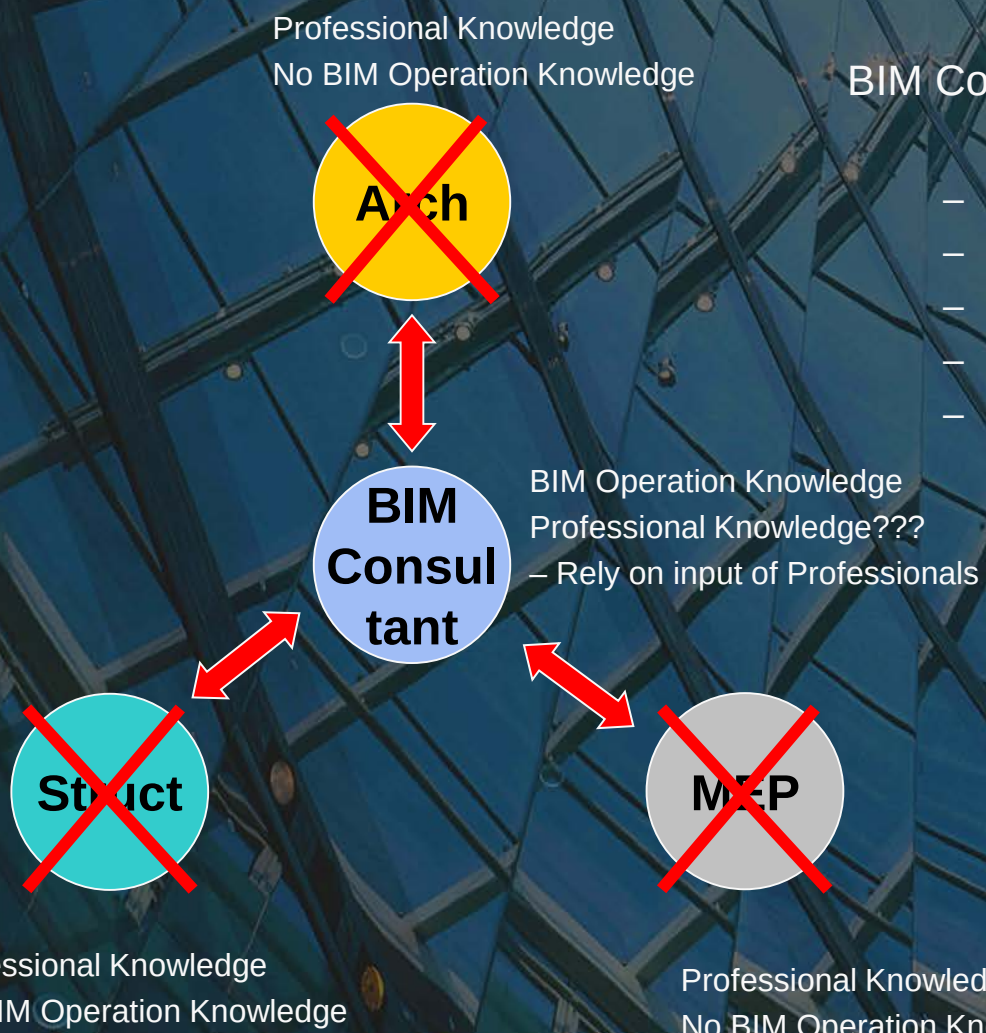
Partial BIM Project Team Structure

- Filing Conversion
  - Release Information – Convert back to other 2D information, lost of information, CAD standard



Category	Projection		Cut	
	Layer name	Color ID	Layer name	Color ID
Cut Pattern	A-WALL-PATT	2	A-WALL-PATT	2
Finish 1 [4]	{A-WALL-MBNT}	2	{A-WALL}	2
Finish 2 [5]	{A-WALL-MBNT}	2	{A-WALL}	2
Hidden Lines	A-WALL-HIDN	2	A-WALL-HIDN	2
Membrane Layer	{A-WALL-MBNT}	2	{A-WALL}	2
Structure [1]	{A-WALL-MBNT}	2	{A-WALL}	2
Substrate [2]	{A-WALL-MBNT}	2	{A-WALL}	2
Surface Pattern	A-WALL-PATT	2	A-WALL-PATT	2
Thermal/Air Layer [	{A-WALL-MBNT}	2	{A-WALL}	2
Wall Sweep - Corni	{A-WALL-MBNT}	2	{A-WALL}	2
Wall Sweeps	{A-WALL-MBNT}	2	{A-WALL}	2
Walls/Interior	I-WALL	2	I-WALL	2
Walls/Exterior	A-WALL	2	A-WALL	2
Walls/Foundation	S-FNDN	2	S-FNDN	2
Walls/Retaining	SITE-WALL	2	SITE-WALL	2
Window Tags	A-GLAZ-IDEN	6		
Windows	A-GLAZ	6	A-GLAZ	6
Architrave	{A-GLAZ}	6	{A-GLAZ}	6
Cavity Closer	{A-GLAZ}	6	{A-GLAZ}	6
Elevation Swing	{A-GLAZ}	6	{A-GLAZ}	6
Flashings	{A-GLAZ}	6	{A-GLAZ}	6
Frame-Sash	{A-GLAZ}	6	{A-GLAZ}	6
Frame/Mullion	A-GLAZ-FRAM	6	A-GLAZ-FRAM	6
Glass	A-GLAZ-GLAS	6	A-GLAZ-GLAS	6
Hidden Lines	{A-GLAZ}	6	{A-GLAZ}	6
Jamb Liner	{A-GLAZ}	6	{A-GLAZ}	6

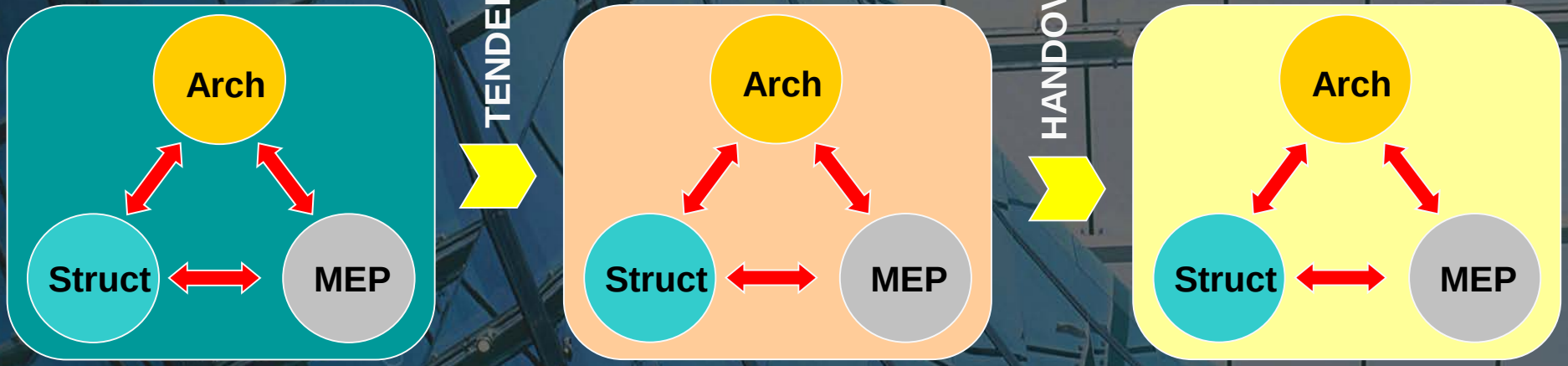
BIM Consultant Team Structure



BIM Consultant

- Roles
- Professional Liability?
- Responsibility
- Training
- Knowledge Transfer

BIM Models



Design/Consultant Models

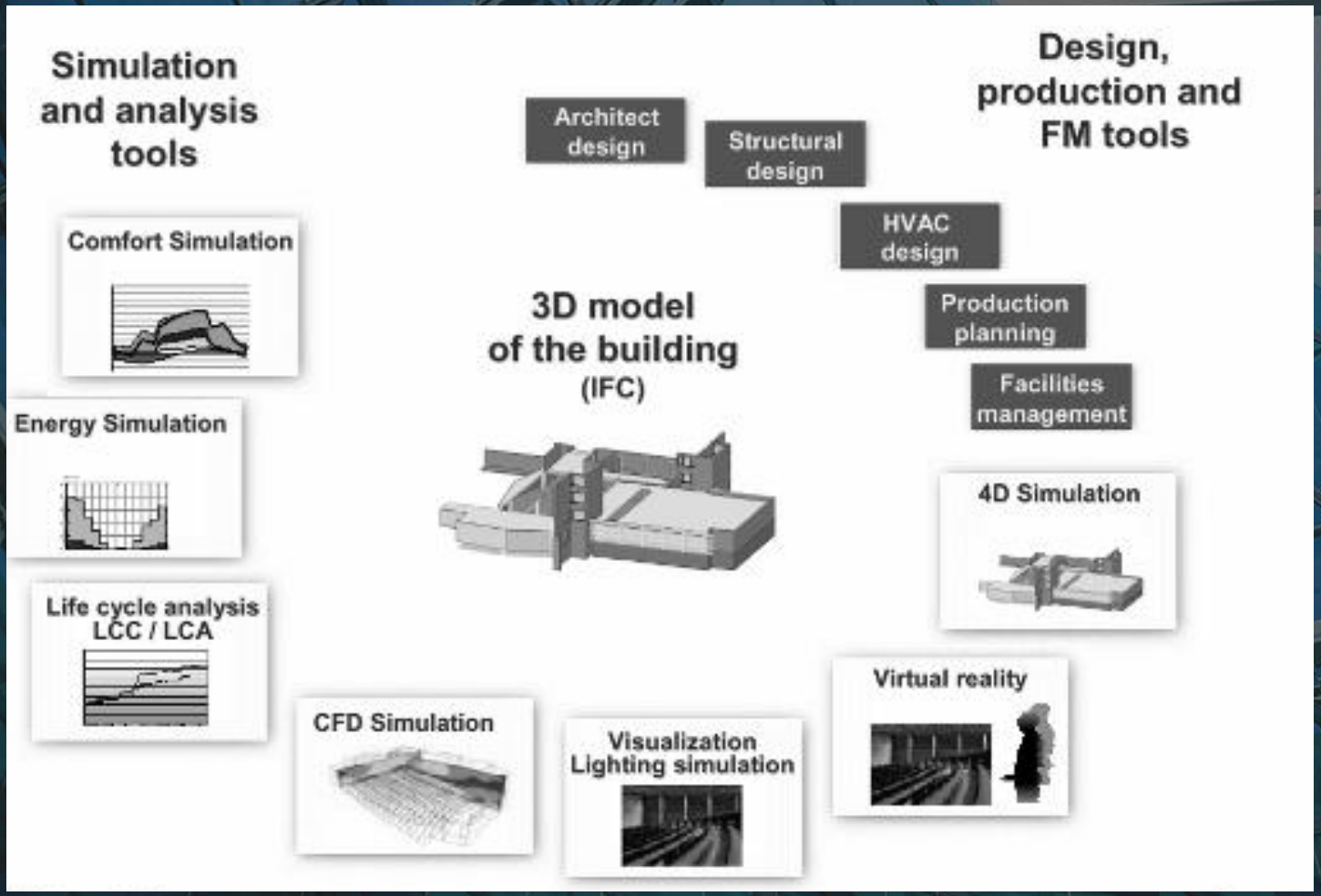
Construction/Contractor Models

Facility Management Models

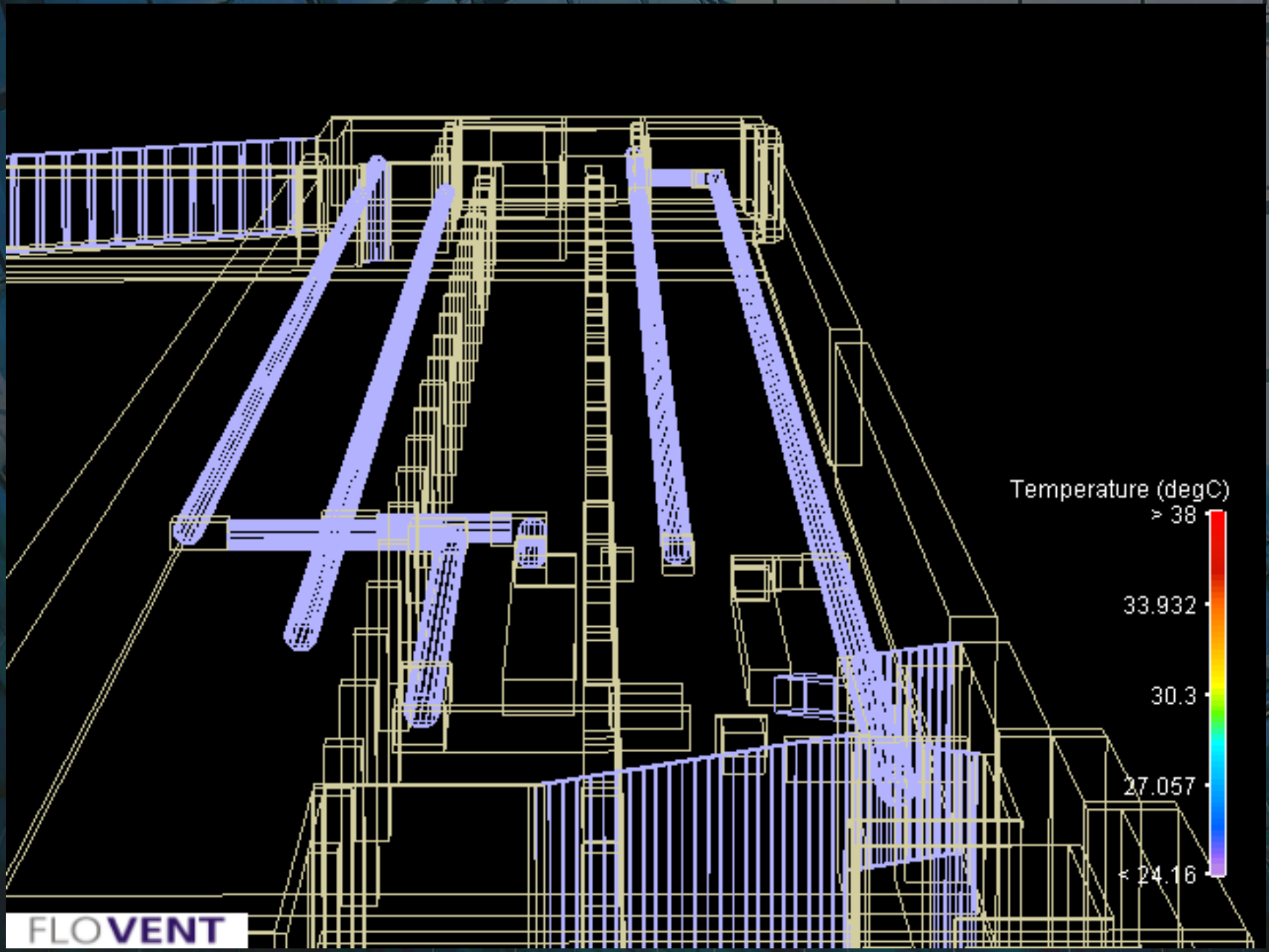
Architect/ Engineers/ Consultants	Main Contractor/ Sub -Con / Specialists	Client Facility Manager
Geometric Data	Modified Geometric Data (Site)	As built Geometric Data
Sizing (Designed)	Sizing (Actual)	
Clash Analysis (Major)	Clash Analysis (Actual) – CSD	
Scientific Analysis	Product Information	Material/ Equipment Life Cycle
Product/ Material specifications	Manufacturer Information	Facility Management Schedule
Drawings Production for tender	Shop drawings production	Alteration & Additions
Budget/ Cost Estimate/ B.Q.	Variations	
	Phasing/ Programming	

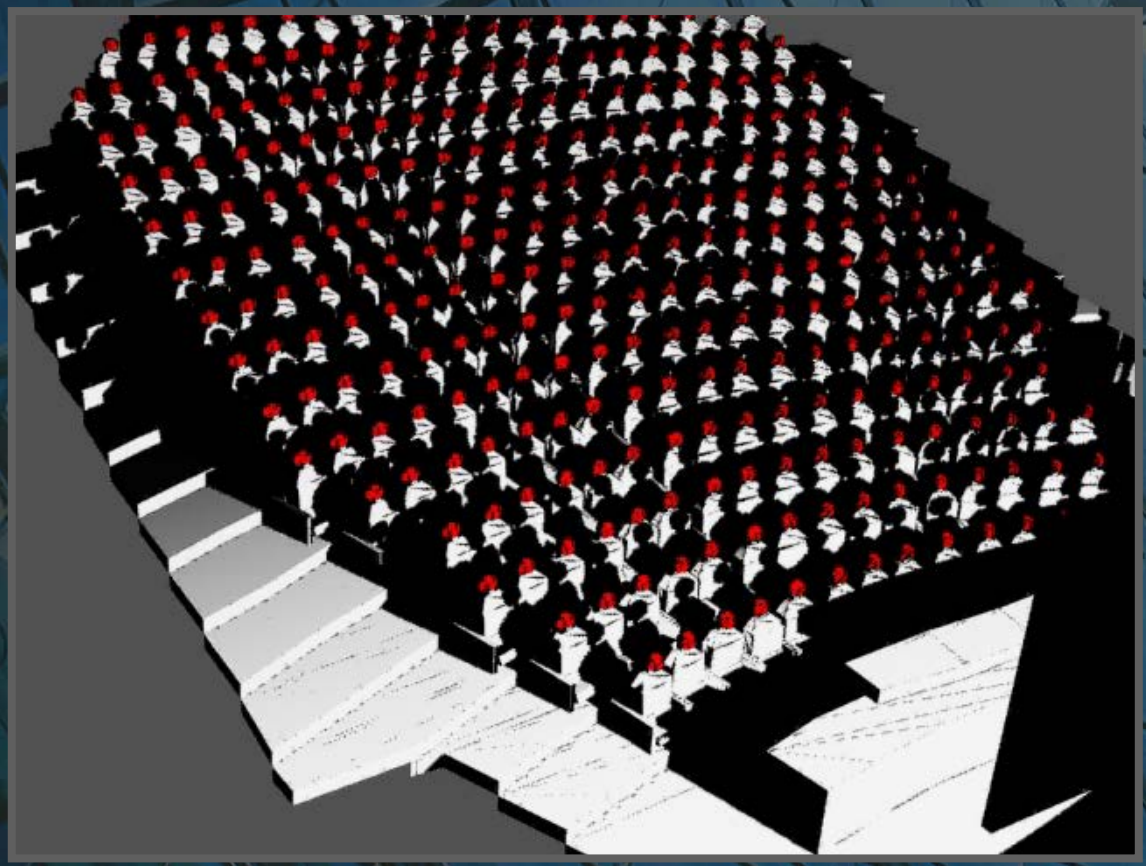
Other Consultants Team

- QS, Environmental Consultants
- Specialist…

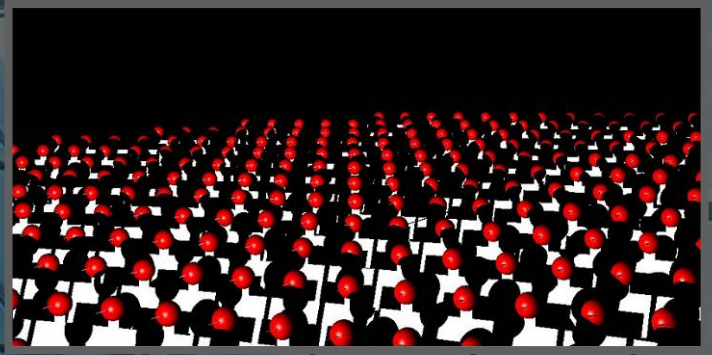


ANALYSIS

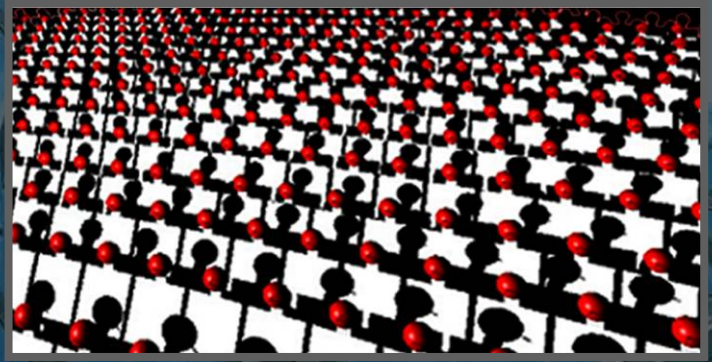




Radiating Light Method



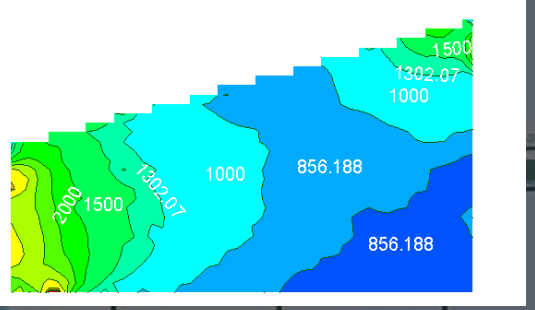
Unsatisfactory sightlines

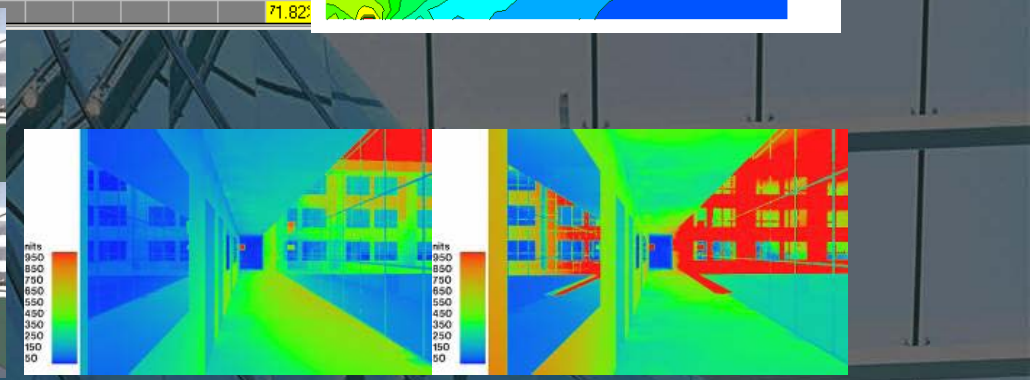


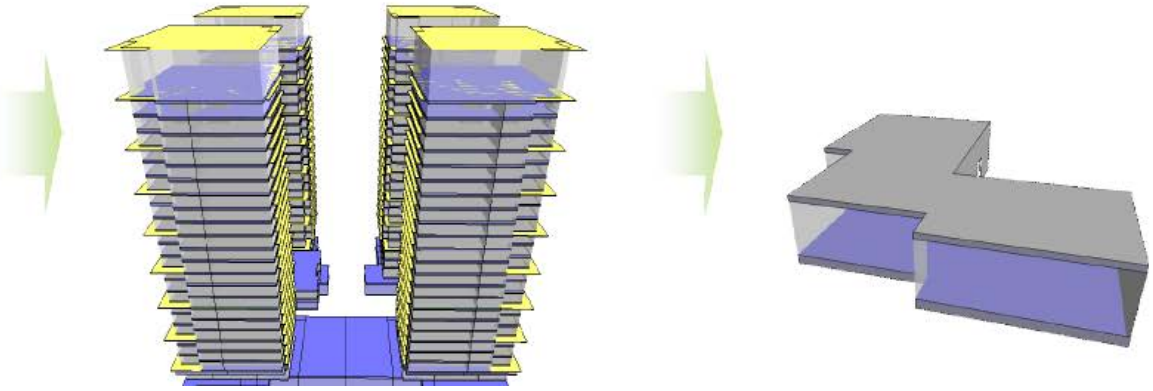
Satisfactory sightlines

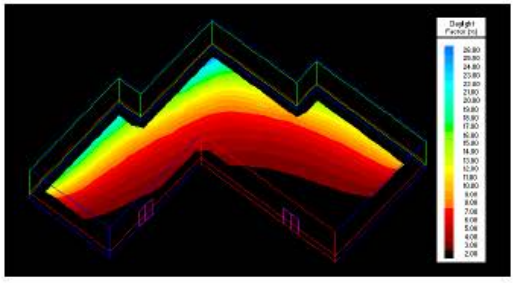
SIGHTLINE STUDIES

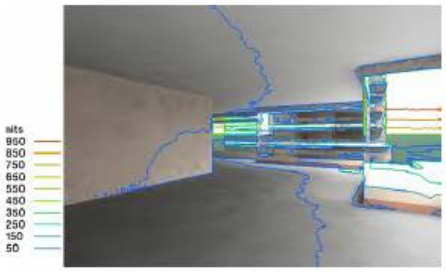
Month	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Jan									100.0	99.7	100.0	100.0	100.0	84.6	38.8	5.2								
Feb								100.0	100.0	100.0	100.0	100.0	100.0	98.7	73.9	32.7	3.0							
Mar							100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	91.5	60.4	25.7							
Apr						0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.0	84.0	51.3	0.0						
May					0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	92.9	0.0	0.0	0.0					
Jun				0.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96.5	0.0	0.0	0.0	0.0				
Jul					0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96.3	0.0	0.0	0.0	0.0				
Aug					0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	90.2	64.8	0.0	0.0					
Sep						0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	92.2	64.0	30.8	0.0						
Oct							100.0	100.0	100.0	100.0	100.0	100.0	100.0	95.0	63.7	26.7								
Nov								100.0	100.0	100.0	100.0	100.0	100.0	77.0	31.7	1.8								
Dec									100.0	95.1	93.6	100												71.82

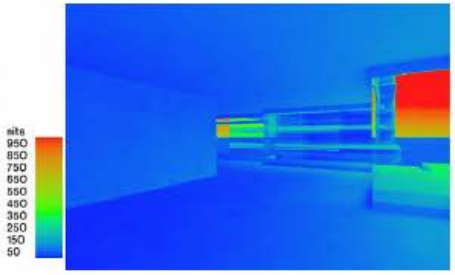


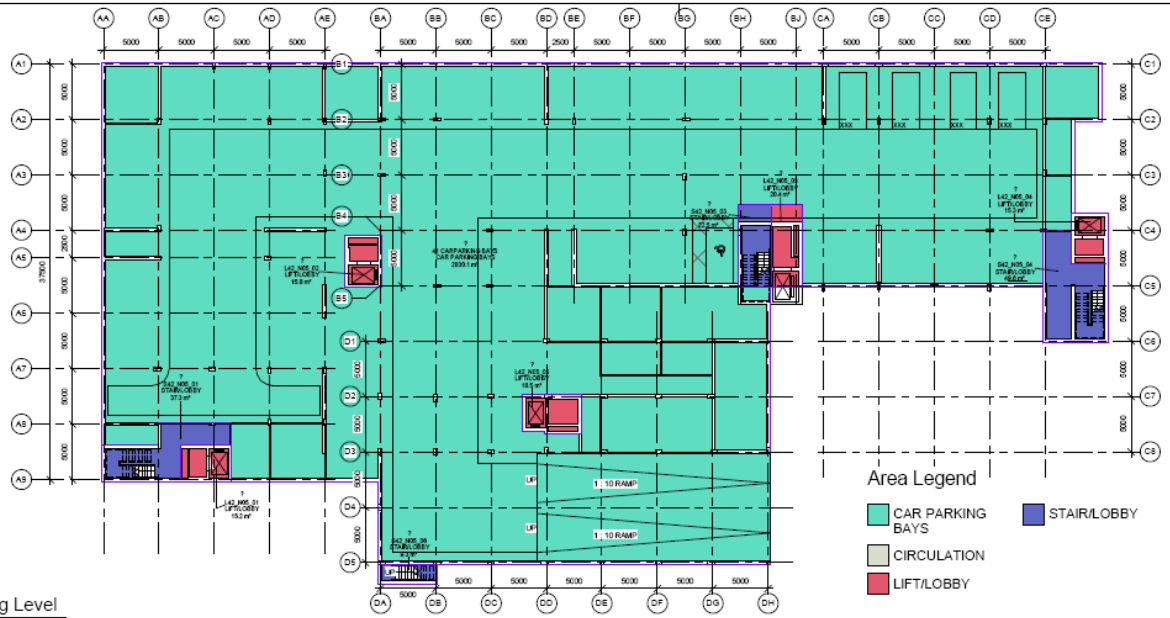












1 Parking Level
1 : 200

2 Level 1
1 : 200

Key Plan:

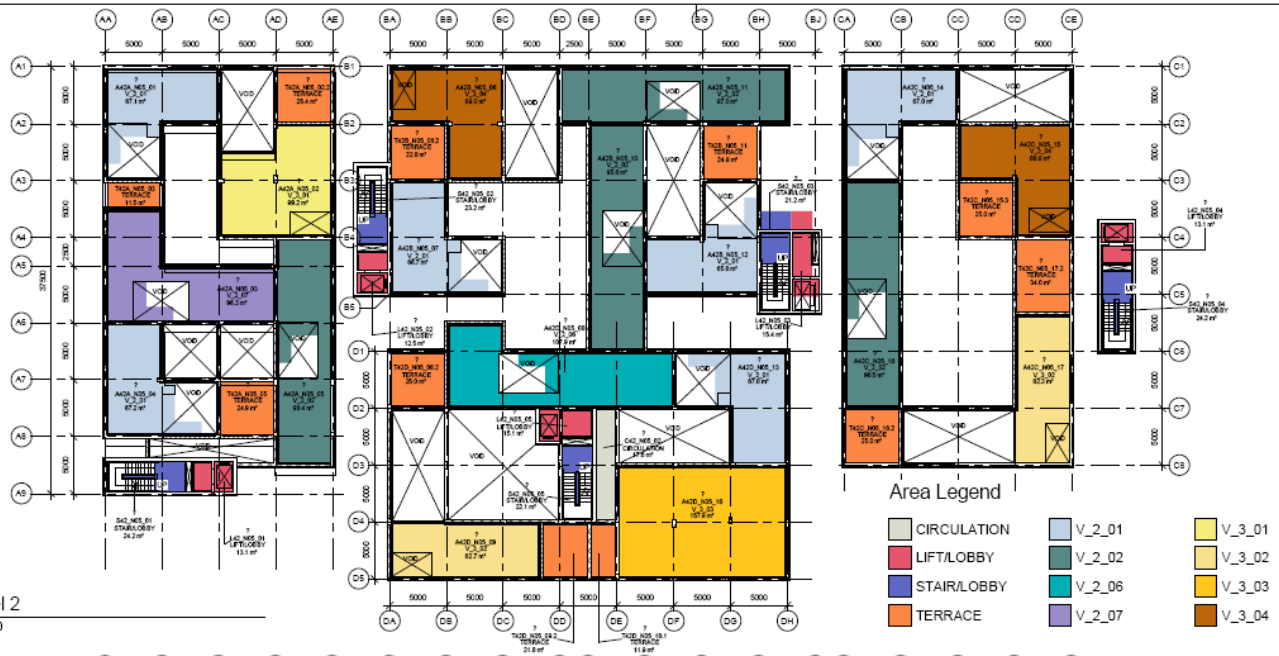
PRELIMINARY DESIGN, SITE PLAN & AREA STATEMENT | MD | 11/8/2008 | S. SUMMERS
Purpose of Issue | Rev | Date | Authorized

Project:
THE BLUE CITY
PHASE-1

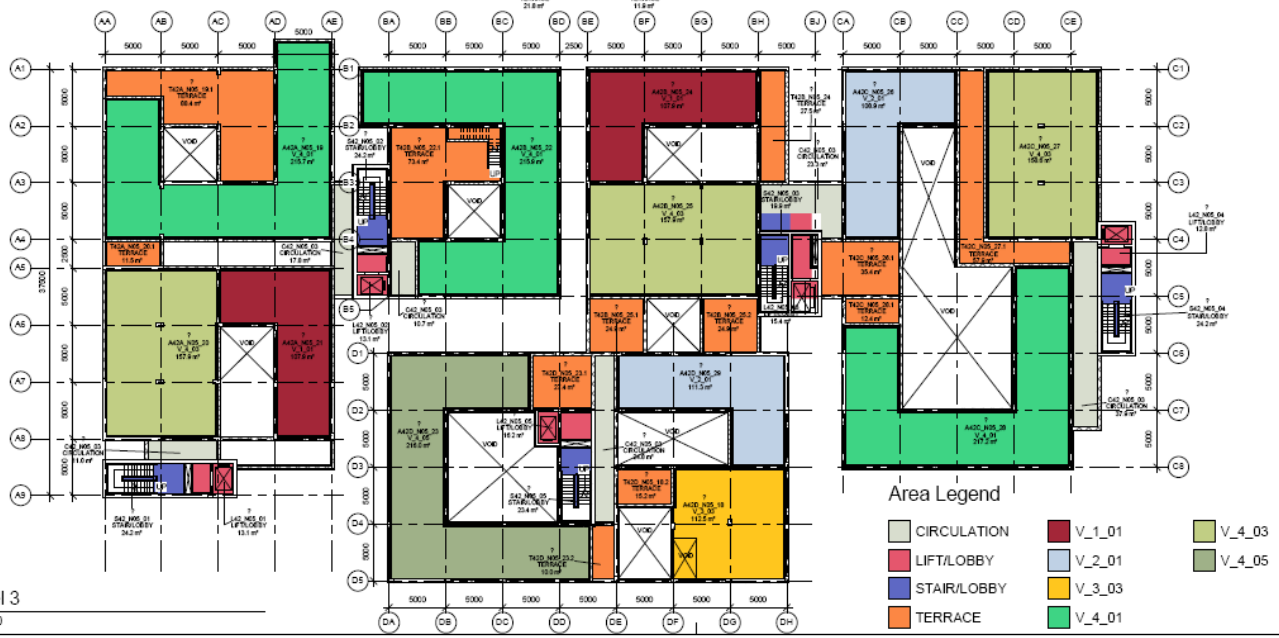
Drawing Plan:

Owner / Investor: Al Sawadi Investment & Tourism Co.LLC
Developer: Blue City Company 1 SAOC
Project Engineer: ASSOCIATED CONSULTING ENGINEERS (ACE) INT'L
Design and Build Contractor: AECO Development LLC
Design Subcontractor: Aedas
Project section: Section 1 - 1.4.2 City Beach Apartments
Drawing Title: NEIGHBORHOOD 05 BASEMENT & LEVEL 1 - AREA PLAN
Drawing Number: BC1-0420-PD-00A-01-060
Scale: 1 : 200 @A1 | Date: 08/05/08 | Rev.: 000
Subcontractor's Project Number: 07860

Designed by:
Drawn by: EL
Checked by: PS
Approved by AECO:
Approved by AS:
Notes:



1 Level 2
1 : 200



2 Level 3
1 : 200

Key Plan:

PRELIMINARY DESIGN, SITE PLAN & AREA STATEMENT	002	13/03/2008	S. SUMMERS
Purpose of Issue	Rev	Date	Authorized

Project:
THE BLUE CITY
PHASE-1

Drawing Plan:

Owner / Investor:
Al Sawadi Investment & Tourism Co.LLC

Developer:
Blue City Company 1 SAOC

Project Engineer:
ASSOCIATED CONSULTING ENGINEERS (ACE) INT'L

Design and Build Contractor:
AECO Development LLC

Design Consultant Architect:
Aedas

Project section:
Section 1 - 1.4.2 City Beach Apartments

Drawing Title:
NEIGHBORHOOD 05 LEVEL 2 & LEVEL 3 - AREA PLAN

Drawing Number:
BC1-0420-PD-00A-01-061

Scale: 1 : 200 @A1	Date: 08/05/08	Rev.: 000
Subcontractor's Project Number:	07860	

Designed by:		Notes:
Drawn by:	EL	
Checked by:	PS	
Approved by AECO:		
Approved by AE:		

1 Level 4
1 : 200

2 Level 5
1 : 200

Key Plan:

PRELIMINARY DESIGN, SITE PLAN & AREA STATEMENT — Purpose of Issue

Project:
THE BLUE CITY
PHASE-1

Drawing Plan:

Owner / Investor: Al Sawadi Investment & Tourism Co.LLC

Developer: Blue City Company 1 SAOC

Project Engineer: ASSOCIATED CONSULTING ENGINEERS (ACE) INT'L

Design and Build Contractor: AECO Development LLC

Design Subcontractor: Aedas

Project and/or: Section 1 - 1.4.2 City Beach Apartments

Drawing Title: NEIGHBORHOOD 05 LEVEL 4 & LEVEL 5 - AREA PLAN

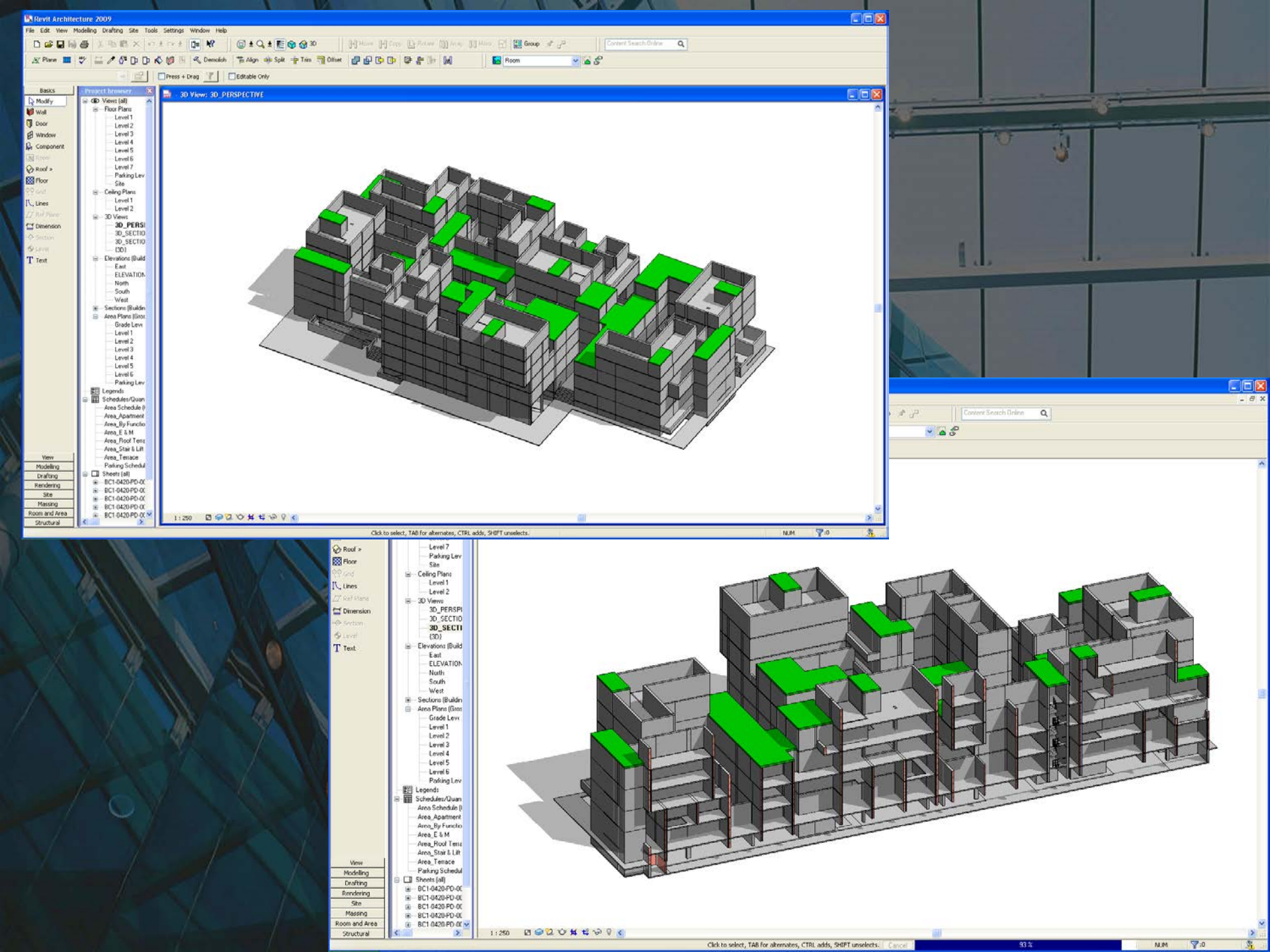
Drawing Number: BC1-0420-PD-00A-01-062

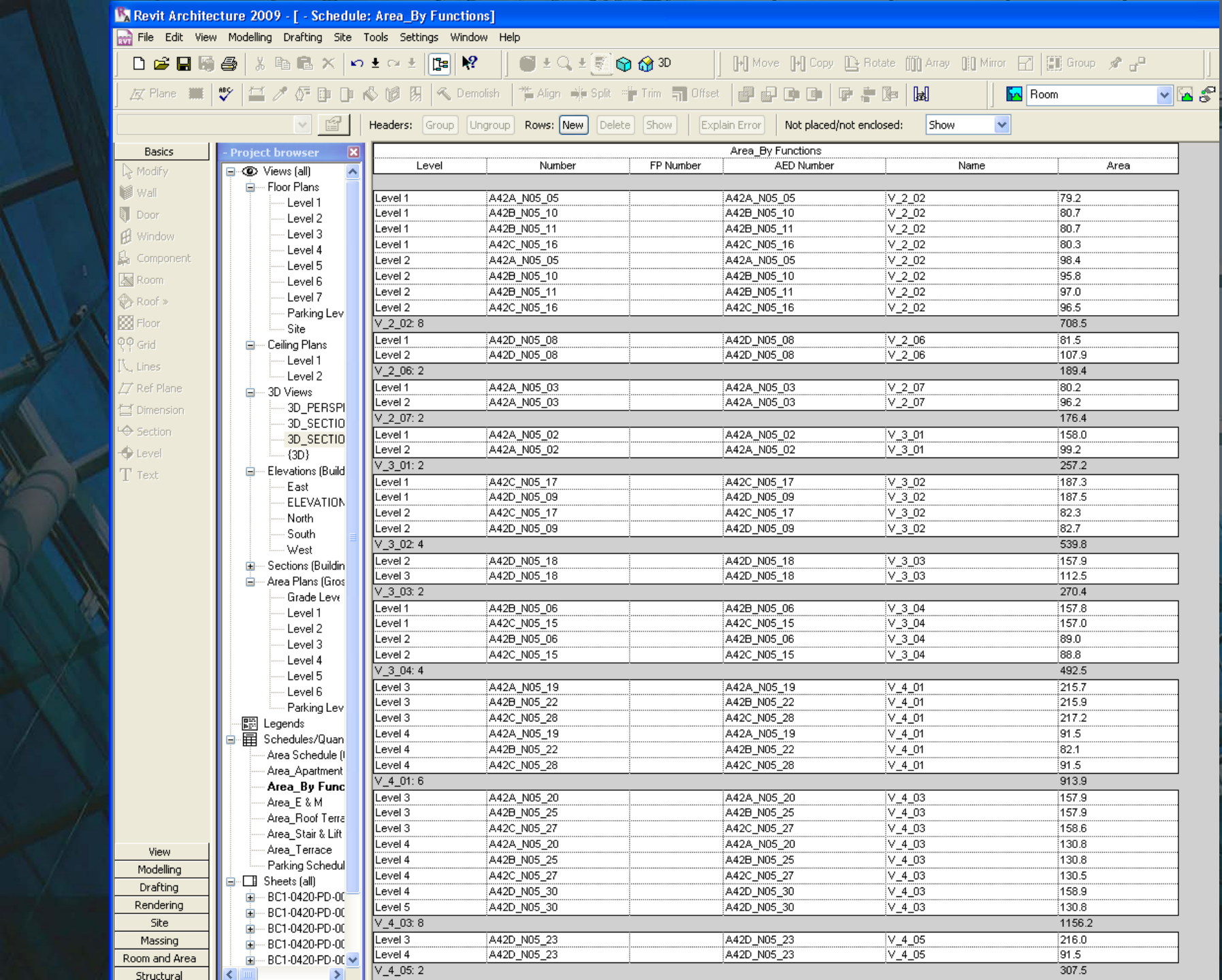
Scale: 1 : 200 @A1 | Date: 08/05/08 | Rev.: 000

Subcontractor's Project Number: 07860

Designed by:
Drawn by: EL
Checked by: PS
Approved by (ACE):
Approved by (AE):

Notes:

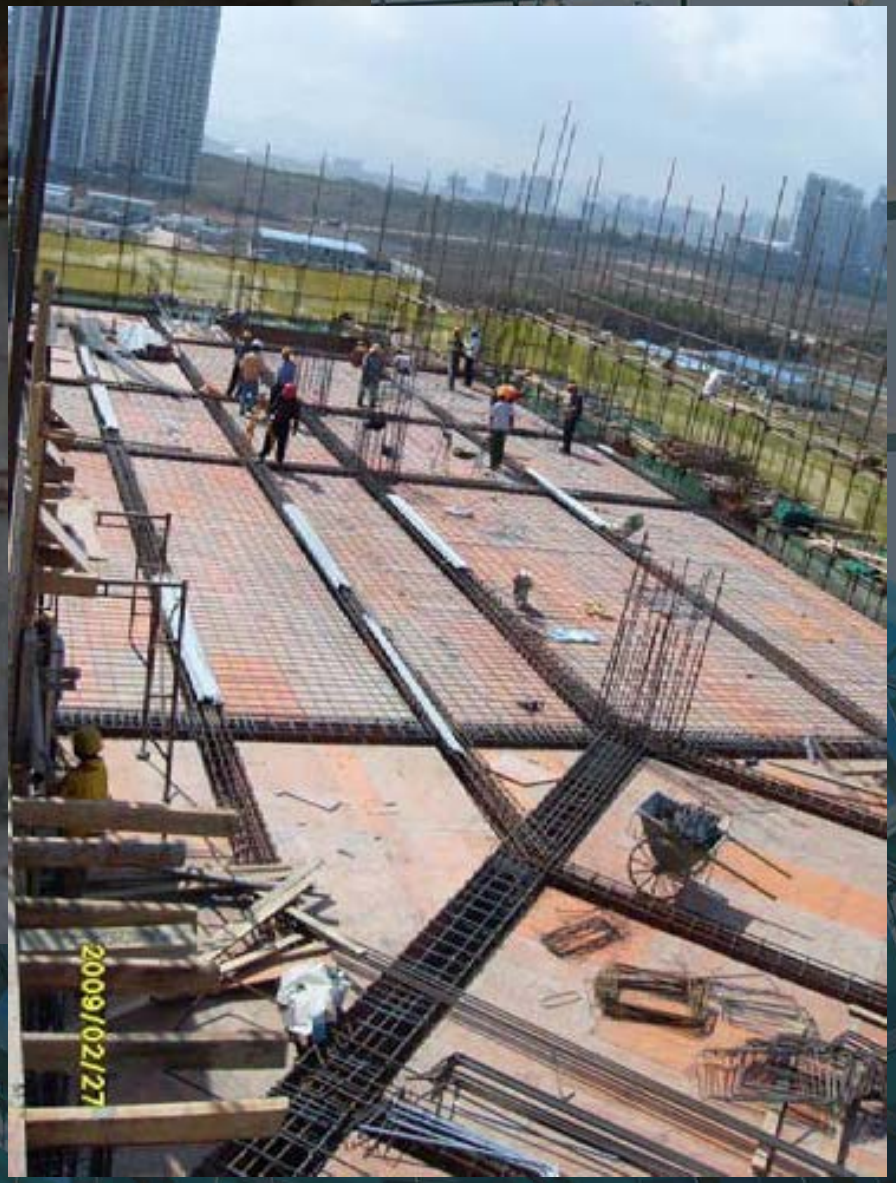

Revit Architecture 2009
3D View: 3D_PERSPECTIVE



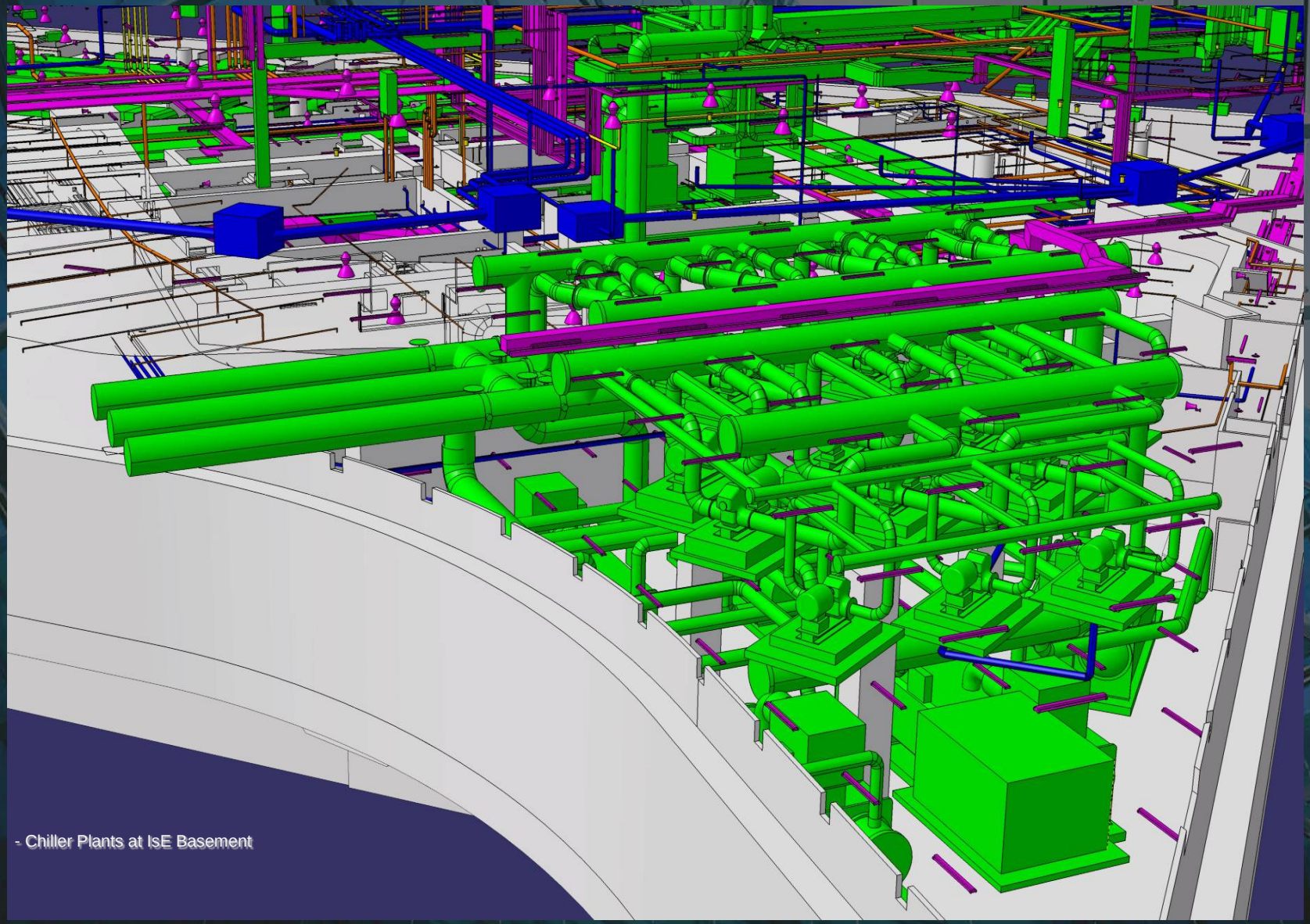
Area_By Functions

Level	Number	FP Number	AED Number	Name	Area
Level 1	A42A_N05_05		A42A_N05_05	V_2_02	79.2
Level 1	A42B_N05_10		A42B_N05_10	V_2_02	80.7
Level 1	A42B_N05_11		A42B_N05_11	V_2_02	80.7
Level 1	A42C_N05_16		A42C_N05_16	V_2_02	80.3
Level 2	A42A_N05_05		A42A_N05_05	V_2_02	98.4
Level 2	A42B_N05_10		A42B_N05_10	V_2_02	95.8
Level 2	A42B_N05_11		A42B_N05_11	V_2_02	97.0
Level 2	A42C_N05_16		A42C_N05_16	V_2_02	96.5
V_2_02: 8					708.5
Level 1	A42D_N05_08		A42D_N05_08	V_2_06	81.5
Level 2	A42D_N05_08		A42D_N05_08	V_2_06	107.9
V_2_06: 2					189.4
Level 1	A42A_N05_03		A42A_N05_03	V_2_07	80.2
Level 2	A42A_N05_03		A42A_N05_03	V_2_07	96.2
V_2_07: 2					176.4
Level 1	A42A_N05_02		A42A_N05_02	V_3_01	158.0
Level 2	A42A_N05_02		A42A_N05_02	V_3_01	99.2
V_3_01: 2					257.2
Level 1	A42C_N05_17		A42C_N05_17	V_3_02	187.3
Level 1	A42D_N05_09		A42D_N05_09	V_3_02	187.5
Level 2	A42C_N05_17		A42C_N05_17	V_3_02	82.3
Level 2	A42D_N05_09		A42D_N05_09	V_3_02	82.7
V_3_02: 4					539.8
Level 2	A42D_N05_18		A42D_N05_18	V_3_03	157.9
Level 3	A42D_N05_18		A42D_N05_18	V_3_03	112.5
V_3_03: 2					270.4
Level 1	A42B_N05_06		A42B_N05_06	V_3_04	157.8
Level 1	A42C_N05_15		A42C_N05_15	V_3_04	157.0
Level 2	A42B_N05_06		A42B_N05_06	V_3_04	89.0
Level 2	A42C_N05_15		A42C_N05_15	V_3_04	88.8
V_3_04: 4					492.5
Level 3	A42A_N05_19		A42A_N05_19	V_4_01	215.7
Level 3	A42B_N05_22		A42B_N05_22	V_4_01	215.9
Level 3	A42C_N05_28		A42C_N05_28	V_4_01	217.2
Level 4	A42A_N05_19		A42A_N05_19	V_4_01	91.5
Level 4	A42B_N05_22		A42B_N05_22	V_4_01	82.1
Level 4	A42C_N05_28		A42C_N05_28	V_4_01	91.5
V_4_01: 6					913.9
Level 3	A42A_N05_20		A42A_N05_20	V_4_03	157.9
Level 3	A42B_N05_25		A42B_N05_25	V_4_03	157.9
Level 3	A42C_N05_27		A42C_N05_27	V_4_03	158.6
Level 4	A42A_N05_20		A42A_N05_20	V_4_03	130.8
Level 4	A42B_N05_25		A42B_N05_25	V_4_03	130.8
Level 4	A42C_N05_27		A42C_N05_27	V_4_03	130.5
Level 4	A42D_N05_30		A42D_N05_30	V_4_03	158.9
Level 5	A42D_N05_30		A42D_N05_30	V_4_03	130.8
V_4_03: 8					1156.2
Level 3	A42D_N05_23		A42D_N05_23	V_4_05	216.0
Level 4	A42D_N05_23		A42D_N05_23	V_4_05	91.5
V_4_05: 2					307.5

Contractor Model

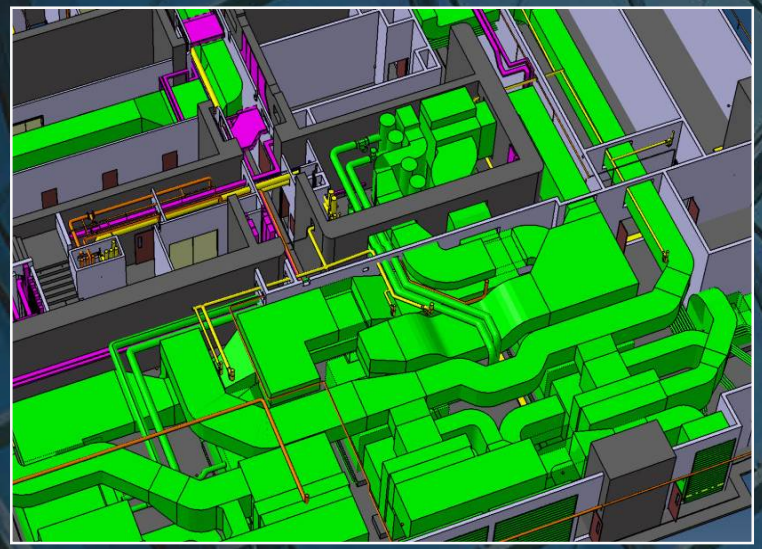


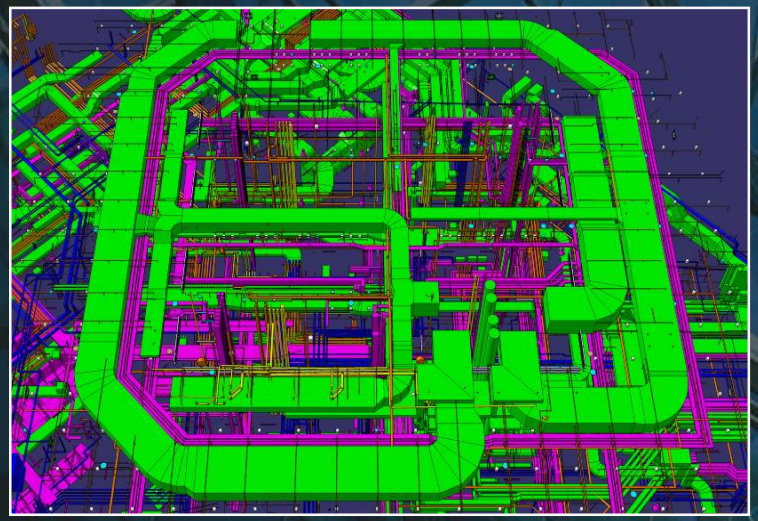
Detail Design and Coordination

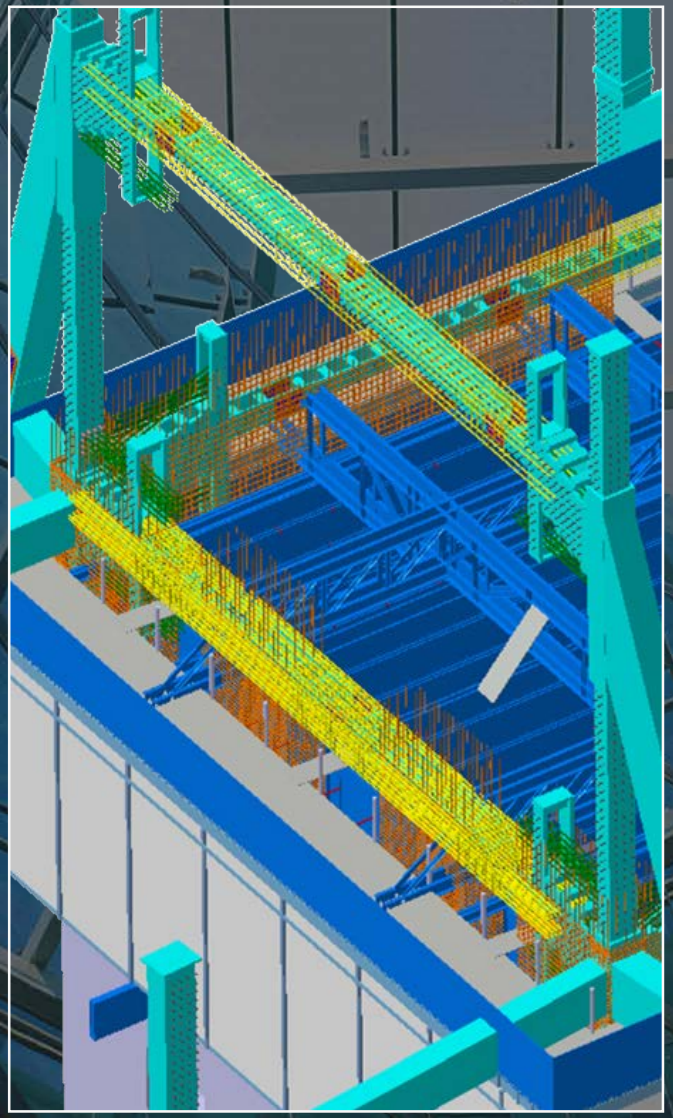


- Chiller Plants at IsE Basement

Detail Design and Coordination

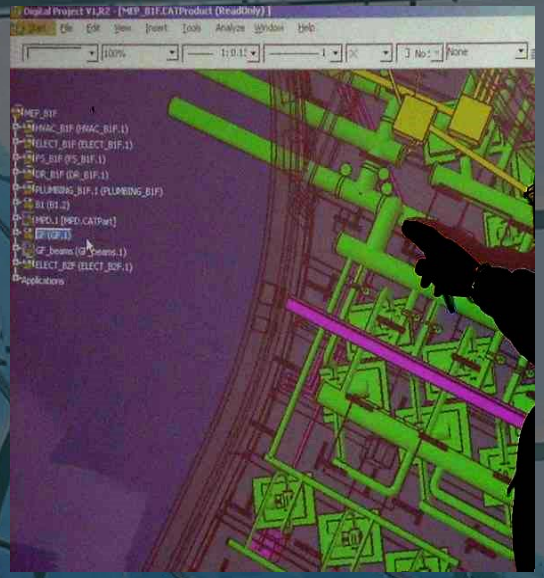




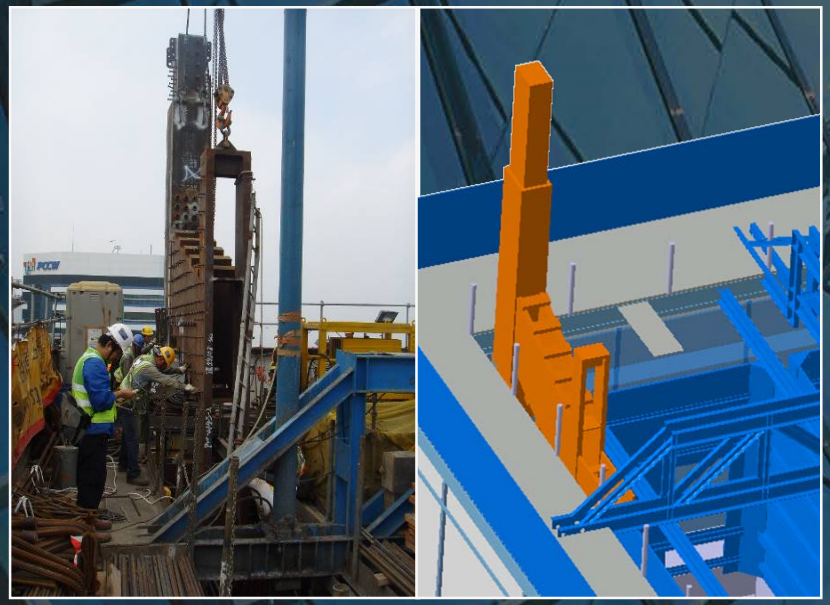


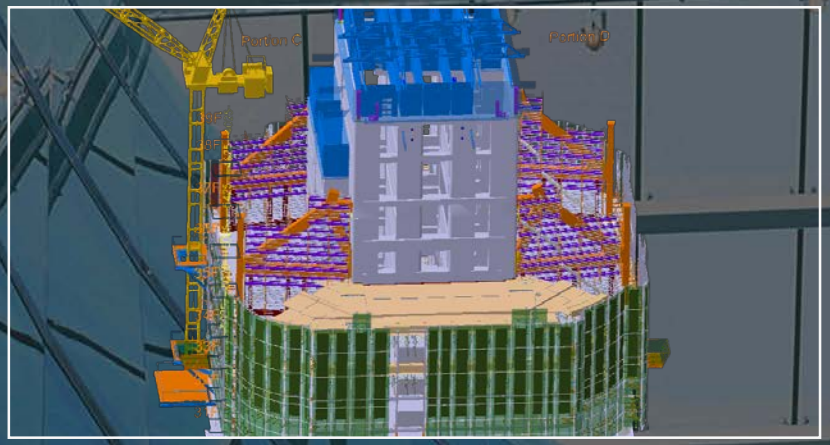
Project-wide multi-discipline design coordination

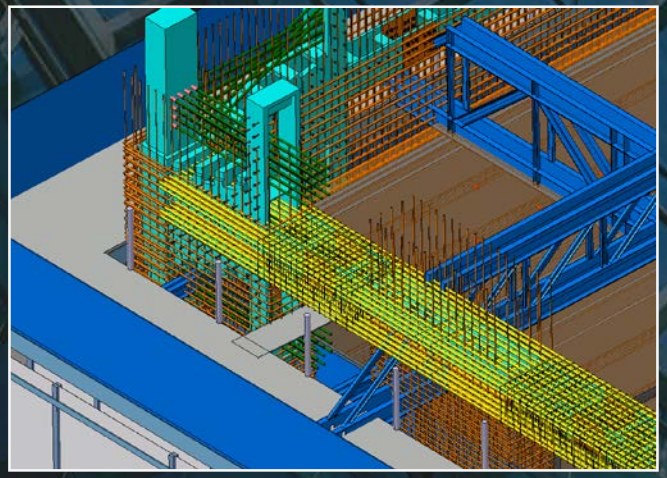
Detail Design and Coordination



Critical Structural Detail Checking

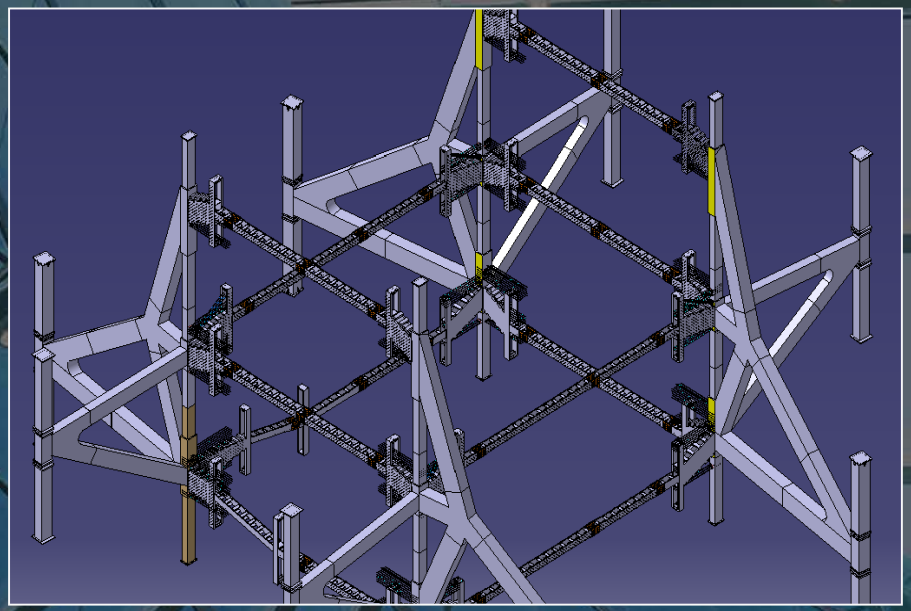


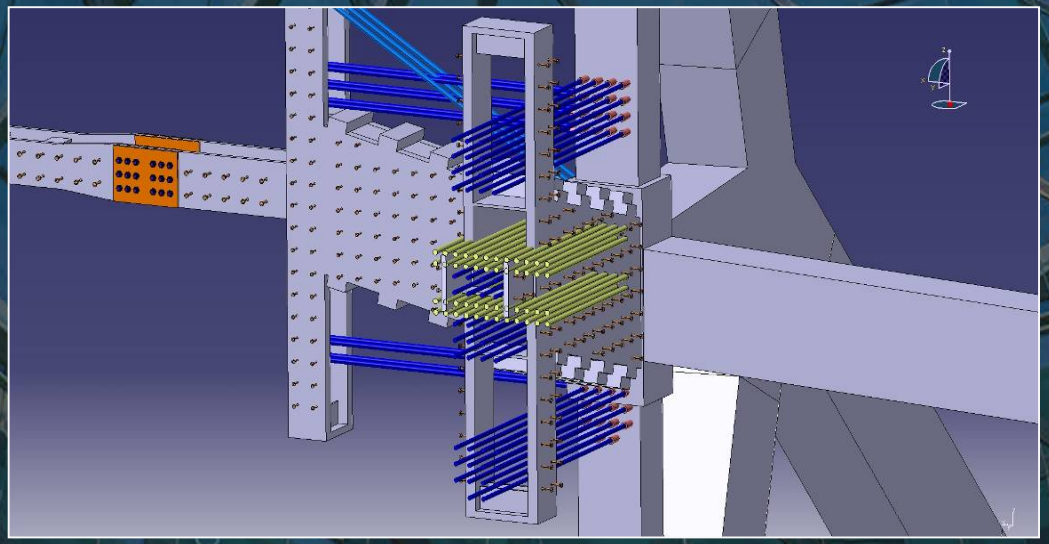




Steel Outrigger

Critical Structural Detail Checking





Steel Outrigger and Rebars

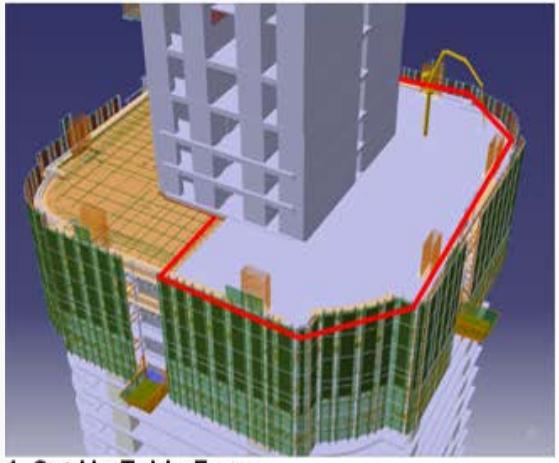
Virtual Prototyping

4 Day Cycle Simulation (Day 1)

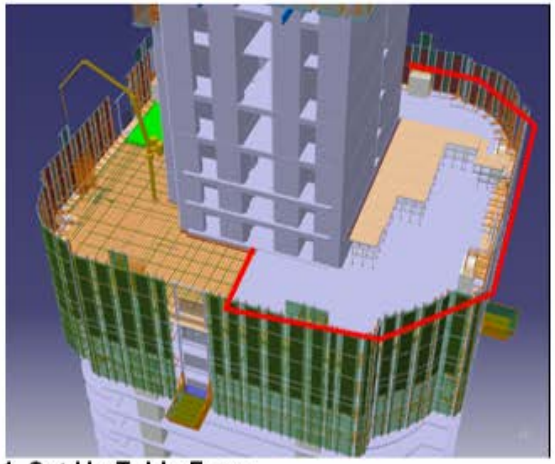
Morning

Afternoon

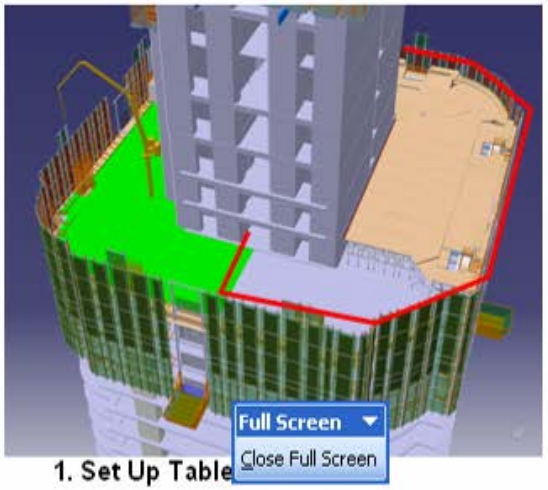
Evening



1. Set Up Table Form
2. Lift Safety Screen
3. Fixing Column Form

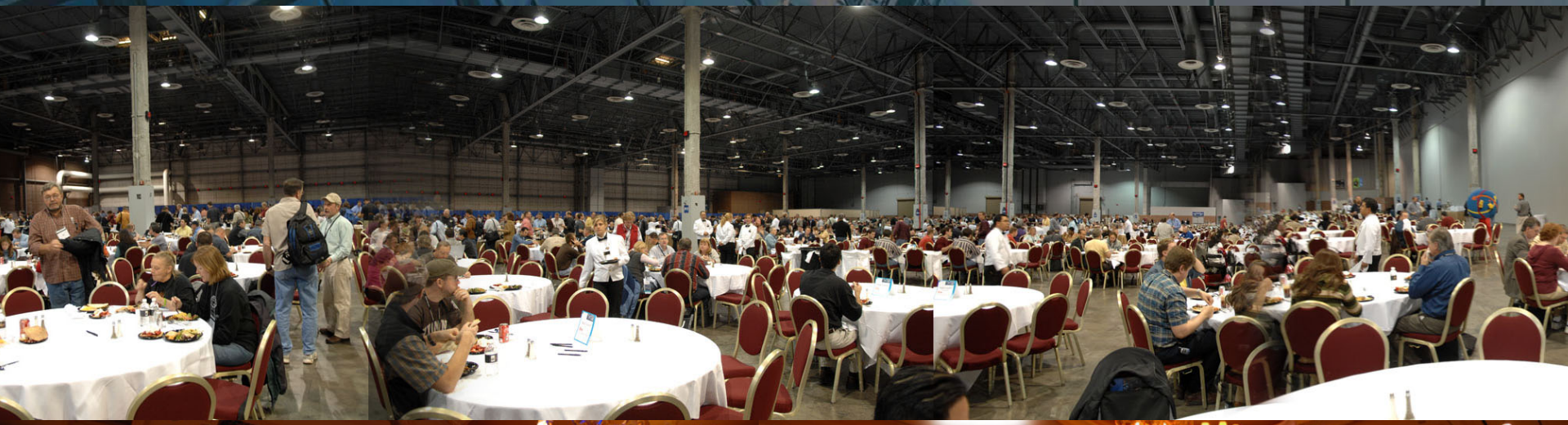


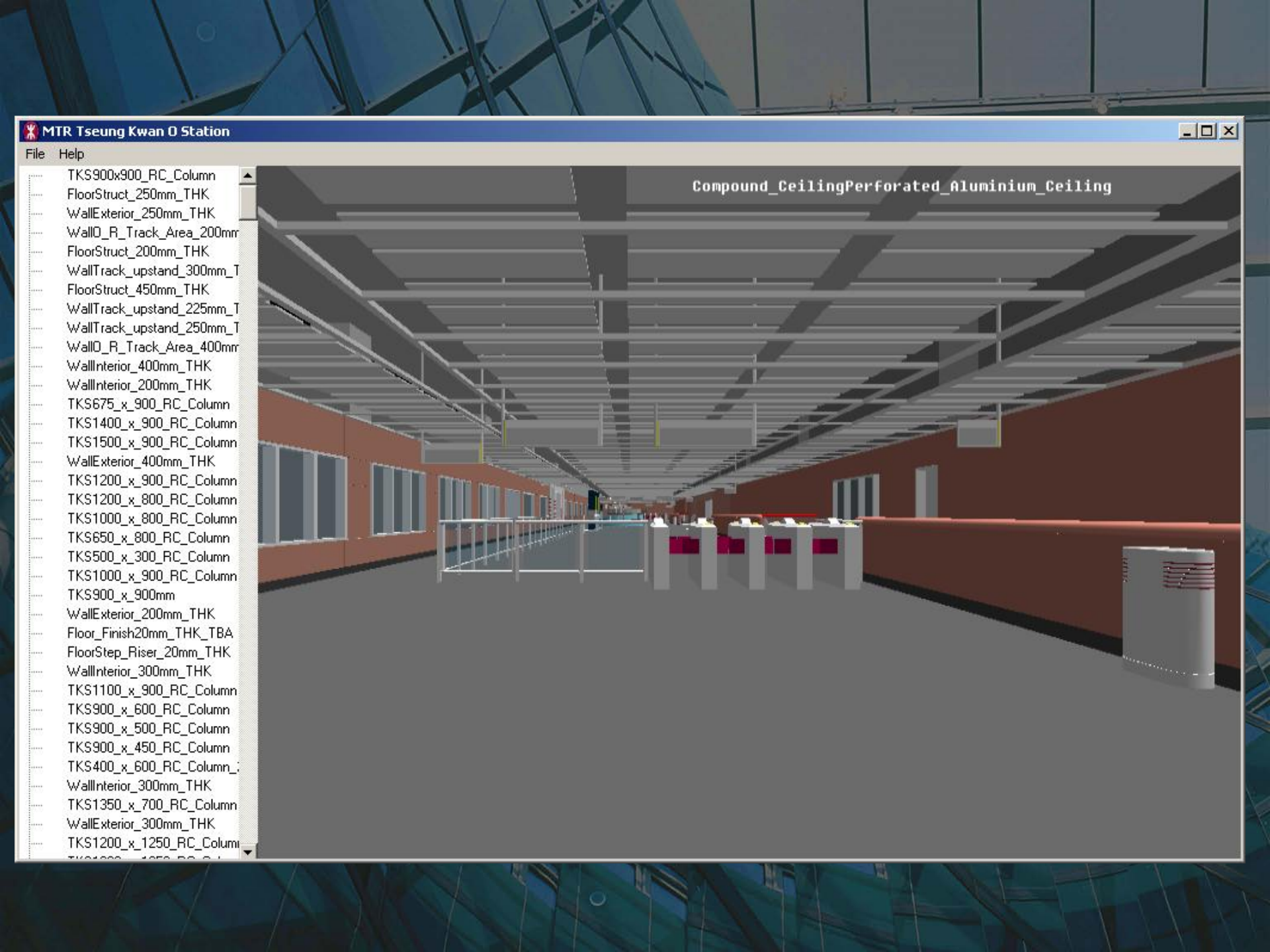
1. Set Up Table Form
2. Lift Safety Screen
3. Fixing Column Form



1. Set Up Table

Is the AEC Industry Changing?

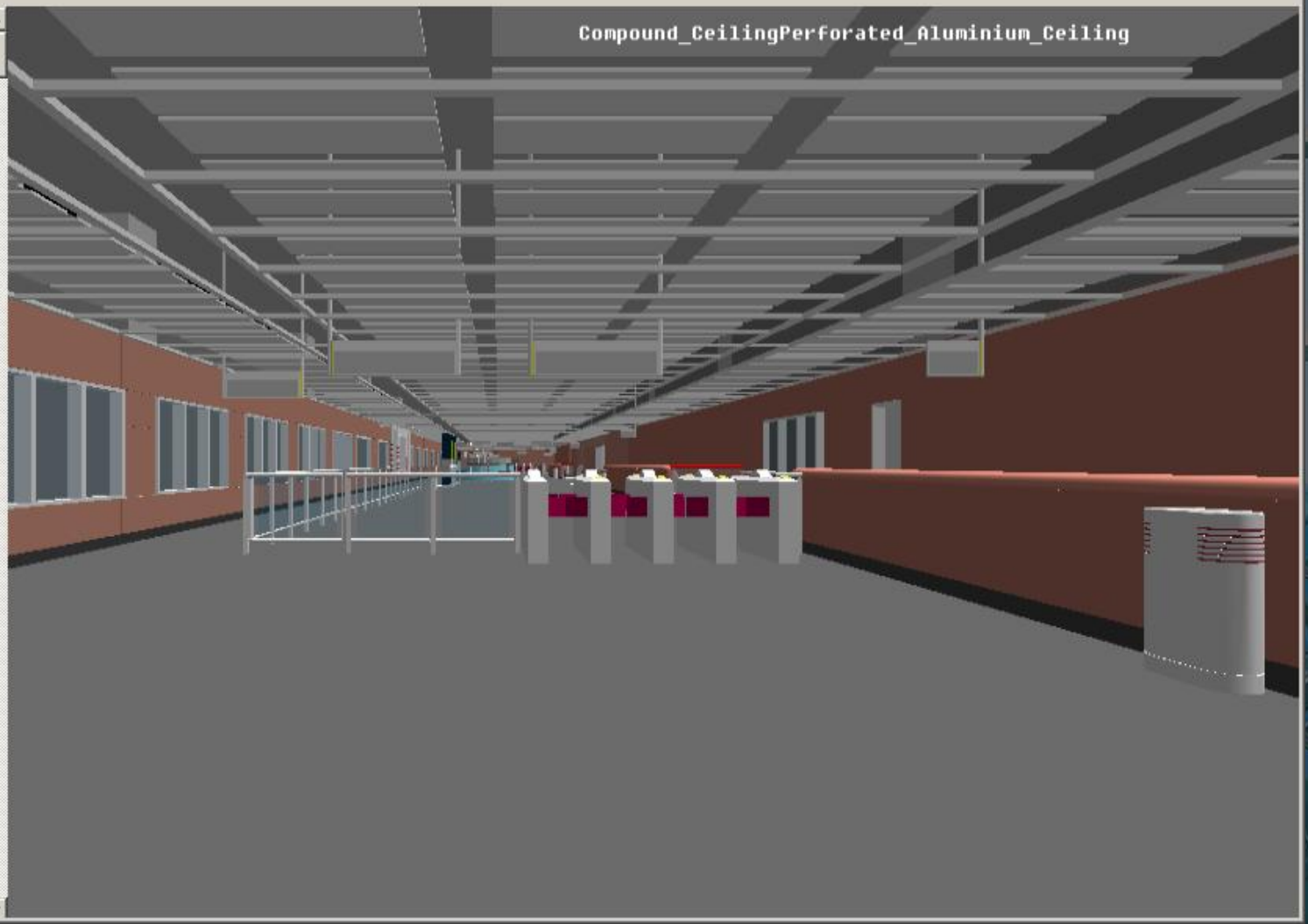


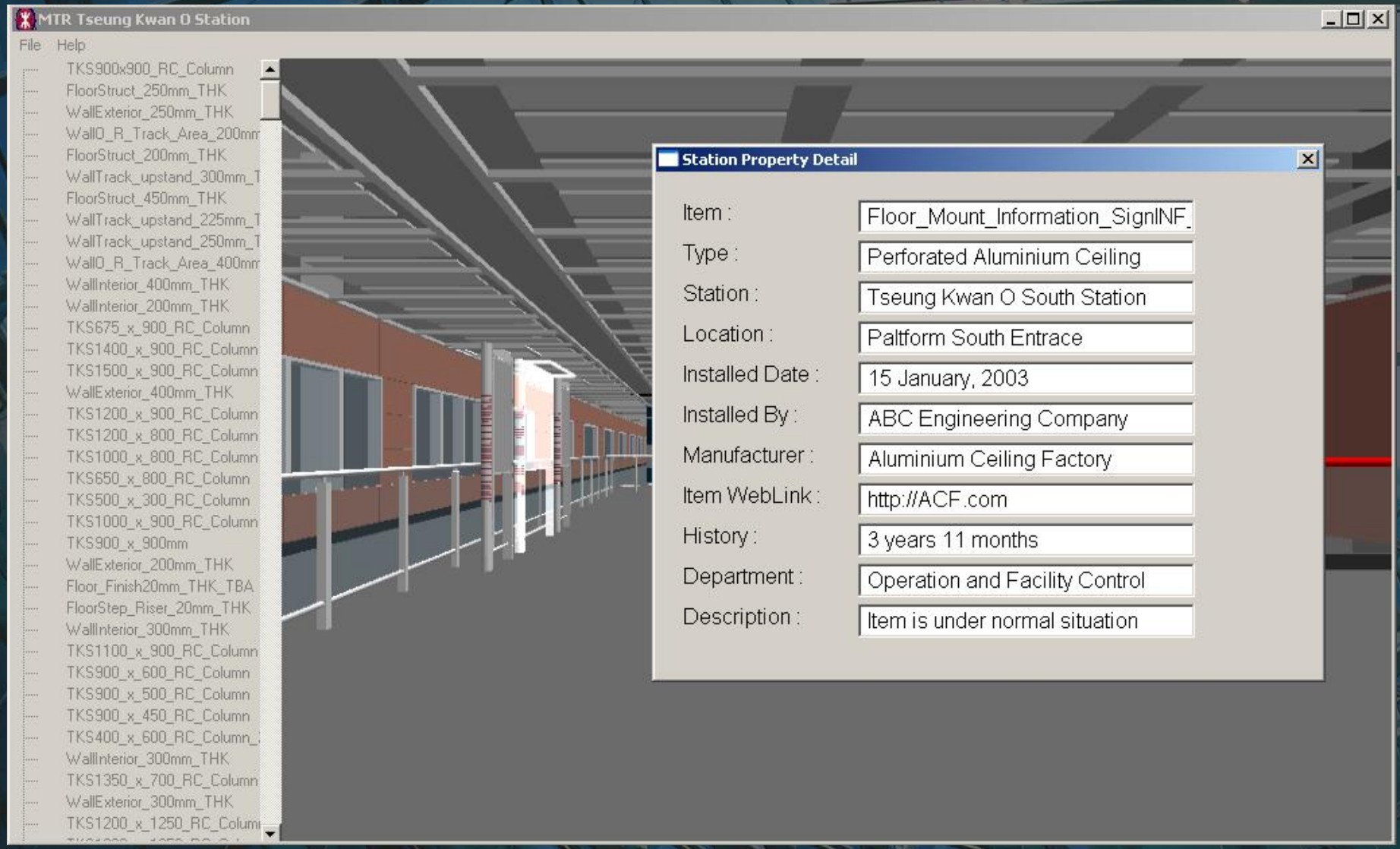

MTR Tseung Kwan O Station
File
Help
TKS900x900_RC_Column
FloorStruct_250mm_THK
WallExterior_250mm_THK
WallO_R_Track_Area_200mm
FloorStruct_200mm_THK
WallTrack_upstand_300mm_T
FloorStruct_450mm_THK
WallTrack_upstand_225mm_T
WallTrack_upstand_250mm_T
WallO_R_Track_Area_400mm
WallInterior_400mm_THK
WallInterior_200mm_THK
TKS675_x_900_RC_Column
TKS1400_x_900_RC_Column
TKS1500_x_900_RC_Column
WallExterior_400mm_THK
TKS1200_x_900_RC_Column
TKS1200_x_800_RC_Column
TKS1000_x_800_RC_Column
TKS650_x_800_RC_Column
TKS500_x_300_RC_Column
TKS1000_x_900_RC_Column
TKS900_x_900mm
WallExterior_200mm_THK
Floor_Finish20mm_THK_TBA
FloorStep_Riser_20mm_THK
WallInterior_300mm_THK
TKS1100_x_900_RC_Column
TKS900_x_600_RC_Column
TKS900_x_500_RC_Column
TKS900_x_450_RC_Column
TKS400_x_600_RC_Column_
WallInterior_300mm_THK
TKS1350_x_700_RC_Column
WallExterior_300mm_THK
TKS1200_x_1250_RC_Colum
Compound_CeilingPerforated_Aluminium_Ceiling

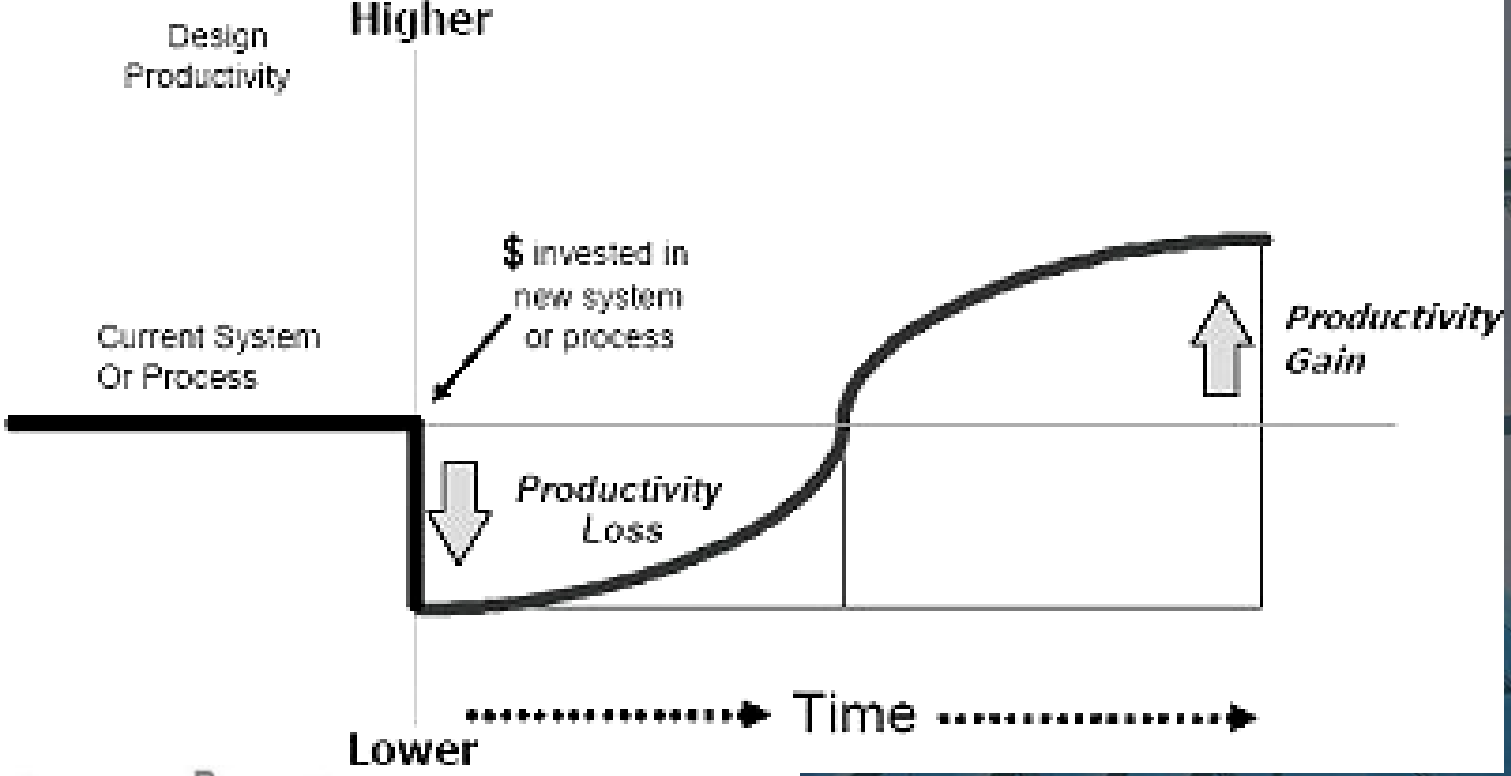
MTR Tseung Kwan O Station

File Help

- TKS900x900_RC_Column
- FloorStruct_250mm_THK
- WallExterior_250mm_THK
- WallO_R_Track_Area_200mm
- FloorStruct_200mm_THK
- WallTrack_upstand_300mm_T
- FloorStruct_450mm_THK
- WallTrack_upstand_225mm_T
- WallTrack_upstand_250mm_T
- WallO_R_Track_Area_400mm
- WallInterior_400mm_THK
- WallInterior_200mm_THK
- TKS675_x_900_RC_Column
- TKS1400_x_900_RC_Column
- TKS1500_x_900_RC_Column
- WallExterior_400mm_THK
- TKS1200_x_900_RC_Column
- TKS1200_x_800_RC_Column
- TKS1000_x_800_RC_Column
- TKS650_x_800_RC_Column
- TKS500_x_300_RC_Column
- TKS1000_x_900_RC_Column
- TKS900_x_900mm
- WallExterior_200mm_THK
- Floor_Finish20mm_THK_TBA
- FloorStep_Riser_20mm_THK
- WallInterior_300mm_THK
- TKS1100_x_900_RC_Column
- TKS900_x_600_RC_Column
- TKS900_x_500_RC_Column
- TKS900_x_450_RC_Column
- TKS400_x_600_RC_Column_
- WallInterior_300mm_THK
- TKS1350_x_700_RC_Column
- WallExterior_300mm_THK
- TKS1200_x_1250_RC_Colum




MTR Tseung Kwan O Station
File
Help
TKS900x900_RC_Column
FloorStruct_250mm_THK
WallExterior_250mm_THK
WallO_R_Track_Area_200mm
FloorStruct_200mm_THK
WallTrack_upstand_300mm_T
FloorStruct_450mm_THK
WallTrack_upstand_225mm_T
WallTrack_upstand_250mm_T
WallO_R_Track_Area_400mm
WallInterior_400mm_THK
WallInterior_200mm_THK
TKS675_x_900_RC_Column
TKS1400_x_900_RC_Column
TKS1500_x_900_RC_Column
WallExterior_400mm_THK
TKS1200_x_900_RC_Column
TKS1200_x_800_RC_Column
TKS1000_x_800_RC_Column
TKS650_x_800_RC_Column
TKS500_x_300_RC_Column
TKS1000_x_900_RC_Column
TKS900_x_900mm
WallExterior_200mm_THK
Floor_Finish20mm_THK_TBA
FloorStep_Riser_20mm_THK
WallInterior_300mm_THK
TKS1100_x_900_RC_Column
TKS900_x_600_RC_Column
TKS900_x_500_RC_Column
TKS900_x_450_RC_Column
TKS400_x_600_RC_Column_
WallInterior_300mm_THK
TKS1350_x_700_RC_Column
WallExterior_300mm_THK
TKS1200_x_1250_RC_Colum
Station Property Detail
Item : Floor_Mount_Information_SignINF_
Type : Perforated Aluminium Ceiling
Station : Tseung Kwan O South Station
Location : Paltform South Entrace
Installed Date : 15 January, 2003
Installed By : ABC Engineering Company
Manufacturer : Aluminium Ceiling Factory
Item WebLink : http://ACF.com
History : 3 years 11 months
Department : Operation and Facility Control
Description : Item is under normal situation



$$\frac{\left(B - \left(\frac{B}{1+E}\right)\right) \times (12 - C)}{A + (B \times C \times D)} = \text{First Year ROI}$$

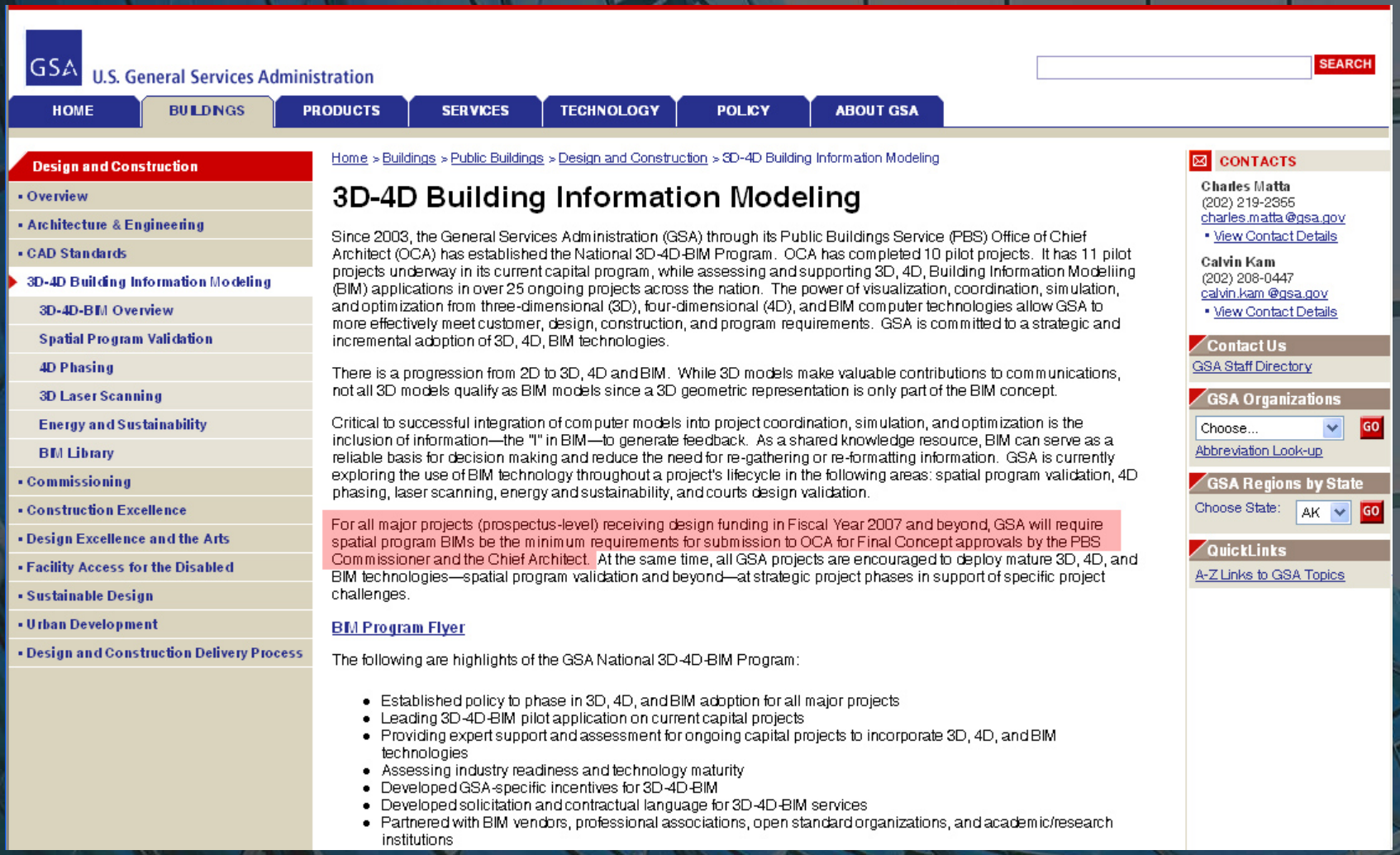
A = cost of hardware and software (dollars)
B = monthly labor cost (dollars)
C = training time (months)
D = productivity lost during training (percentage)
E = productivity gain after training (percentage)

A = cost of hardware and software	$6,000
B = monthly labor cost	$4,200
C = training time	3 months
D = productivity loss during training	50%
E = productivity gain after training	25%

Source 26/1/07: http://aec.cadalyst.com/aec/article/articleDetail.jsp?id=124222

PRODUCTIVITY

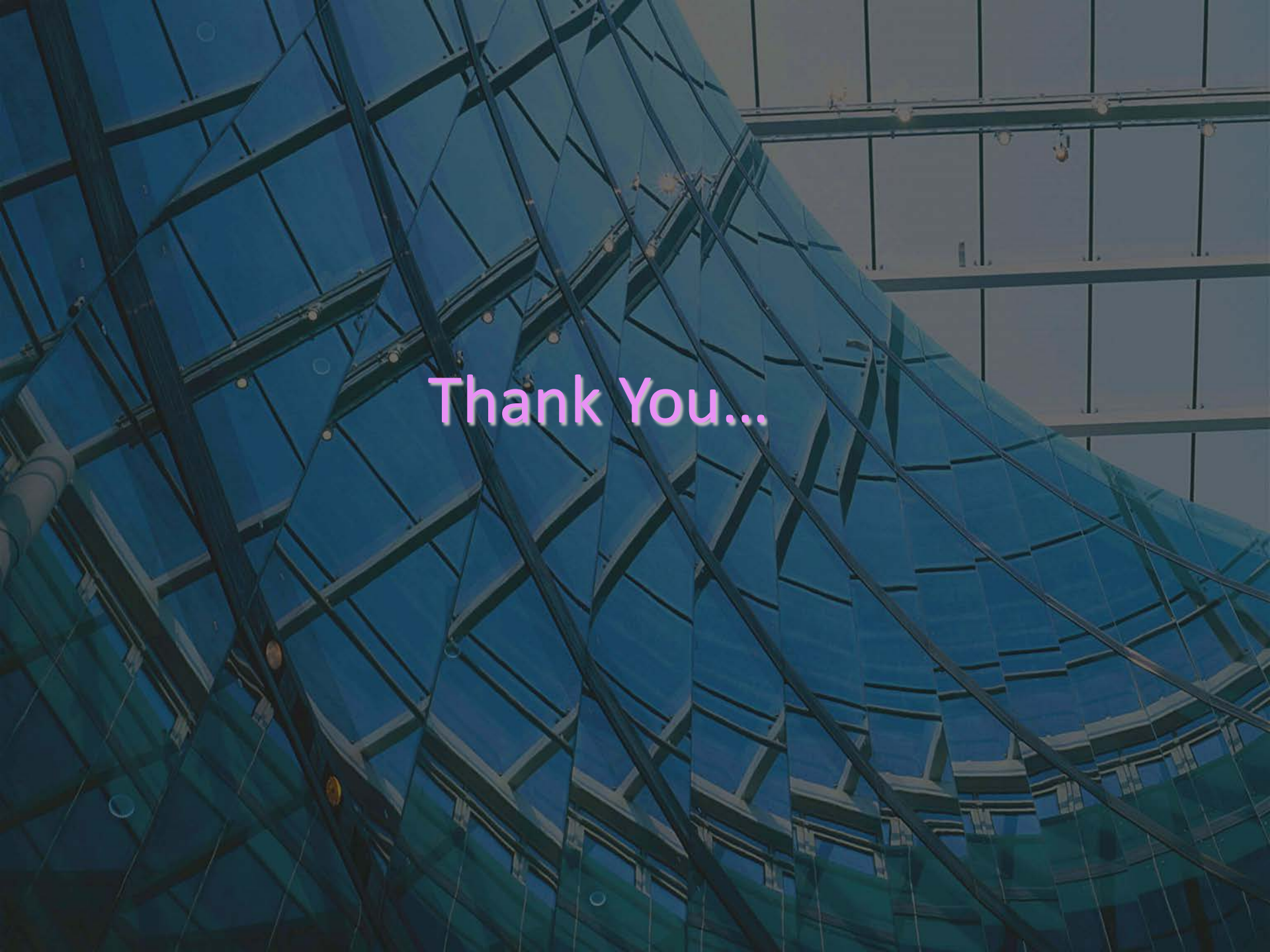
>60%



For all major projects (prospectus-level) receiving design funding in Fiscal Year 2007 and beyond, GSA will require spatial program BIMs be the minimum requirements for submission to OCA for Final Concept approvals by the PBS Commissioner and the Chief Architect.

Major Implications

- Time implications – SD, DD, CD
- Procurement - contract
- Professional Roles and Scope, HKIA? AIA?
- Existing Professional Fee Structures?
- BIM Consultants?


Thank You…