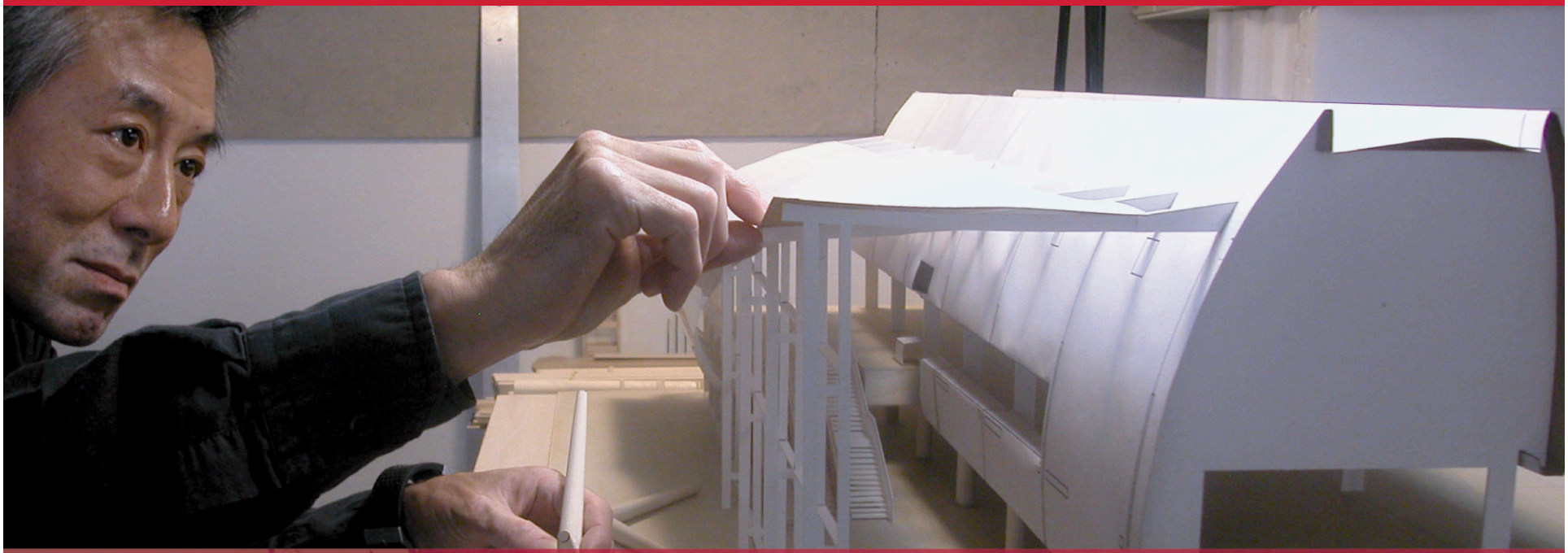


3D, 4D and Building Information Modeling: Get ready, Planners!

FAA / NASA / Industry Airport Planning Workshop

September 12, 2006

Gensler

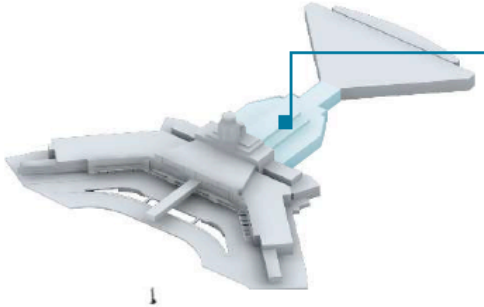
Problem Statement

The greatest challenges facing airport capacity projects – too little, too late - are compounded by inefficiencies in the transfer of information from planning to design and construction:

- **Program**: Engineering conflicts discovered in design may dilute performance benefits expected of the plan
- **Value**: Escalation of project costs dilutes what can be built in today's dollars
- **Contingency**: Change orders driven by unresolved design issues or errors further dilute project budget
- **Momentum**: Delays, problems and escalating costs erode both client confidence and project momentum

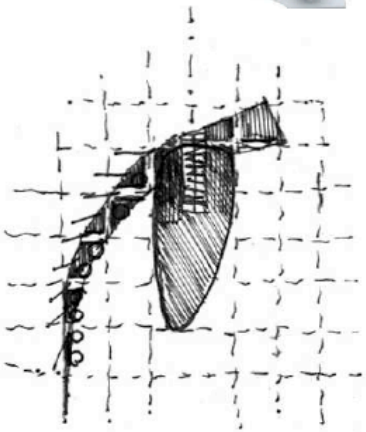
Gensler

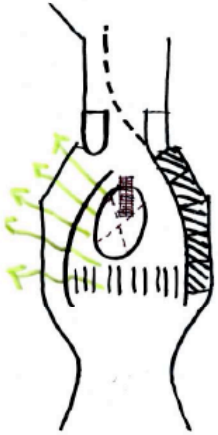
Traditional 3d visualization used in planning

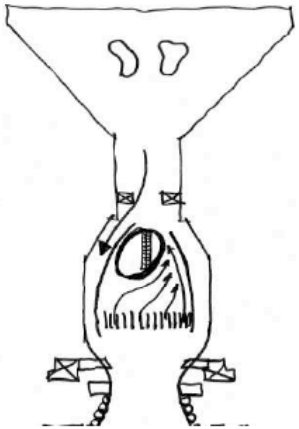


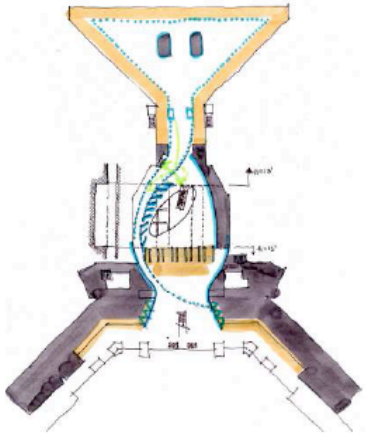
Base ++ Alternate Concourse

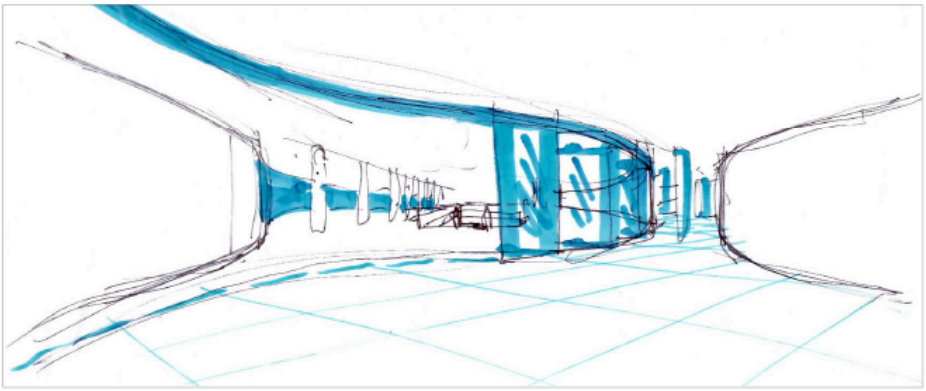
- New opening to baggage claim creates larger double-height space
- Opening in floor acts as 'valve' to direct departing passengers toward security
- Path for arriving passengers is clear; descent to bag claim is through new double-height space
- Suspended ceiling equalizes height of major space and articulates oval opening in floor



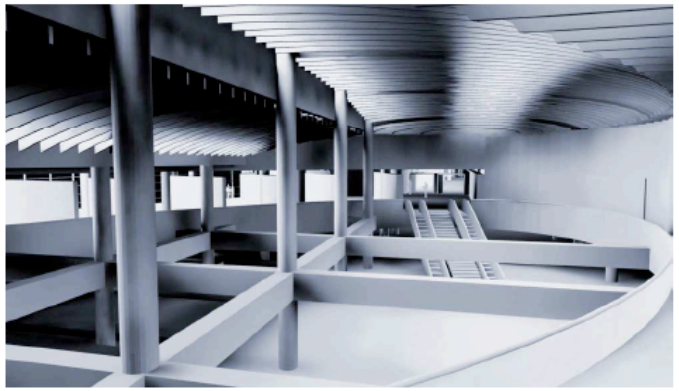








view from Boarding Area D

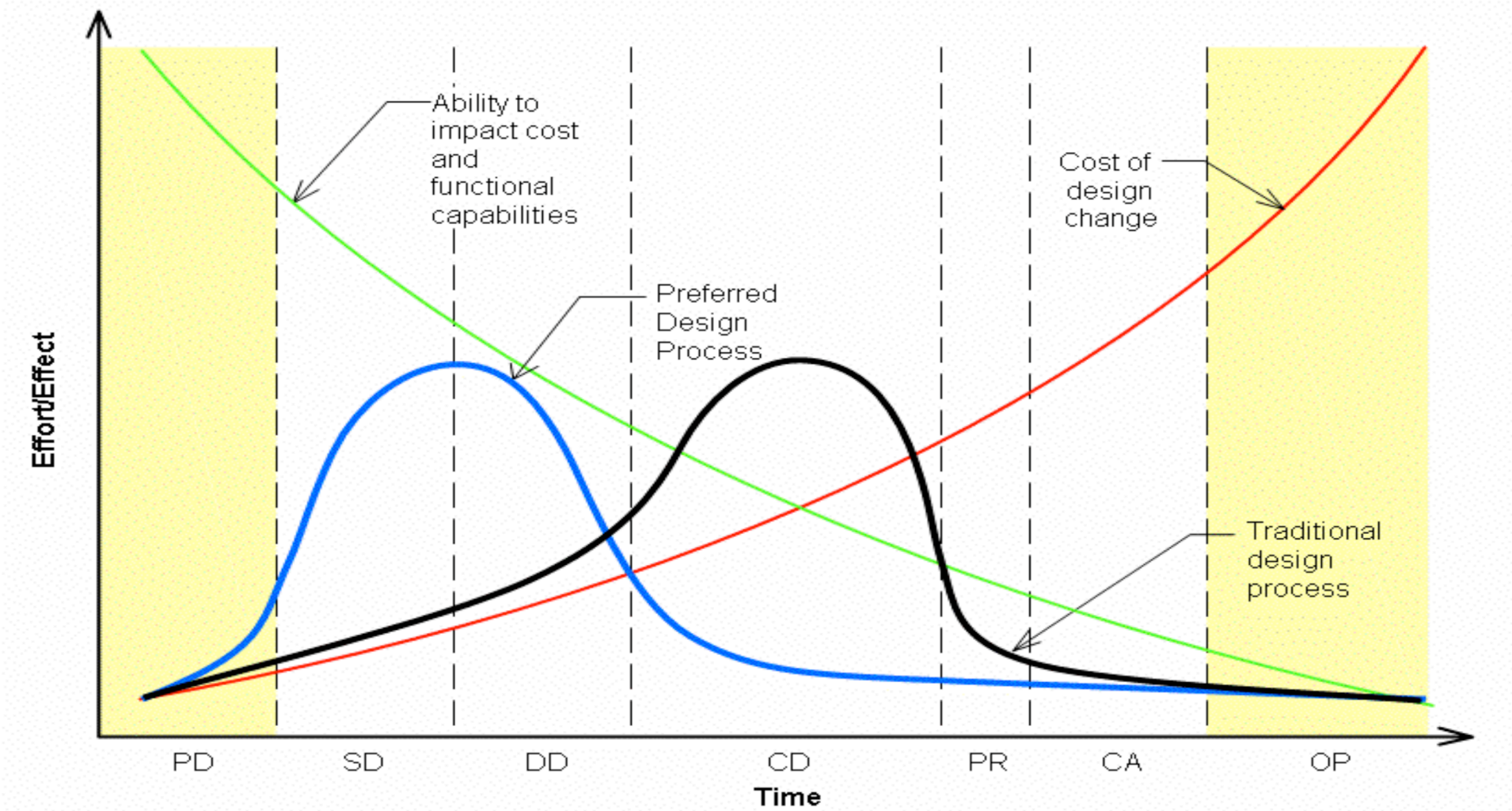


view of double-height space above Baggage Claim

CURT

THE CONSTRUCTION USERS ROUNDTABLE

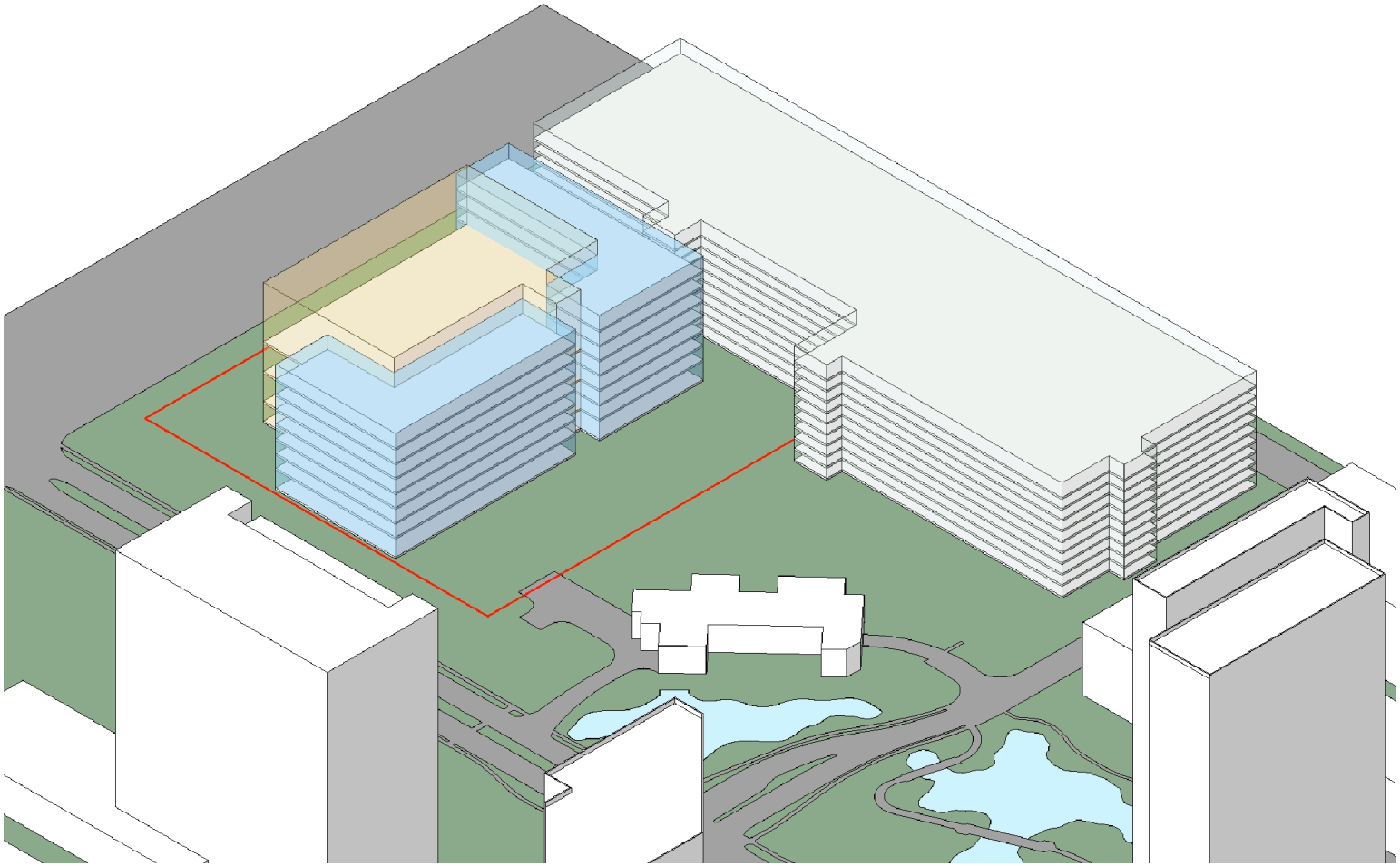
"THE OWNERS VOICE TO THE CONSTRUCTION INDUSTRY"

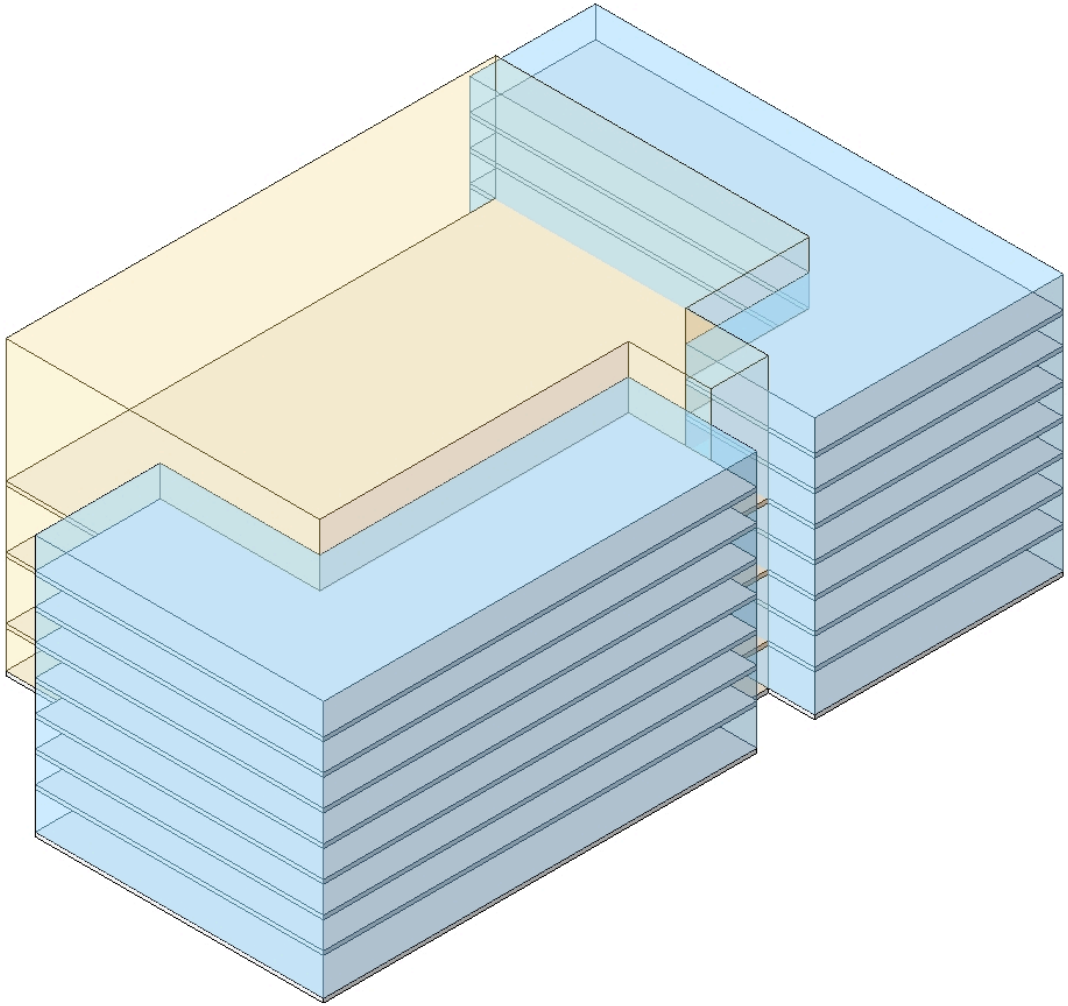


Architects are increasingly turning to Building Information Modeling (BIM) with the simple idea that we should create “intelligent” 3D digital models instead of 2D paper drawings to communicate design ideas and guide construction.

Applications of BIM:

- Documentation Models
- Analysis Models
- Coordination Models
- Fabrication Models
- 4D Construction Models
- Building Lifecycle Models

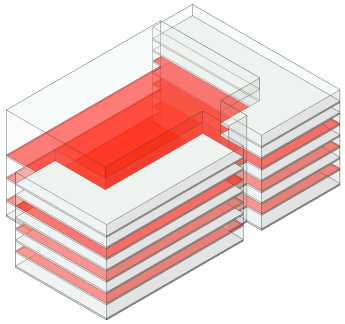


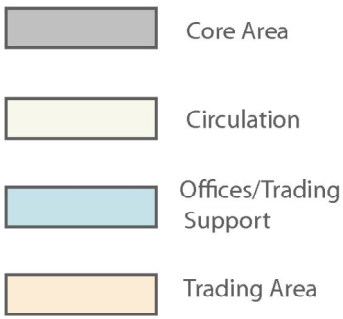


Offices/Trading Support

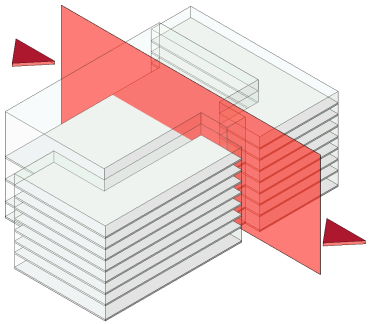
Trading Area

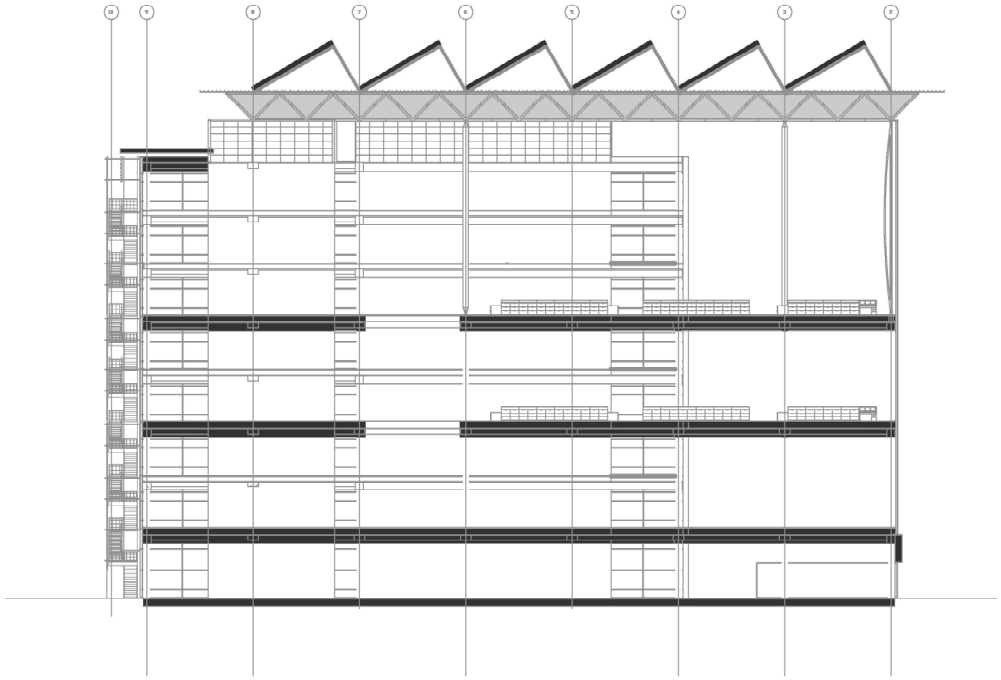
Conceptual Diagram



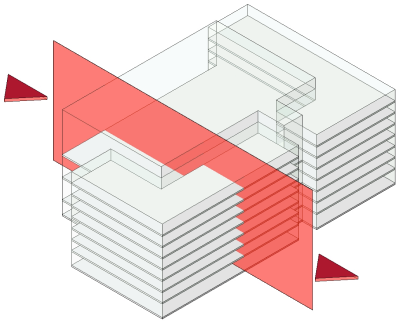


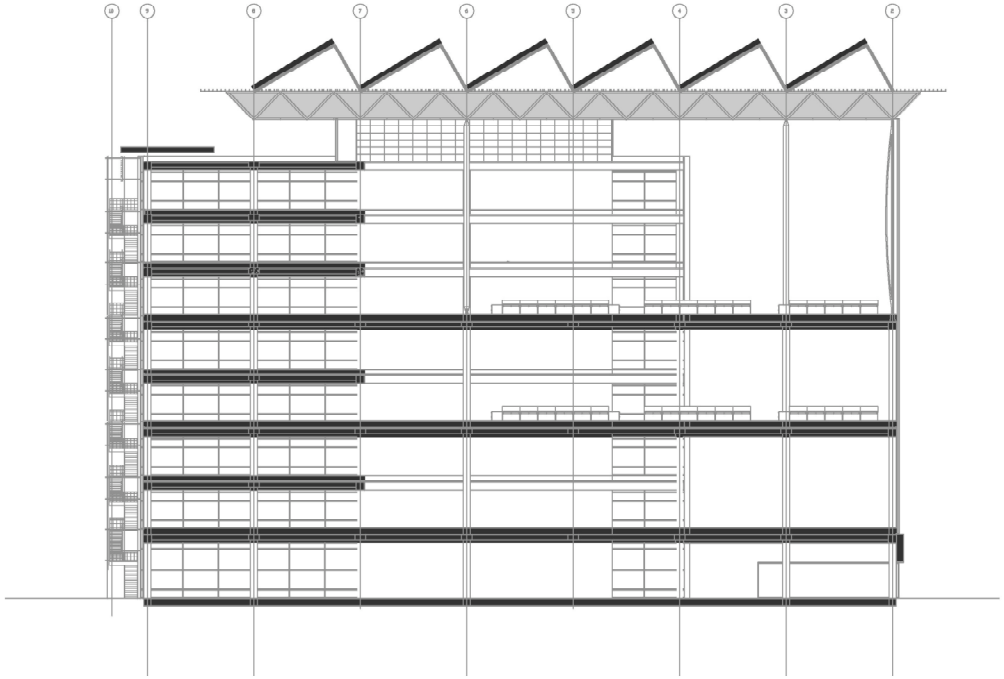
Level 2,4,6 Plan



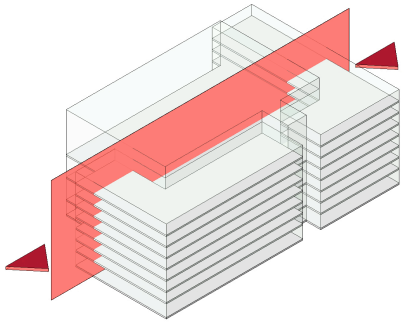


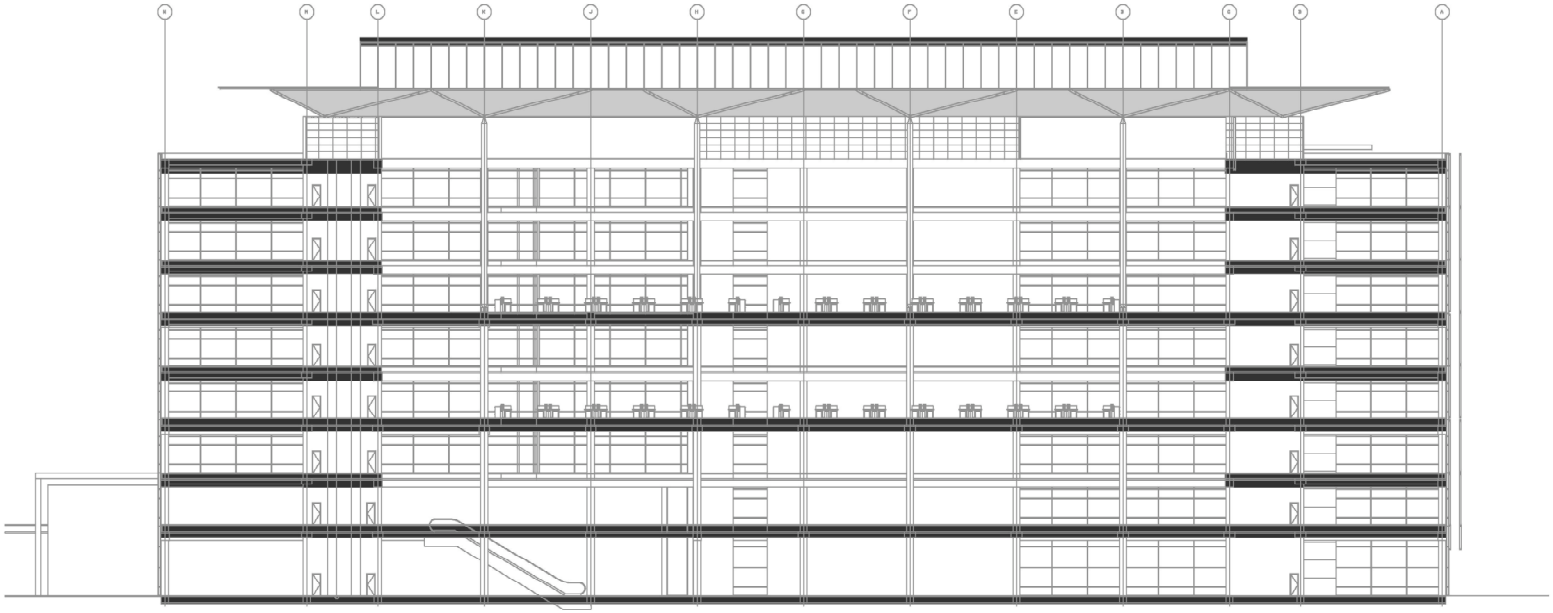
Section A



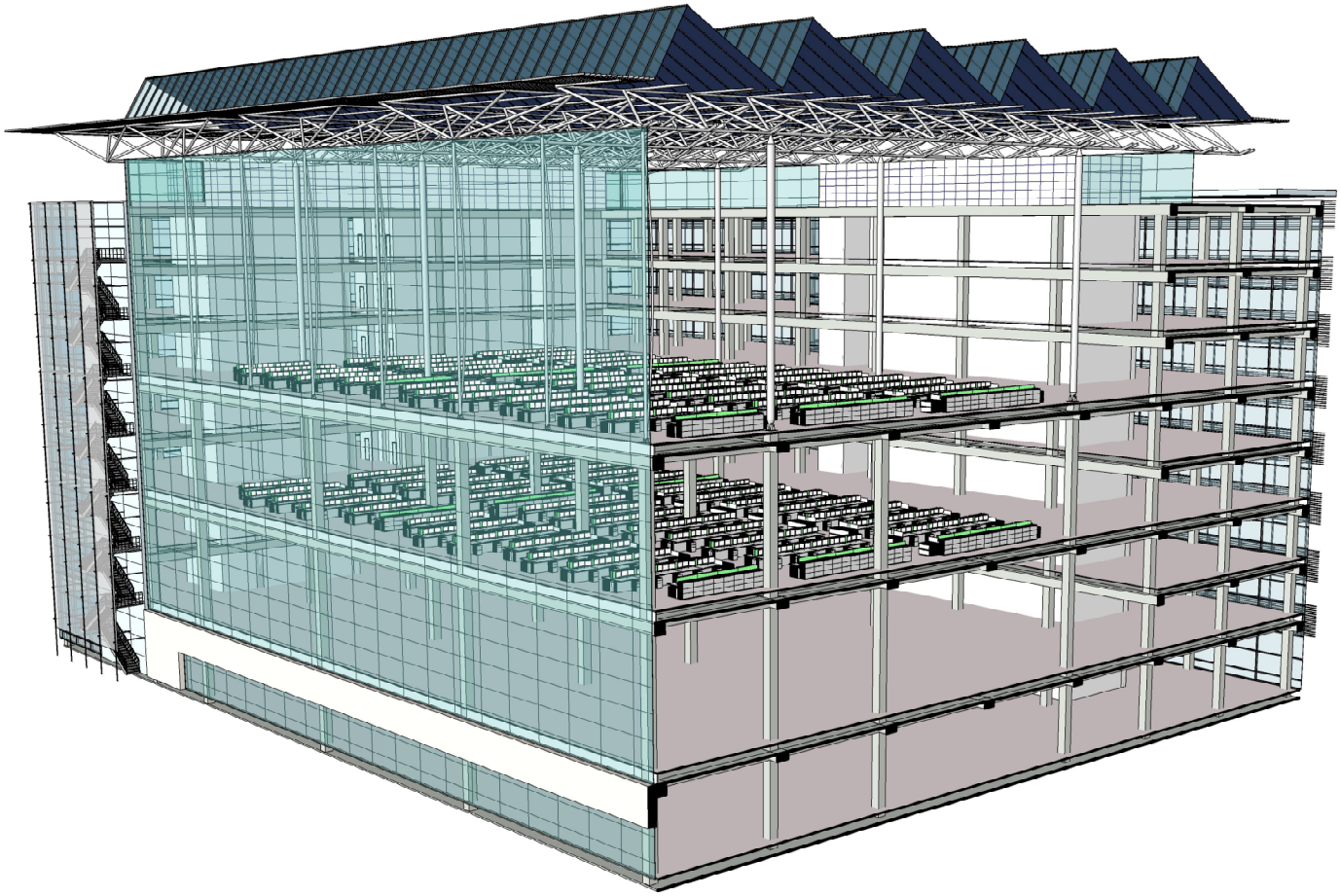


Section B

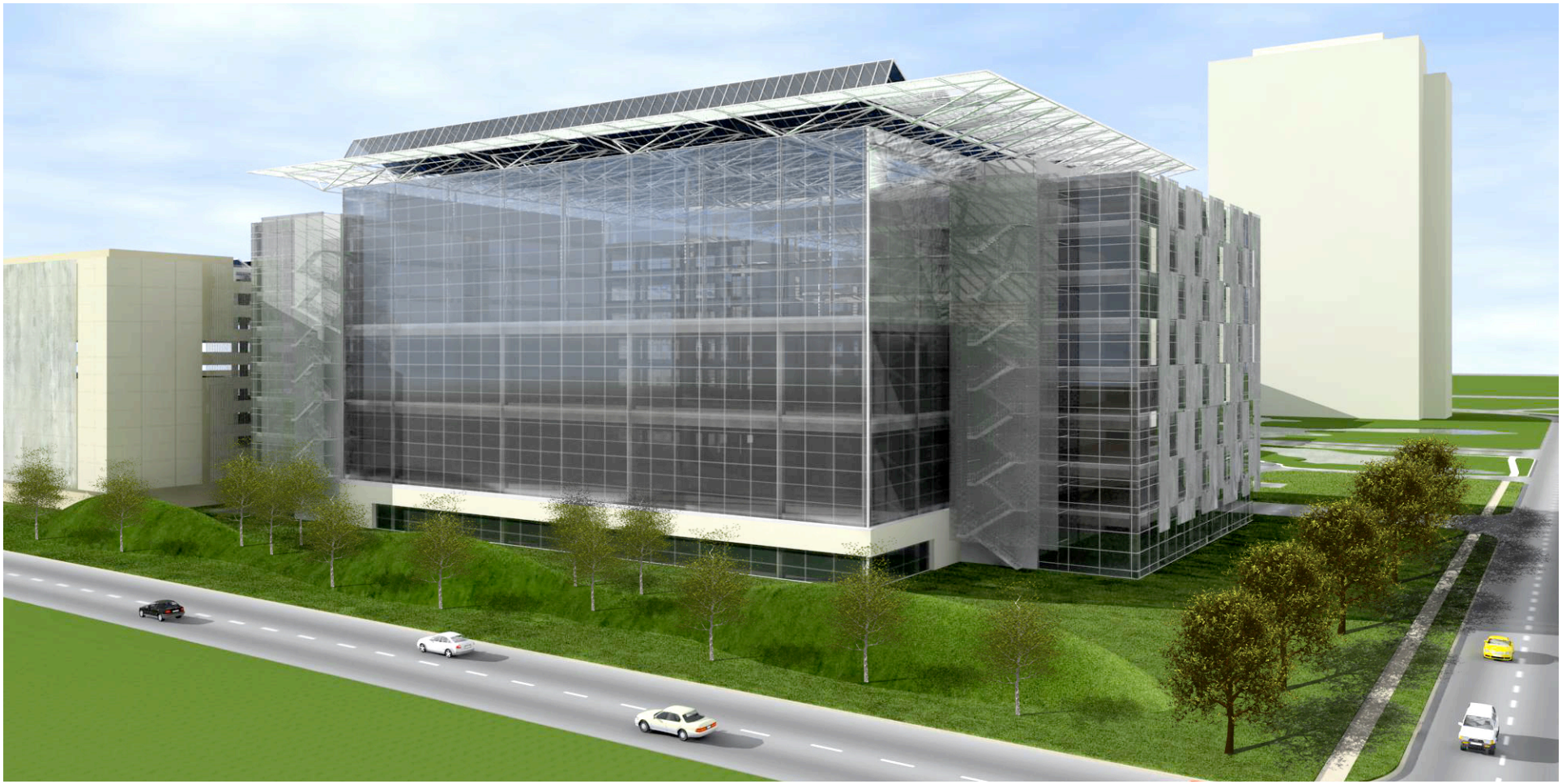




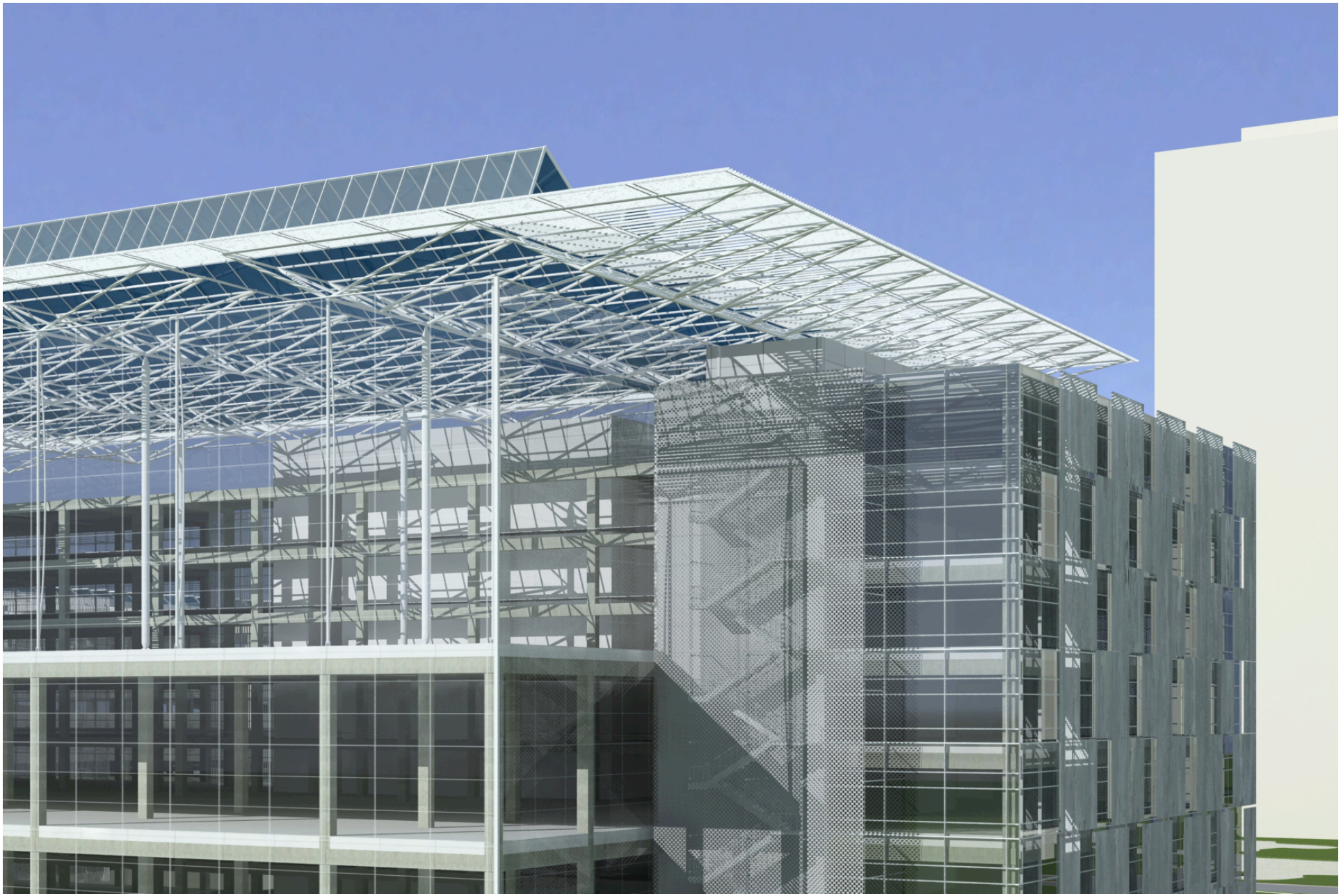
Section C



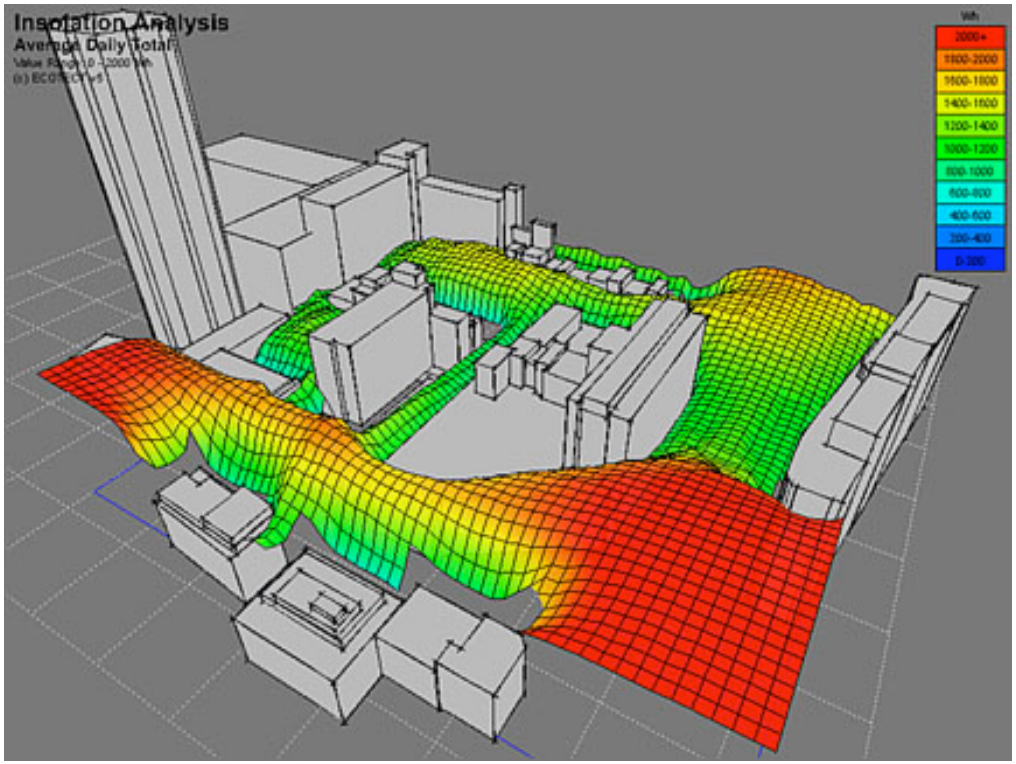
3D Section

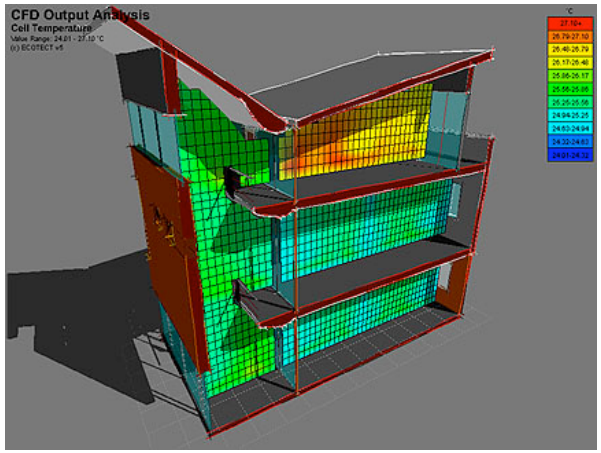


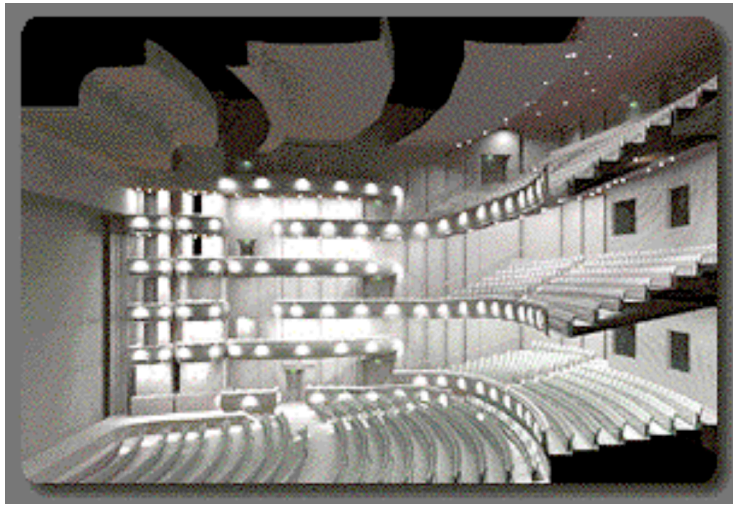
North Elevation



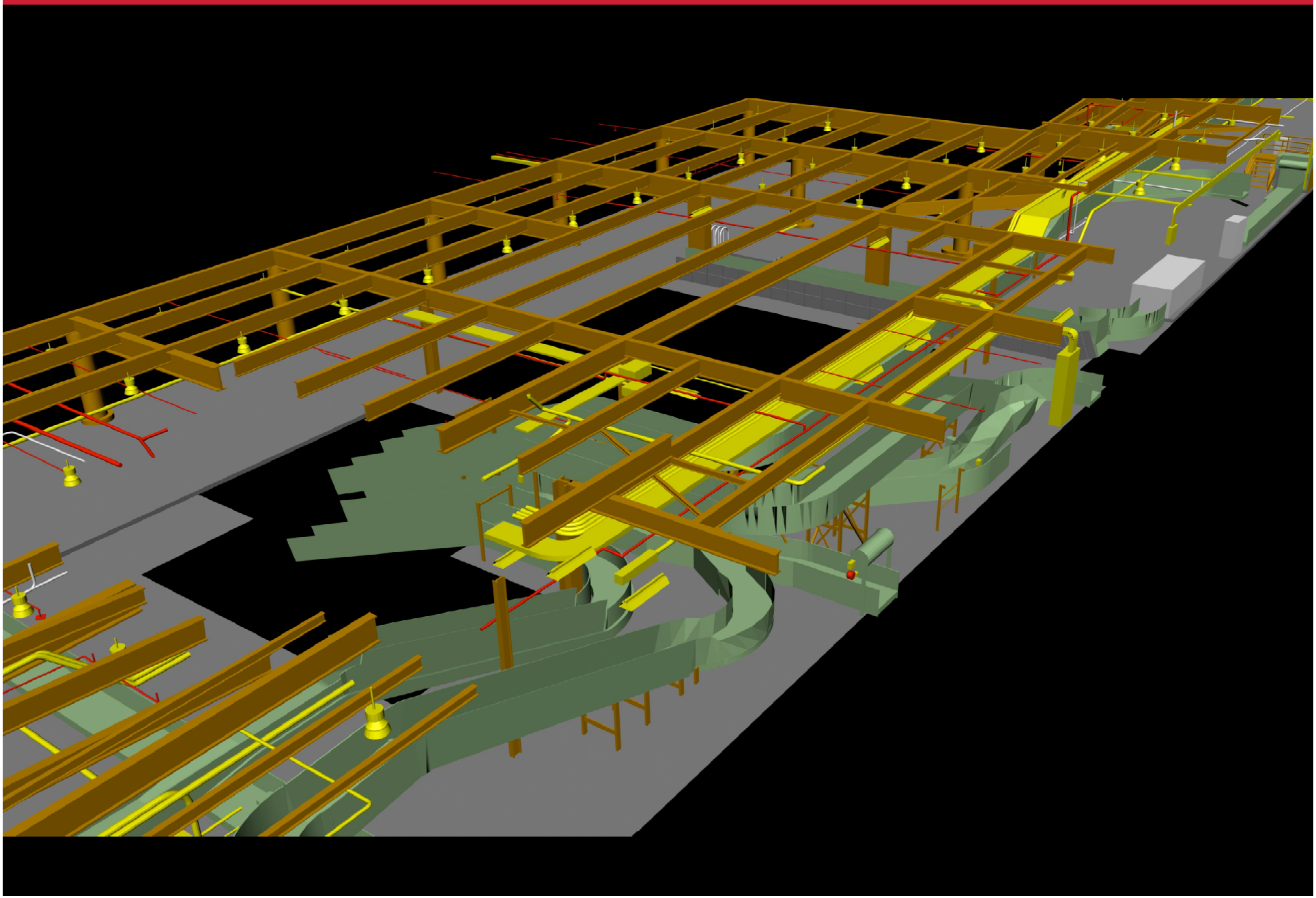
Analysis Models



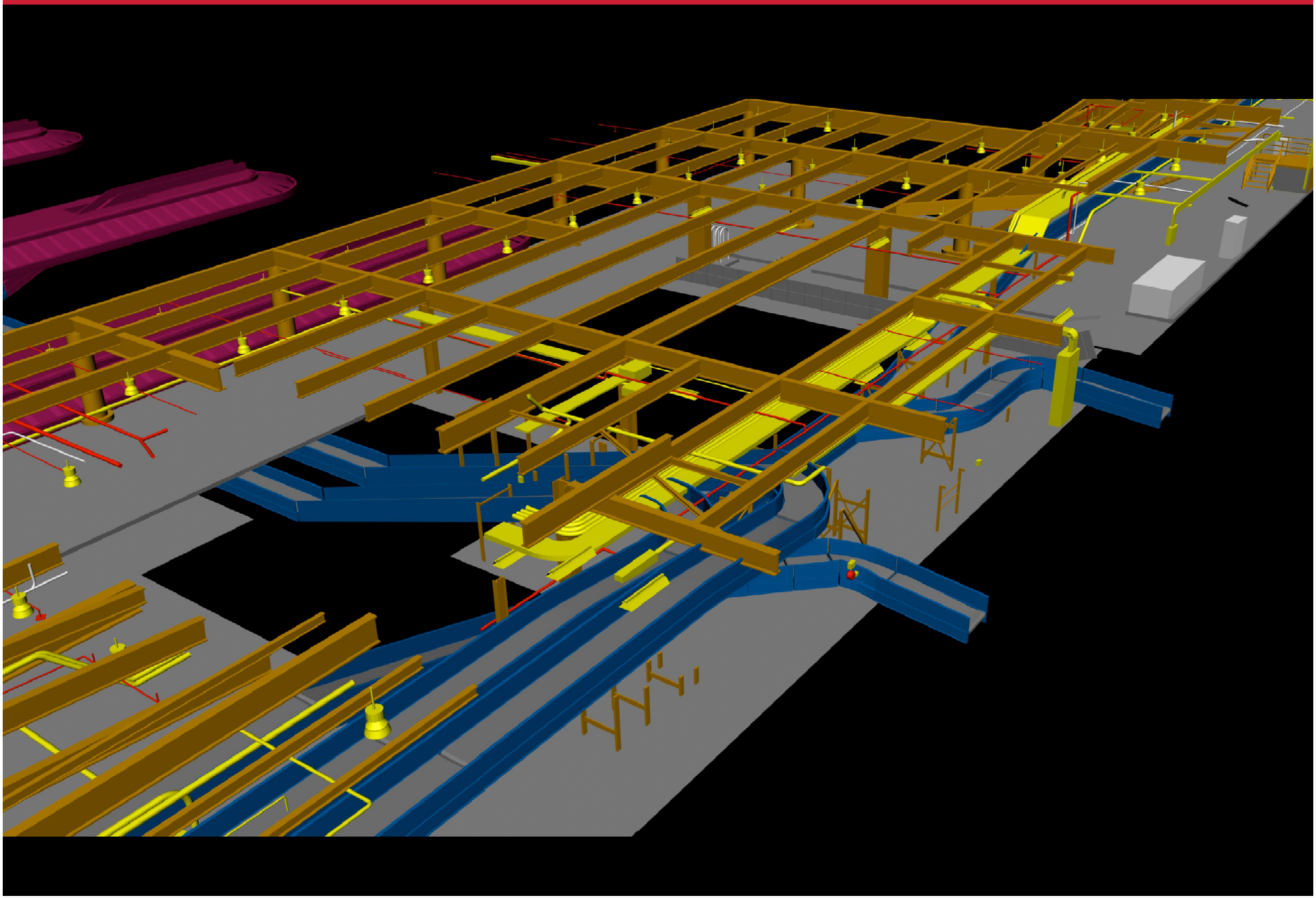




Coordination Models: Existing BHS



Coordination Models: Proposed BHS



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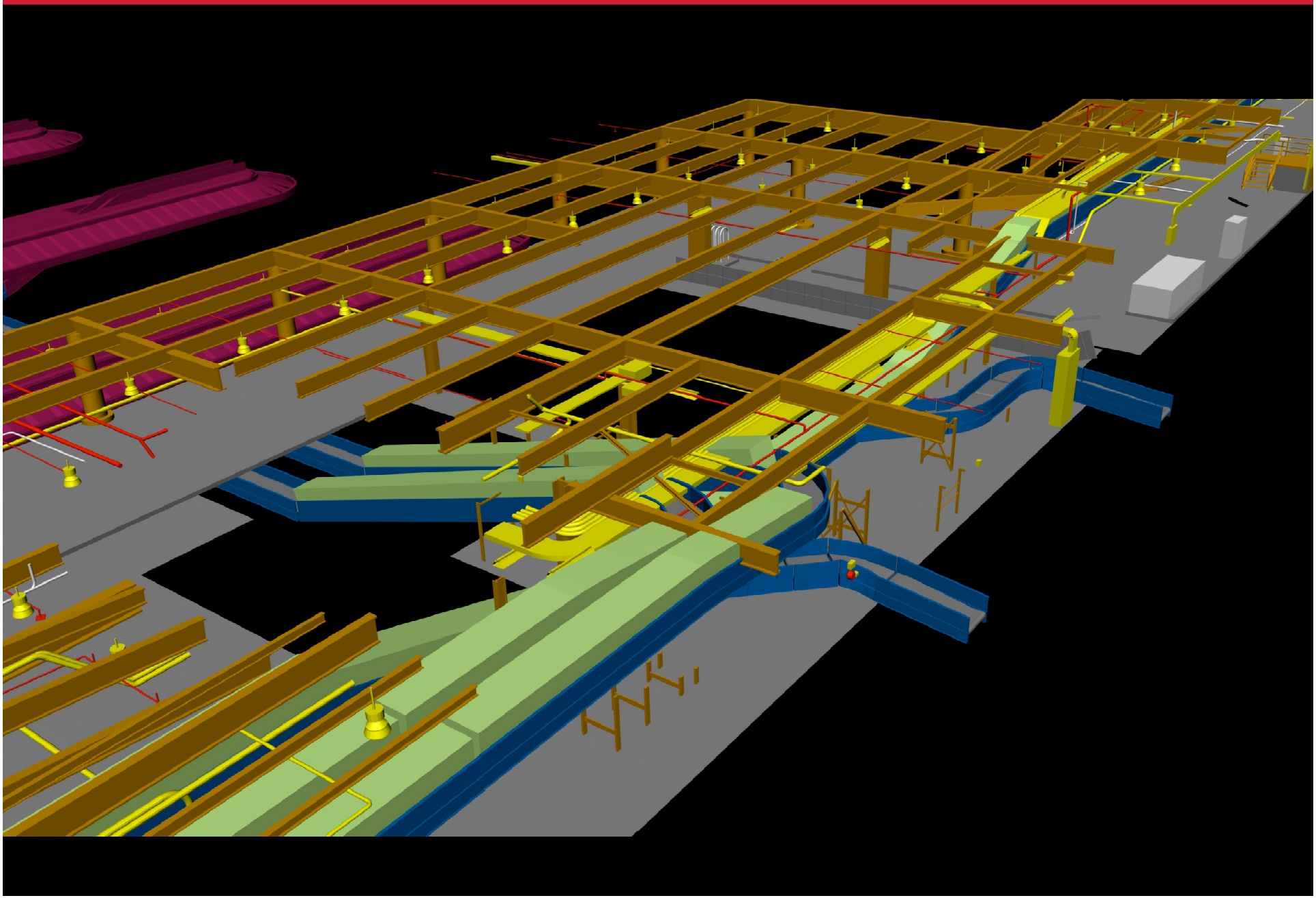
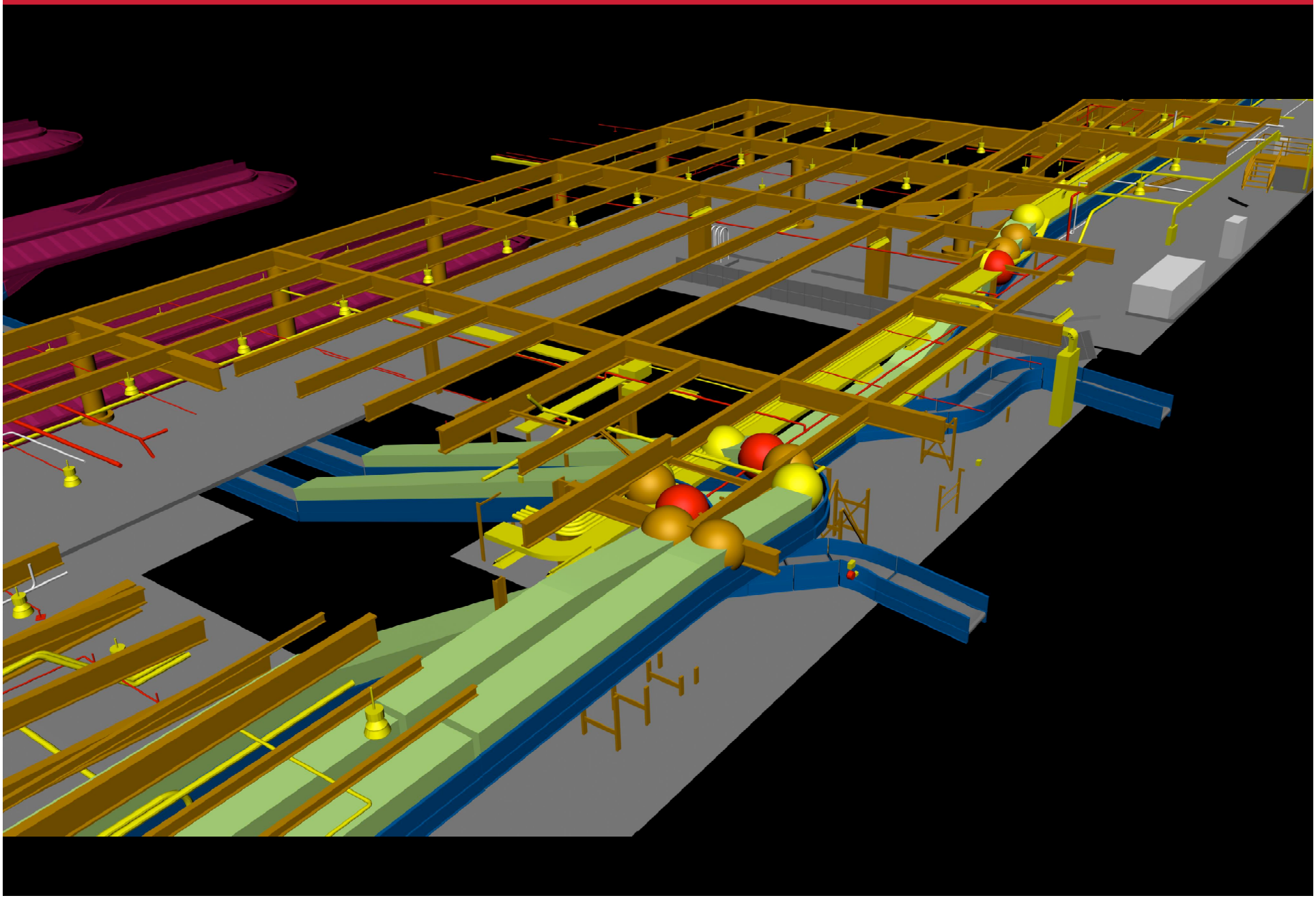
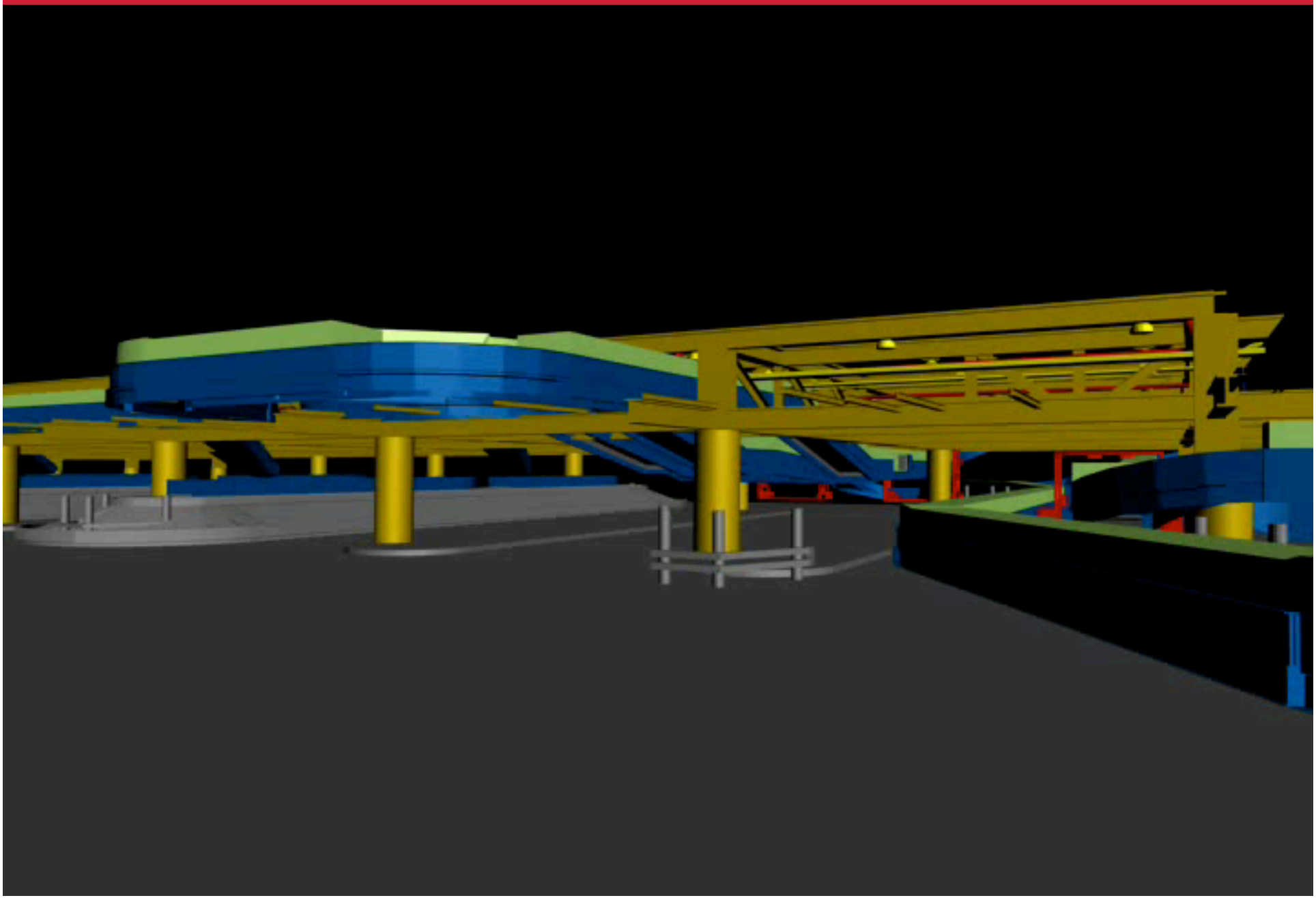
Coordination Models: Establish Required Clearances



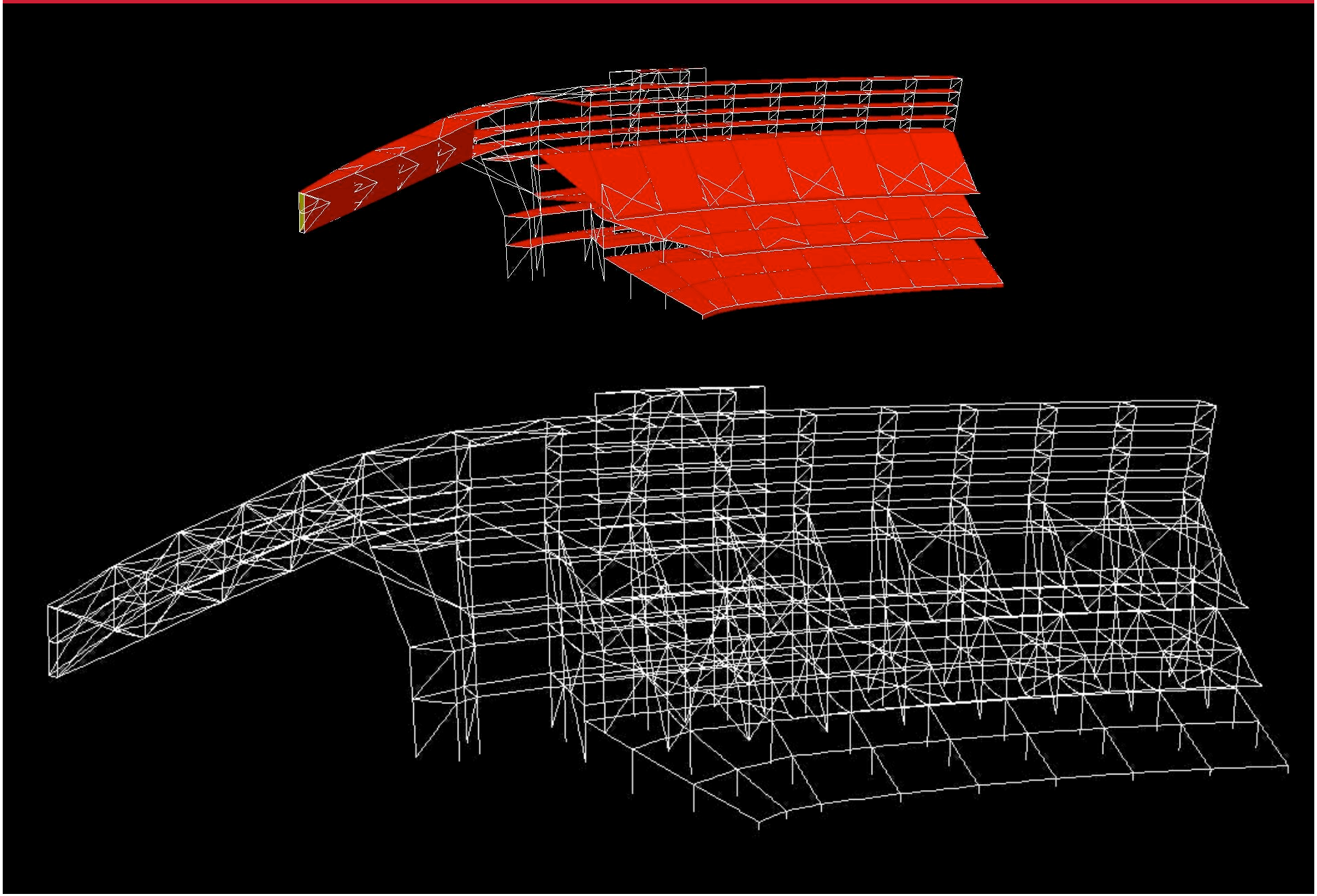
Coordination Models: Identify Conflicts



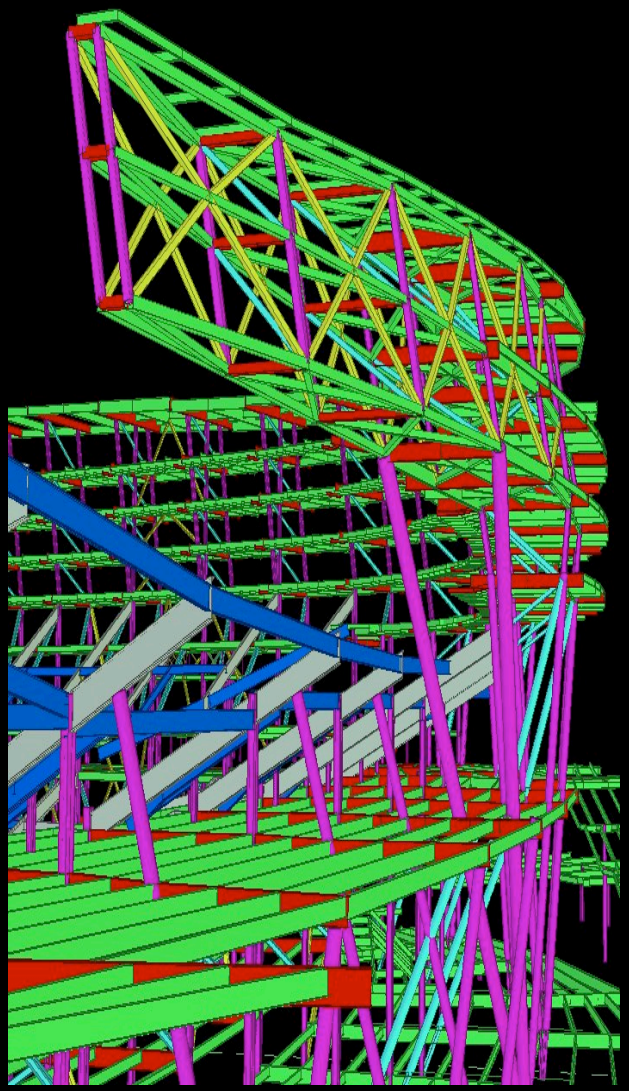
Coordination Models: Animations



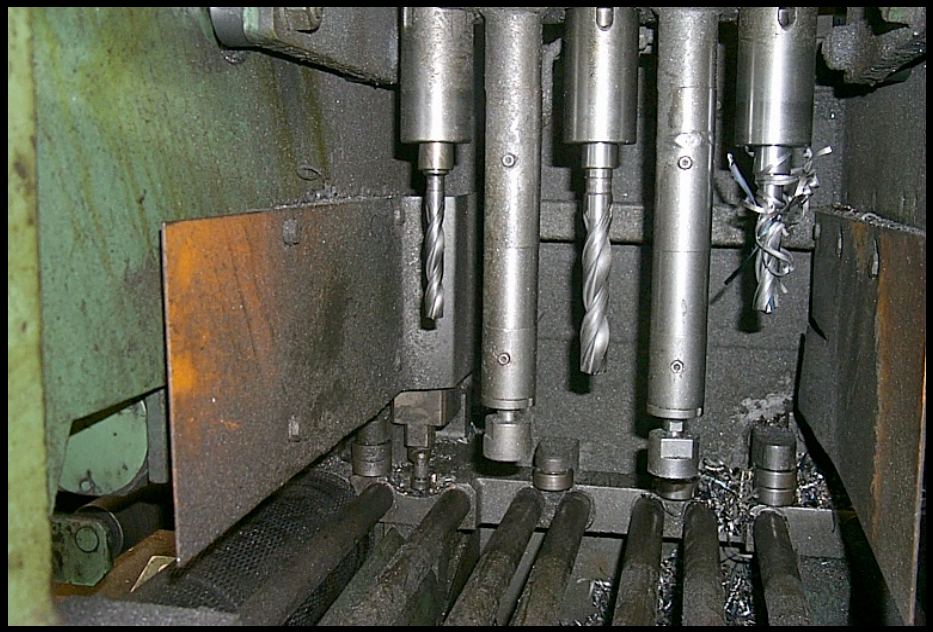
Fabrication Models

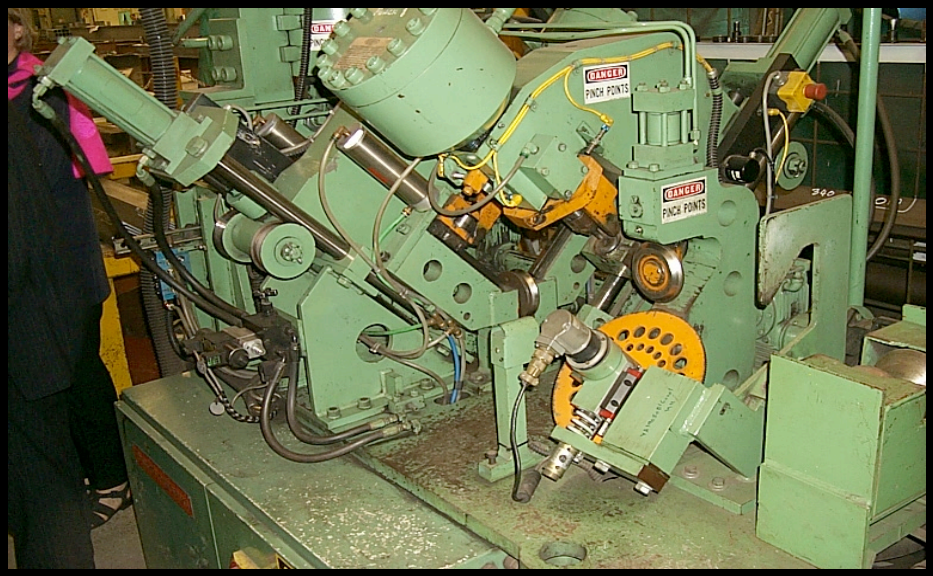


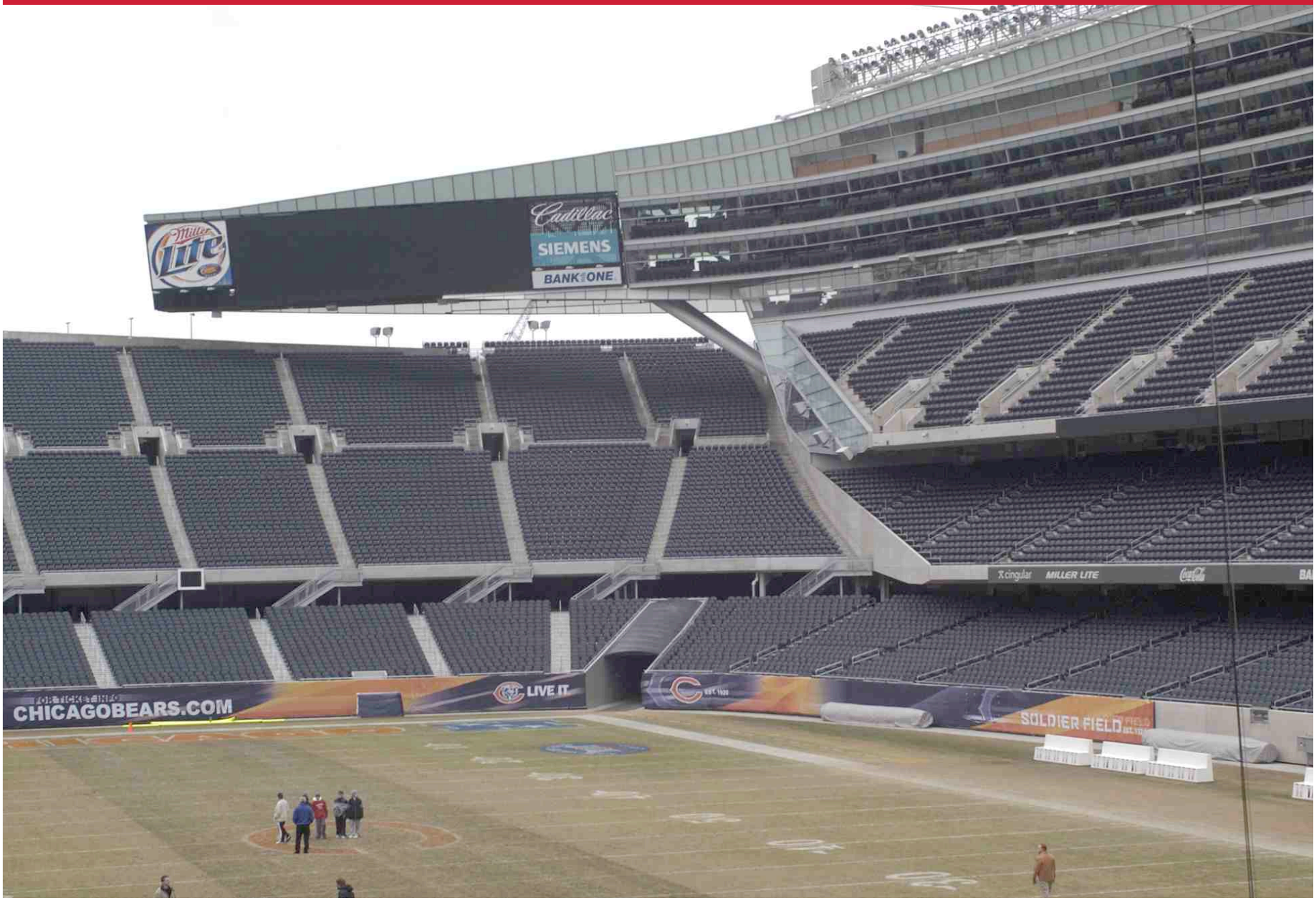
Fabrication Models



Fabrication Models

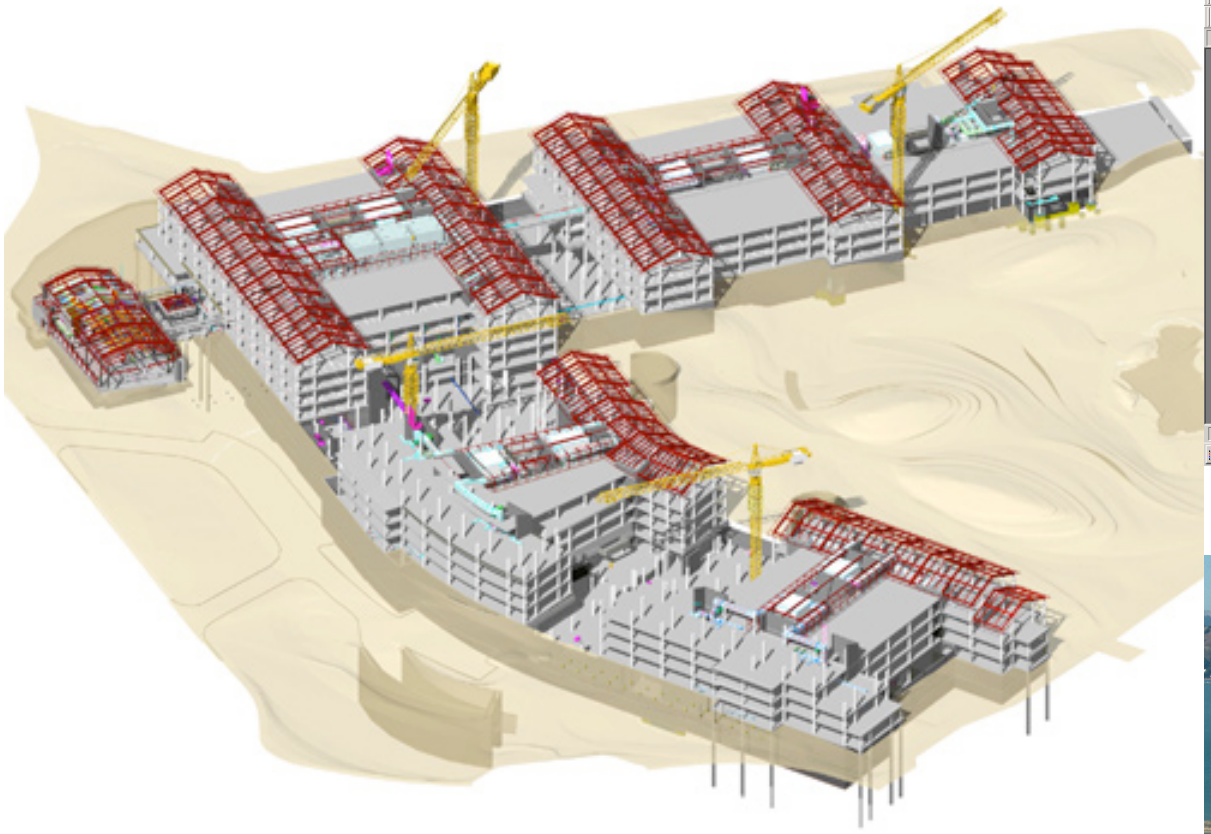


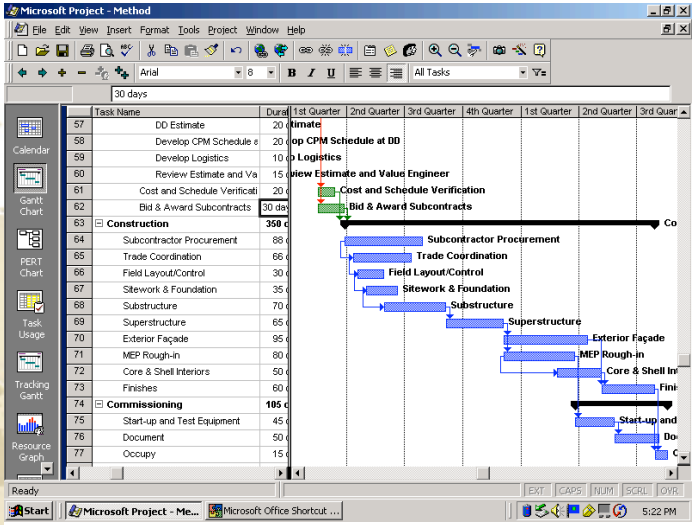



Miller Lite
Cadillac
SIEMENS
BANK ONE
Cingular
MILLER LITE
CHICAGOBEARS.COM
LIVE IT
SOLDIER FIELD

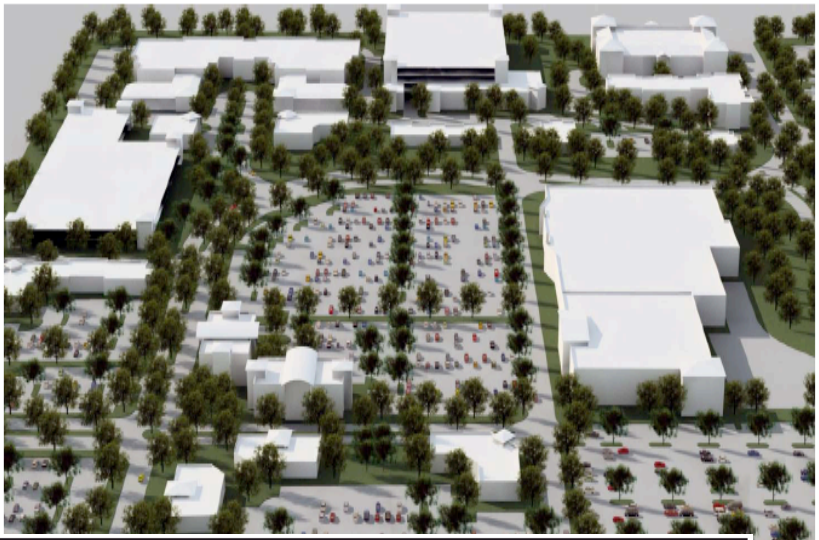
Gensler

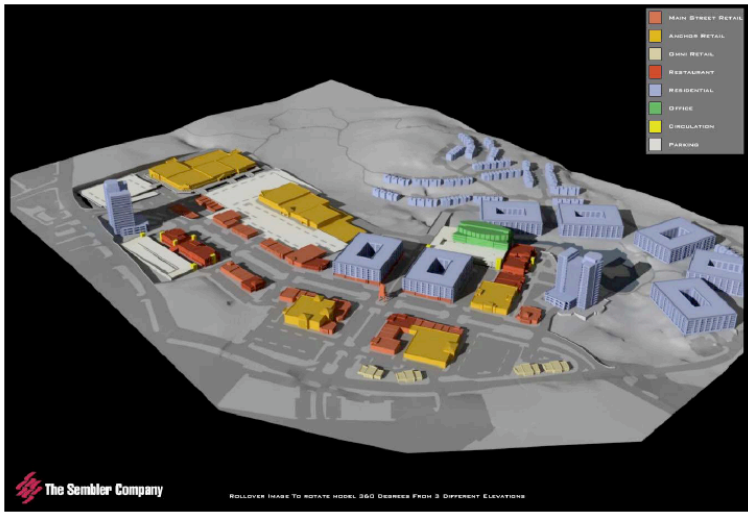
4D Construction Models



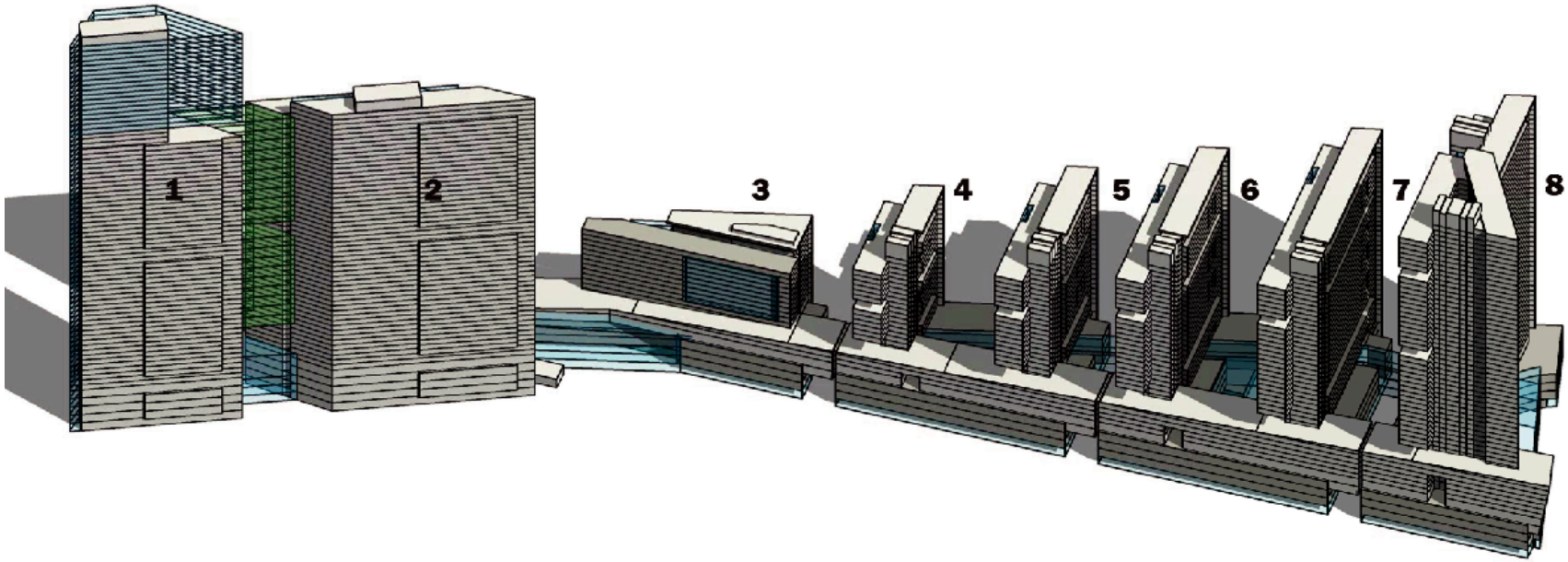


Site Concept Rendering
Gensler
Potomac Yard




Main Street Retail
Anchor Retail
Mini Retail
Restaurant
Residential
Office
Circulation
Parking
The Sembler Company
Rollover Image To rotate model 360 Degrees From 3 Different Elevations

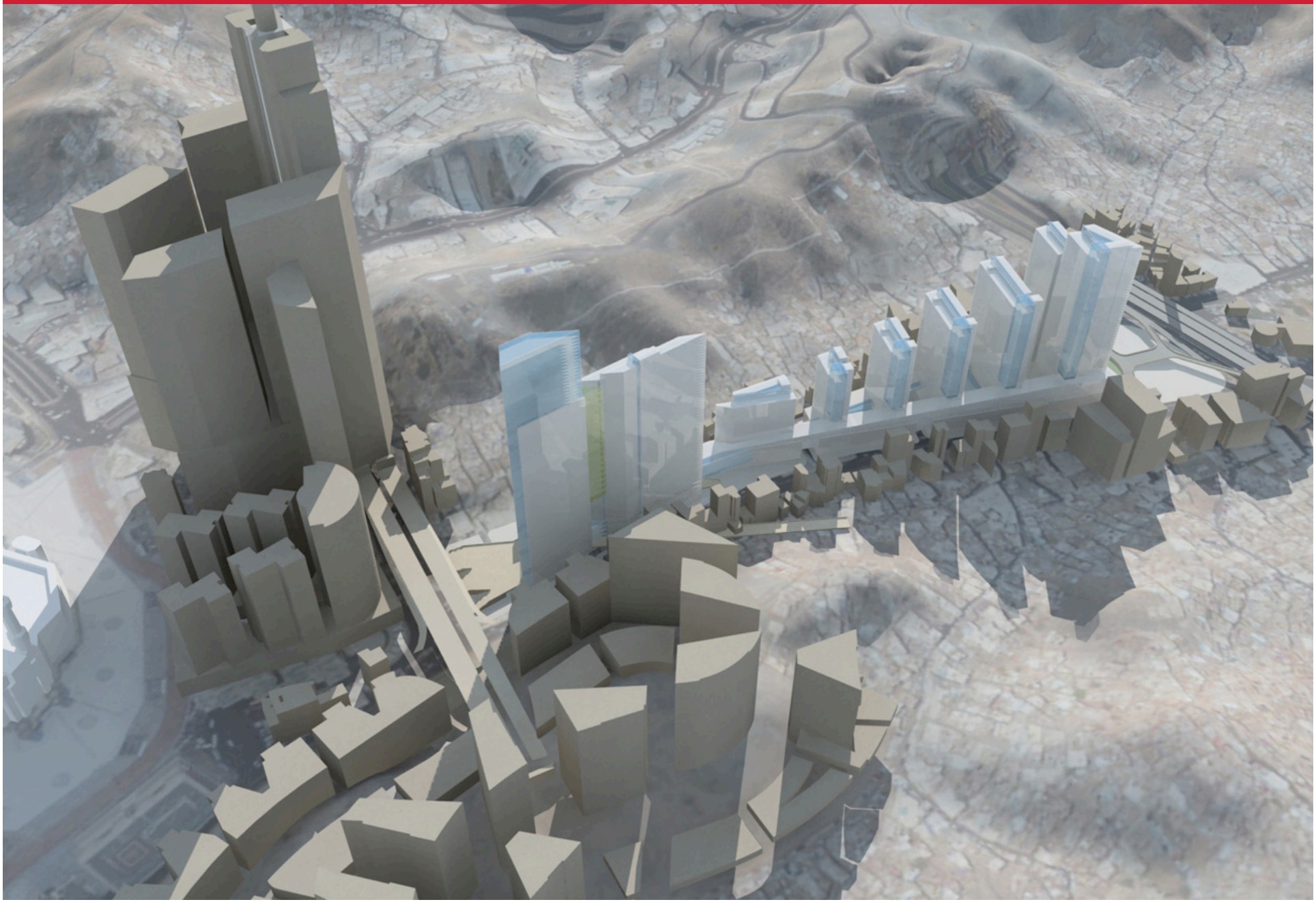
View 1



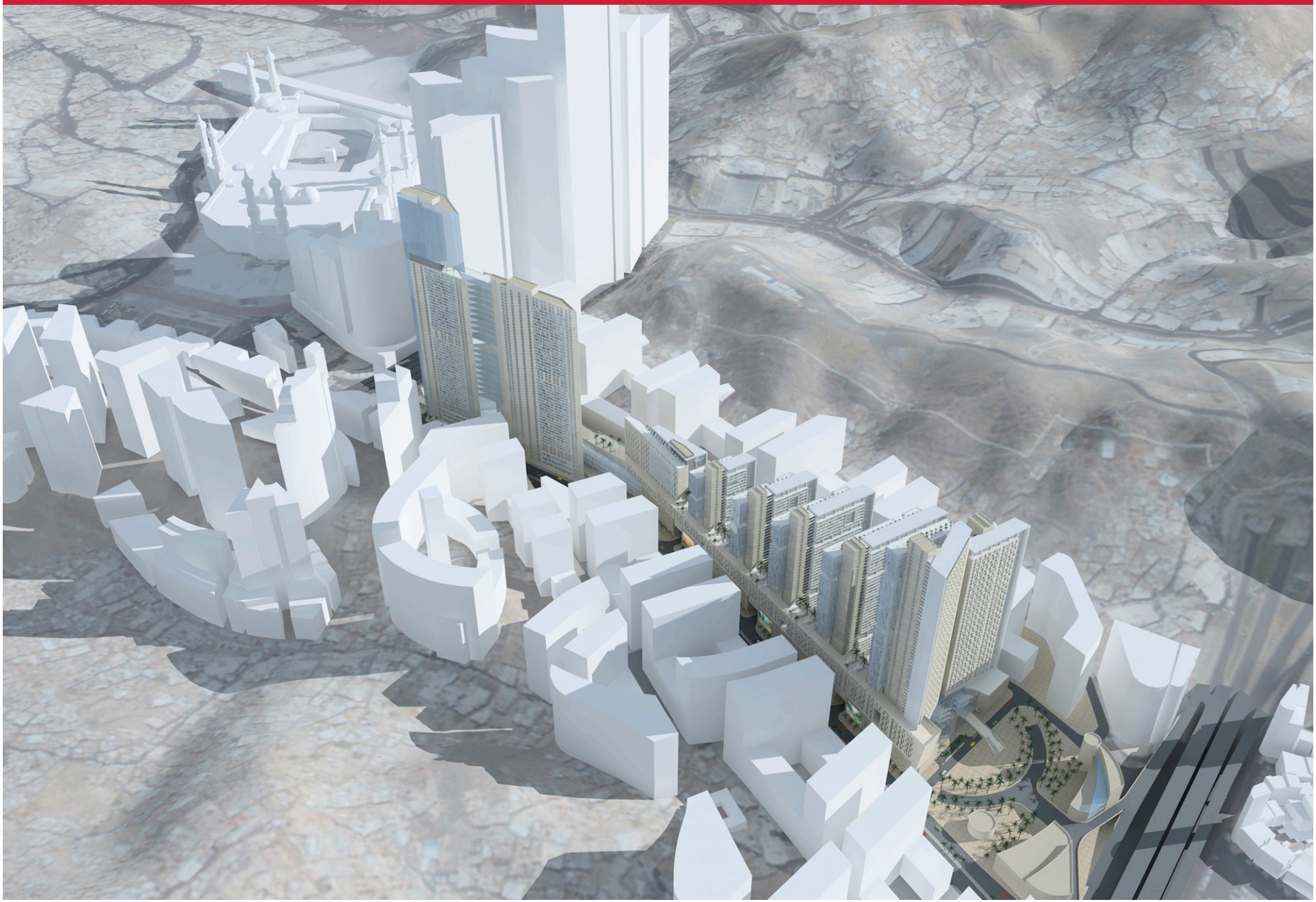
Building	Gross Floor Area (m²)	Floors (Actual)	Typical Floorplate (m²)	Height (Floors)
Retail - (Net: 45,111 m²)	**103,162**	**4**	**25791**	**4**
Linear Low-Rise Residential	**5,994**	**1**	**5994**	**5**
(1) Hotel - North	**73,857**	**75**	**985**	**75**
(2) Service Apartments - North	**83,188**	**56**	**1486**	**57**
Hotel-Apt Prayer Decks	7,224	21	344	54
(3) Residential 1	**17,304**	**16**	**1082**	**20**
Linear Low-Rise Residential	3,928	2	1964	7
Residential-Apt Prayer Decks	5,082	2	2541	7
(4) Residential 2	**15,034**	**23**	**654**	**27**
Linear Low-Rise Residential	4,013	5	803	9
Residential-Apt Prayer Decks	2,209	5	442	18
(5) Residential 3	**25,767**	**28**	**920**	**32**
Linear Low-Rise Residential	4,872	6	812	10
Residential-Apt Prayer Decks	2,711	5	542	23
(5) Residential 3	**25,767**	**28**	**920**	**32**
Linear Low-Rise Residential	4,872	6	812	10
Residential-Apt Prayer Decks	2,711	5	542	23
(6) Residential 4	**40,966**	**33**	**1241**	**37**
Linear Low-Rise Residential	6,258	7	894	11
Residential-Apt Prayer Decks	3,549	5	710	23
(7) Residential 5	**58,628**	**38**	**1543**	**42**
Linear Low-Rise Residential	7,118	7	1017	11
Residential-Apt Prayer Decks	4,219	5	844	33
(8) Hotel - South	**73,591**	**51**	**1443**	**58**
Linear Low-Rise Residential	9,359	8	1170	12
Service Apartments - South	44,050	47	937	51
Residential-Apt Prayer Decks	3,940	5	788	33

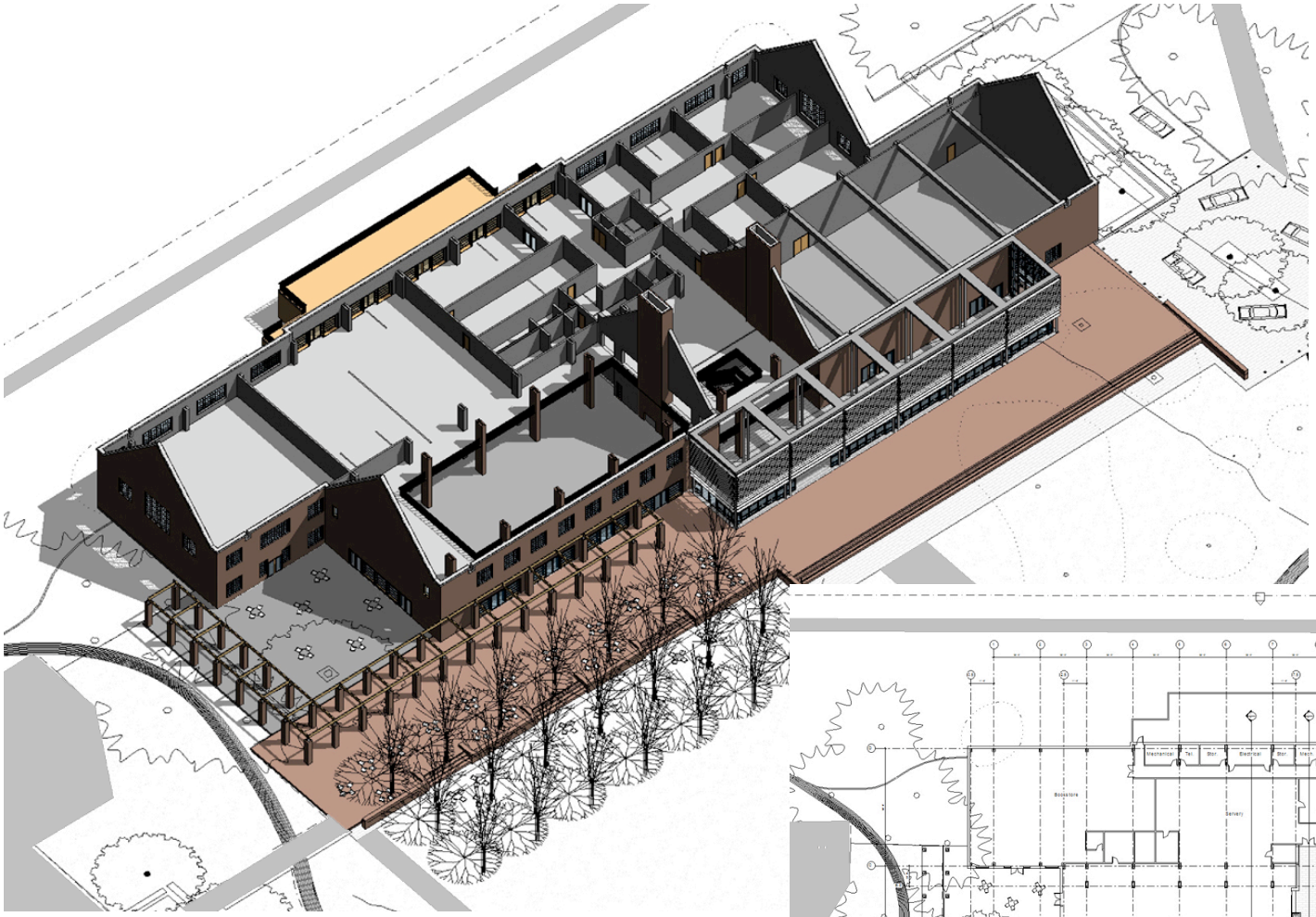
Total Building Area =	**577,089**	**m² (gross)**	
Total Residential Area =	**326,479**	**m² (gross)**	
Total Hotel Area =	**147,448**	**m² (gross)**	
Total Retail Area =	**103,162**	**m² (gross)**	**Net Retail Area = 45111 m²**
Total Prayer Deck Area =	**28,934**	**m² (gross)**	

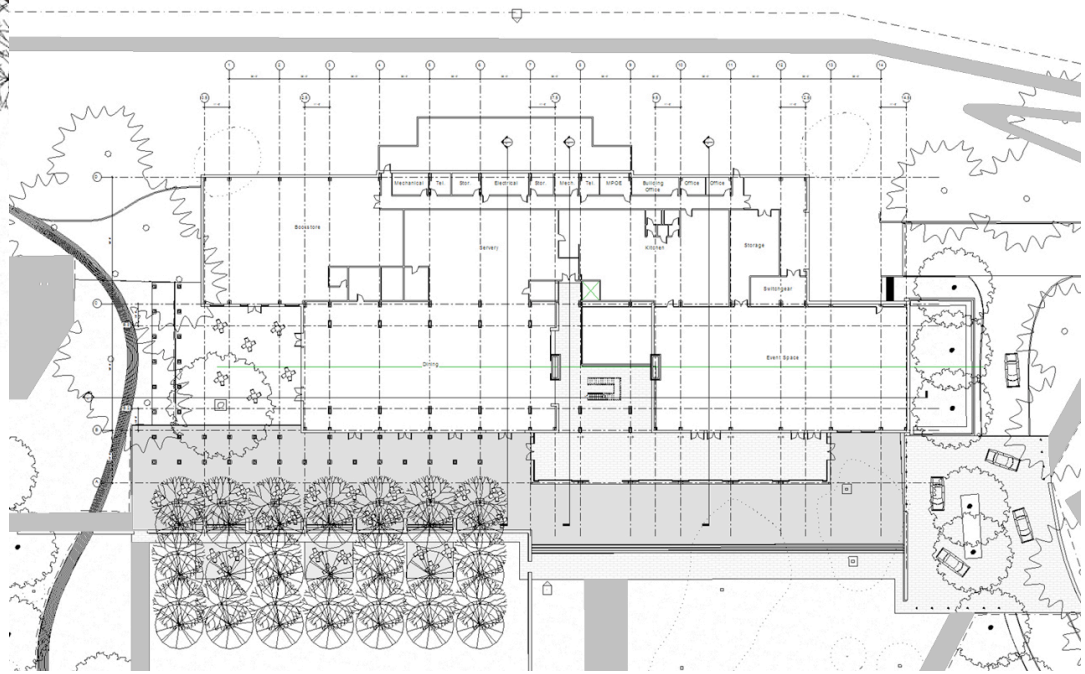
Darb al-Khalil Master Plan

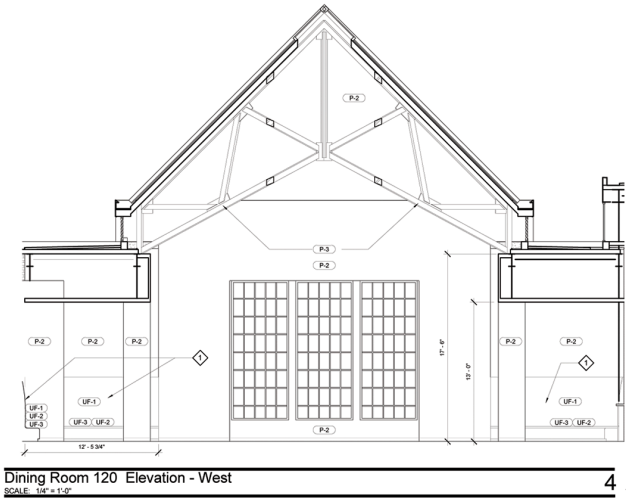


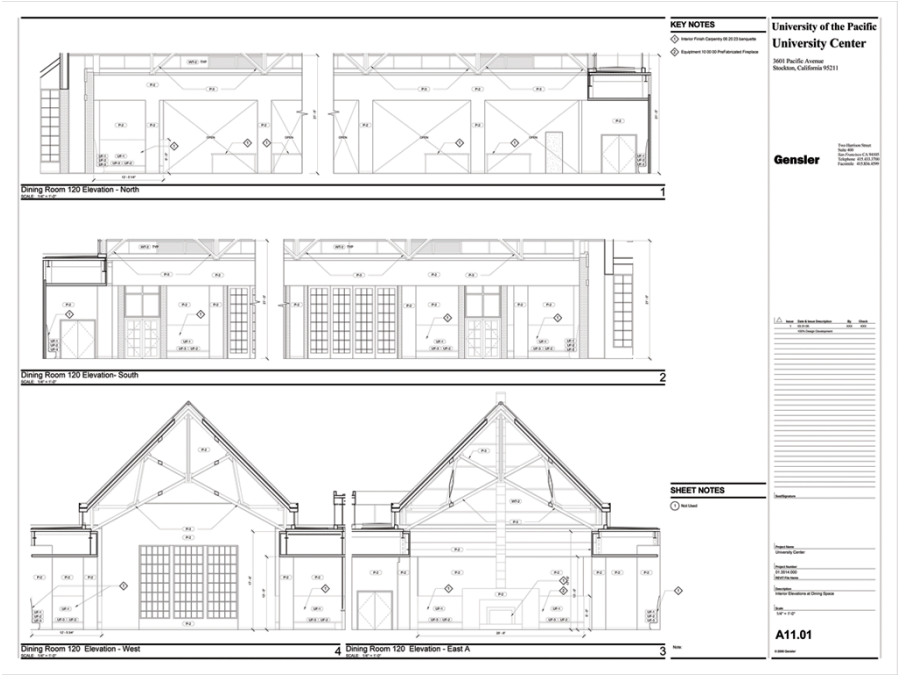
Darb al-Khalil Master Plan

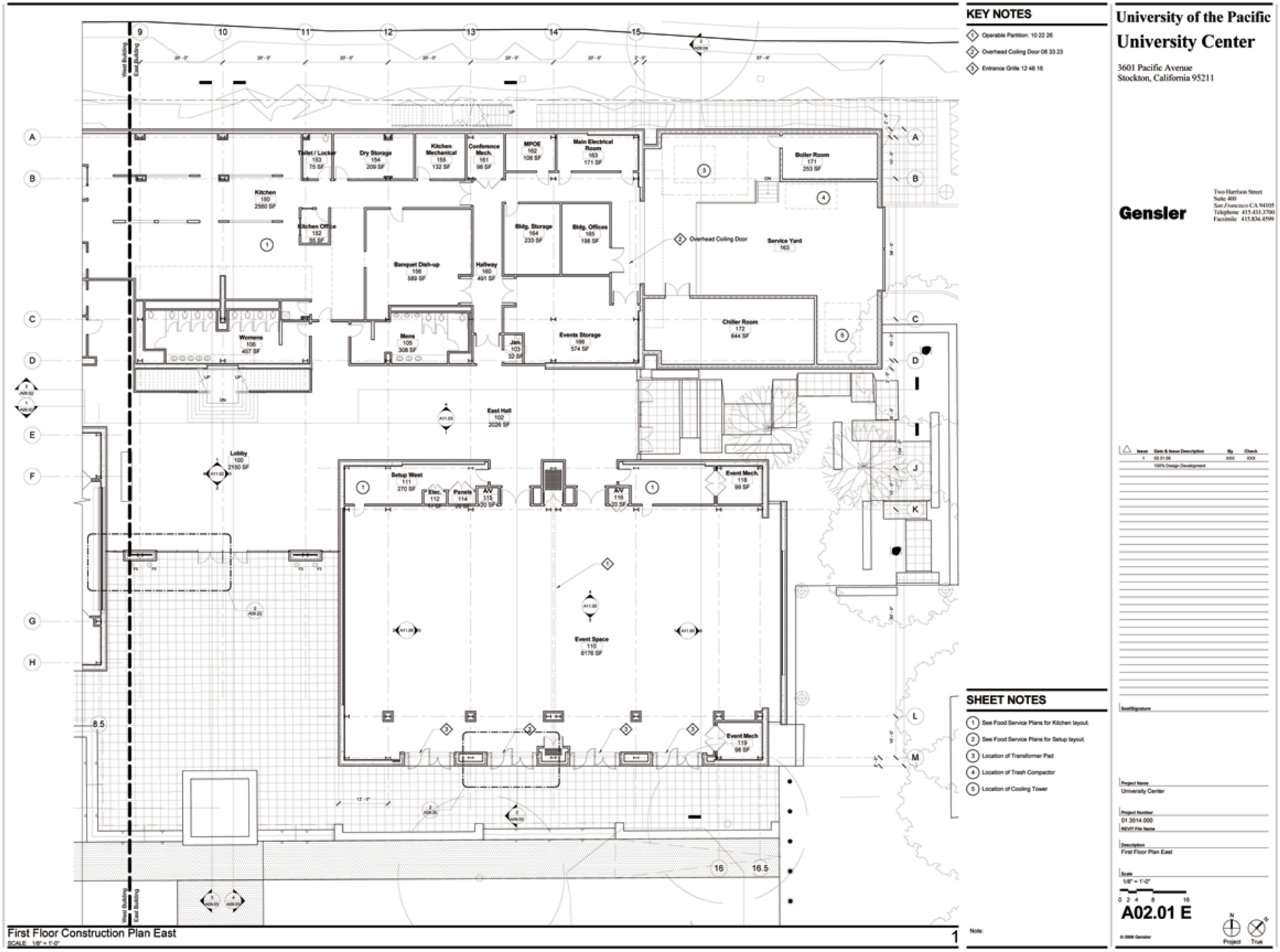


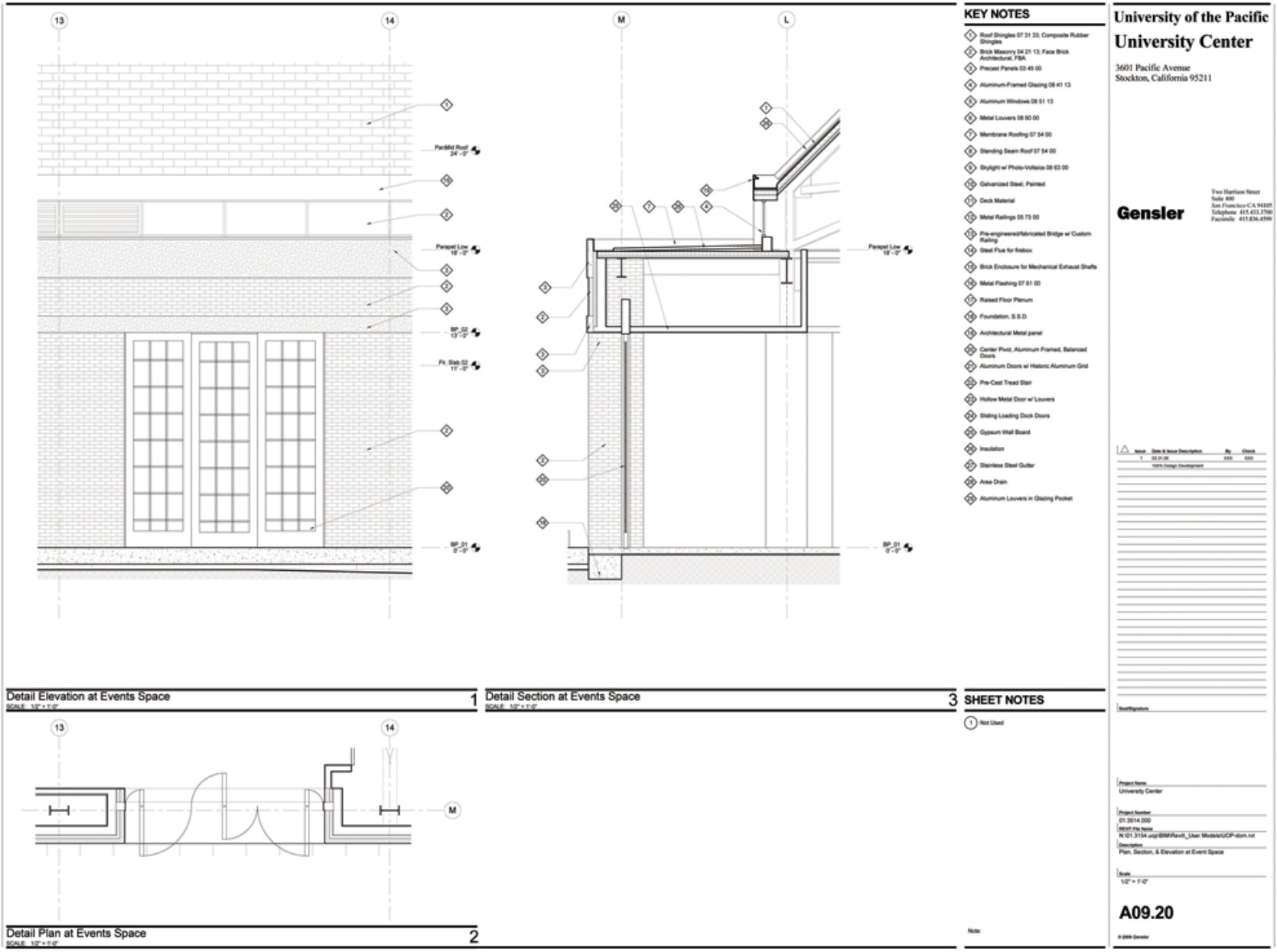


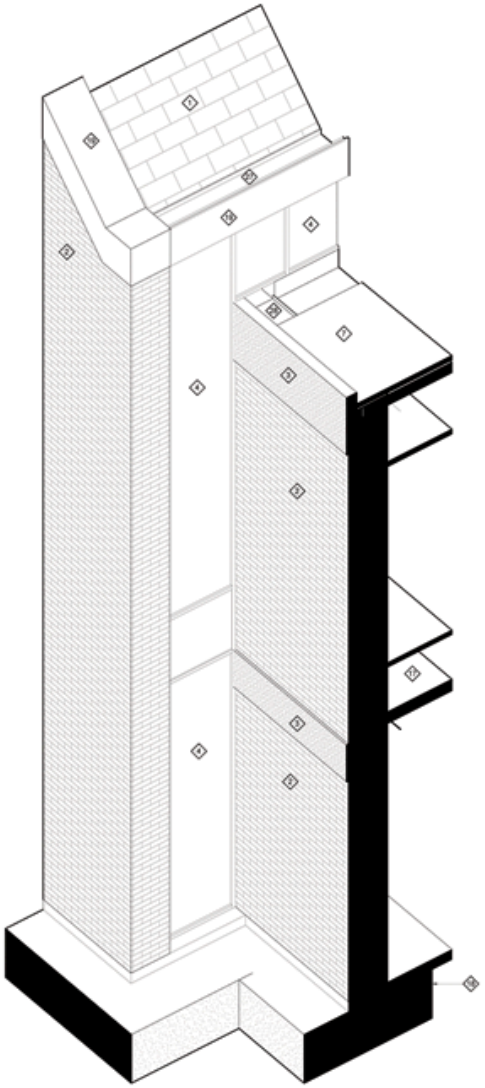

Mechanical
Elevator
Building Office
Office
Office
Bookstore
Servery
Kitchen
Storage
Switchgear
Dining
Event Space


Dining Room 120 Elevation - West
SCALE: 1/4" = 1'-0"
4

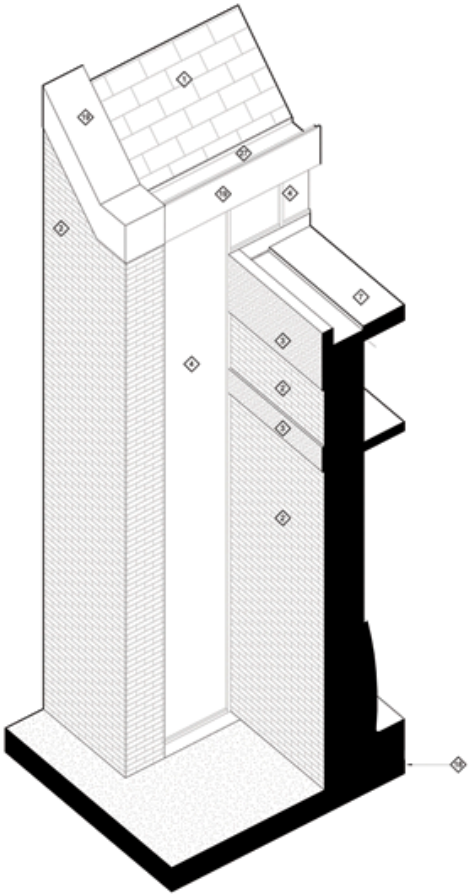

KEY NOTES
Dining Room 120 Elevation - North
1
Dining Room 120 Elevation- South
2
SHEET NOTES
Dining Room 120 Elevation - West
4
Dining Room 120 Elevation - East A
3
University of the Pacific
University Center
3601 Pacific Avenue
Stockton, California 95211
Gensler
A11.01


KEY NOTES
1 Operable Partition: 10 22 26
2 Overhead Coiling Door 08 33 23
3 Entrance Grille 12 48 16
University of the Pacific
University Center
3601 Pacific Avenue
Stockton, California 95211
Gensler
Two Harrison Street
Suite 400
San Francisco CA 94105
Telephone 415.433.3700
Facsimile 415.836.4599
Issue Date & Issue Description By Check
1 03.31.06 XXX XXX
100% Design Development
Seal/Signature
Project Name
University Center
Project Number
01.3514.000
REVIT File Name
Description
First Floor Plan East
Scale
1/8" = 1'-0"
0 2 4 8 16
A02.01 E
© 2006 Gensler
Project True
SHEET NOTES
1 See Food Service Plans for Kitchen layout.
2 See Food Service Plans for Setup layout.
3 Location of Transformer Pad
4 Location of Trash Compactor
5 Location of Cooling Tower
Note:
Kitchen 150 2560 SF
Toilet / Locker 153 75 SF
Dry Storage 154 209 SF
Kitchen Mechanical 156 132 SF
Conference Mech. 161 98 SF
MPOE 162 108 SF
Main Electrical Room 163 171 SF
Boiler Room 171 253 SF
Kitchen Office 152 55 SF
Banquet Dish-up 156 589 SF
Hallway 160 491 SF
Bldg. Storage 164 233 SF
Bldg. Offices 165 198 SF
Overhead Coiling Door
Service Yard 163
Chiller Room 172 644 SF
Womens 106 457 SF
Mens 105 308 SF
Jan 103 32 SF
Events Storage 166 574 SF
East Hall 102 2026 SF
Lobby 100 2150 SF
Setup West 111 270 SF
Elec. 112
Panels 114
A/V 115 20 SF
A/V 116 20 SF
Event Mech. 118 99 SF
Event Space 110 6176 SF
Event Mech 119 98 SF
First Floor Construction Plan East
SCALE 1/8" = 1'-0"
1


13
14
M
L
Detail Elevation at Events Space
SCALE 1/2" = 1'-0"
1
Detail Section at Events Space
SCALE 1/2" = 1'-0"
3
Detail Plan at Events Space
SCALE 1/2" = 1'-0"
2
KEY NOTES
SHEET NOTES
Not Used
University of the Pacific
University Center
3601 Pacific Avenue
Stockton, California 95211
Gensler
Two Harrison Street
Suite 400
San Francisco CA 94105
Telephone 415.433.3700
Facsimile 415.836.4599
Issue
Date & Issue Description
By
Check
100% Design Development
Seal/Signature
Project Name
University Center
Project Number
01.3514.000
REVIT File Name
Description
Plan, Section, & Elevation at Event Space
Scale
1/2" = 1'-0"
A09.20
Note:



Axonometric at North Corner
SCALE
2



Axonometric at Dining Room Corner
SCALE
1

KEY NOTES

1. Roof Shingles 07 31 33; Composite Rubber Shingles
2. Brick Masonry 04 21 13; Face Brick Architectural, FBA
3. Precast Panels 03 45 00
4. Aluminum-Framed Glazing 08 41 13
5. Aluminum Windows 08 51 13
6. Metal Louvers 08 90 00
7. Membrane Roofing 07 54 00
8. Standing Seam Roof 07 54 00
9. Skylight w/ Photo-Voltaics 08 63 00
10. Galvanized Steel, Painted
11. Deck Material
12. Metal Railings 05 73 00
13. Pre-engineered/fabricated Bridge w/ Custom Railing
14. Steel Flue for firebox
15. Brick Enclosure for Mechanical Exhaust Shafts
16. Metal Flashing 07 61 00
17. Raised Floor Plenum
18. Foundation, S.S.D.
19. Architectural Metal panel
20. Center Pivot, Aluminum Framed, Balanced Doors
21. Aluminum Doors w/ Historic Aluminum Grid
22. Pre-Cast Tread Stair
23. Hollow Metal Door w/ Louvers
24. Sliding Loading Dock Doors
25. Gypsum Wall Board
26. Insulation
27. Stainless Steel Gutter
28. Area Drain
29. Aluminum Louvers in Glazing Pocket

SHEET NOTES

1. Not Used

Note:

University of the Pacific

University Center

3601 Pacific Avenue
Stockton, California 95211

Gensler

Two Harrison Street
Suite 400
San Francisco CA 94105
Telephone 415.433.3700
Facsimile 415.836.4599

Issue	Date & Issue Description	By	Check
1	03.31.08 100% Design Development	XXX	XXX

Seal/Signature

Project Name
University Center

Project Number
01.3514.000

REVIT File Name
N:\01.3154.usp\BIM\Revit_User Models\UOP-dorm.rvt

Description
Axonometrics

Scale

A09.30

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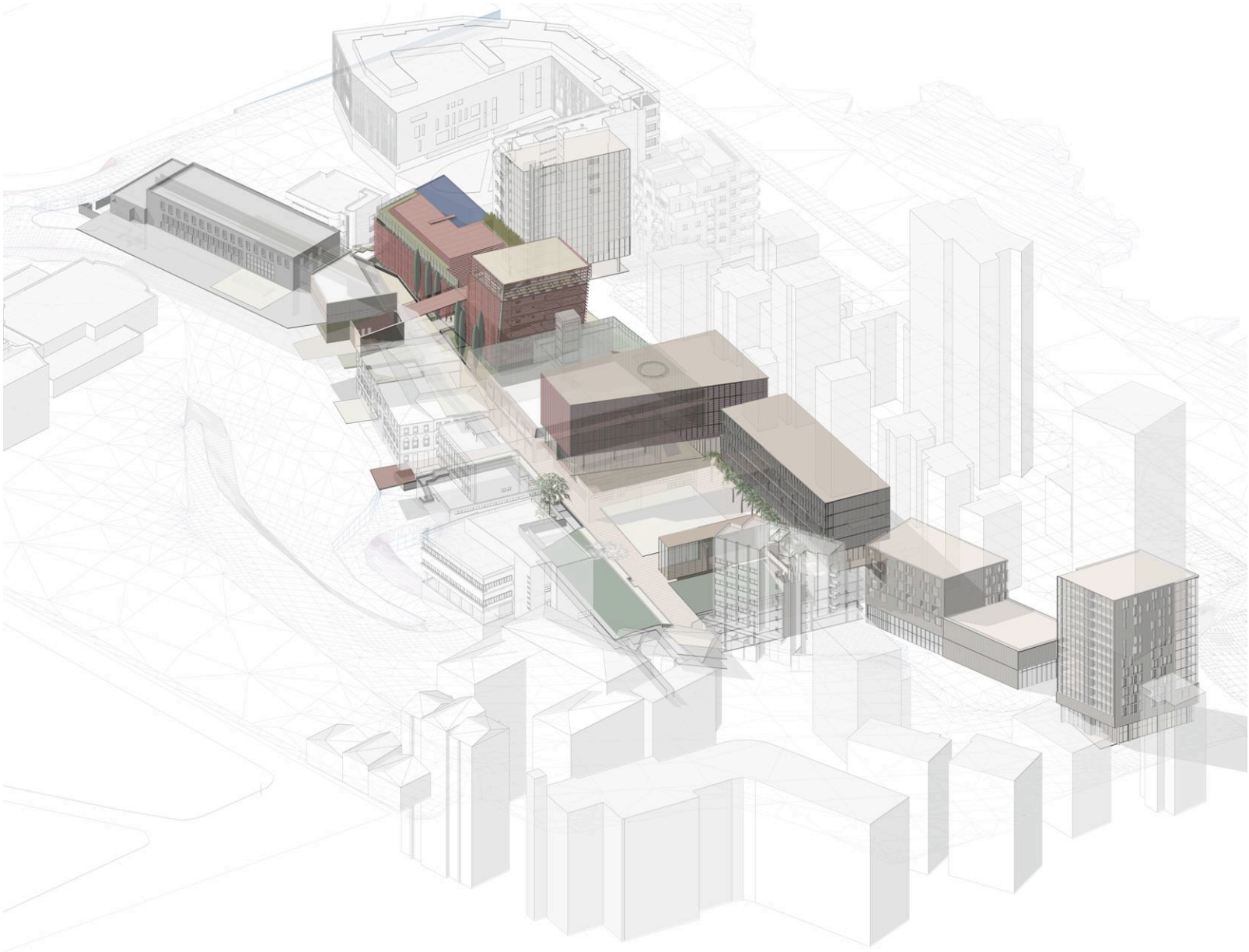
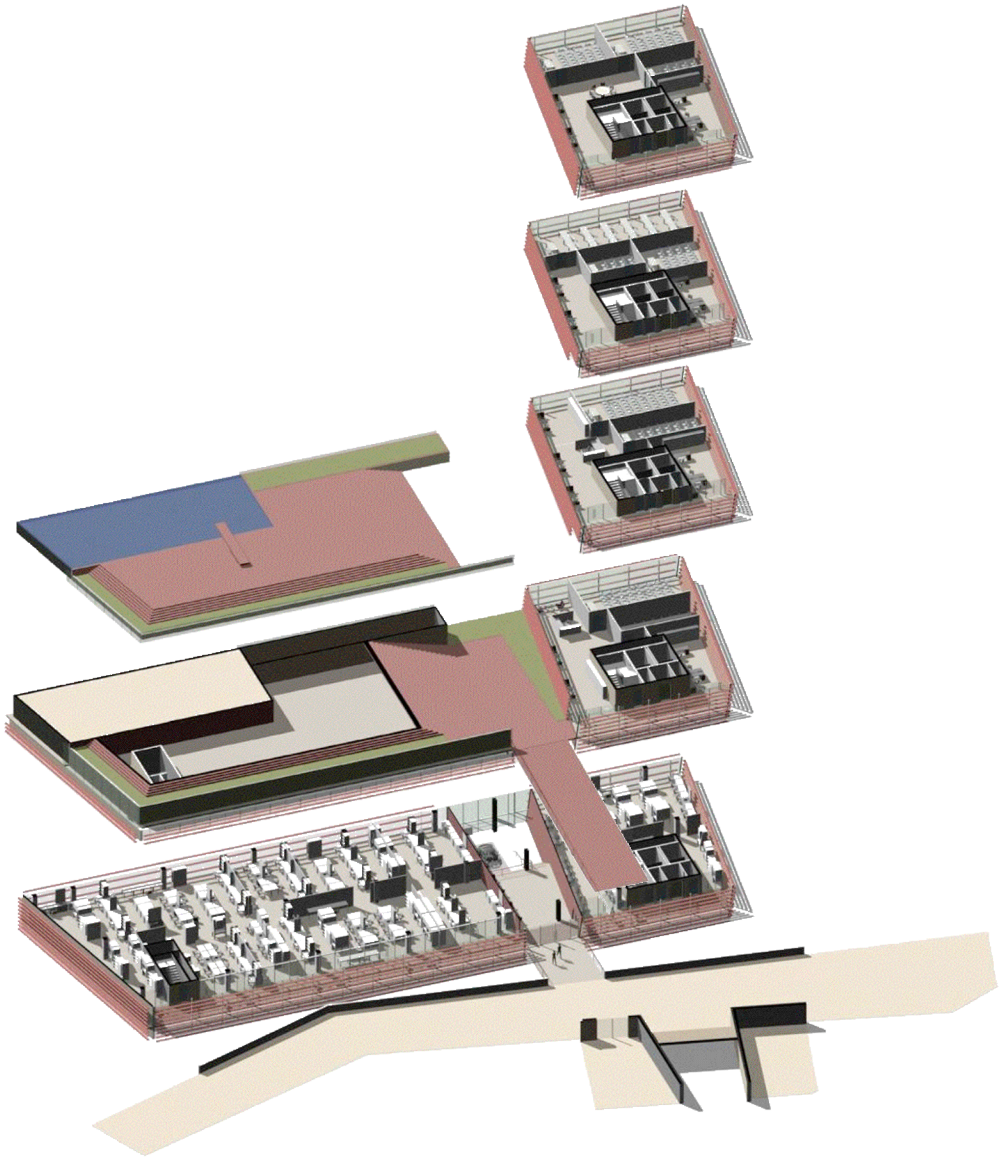
Gensler

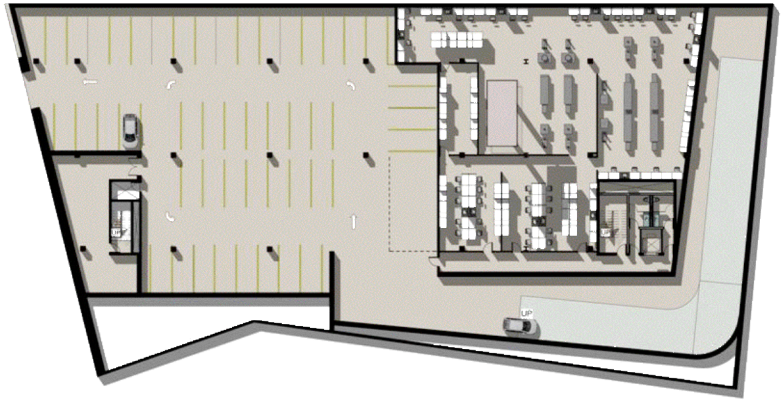
American University of Beirut

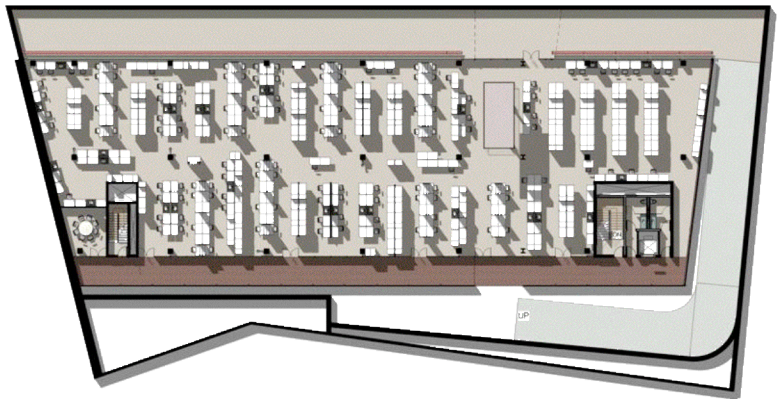


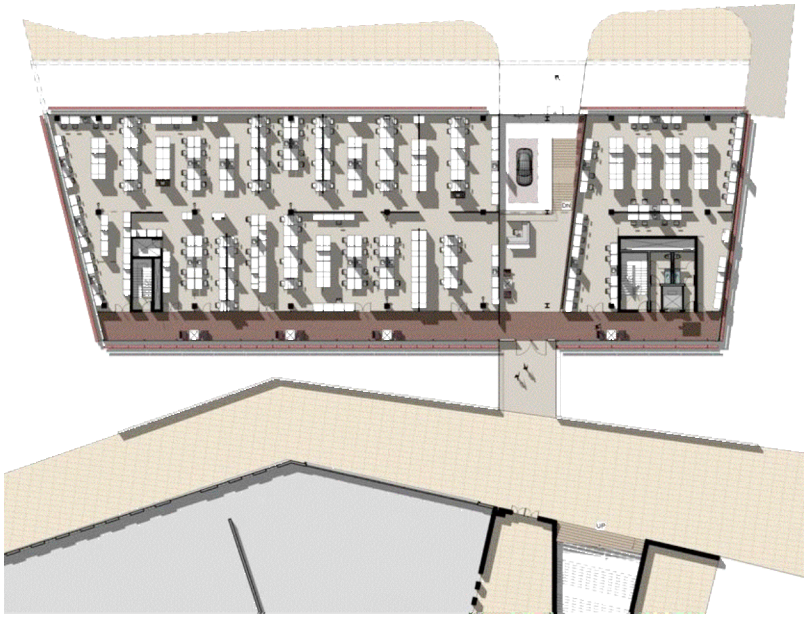
Revit and Photoshop

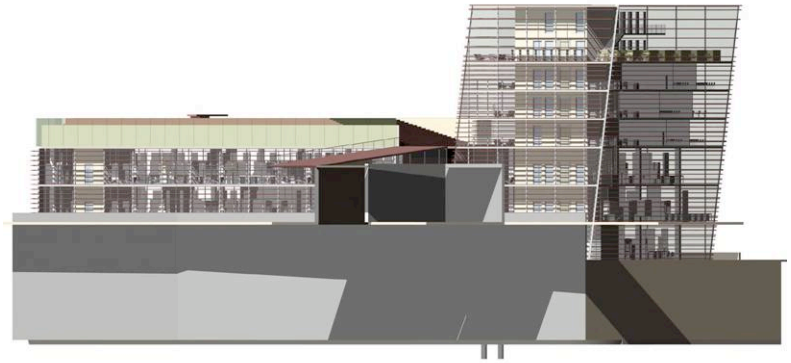


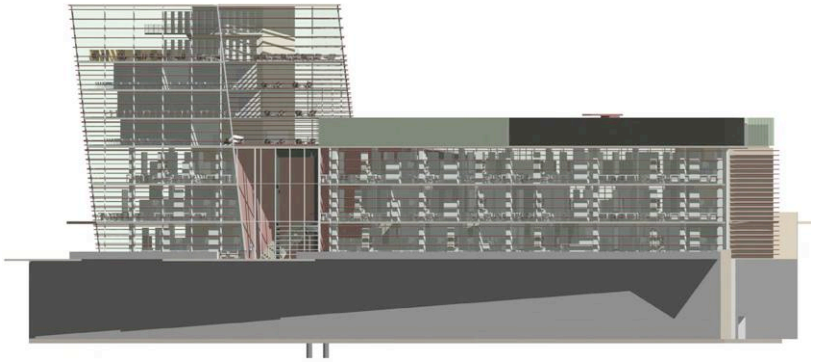
Revit and Photoshop

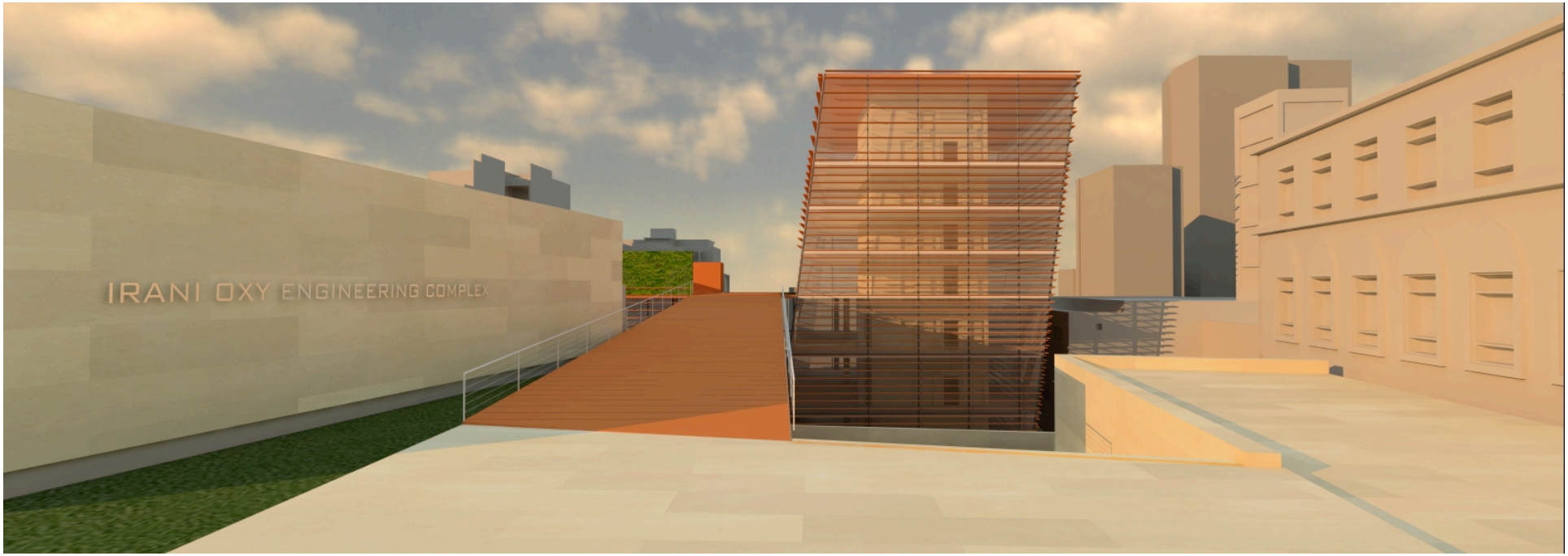








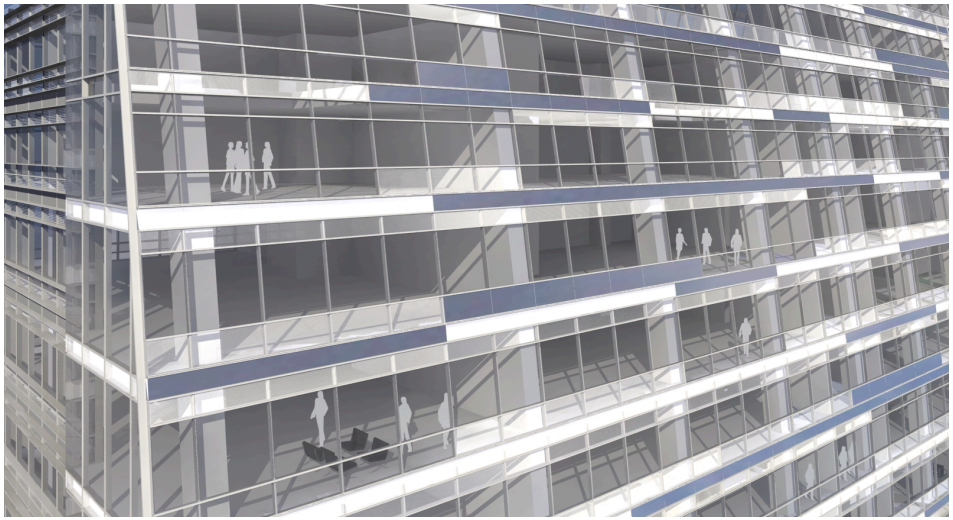


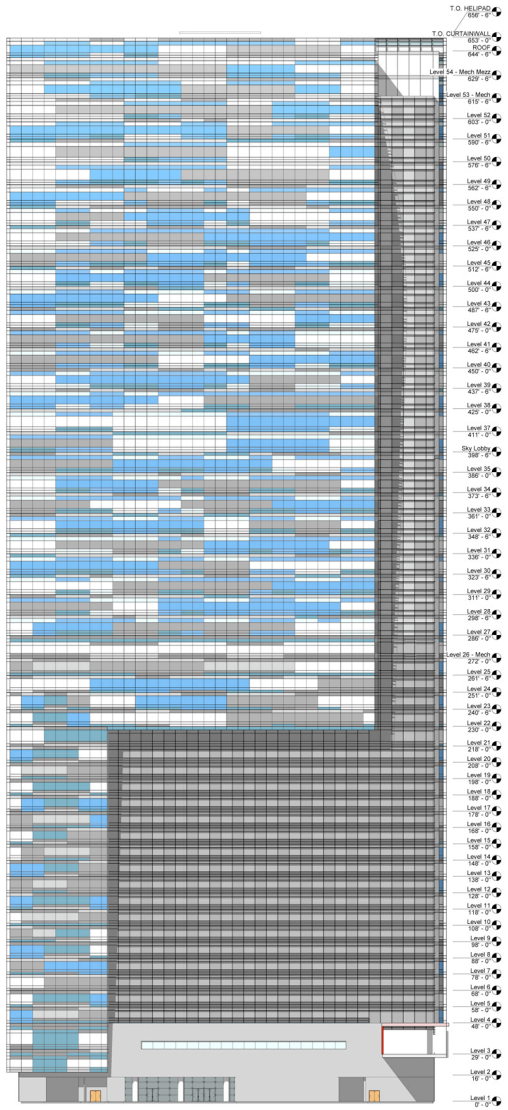


Revit model rendered in VRay

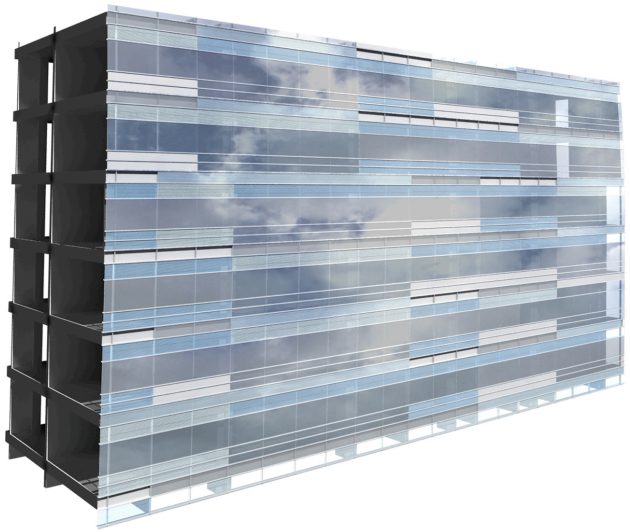
Gensler

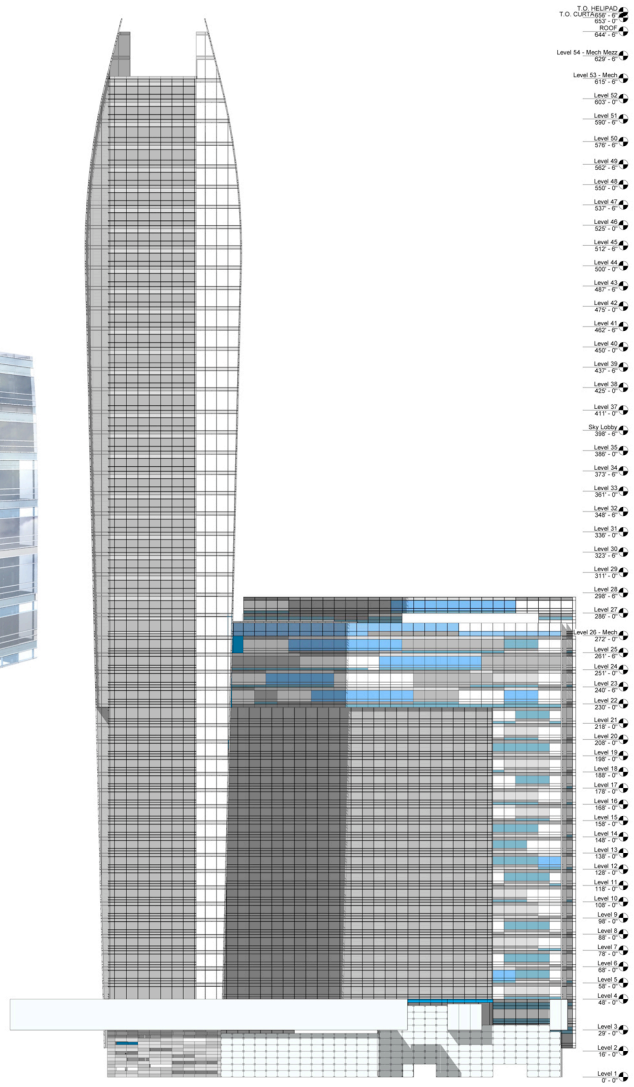
Hotel and Residences at LA Live



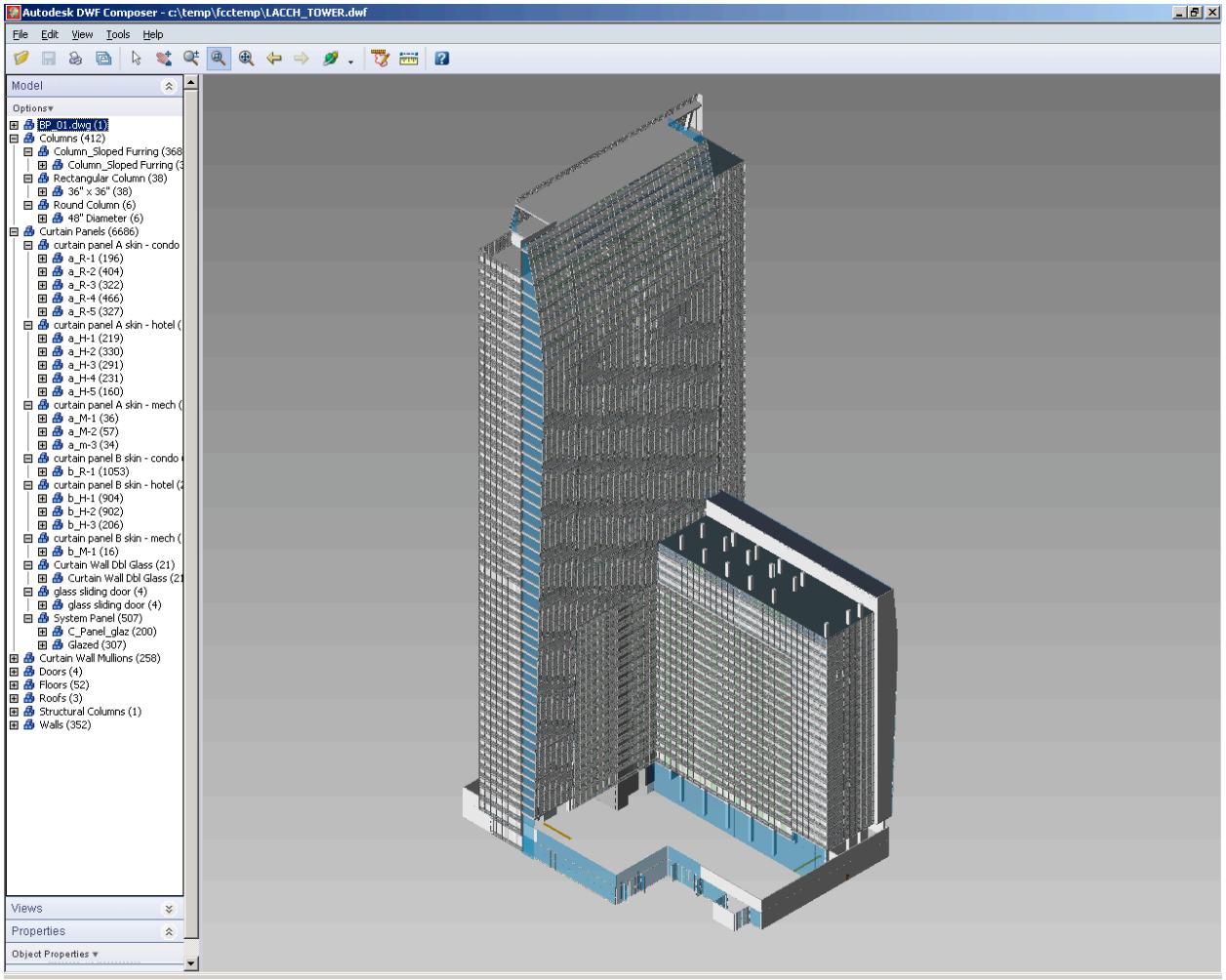


1 WEST ELEVATION VIEW
1" = 30'-0"



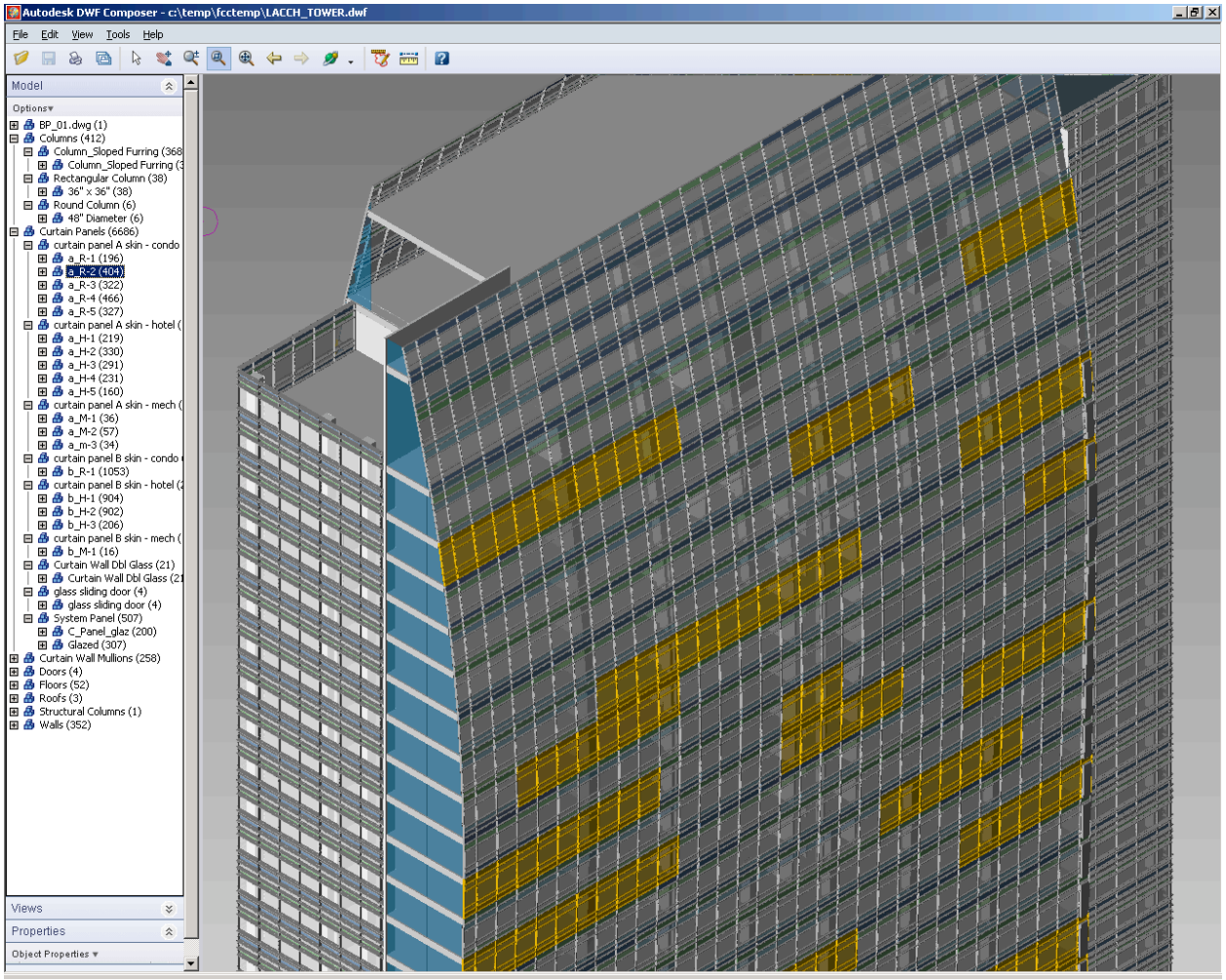


1 Callout of SOUTH ELEVATION
1" = 30'-0"



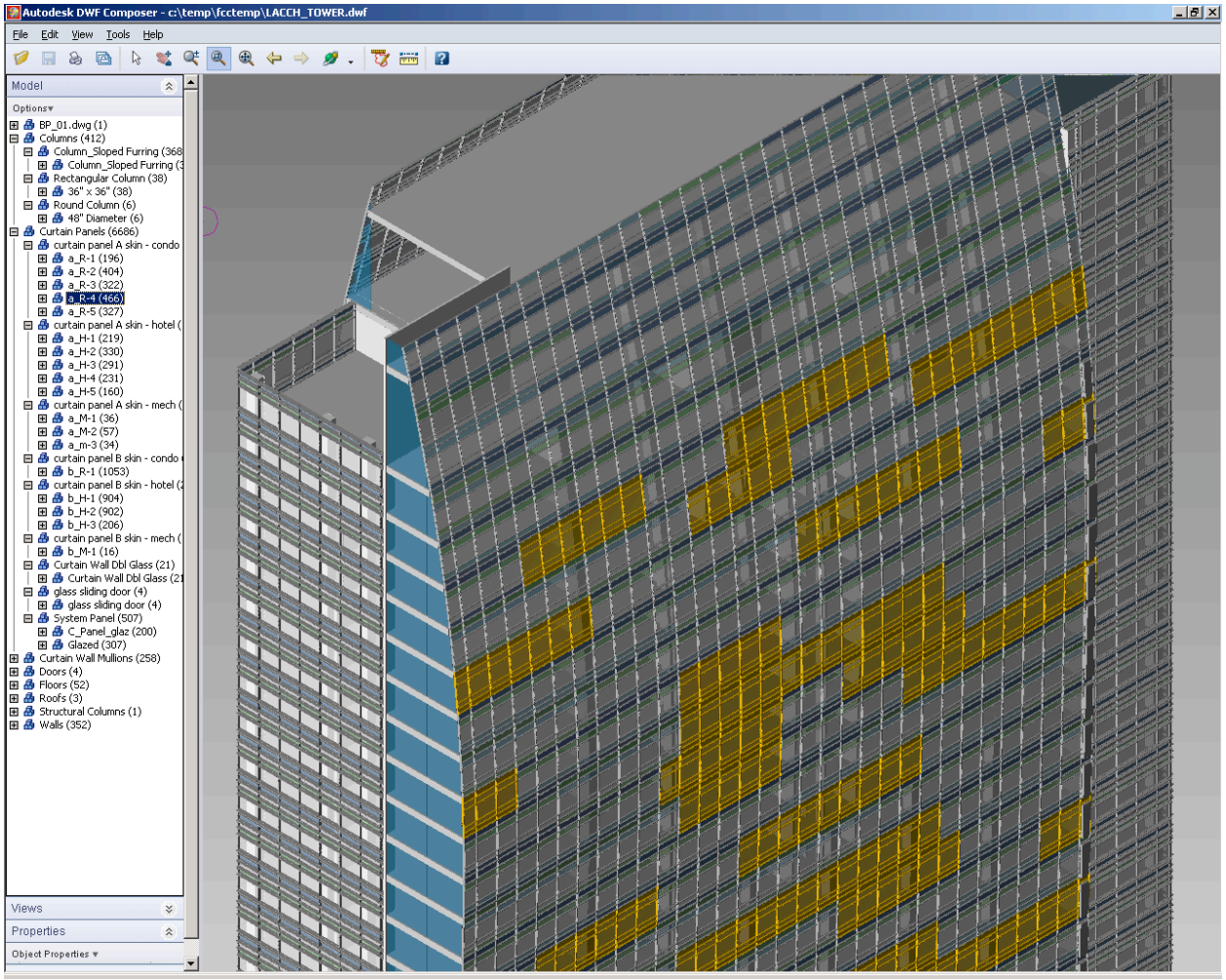
Floor Area Schedule

Level	Area		Perimeter
ROOF	10,669	SF	636' - 2"
Level 54 (Mech.)	13,871	SF	665' - 7"
Level 53	19,381	SF	676' - 9"
Level 52	20,286	SF	685' - 0"
Level 51	21,065	SF	692' - 2"
Level 50	21,721	SF	698' - 2"
Level 49	22,253	SF	703' - 1"
Level 48	22,663	SF	706' - 10"
Level 47	22,952	SF	709' - 6"
Level 46	23,120	SF	711' - 0"
Level 45	23,167	SF	711' - 6"
Level 44	23,093	SF	710' - 10"
Level 43	22,965	SF	709' - 7"
Level 42	22,836	SF	708' - 5"
Level 41	22,708	SF	707' - 3"
Level 40	22,580	SF	706' - 1"
Level 39	22,451	SF	704' - 11"
Level 38	22,323	SF	703' - 9"
Level 37	22,195	SF	702' - 7"
Level 36	22,066	SF	701' - 4"
Level 35	21,938	SF	700' - 2"
Level 34	21,810	SF	699' - 0"
Level 33	21,681	SF	697' - 10"
Level 32	21,553	SF	696' - 8"
Level 31	21,425	SF	695' - 6"
Level 30	21,297	SF	694' - 4"
Level 29	21,168	SF	693' - 2"
Level 28	21,040	SF	691' - 11"
Level 27	24,974	SF	1103' - 7"
Level 26	25,152	SF	1102' - 11"
Level 25	37,025	SF	1102' - 5"
Level 24	35,898	SF	1117' - 10"
Level 23	35,866	SF	1119' - 5"
Level 22	35,811	SF	1120' - 2"
Level 21	33,369	SF	1137' - 10"
Level 20	33,325	SF	1136' - 2"
Level 19	33,279	SF	1134' - 5"
Level 18	33,233	SF	1132' - 9"
Level 17	33,186	SF	1131' - 0"
Level 16	33,140	SF	1129' - 3"
Level 15	33,094	SF	1127' - 7"
Level 14	33,048	SF	1125' - 10"
Level 13	33,001	SF	1124' - 2"
Level 12	32,955	SF	1122' - 5"
Level 11	32,909	SF	1120' - 8"
Level 10	32,863	SF	1119' - 0"
Level 9	32,816	SF	1117' - 3"
Level 8	32,770	SF	1115' - 6"
Level 7	32,724	SF	1113' - 10"
Level 6	32,678	SF	1112' - 1"
Level 5	32,631	SF	1110' - 4"
Level 4	32,585	SF	1108' - 8"
Grand total	**1,384,608**	**SF**	



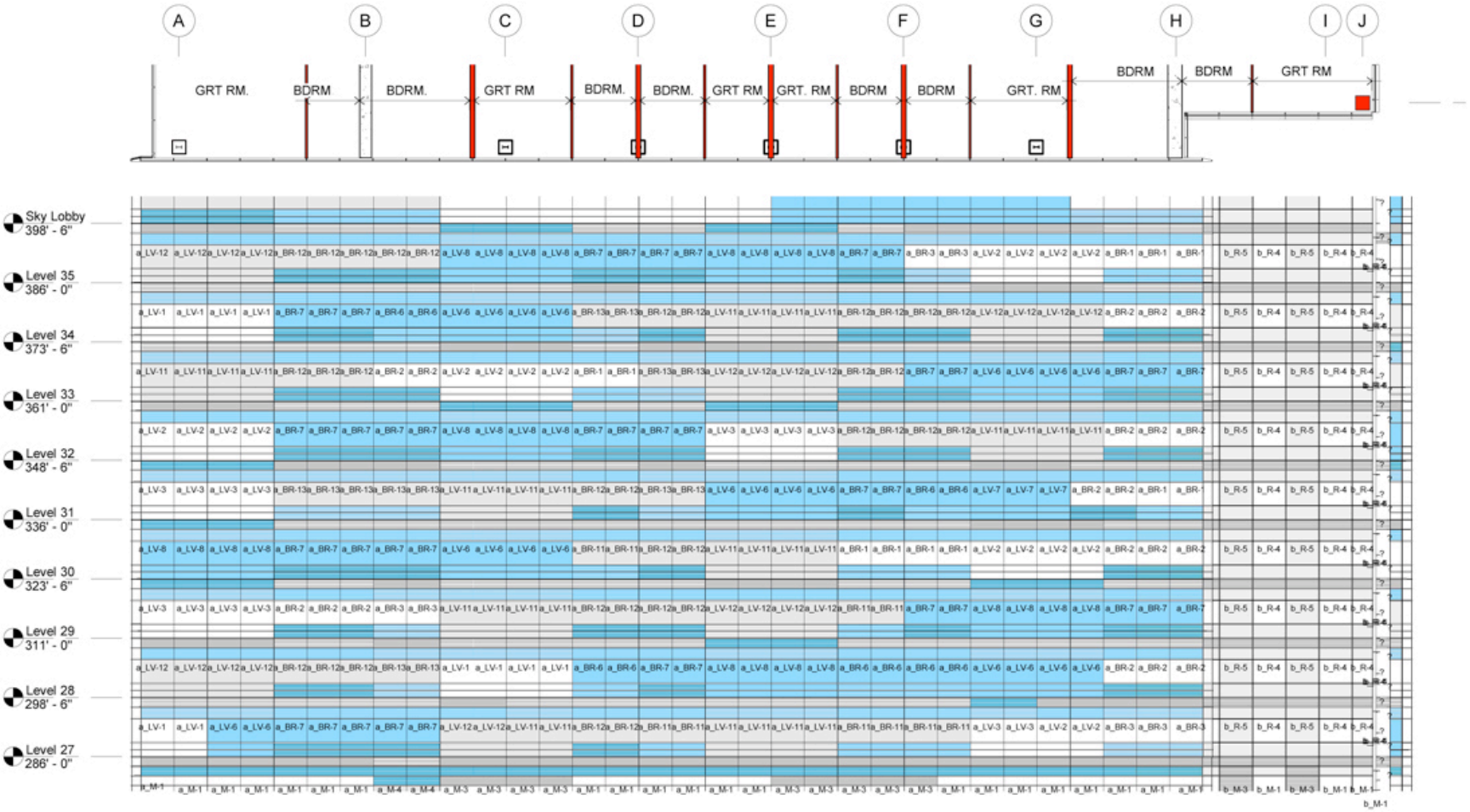
Panel Schedule by Width (under 7' panels only)

Family	Type	Width	Type Mark	Count
curtain panel A skin - hotel	a_H-1	0' - 2"	a_H-1	2
curtain panel A skin - hotel	a_H-1	2' - 5"	a_H-1	1
curtain panel A skin - hotel	a_H-1	3' - 4"	a_H-1	1
curtain panel A skin - hotel	a_H-1	3' - 6"	a_H-1	6
curtain panel A skin - hotel	a_H-1	3' - 7"	a_H-1	1
curtain panel A skin - hotel	a_H-1	3' - 9 1/2"	a_H-1	4
curtain panel A skin - hotel	a_H-1	4' - 6"	a_H-1	13
curtain panel A skin - hotel	a_H-1	6' - 2"	a_H-1	1
curtain panel A skin - hotel	a_H-2	2' - 5"	a_H-2	4
curtain panel A skin - hotel	a_H-2	3' - 4"	a_H-2	2
curtain panel A skin - hotel	a_H-2	3' - 6"	a_H-2	8
curtain panel A skin - hotel	a_H-2	3' - 7"	a_H-2	1
curtain panel A skin - hotel	a_H-2	3' - 9 1/2"	a_H-2	4
curtain panel A skin - hotel	a_H-2	4' - 6"	a_H-2	13
curtain panel A skin - hotel	a_H-2	6' - 2"	a_H-2	2
curtain panel A skin - hotel	a_H-3	0' - 10"	a_H-3	1
curtain panel A skin - hotel	a_H-3	2' - 5"	a_H-3	14
curtain panel A skin - hotel	a_H-3	3' - 6"	a_H-3	10
curtain panel A skin - hotel	a_H-3	4' - 6"	a_H-3	8
curtain panel A skin - hotel	a_H-3	6' - 2"	a_H-3	18
curtain panel A skin - hotel	a_H-4	0' - 6"	a_H-4	1
curtain panel A skin - hotel	a_H-4	2' - 5"	a_H-4	3
curtain panel A skin - hotel	a_H-4	3' - 4"	a_H-4	2
curtain panel A skin - hotel	a_H-4	3' - 6"	a_H-4	14
curtain panel A skin - hotel	a_H-4	3' - 7"	a_H-4	1
curtain panel A skin - hotel	a_H-4	3' - 9 1/2"	a_H-4	6
curtain panel A skin - hotel	a_H-4	4' - 6"	a_H-4	10
curtain panel A skin - hotel	a_H-4	6' - 2"	a_H-4	1
curtain panel A skin - hotel	a_H-5	3' - 4"	a_H-5	3
curtain panel A skin - hotel	a_H-5	3' - 6"	a_H-5	6
curtain panel A skin - hotel	a_H-5	3' - 7"	a_H-5	1
curtain panel A skin - hotel	a_H-5	3' - 9 1/2"	a_H-5	4
curtain panel A skin - hotel	a_H-5	4' - 6"	a_H-5	7
curtain panel A skin - mech	a_M-2	2' - 5"	a_M-2	1
curtain panel A skin - mech	a_M-2	3' - 6"	a_M-2	2
curtain panel A skin - mech	a_M-2	4' - 6"	a_M-2	4
curtain panel A skin - mech	a_m-3	3' - 4"	a_M-3	2
curtain panel A skin - mech	a_m-3	3' - 7"	a_M-3	1
curtain panel A skin - condo	a_R-1	3' - 4"	a_R-1	2
curtain panel A skin - condo	a_R-1	3' - 6"	a_R-1	12
curtain panel A skin - condo	a_R-1	3' - 7"	a_R-1	2
curtain panel A skin - condo	a_R-1	4' - 6"	a_R-1	15
curtain panel A skin - condo	a_R-2	3' - 4"	a_R-2	10
curtain panel A skin - condo	a_R-2	3' - 6"	a_R-2	8
curtain panel A skin - condo	a_R-2	3' - 7"	a_R-2	10
curtain panel A skin - condo	a_R-2	4' - 6"	a_R-2	11
curtain panel A skin - condo	a_R-3	3' - 4"	a_R-3	3
curtain panel A skin - condo	a_R-3	3' - 6"	a_R-3	6



Panel Schedule by Width (under 7' panels only)

Family	Type	Width	Type Mark	Count
curtain panel A skin - hotel	a_H-1	0' - 2"	a_H-1	2
curtain panel A skin - hotel	a_H-1	2' - 5"	a_H-1	1
curtain panel A skin - hotel	a_H-1	3' - 4"	a_H-1	1
curtain panel A skin - hotel	a_H-1	3' - 6"	a_H-1	6
curtain panel A skin - hotel	a_H-1	3' - 7"	a_H-1	1
curtain panel A skin - hotel	a_H-1	3' - 9 1/2"	a_H-1	4
curtain panel A skin - hotel	a_H-1	4' - 6"	a_H-1	13
curtain panel A skin - hotel	a_H-1	6' - 2"	a_H-1	1
curtain panel A skin - hotel	a_H-2	2' - 5"	a_H-2	4
curtain panel A skin - hotel	a_H-2	3' - 4"	a_H-2	2
curtain panel A skin - hotel	a_H-2	3' - 6"	a_H-2	8
curtain panel A skin - hotel	a_H-2	3' - 7"	a_H-2	1
curtain panel A skin - hotel	a_H-2	3' - 9 1/2"	a_H-2	4
curtain panel A skin - hotel	a_H-2	4' - 6"	a_H-2	13
curtain panel A skin - hotel	a_H-2	6' - 2"	a_H-2	2
curtain panel A skin - hotel	a_H-3	0' - 10"	a_H-3	1
curtain panel A skin - hotel	a_H-3	2' - 5"	a_H-3	14
curtain panel A skin - hotel	a_H-3	3' - 6"	a_H-3	10
curtain panel A skin - hotel	a_H-3	4' - 6"	a_H-3	8
curtain panel A skin - hotel	a_H-3	6' - 2"	a_H-3	18
curtain panel A skin - hotel	a_H-4	0' - 6"	a_H-4	1
curtain panel A skin - hotel	a_H-4	2' - 5"	a_H-4	3
curtain panel A skin - hotel	a_H-4	3' - 4"	a_H-4	2
curtain panel A skin - hotel	a_H-4	3' - 6"	a_H-4	14
curtain panel A skin - hotel	a_H-4	3' - 7"	a_H-4	1
curtain panel A skin - hotel	a_H-4	3' - 9 1/2"	a_H-4	6
curtain panel A skin - hotel	a_H-4	4' - 6"	a_H-4	10
curtain panel A skin - hotel	a_H-4	6' - 2"	a_H-4	1
curtain panel A skin - hotel	a_H-5	3' - 4"	a_H-5	3
curtain panel A skin - hotel	a_H-5	3' - 6"	a_H-5	6
curtain panel A skin - hotel	a_H-5	3' - 7"	a_H-5	1
curtain panel A skin - hotel	a_H-5	3' - 9 1/2"	a_H-5	4
curtain panel A skin - hotel	a_H-5	4' - 6"	a_H-5	7
curtain panel A skin - mech	a_M-2	2' - 5"	a_M-2	1
curtain panel A skin - mech	a_M-2	3' - 6"	a_M-2	2
curtain panel A skin - mech	a_M-2	4' - 6"	a_M-2	4
curtain panel A skin - mech	a_m-3	3' - 4"	a_M-3	2
curtain panel A skin - mech	a_m-3	3' - 7"	a_M-3	1
curtain panel A skin - condo	a_R-1	3' - 4"	a_R-1	2
curtain panel A skin - condo	a_R-1	3' - 6"	a_R-1	12
curtain panel A skin - condo	a_R-1	3' - 7"	a_R-1	2
curtain panel A skin - condo	a_R-1	4' - 6"	a_R-1	15
curtain panel A skin - condo	a_R-2	3' - 4"	a_R-2	10
curtain panel A skin - condo	a_R-2	3' - 6"	a_R-2	8
curtain panel A skin - condo	a_R-2	3' - 7"	a_R-2	10
curtain panel A skin - condo	a_R-2	4' - 6"	a_R-2	11
curtain panel A skin - condo	a_R-3	3' - 4"	a_R-3	3
curtain panel A skin - condo	a_R-3	3' - 6"	a_R-3	6


A
B
C
D
E
F
G
H
I
J
GRT RM.
BDRM
BDRM.
GRT RM
BDRM.
BDRM.
GRT RM
GRT. RM
BDRM
BDRM
GRT. RM
BDRM
BDRM
GRT RM
Sky Lobby 398' - 6"
Level 35 386' - 0"
Level 34 373' - 6"
Level 33 361' - 0"
Level 32 348' - 6"
Level 31 336' - 0"
Level 30 323' - 6"
Level 29 311' - 0"
Level 28 298' - 6"
Level 27 286' - 0"

6
VRE1-46 - Frit on Clear
6SB
VRE1-46 - Frit on Clear - Shadow Box
4
Metal Panel - Alum.
5
VRE5-54 - 75% Line Frit on Blue Glass
3
VRE5-38 - 25% Line Frit on Blue Glass
3SB
VRE1-46 - Frit on Clear - Shadow Box
2
VRE5-46 - 50% Line Frit on Blue Glass
2SB
VRE5-46 - Frit on Blue Glass - Shadow Box
VRE5-46 - Blue Vision
a_H-1
a_LH-2
a_LH-3
a_LH-6
a_LH-7
a_LH-8
a_LH-11
a_LH-12
a_LH-13
a_M-1
a_M-2
a_M-3
a_M-4
a_M-5
b_M-1
b_M-2
a_BR-1
a_BR-2
a_BR-3
a_BR-13
a_BR-7
a_BR-8
a_BR-11
a_BR-12
a_BR-13
a_LV-1
a_LV-2
a_LV-3
a_LV-6
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a_LV-8
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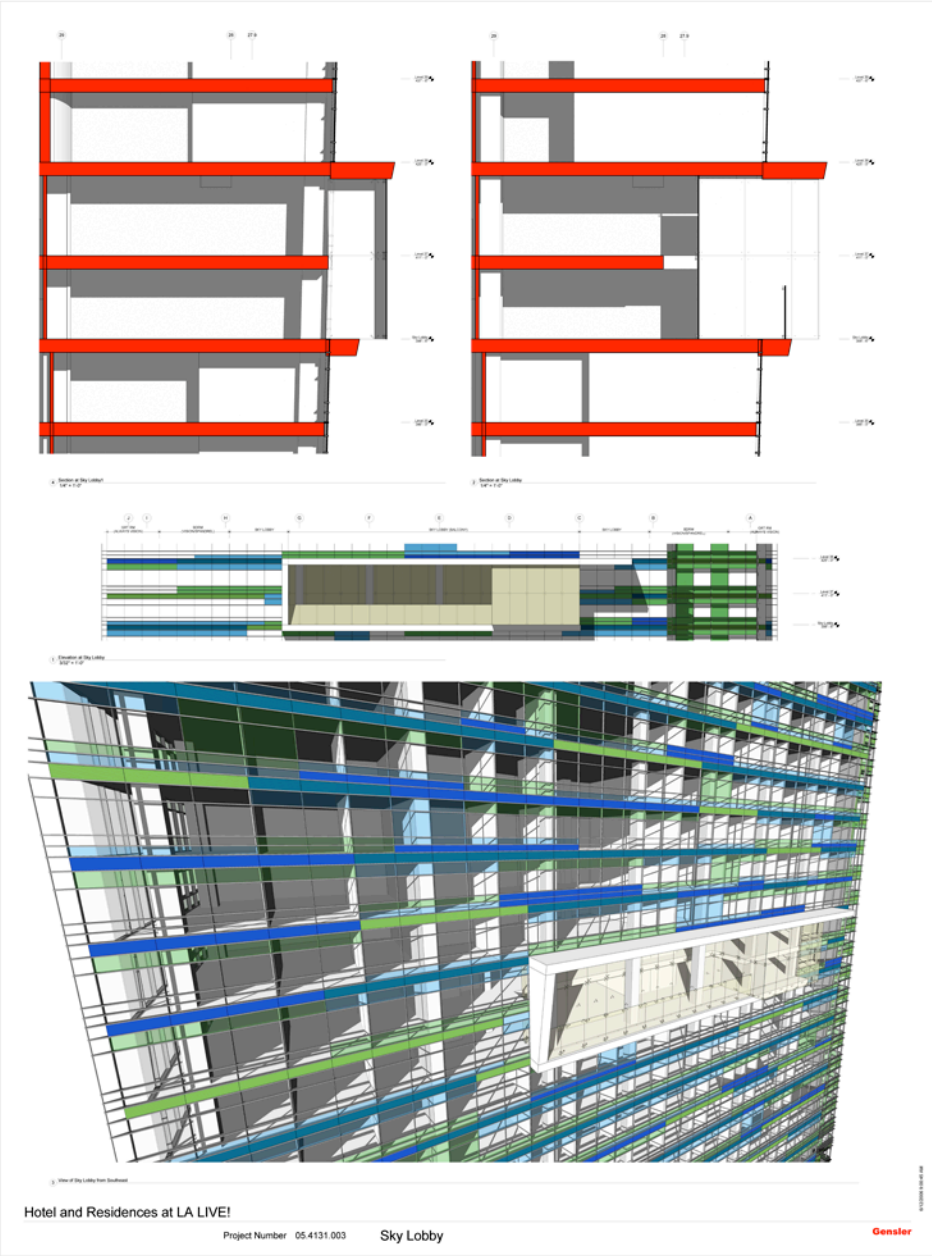
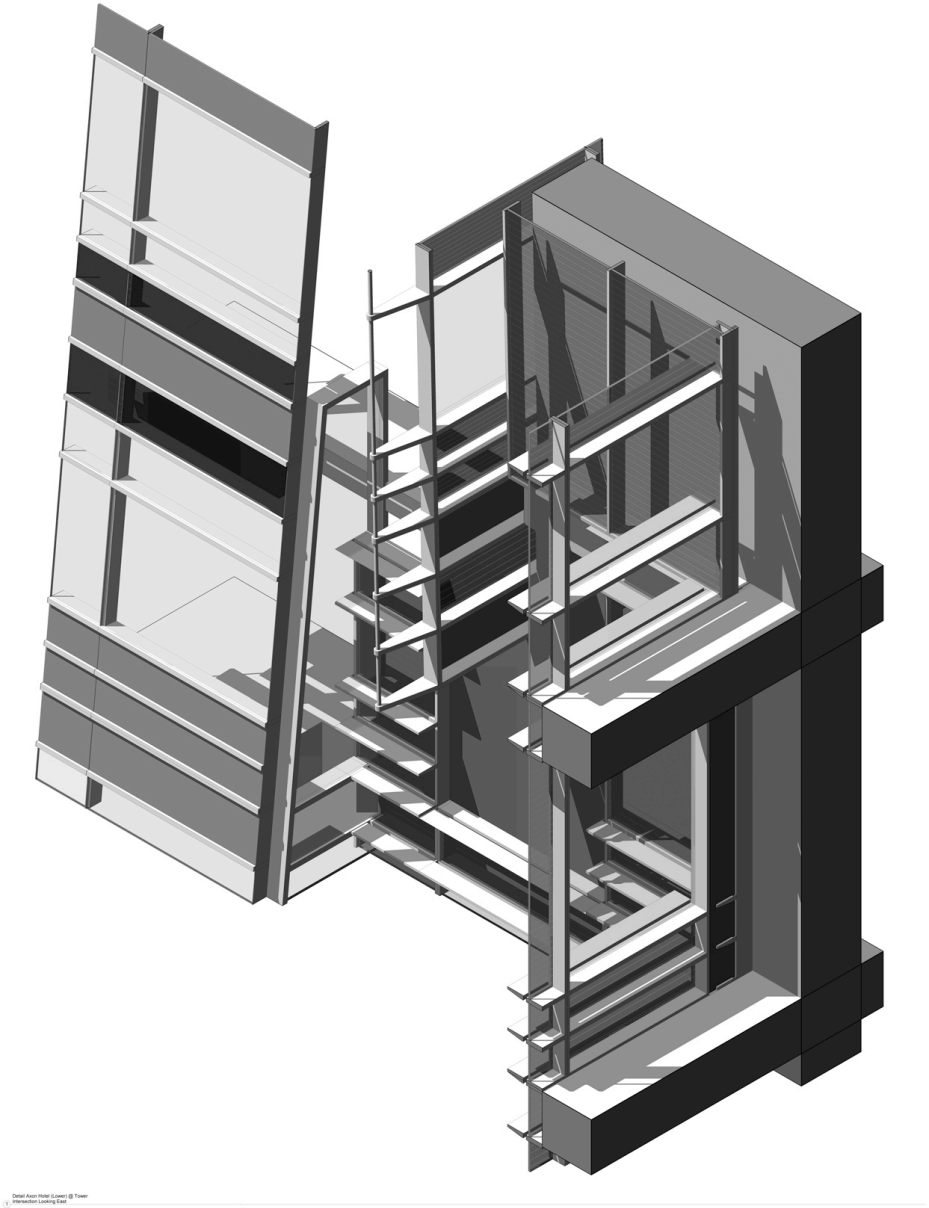
a_H-13
a_H-14


Hotel and Residences at LA LIVE!
Project Number 05.4131.003
Sky Lobby
Gensler



Typical Implementation

Small Scale

- Vignettes and Design Studies
- Site Massing and Master Planning
- Test Fits and Space Planning
- Small-Scale Architecture and Workplace CDs
- Mission Critical & Retail Rollout
- Large-Scale Architecture CDs
- Multi-Discipline Coordination Models
- Integrated Delivery: Design to Manufacturing

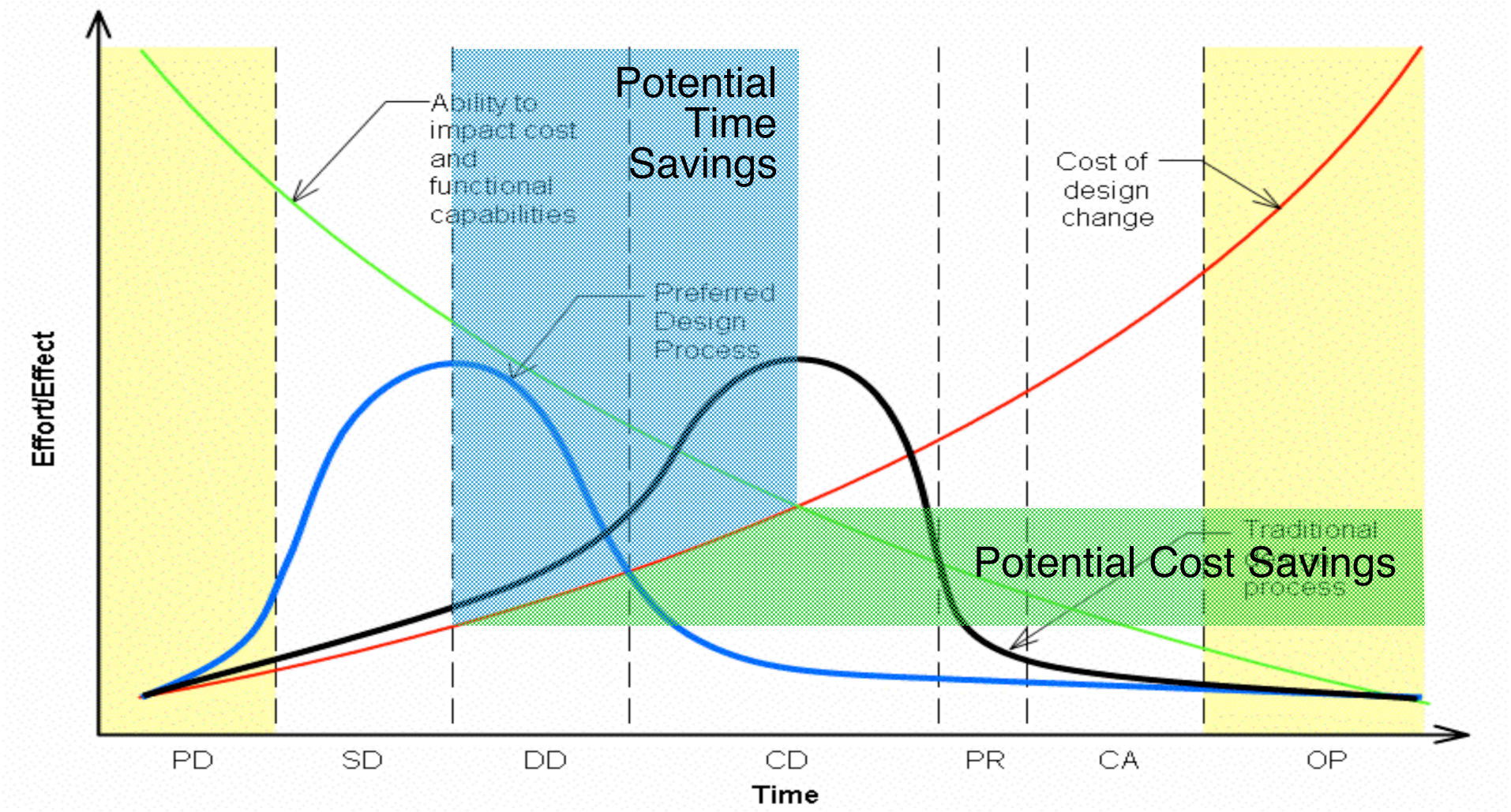
Large Scale

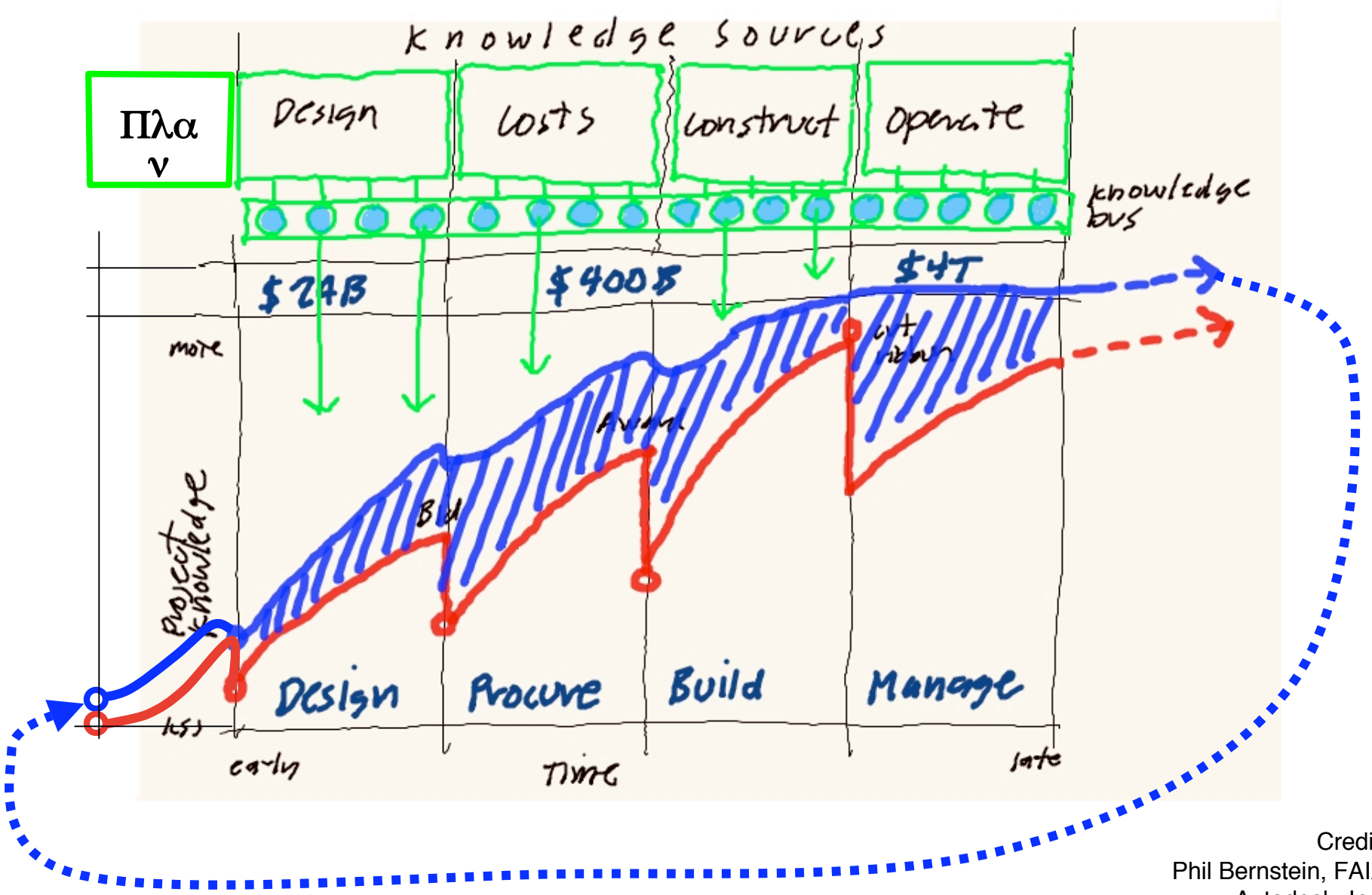
Potential Savings

CURT

THE CONSTRUCTION USERS ROUNDTABLE

"THE OWNERS VOICE TO THE CONSTRUCTION INDUSTRY"



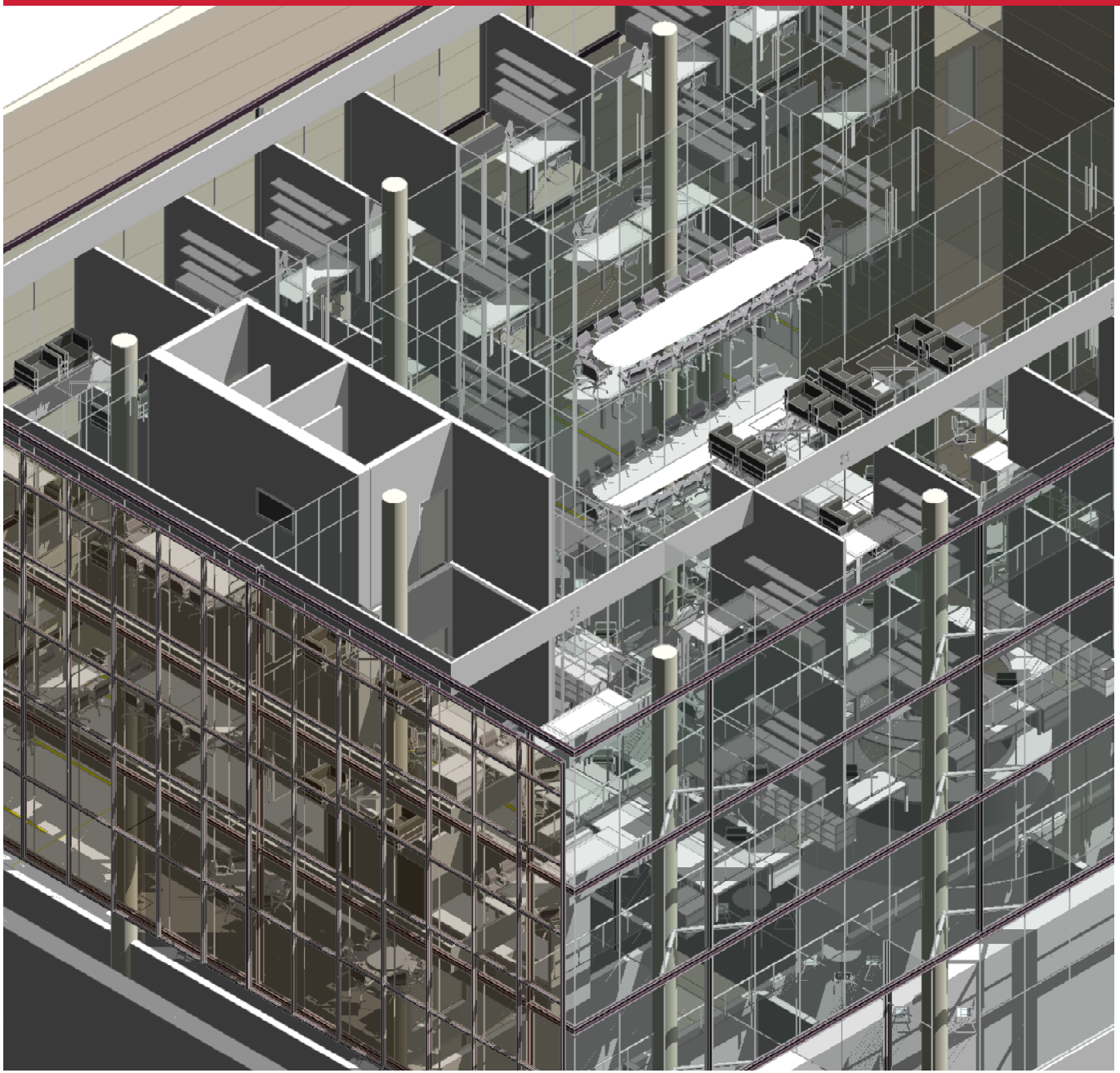


Credit:
Phil Bernstein, FAIA
Autodesk, Inc.

How does BIM help Airports?

Problem	Solution
Program: Engineering conflicts discovered in design may dilute performance benefits expected of the plan	'Yield' of usable, leasable, or functional components confirmed in real-time
Value: Escalation of project costs dilutes what can be built in today's dollars	Accelerating the planning/design/construction process can save 1% or more per month in project costs
Contingency: Change orders driven by unresolved design issues or errors further dilute project budget	Costly system conflicts in construction avoided thereby reducing contingency requirements
Momentum: Delays, conflicts and escalating costs erode client confidence and project momentum	Greater confidence in design and accelerated delivery lessens project susceptibility to reprogramming or cancellation

Conclusion



As Architects replace 2D deliverables with BIMs, Planners need to develop solutions in BIM to contribute to an integrated design/delivery process