

THE NEW YORK TIMES BUILDING

BENJAMIN R. BARBEN | CRAIG A. CASEY | NICOLE L. DUBOWSKI | JUSTIN M. MILLER



TENANT REDESIGN
CORE REDESIGN
FAÇADE REDESIGN
IPD/BIM LESSONS
CONCLUSIONS
QUESTIONS

INTRODUCTION
EXISTING CONDITIONS
PROJECT GOALS
TENANT
CORE
ENVELOPE
OVERVIEW

A CASE STUDY FOR THE USE OF BIM / IPD FOR THE ANALYSIS AND DESIGN OF THE NEW YORK TIMES BUILDING NEW YORK, NY

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ARCHITECTURE

OWNED BY THE NEW YORK TIMES COMPANY & FOREST CITY RATNER COMPANIES

RENZO PIANO BUILDING WORKSHOP
FXFOWLE ARCHITECTS

52 STORY TOWER
746 FEET TALL

CERAMIC TUBE SHADING ARRAY OVER ULTRA CLEAR
GLASS CURTAIN WALL SYSTEM

EXPOSED STRUCTURAL STEEL



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STRUCTURE

FOUNDATIONS:

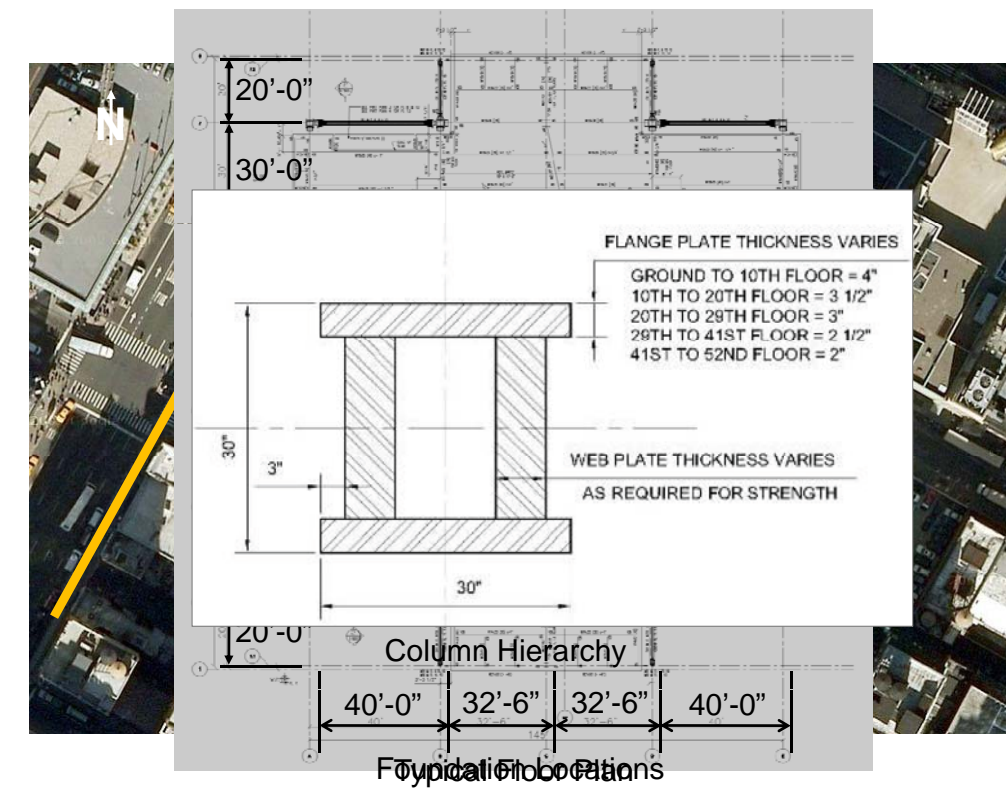
- (7) - 24" DIAMETER CAISSONS WITH 6,000 PSI
- 6,000 PSI SPREAD FOOTINGS EVERYWHERE ELSE

GRAVITY SYSTEM:

- COMPOSITE STEEL SYSTEM
 - 3" METAL DECKING SPANS 10'
 - 2 ½" N.W. CONCRETE
- TYPICAL FLOOR-TO-FLOOR HEIGHT IS 13.75'

BUILT-UP COLUMNS:

- 30" X 30"
- WEB PLATES VARY 7" TO 1"
- FLANGE PLATES VARY 4" TO 2"



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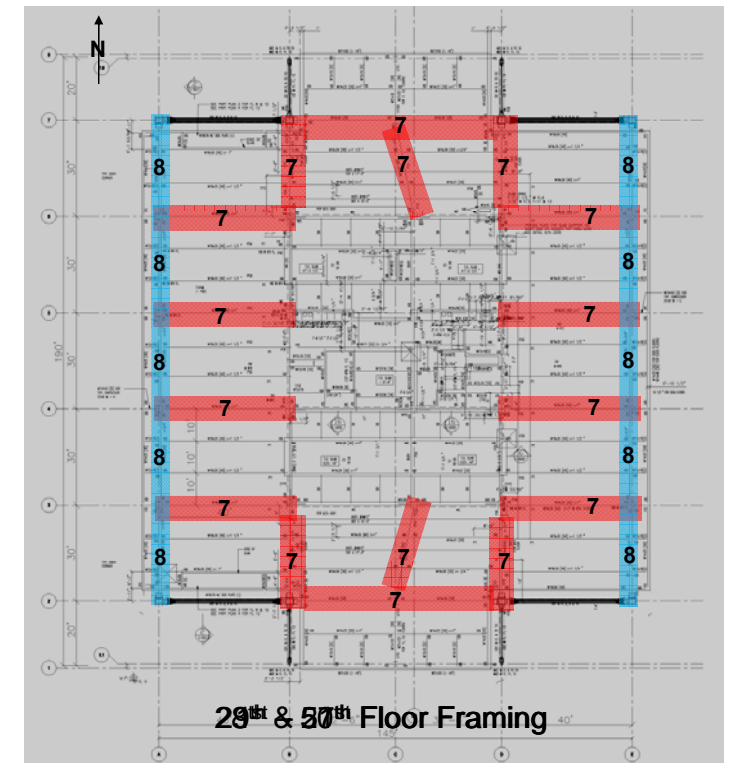
STRUCTURE

CANTILEVER BAYS:

- MIDDLE LINE IS A VIENDEEL FRAME (1)
- EXTERIOR LINES ARE SINGLE STEEL RODS (2)

LATERAL FORCE RESISTING SYSTEM:

- STEEL ROD X-BRACING (3)
- CONCENTRIC BRACES BEHIND ELEVATOR SHAFTS (4)
 - CHEVRON (5)
 - SINGLE DIAGONAL (6)
- OUTRIGGERS AT 28TH AND 51ST FLOOR (7)
- THERMAL BELT TRUSSES (8)



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MECHANICAL

COOLING

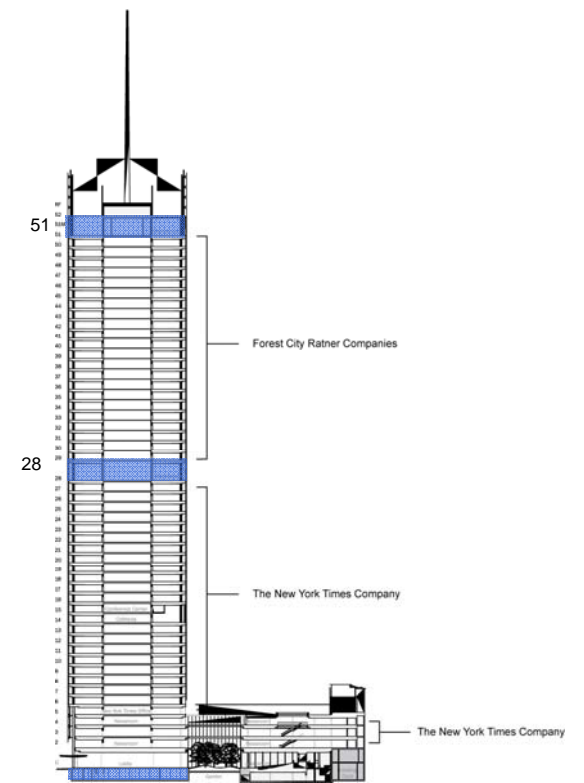
- 6250 TON CHILLED WATER SYSTEM
 - (5) 1,200 TON CENTRIFUGAL CHILLERS
 - (1) 250 TON SINGLE STAGE ABSORPTION CHILLER

HEATING

- PURCHASED HIGH-PRESSURE STEAM
- LOW PRESSURE DISTRIBUTED TO FLOOR-BY-FLOOR AHU'S HEATING COIL
- HUMIDIFICATION

COGENERATION PLANT

- NATURAL-GAS FIRED
- PROVIDES 1.4 MW OF ELECTRICITY
- WASTE HEAT PRODUCES PERIMETER HEATING HOT WATER



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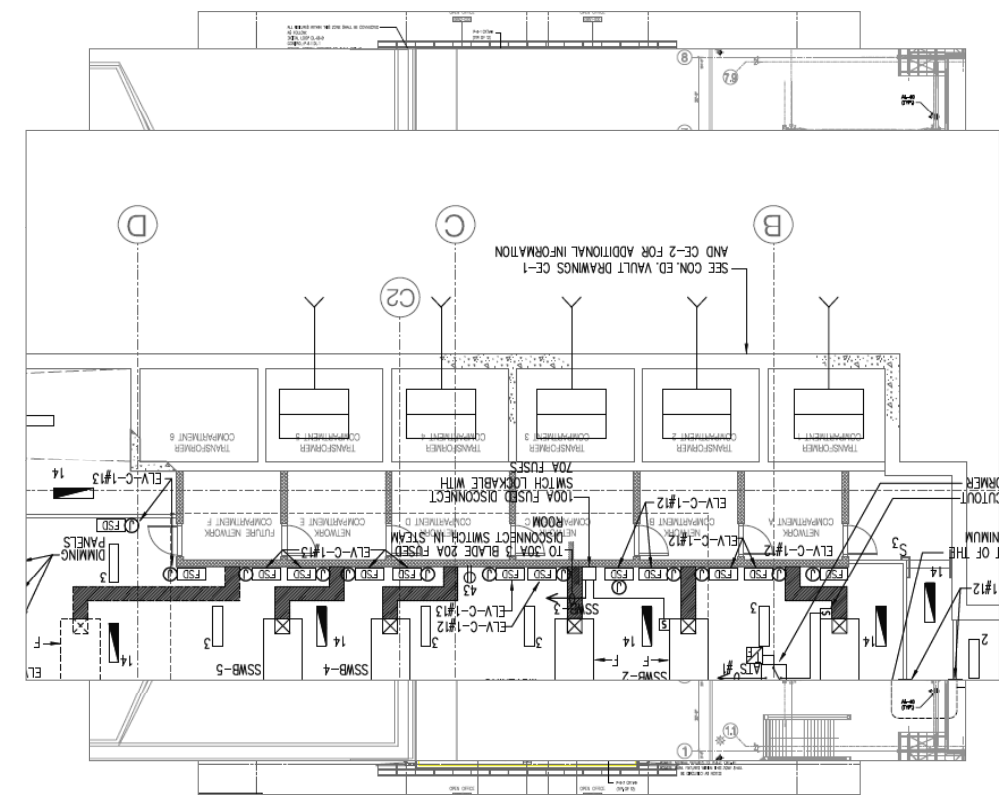
LIGHTING/ELECTRICAL

LIGHTING

- INTERIOR
 - 18,000 (2) 14W FLUORESCENT LAMP FIXTURES
 - DIGITALLY ADDRESSABLE BALLASTS
 - COMPLEX DAYLIGHT HARVESTING SYSTEM
 - DESIGNED TO 1.1 W/FT²
 - DIMMED TO 30 FC
- EXTERIOR
 - 250W METAL HALIDE LAMPS ILLUMINATING THE FAÇADE
 - 1 FC AT TOP, 3 FC AT SIGNAGE

ELECTRICAL

- 5 SERVICE ENTRANCES
- CONDUIT IN NYT SPACE
- BUS DUCT IN FCRC



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EMPLOY INTEGRATED PROJECT DELIVERY METHODS
WITH USE OF BUILDING INFORMATION MODELING
TOOLS TO AID IN THE FOLLOWING ANALYSES

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TENANT

THE ANALYSIS OF THE TENANT SPACES WAS INTENDED TO DECREASE THE BUILDING'S LIFE CYCLE COST. TO ACCOMPLISH THIS, THE BUILDING MECHANICAL, LIGHTING AND STRUCTURAL SYSTEMS ALONG WITH THE ARCHITECTURAL CHANGES WERE ALL ANALYZED FOR THE BENEFIT TO THE OWNER.

Structural
Reduce Quantity of Structural Members
Accurate Revit Model Creation
Create a RAM Model to Aid in Design
Design a Constructable Concrete-Steel Connection
Lighting/Electrical
Design a Task-Ambient Lighting System
Decrease Lighting Energy Consumption
Share Lighting Power Density with Mechanical Loads
Mechanical
Design Displacement Ventilation System
Model system in Revit MEP
Construction
Decrease Construction Cost
Maintained Architect's Vision
Shorten/Maintain Construction Schedule
Use Revit Model for Take-off
Increase Profitability to FCRC

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CORE

THE ANALYSIS OF THE STRUCTURAL CORE WAS INTENDED TO OPTIMIZE THE STRUCTURAL SYSTEM. THIS WILL HAVE AN EFFECT ON ARCHITECTURE, CONSTRUCTABILITY, AND MEP DISTRIBUTION, THEREFORE THESE AFFECTS WILL BE ANALYZED IN A COLLABORATIVE EFFORT.

Structural
Eliminate Outriggers
Eliminate X-Bracing
Concrete Only Core
Accurate Revit Model Creation
Create ETABS Model to Maintain Dynamic Properties
Lighting/Electrical
Reduce Vertical Distribution Space Requirements
Accurate Revit Model Creation
Clash Detection through Core
Mechanical
Accurate Revit MEP Model Creation
Reduce penetrations and clashes with core structure
Construction
Decrease Construction Cost
Maintained Architect's Vision
Shorten/Maintain Construction Schedule
Use Revit Model for Take-off

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ENVELOPE

THE ANALYSIS OF THE BUILDING ENVELOPE WAS INTENDED TO IMPROVE THE INDOOR ENVIRONMENTAL QUALITY WHILE DECREASING BUILDING ENERGY CONSUMPTION. THIS WILL HAVE AN EFFECT ON ARCHITECTURE, DAYLIGHTING, AMBIENT LOADS, CONSTRUCTION COSTS, AND THE BUILDING'S LIFE-CYCLE.

Structural
Eliminate Thermal Trusses
Maintain the Original Architecture including the Cantilevered Bays
Accurate Revit Model Creation
Disengage Columns from Lateral System
Lighting/Electrical
Maintain Architect's vision of transparency through daylighting system
Reduce Energy Consumption Due to Daylight Harvesting
Use Daysim and Excel to Calculate Energy Savings using DA
Accurate Revit Model Creation of Shading Device
Use Ecotect to Obtain Annual Incident Solar Radiation on Façade
Design a PV system to offset energy consumption
Exterior Lighting Design that Reduces Energy Consumption
Use Radiance to Produce Renderings of Façade
Mechanical
Establish BIM->Energy Model Workflow "Best Practices"
Utilize a BIM compatible software (IES<VE>) for energy simulations
Reduce Ambient Load Profile with Envelope Construction Optimization
Determine Cooling Load Reduction due to decreased Lighting Power Density
Design of Mixed-Mode Ventilation System
Utilize IES<VE> Macroflo for Mixed-Mode Design
Construction
Decrease Construction Cost
Maintained Architect's Vision
Shorten/Maintain Construction Schedule
Use Revit Model for Take-off

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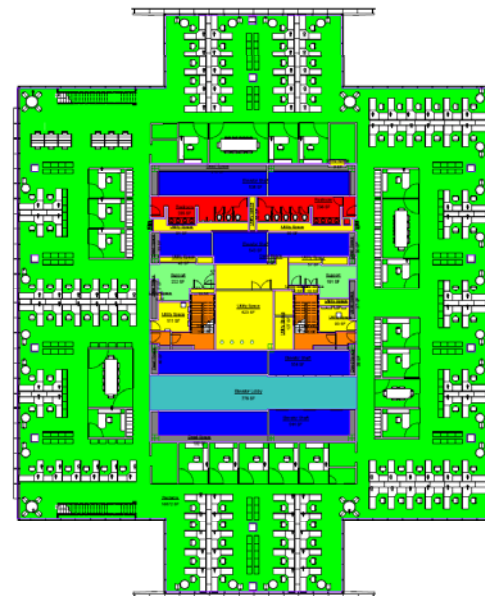
UFAD → DV

CONCLUSIONS

ORIGINAL 5-17

Area Legend

- Dead Space
- Elevator Lobby
- Elevator Shaft
- Rentable
- Restroom
- Stairway
- Support
- Utility Space

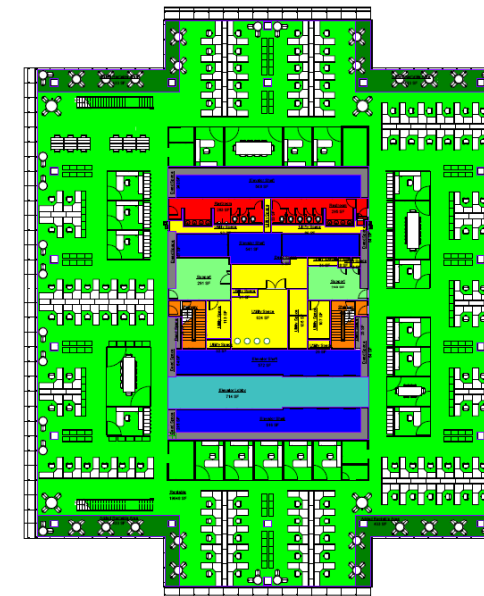


Rentable Area	19285 SF
Not Rentable Area	5964 SF

PROPOSED 5-17

Area Legend

- Added Rentable Area
- Dead Space
- Elevator Lobby
- Elevator Shaft
- Rentable
- Restroom
- Stairway
- Support
- Utility Space



Rentable Area	21289 SF
Not Rentable Area	5826 SF

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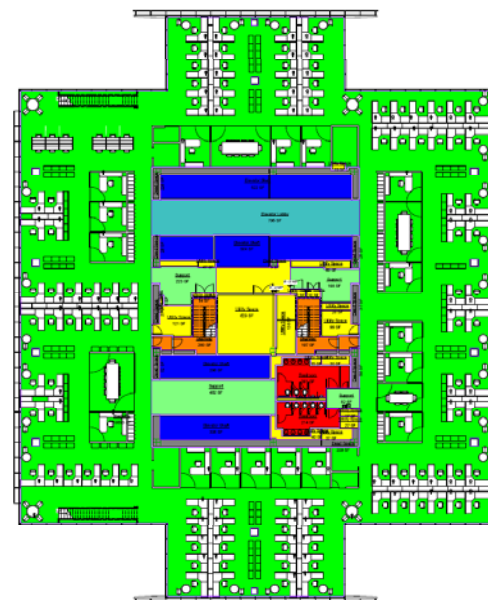
UFAD → DV

CONCLUSIONS

ORIGINAL 18-27

Area Legend

- Dead Space
- Elevator Lobby
- Elevator Shaft
- Rentable
- Restroom
- Stairway
- Support
- Utility Space

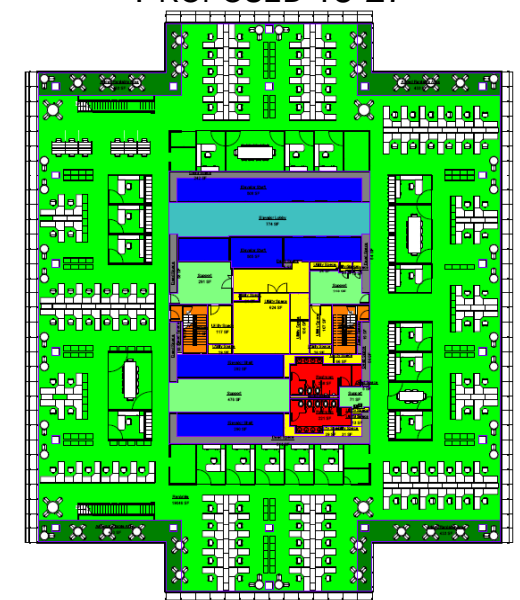


Rentable Area	19678 SF
Not Rentable Area	5431 SF

PROPOSED 18-27

Area Legend

- Added Rentable Area
- Dead Space
- Elevator Lobby
- Elevator Shaft
- Rentable
- Restroom
- Stairway
- Support
- Utility Space



Rentable Area	21835 SF
Not Rentable Area	5280 SF

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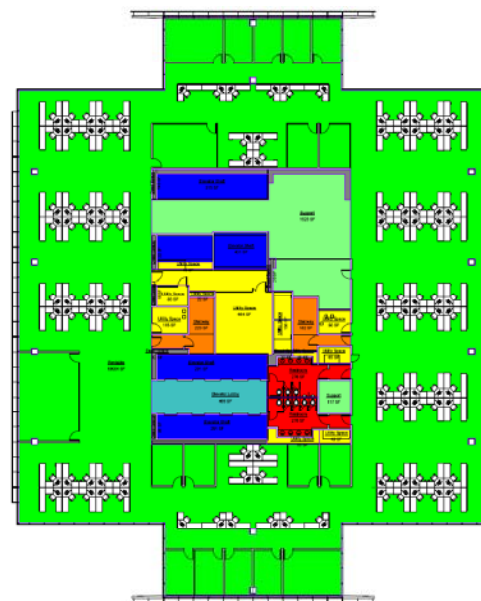
UFAD → DV

CONCLUSIONS

ORIGINAL 29-38

Area Legend

- Dead Space
- Elevator Lobby
- Elevator Shaft
- Rentable
- Restroom
- Stairway
- Support
- Utility Space

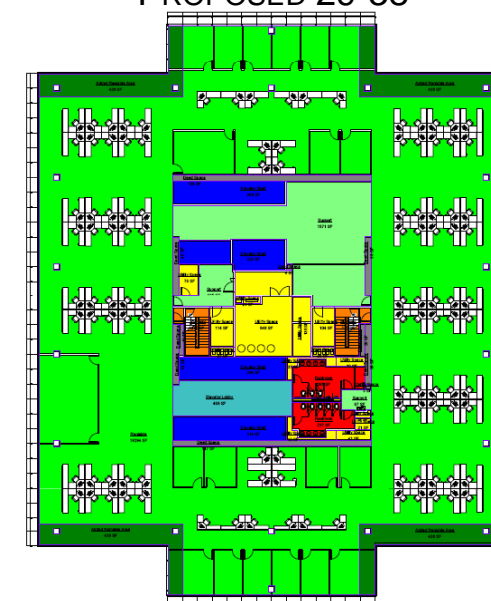


Rentable Area	20726 SF
Not Rentable Area	4410 SF

PROPOSED 29-38

Area Legend

- Added Rentable Area
- Dead Space
- Elevator Lobby
- Elevator Shaft
- Rentable
- Restroom
- Stairway
- Support
- Utility Space



Rentable Area	22975 SF
Not Rentable Area	4265 SF

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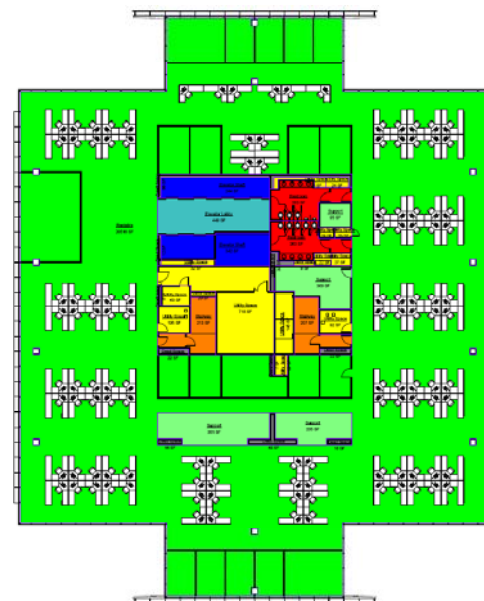
UFAD → DV

CONCLUSIONS

ORIGINAL 39-50

Area Legend

- Dead Space
- Elevator Lobby
- Elevator Shaft
- Rentable
- Restroom
- Stairway
- Support
- Utility Space

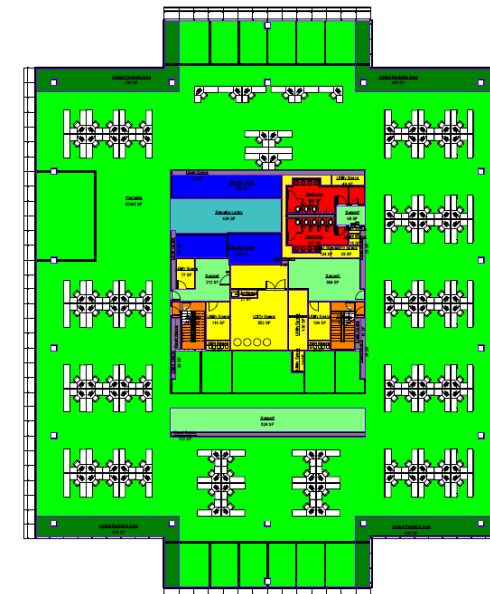


Rentable Area	21516 SF
Not Rentable Area	3620 SF

PROPOSED 39-50

Area Legend

- Added Rentable Area
- Dead Space
- Elevator Lobby
- Elevator Shaft
- Rentable
- Restroom
- Stairway
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- Utility Space



Rentable Area	23558 SF
Not Rentable Area	3604 SF

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RENTAL CHANGES

APPLIED COST DATA TO FCRC SPACES

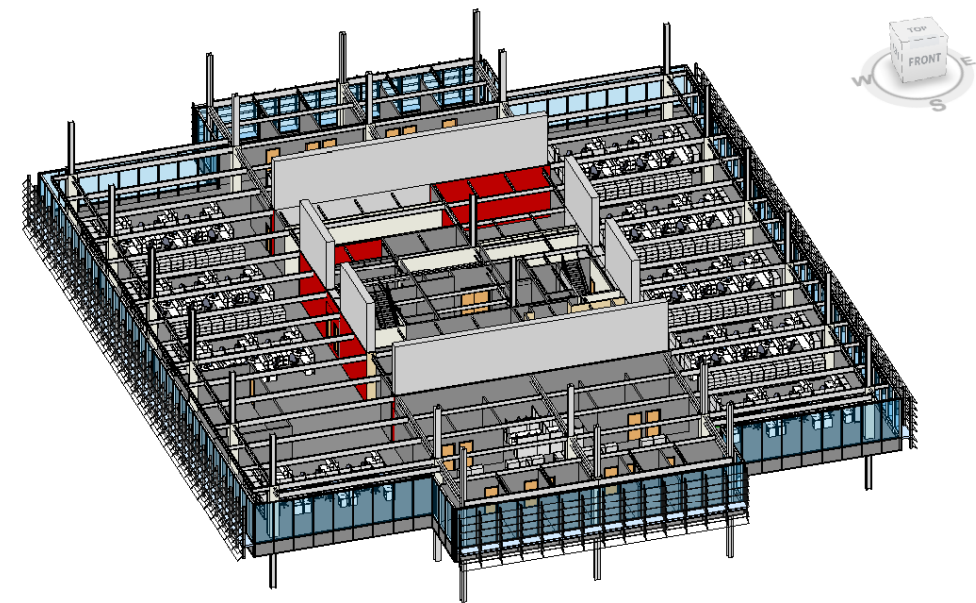
AVG: \$60.58 /FT²/YEAR

ORIGINAL: \$1,279,000 /FLOOR/YEAR

PROPOSED: \$1,409,000 /FLOOR/YEAR

AVERAGE DIFFERENCE: \$130,000 /FLOOR/YEAR

\$2,846,736.54 /Year Additionally



PROPOSED FCRC 32ND FLOOR

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STRUCTURAL REDESIGN OF GRAVITY SYSTEM

ITERATIVE DECK AND BEAM DESIGN

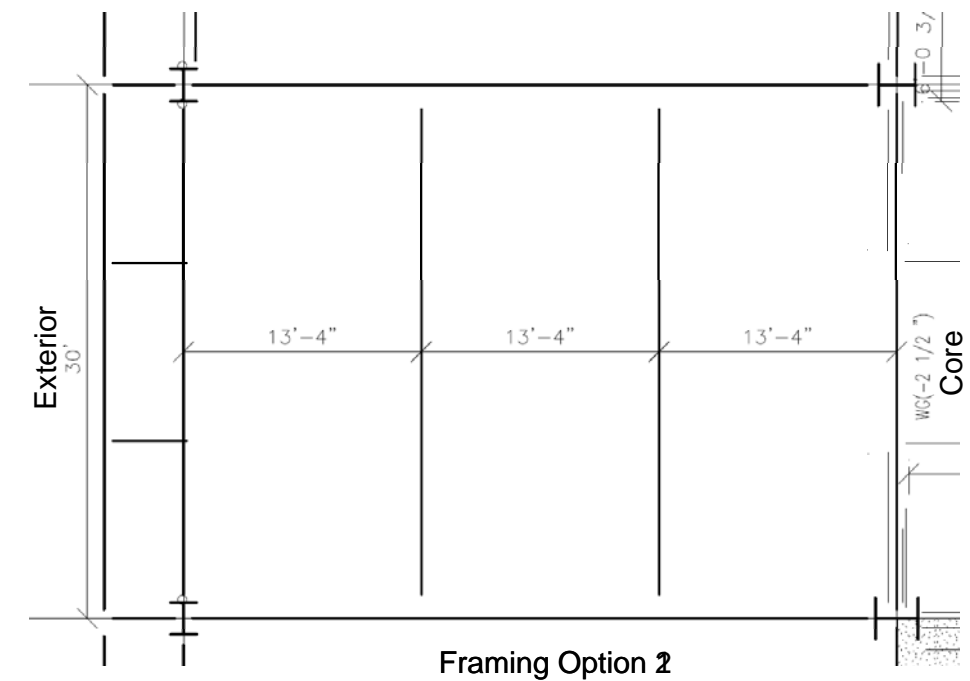
- 14 DIFFERENT SOLUTIONS REDUCED TO ONE POTENTIAL SOLUTION

LS/WF/NW	TS/WF/NW
LS/SB/NW	TS/SB/NW
LS/WF/LW	TS/WF/LW
LS/SB/LW	TS/SB/LW

LS = LONG SPAN DECK & TS = TYPICAL SPAN DECK
 WF = WIDE FLANGE SHAPE & SB = SMARTBEAM
 NW – N.W CONCRETE & LW – L.W. CONCRETE

• SOLUTION?:

- L.W. CONCRETE ON LONG SPAN DECK WITH W-SHAPES



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WALKING EXCITATION ANALYSIS:

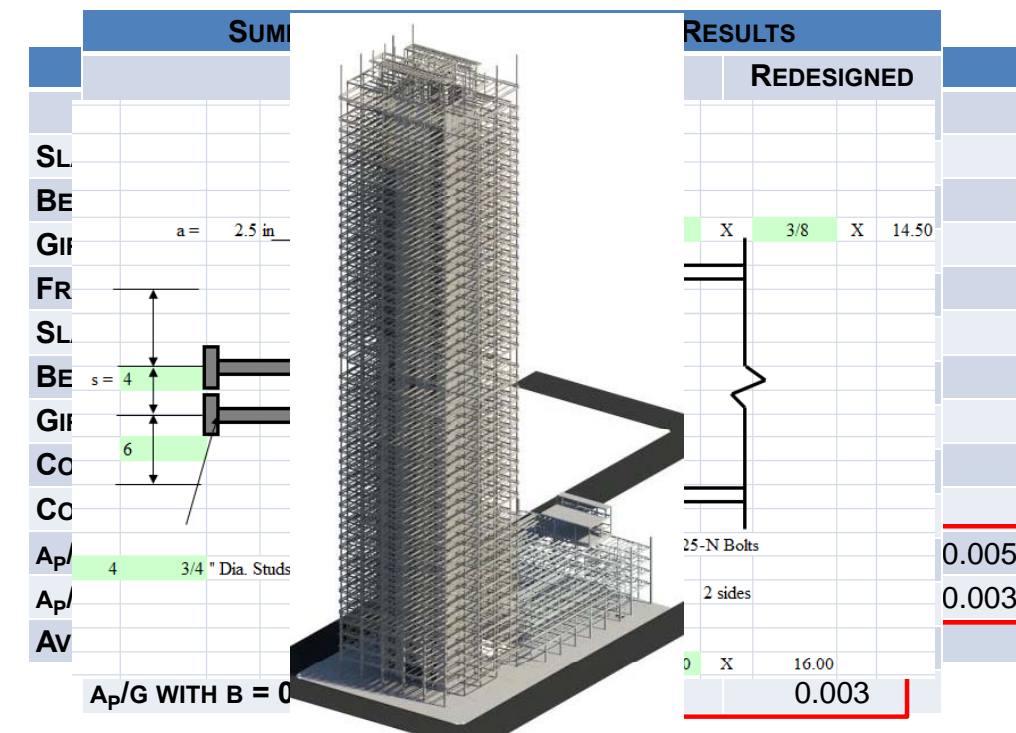
- DESIGN GUIDE 11:
 - BEAM/ JOIST PANEL MODE
 - GIRDER PANEL MODE
- DR. HANAGAN:
 - SLAB PANEL MODE

FINAL DESIGN:

- USE EXISTING FRAMING WITH L.W. CONCRETE
- IMPACTS LATERAL SYSTEM AND FOUNDATIONS

STEEL TO CONCRETE CONNECTION:

- SINGLE ANGLE WITH SLOTTED BOLT HOLES WELDED TO AN EMBEDDED PLATE



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INTERIOR LIGHTING DESIGN

DESIGN CRITERIA

30 FC

1.1W/FT²

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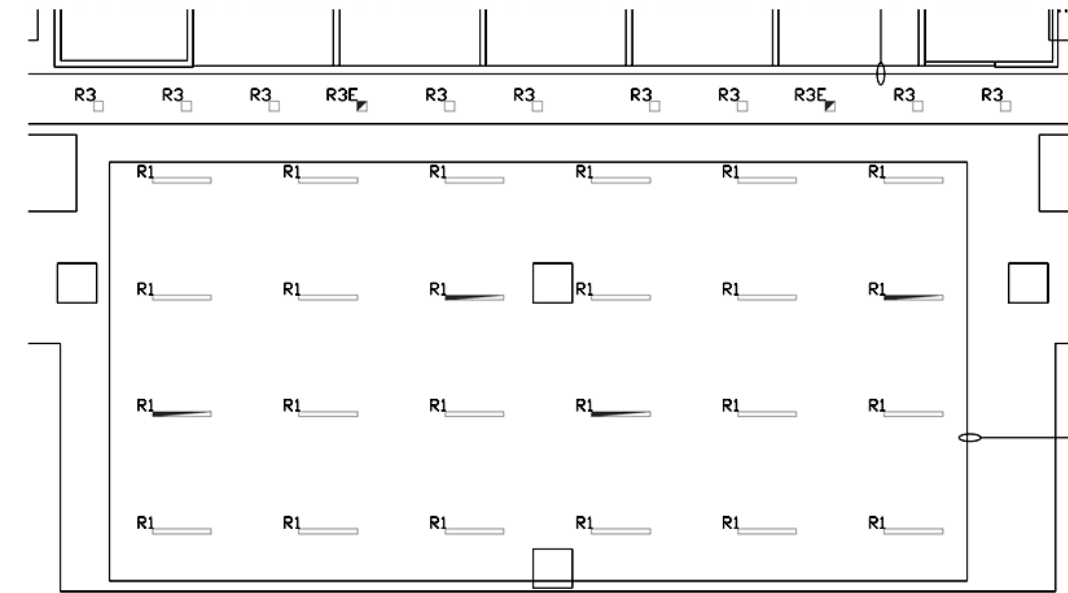
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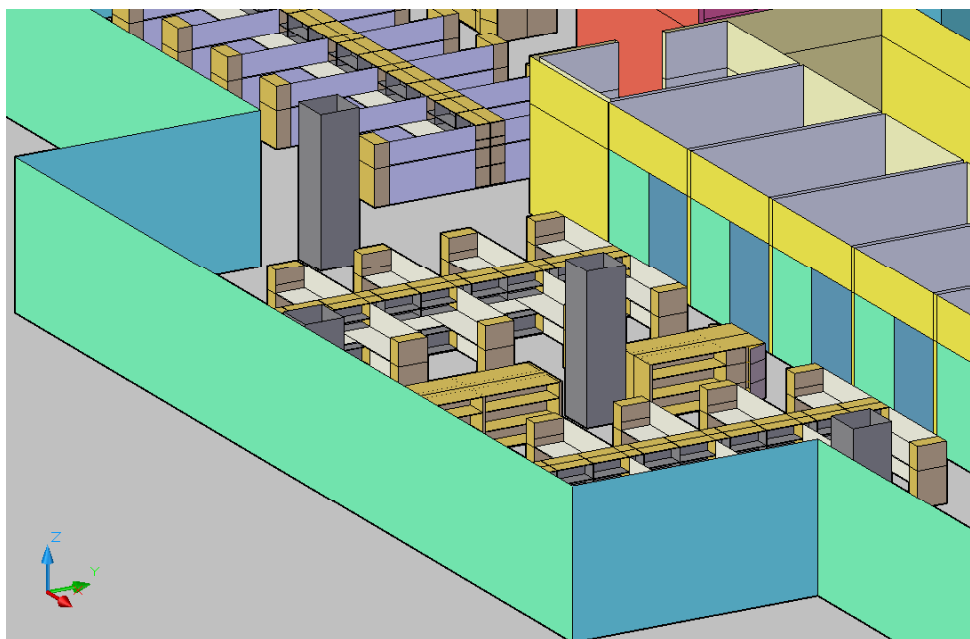
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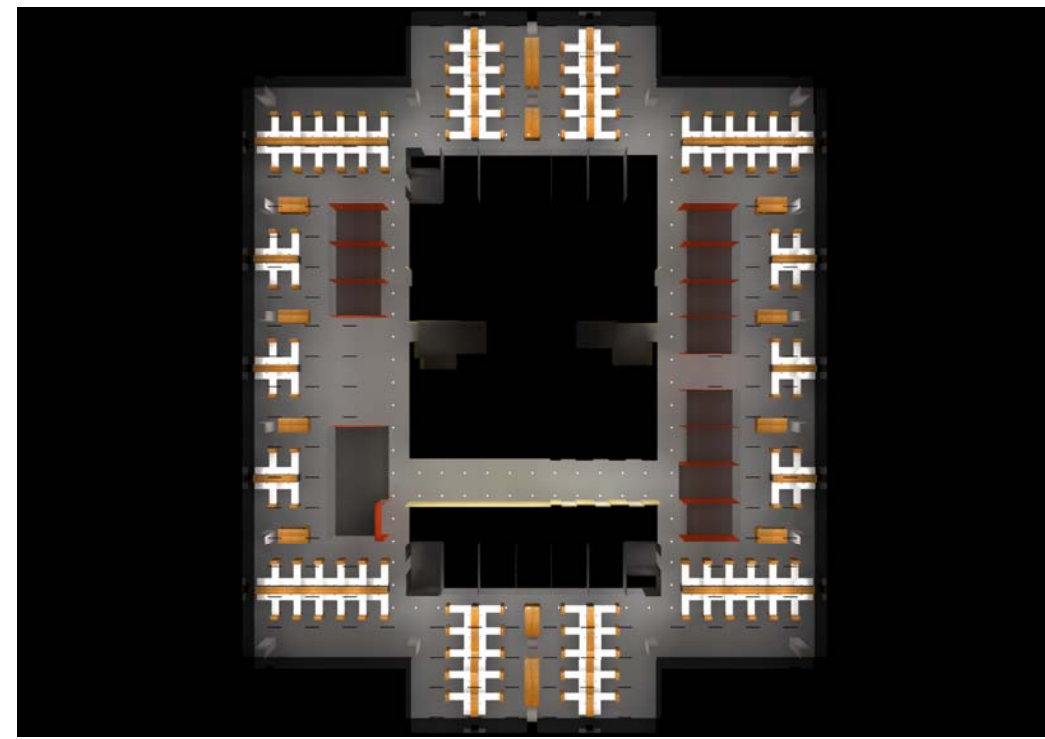
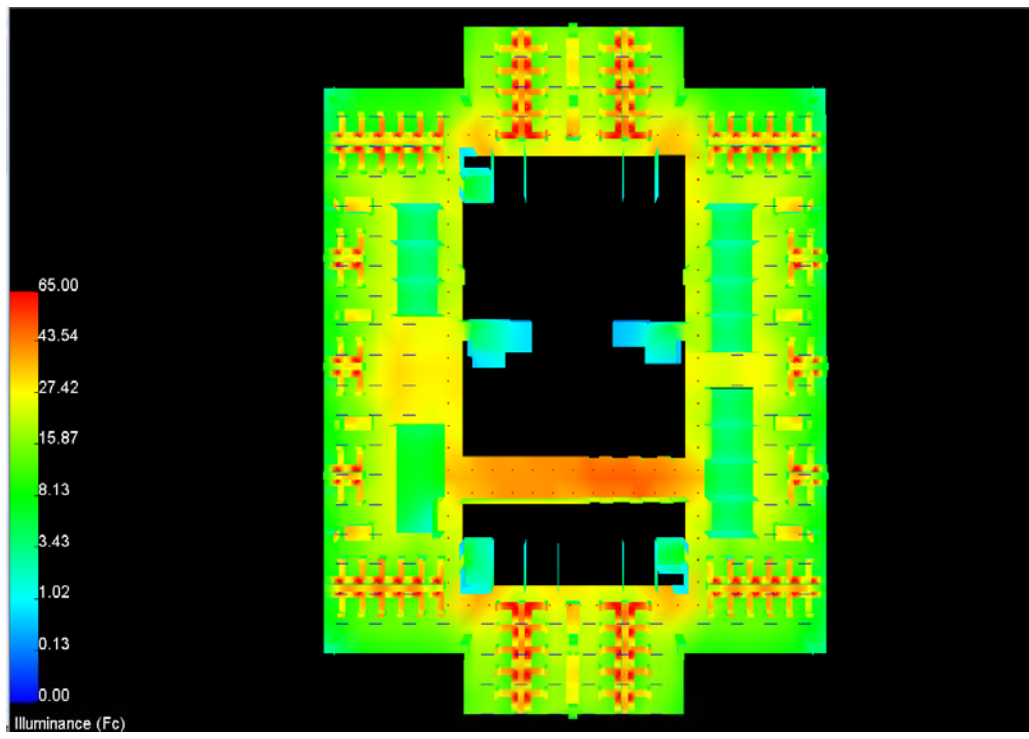
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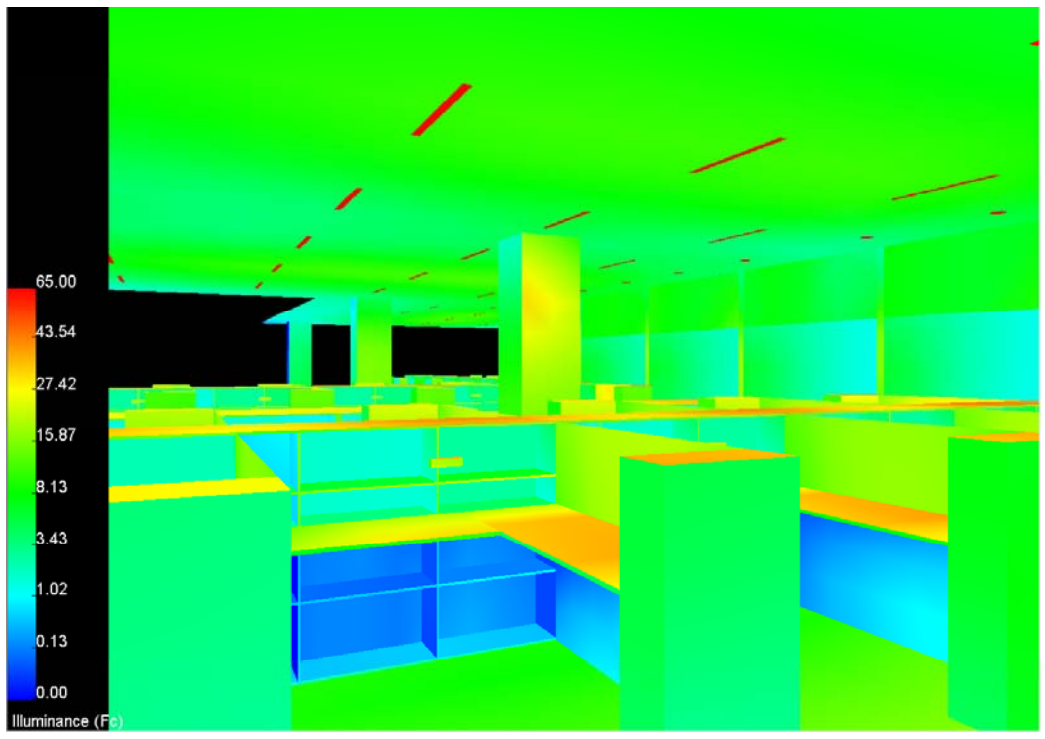
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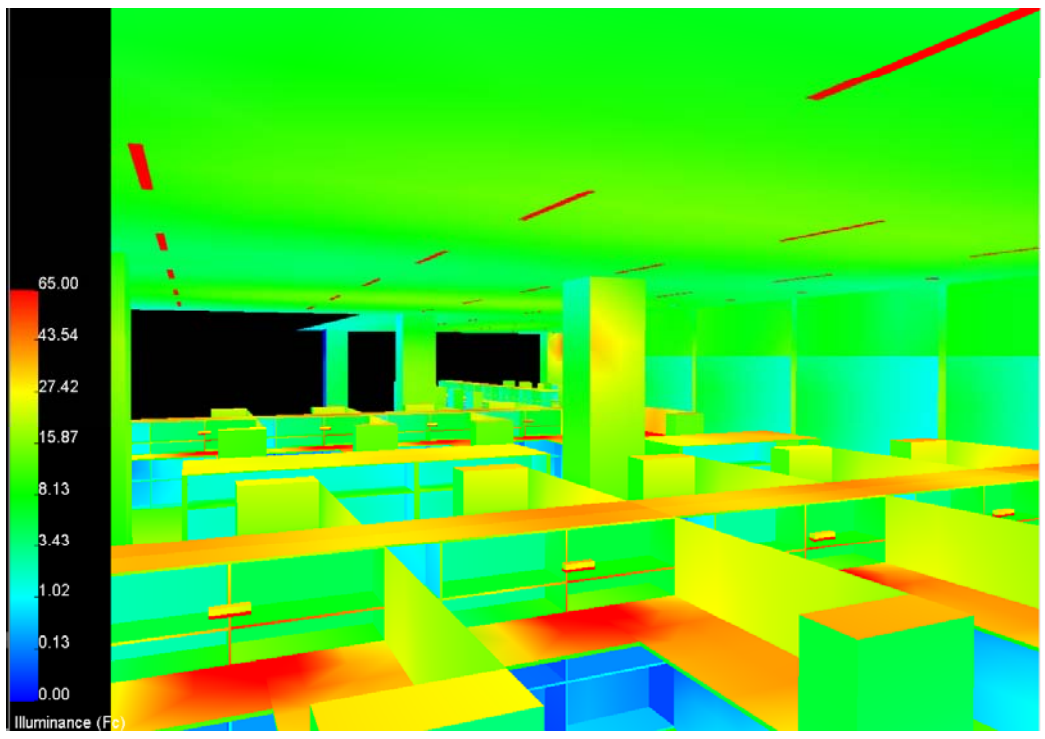
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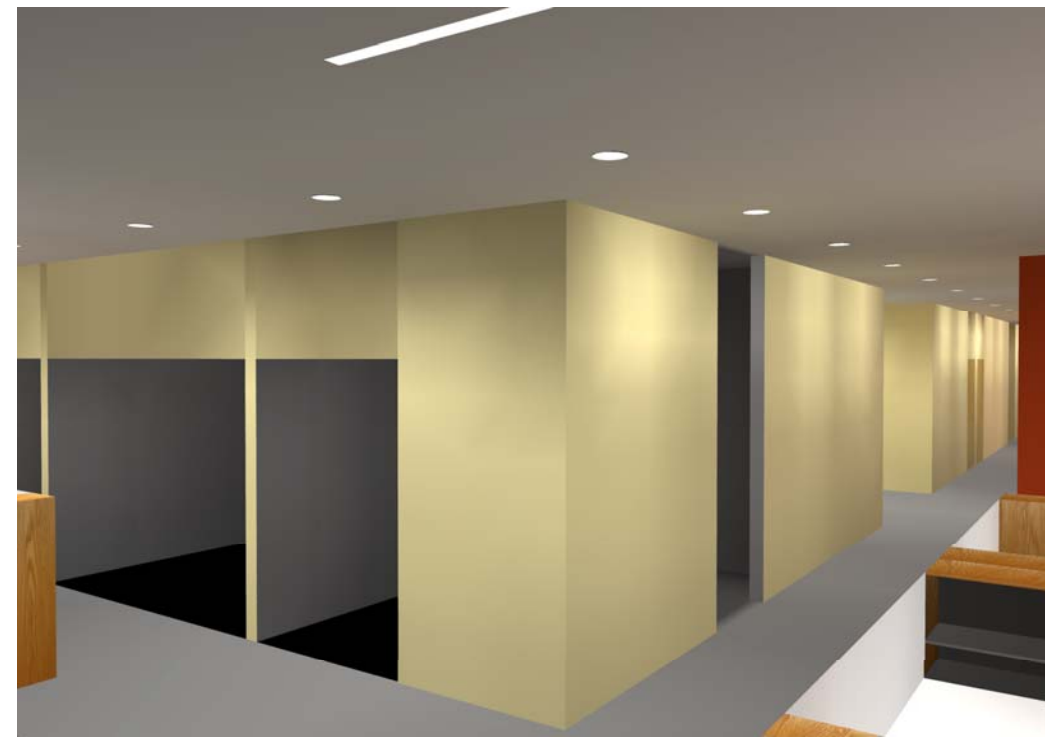
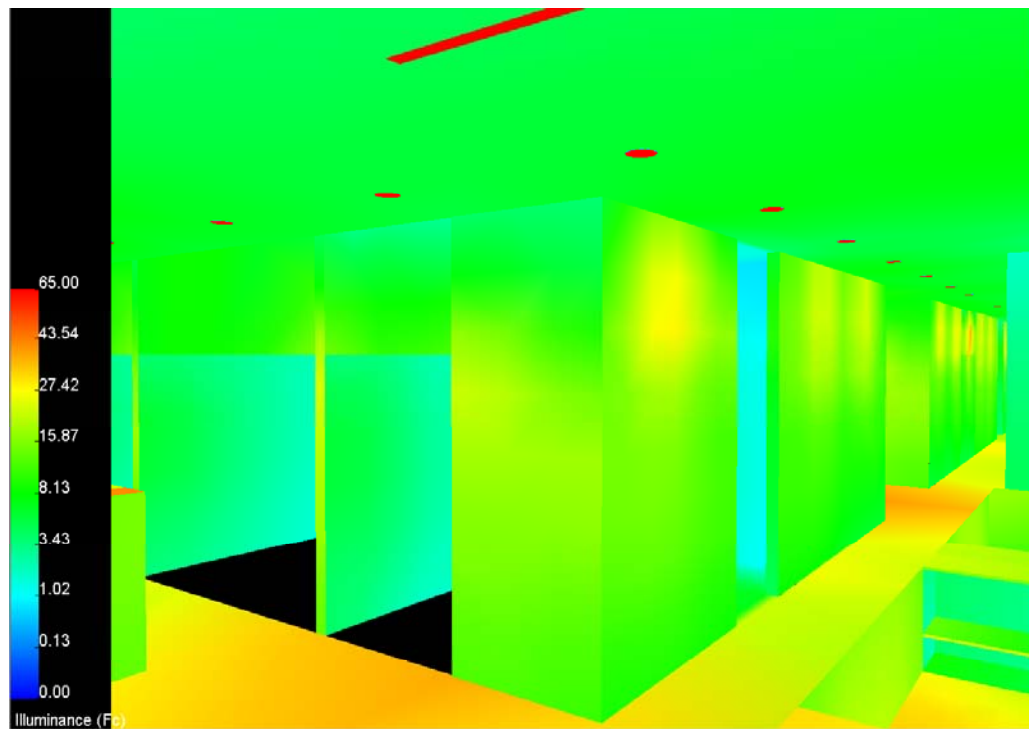
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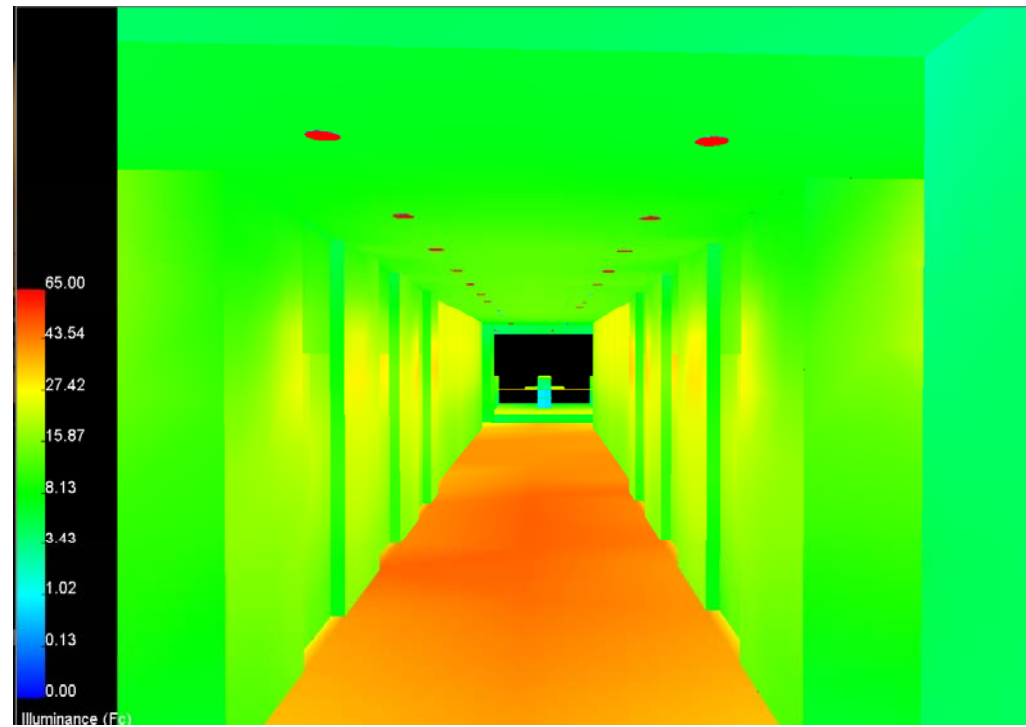
ARCHITECTURAL LAYOUT

GRAVITY SYSTEM

INTERIOR LIGHTING

UFAD → DV

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INTERIOR LIGHTING DESIGN SUMMARY

<u>Design Summary</u>	Original Design	Design Criteria	Proposed Redesign
Target Illuminance (fc)	50	30	30
Lighting Power Density (W/ft ²)	1.07	1.1	0.469
Energy Savings (\$/ft ² /year)	\$0.02	-	\$0.41
Total Energy Savings (\$/year)	\$21,976.65	-	\$462,242.21

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AIR DISTRIBUTION REDESIGN

OBJECTIVES:

IMPROVE UPON INDOOR ENVIRONMENTAL QUALITY FOR BUILDING OCCUPANTS

ACCESS BIM TOOLS FOR MECHANICAL SYSTEM DESIGN AND COORDINATION

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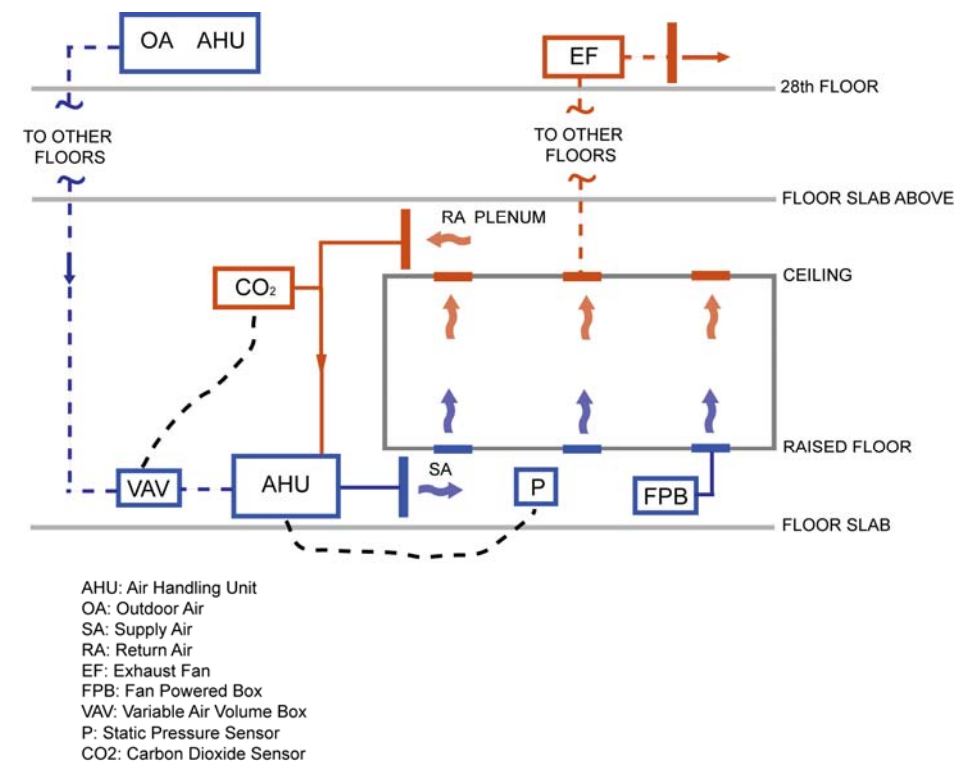
GRAVITY SYSTEM

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EXISTING UNDERFLOOR AIR DISTRIBUTION SYSTEM (UFAD)



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PROPOSED DISPLACEMENT VENTILATION (DV) SYSTEM

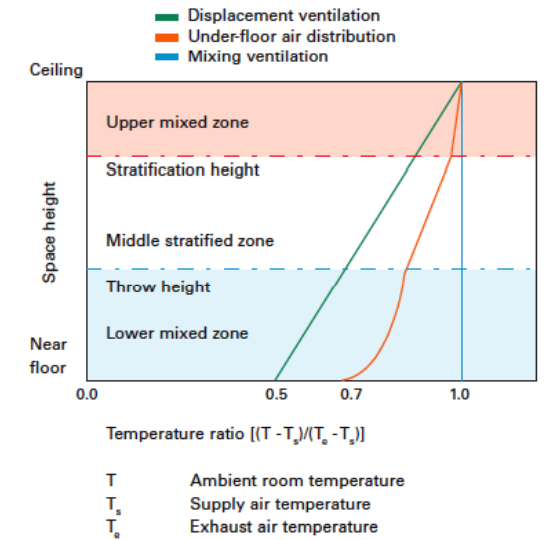
Ducted System
More effective stratification

Original design intent satisfied ✓

High-profile sustainability
Cost-effectiveness
Raised-floor



Temperature Profile Comparison



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DESIGN OF DV SYSTEM

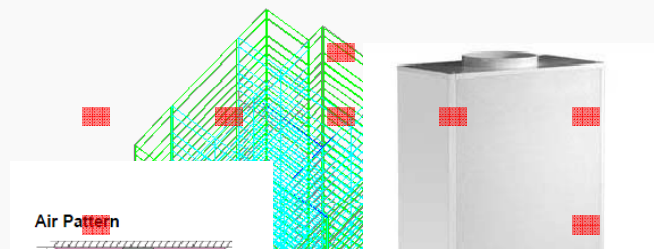
IES VE COOLING LOAD DETERMINATION - TYPICAL OFFICE FLOOR LOADS

APPLICATION OF ASHRAE LOAD FACTORS FOR A DV SYSTEM

DIFFUSER SELECTION – PRICE HVAC FLOOR MOUNTED THREE-WAY DIFFUSER

ARCHITECTURAL INTEGRATION

LAYOUT, SIZING & DESIGN



	Load Factors	Load Type
Q_{oe} (Btu/h)	0.295	Occupants, Desk Lamps & Equipment
Q_l (Btu/h)	0.132	Overhead Lighting
Q_{ex} (Btu/h)	0.185	Heat Conduction through the Room Envelope and Transmitted Solar Radiation
Q_{total} (Btu/h)		Total Cooling Load

Zone	DF-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	23	11	20	14	28
Zone 2 - W Perimeter Open Office	DF-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	23	11	20	14	28
Zone 3 - N Perimeter Open Office	DF-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	23	11	20	14	28
Zone 4 - E Perimeter Open Office	DF-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	23	11	20	14	28
Zone 5 - S Perimeter Open Office	DF-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	23	11	20	14	28
Zone 5 - SE Perimeter Open Office	DF-3 Series	1	24 x 48 x 13	16 x 8	30	475	0.06	0.02	---	10	20	14	28
Zone 6 - SW Perimeter Open Office	DF-3 Series	1	24 x 48 x 13	16 x 8	30	475	0.06	0.02	---	10	20	14	28
Zone 7 - NE Perimeter Open Office	DF-3 Series	1	24 x 48 x 13	16 x 8	30	475	0.06	0.02	---	10	20	14	28
Zone 8 - Enclosed Offices	DF-3 Series	18	24 x 24 x 13	10	20	155	---	---	---	7	14	10	22
Zone 9 - Conference	DF-3 Series	3	24 x 24 x 13	10	20	155	---	---	---	7	14	10	22

Load factors determined by ASHRAE RP-949.

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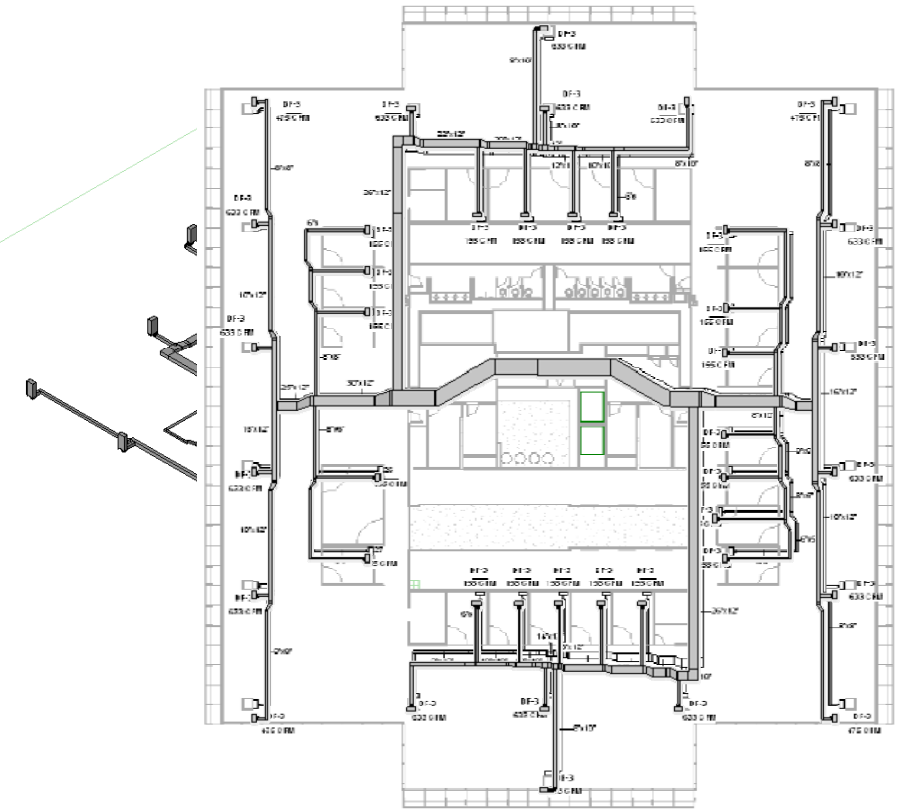
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CONCLUSIONS

Tenant Goals	Achieved Goal	Reduced Payback Period	Increase Occupant Comfort
<ul style="list-style-type: none"> ✓ Yes ✗ No - Non-Applicable 			
Structural			
Reduce Quantity of Structural Members	✗	-	-
Accurate Revit Model Creation	✓	-	-
Create a RAM Model to Aid in Design	✓	-	-
Design a Constructable Concrete-Steel Connection	✓	-	-
Lighting/Electrical			
Design a Task Ambient Lighting System	✓	✓	✓
Decrease Lighting Energy Consumption	✓	✓	-
Share Lighting Power Density with Mechanical Loads	✓	-	-
Mechanical			
Design Displacement Ventilation System	✓	-	✓
Model system in Revit MEP	✓	-	-
Construction			
Decrease Construction Cost	✓	✓	-
Maintained Architect's Vision	✓	-	-
Shorten/Maintain Construction Schedule	✓	-	-
Use Revit Model for Take-off	✓	-	-
Increase Profitability to FCRC	✓	✓	-

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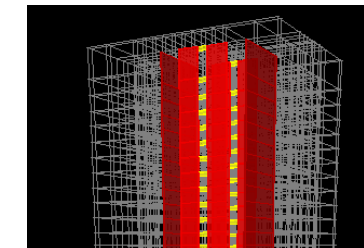
CORE REDESIGN

STRUCTURE

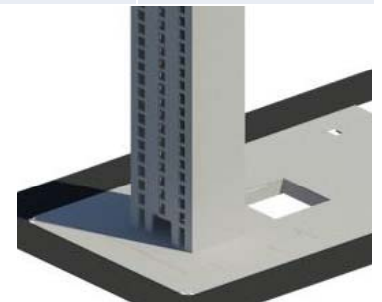
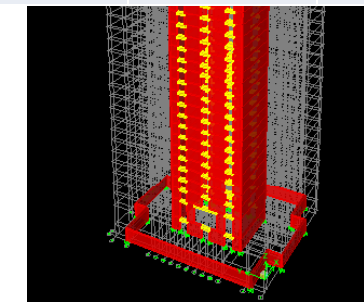
- ARCHITECTURE
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STRUCTURAL REDESIGN OF THE CORE

- CHANGED FROM STEEL BRACED FRAME TO CONCRETE SHEAR WALLS
- MODELS
 - ETABS
 - REVIT
- LATERAL LOADS DETERMINED FROM:
 - WIND:
 - TT WIND TUNNEL TEST
 - 1968 NYC BUILDING CODE
 - METHOD 2 OF ASCE 7-05
 - SEISMIC:
 - ELF METHOD OF ASCE 7-05
- WIND GOVERNED FOR STRENGTH AND SERVICEABILITY



Lateral Base Shear Design Summary				
Variable	TT Wind Tunnel Test	1968 NYCBC	ASCE 7-05	Thesis "Wind Tunnel Test"
V_{NS}	3450 kips	4075 kips	8995 kips	3968 kips
V_{WE}	2850 kips	3297 kips	7001 kips	3278 kips
I	1.0	1.0	1.15	1.15



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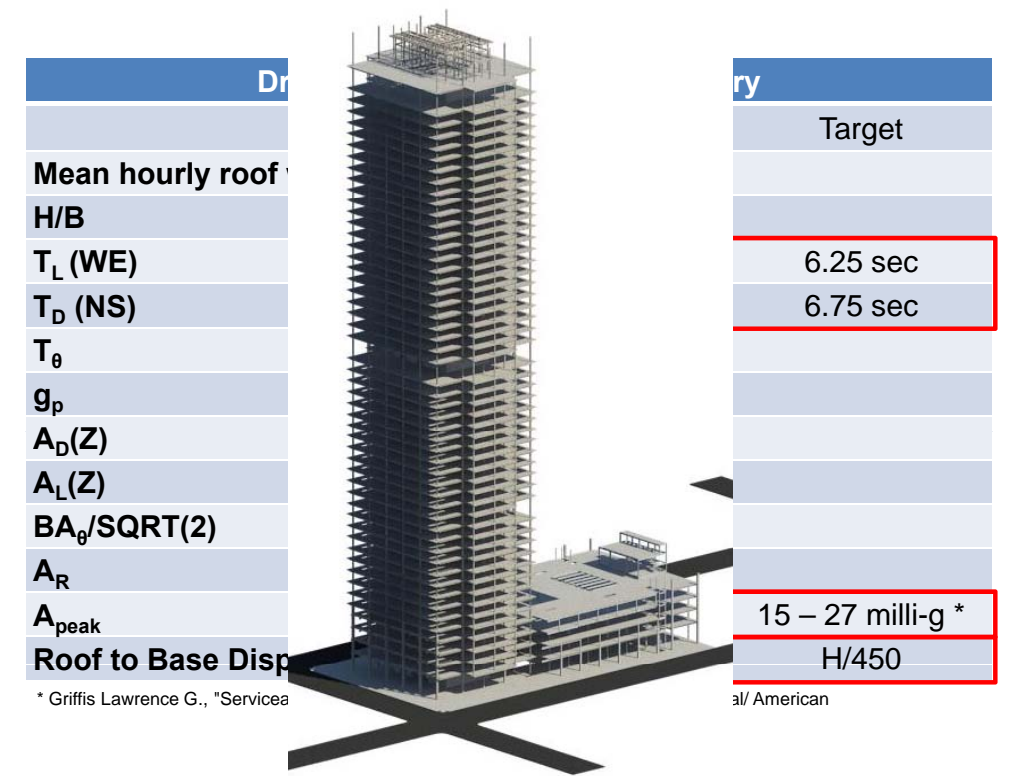
CORE REDESIGN

- STRUCTURE**
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STRUCTURAL REDESIGN OF THE CORE

FINAL DESIGN:

- **ELIMINATED FLOOR:**
 - 1,000 BEAMS
 - 20 BRACED SHEAR WALLS
 - 30X44 COUPLING BEAMS, 10FT LONG (TYP.)
- **31ST – 40TH FLOOR:**
 - 8,000 PSI
 - 24" THICK SHEAR WALLS
 - 24X44 COUPLING BEAMS, 10FT LONG (TYP.)
- **41ST – 52ND FLOOR:**
 - 6,000 PSI
 - 18" THICK SHEAR WALLS
 - 18X44 COUPLING BEAMS, 10FT LONG (TYP.)



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ARCHITECTURAL REDESIGN OF CORE

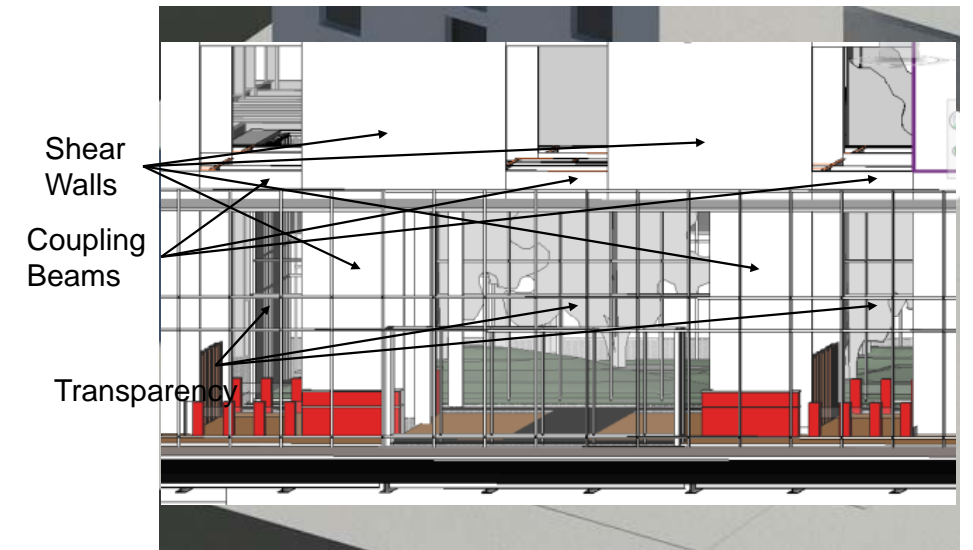
ARCHITECTURAL DESIRES:

- OPENNESS
- TRANSPARENCY

STRUCTURAL NEEDS:

- LATERAL STRENGTH

SOLUTION MAINTAINED ARCHITECT'S VISION



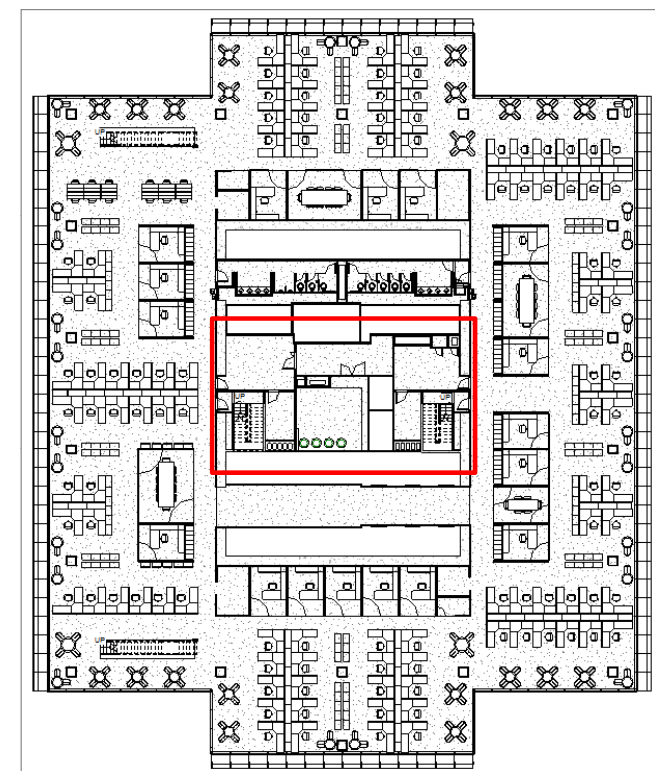
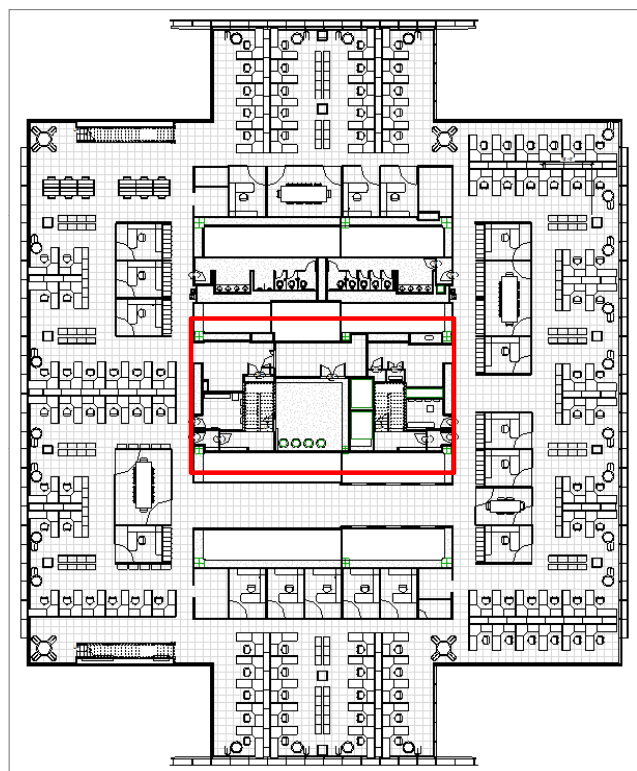
Revit model

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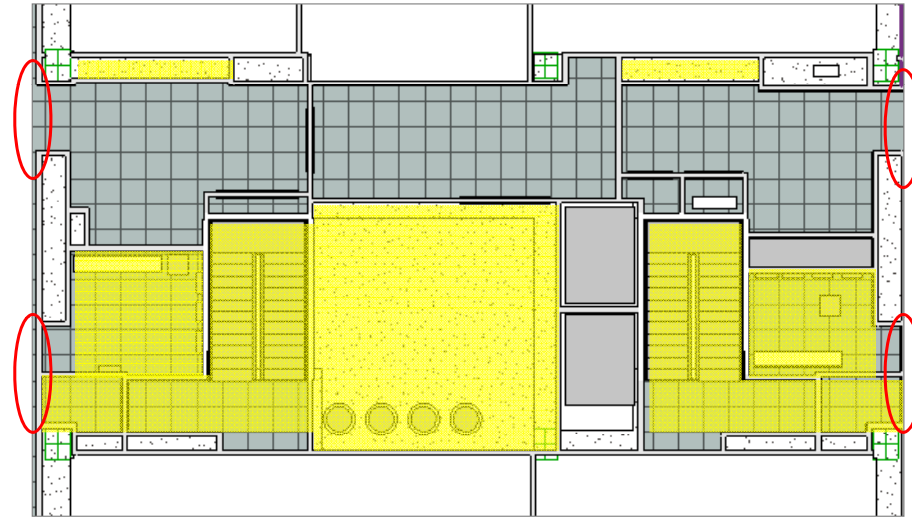
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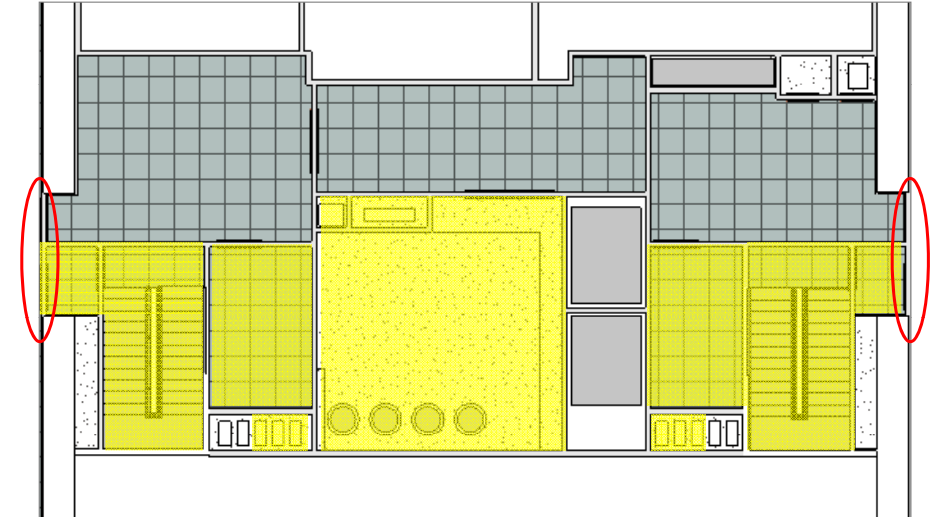
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ORIGINAL



PROPOSED



ACCURATE CORES

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(4) 500 MCM CONDUCTORS PER 3.5" CONDUIT
(6) FEEDERS TO MECHANICAL ROOMS

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13.85714286	2 -	5
	Length/#	Mat Cost and Labor
Conduit	189.2857143	\$53.30
Conductor	757.1428571	\$21.45
	Total	\$26,329.64 \$0.00
	G Total	\$26,329.64

13.85714286	2 -	5	6 -	9	10 -	13	14 -	17
	Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor
Conduit	189.2857143	\$53.30	244.7143	\$53.30	300.1429	\$53.30	355.5714	\$53.30
Conductor	757.1428571	\$21.45	978.8571	\$21.45	1200.571	\$21.45	1422.286	\$21.45
Total	\$26,329.64	\$0.00	Total	\$34,039.76	\$0.00	Total	\$41,749.87	\$0.00
G Total	\$26,329.64		G Total	\$34,039.76		G Total	\$41,749.87	\$0.00
Total Cost	\$344,292.37							

18 -	21	22 -	25	26 -	28
Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor
411	\$53.30	466.4286	\$53.30	508	\$53.30
1644	\$21.45	1865.714	\$21.45	2032	\$21.45
Total	\$57,170.10	\$0.00	Total	\$64,880.21	\$0.00
G Total	\$57,170.10		G Total	\$64,880.21	\$0.00



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(4) 500 MCM CONDUCTORS PER 3.5" CONDUIT
(9) FEEDERS TO ELECTRICAL ROOMS/SIDE

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13.85714286	2	-	4
	Length/#	Mat Cost and Labor	
Conduit	350.8571429	\$53.30	
Conductor	1403.428571	\$21.45	
	Total	\$48,804.23	\$0.00
	G Total	\$48,804.23	

13.85714286	2	4	5	7	8	10	11	13	14	16
Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#
Conduit	350.8571429 \$53.30	434 \$53.30	517.1429 \$53.30	600.2857 \$53.30	683.4286 \$53.30					
Conductor	1403.428571 \$21.45	1736 \$21.45	2068.571 \$21.45	2401.143 \$21.45	2733.714 \$21.45					
Total	\$48,804.23 \$0.00	\$60,369.40 \$0.00	\$71,934.57 \$0.00	\$83,499.74 \$0.00	\$95,064.91 \$0.00					
G Total	\$48,804.23	\$60,369.40	\$71,934.57	\$83,499.74	\$95,064.91					
Total Cost	\$855,584.23									

17	19	20	22	23	25	26
Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#	Mat Cost and Labor	Length/#
766.5714 \$53.30	849.7143 \$53.30	932.8571 \$53.30	1016 \$53.30	1064 \$53.30	1147.143 \$53.30	1229.286 \$53.30
3066.286 \$21.45	3398.857 \$21.45	3731.429 \$21.45	4064 \$21.45	4400 \$21.45	4732.571 \$21.45	5065.143 \$21.45
Total	\$106,630.09 \$0.00	\$118,195.26 \$0.00	\$129,760.43 \$0.00	\$141,325.60 \$0.00	\$152,890.77 \$0.00	\$164,455.94 \$0.00
G Total	\$106,630.09	\$118,195.26	\$129,760.43	\$141,325.60	\$152,890.77	\$164,455.94
Lighting	Mechanical					
\$855,584.23	\$344,292.37					
Total Cost	\$1,199,876.60					

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System Choice	
(1) 1600 Amp Sets & (1) 2500 Amp	
Total Cost	\$1,754,285.00

	1600 Amps			2500 Amp		
	1 Set			1 Set per side		
	1-28			1-28		
	Length/#	Mat Cost	Lab Cost	Length/#	Mat Cost	Lab Cost
Plugin	388	\$624.00		388	\$923.00	
Feeder	120	\$598.00		120	\$910.00	
90 L/R	3	\$3,380.00		3	\$4,387.50	
90 U/D	2	\$3,380.00		2	\$4,387.50	
Taps	28	\$4,192.50		28	\$5,850.00	
Total		\$448,162.00		Total	\$653,061.50	

System Choice	
(1) 1600 Amp Sets & (1) 2500 Amp	
Total Cost	\$1,754,285.00

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BUS DUCT ANALYSIS

NEGATIVES
INCREASED COST
\$1,200,000 → \$1,800,000

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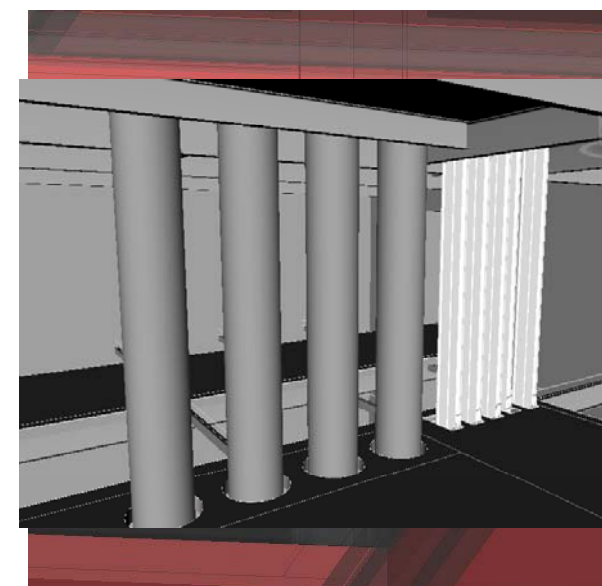
- STRUCTURE
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BUS DUCT ANALYSIS

- BENEFITS
- FUTURE EXPANSION CAPABILITIES
- DECREASED SPACE REQUIRED PER FLOOR



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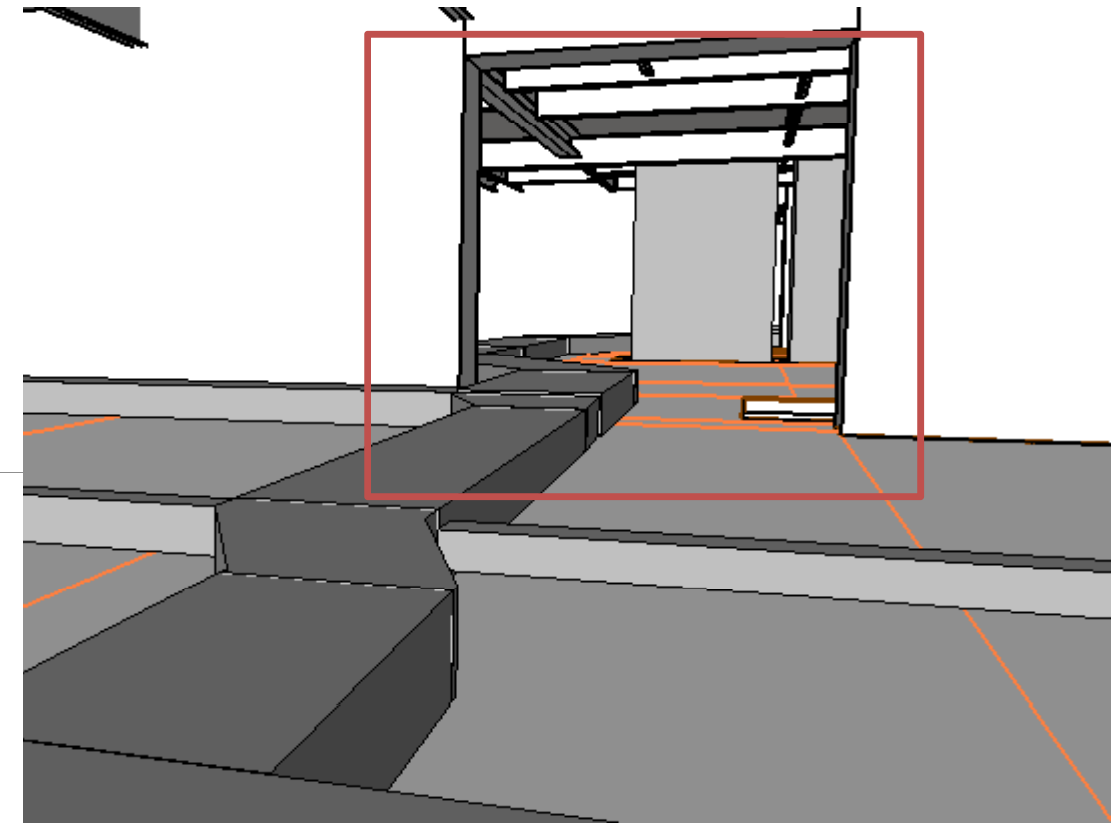
- CONSTRUCTION IMPLICATIONS
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OBJECTIVES

MAINTAIN ADEQUATE SPACE FOR THE AIR HIGHWAY RUNNING THROUGH CORE

INSERT AIR DISTRIBUTION DUCTWORK INTO BIM MODEL, RUN CLASH DETECTION

REVIT MEP → NAVISWORKS



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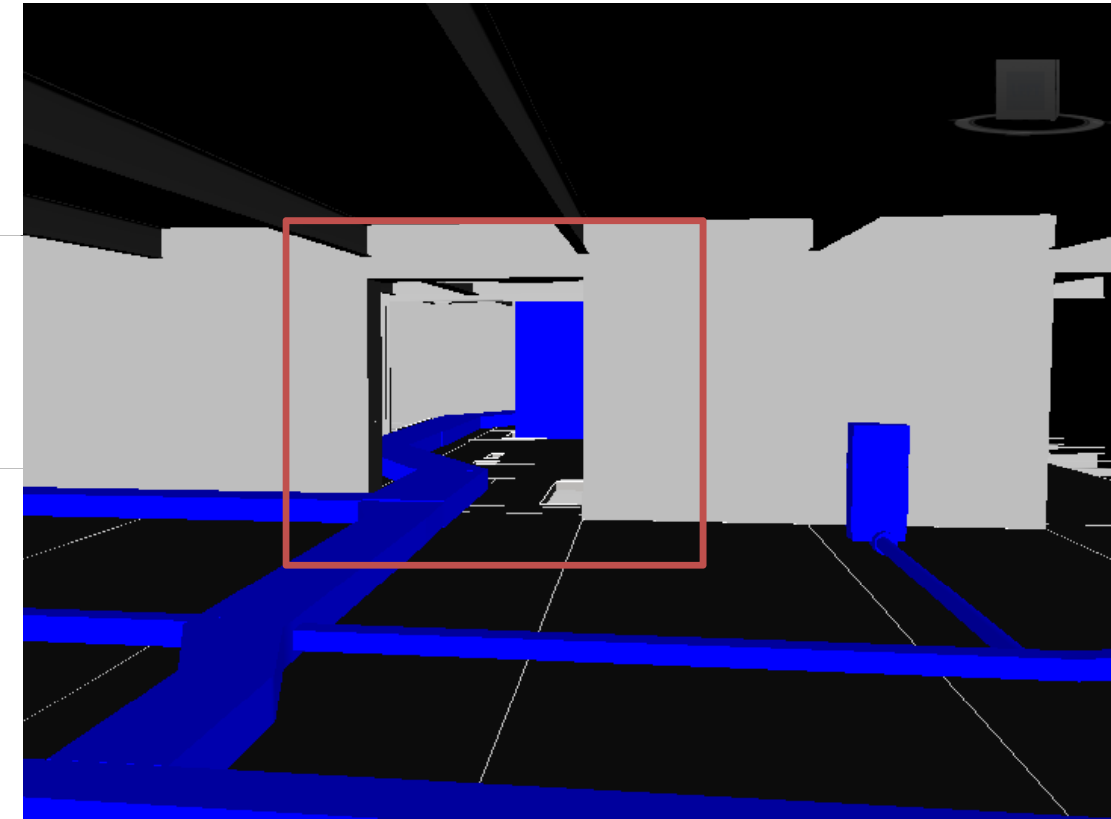
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DIFFERENCES

STEEL

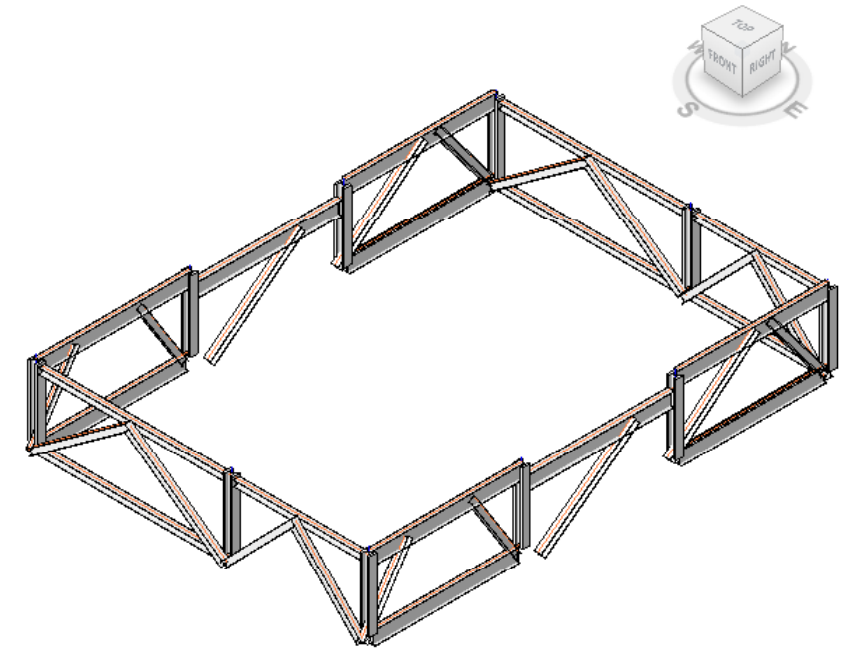
- BUILT UP COLUMNS
- LARGE FRAMING MEMBERS
- OUTRIGGER SYSTEM IN PLACE

CONCRETE

- 30" – 24" – 18" THICKNESS
- 44" DEEP COUPLING BEAMS

DIFFERENCE

- CONCRETE TAKES UP PLACE OF FRAMING
- ADDITIONAL SAVINGS FROM OTHER REDUCTIONS
- EXTERIOR COLUMN "KNUCKLES" ELIMINATED
- X-BRACING ELIMINATED
- OUTRIGGERS ELIMINATED



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USING MODEL

ACQUIRE STRUCTURAL MODEL

MODEL GENERATED AND ANALYZED

UPDATED IN REVIT STRUCTURES

GENERATE SCHEDULES OF STRUCTURE

“MARK” STEEL MEMBERS DISPLACED BY CONCRETE

STRUCTURAL FRAMING AND COLUMN SCHEDULES

APPLY COST DATA

R.S.MEANS CONSTRUCTION DATA APPLIED TO TAKE-OFFS

COULD BE UPDATED WITH CHANGES TO STRUCTURE

UPDATE AND COMPARE SCHEDULES

CONSTRUCTION SCHEDULE CHANGES UPDATED FOR NEW CORE SYSTEM

COMPARED TO ORIGINAL TO REMAIN ON SCHEDULE

Concrete Shear Wall Schedule								
Family and Type	Volume	Area	Length	Structural Usage				
590 62: 2	1181.25	472	20					
650 00								
Basic Wat Wall 30"	18200.00	7280	560	Shear				
650 00: 28	18200.00	7280	560					
700 00								
Basic Wat Wall 30"	44800.00	17920	1280	Shear				
700 00: 64	44800.00	17920	1280					
731 25								
Basic Wat Wall 30"	2924.99	1170	40	Shear				
731 25: 4	2924.99	1170	40					
750 00								
Basic Wat Wall 30"	9000.00	3600	240	Shear				
750 00: 12	9000.00	3600	240					
759 37								
Basic Wat Wall 30"	1518.74	607	20	Shear				
759 37: 2	1518.74	607	20					
800 00								
Basic Wat Wall 30"	3200.00	1280	80	Shear				
Summary								
9th Floor Total	\$ 554,437.37	\$ 4,180.79	\$ 2,099.62	\$ 560,717.77	\$ 609,797.04	\$ 7,190.38	\$ 2,308.91	\$ 610,296.26
Building Total	\$ 31,045,492.72	\$ 734,124.24	\$ 117,578.72	\$ 31,400,195.12	\$ 34,145,634.24	\$ 402,661.28	\$ 129,795.96	\$ 34,680,590.56

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FINDINGS

STRUCTURAL STEEL CORE COST
 ENTIRE TOWER: \$34,680,590.56

STRUCTURAL CONCRETE CORE COST
 ENTIRE TOWER: \$14,816,240.03

	Ext. Mat.	Ext. Labor	Ext. Equip.	Ext. Total	Ext. Mat. O&P	Ext. Labor O&P	Ext. Equip. O&P	Ext. Total O&P
8th Floor Total	\$ 554,437.37	\$ 4,180.79	\$ 2,099.62	\$ 560,717.77	\$ 609,797.04	\$ 7,190.38	\$ 2,308.91	\$ 619,296.26
Building Total	\$ 31,048,492.72	\$ 234,124.24	\$ 117,578.72	\$ 31,400,195.12	\$ 34,148,634.24	\$ 402,661.28	\$ 129,898.96	\$ 34,680,590.56

\$ 34,680,590.56

	Ext. Mat.	Ext. Labor	Ext. Equip.	Ext. Total	Ext. Mat. O&P	Ext. Labor O&P	Ext. Equip. O&P	Ext. Total O&P
Building Total	\$ 8,855,631.75	\$ 3,276,027.75	\$ 33,794.34	\$ 11,955,388.88	\$ 9,789,884.20	\$ 5,220,710.12	\$ 30,270.10	\$ 14,816,240.03

\$ 14,816,240.03

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SCHEDULE CHANGES

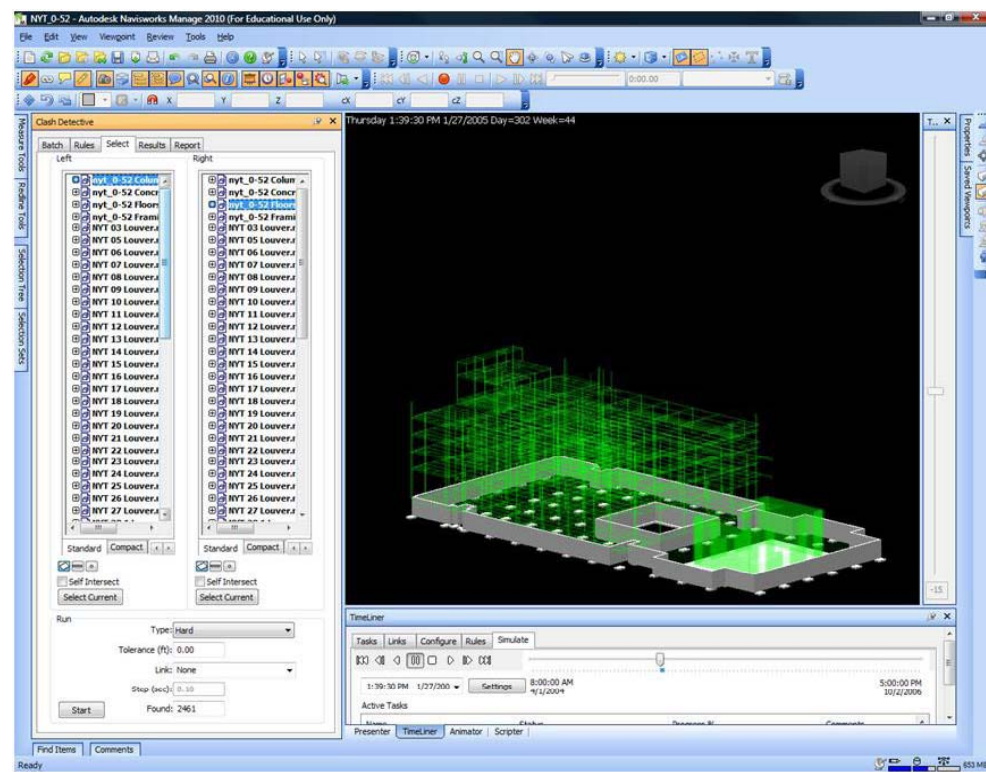
2 MONTH EARLIER START FOR TOWER

2 MONTH LONGER CRANE DURATION

APPROX. \$60,000.00 FOR CRANES AND CREW INCREASE

TEMPORARY HEAT FOR CORE DURING WINTER MONTHS

ADDITIONAL \$3,000,000.00 FOR TEMPORARY HEAT



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Core Goals			
	Achieved Goal	Reduced Payback Period	Increase Occupant Comfort
✓ Yes ✗ No - Non-Applicable			
Structural			
Eliminate Outriggers	✓	✓	-
Eliminate X-Bracing	✓	✓	-
Concrete Only Core	✓	✓	✓
Accurate Revit Model Creation	✓	-	-
Create ETABS Model to Maintain Dynamic Properties	✓	-	-
Lighting/Electrical			
Reduce Vertical Distribution Space Requirements	✓	✗	-
Accurate Revit Model Creation	✓	-	-
Clash Detection through Core	✓	-	-
Mechanical			
Accurate Revit MEP Model Creation	✓	-	-
Reduce penetrations and clashes with core structure	✓	-	-
Construction			
Decrease Construction Cost	✓	✓	-
Maintained Architect's Vision	✓	-	-
Shorten/Maintain Construction Schedule	✓	-	-
Use Revit Model for Take-off	✓	-	-

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ARCHITECTURAL PRECEDENTS

- **DISENGAGED FROM THE LATERAL SYSTEM**
- **MOVED INSIDE THE BUILDING ENVELOPE**
 - **ELIMINATES:**
 - **THERMAL DIFFERENTIALS**
 - **THE NEED OF THERMAL TRUSSES**
- **BUILT-UP SECTIONS ARE REQUIRED TO MAINTAIN ARCHITECT'S VISION AT CANTILEVERED BAYS**
- **INTEGRATION OF OPERABLE WINDOWS AND LOUVERS**

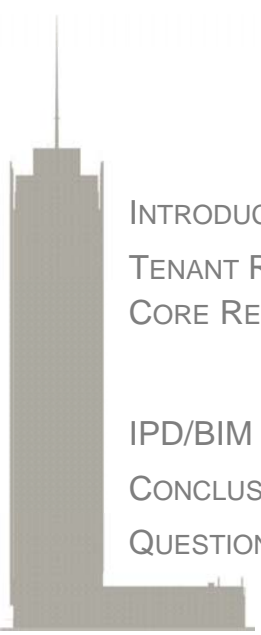


Debis Headquarters Building in Berlin, Germany

Aurora Place in Sydney, Australia

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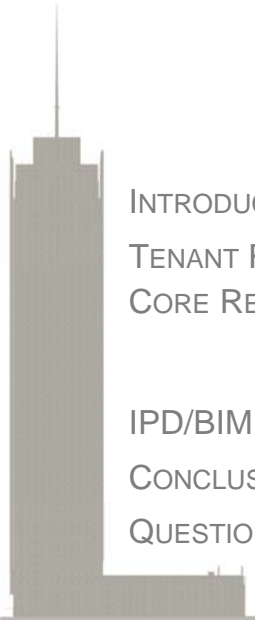
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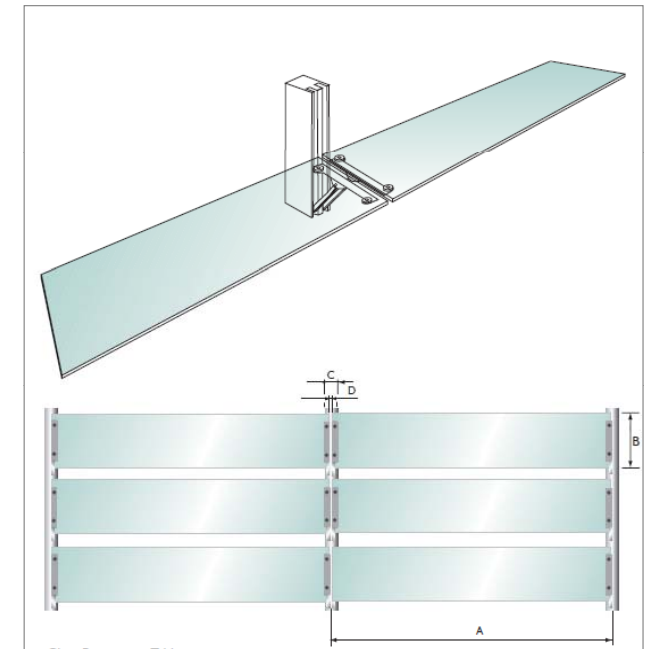
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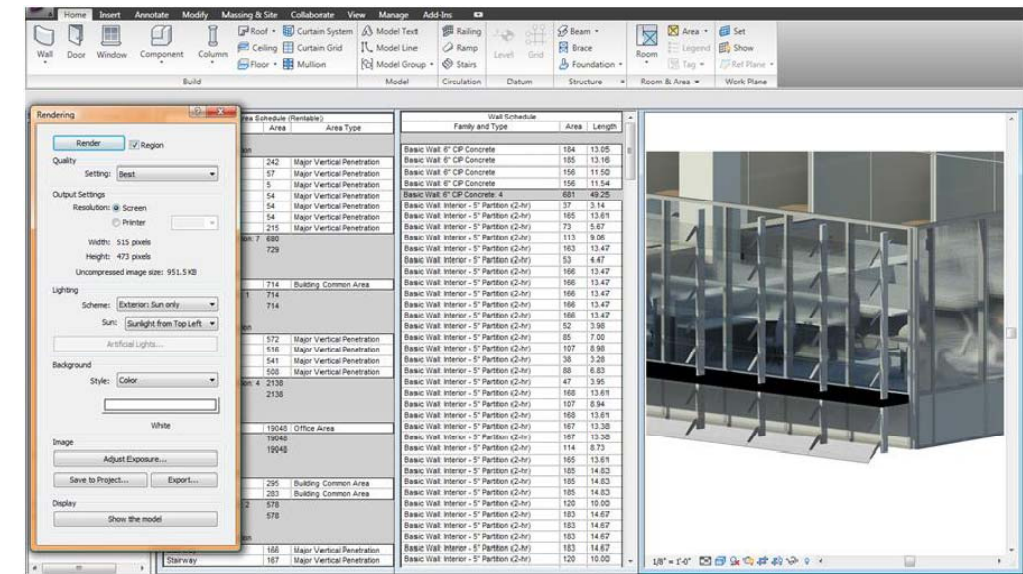
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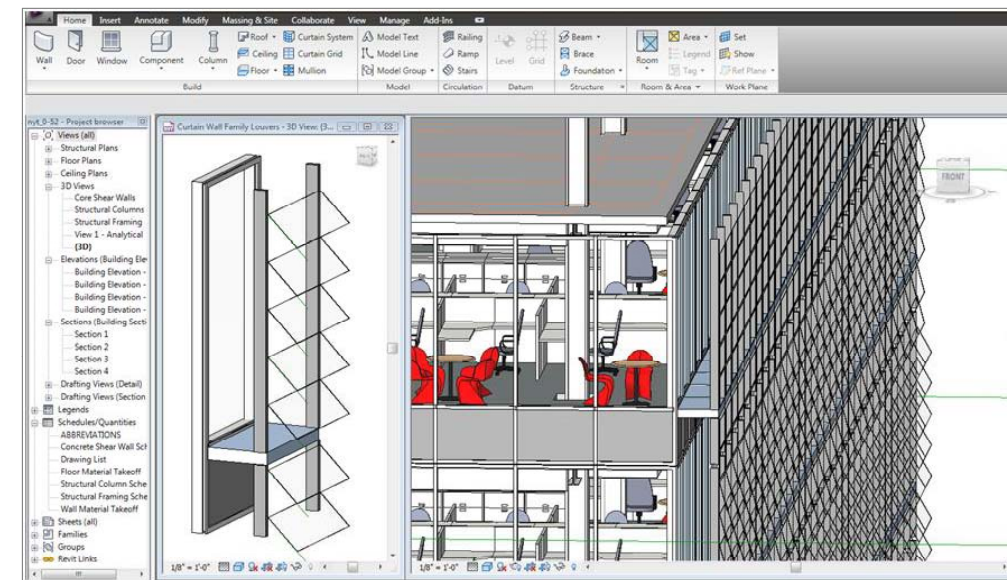
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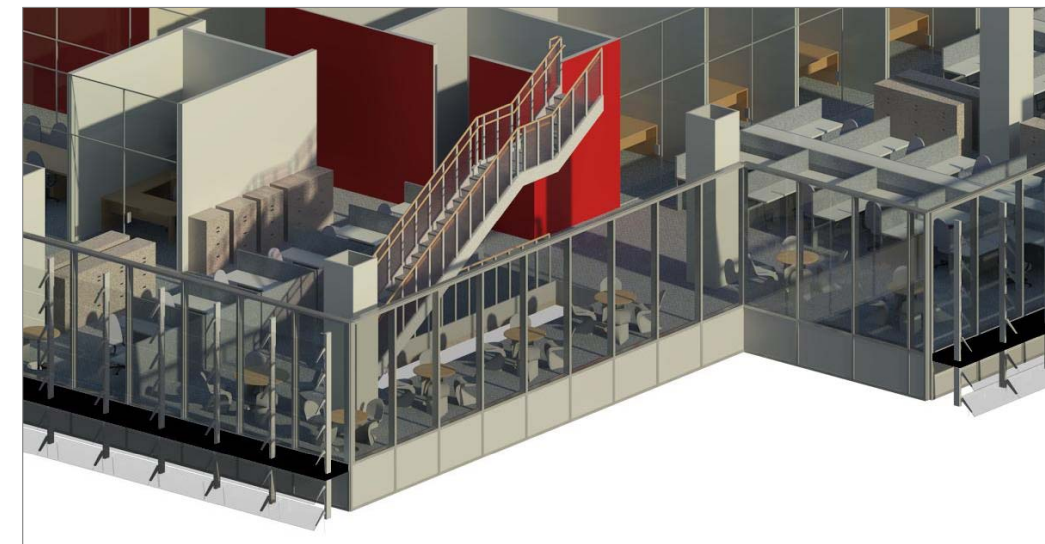
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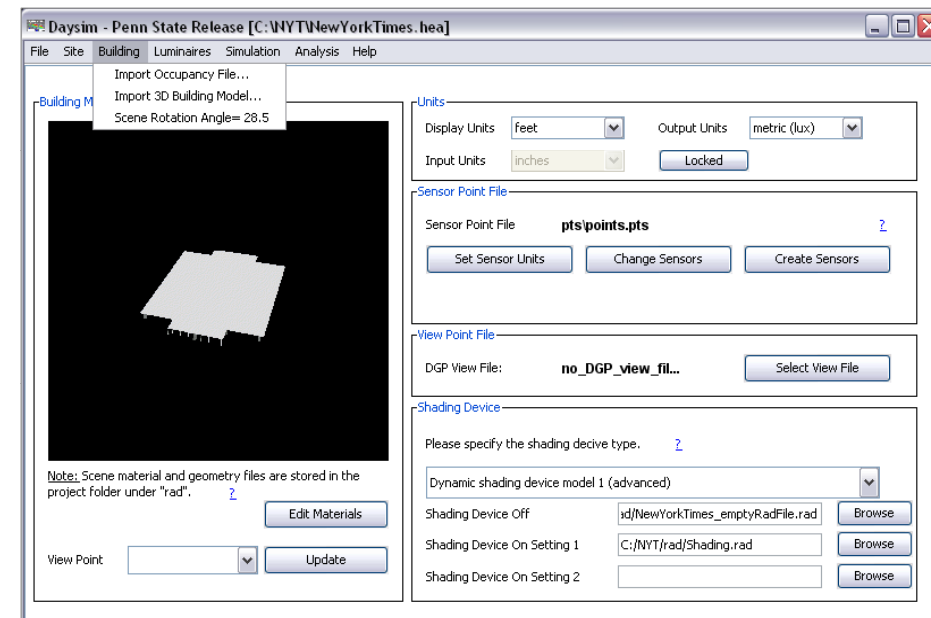
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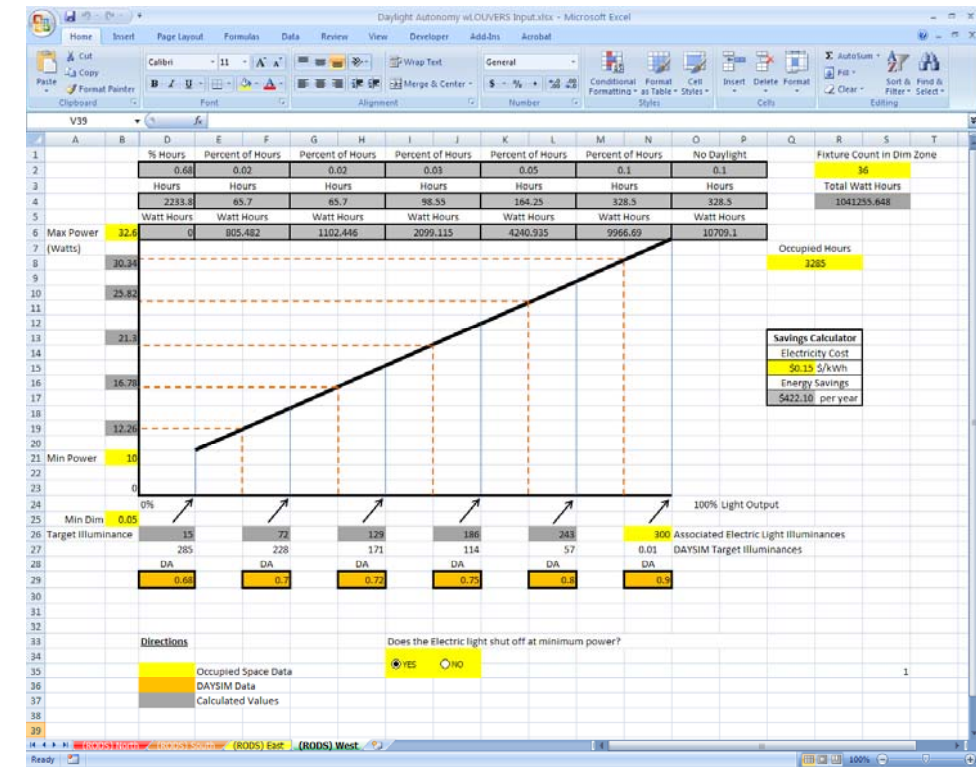
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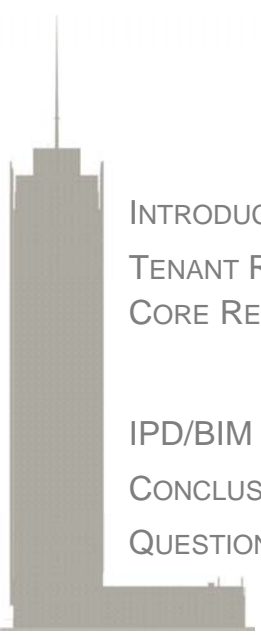
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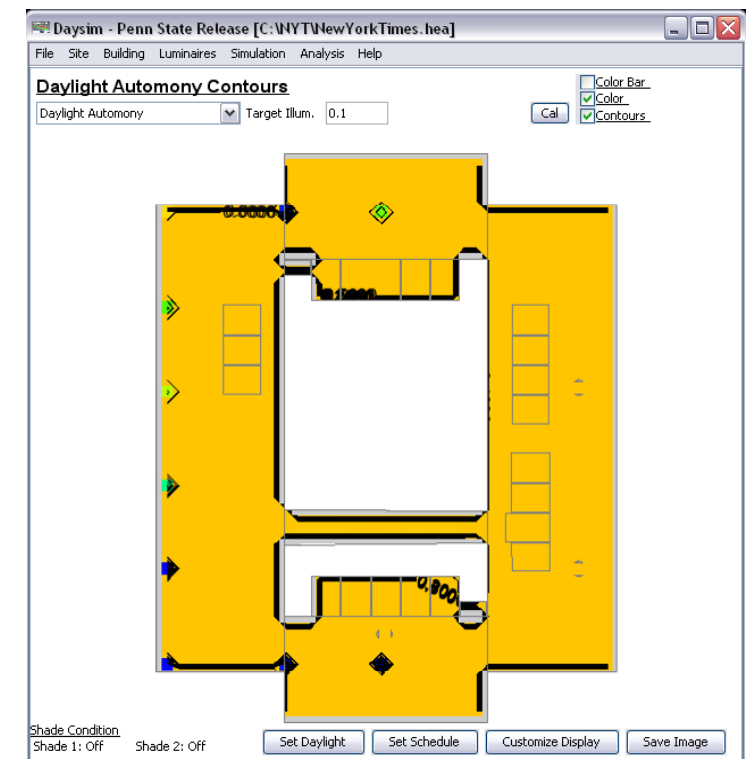
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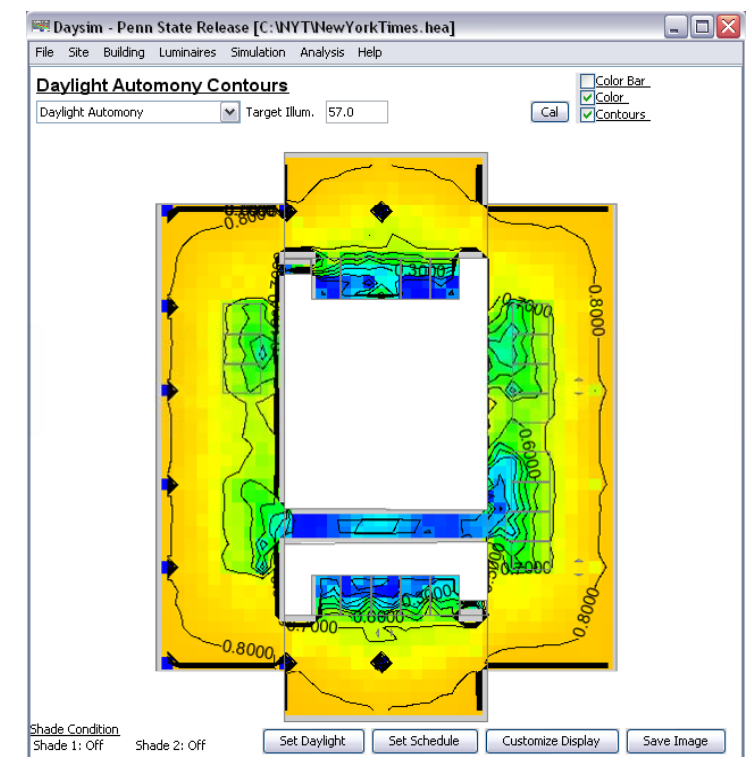
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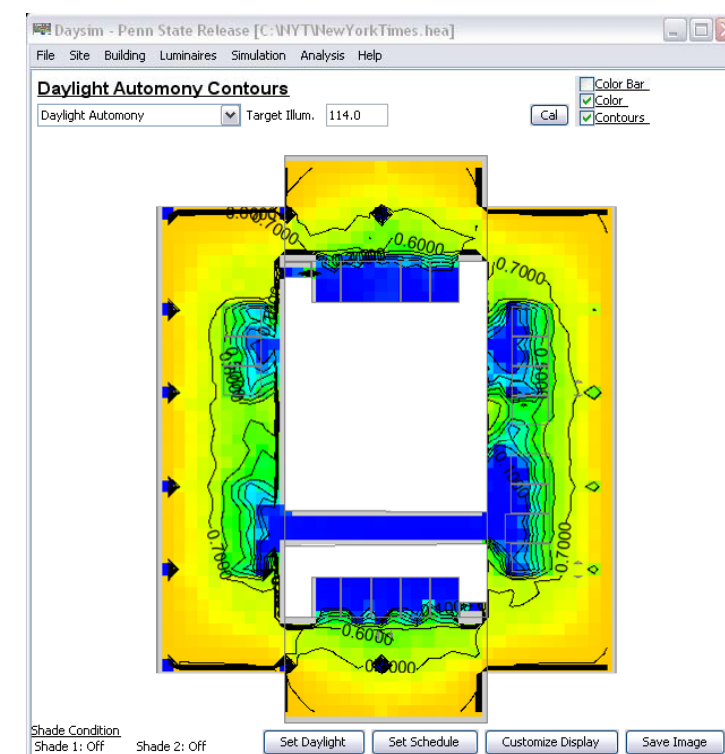
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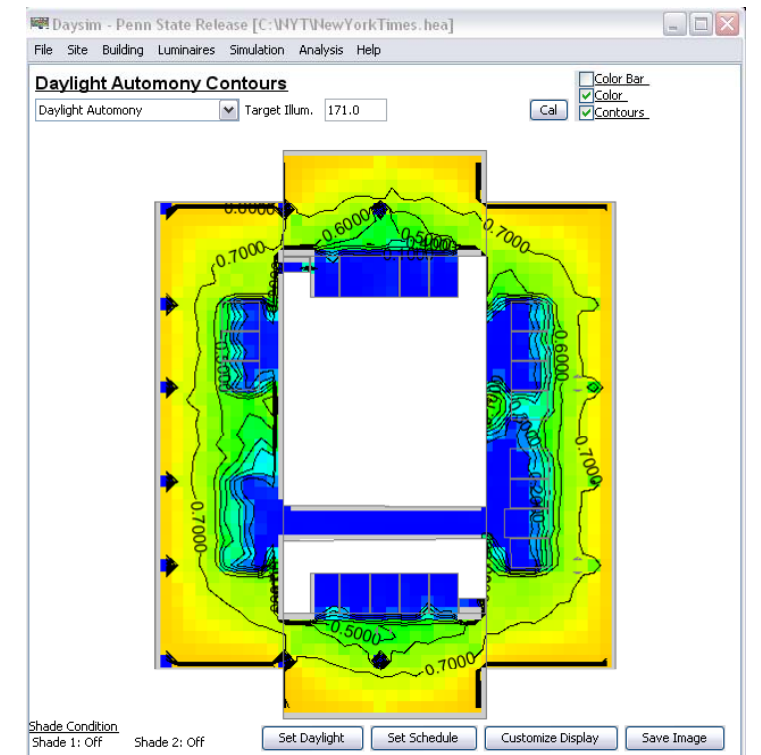
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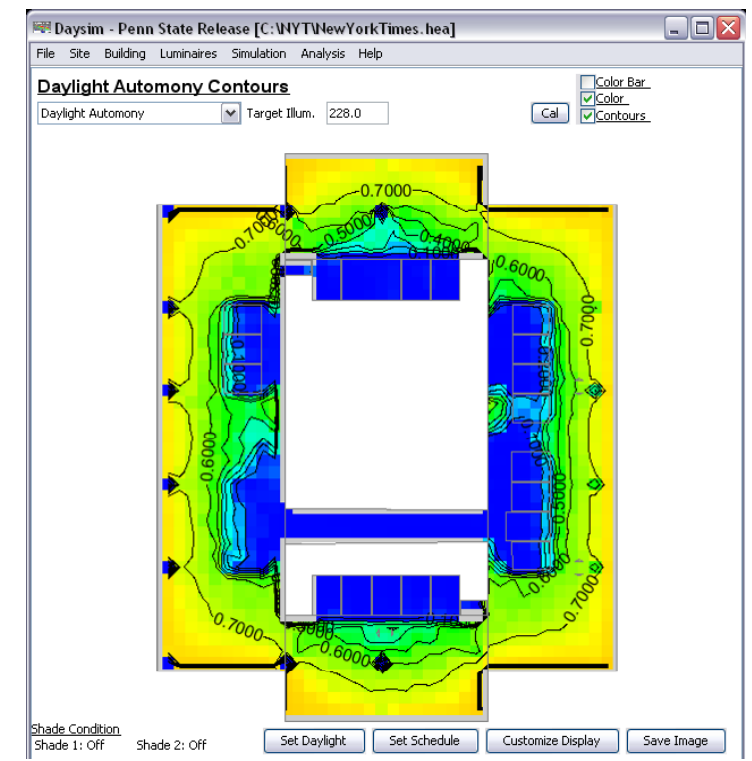
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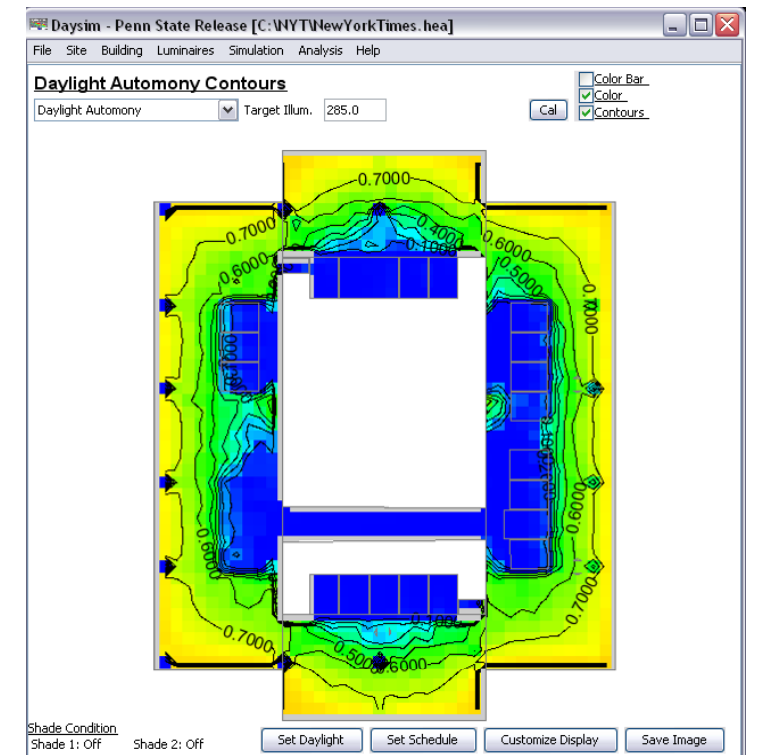
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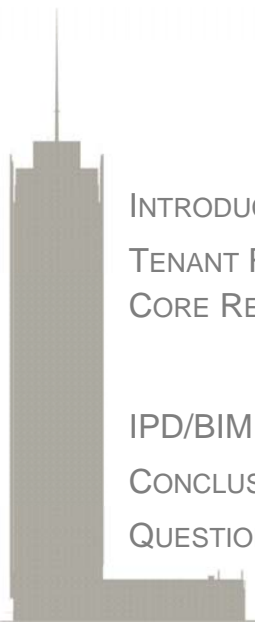
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DAYLIGHTING SUMMARY

North Façade	\$140.70
East Façade	\$422.10
South Façade	\$140.70
West Façade	\$422.10
Total	\$1,125.60
50 Floor Total	\$56,280.00

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REVIT → IES<VE>
REVIT → ECOTECT ANALYSIS

SOFTWARE INTEROPERABILITY

GREEN BUILDING XML (GBXML)

INFORMATION TRANSFER

- BUILDING GEOMETRY
- WALL CONSTRUCTIONS
- SHADING DEVICES

WORKFLOW “BEST PRACTICES”

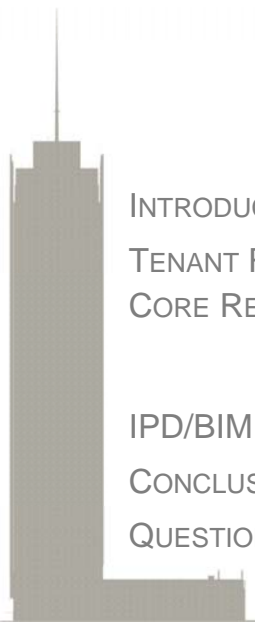
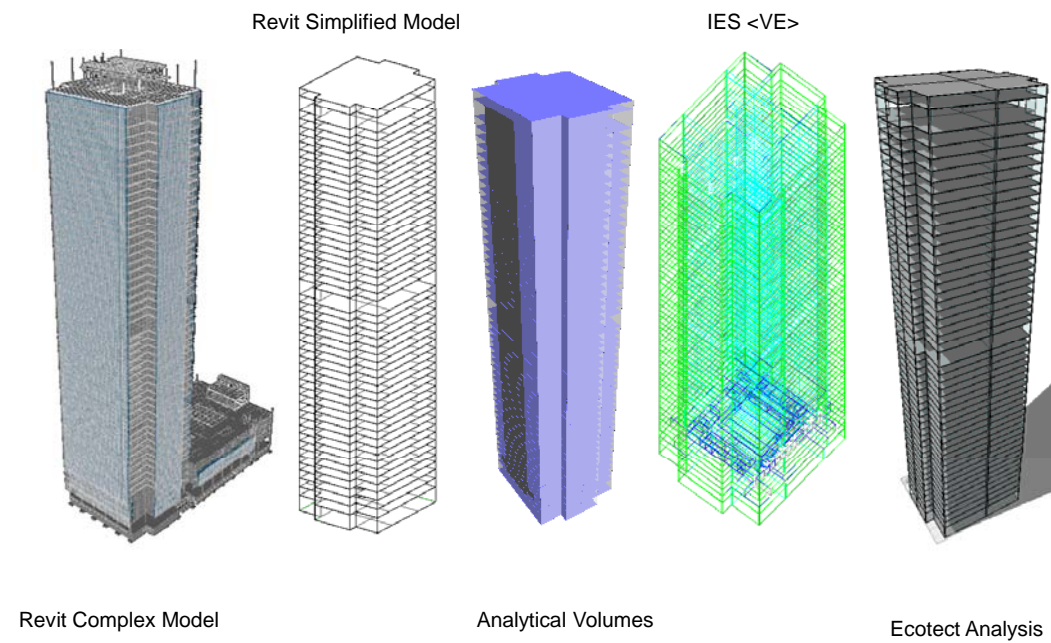
- ROOM-BASED MODELING
- SIMPLIFICATION
- PARAMETERS

ADVANTAGES

- VISUALIZATION
- INFLUENCE EARLY DESIGN DECISIONS

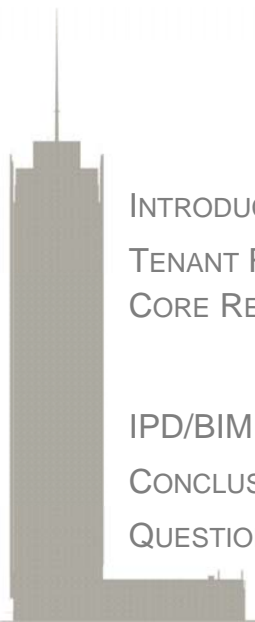
DISADVANTAGES

- CAREFUL MODEL INSPECTION
- TIME-CONSUMING TO ELIMINATE ERRORS
- CUSTOM FAMILIES DID NOT EXPORT
- SHADING SYSTEM DID NOT EXPORT
- NO REVERSE TRANSFER TO BIM MODEL



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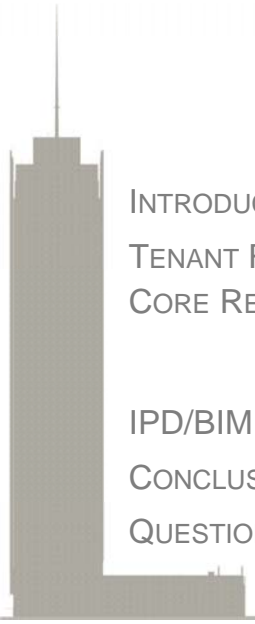
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ENVELOPE CONSTRUCTIONS

Model Input Parameter	Baseline Design Input	Proposed Design Input
Spandrel Panel	Recessed 3/16" Aluminum Spandrel Panel: Uvalue: 0.08 Btu/ft ² -F-hr 2-1/2" Rigid Insulation behind	Recessed 3/16" Aluminum Spandrel Panel: Uvalue: 0.08 Btu/ft ² -F-hr 2-1/2" Rigid Insulation behind
Fenestration Type	1" IGU Vision Lite - Clear w/ Low e Double Pane - Aluminum Frame	1" Coltlite Double glazed panel
Fenestration U-value	U value for glazing: 0.625 Btu/ft ² -F-hr	U value for glazing: 0.405 Btu/ft ² -F-hr
Fenestration Visible Light Transmittance	0.96 (96% transmittance)	0.79 (79% transmittance)
Shading Device	1-5/8" Diameter Ceramic Tubes	Colt Shading Louvres



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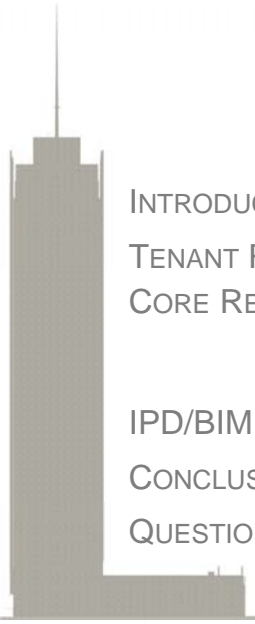
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LIGHTING POWER DENSITY REDUCTION

Model Input Parameter	Baseline Design Input	Proposed Design Input
Interior Lighting Power Density	1.1 W/m ²	.46 W/m ²

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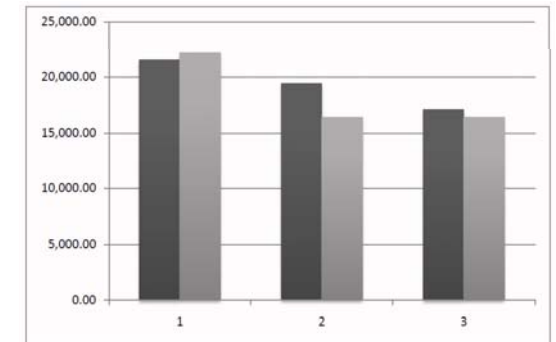


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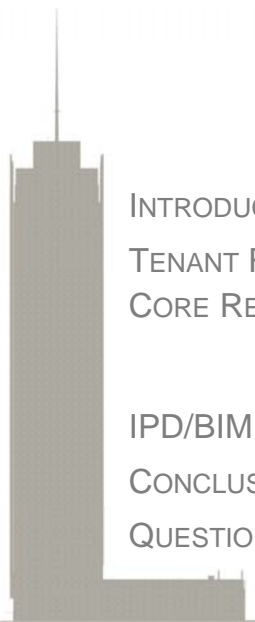
SIMULATION RESULTS

Peak Load	Baseline Design	Proposed Design	% Reduction due to Glazing / Shading	Proposed with Reduced Lighting Power Density	% Reduction due to Reduced Lighting
Peak Cooling Load	21,554.50 (kBtu/h)	19,442.50 (kBtu/h)	9.80 %	17,090.20 (kBtu/h)	20.71 %
Peak Heating Load	22,196.00 (kBtu/h)	16,460.20 (kBtu/h)	25.84 %	16,460.20 (kBtu/h)	----



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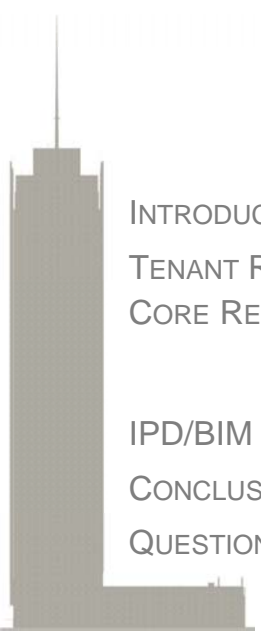
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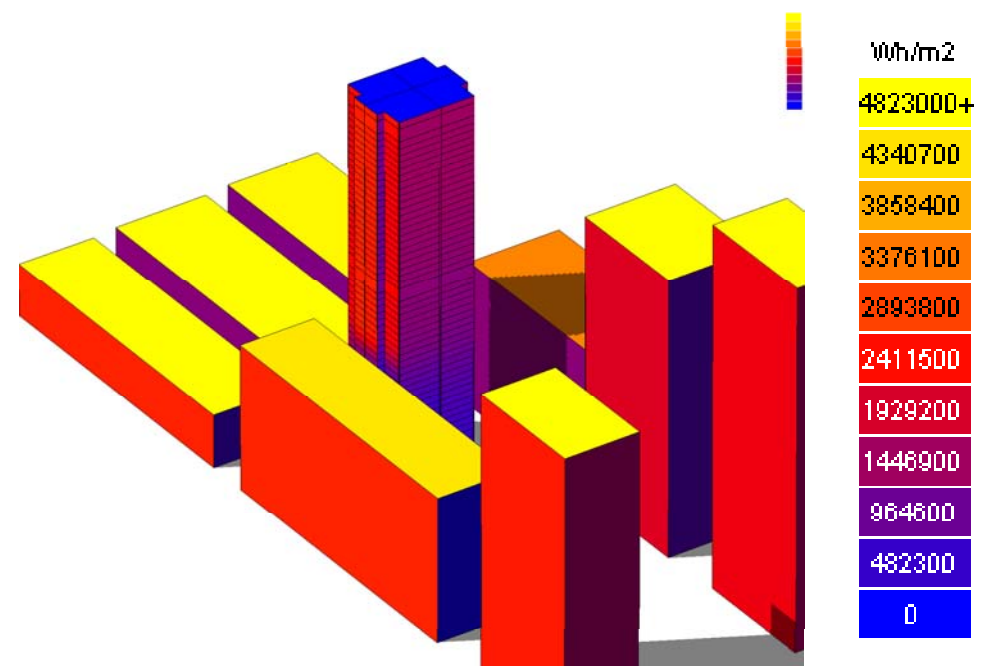
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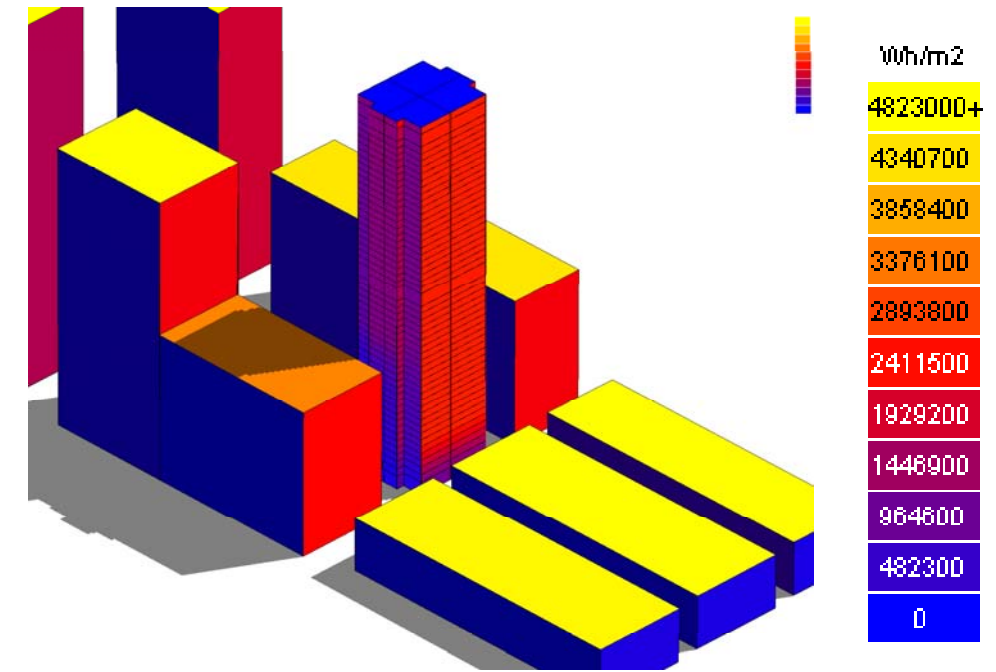
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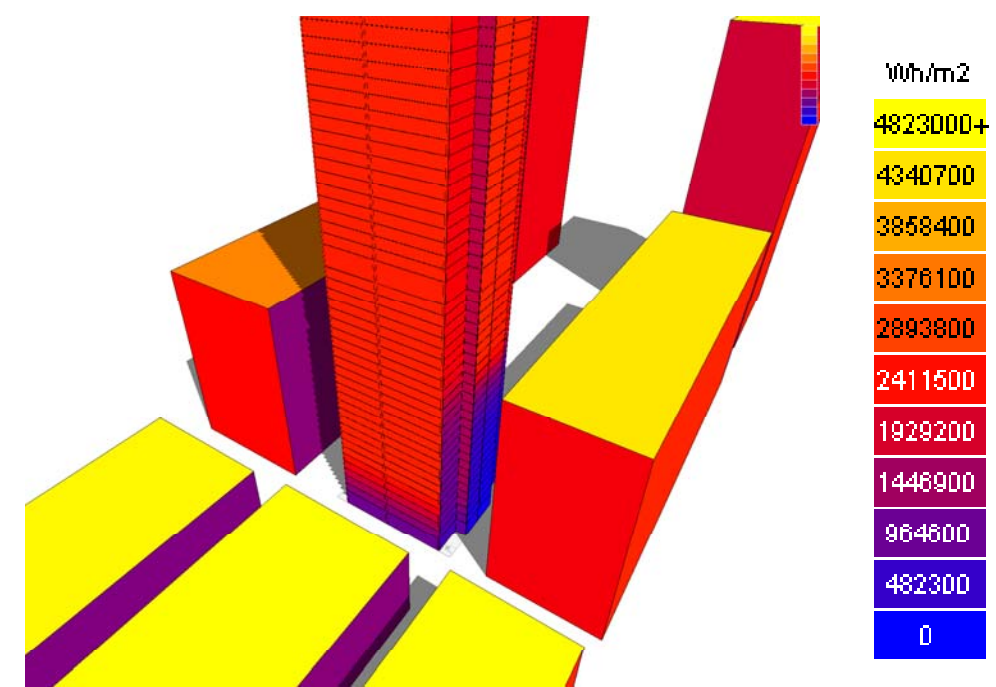
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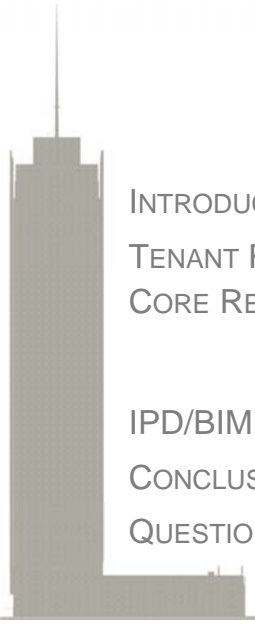
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Solar Availability						
		ft ²	m ²	wh/m ²	kwh	Cost
East Façade						
	5 - 17	3575	332.25	202300	10216.53	\$214,500.00
	18 - 54	10175	945.63	1446900	207971.7	\$610,500.00
South Façade						
	18 - 54	10175	945.63	2652650	381281.5	\$610,500.00
West Façade						
	8 - 54	12925	1201.21	2652650	484330.5	\$775,500.00
Data						
		PVs		Electricity		
		\$/ft2		\$/kwh		
		\$60.00		\$0.15		
		Conversion Efficiency				
		16%				
		Inverting Efficiency				
		95%				

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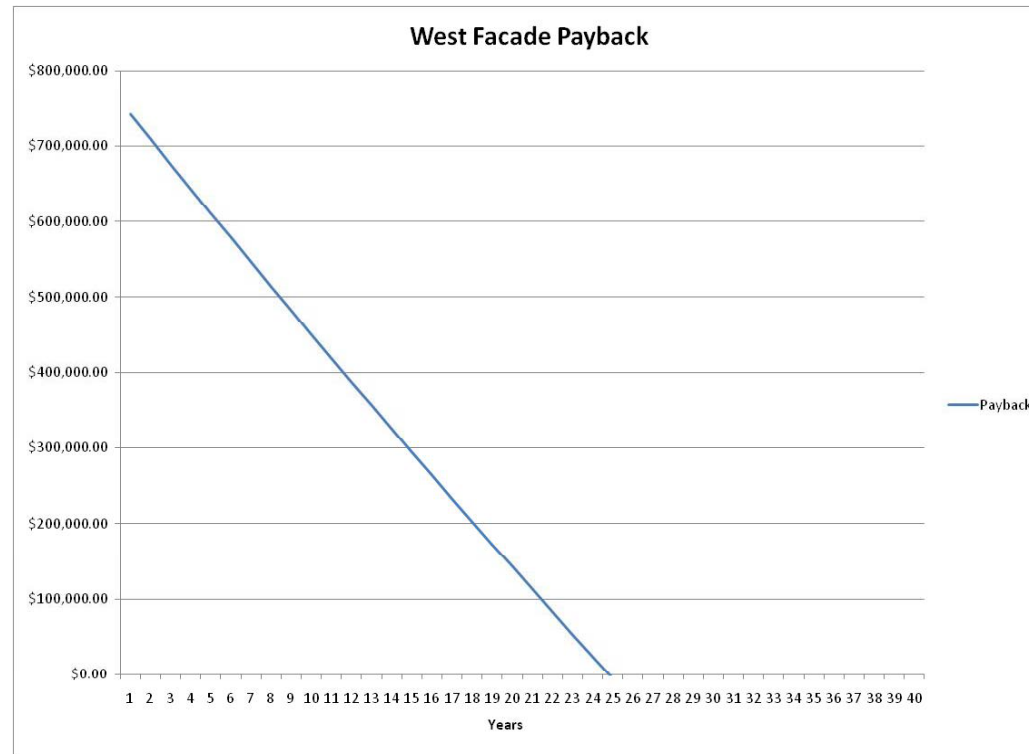
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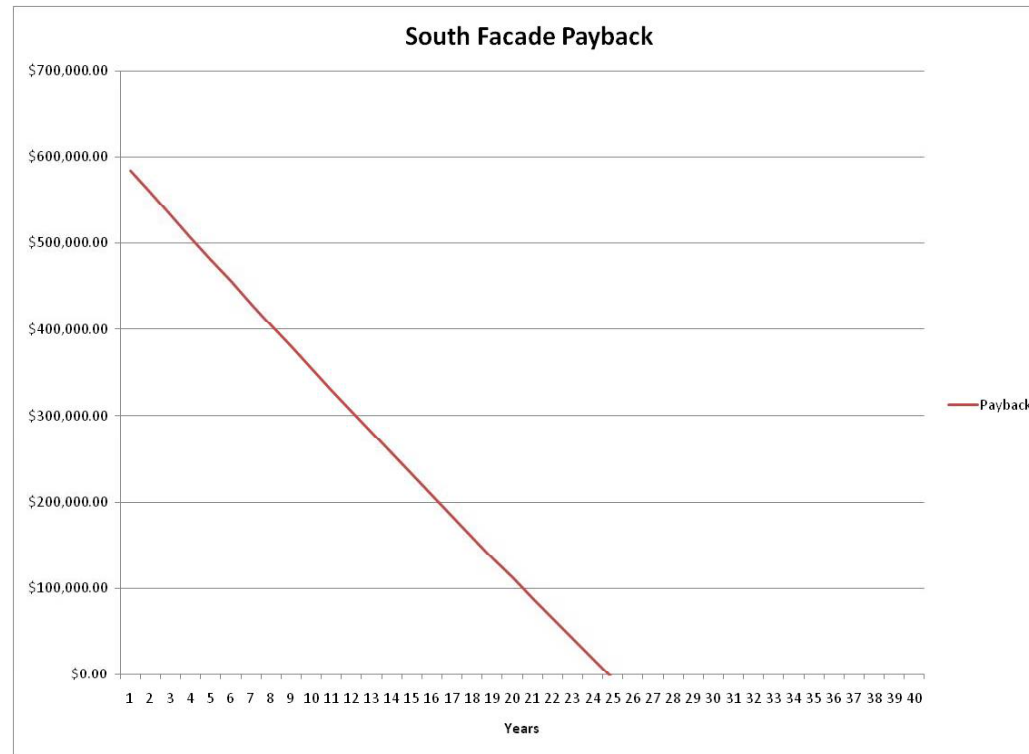
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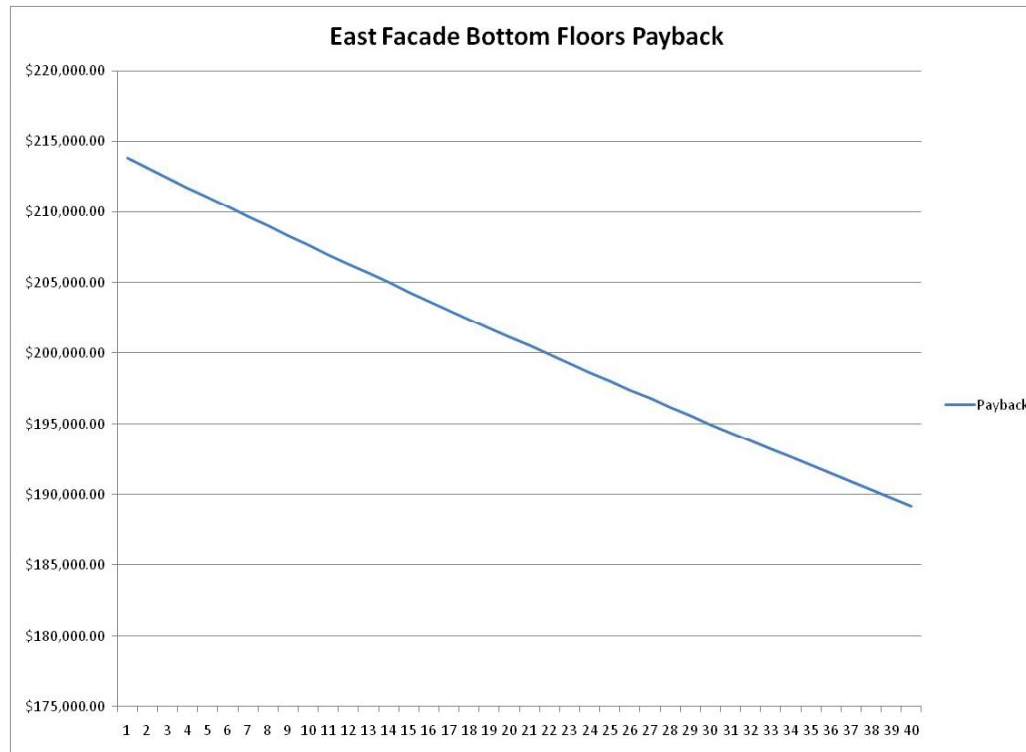
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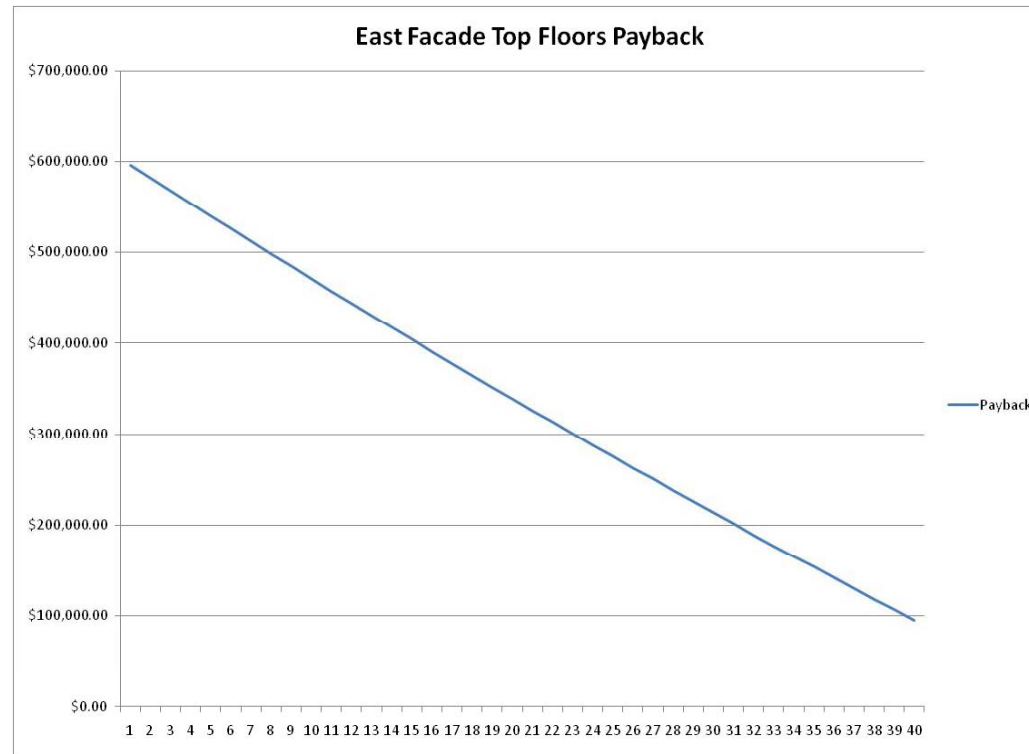
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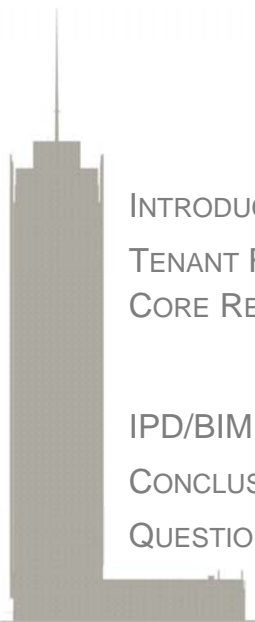
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INVESTIGATE FEASIBILITY AND DESIGN PROCESS OF IMPLEMENTING HYBRID VENTILATION IN THE NEW YORK TIMES BUILDING

DETERMINE IMPACT OF BIM AND ANALYSIS SOFTWARE FOR MIXED-MODE DESIGN

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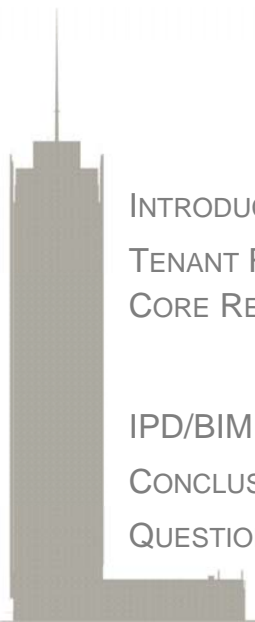
ENERGY SAVINGS & PAYBACK ANALYSIS

CONTROL STRATEGY

BIM → IES <VE> MACROFLO INVESTIGATION

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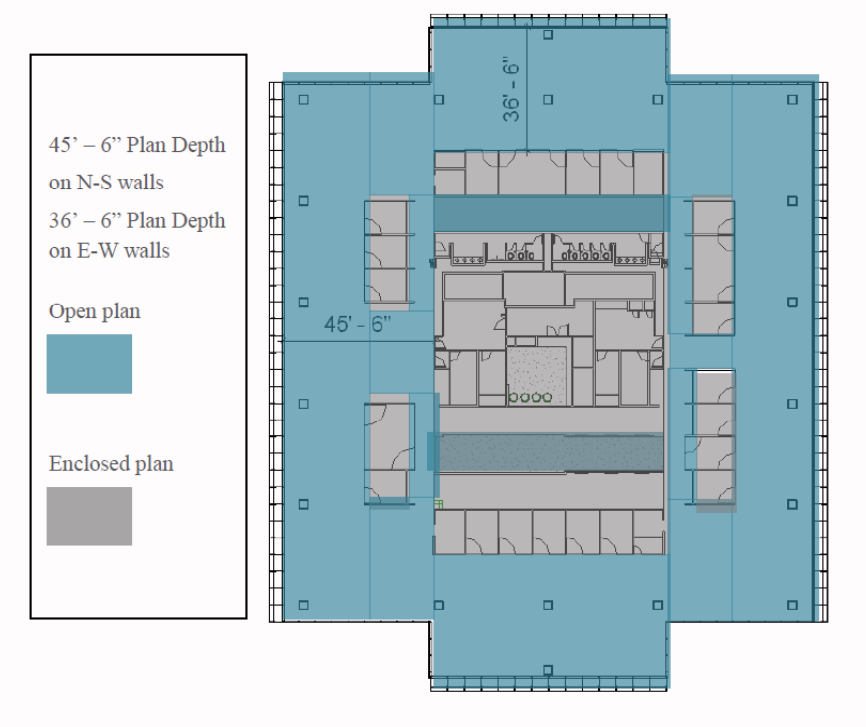
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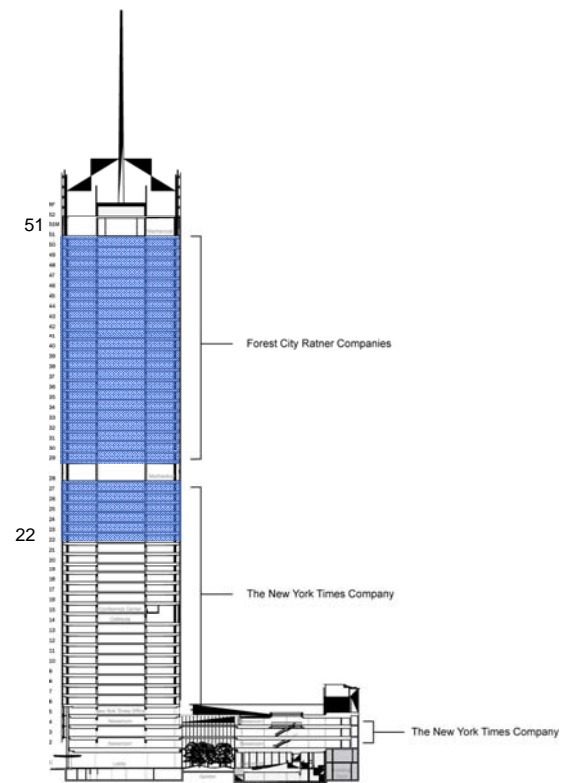
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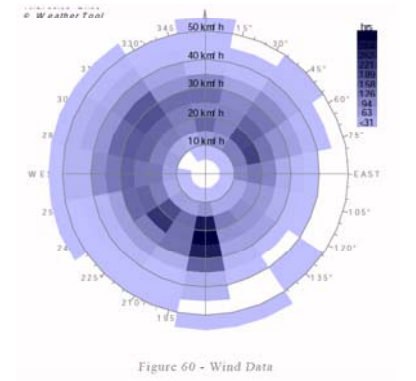
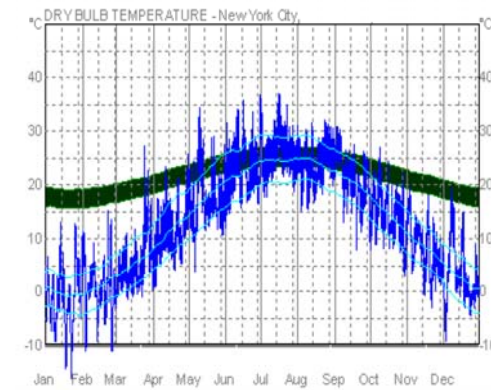


Figure 60 - Wind Data

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Colt Coltite LWI Ventilator, type LWI

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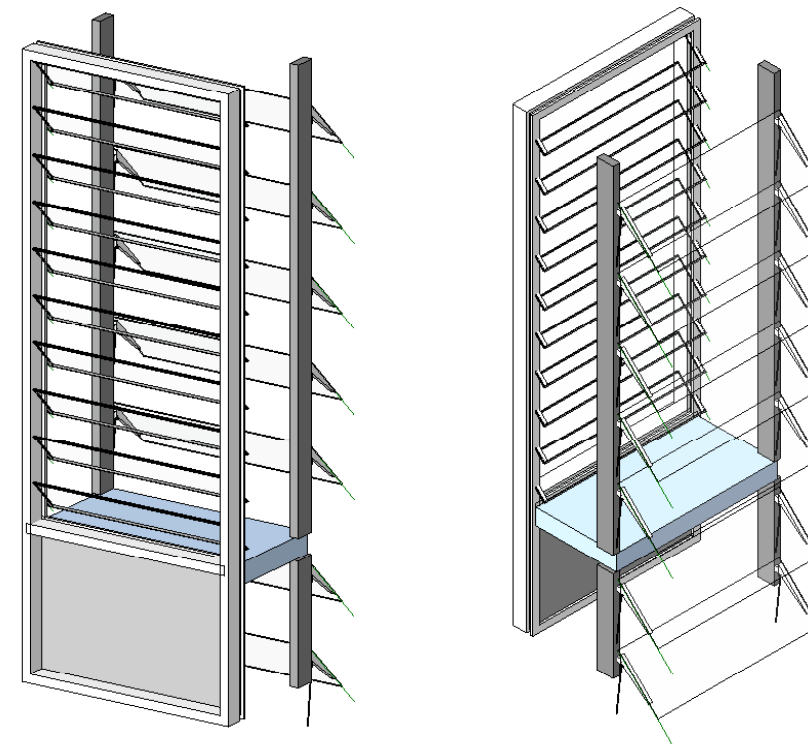
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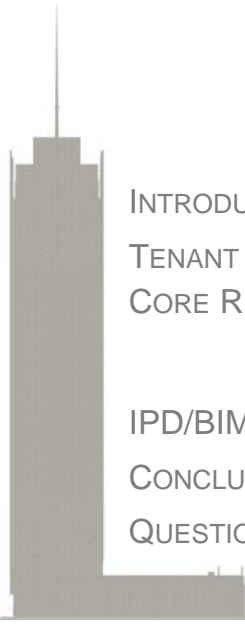
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SINGLE ZONE MODEL

HOURLY TMY-2 WEATHER DATA
LOCAL WIND SPEED DETERMINED
BUOYANCY (STACK EFFECT) AND WIND FLOW RATES
COOLING AND VENTILATION LOADS MET

RESULT

TOTAL OF 18 OPERABLE GLAZING PANELS PER FLOOR
3000+ HOURS FEASIBLE
ADJUSTED FOR UTILIZABLE HOURS

34.8% REDUCTION IN COOLING LOAD
ANNUAL COST SAVINGS OF **\$145,419**

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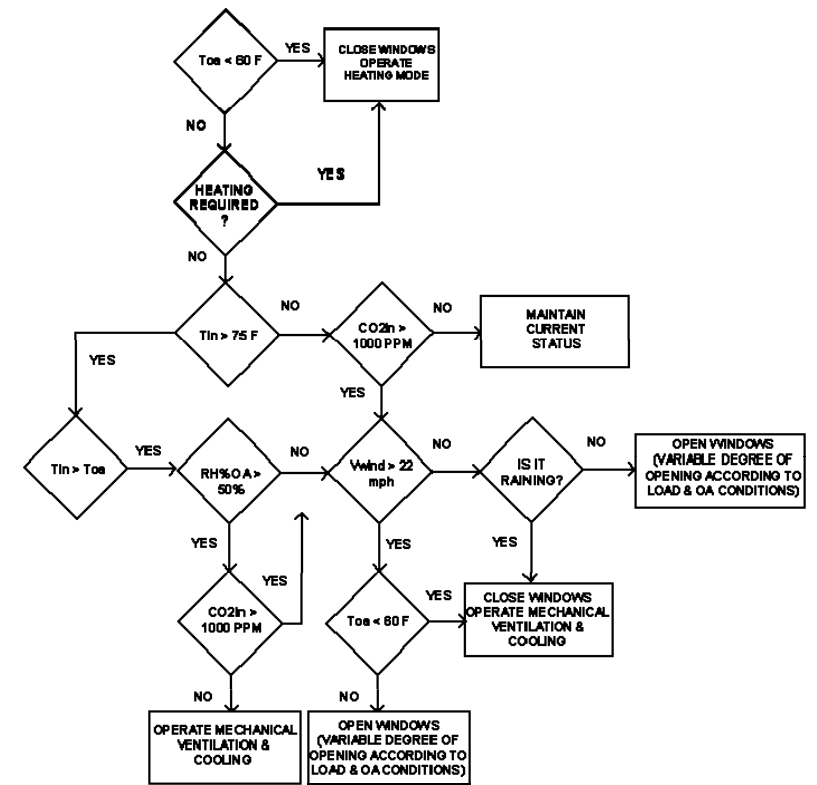
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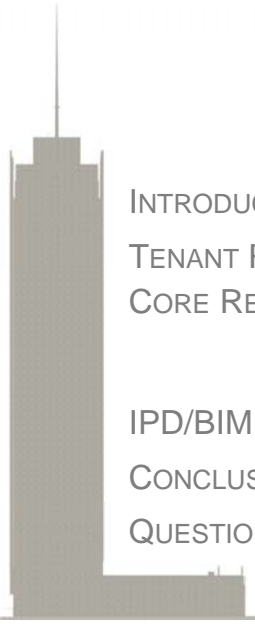
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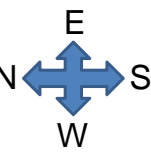
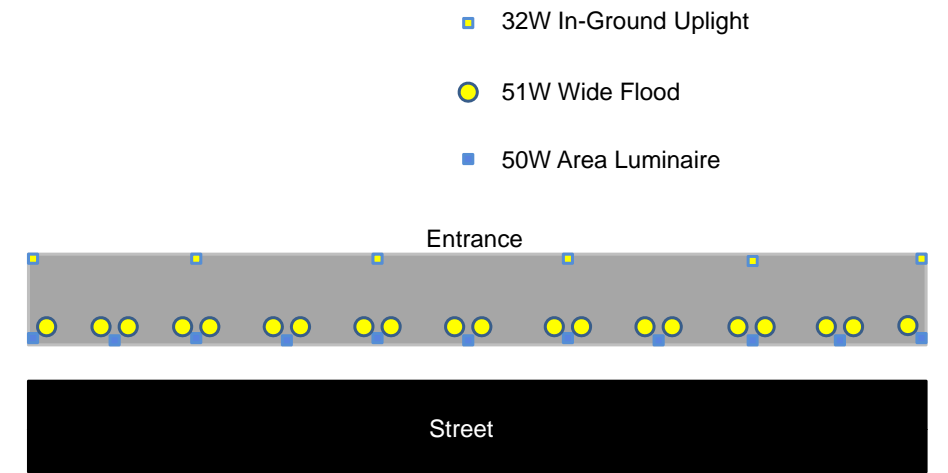
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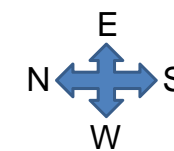
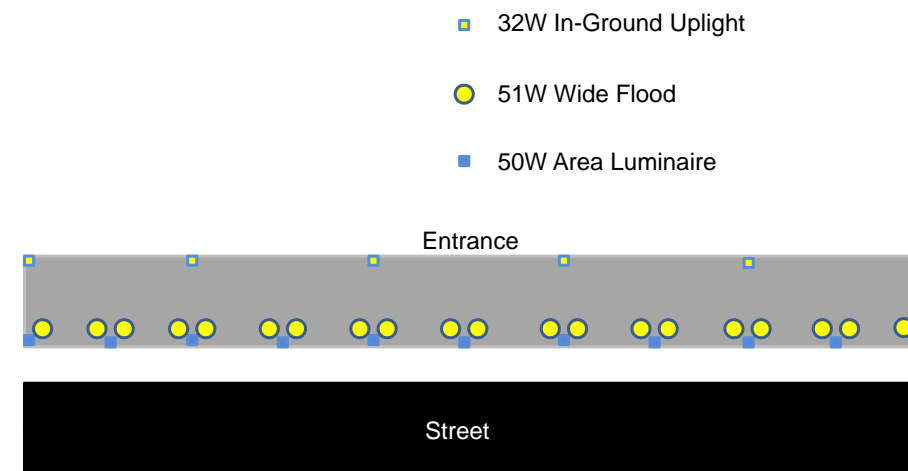
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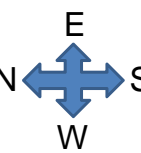
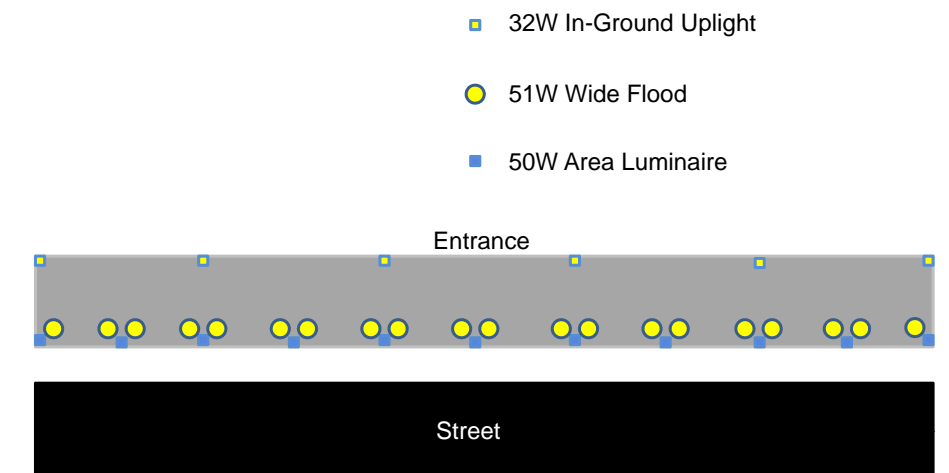
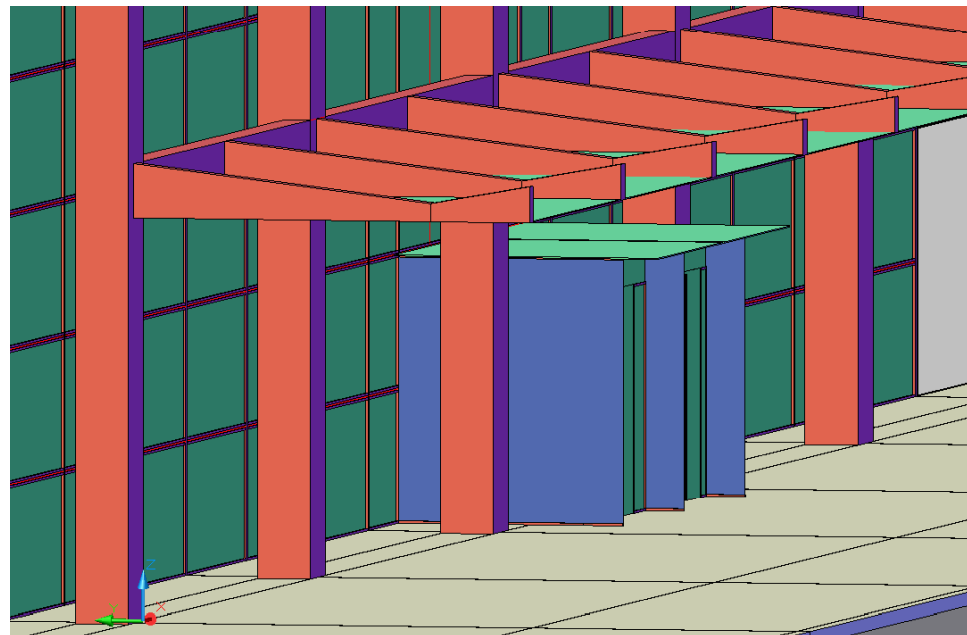


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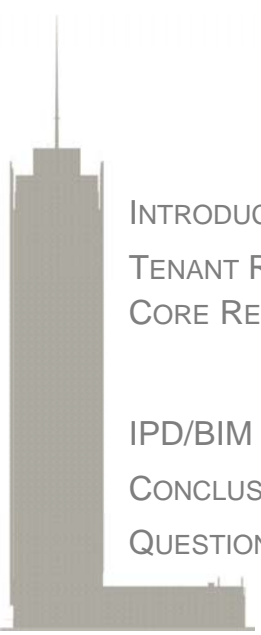
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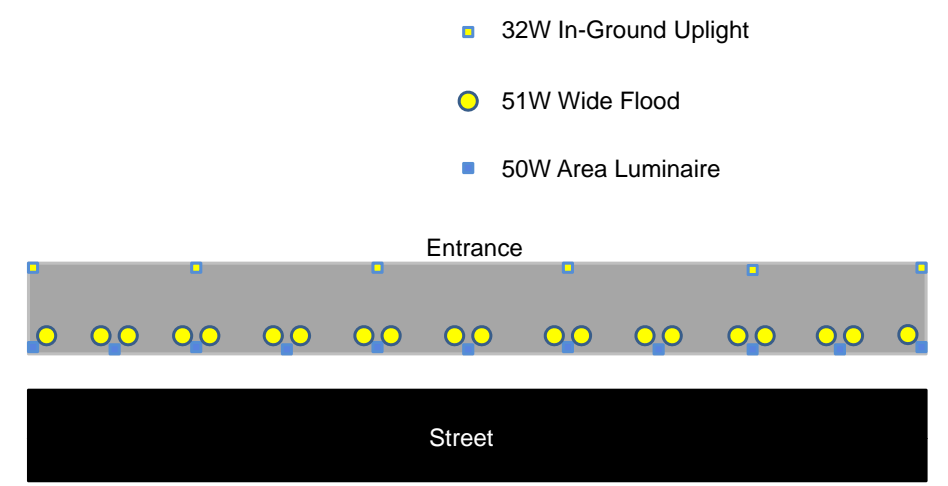
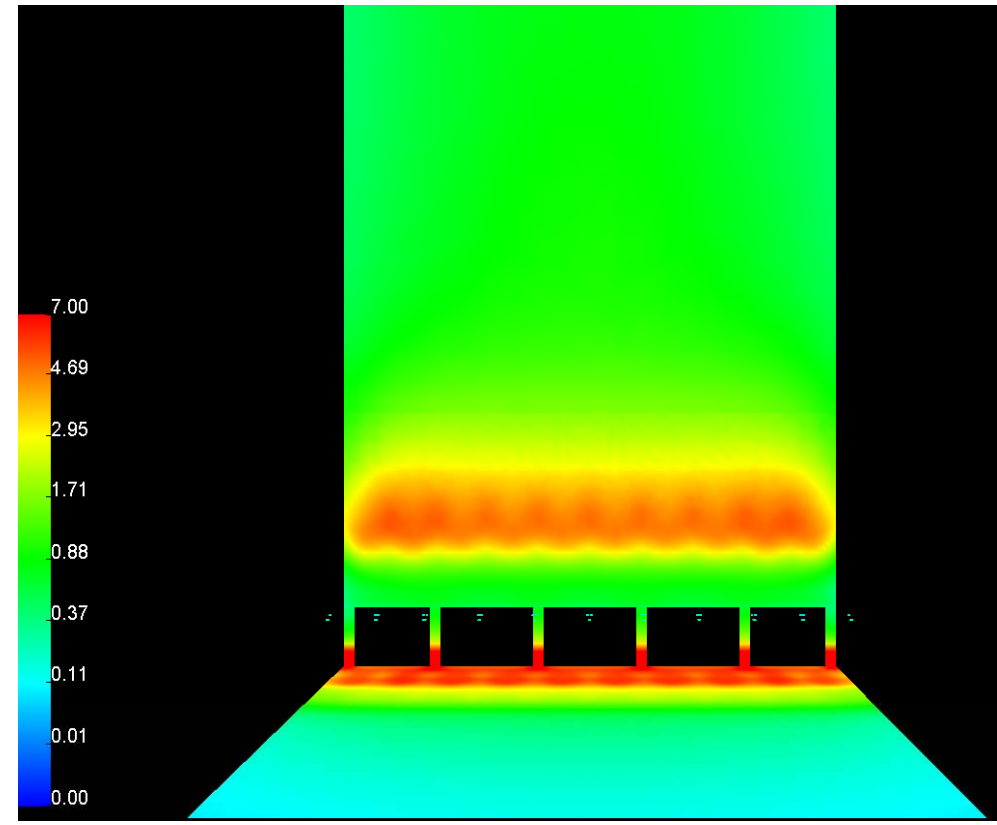
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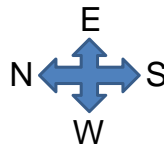


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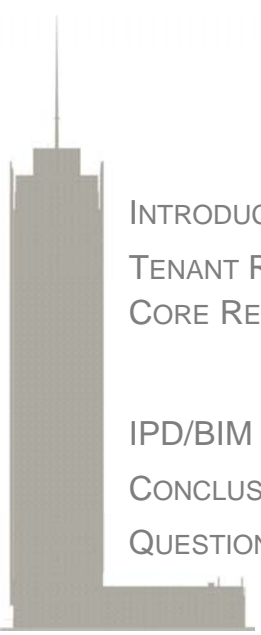


- 32W In-Ground Uplight
- 51W Wide Flood
- 50W Area Luminaire



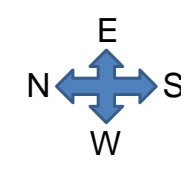
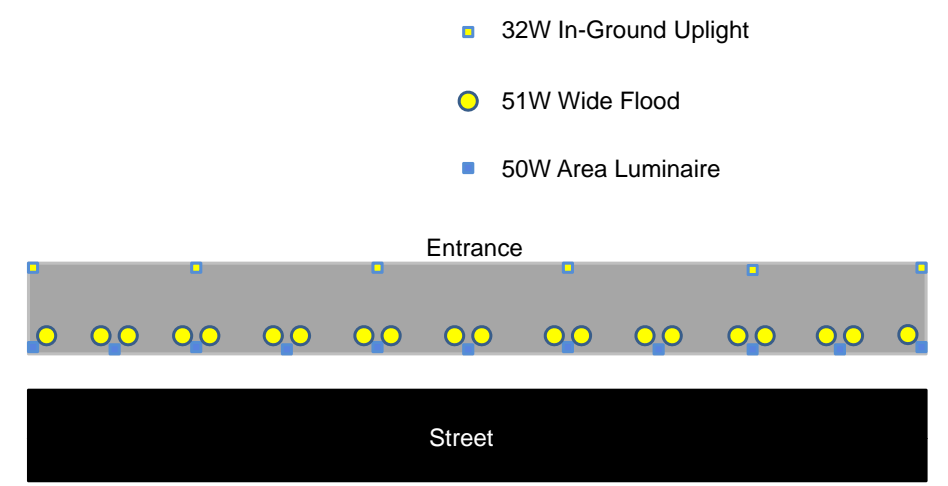
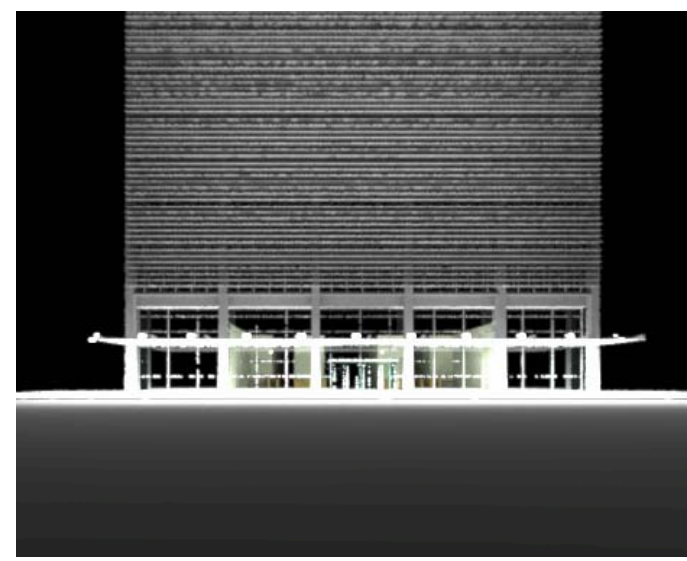
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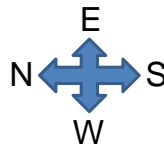
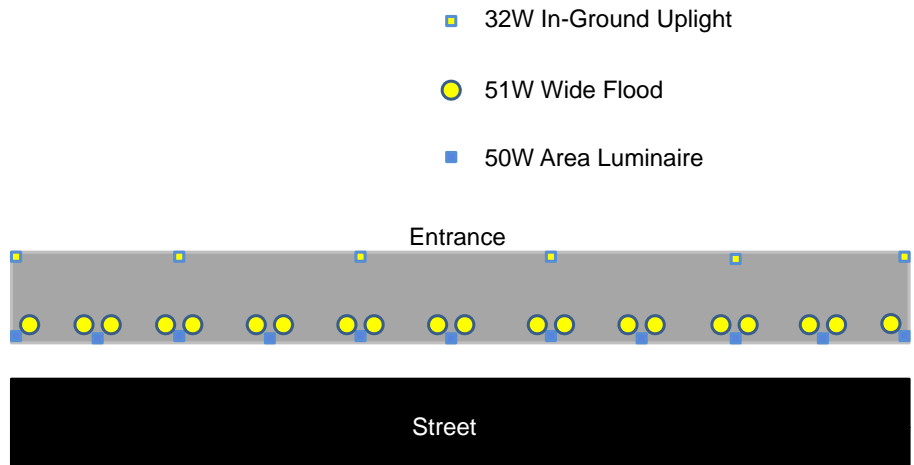
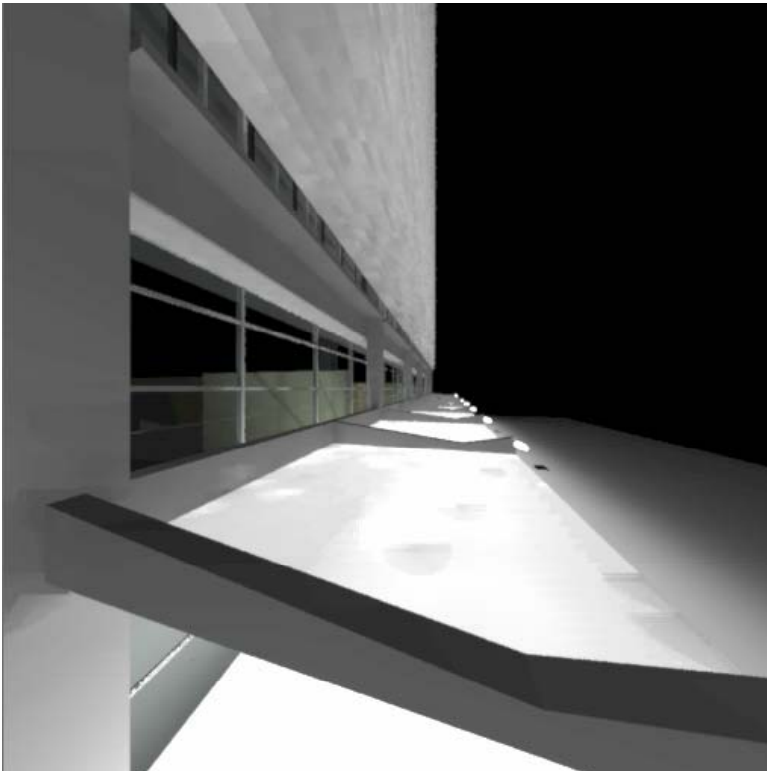
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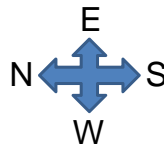
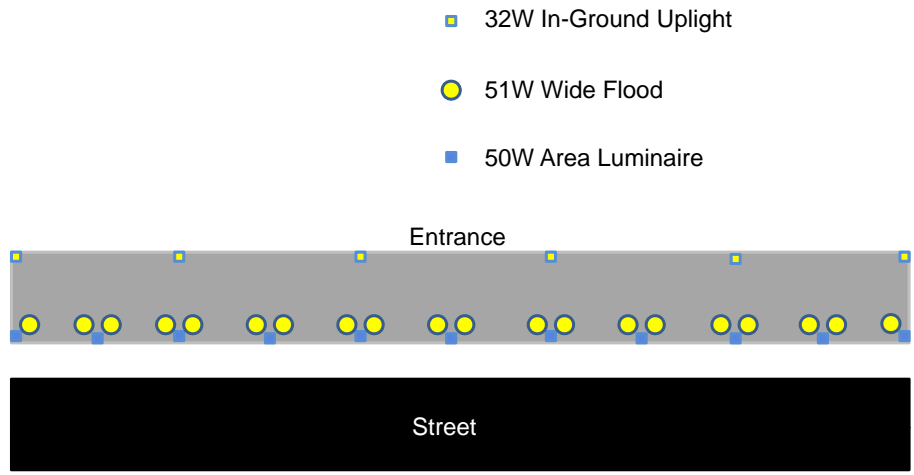
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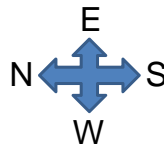
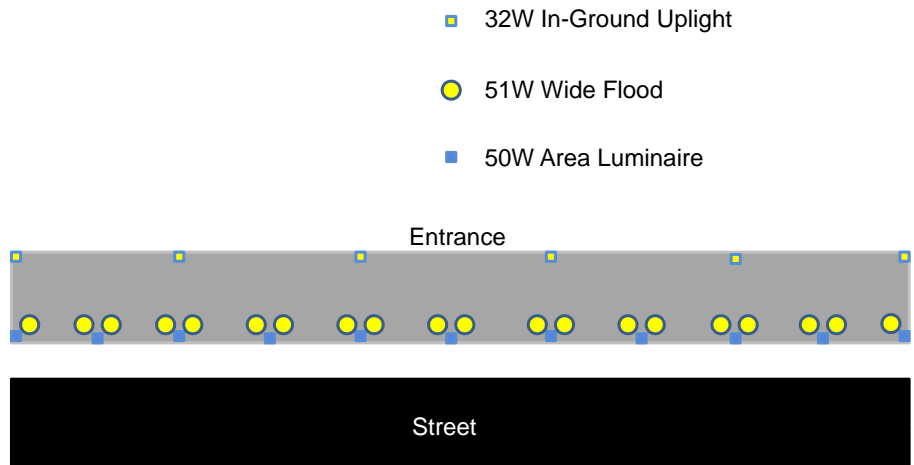


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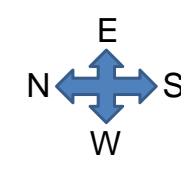
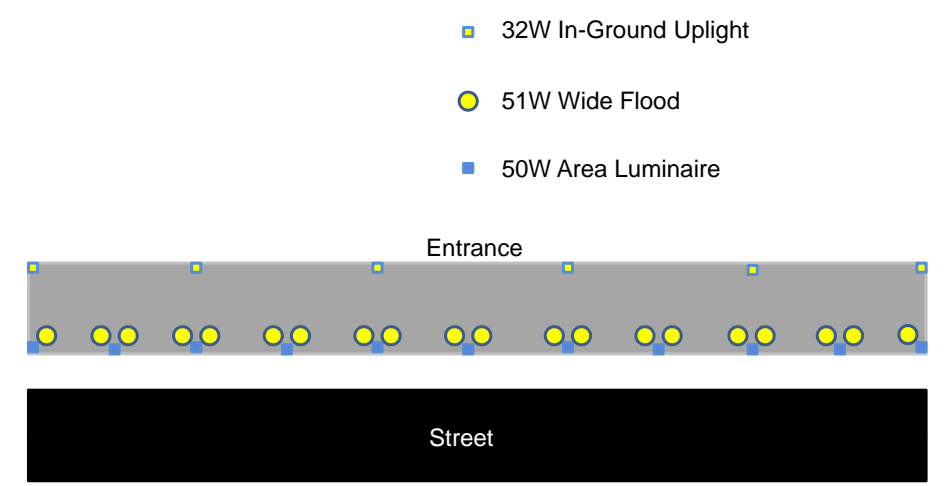
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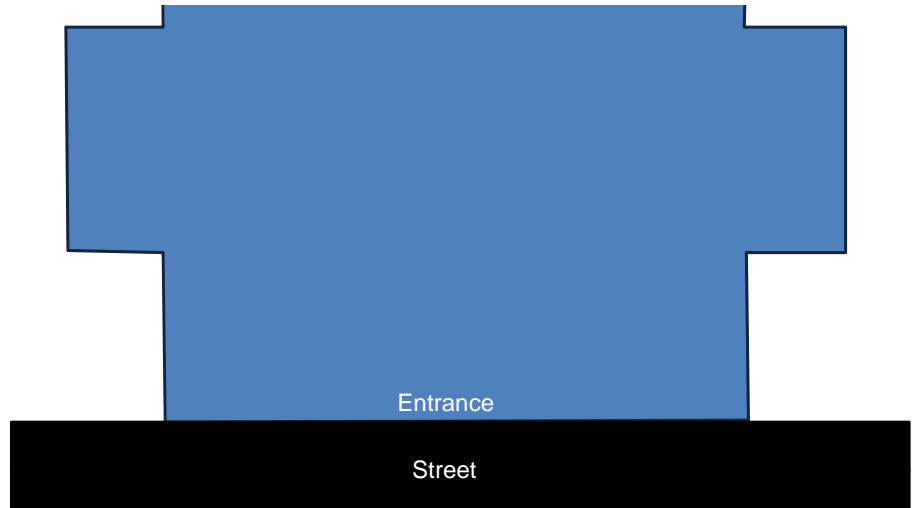
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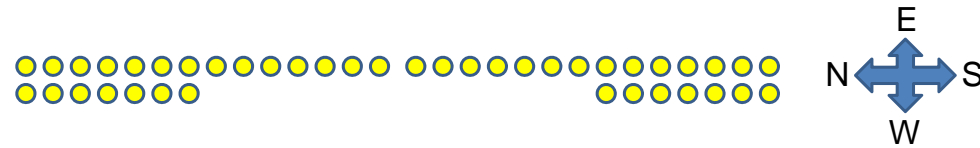
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EXTERIOR FAÇADE LIGHTING DESIGN



● 51W Spot, Flood, or Wide Flood



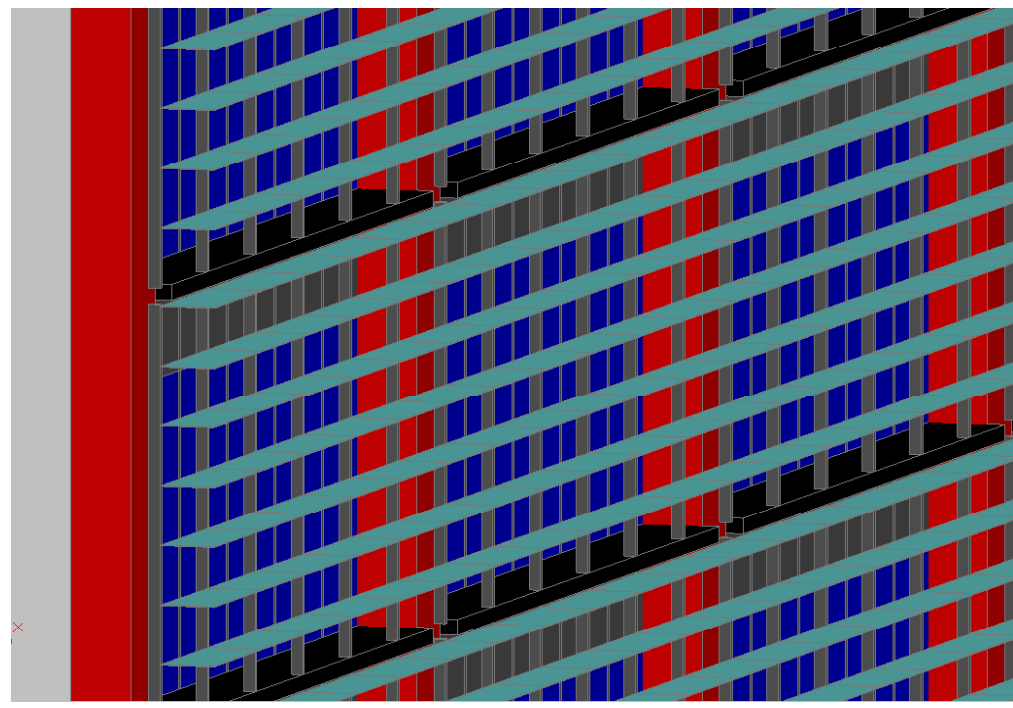
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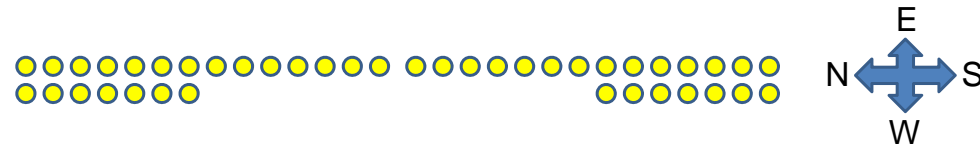


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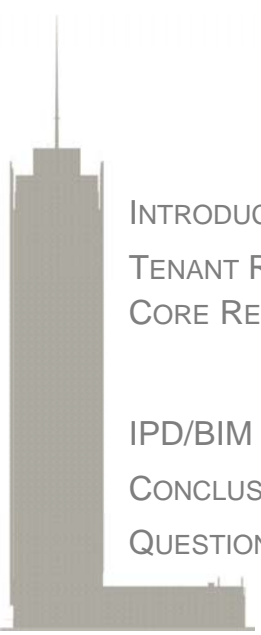


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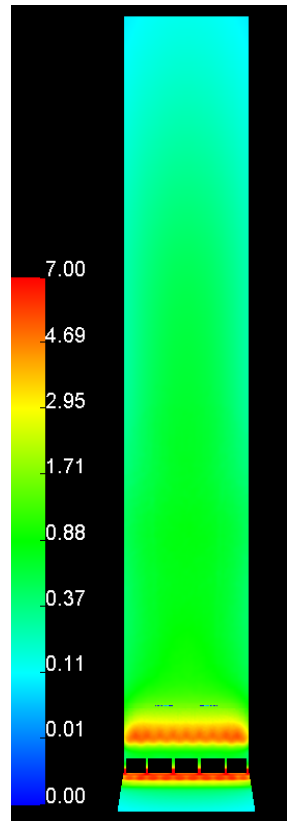
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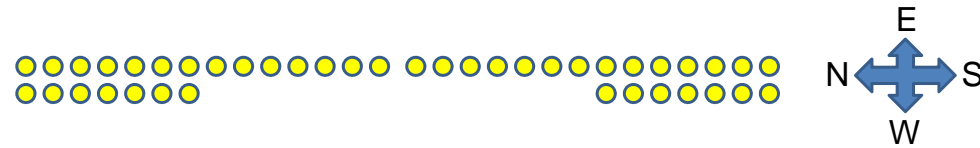


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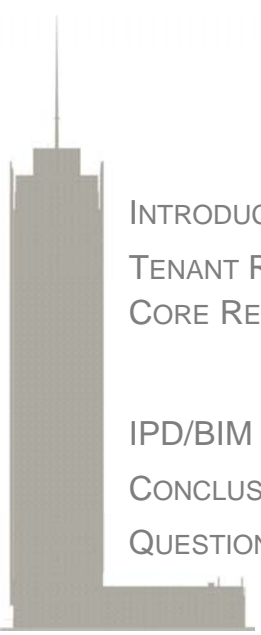


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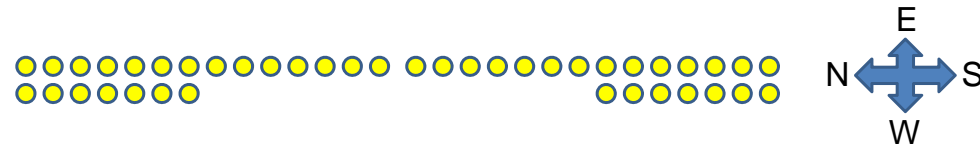


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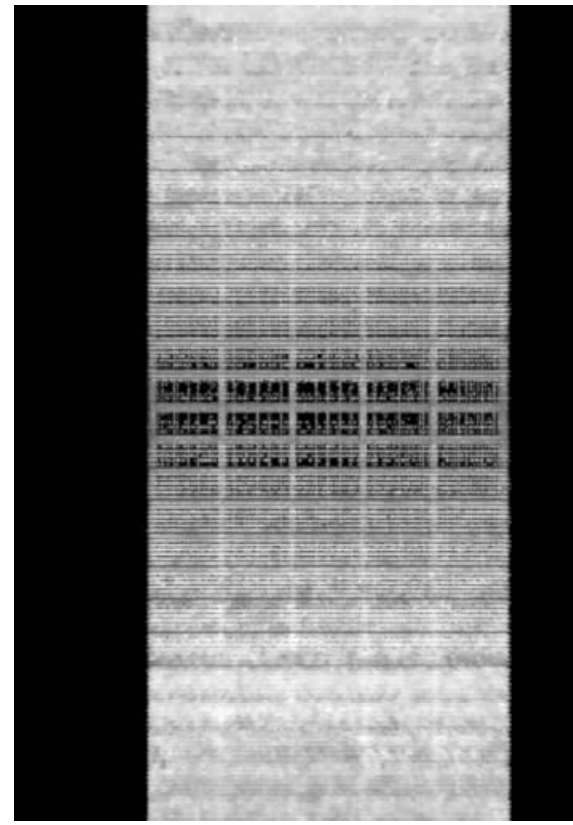
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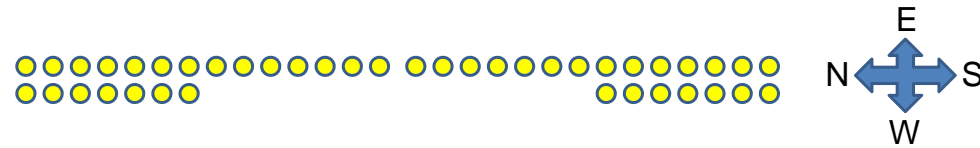


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EXTERIOR LIGHTING DESIGN SUMMARY

Designs	Total Wattage	Reduction from ASHRAE
Allowable by ASHRAE	24,390	-
Previous Design	15,710	35.59%
Proposed Redesign	3,898	84.02%

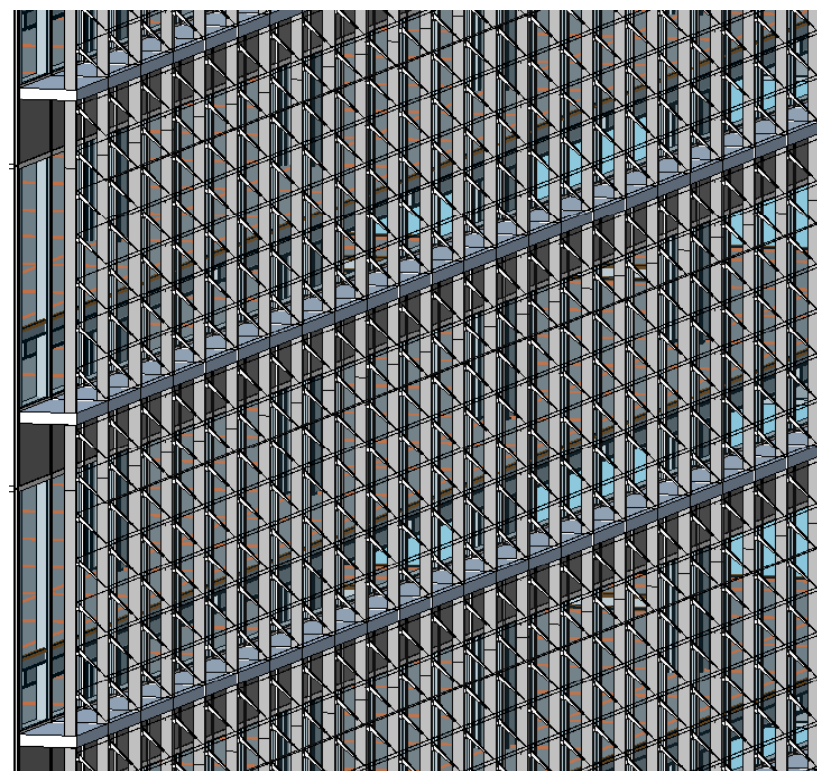
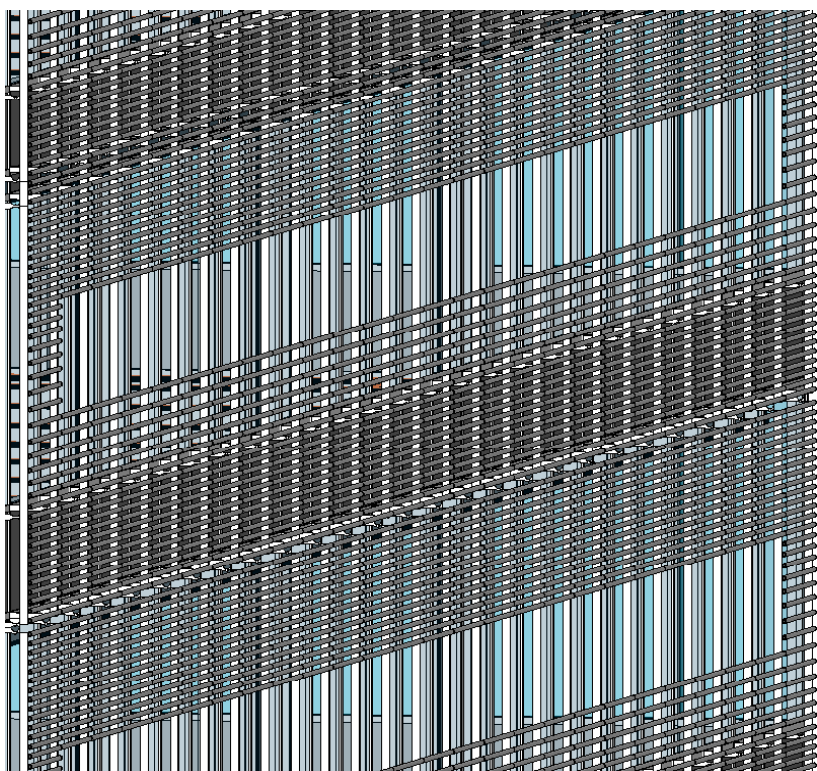
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TAKE-OFFS

ENVELOPE AREA TAKE-OFFS FROM MODEL

ORIGINAL

APPLY COST DATA TO MODELED FAÇADE FAMILIES

CALCULATE NUMBER OF RODS

PROPOSED LOUVERS AND OPERABLE WINDOWS

APPLY COST DATA TO MODELED LOUVERS AND OPERABLE WINDOW FAMILIES

DIFFERENCES

ORIGINAL CURTAIN WALL: \$80,509,220.00

CERAMIC RODS: \$3,023,640.00

NON-OPERABLE PANELS: \$77,156,312.50

OPERABLE PANELS: \$7,715,812.50

LOUVERS: \$11,563,300.00

TOTALS			
Curtain Wall	555236	Sq. Ft. =	\$ 80,509,220.00
Ceramic Rods	755910	L.F. = 151182 5' Lengths =	\$ 3,023,640.00
Total			\$ 83,532,860.00

Louver Area	8.75	S.F. per 5' length	
Louver Cost	\$350.00	per 5' length	
TOTALS			
Curtain Wall	568000	Sq. Ft. =	\$ 82,360,000.00
Louvers	165190	L.F. = 33038 5' Lengths =	\$ 11,563,300.00
Total			\$ 93,923,300.00

Operable Window Louver	5	S.F. per 5' length	
Number of Operable Window Louvers	10	Louvers per glazing panel	
Operable Window Louver Cost	\$215.00	per S.F. of glazing panel	
TOTALS			
Curtain Wall	532112.5	Sq. Ft. =	\$ 77,156,312.50
Operable Curtian Wall	35887.5	Sq. Ft. =	\$ 7,715,812.50
Total			\$ 84,872,125.00

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Envelope Goals			
	Achieved Goal	Reduced Payback Period	Increase Occupant Comfort
✓ Yes			
✗ No			
- Non-Applicable			
Structural			
Eliminate Thermal Trusses	✓	✓	-
Maintain the Original Architecture including the Cantilevered Bays	✓	-	-
Accurate Revit Model Creation	✓	-	-
Disengage Columns from Lateral System	✓	✓	-
Lighting/Electrical			
Maintain Architect's vision of transparency through daylighting system	✓	-	✓
Reduce Energy Consumption Due to Daylight Harvesting	✓	✓	-
Use Daysim and Excel to Calculate Energy Savings using DA	✓	-	-
Accurate Revit Model Creation of Shading Device	✓	-	-
Use Ecotect to Obtain Annual Incident Solar Radiation on Façade	✓	-	-
Design a PV system to offset energy consumption	✓	✓	-
Exterior Lighting Design that Reduces Energy Consumption	✓	✓	-
Use Radiance to Produce Renderings of Façade	✓	-	-
Mechanical			
Establish BIM->Energy Model Workflow "Best Practices"	✓	-	-
Utilize a BIM compatible software (IES<VE>) for energy simulations	✓	-	-
Reduce Ambient Load Profile with Envelope Construction Optimization	✓	✓	-
Determine Cooling Load Reduction due to decreased Lighting Power Density	✓	✓	-
Design of Mixed-Mode Ventilation System	✓	✓	-
Utilize IES<VE> Macroflo for Mixed-Mode Design	✗	-	-
Construction			
Decrease Construction Cost	✗	✓	-
Maintained Architect's Vision	✓	-	-
Shorten/Maintain Construction Schedule	✓	-	-
Use Revit Model for Take-off	✓	-	-

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