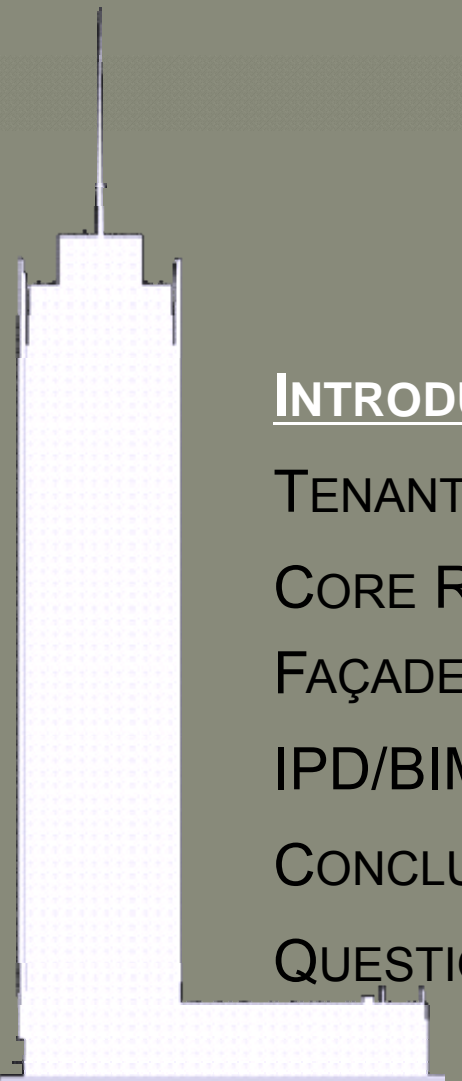


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A CASE STUDY FOR THE USE OF IPD/BIM

FOR THE ANALYSIS AND DESIGN OF
THE NEW YORK TIMES BUILDING
NEW YORK, NY

THE NEW YORK TIMES BUILDING

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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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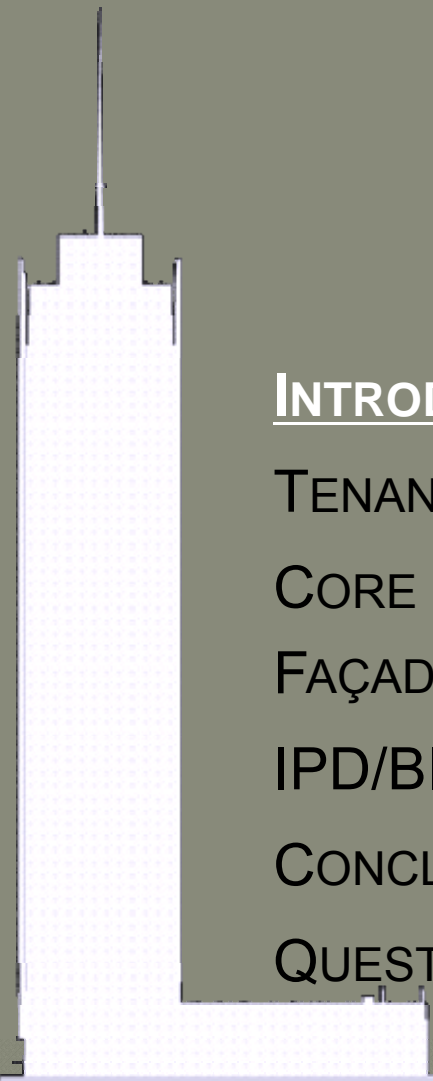
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FOUNDATIONS:

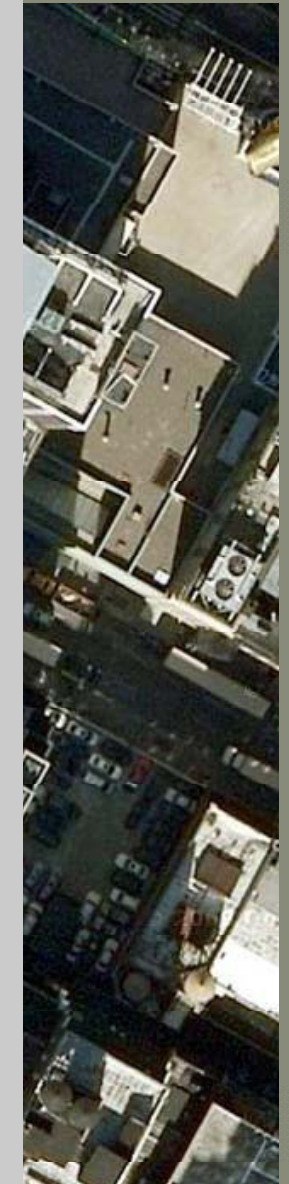
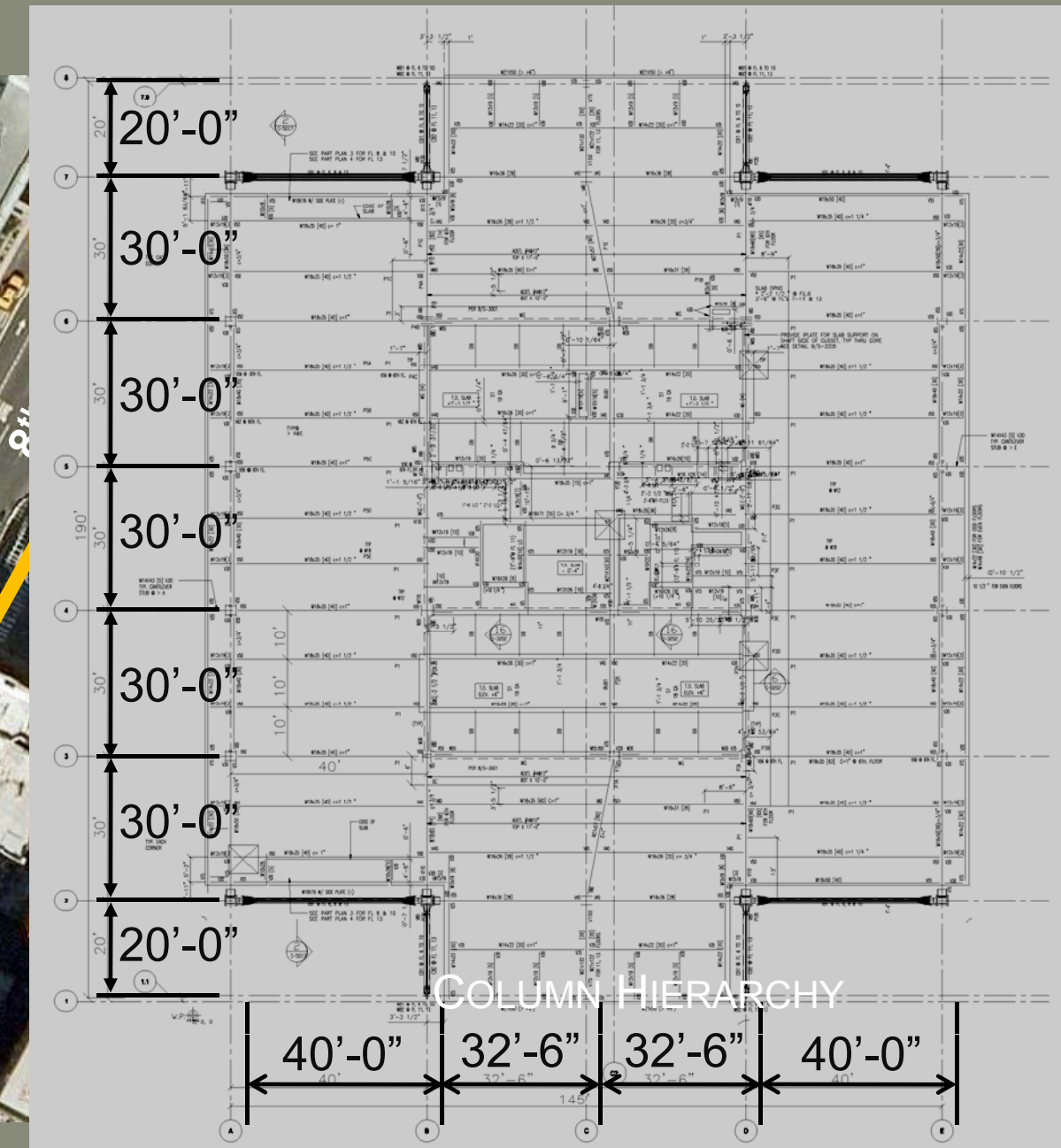
- (7) - 24" DIAMETER CAISSONS WITH 6,000 PSI
- 6,000 PSI SPREAD FOOTINGS EVERYWHERE ELSE

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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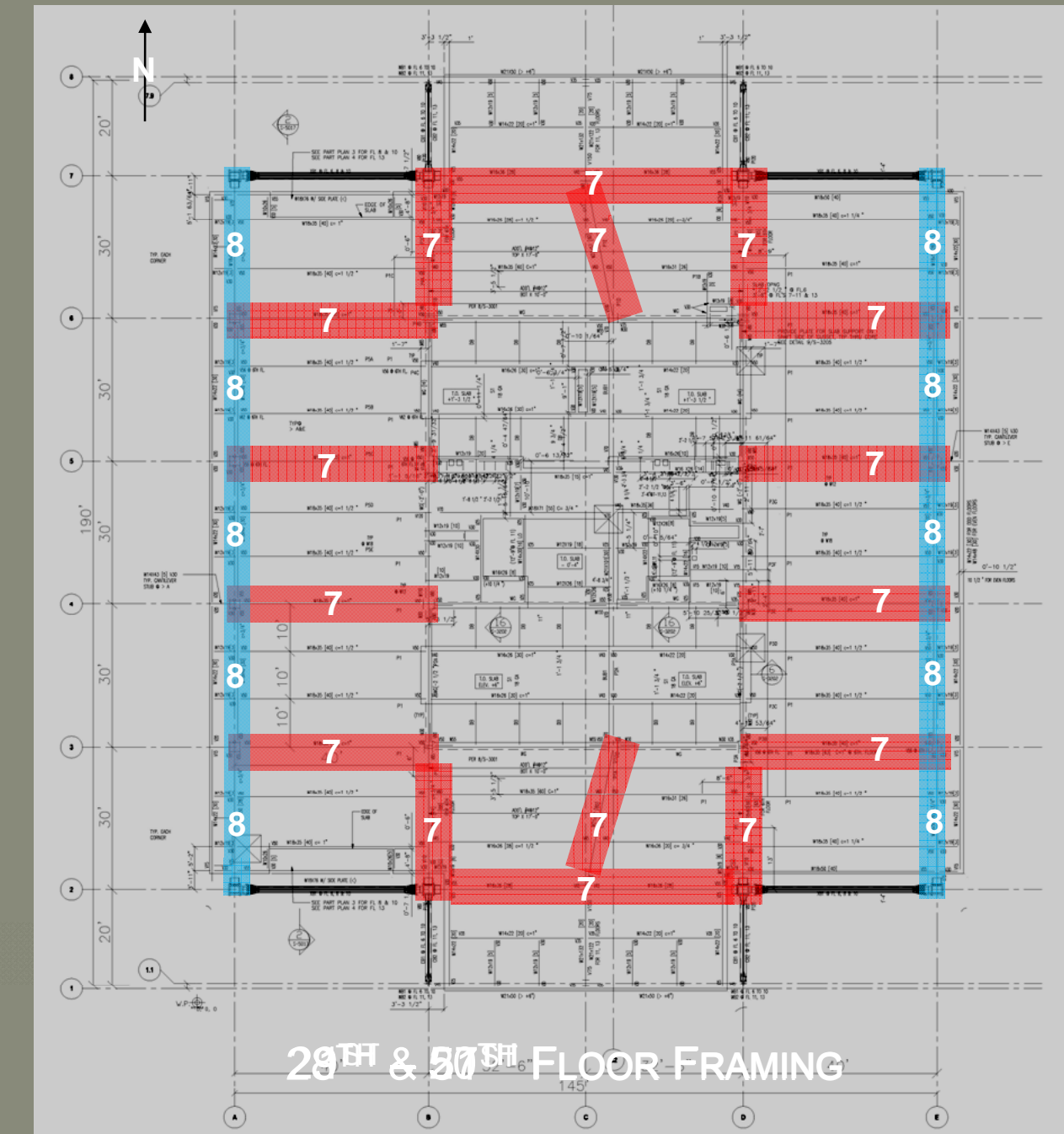
STRUCTURE

CANTILEVER BAYS:

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

LATERAL FORCE RESISTING SYSTEM:

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



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MECHANICAL

COOLING

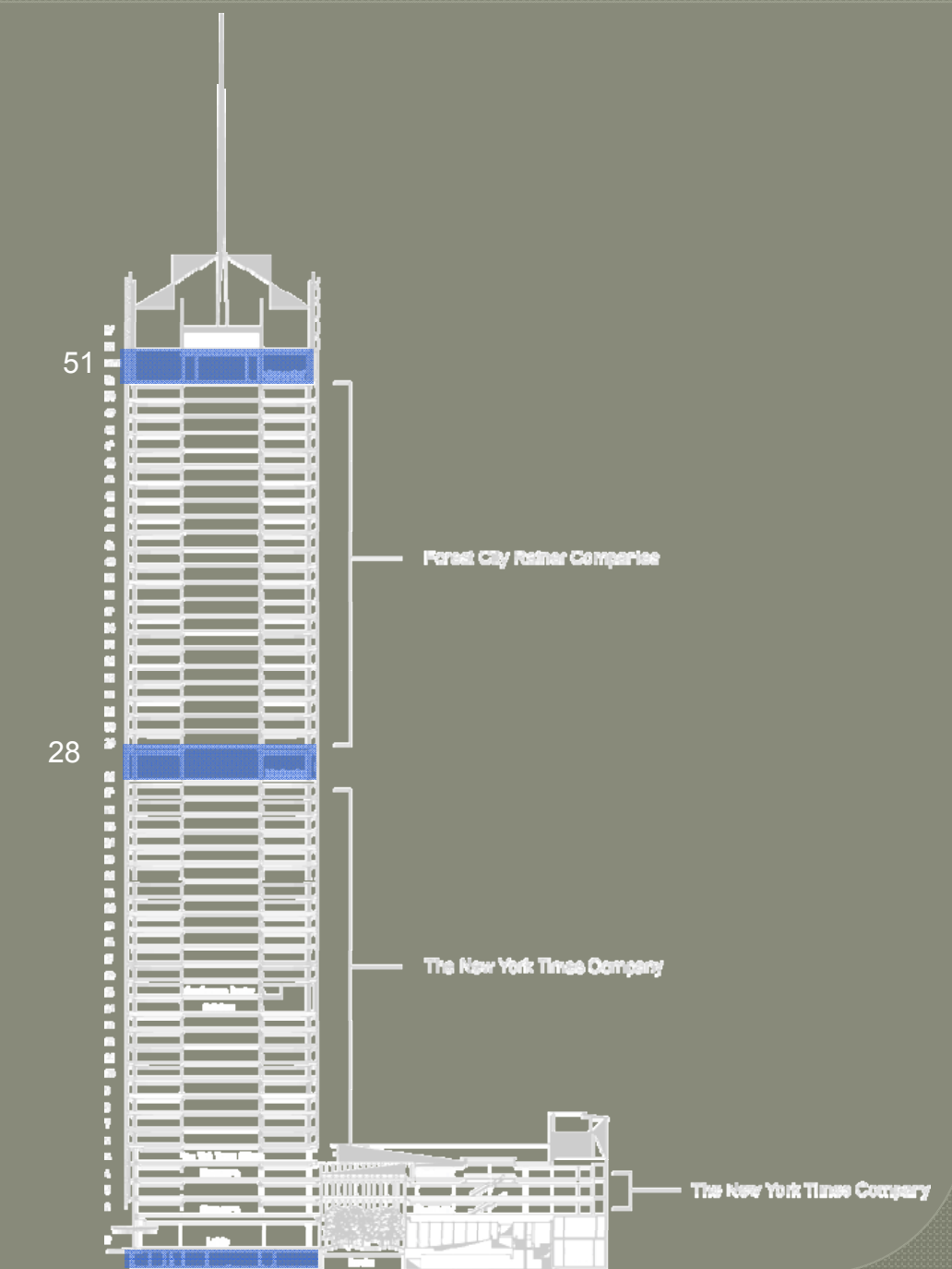
- 6250 TON CHILLED WATER SYSTEM
 - (5) 1,200 TON CENTRIFUGAL CHILLERS
 - (1) 250 TON SINGLE STAGE ABSORPTION CHILLER

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 (SBLD)

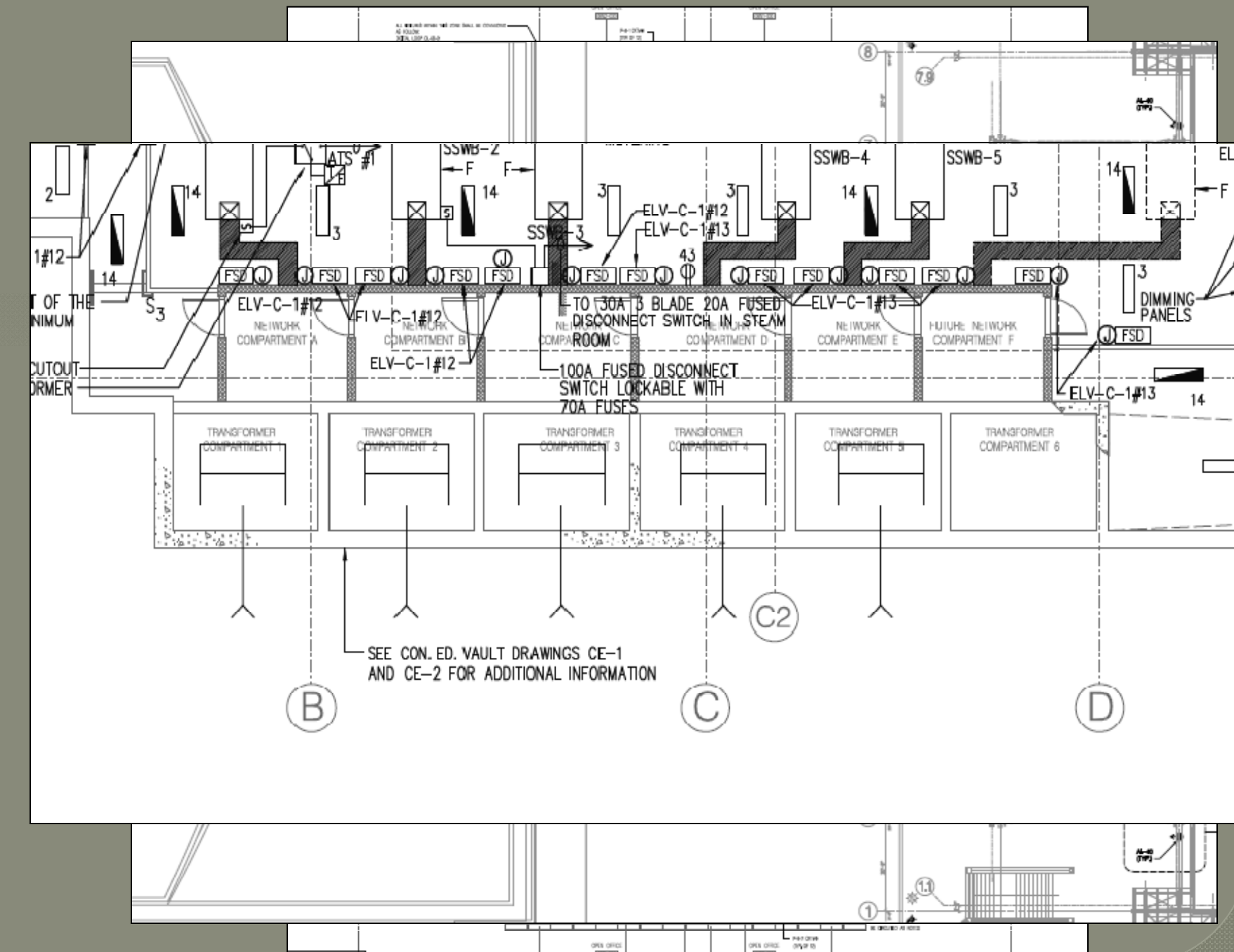
- 18,000 (2) 14w FLUORESCENT LAMP FIXTURES
- DIGITALLY ADDRESSABLE BALLASTS
- COMPLEX DAYLIGHT HARVESTING SYSTEM
- DESIGNED TO 1.1 W/FT²
- DIMMED TO 30 FC

EXTERIOR (OVI)

- 250W METAL HALIDE LAMPS ILLUMINATING THE FAÇADE
- 1 FC AT TOP, 3 FC AT SIGNAGE

ELECTRICAL (FLACK + KURTZ)

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



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CONSTRUCTION MANAGEMENT

SUMMARY SCHEDULE

FUNCTION: CLASS A OFFICE SPACE

FIRST FLOOR RETAIL, OPEN-AIR PAPER BIRCH
GARDEN, CULTURAL CENTER & PERFORMANCE
SPACE

ASSUMED \$1 BILLION

APPROXIMATELY 1.5 MILLION SQUARE FEET

CORE & SHELL: AMEC

NYT INTERIORS: TURNER CONSTRUCTION

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DURATIONS	DATE	DURATIONS	DATE
Start of Construction	12/1/2003	Concrete Fill / Tower Topout	8/23/2006
Start Demolition	12/1/2003	Curtainwall - Podium Finish	3/13/2006
Finish Demolition	6/30/2004	Curtainwall - Tower	1/3/2007
Start of Excavation Foundations	4/19/2004	MP - Start	5/3/2004
Finish Foundations	9/12/2005	MP - Finish	4/23/2007
Start of Steel Erection (Tower)	5/2/2005	Electrical - Start	8/19/2005
Start of Steel Erection (Podium)	7/26/2005	Electrical - Finish	4/12/2007
Steel Top Out	5/24/2006	Interior Finishes - Start	10/3/2005
Mobilize Podium Concrete	10/24/2005	Interior Finishes - Finish	6/20/2007
Podium Concrete Finished	12/6/2005	Remove Tower Cranes	7/25/2006
Mobilize Tower Concrete	7/18/2005	Remove Hoists	5/31/2007
Pour Concrete 51,52	7/24/2006	Project Closeout	6/20/2007

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PROJECT GOALS

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

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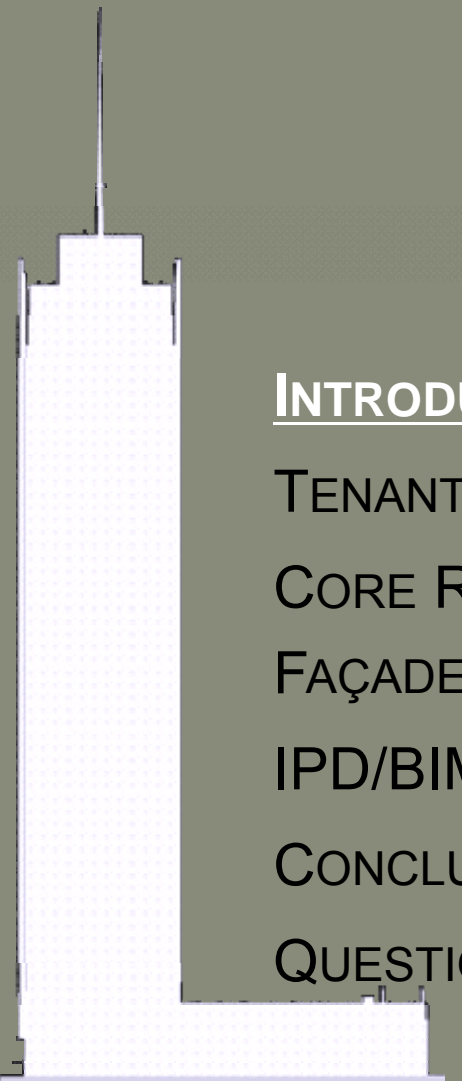
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DECREASE THE BUILDING'S LIFE CYCLE COST BY ANALYZING:

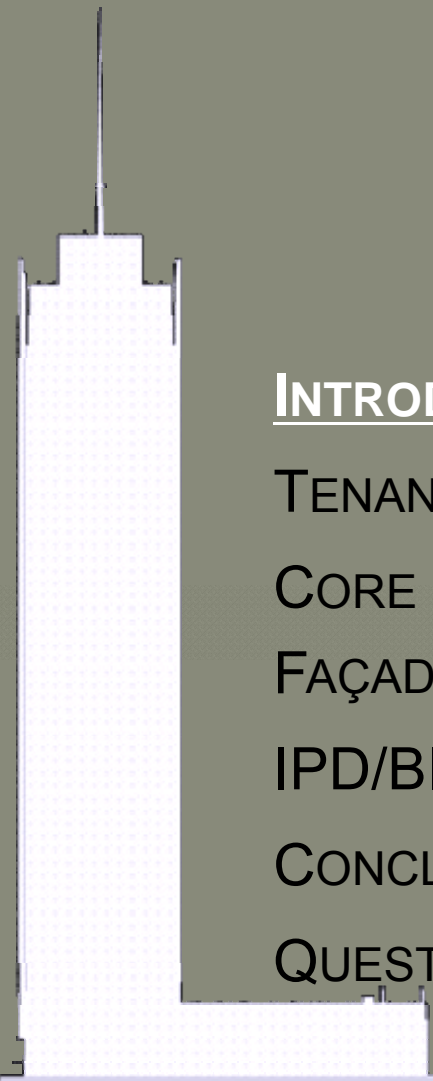
- BUILDING MECHANICAL SYSTEMS
- BUILDING LIGHTING SYSTEMS
- BUILDING STRUCTURAL SYSTEMS
- BUILDING ARCHITECTURE

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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OPTIMIZE THE STRUCTURAL CORE WHILE ANALYZING THE EFFECTS ON:

- BUILDING MECHANICAL SYSTEMS
- BUILDING ELECTRICAL SYSTEMS
- BUILDING ARCHITECTURE
- BUILDING CONSTRUCTION COST AND SCHEDULING

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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OPTIMIZE THE BUILDING ENVELOPE TO IMPROVE THE INDOOR ENVIRONMENTAL QUALITY AND DECREASE BUILDING ENERGY CONSUMPTION BY ANALYZING:

- ENVELOPE THERMAL PERFORMANCE
- DAYLIGHT HARVESTING CAPABILITIES
- RENEWABLE ENERGY INCORPORATION
- BUILDING ARCHITECTURE
- BUILDING CONSTRUCTION COST

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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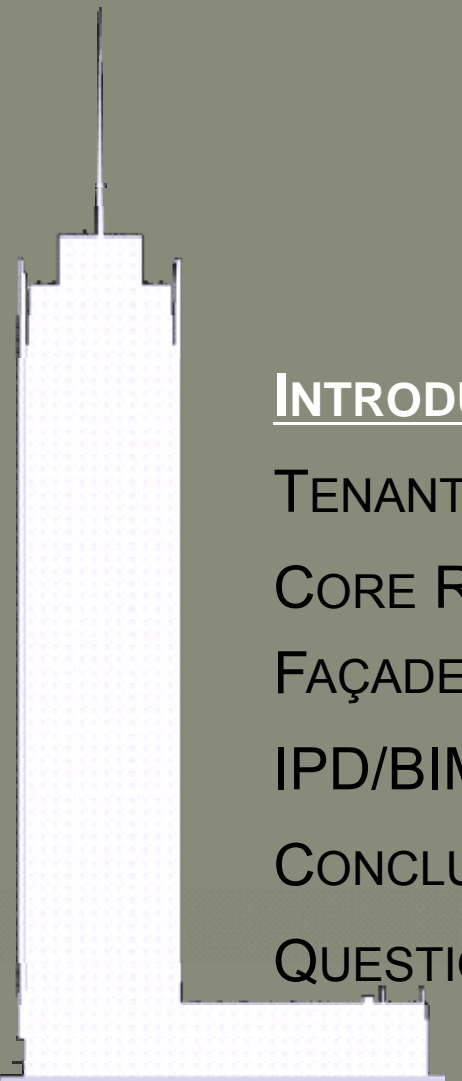
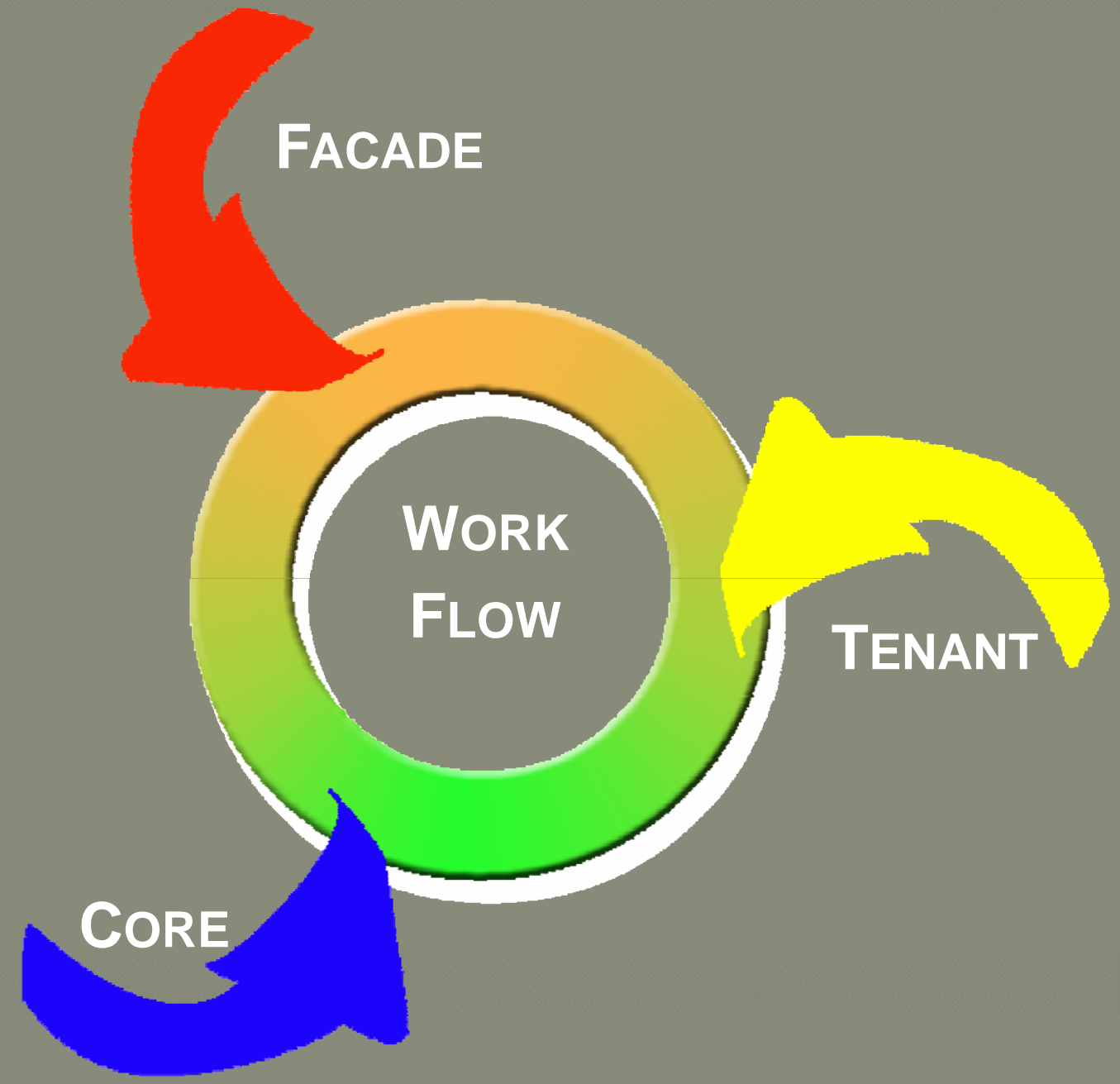
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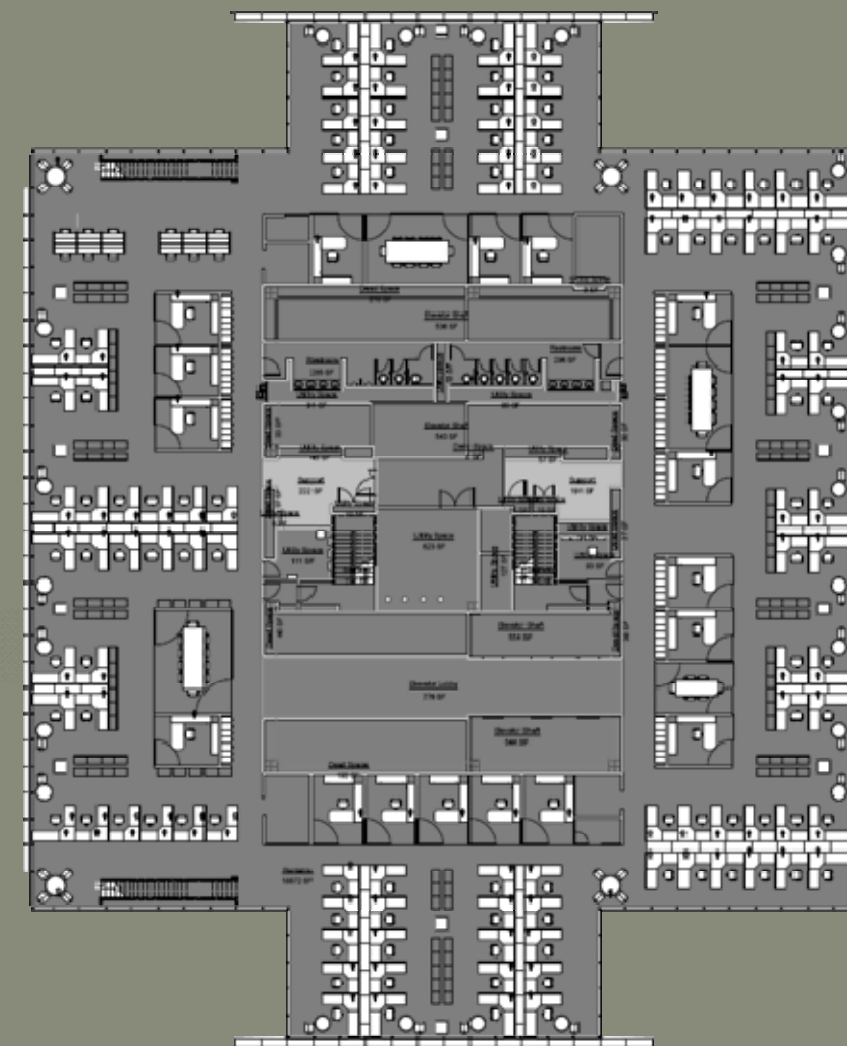
GRAVITY SYSTEM

INTERIOR LIGHTING

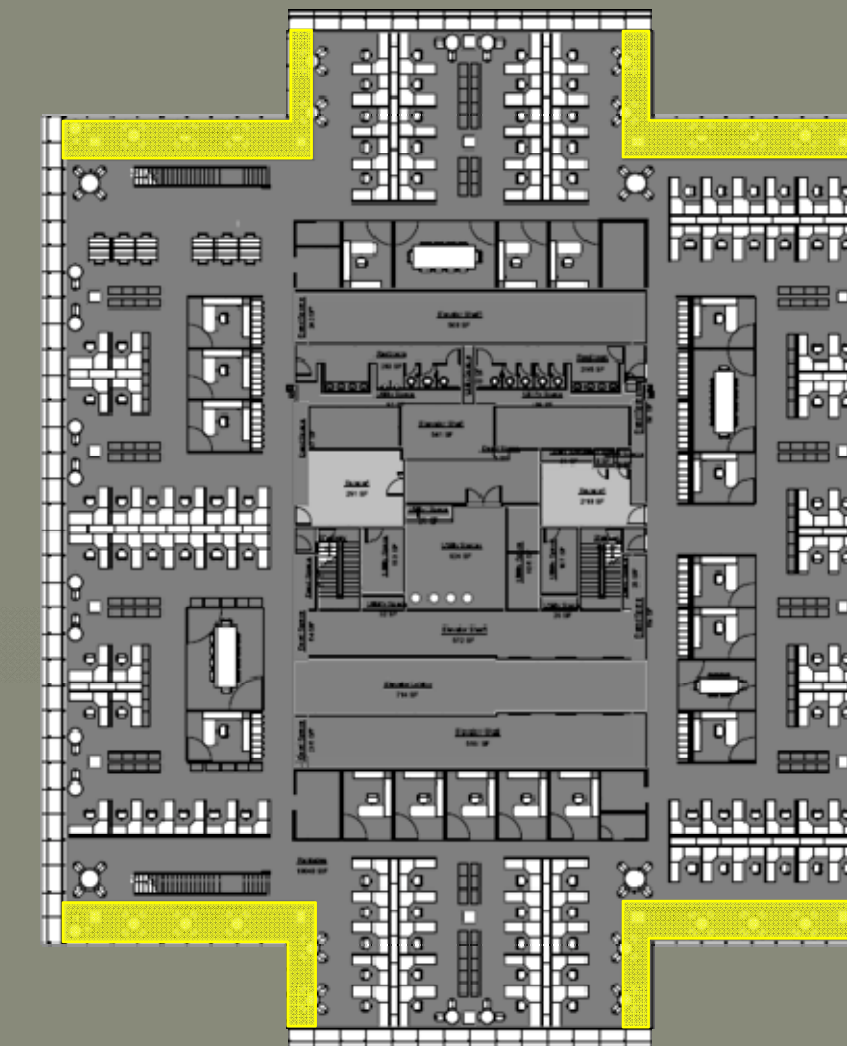
UFAD → DV

CONCLUSIONS

ARCHITECTURAL LAYOUT



ORIGINAL 5-17



PROPOSED 5-17

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RENT 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

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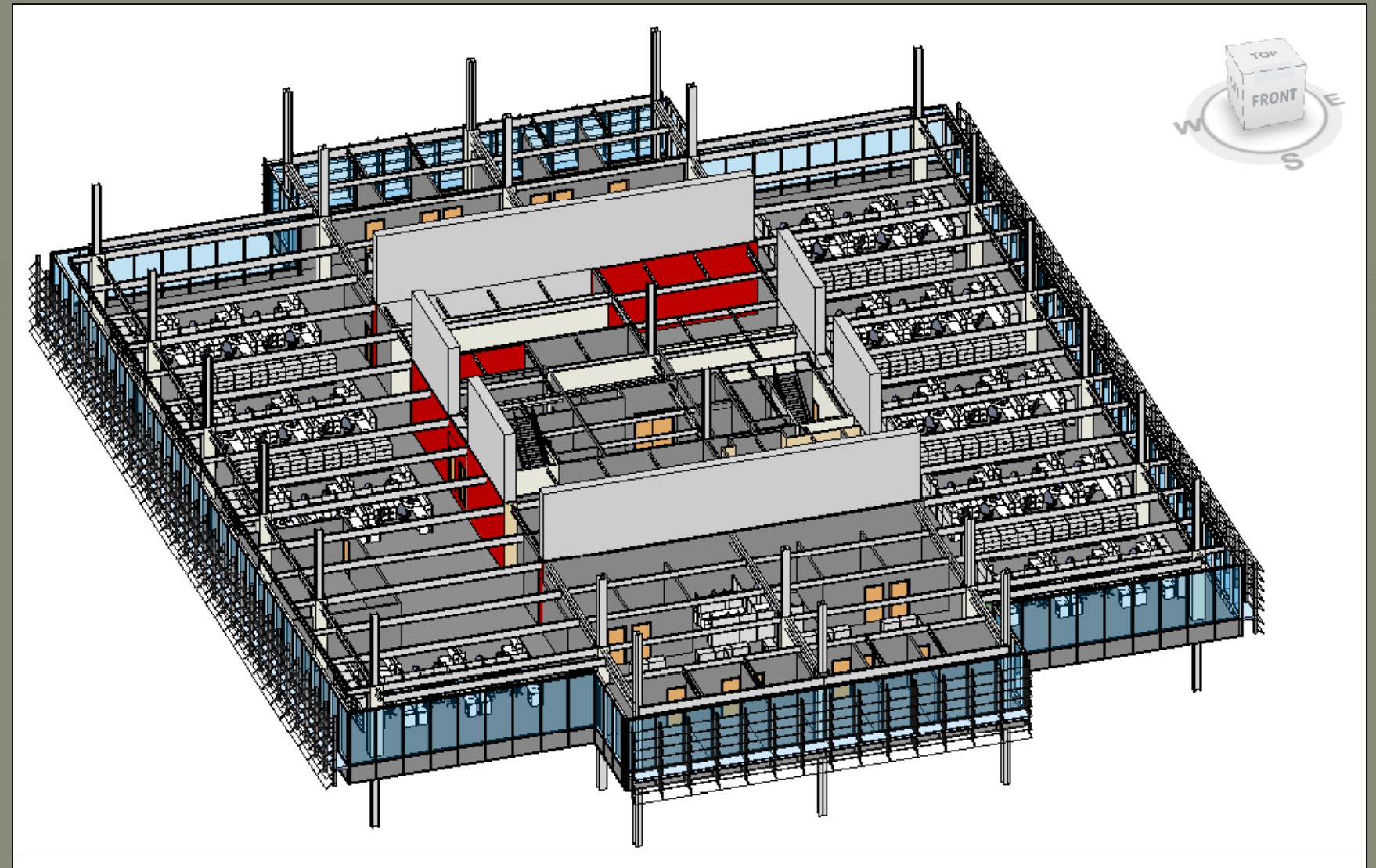
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PROPOSED FCRC 32ND FLOOR

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REDESIGN OF GRAVITY SYSTEM

ITERATIVE DECK AND BEAM DESIGN

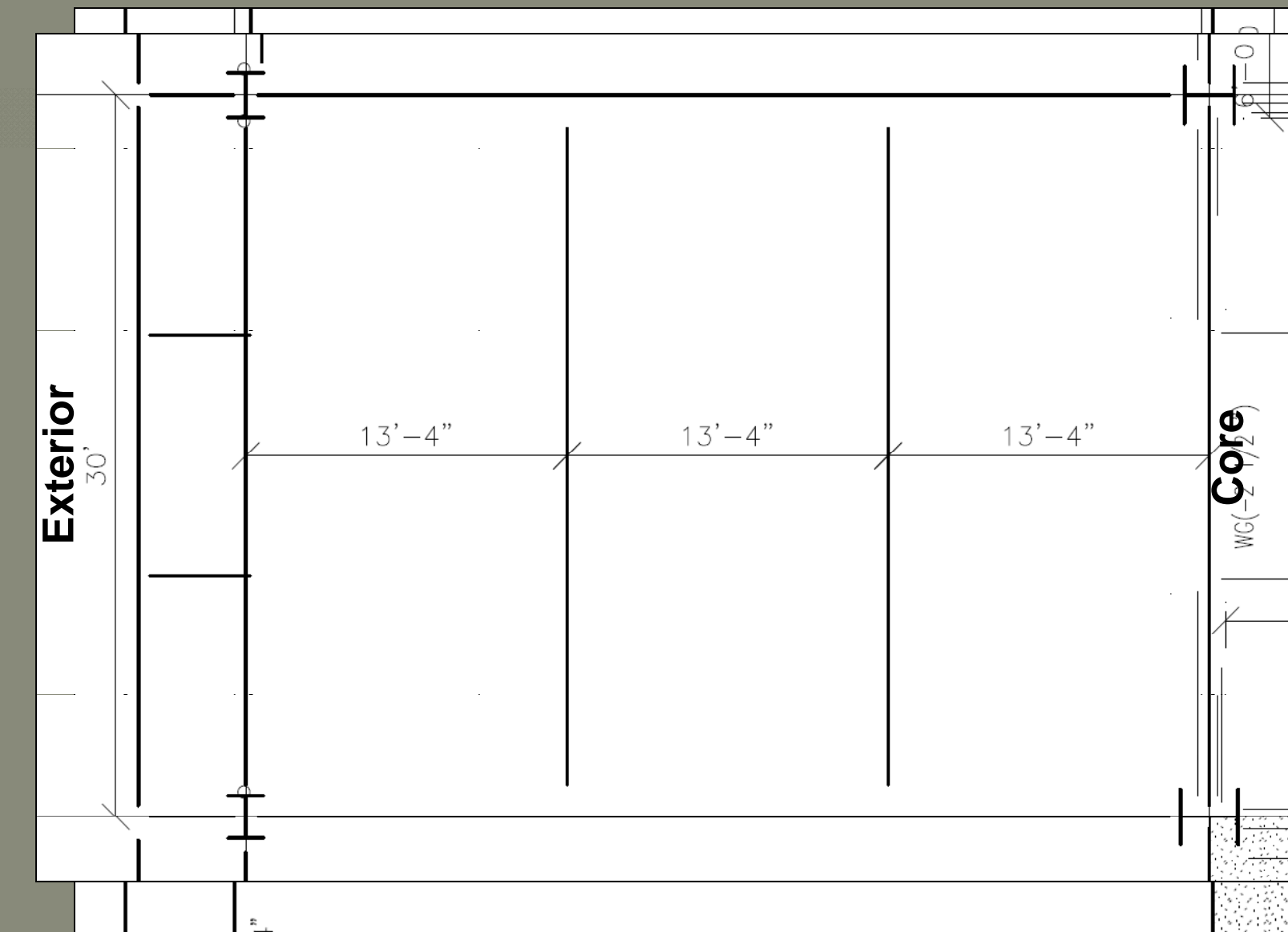
- 14 DIFFERENT SOLUTIONS REDUCED TO ONE POTENTIAL SOLUTION

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



Framing Option 2

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REDESIGN OF GRAVITY SYSTEM

WALKING EXCITATION ANALYSIS:

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

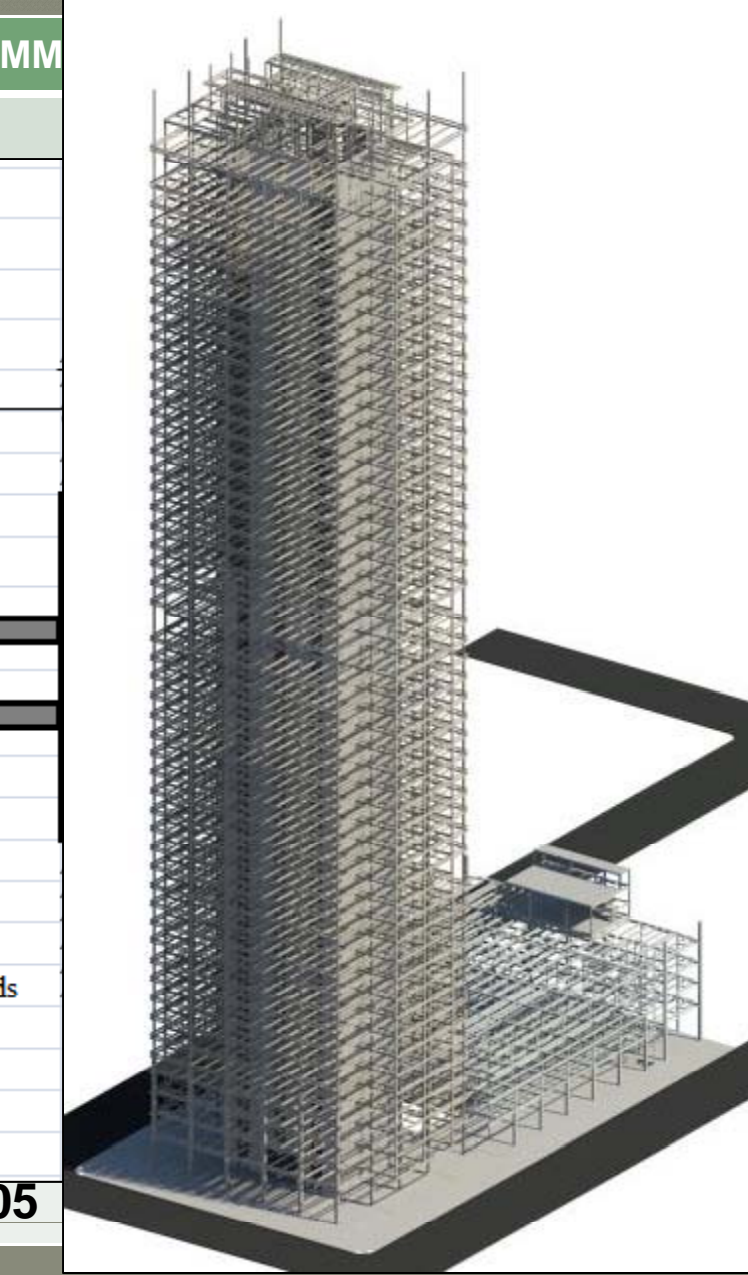
FINAL DESIGN:

- 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

SUMMARY		RESULTS	
		REDESIGNED	
SLAB			
BEAM	a = 2.5 in	X	3/8 X 14.50
GIRDER			
FRAMING			
SLAB			
BEAM	s = 4		
GIRDER	6		
COMPOSITE			
COMPOSITE			
A _p /G	4 3/4 " Dia. Studs		
A _p /G			
AVG.			
A_p/G WITH B = 0.05			
		X	16.00
			0.003



The image shows a 3D model of the building's steel frame, highlighting the gravity system redesign. The model is a tall, rectangular structure with a complex internal steel skeleton. A large, dark, arrow-shaped graphic points from the right side of the model towards the left, indicating the direction of the redesign or the specific area of focus.

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DESIGN CRITERIA

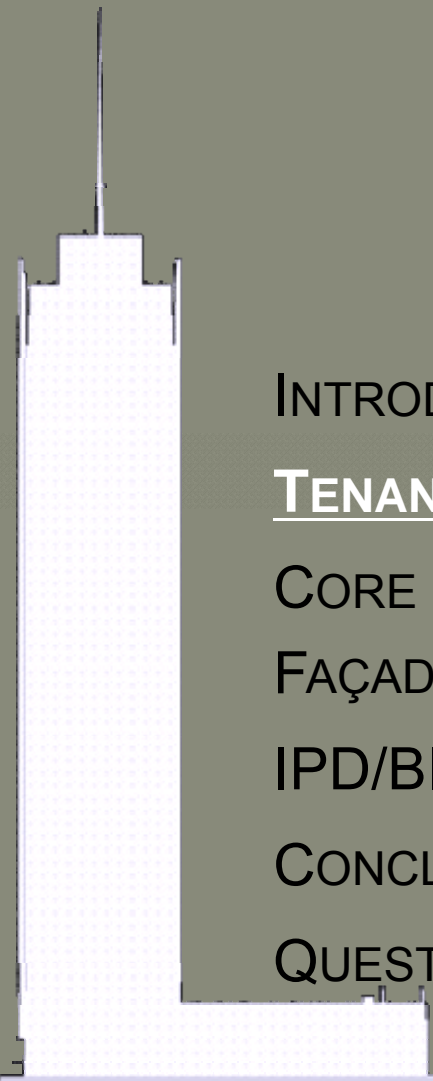
30 FC

1.1W/FT²

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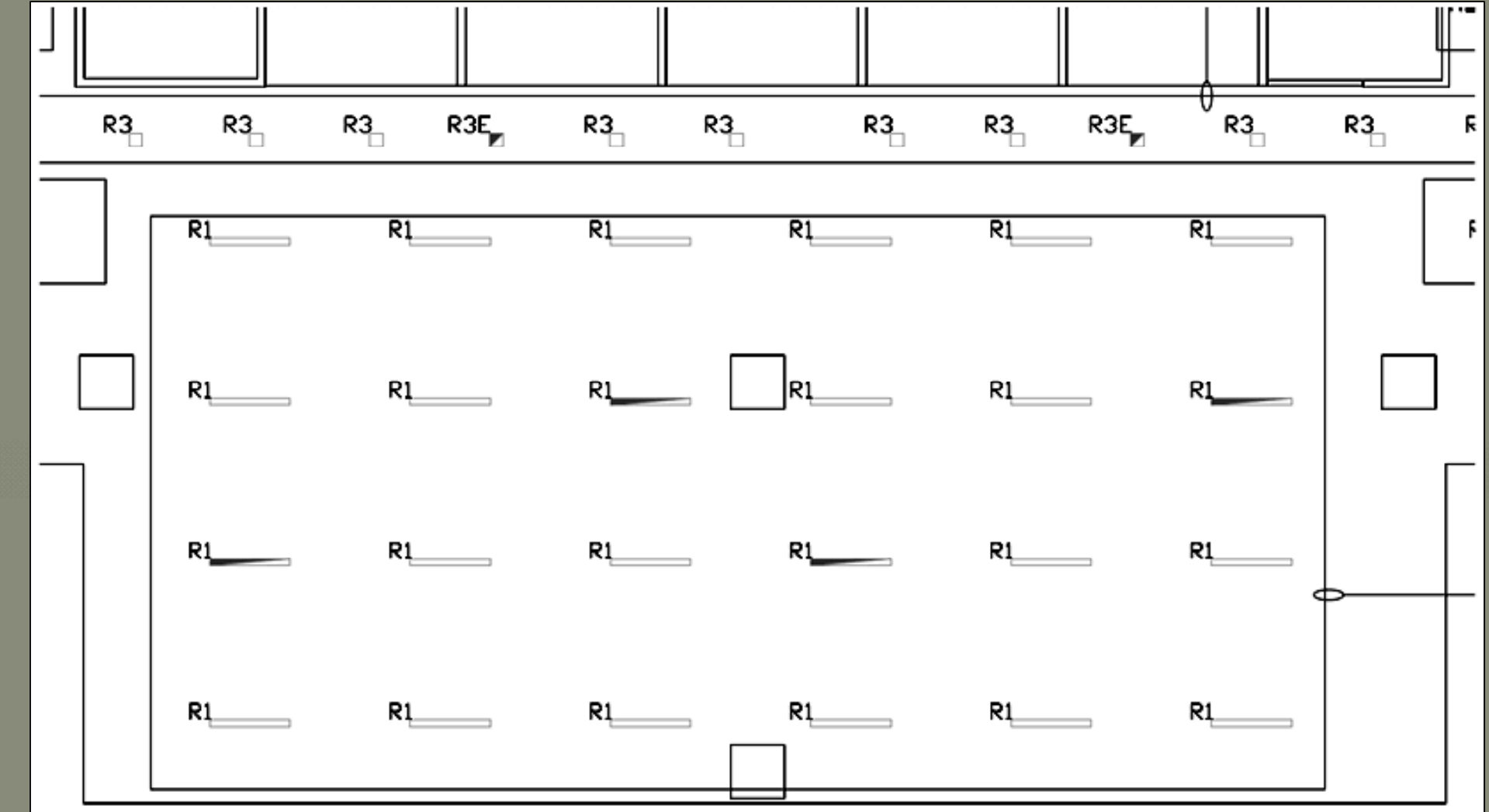
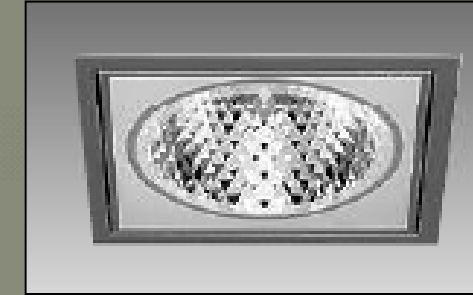
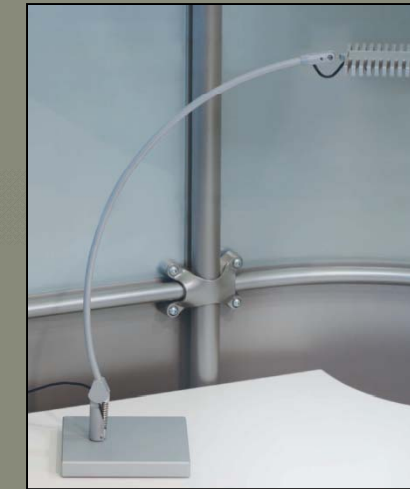
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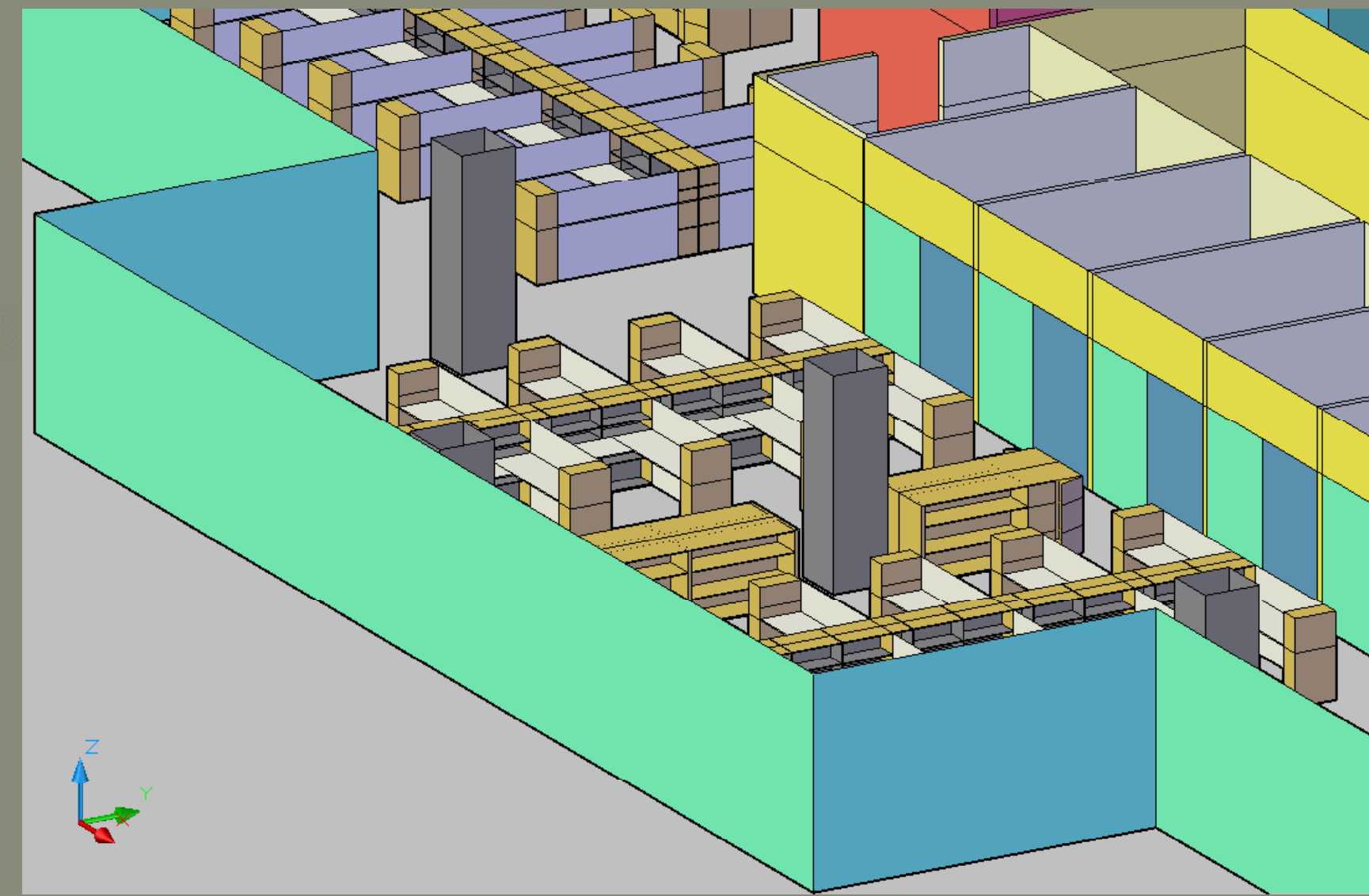
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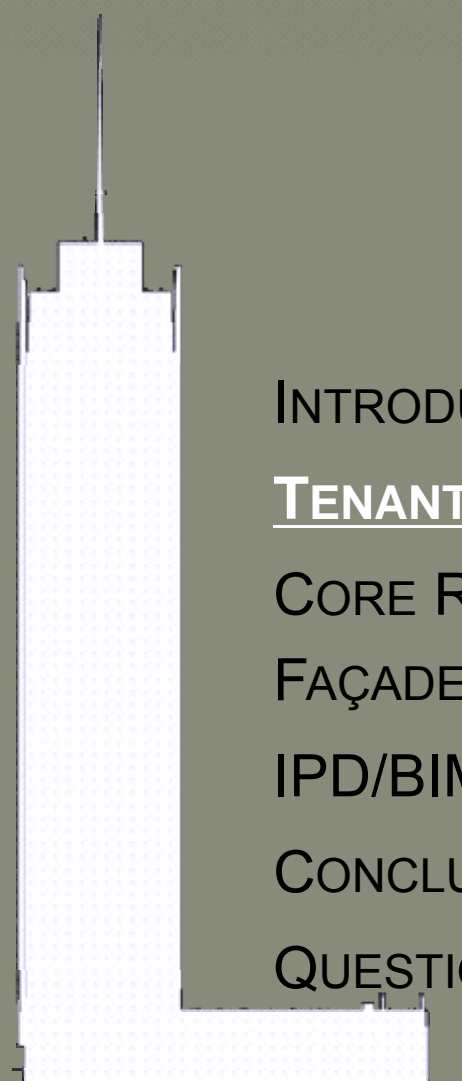
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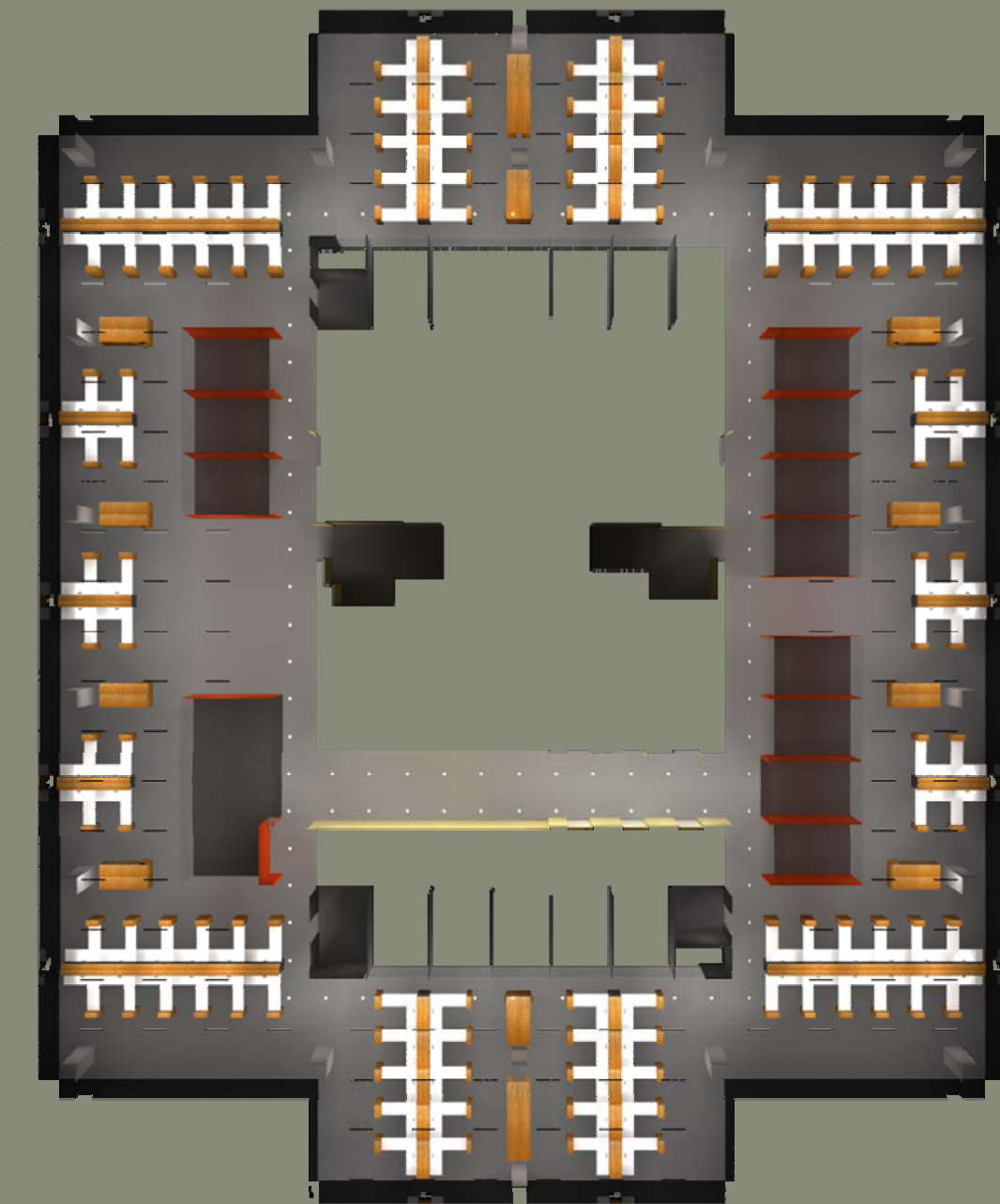
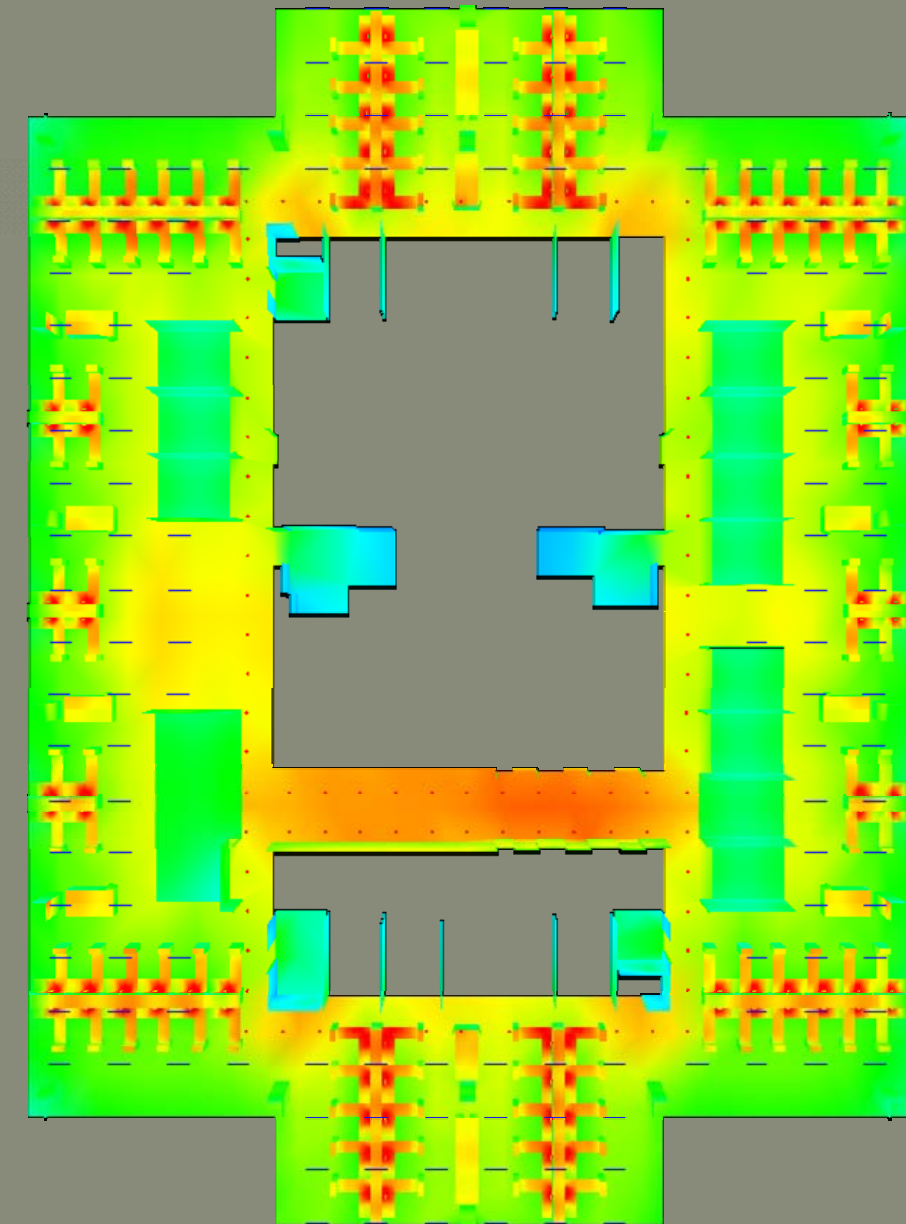
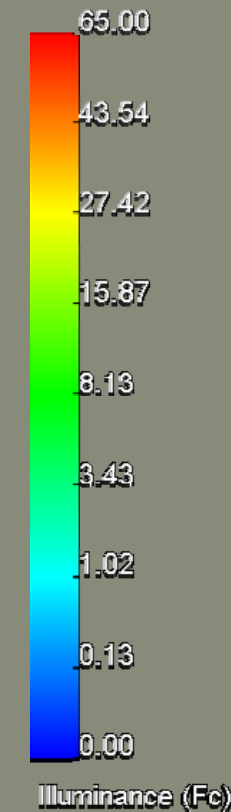
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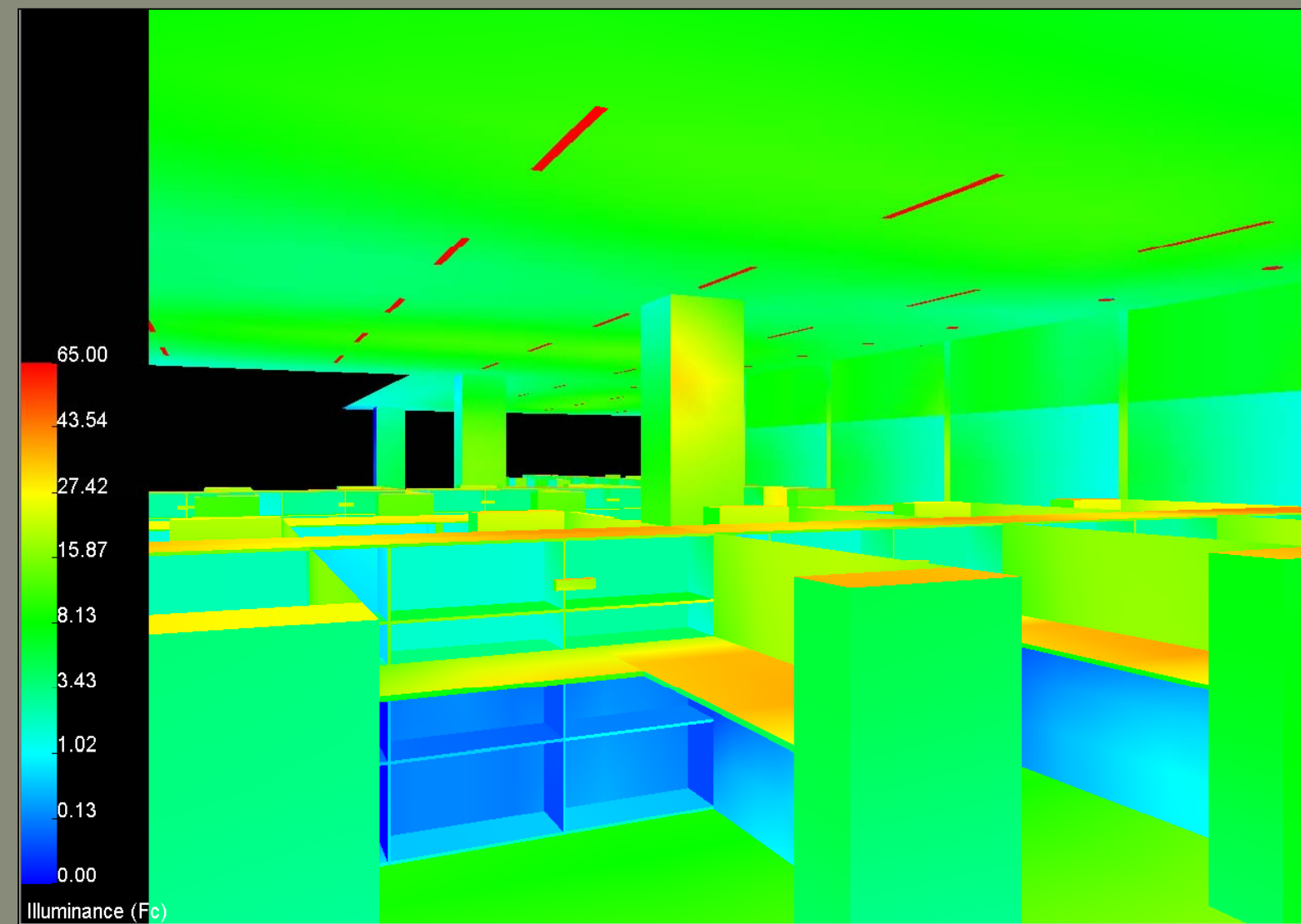
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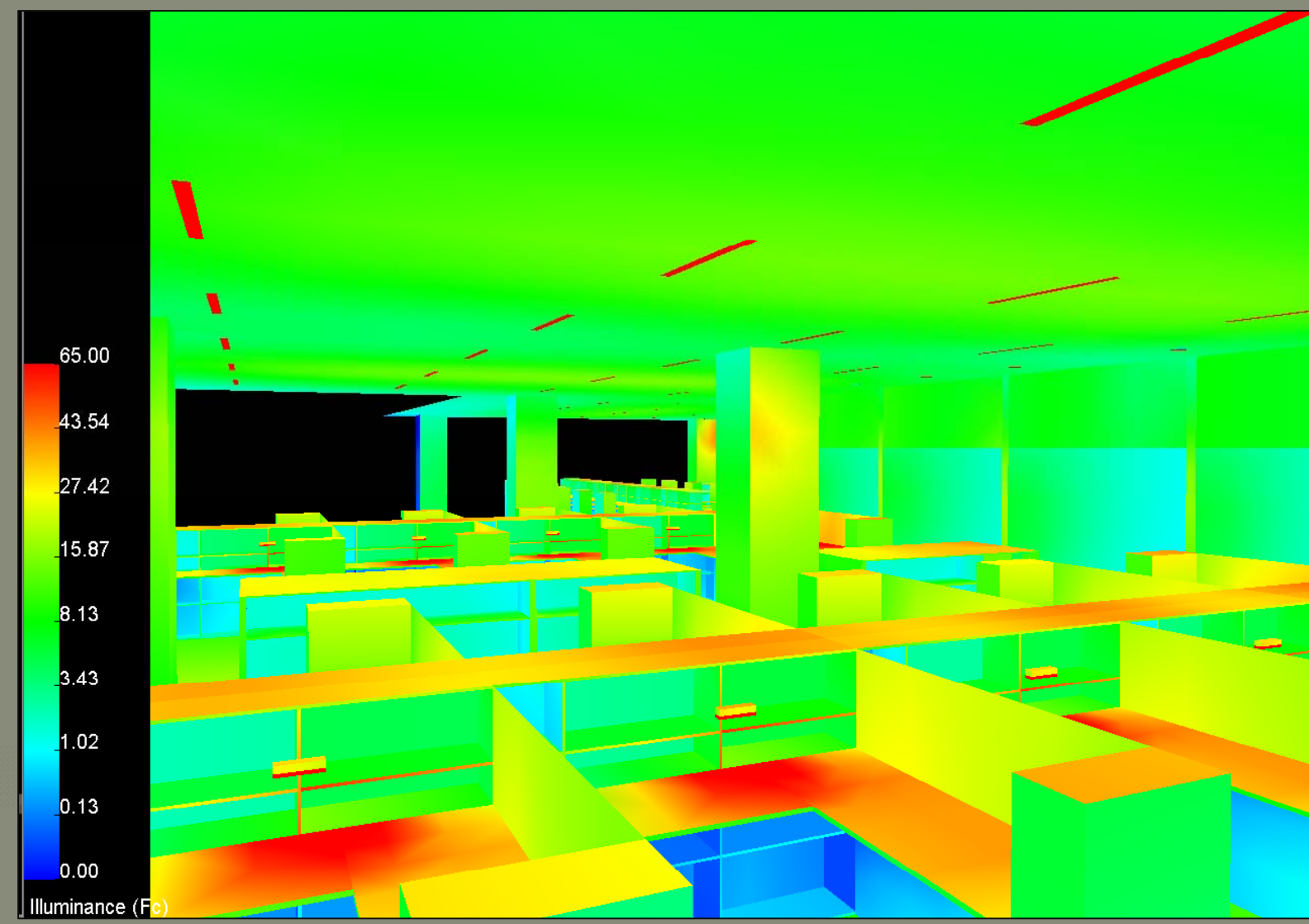
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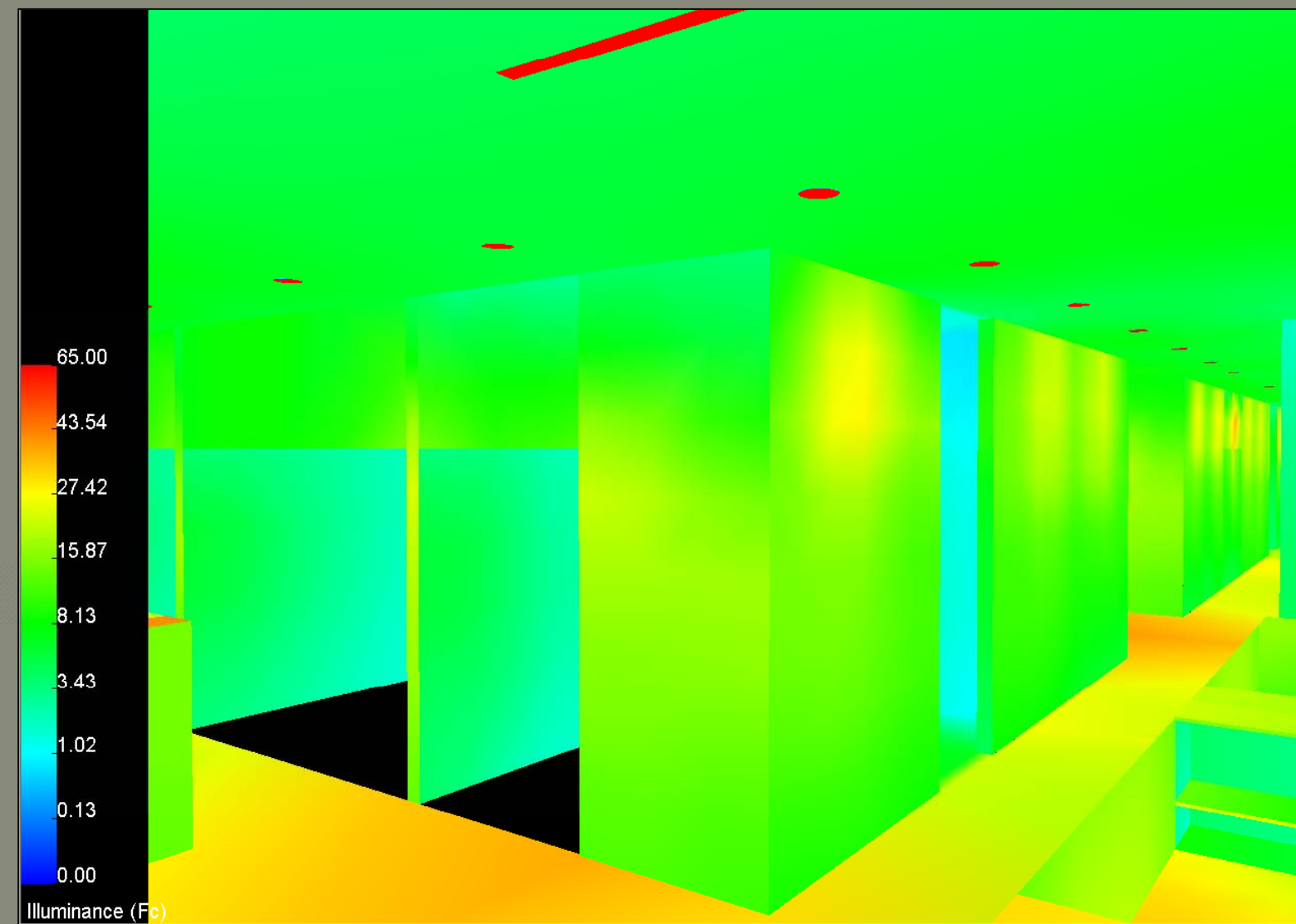
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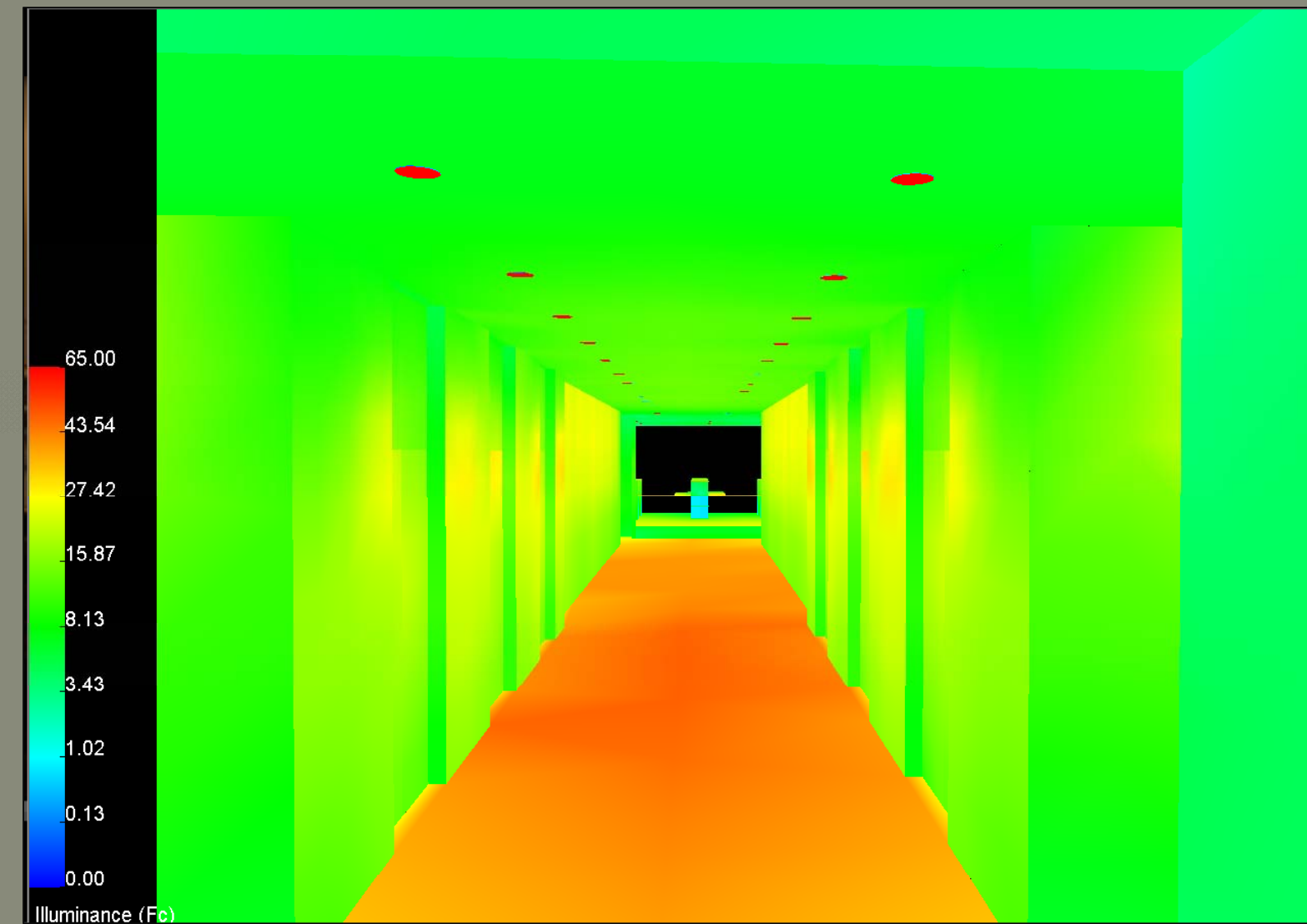
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DESIGN SUMMARY	ORIGINAL DESIGN	DESIGN CRITERIA	PROPOSED REDESIGN
TARGET ILLUMINANCE (FC)	50	30	30
LIGHTING POWER DENSITY (W/FT ²)	1.07	1.1	0.469
ENERGY SAVINGS (\$/FT ² /YEAR)	\$0.02	-	\$0.41
TOTAL SAVINGS (\$/YEAR)	\$21,976.65	-	\$462,242.21

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AIR DISTRIBUTION REDESIGN

OBJECTIVES:

IMPROVE UPON INDOOR ENVIRONMENTAL QUALITY
FOR BUILDING OCCUPANTS

ACCESS BIM TOOLS FOR MECHANICAL SYSTEM
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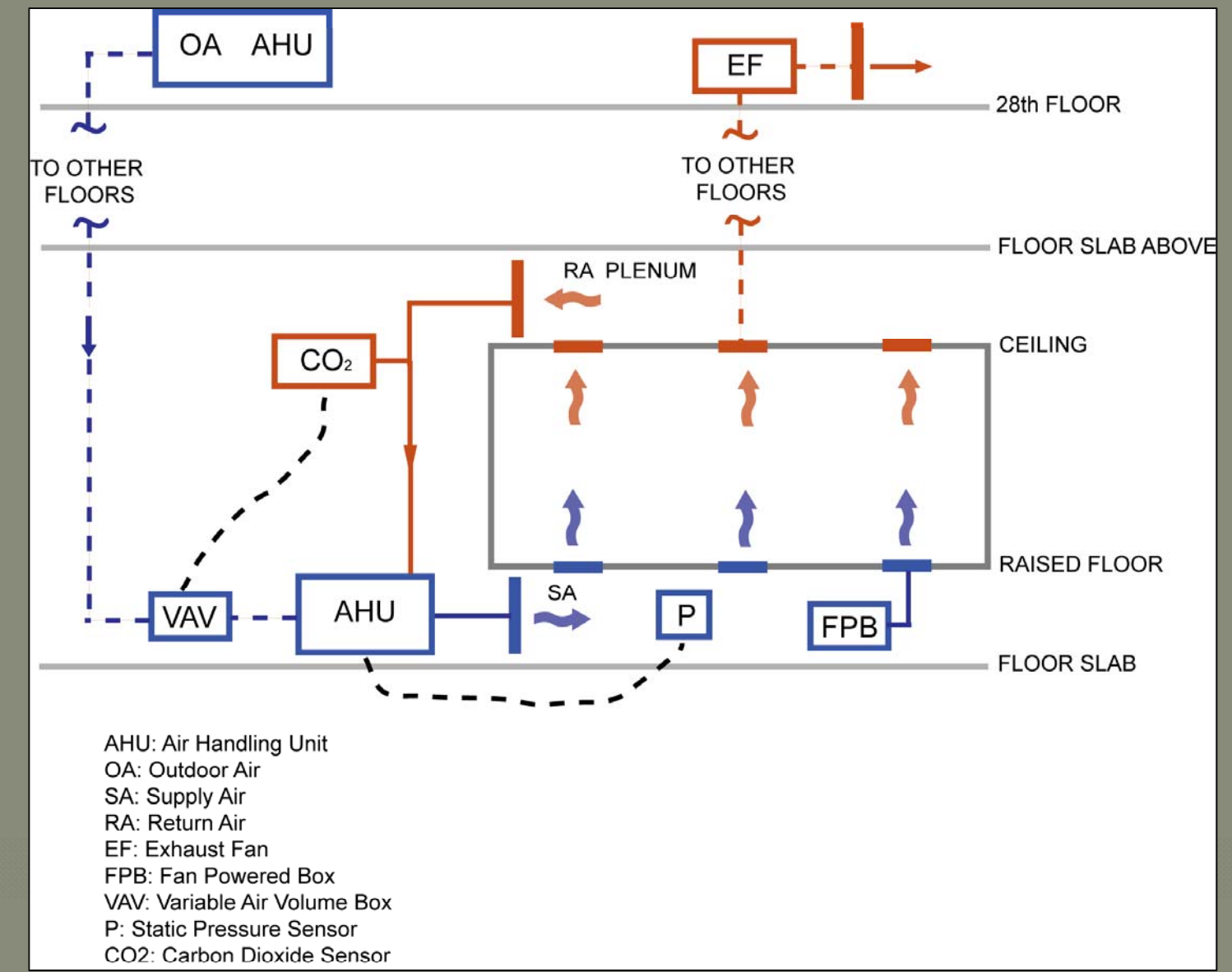
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EXISTING UNDERFLOOR AIR DISTRIBUTION SYSTEM (UFAD)



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PROPOSED DISPLACEMENT VENTILATION (DV) SYSTEM

DUCTED SYSTEM

MORE EFFECTIVE STRATIFICATION

ORIGINAL DESIGN INTENT SATISFIED ✓

HIGH-PROFILE SUSTAINABILITY

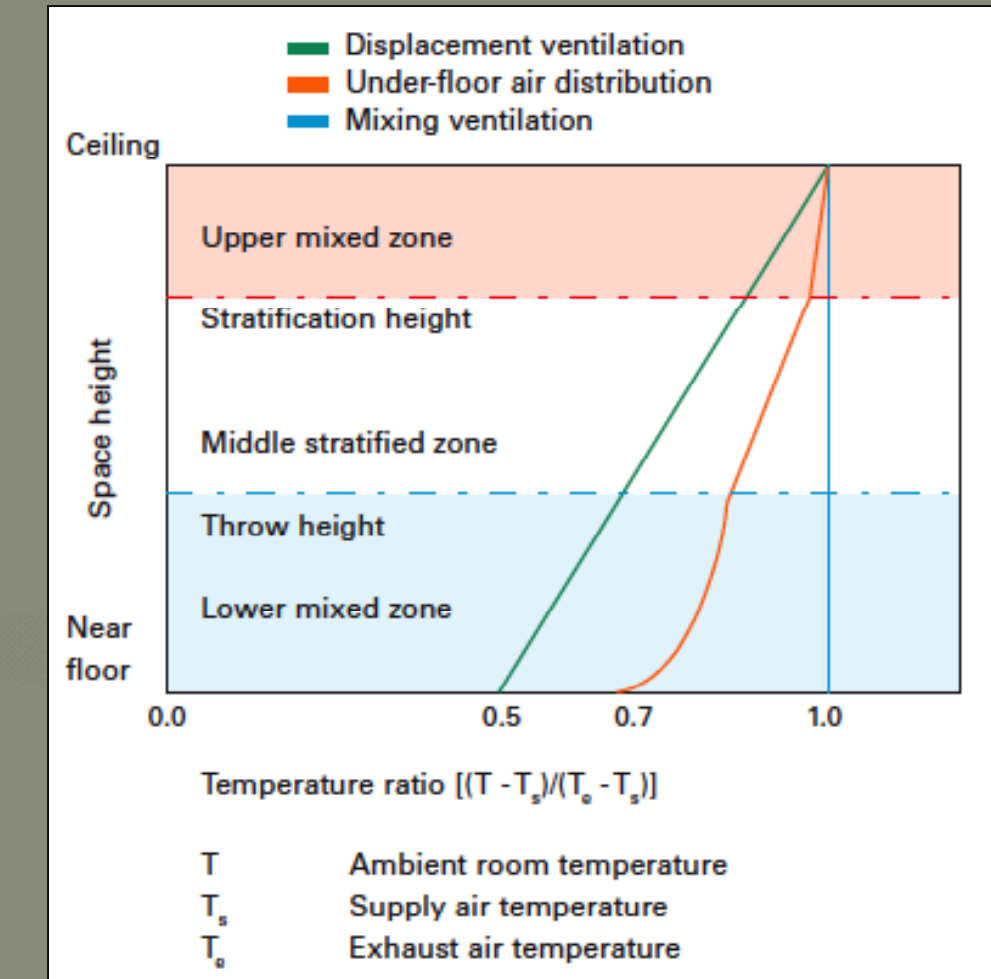
COST-EFFECTIVENESS

RAISED-FLOOR



SOURCE: PRICE

TEMPERATURE PROFILE COMPARISON



SOURCE: HALTON

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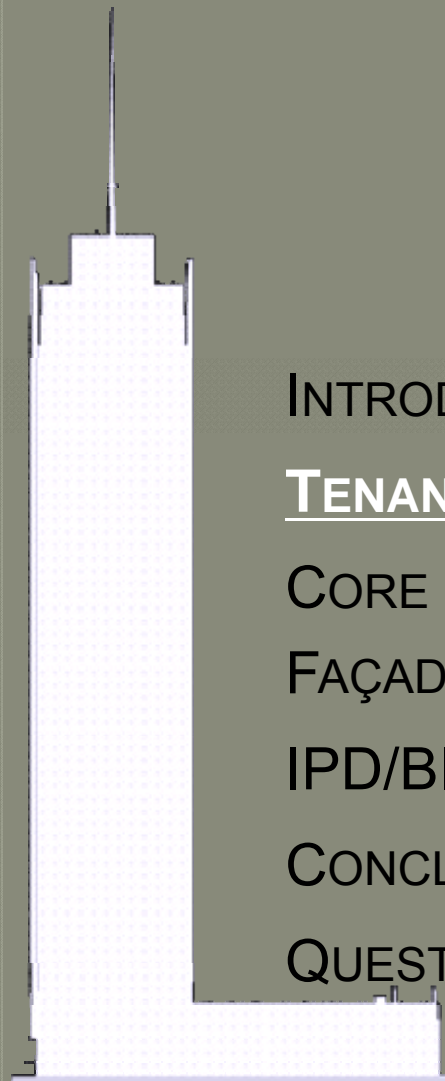
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	Load Factors	Load Type
Q_{oe} (Btu/h)	0.295	Occupants, Desk Lamps & Equipment
Q_l (Btu/h)	0.132	Overhead Lighting
Q_{ex} (Btu/h)	0.185	Heat Conduction through the Room Envelope and Transmitted Solar Radiation
Q_{total} (Btu/h)		Total Cooling Load

Load factors determined by ASHRAE RP-949

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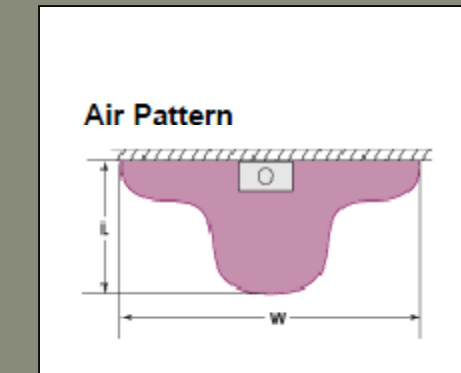
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Space (add tag)	Unit Type	# of Diffusers per Zone	Unit Size [Face Area, ft²] W x H x	Inlet Size	Face Velocity FPM	Airflow CFM	Total Pressure in.w.g.	Static Pressure in.w.g.	Noise Criteria NC	Adjacent Zone			
										ΔT = 5°F		ΔT = 10°F	
										Length ft.	Width ft.	Length ft.	Width ft.
Zone 1 - NW 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 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

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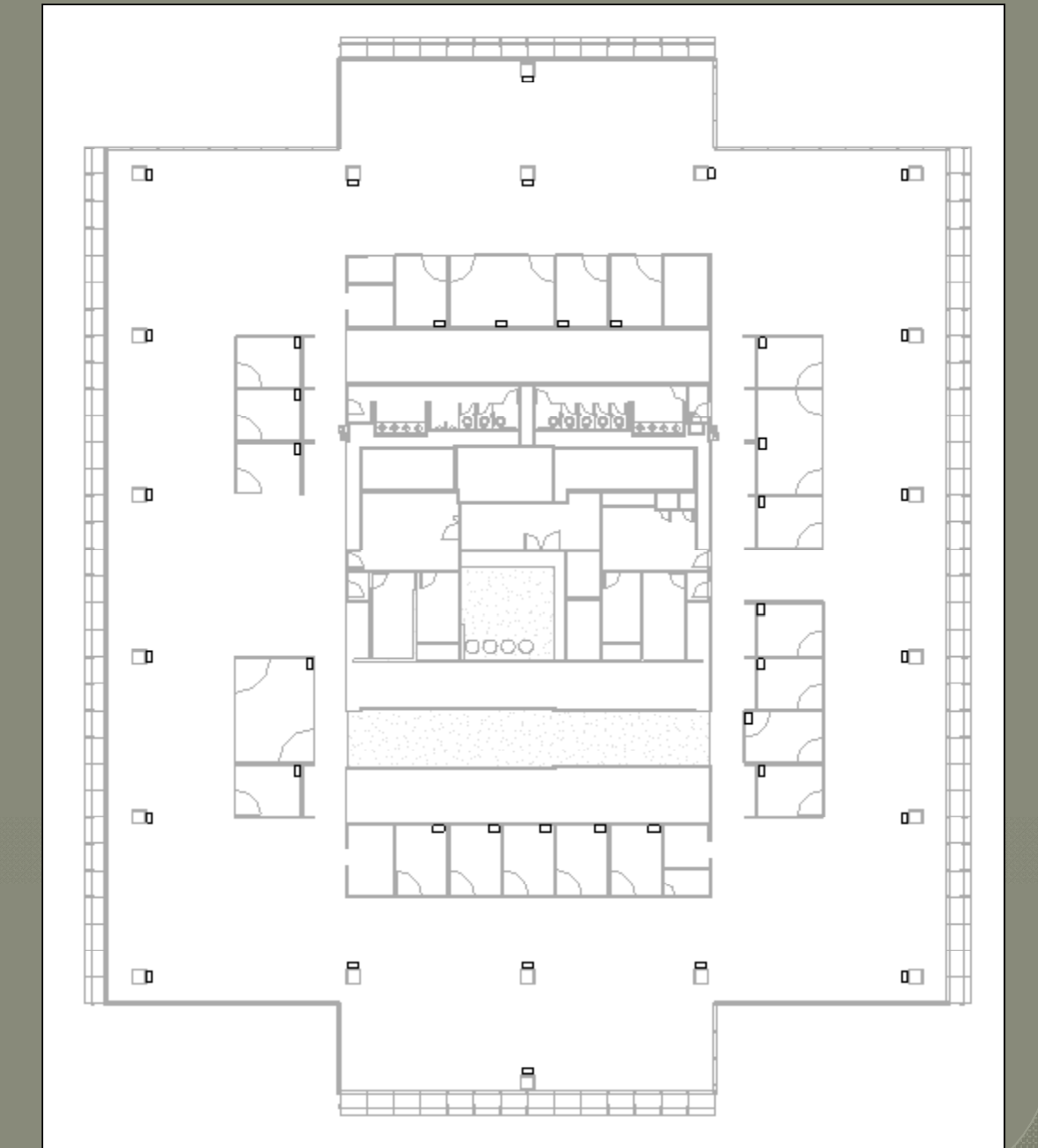
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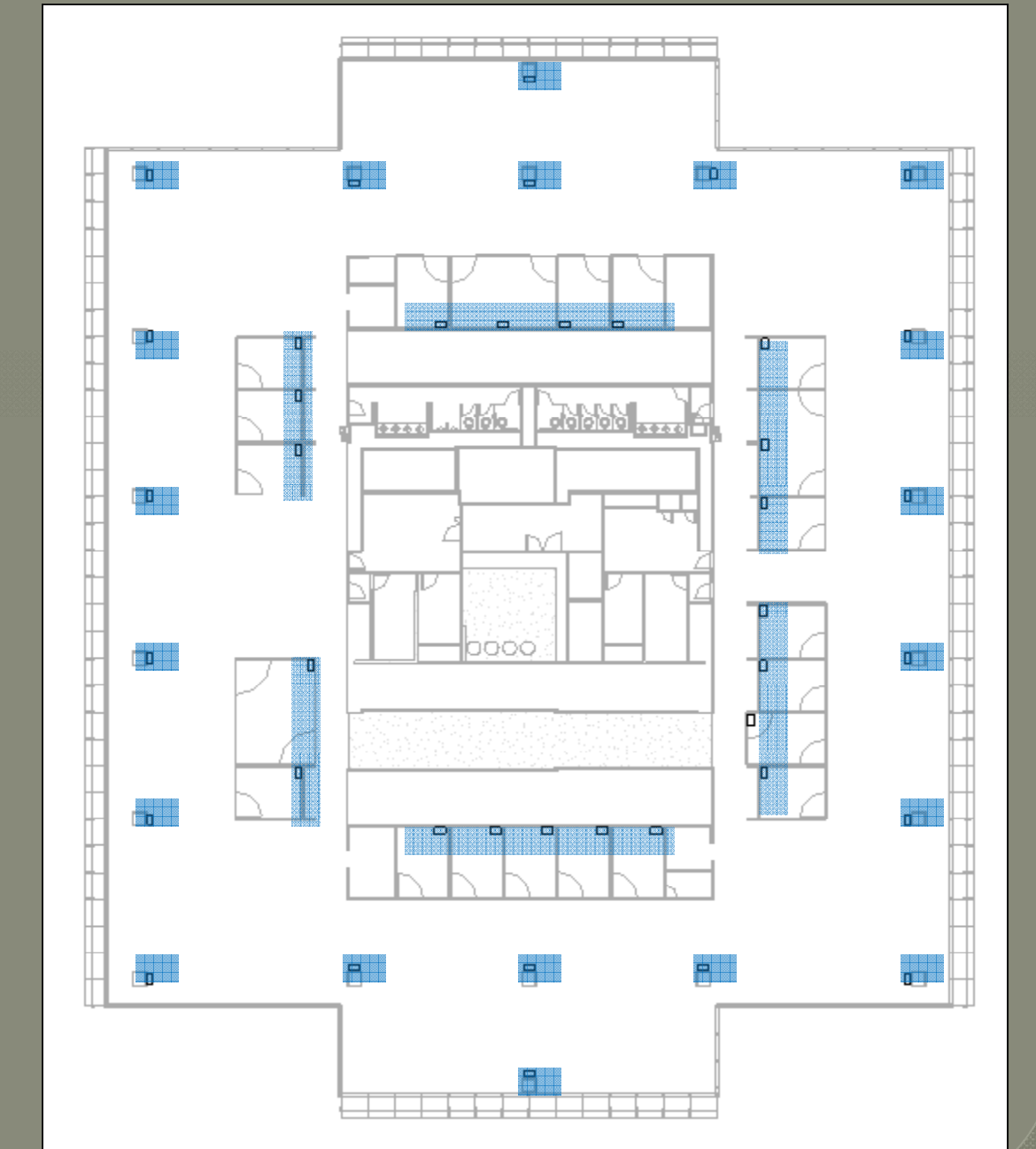
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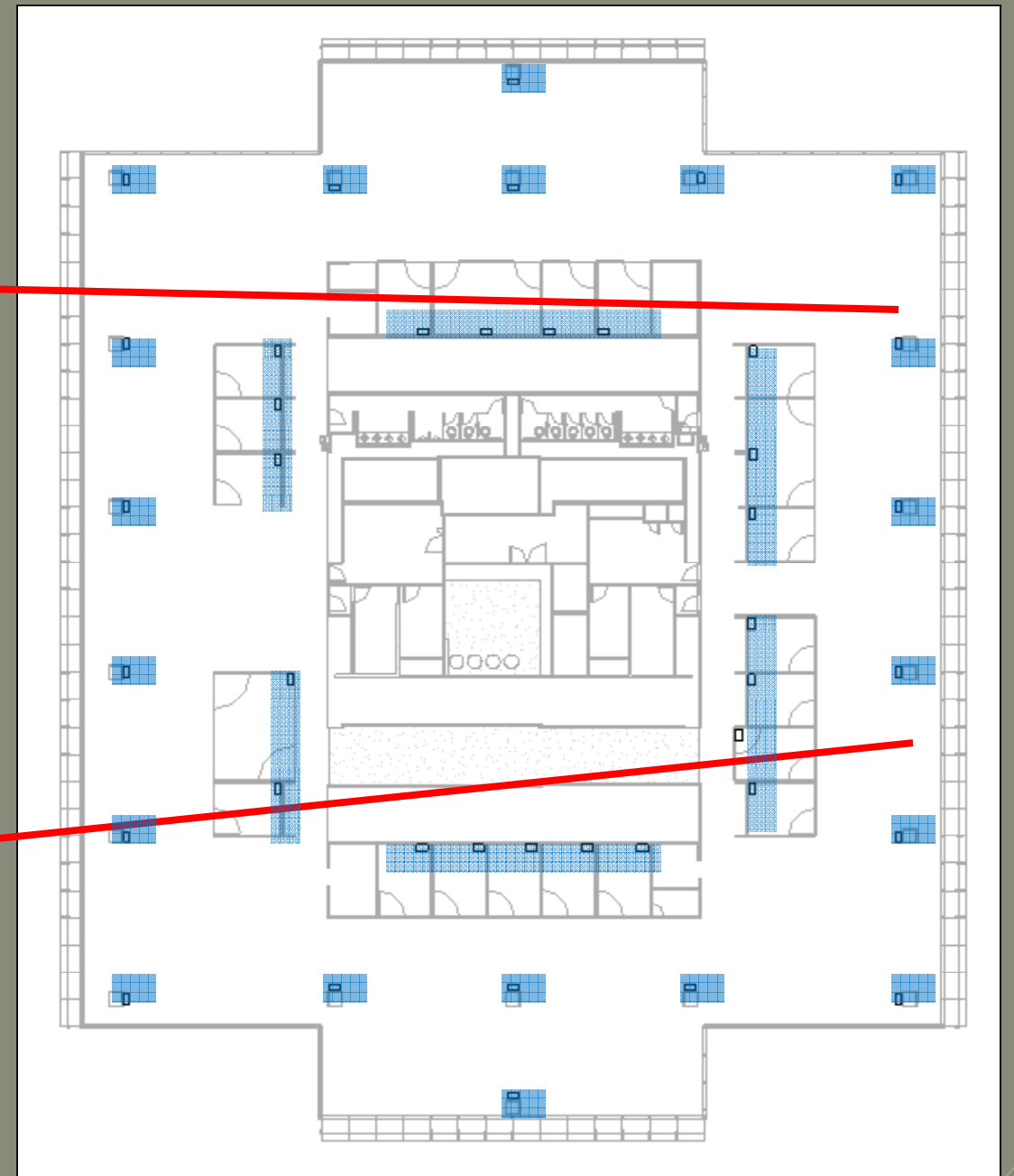
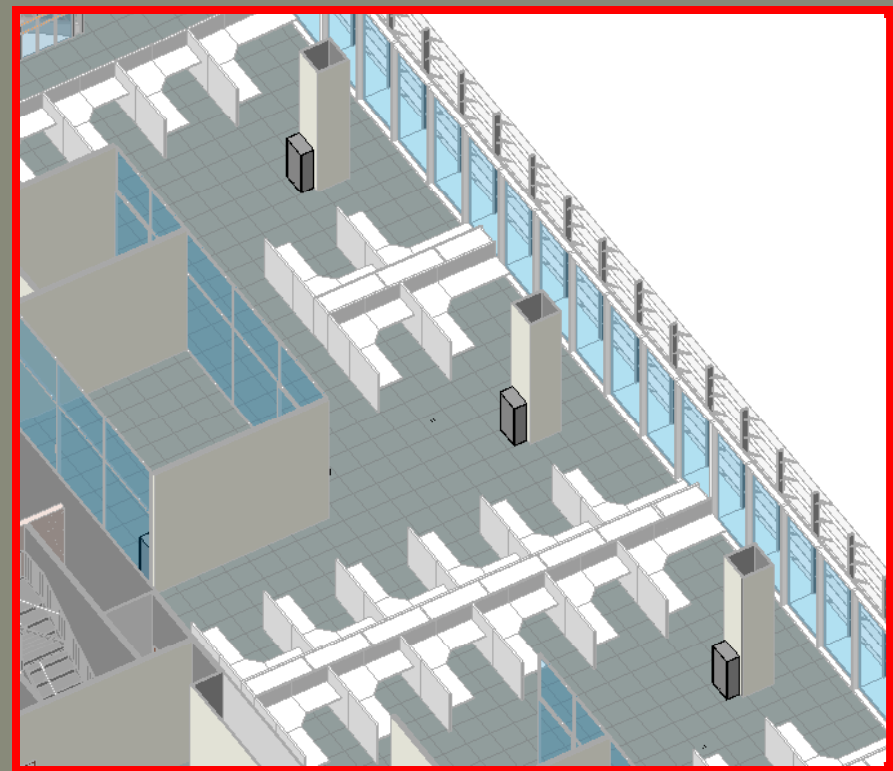
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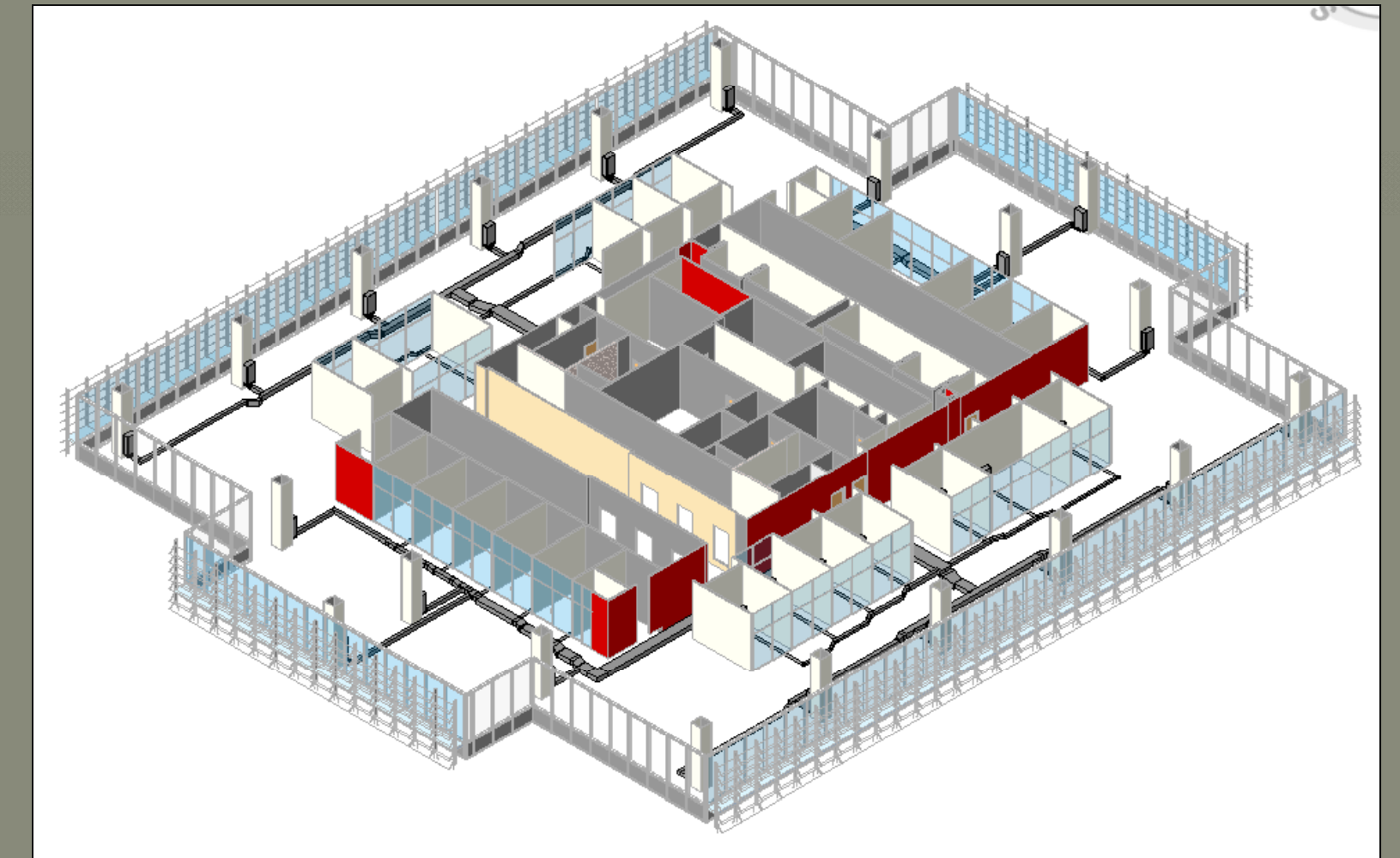
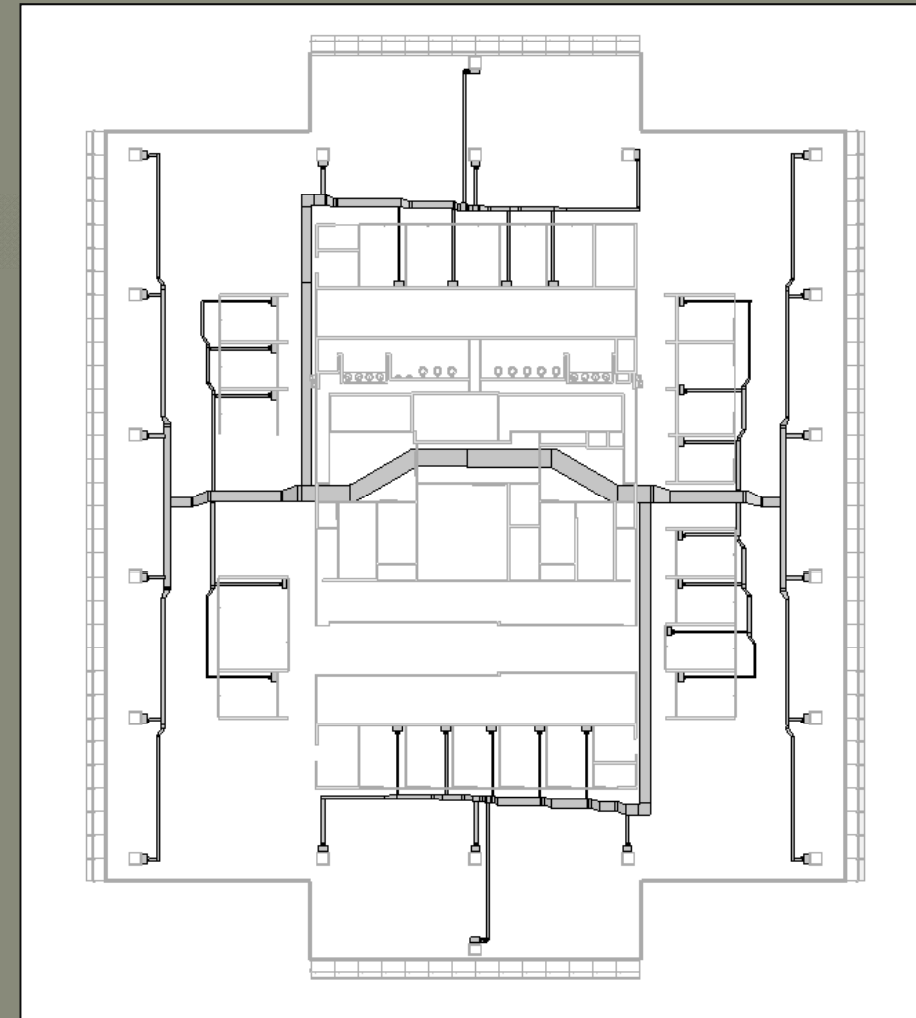
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REDESIGN OF CORE

•CHANGED FROM STEEL BRACED FRAME TO CONCRETE SHEAR WALLS

•MODELS:

•ETABS

•REVIT

•LATERAL LOADS DETERMINED FROM:

•WIND:

•TT WIND TUNNEL TEST

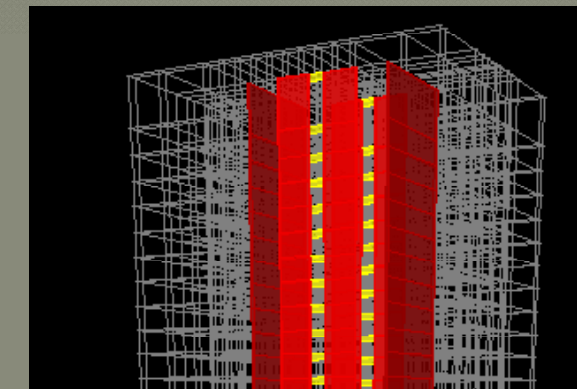
•1968 NYC BUILDING CODE

•METHOD 2 OF ASCE 7-05

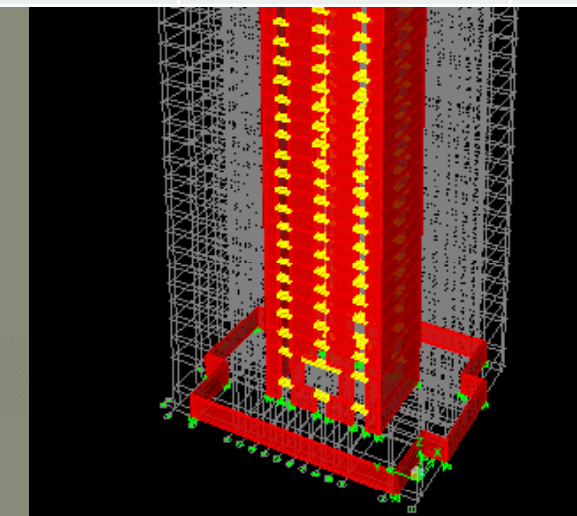
•SEISMIC:

•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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REDESIGN OF CORE

FINAL DESIGN:

- 1ST – 30TH FLOOR:
 - 10,000 PSI
 - 30" THICK 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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DRIFT & DYNAMIC ANALYSIS SUMMARY

		TARGET
MEAN HOURLY ROOF WIND SPEED	63.3 MPH	
H/B	4.63	
T _L (WE)	6.46 SEC	6.25 SEC
T _D (NS)	6.64 SEC	6.75 SEC
T _θ	4.41 SEC	
G _p	3.75	
A _D (Z)	1.86 MILLI-G	
A _L (Z)	2.72 MILLI-G	
BA _θ /SQRT(2)	2.09 MILLI-G	
A _R	3.90 MILLI-G	
A _{PEAK}	14.6 MILLI-G	15 – 27 MILLI-G *
ROOF TO BASE DISPL. RATIO	H/690	H/450

* GRIFFIS LAWRENCE G., "SERVICEABILITY LIMIT STATES UNDER WIND LOAD" ENGINEERING JOURNAL/ AMERICAN INSTITUTE OF STEEL CONSTRUCTION, 1993

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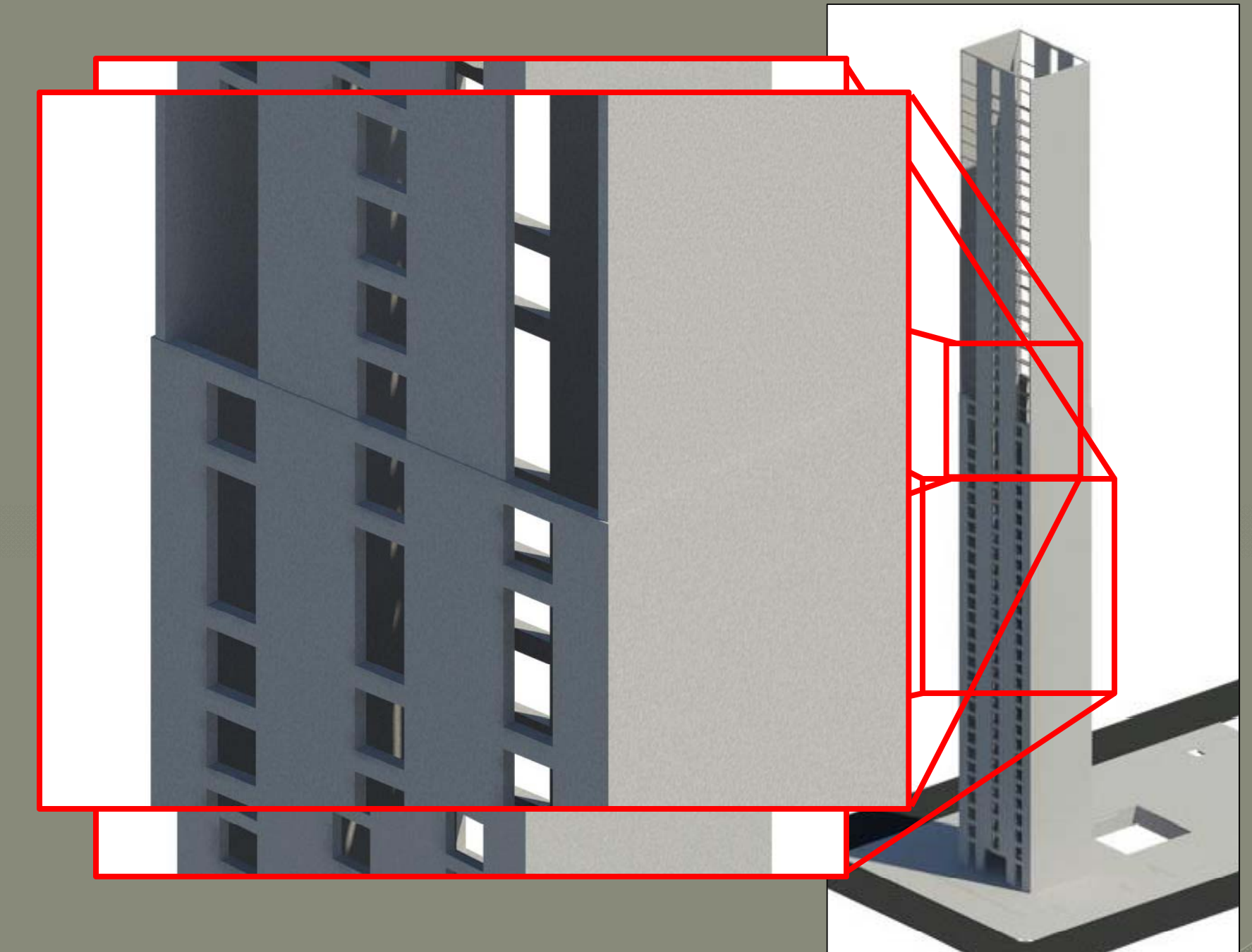
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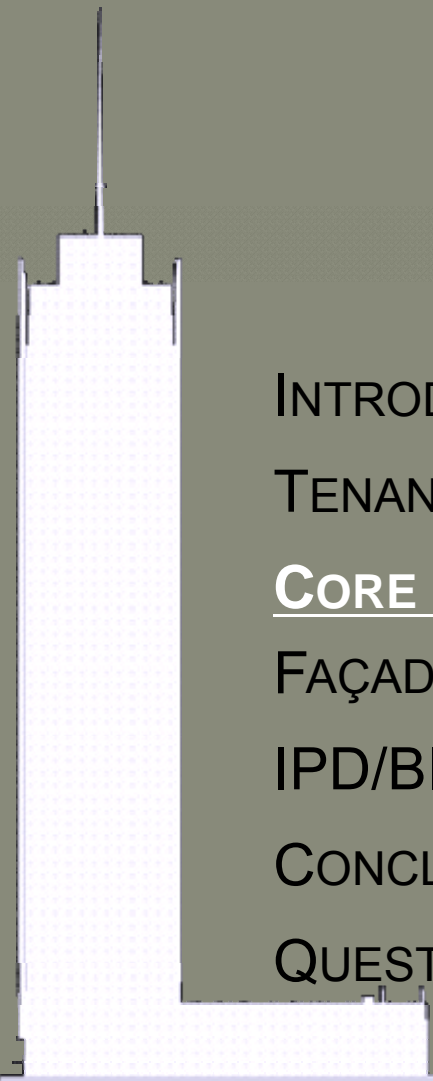
- PROVIDES:
 - MEP ACCESS BETWEEN THE CORE AND TENANT SPACE
- ELIMINATES:
 - OUTRIGGERS
 - X-BRACING RODS



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FINAL DESIGN:

•MAINTAINS:

•ARCHITECTURAL DESIRES:

- OPENNESS
- TRANSPARENCY

•STRUCTURAL NEEDS:

- LATERAL STRENGTH

SHEAR WALLS

COUPLING BEAMS



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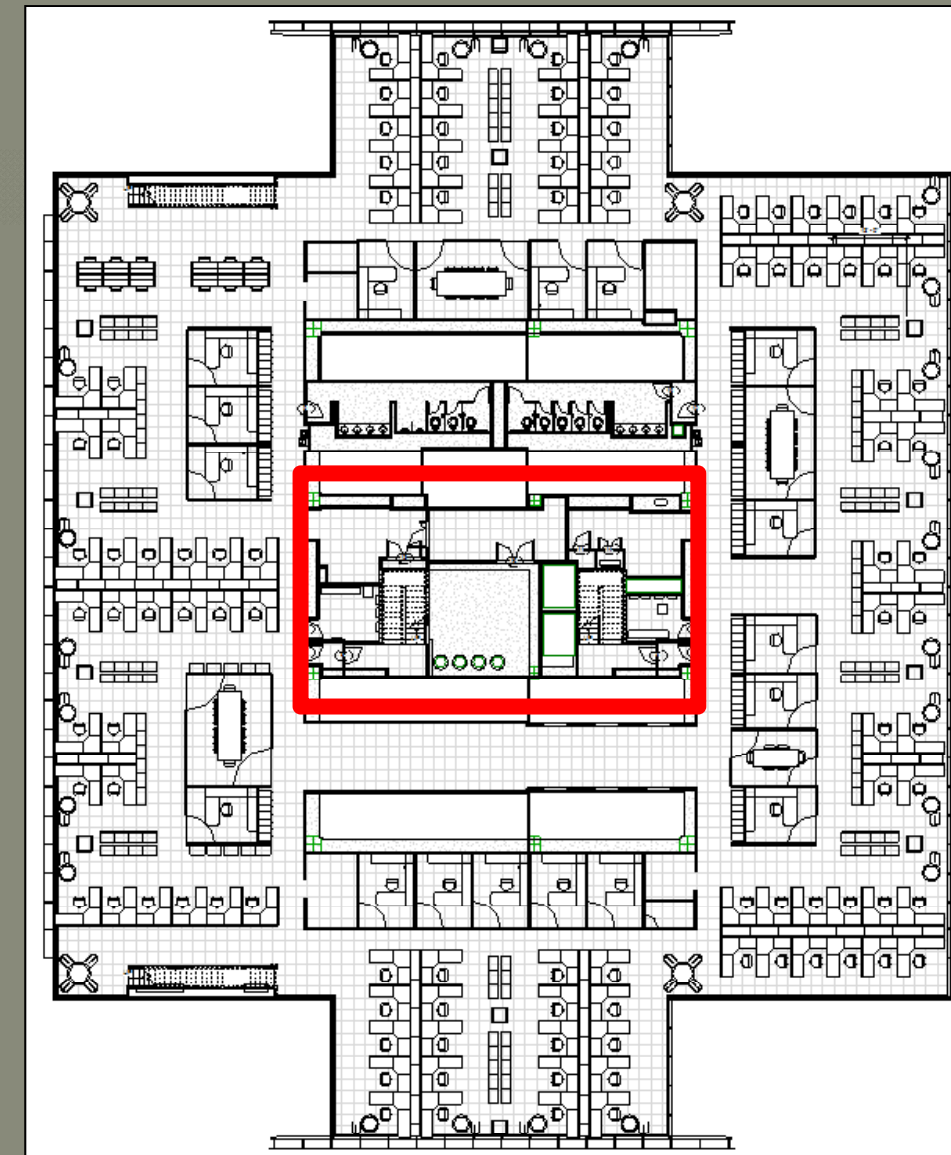
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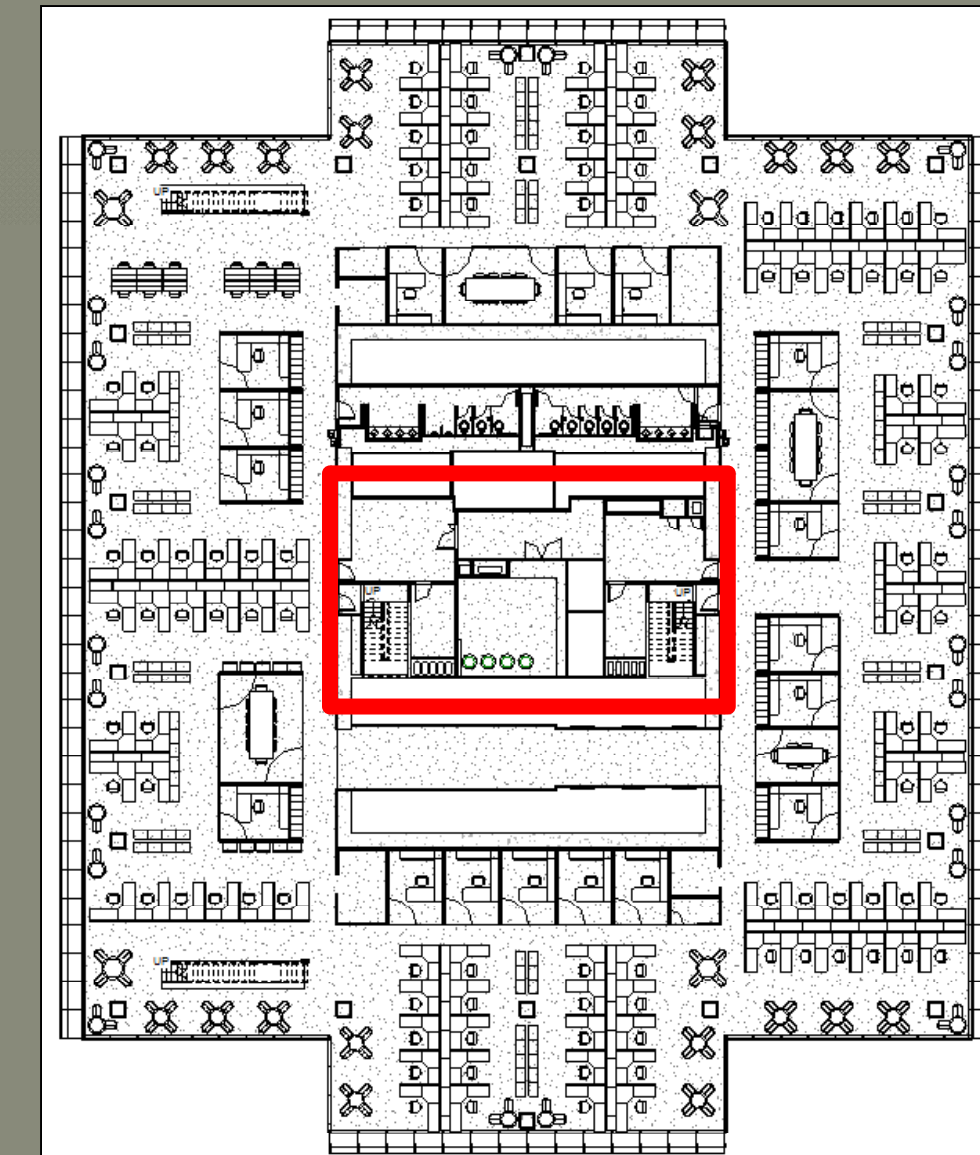
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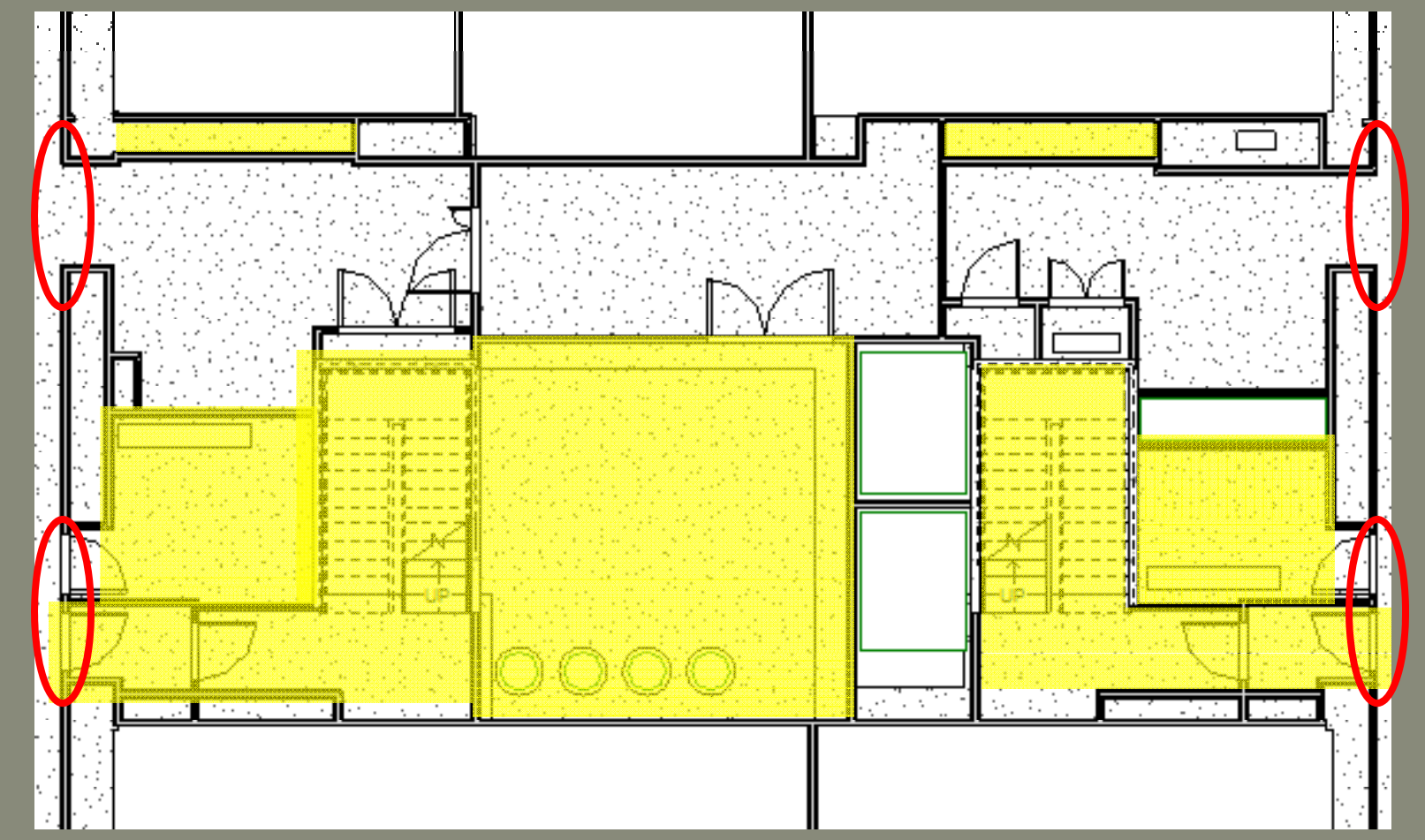
PROPOSED

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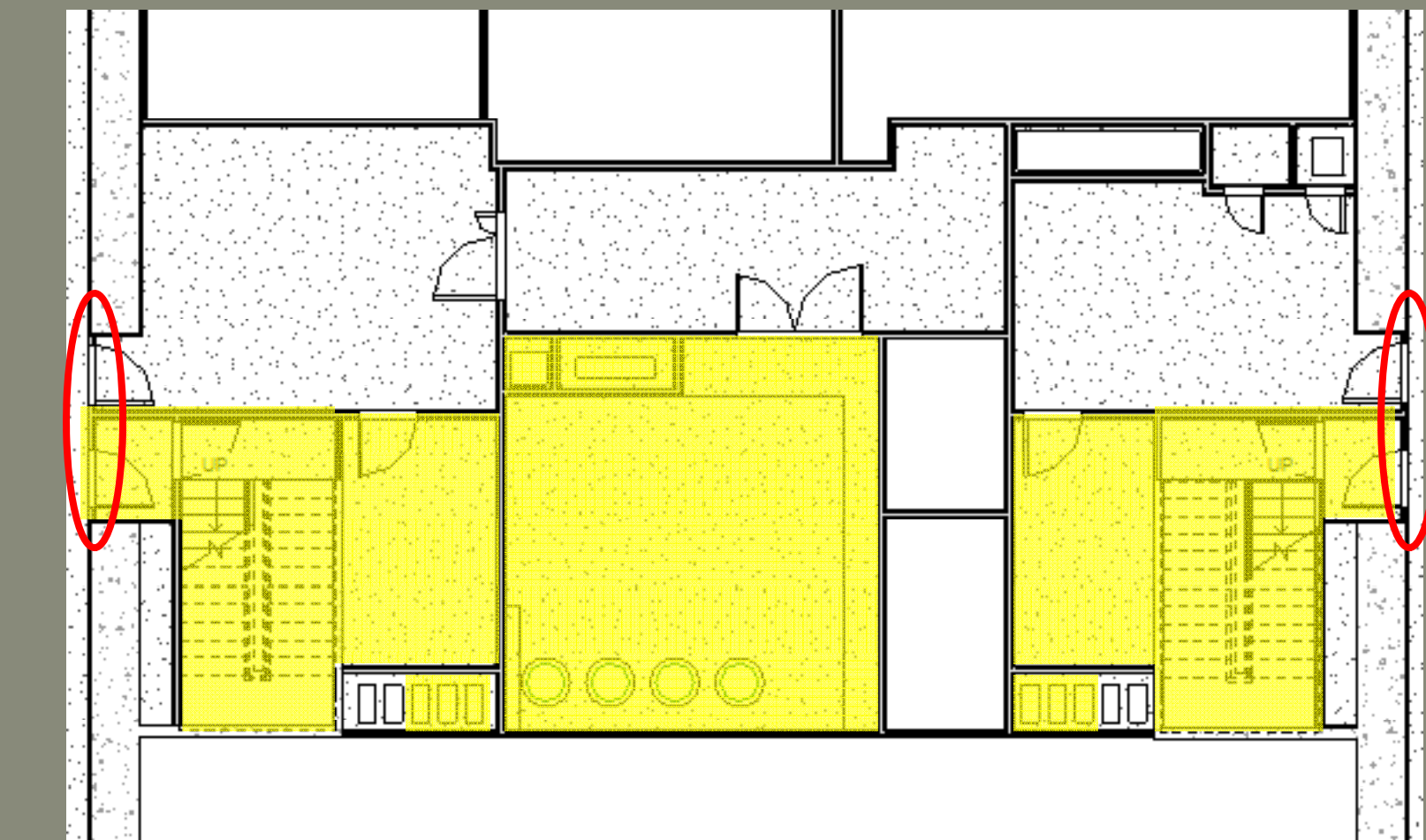
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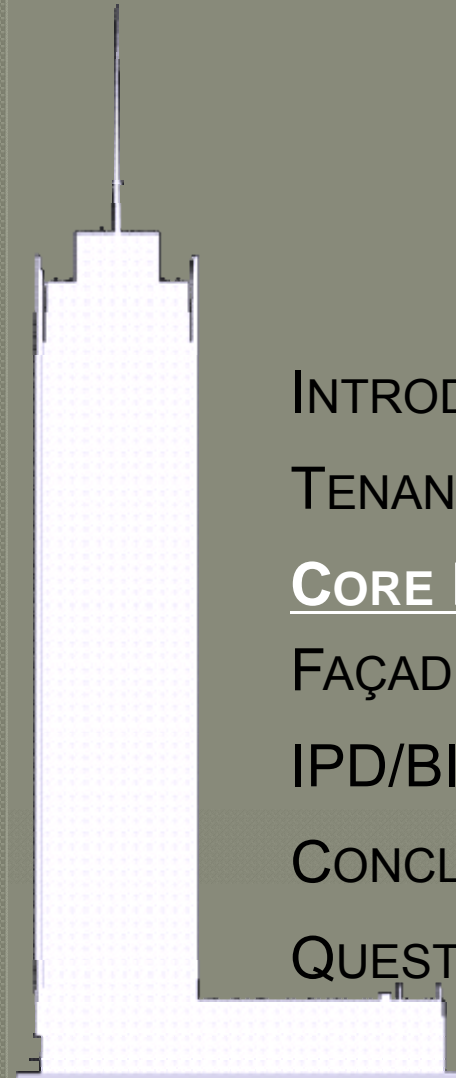
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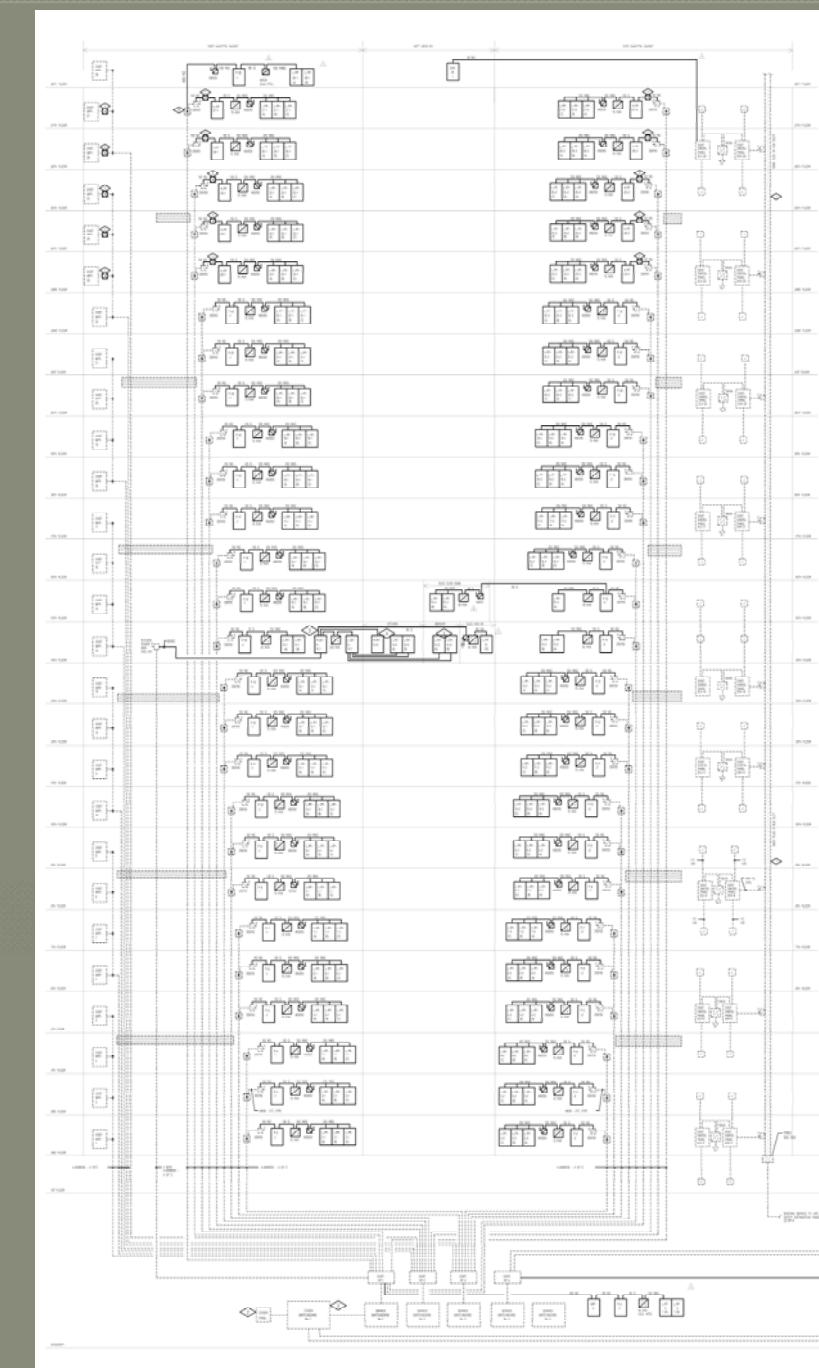
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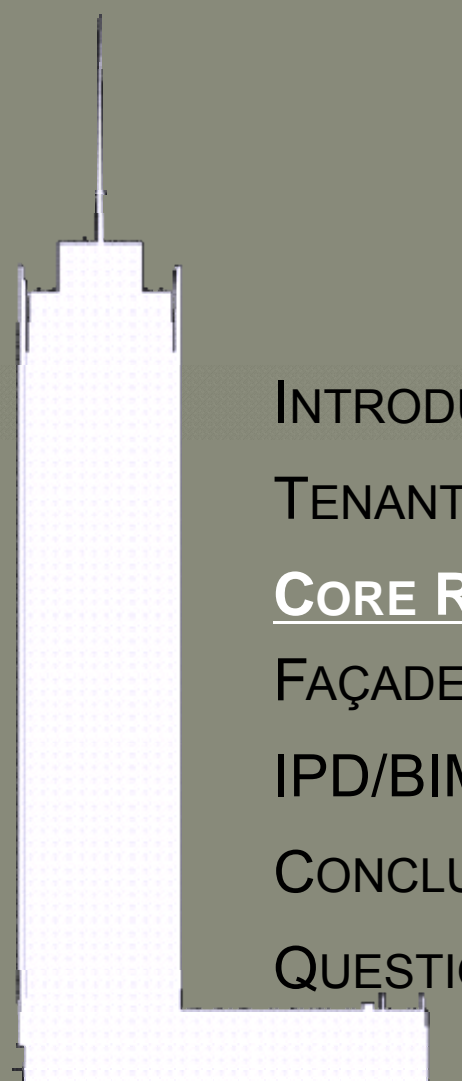
(4) 500 MCM CONDUCTORS PER 3.5" CONDUIT

(6) FEEDERS TO MECHANICAL ROOMS



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(4) 500 MCM CONDUCTORS PER 3.5" CONDUIT
 (6) FEEDERS TO MECHANICAL ROOMS
 MECHANICAL TOTAL=\$344,292.37

\$70,662.80

\$64,880.21

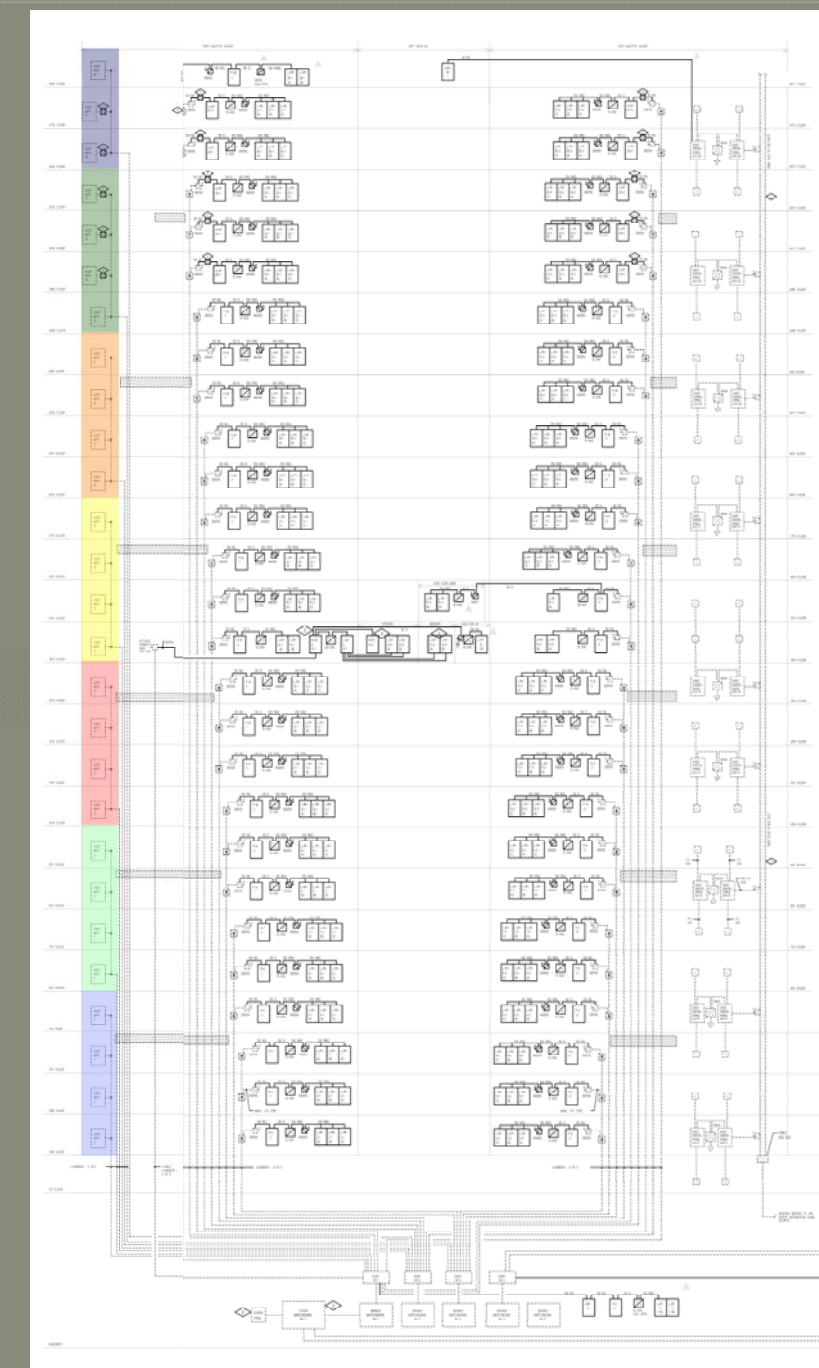
\$57,170.10

\$49,749.87

\$41,749.87

\$34,039.76

\$26,329.64



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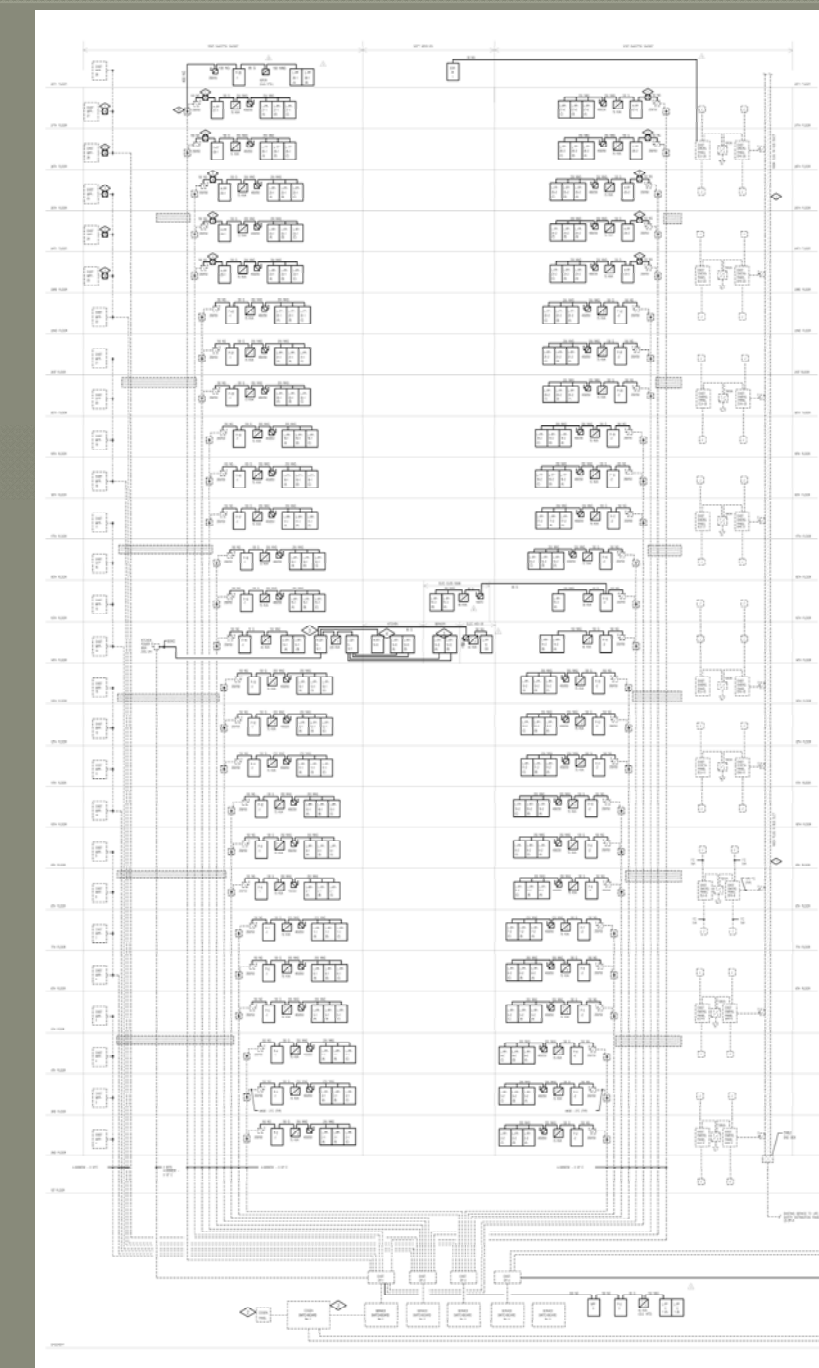
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(4) 500 MCM CONDUCTORS PER 3.5" CONDUIT

(9) FEEDERS TO ELECTRICAL ROOMS/SIDE



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BUS DUCT ANALYSIS

(4) 500 MCM CONDUCTORS PER 3.5" CONDUIT
 (9) FEEDERS TO ELECTRICAL ROOMS/SIDE
 ELECTRICAL TOTAL=\$855,548.23

\$141,325.60

\$129,760.43

\$118,195.26

\$106,630.09

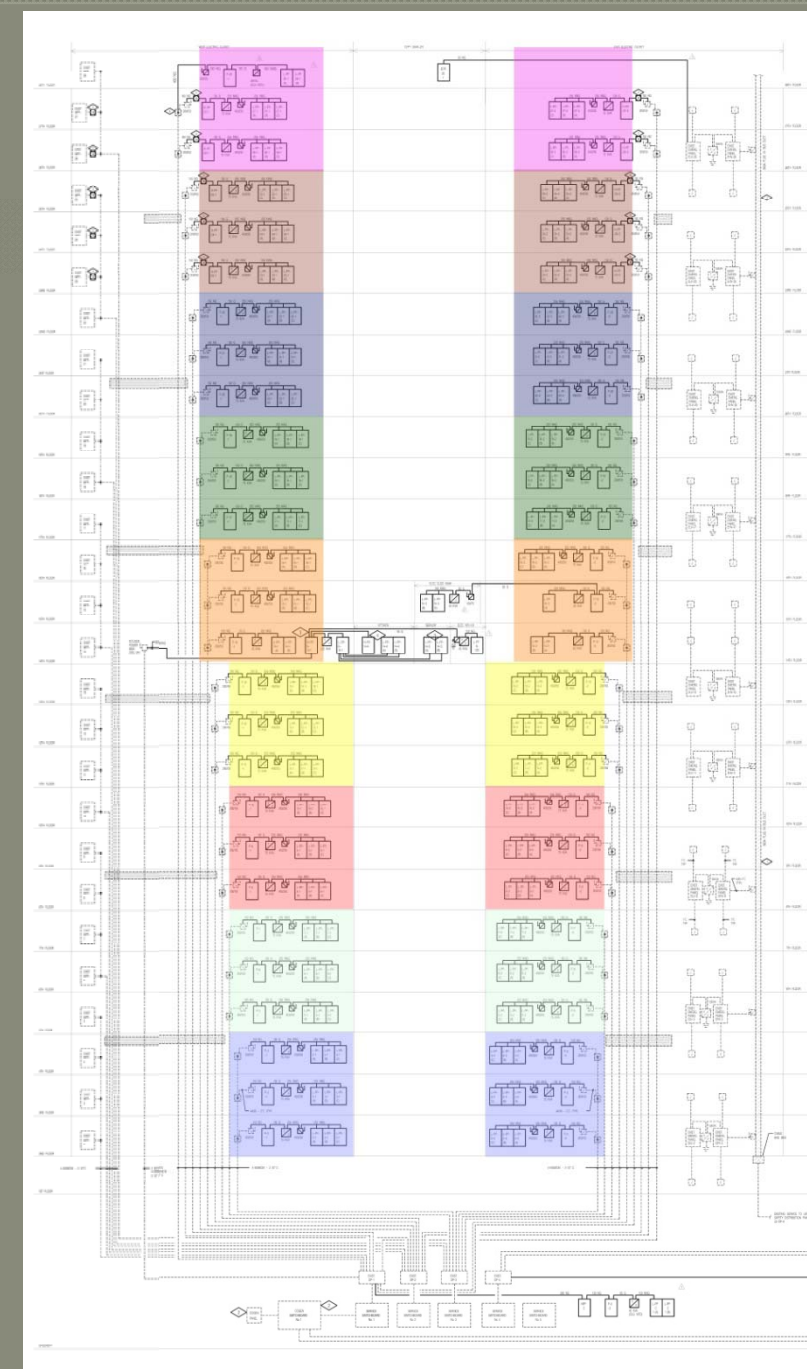
\$95,064.91

\$83,499.74

\$71,934.57

\$60,369.40

\$48,804.23



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BUS DUCT ANALYSIS

TOTAL ORIGINAL CONDUIT FEEDER COST
\$1,199,876.60

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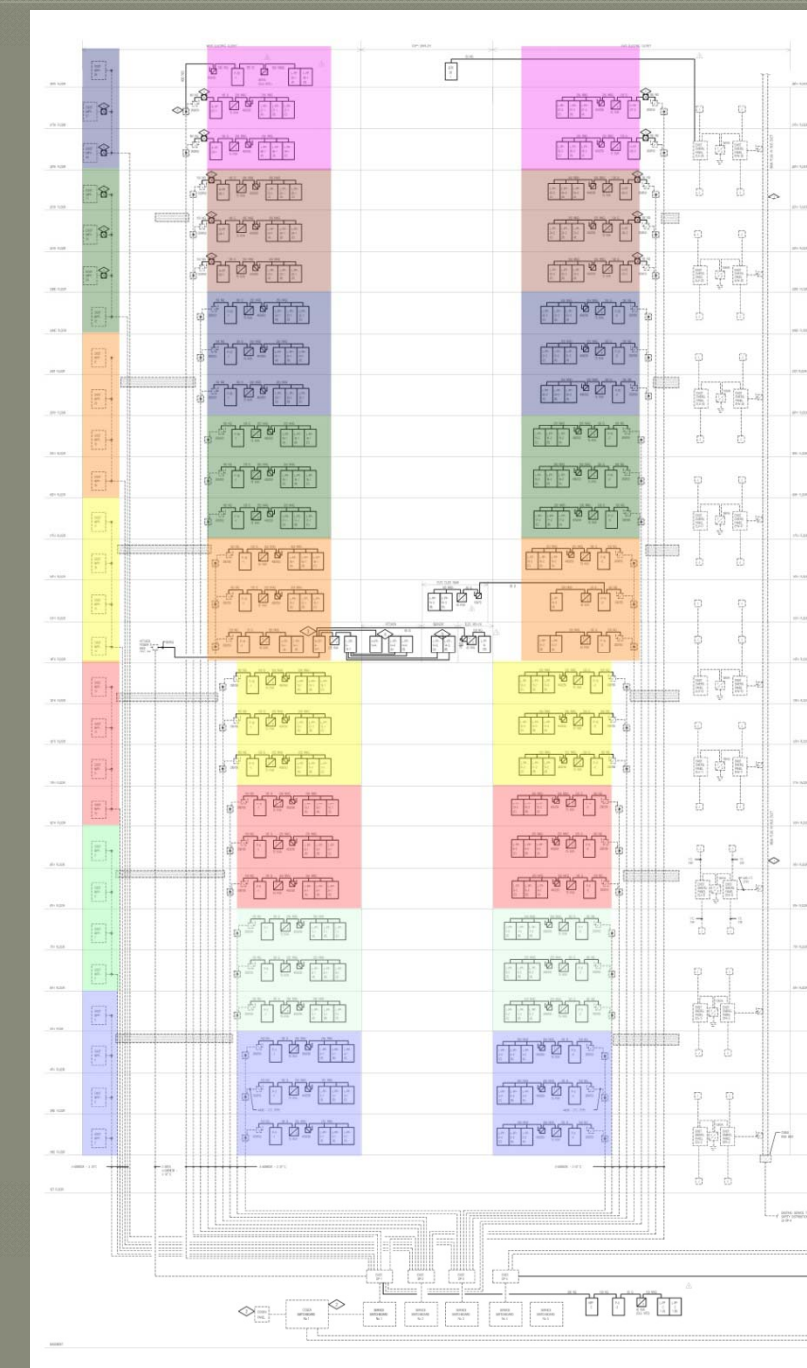
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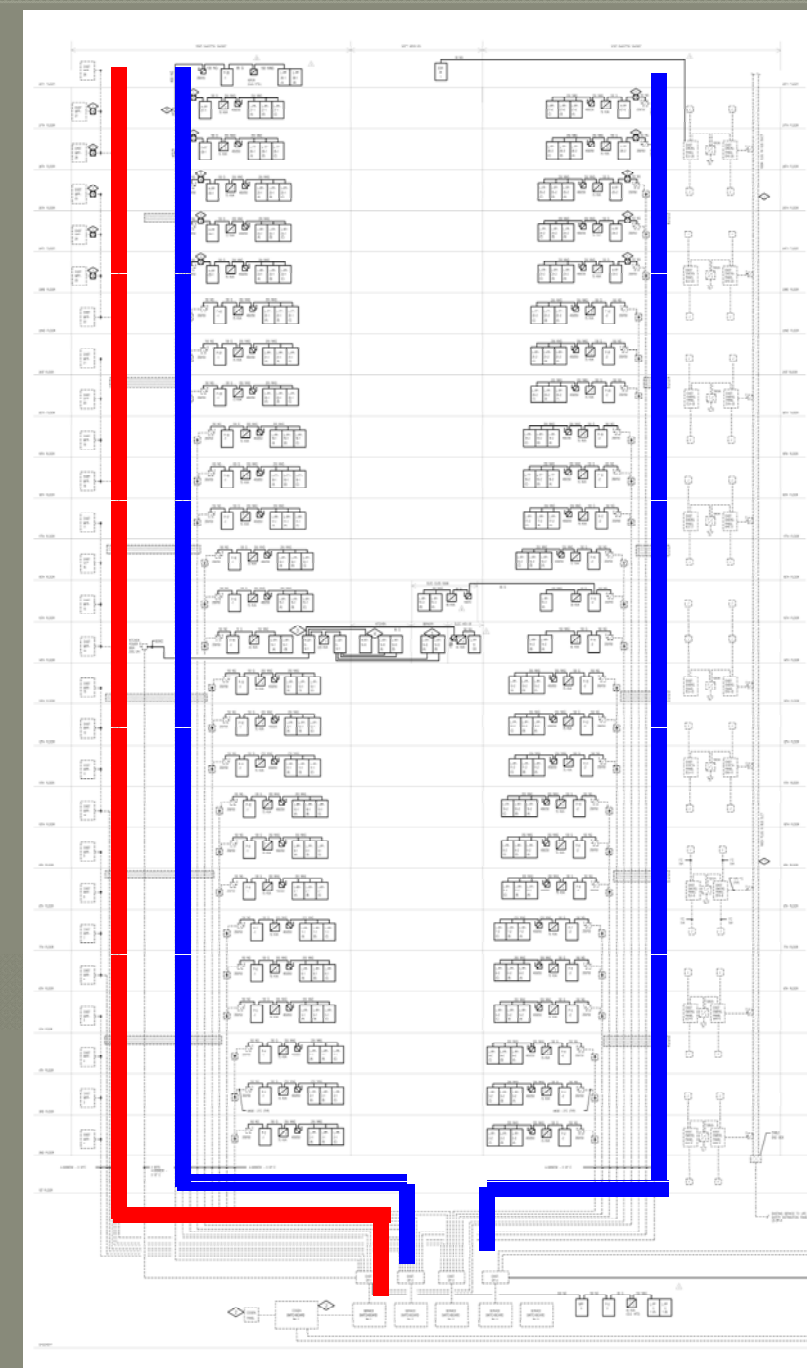
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MECHANICAL ROOMS

ELECTRICAL ROOMS

	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	



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TOTAL PROPOSED BUS DUCT COST
\$1,754,285.00

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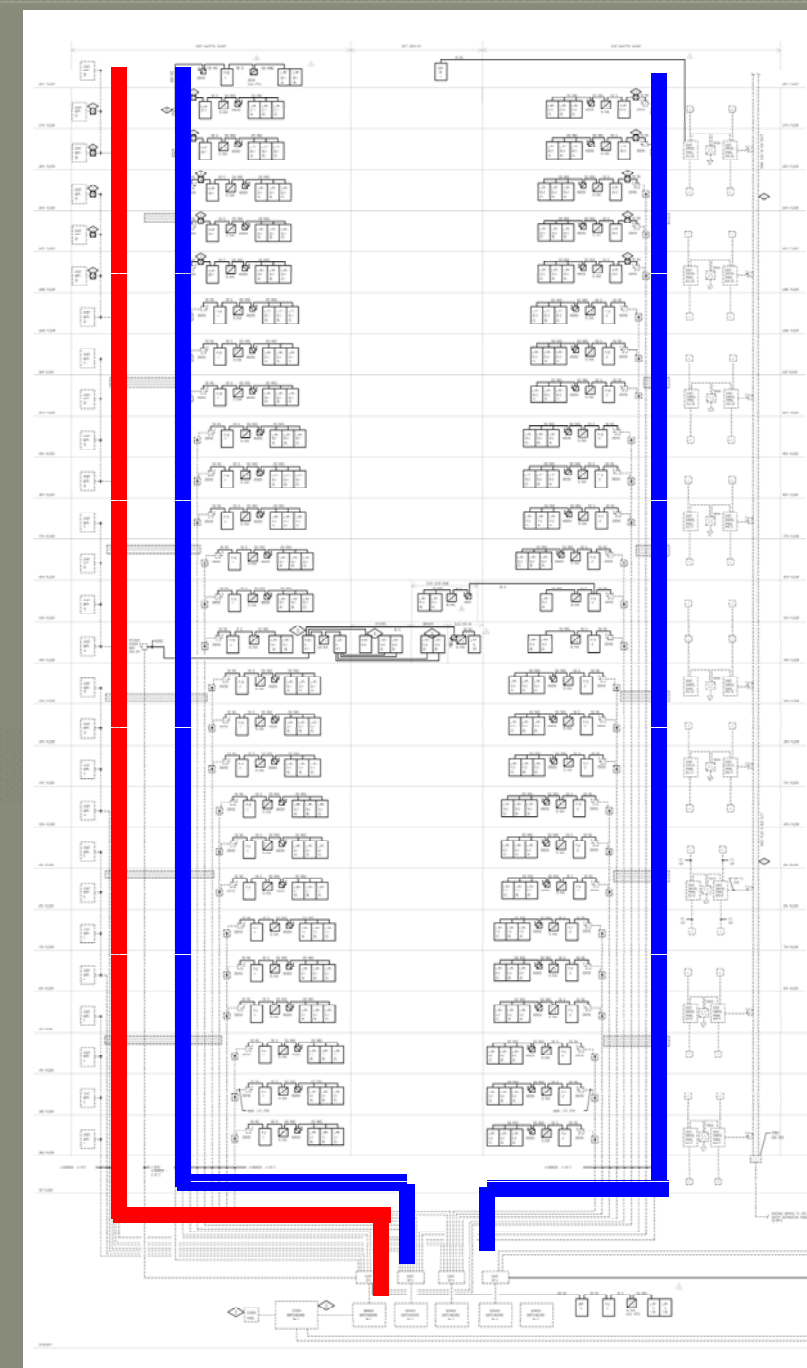
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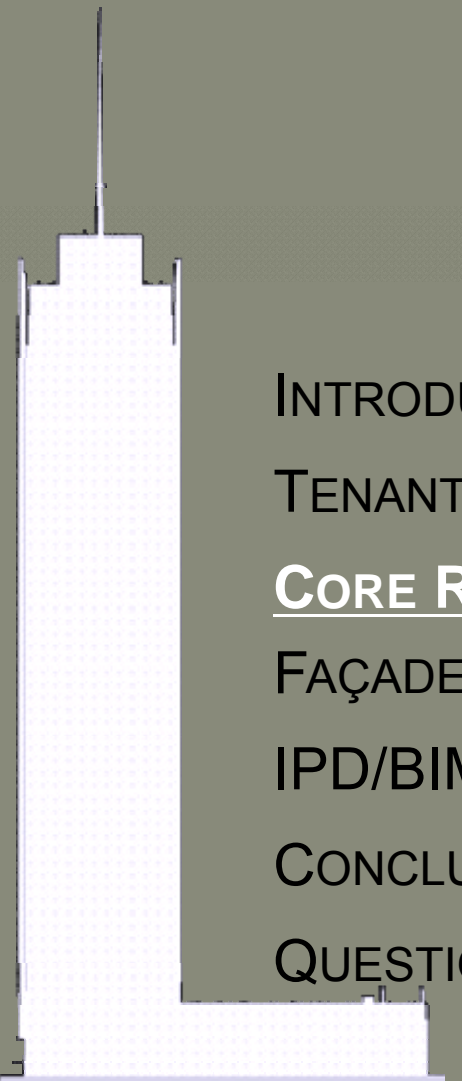
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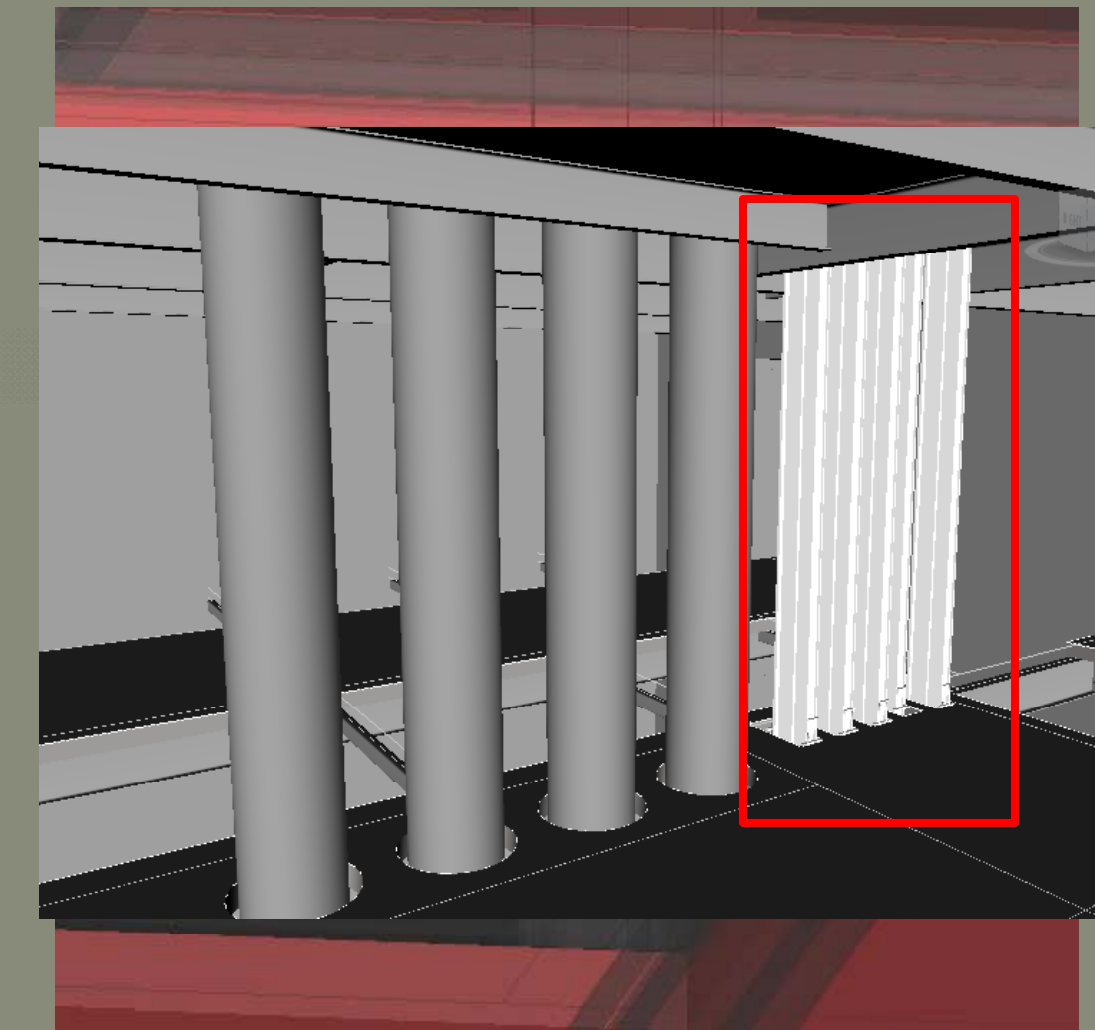
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NEGATIVES

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

BENEFITS

FUTURE EXPANSION CAPABILITIES
DECREASED SPACE REQUIRED PER FLOOR



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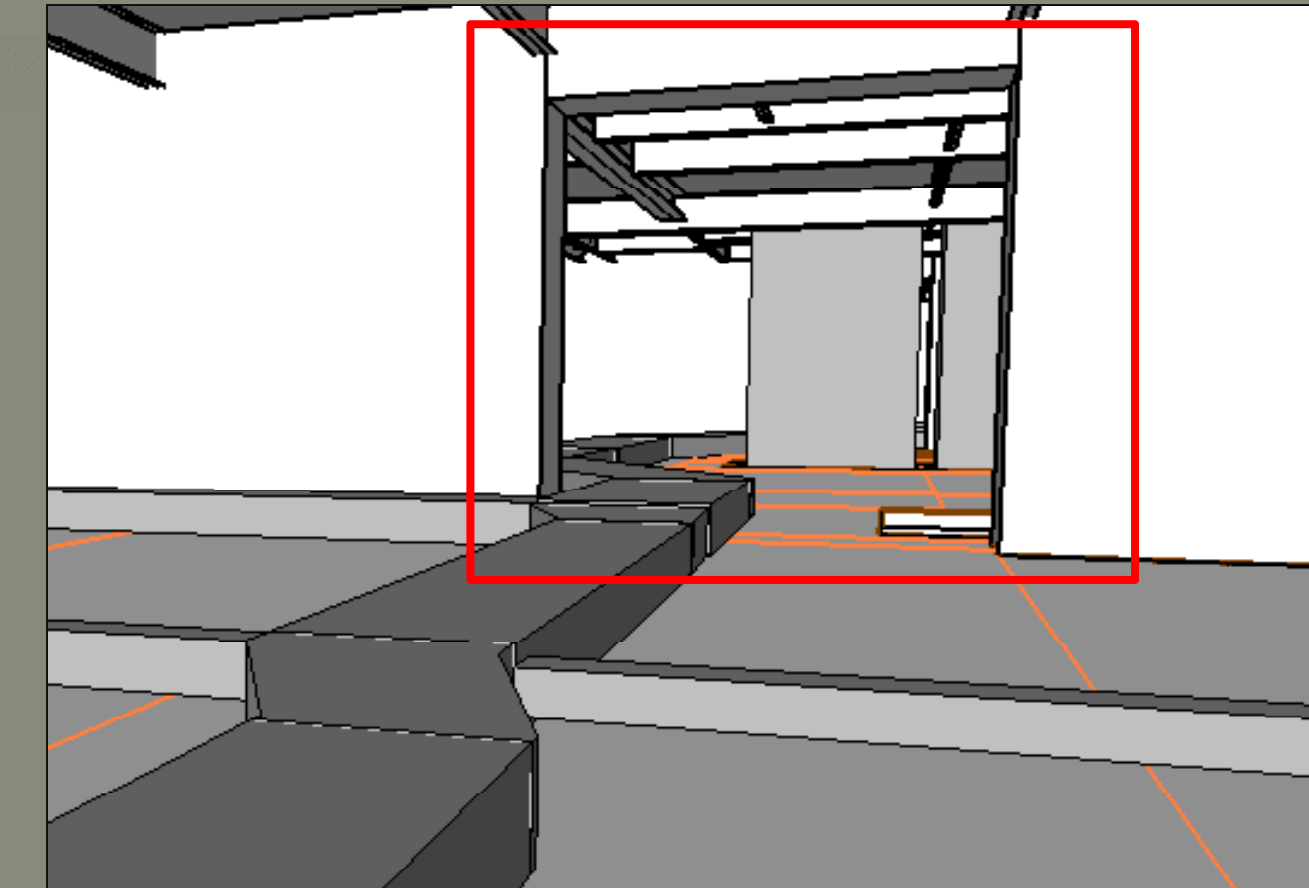
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OBJECTIVES

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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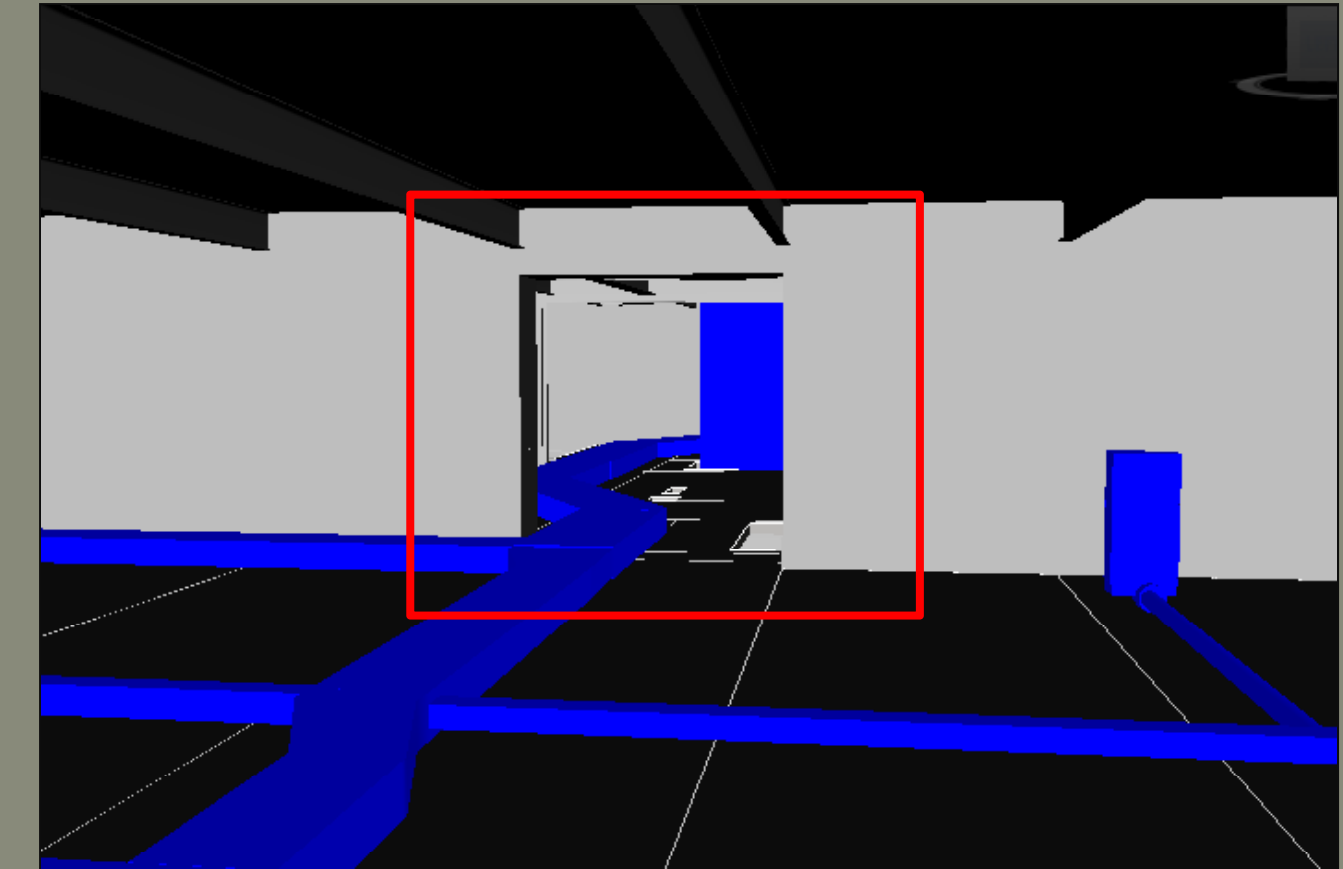
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STEEL

BUILT UP COLUMNS

LARGE FRAMING MEMBERS

OUTRIGGER SYSTEM IN PLACE

CONCRETE

30" – 24" – 18" THICKNESS

44" DEEP COUPLING BEAMS

DIFFERENCE

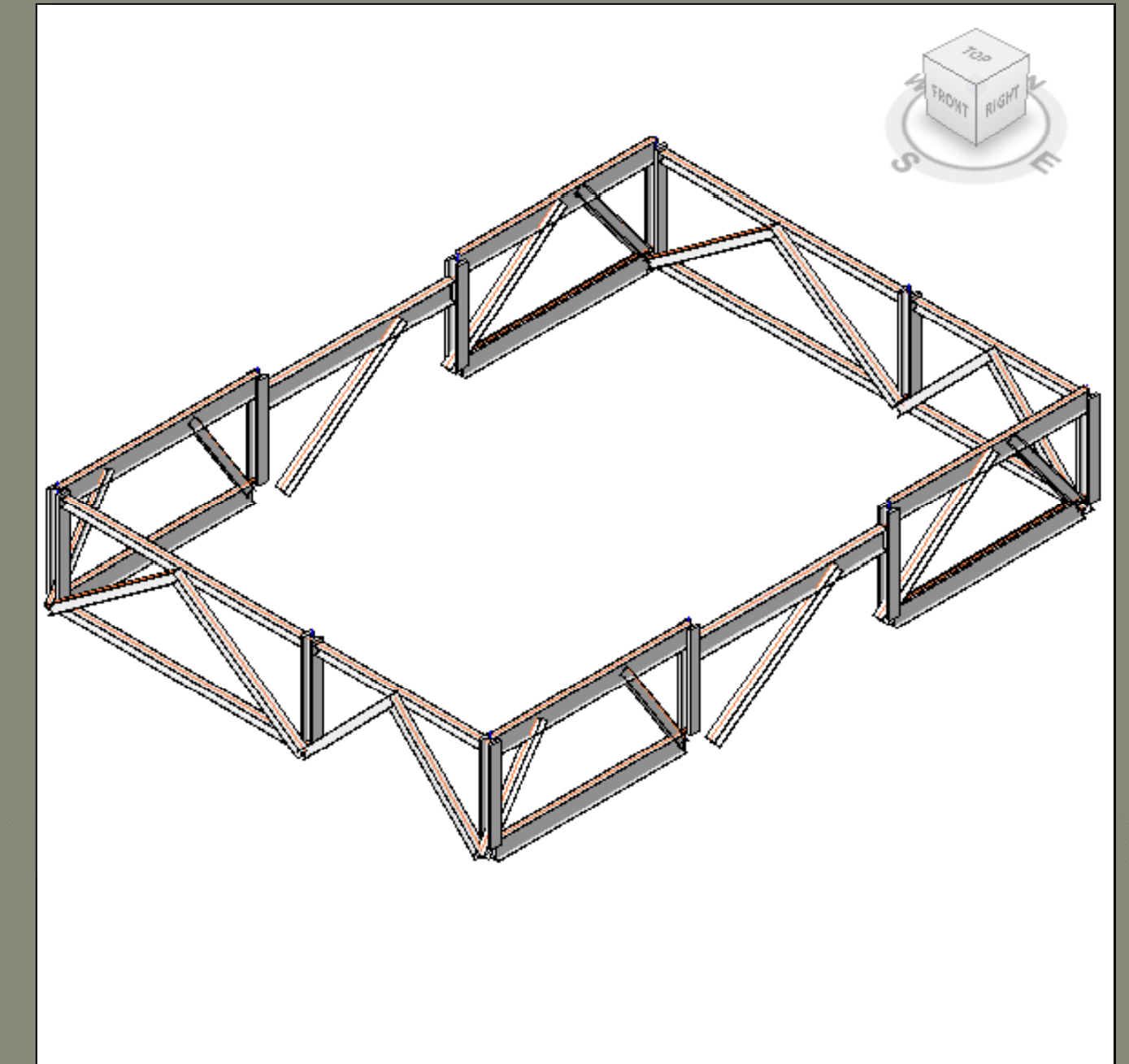
CONCRETE TAKES UP PLACE OF FRAMING

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 Wall: Wall 30"	18200.00	7280	560	Shear
650.00: 28	18200.00	7280	560	
700.00				
Basic Wall: Wall 30"	44800.00	17920	1280	Shear
700.00: 64	44800.00	17920	1280	

	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	\$ 129,298.96	\$ 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	\$ 11,955,381.88	\$ 9,789,884.20	\$ 5,220,710.32	\$ 36,270.10	\$ 14,816,240.03

\$ 14,816,240.03

Concrete Shear Wall Schedule

2343.76: 2	4687.51	1875	130	
2437.50				
Basic Wall: Wall 30"	4875.00	1950	130	Shear
2437.50: 2	4875.00	1950	130	
2500.00				
Basic Wall: Wall 30"	5000.00	2000	130	Shear
2500.00: 2	5000.00	2000	130	
2600.00				
Basic Wall: Wall 30"	5200.00	2080	130	Shear
2600.00: 2	5200.00	2080	130	

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SCHEDULE CHANGES

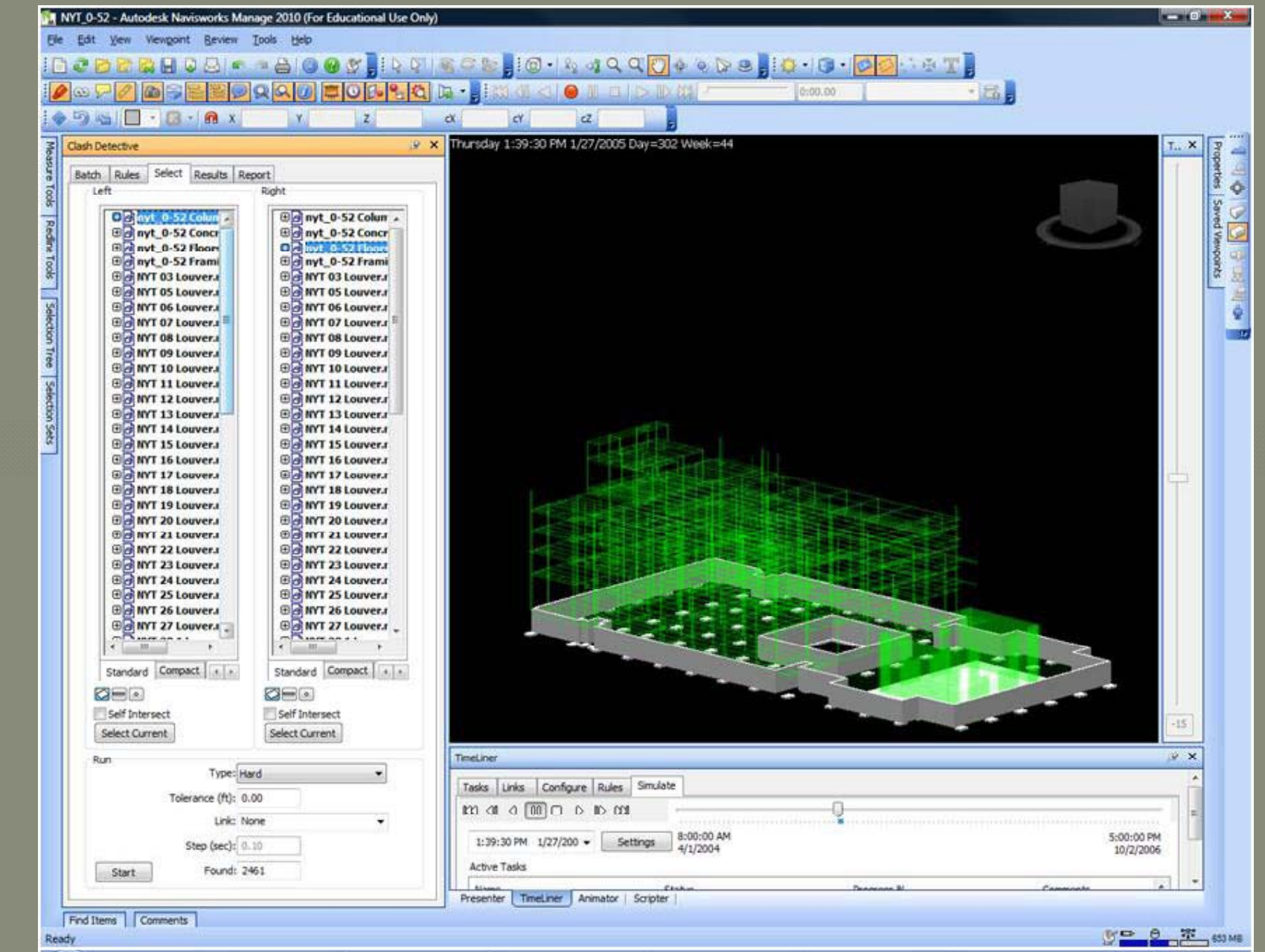
2 MONTH EARLIER START FOR TOWER

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

- ✓ Yes
- ✗ No
- Non-Applicable

Achieved Goal

Reduced Payback Period

Increase Occupant Comfort

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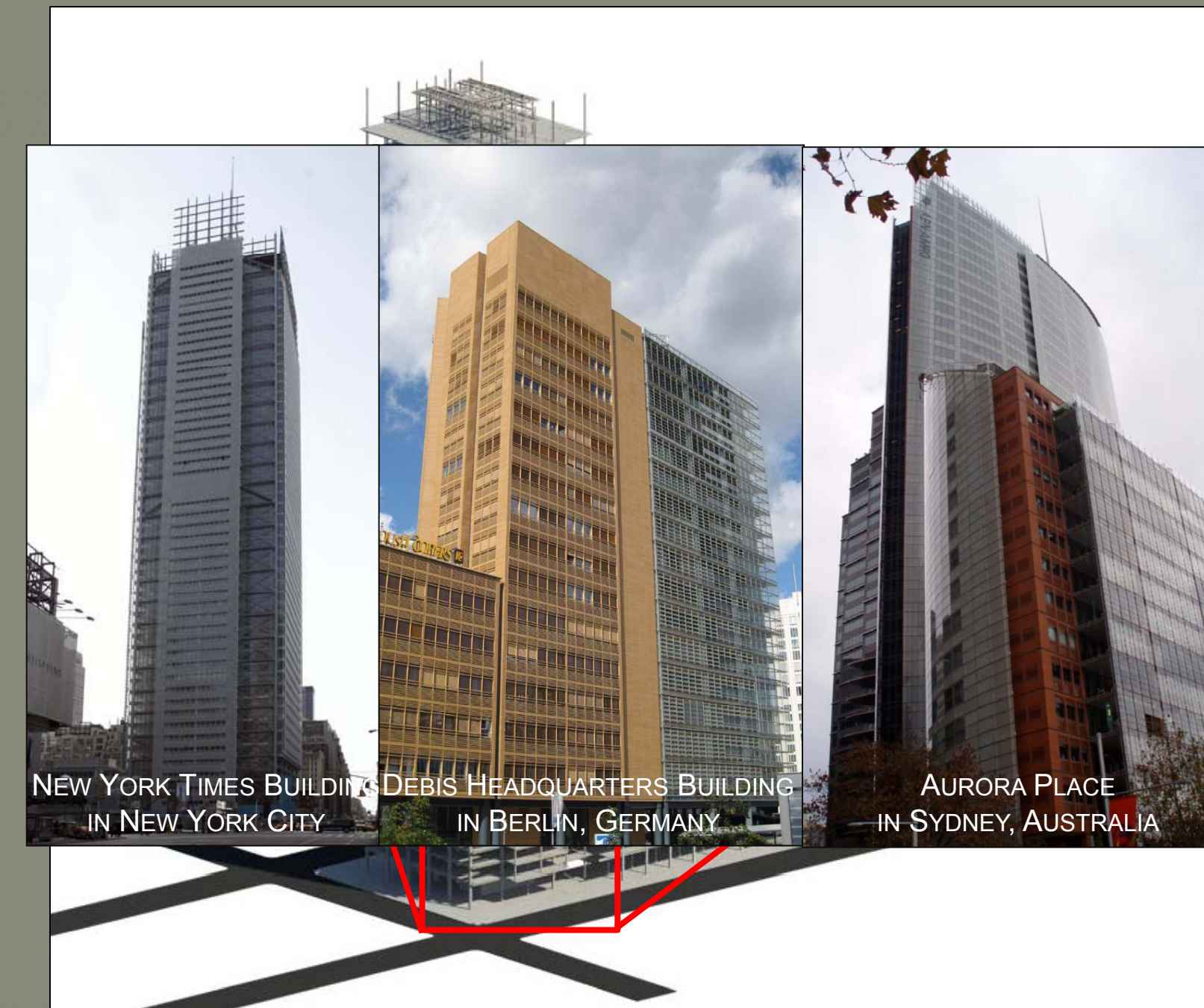
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ARCHITECTURAL PRECEDENTS

- EXPOSED STRUCTURAL STEEL:
 - 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



NEW YORK TIMES BUILDING
IN NEW YORK CITY

DEBIS HEADQUARTERS BUILDING
IN BERLIN, GERMANY

AURORA PLACE
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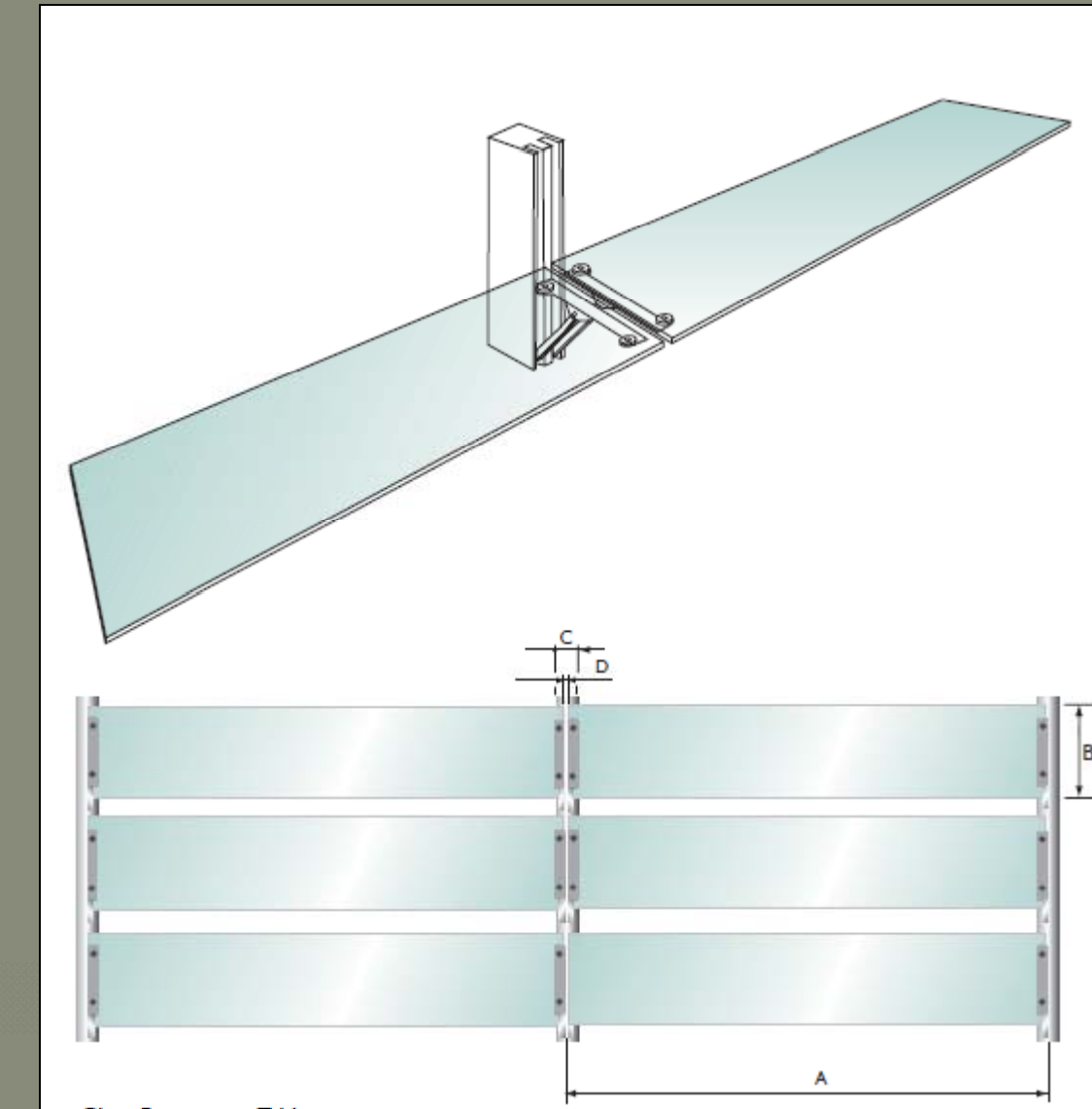
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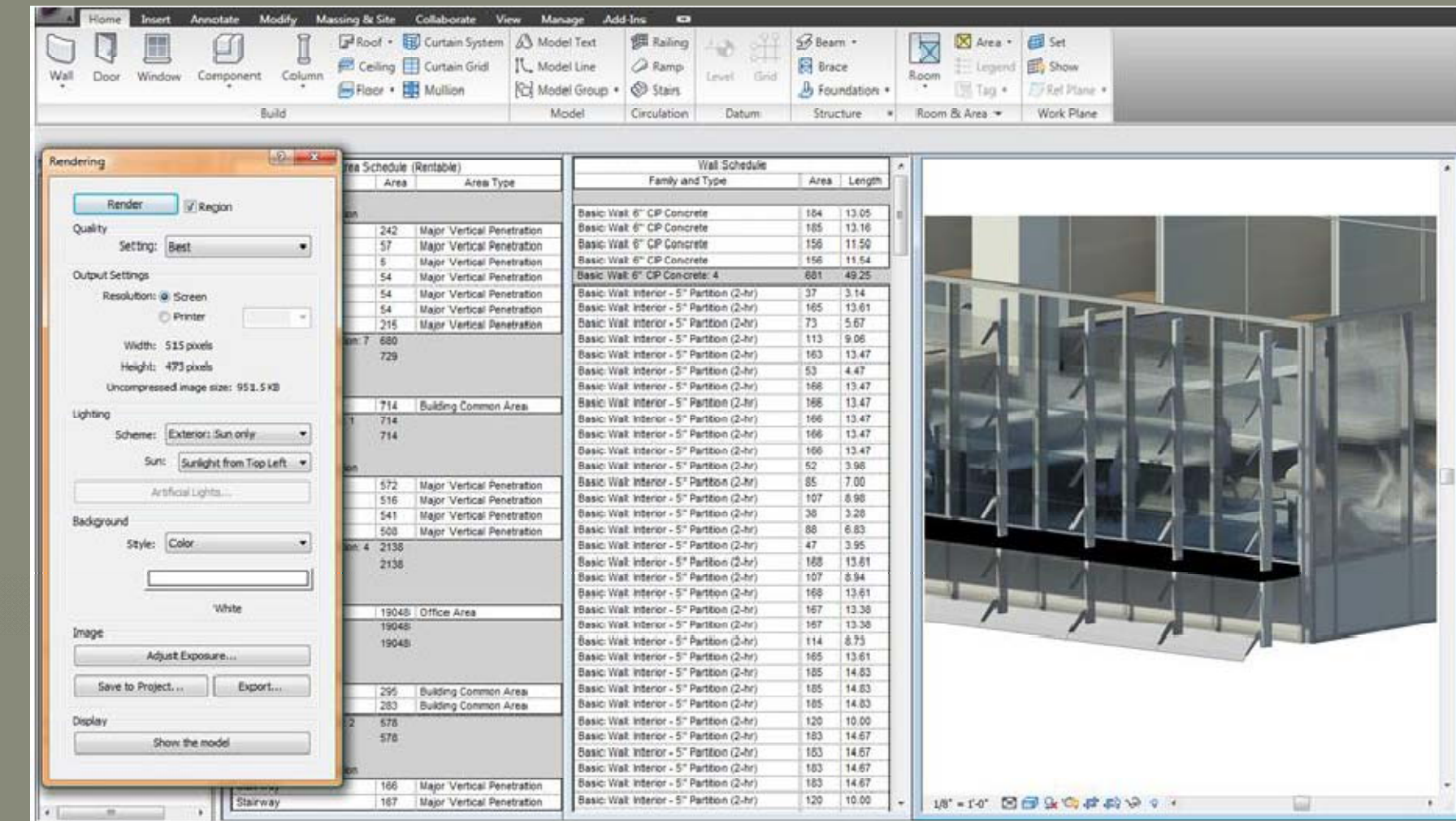
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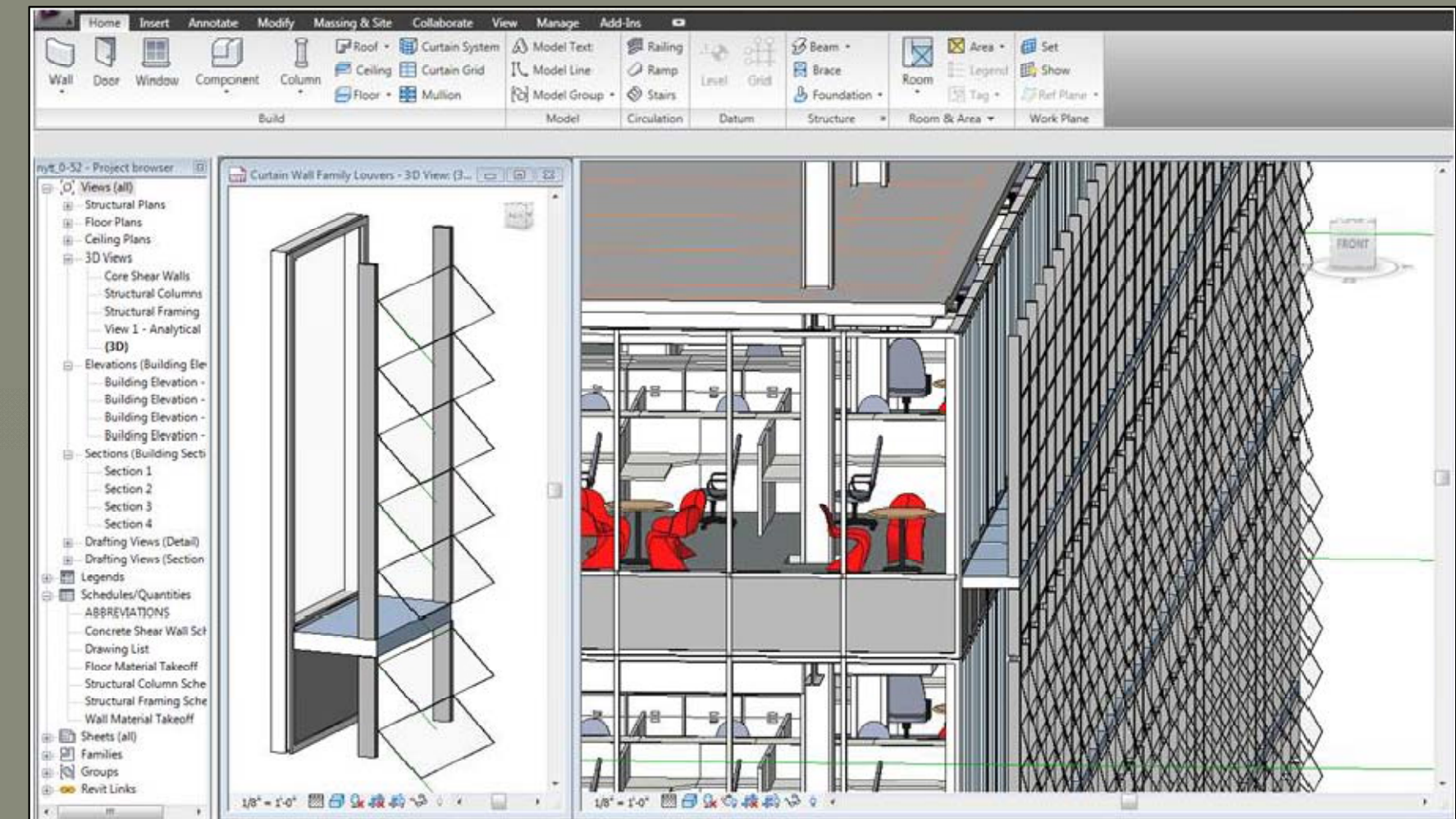
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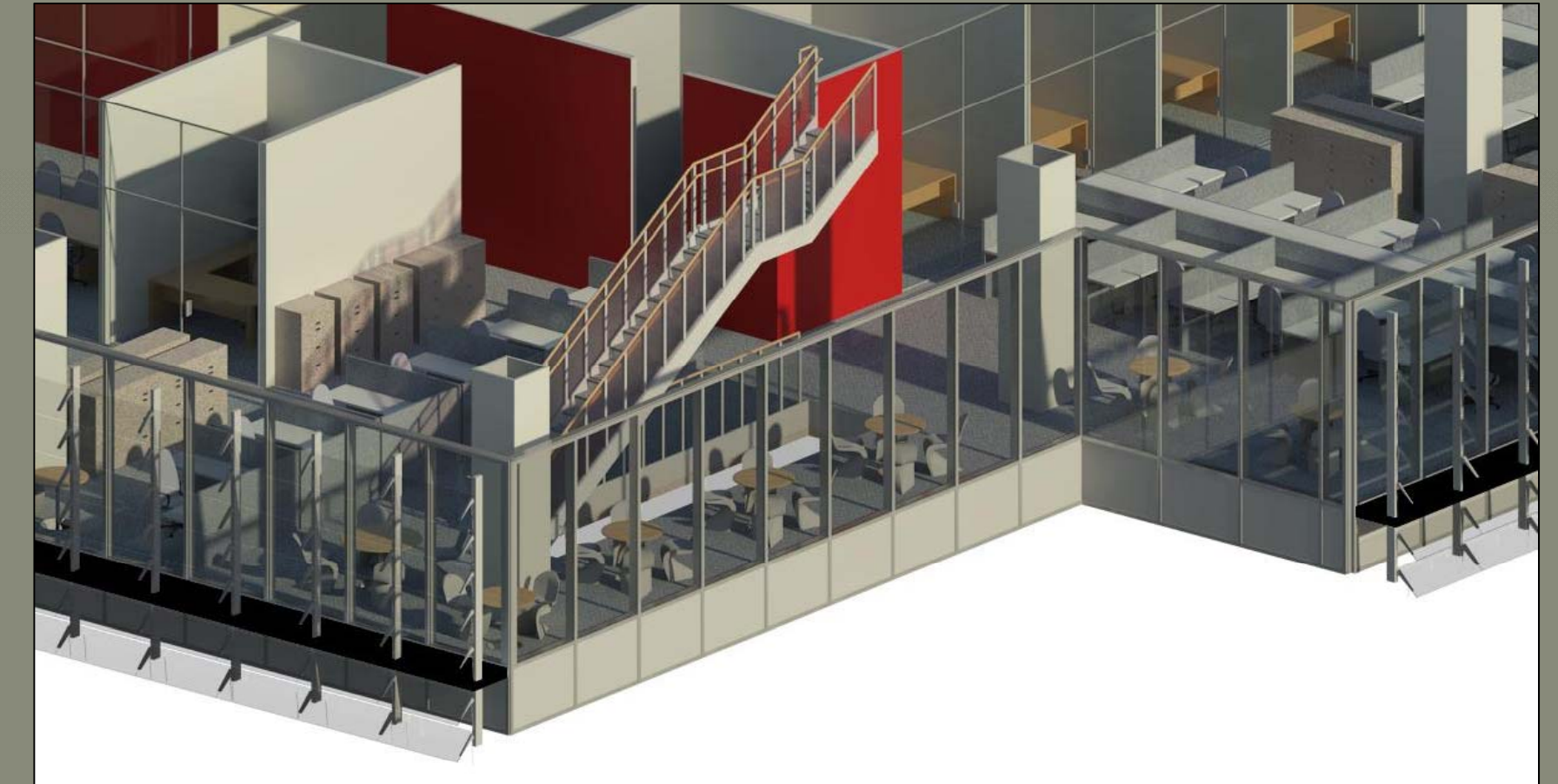
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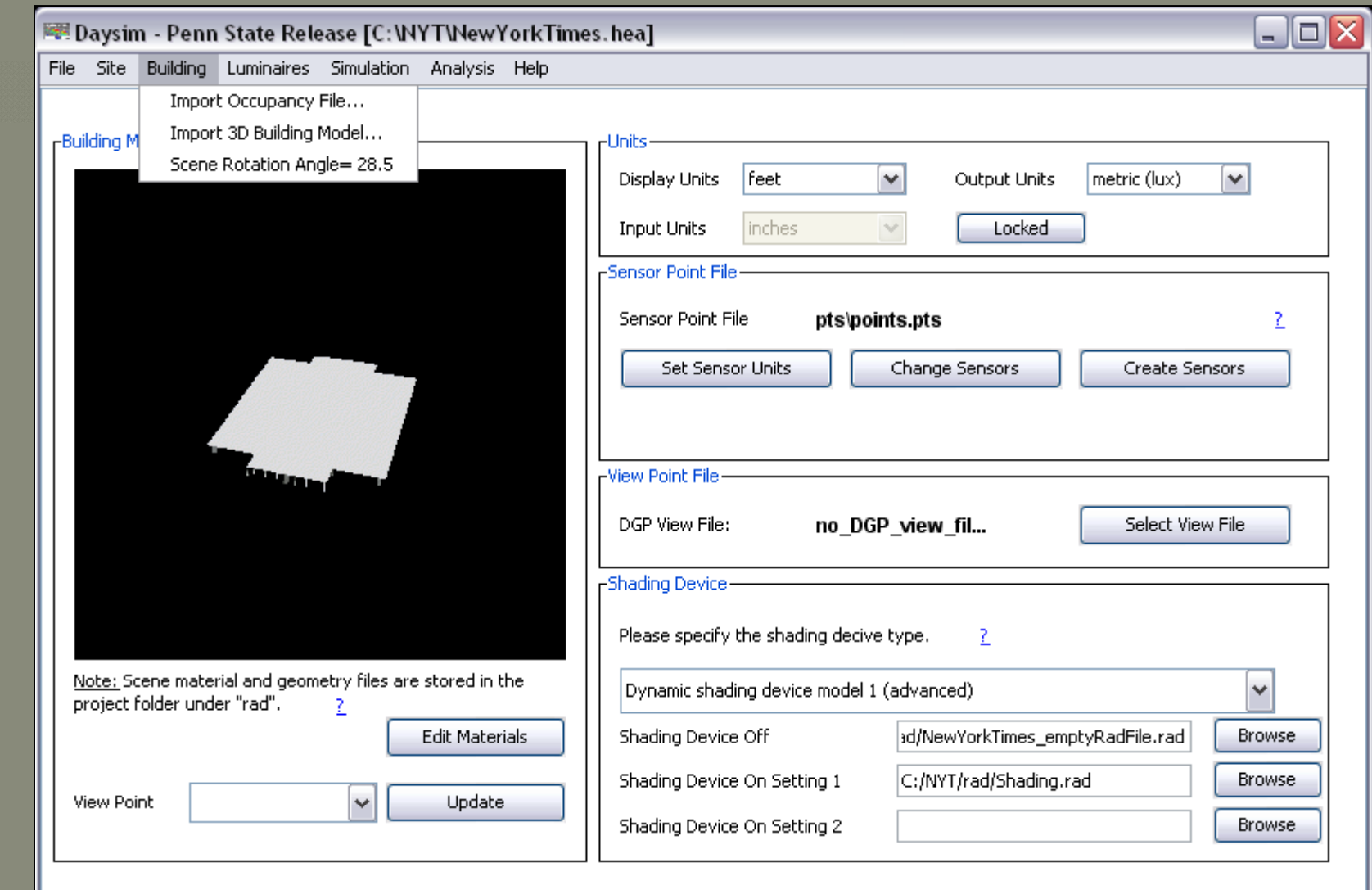
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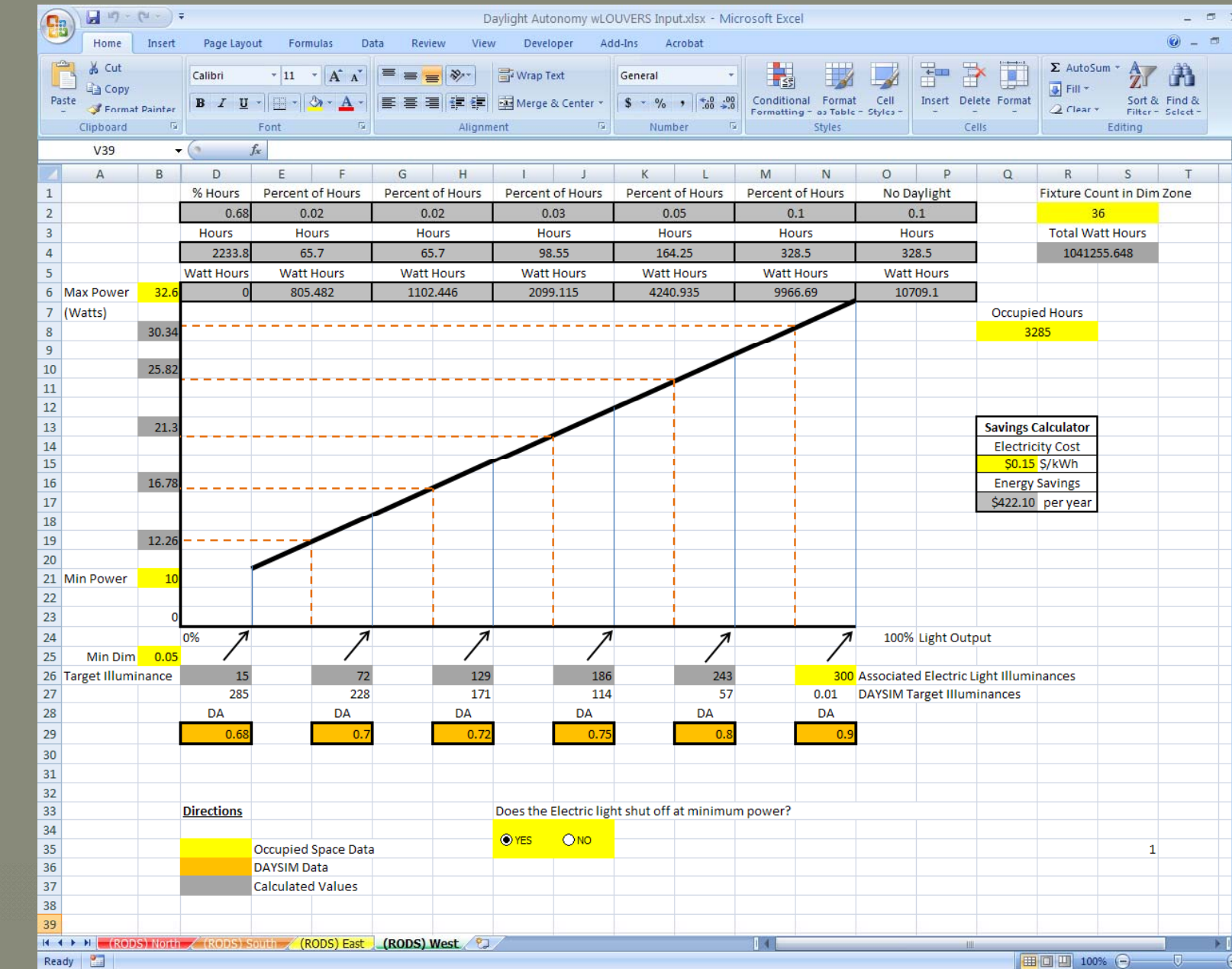
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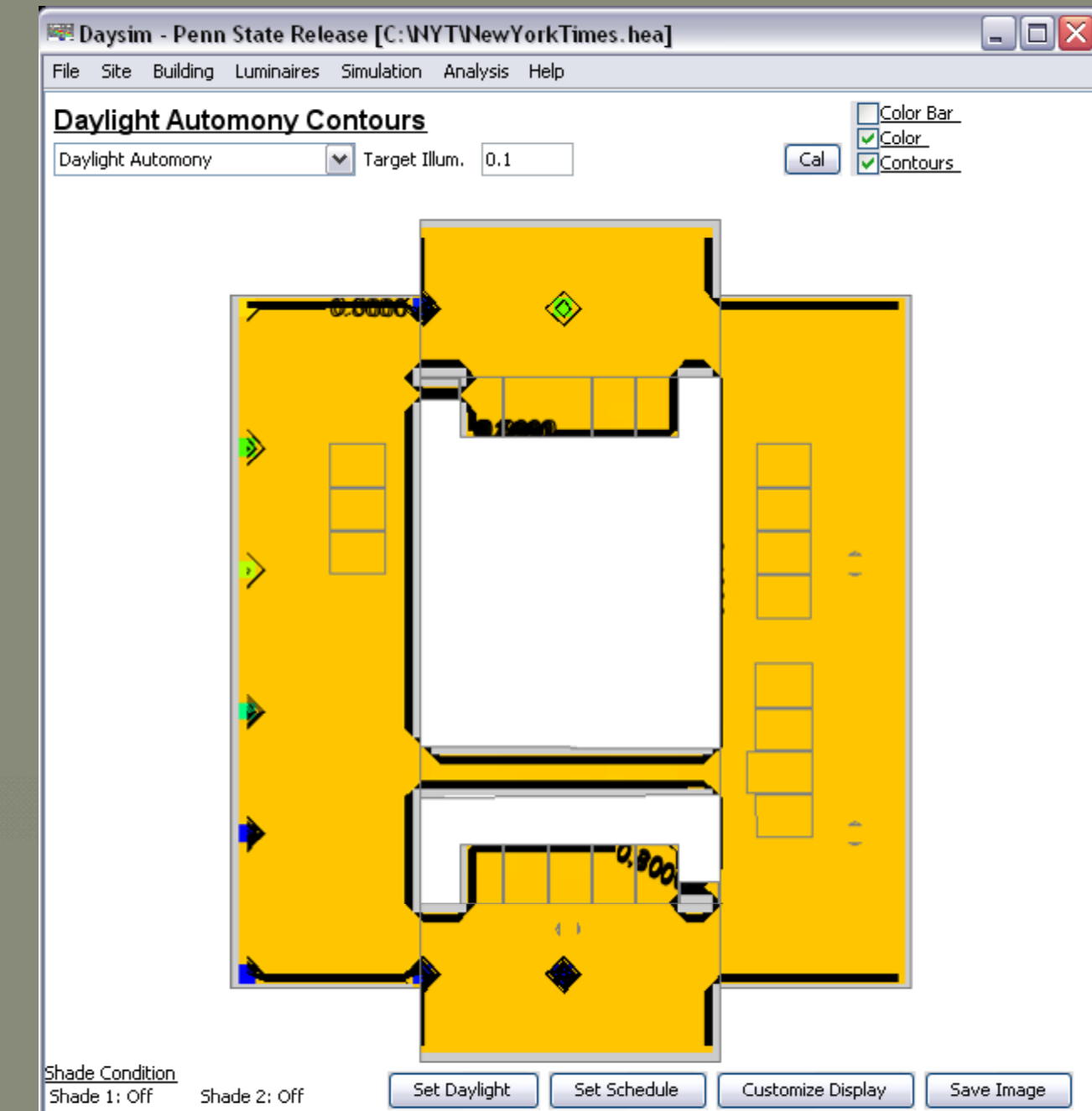
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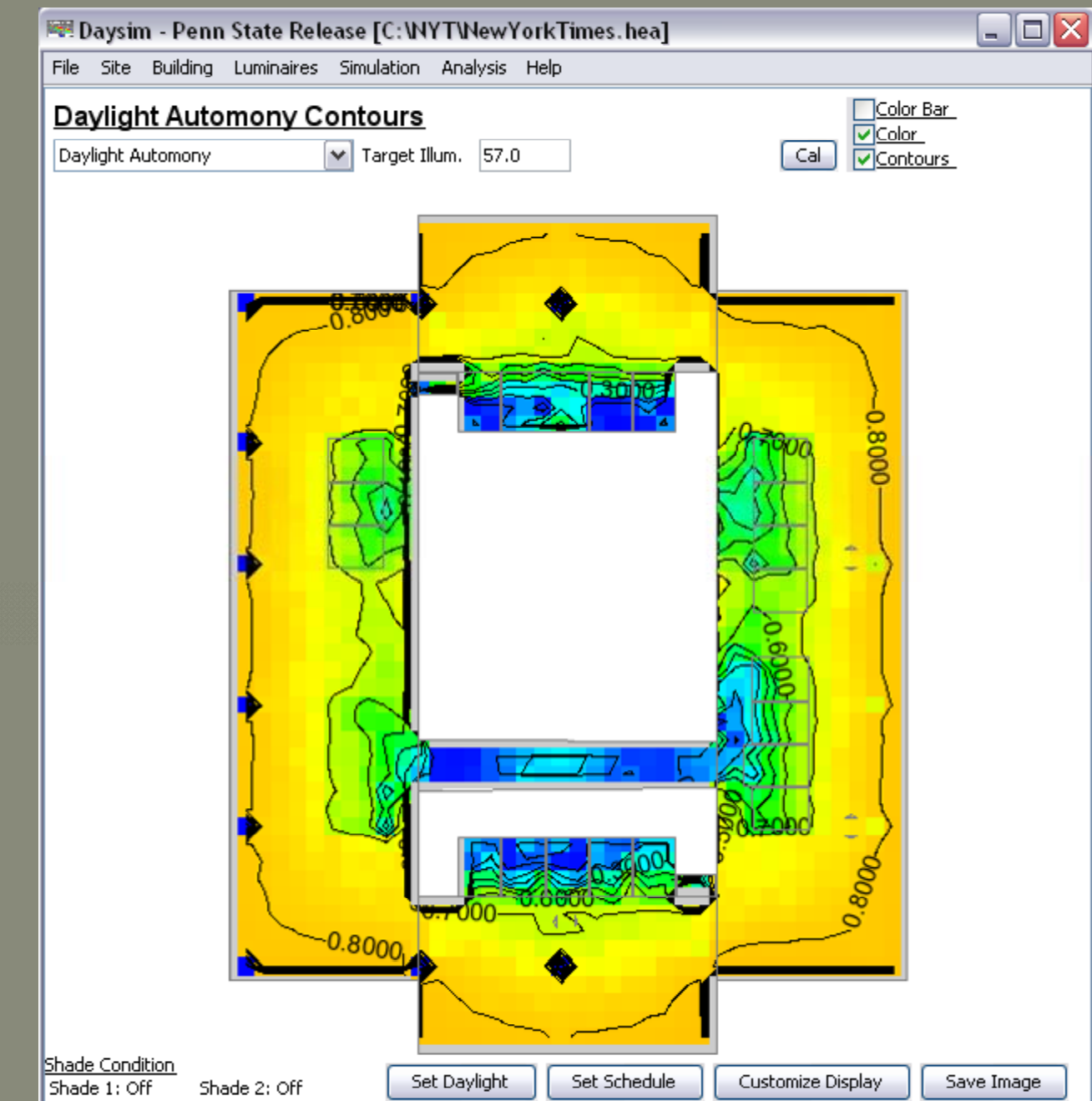
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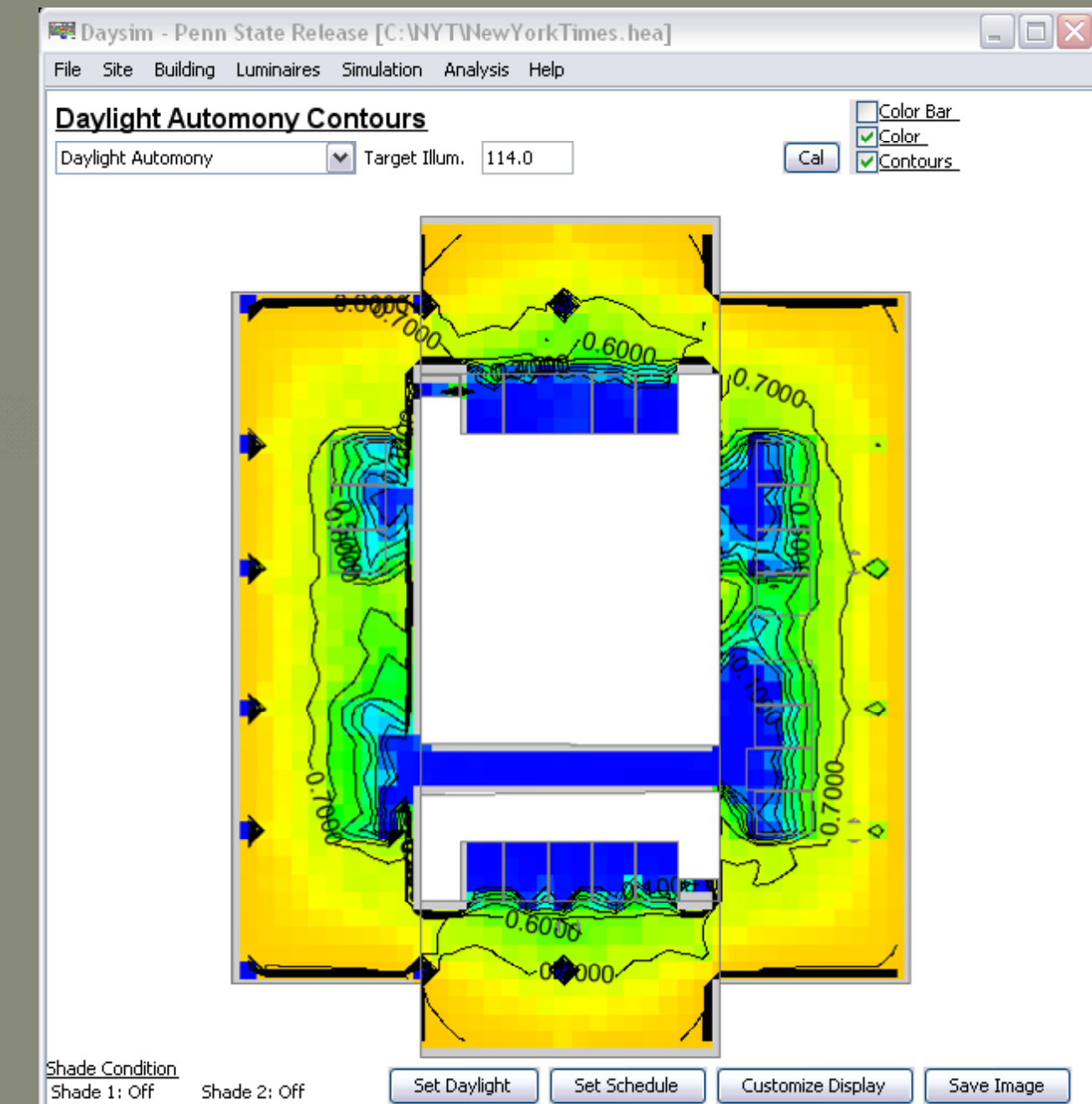
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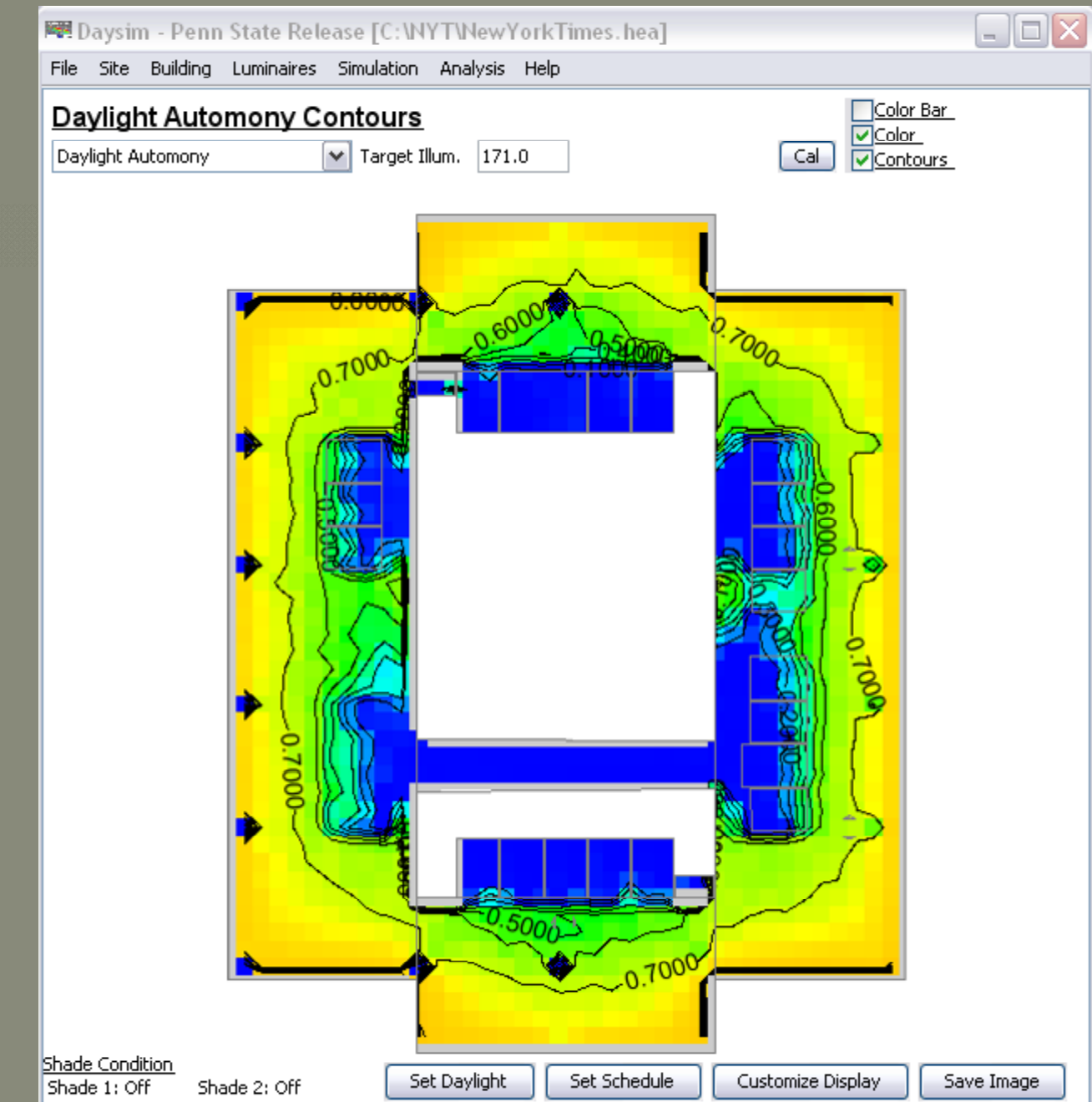
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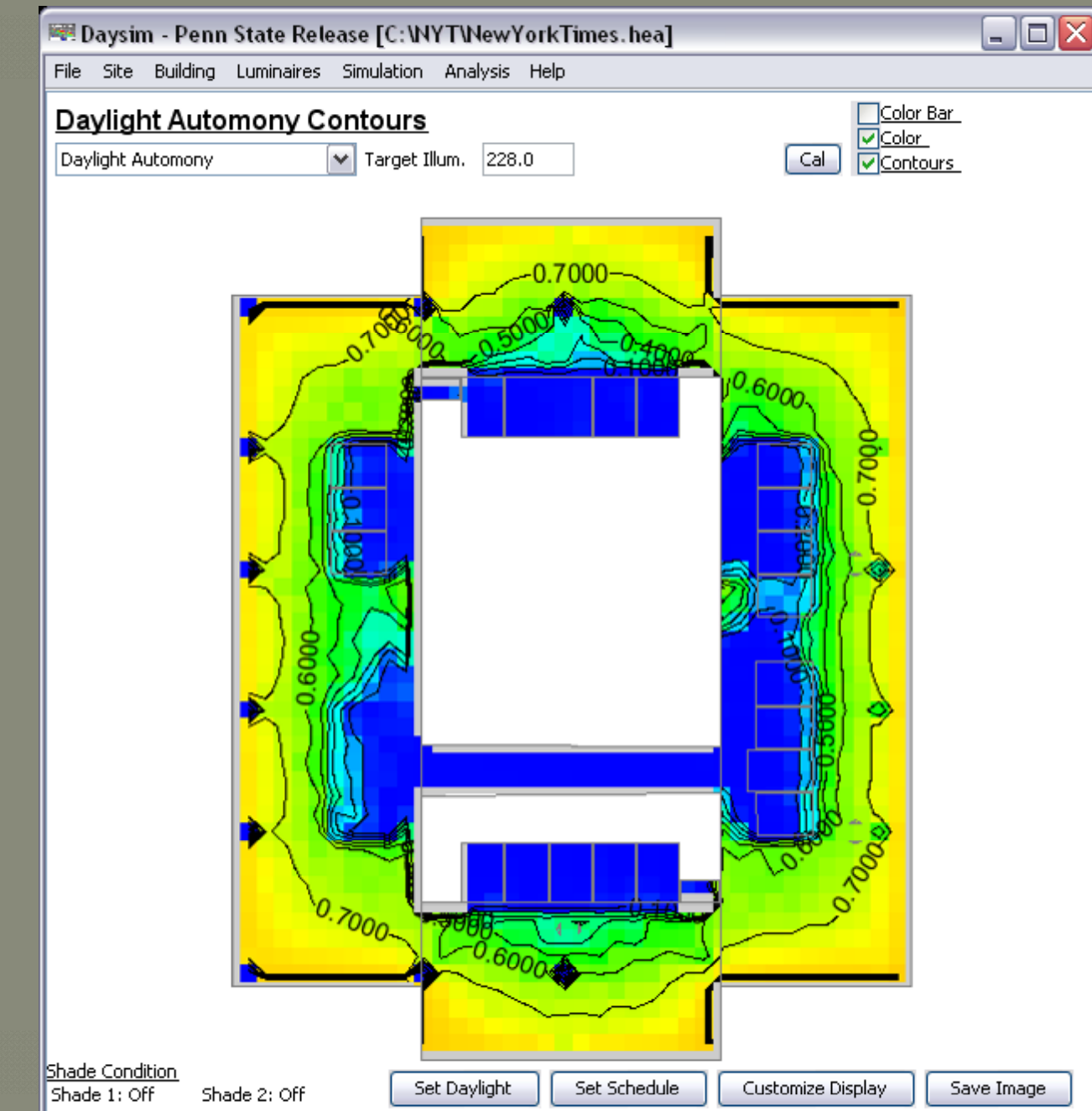
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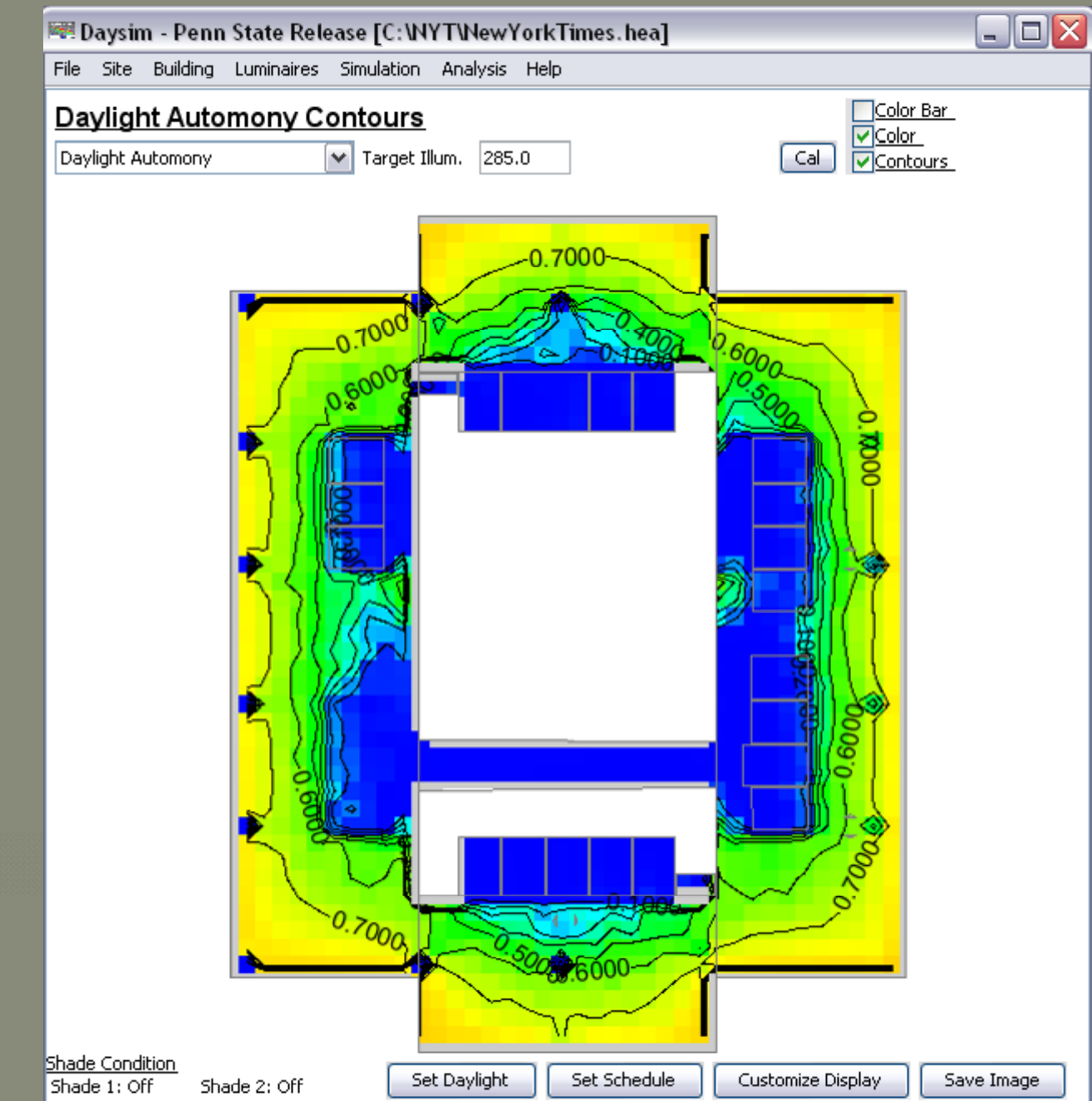
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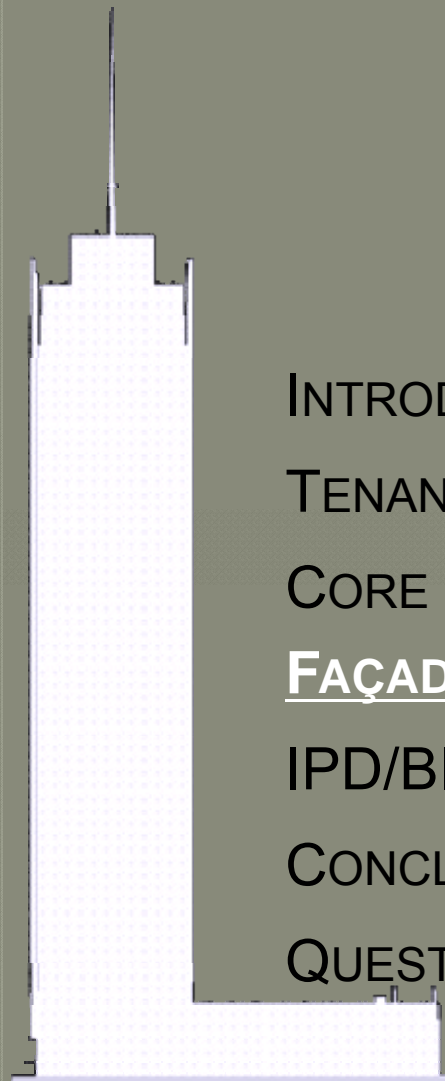


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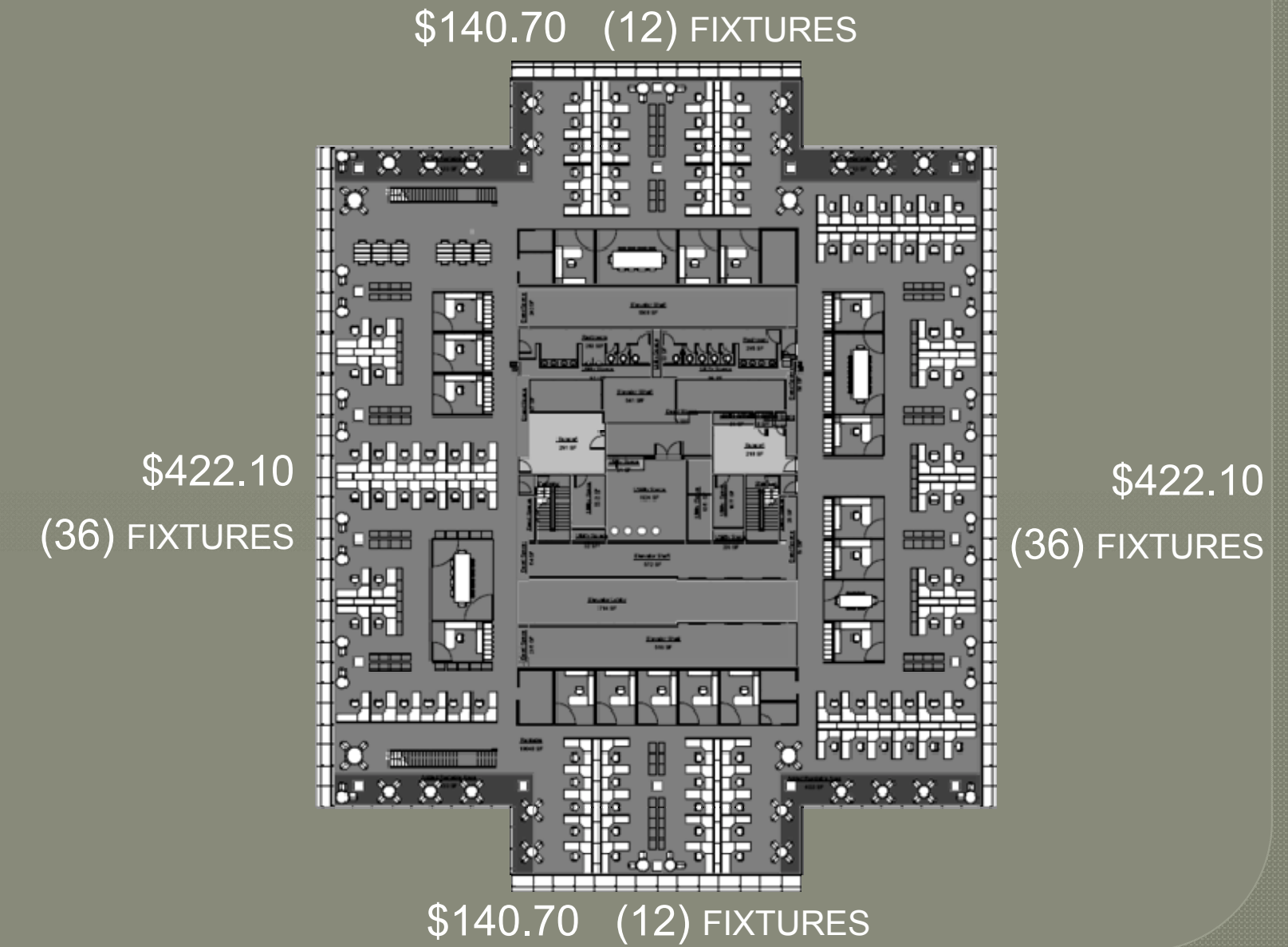
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TOTAL ENERGY SAVINGS PER YEAR
\$56,280.00

NEW YORK TIMES BALLAST QUOTES
NORMAL \$15/PER

DIMMING \$30-\$75/PER WITH WILLINGNESS TO DECREASE



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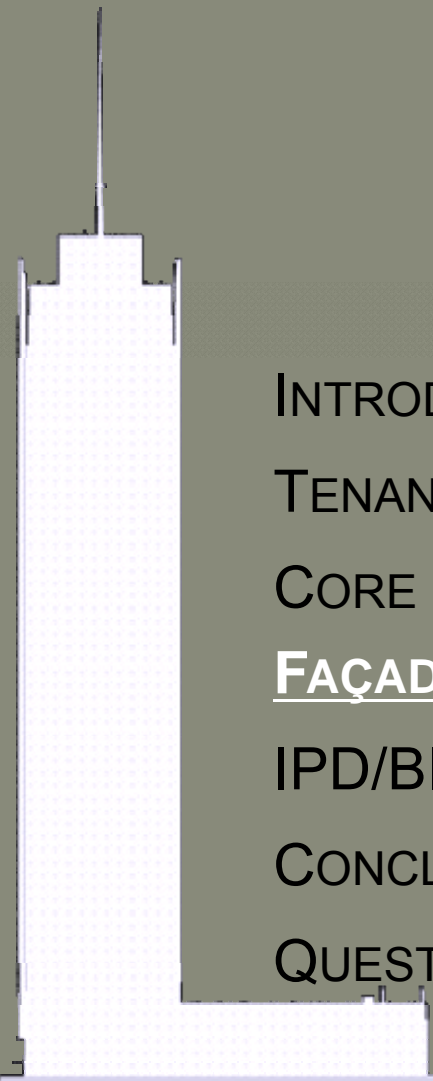
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REVIT → IES<VE>

REVIT → ECOTECT ANALYSIS

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DISADVANTAGES

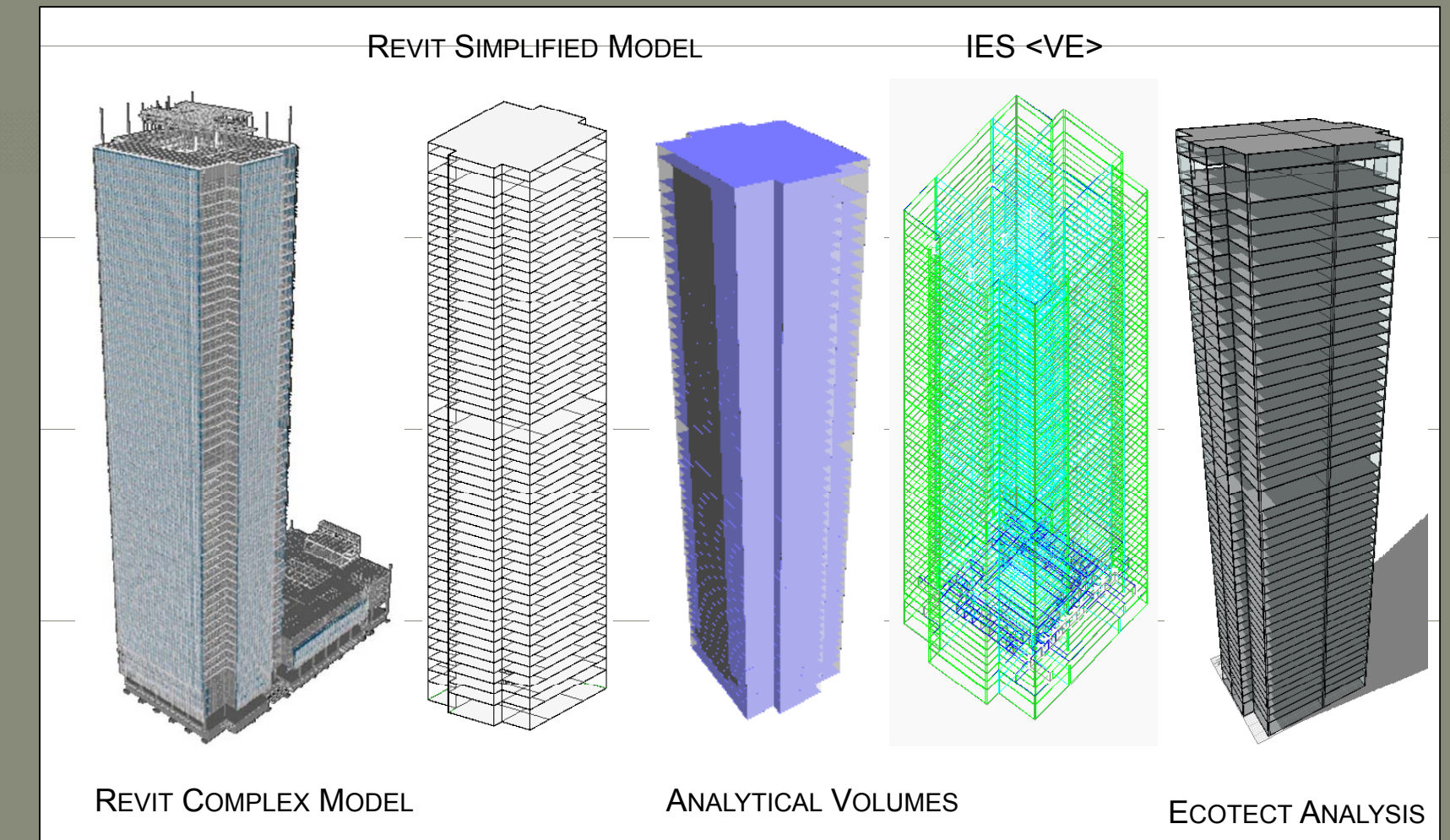
CAREFUL MODEL INSPECTION

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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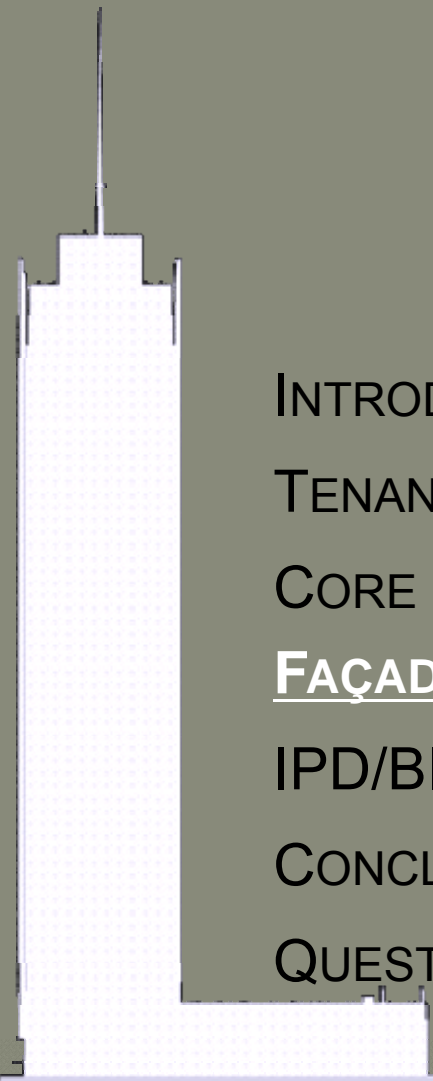
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MODEL INPUT PARAMETER	BASELINE DESIGN INPUT	PROPOSED DESIGN INPUT
SPANDREL PANEL	RECESSED 3/16" ALUMINUM SPANDREL PANEL; UVALUE: 0.08 BTU/FT ² -F-HR 2-1/2" RIGID INSULATION BEHIND	RECESSED 3/16" ALUMINUM SPANDREL PANEL; UVALUE: 0.08 BTU/FT ² -F-HR 2-1/2" RIGID INSULATION BEHIND
FENESTRATION TYPE	1" IGU VISION LITE - CLEAR W/ LOW E DOUBLE PANE - ALUMINUM FRAME	1.1" COLTLITE DOUBLE GLAZED PANEL
FENESTRATION U-VALUE	UVALUE FOR GLAZING: 0.625 BTU/FT ² -F-HR	UVALUE FOR GLAZING: 0.405 BTU/FT ² -F-HR
FENESTRATION VISIBLE LIGHT TRANSMITTANCE	0.96 (96% TRANSMITTANCE)	0.79 (96% TRANSMITTANCE)
SHADING DEVICE	1-5/8" DIAMETER CERAMIC TUBES	COLT SHADING LOUVRES

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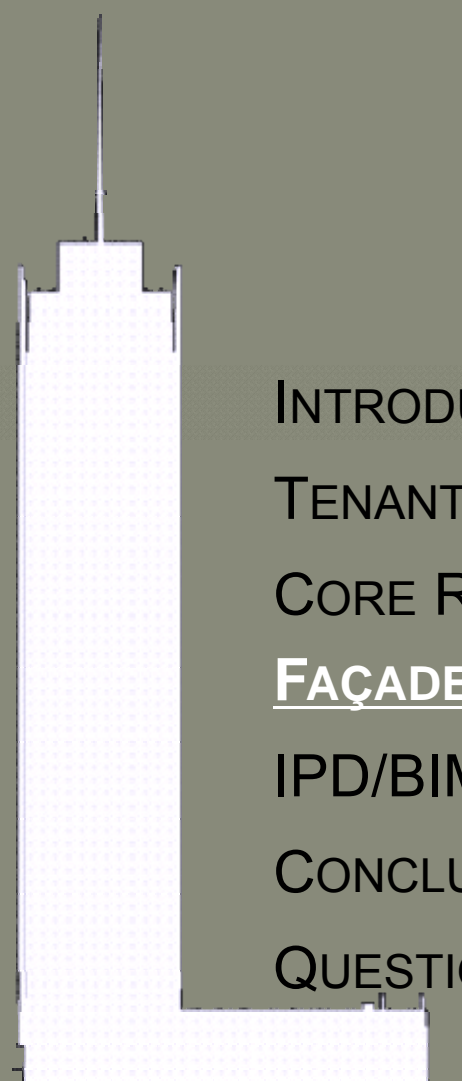
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MODEL INPUT PARAMETER	BASELINE DESIGN INPUT	PROPOSED DESIGN INPUT
INTERIOR LIGHTING POWER DENSITY	1.1 W/M ²	.46 W/M ²

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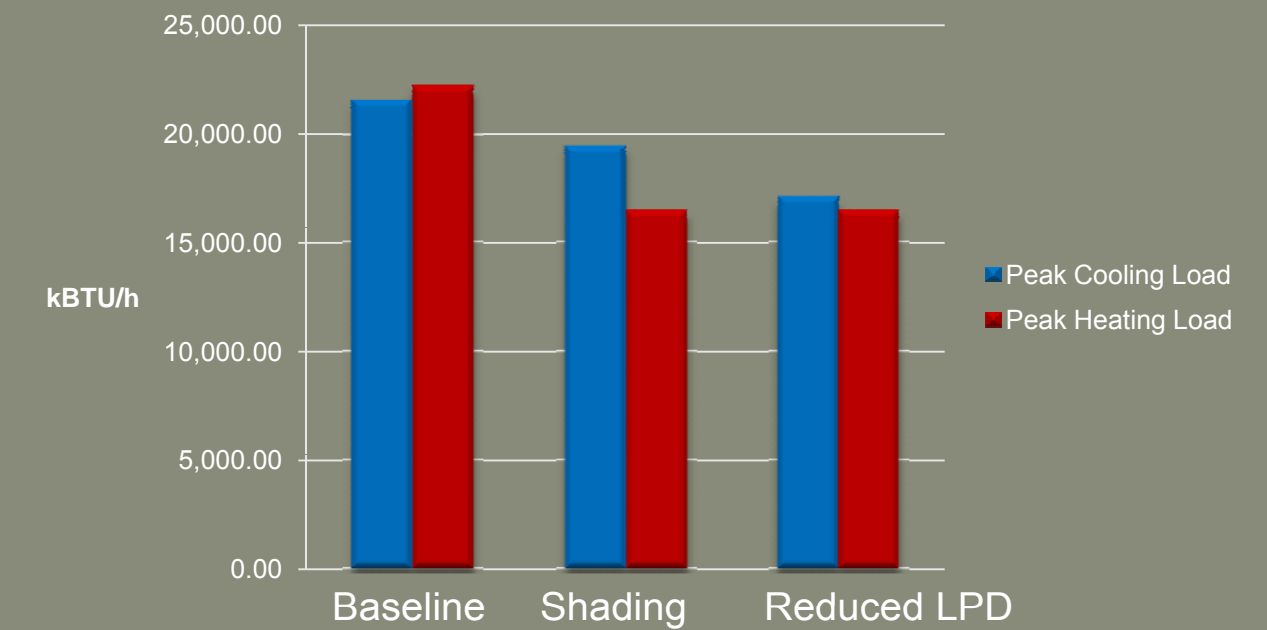
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SIMULATION RESULTS

PEAK LOAD	BASELINE DESIGN	PROPOSED DESIGN	% REDUCTION DUE TO GLAZING / SHADING	PROPOSED WITH REDUCED LIGHTING POWER DENSITY	% REDUCTION DUE TO REDUCED LIGHTING
PEAK COOLING TOTAL LOAD (KBTU/H)	21,554.50	19,442.50	9.80	17,090.20	20.71
PEAK HEATING LOAD (KBTU/H)	22,196.00	16,460.20	25.84	16,460.20	----



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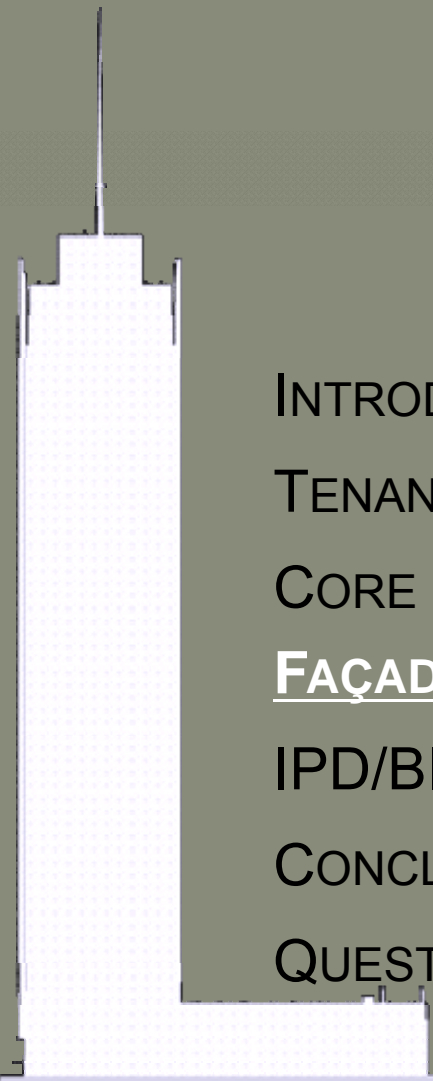
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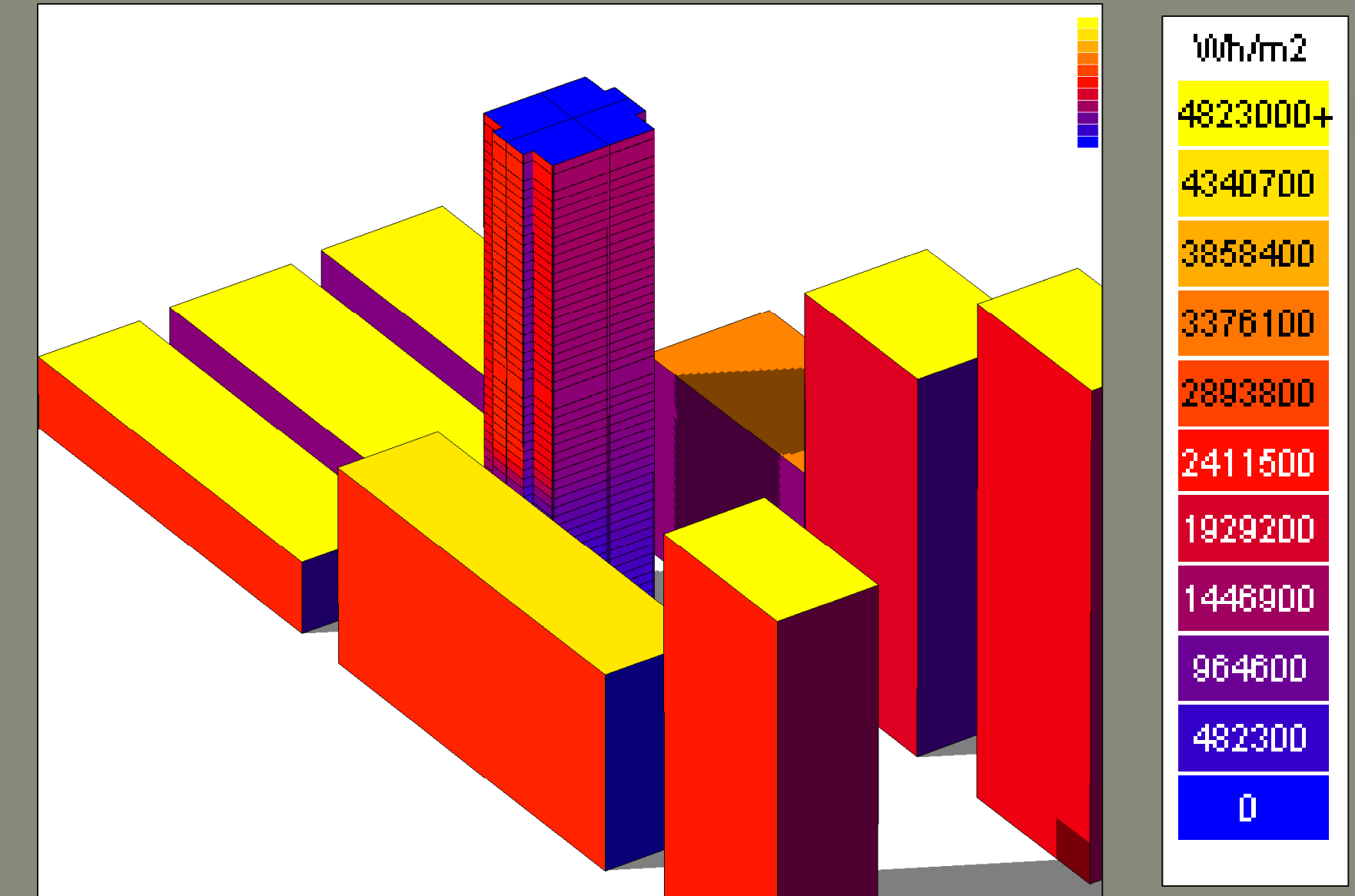
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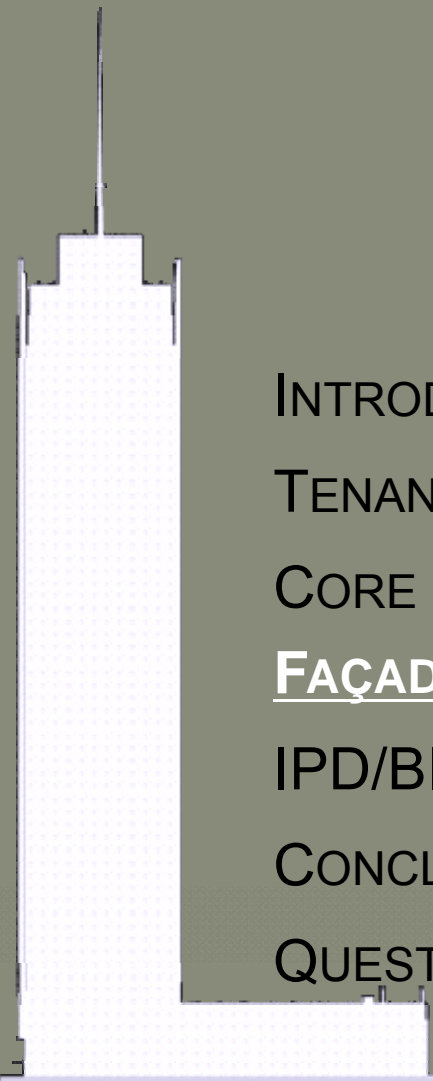
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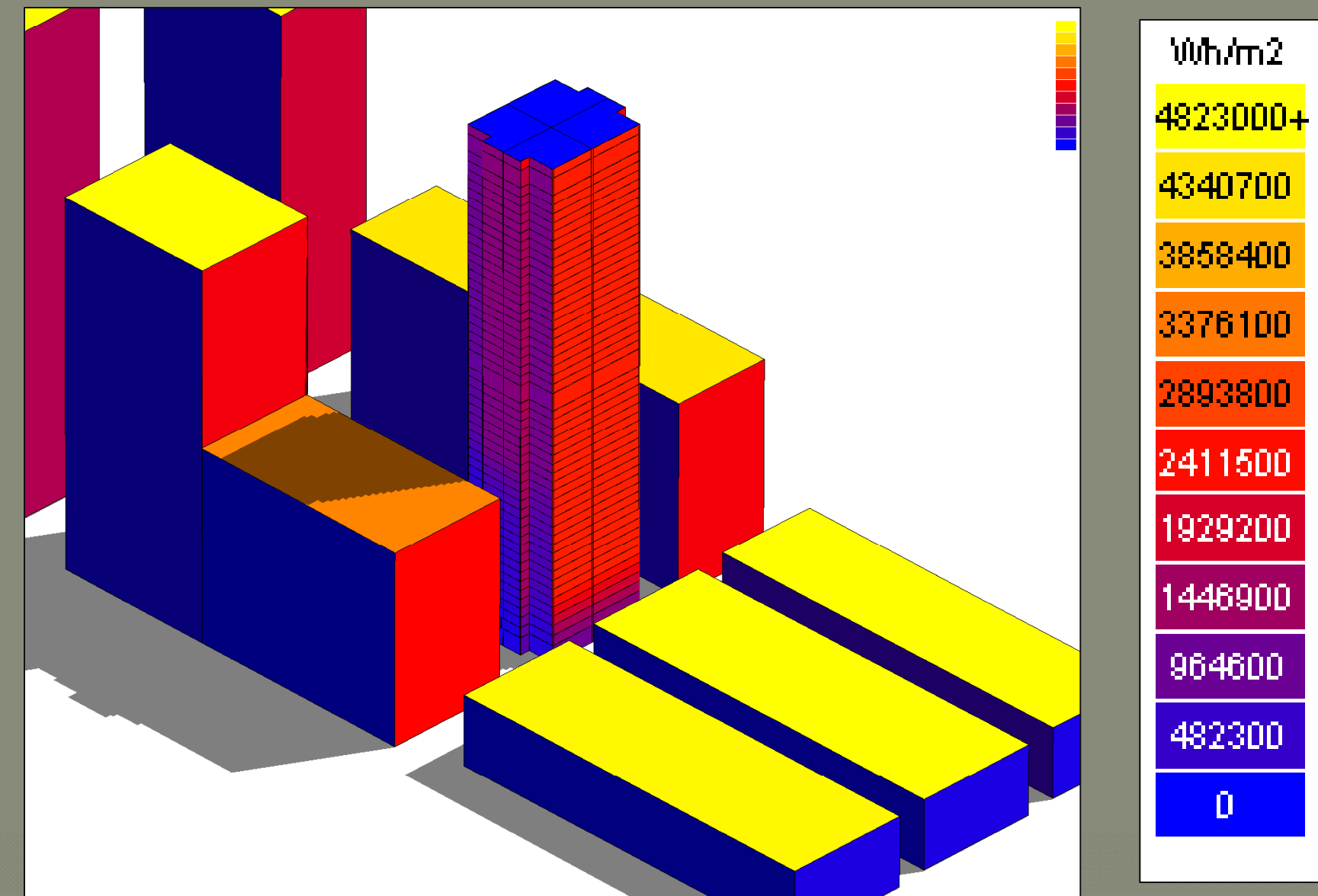
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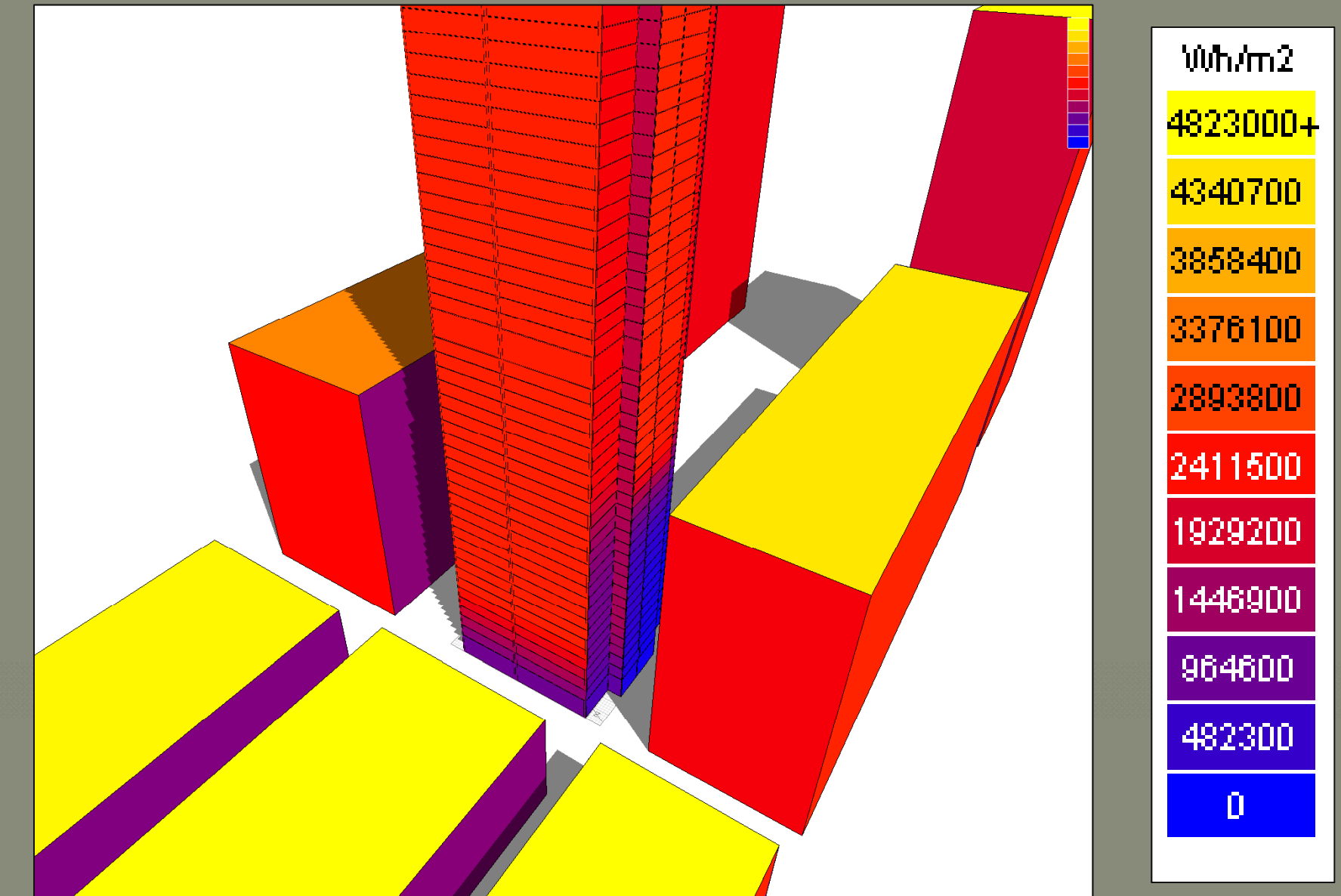
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FAÇADE SECTION	COVERAGE AREA (FT ²)	PRODUCTION KWH/YEAR	COST
EAST FAÇADE FLOORS:5-17	3,575	10,216.53	\$214,500
EAST FAÇADE FLOORS:18-54	10,175	207,971.7	\$610,500
SOUTH FAÇADE FLOORS:18-54	10,175	381,281.5	\$610,500
WEST FAÇADE FLOORS:8-54	12,925	484,330.5	\$775,500

PRODUCTION CALCULATION INPUT	
COST/FT ²	\$60.00
CONVERSION EFFICIENCY	16%
INVERTING EFFICIENCY	95%

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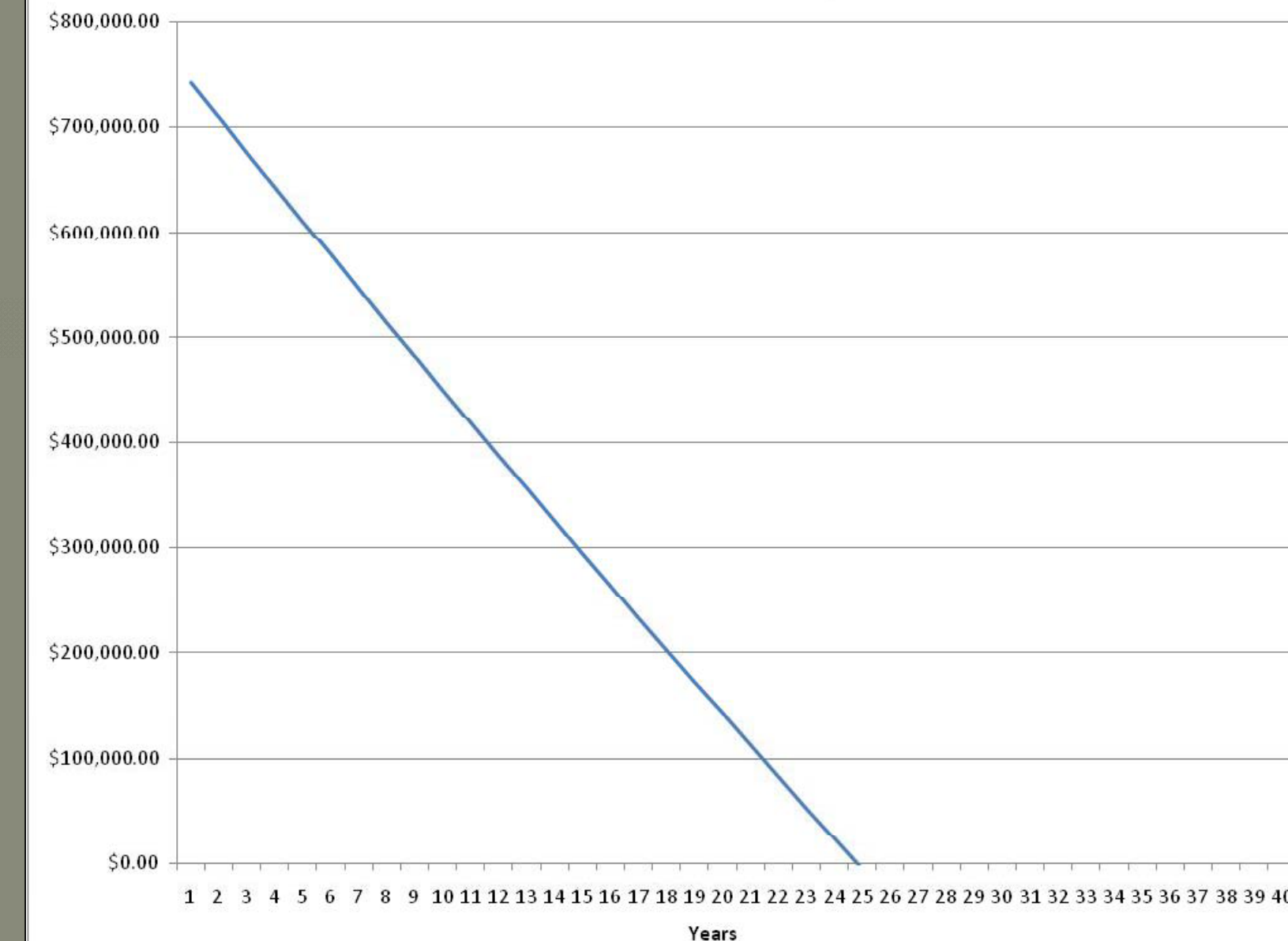
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WEST FAÇADE FLOORS:8-54	12,925	484,330.5	\$775,500

West Facade Payback



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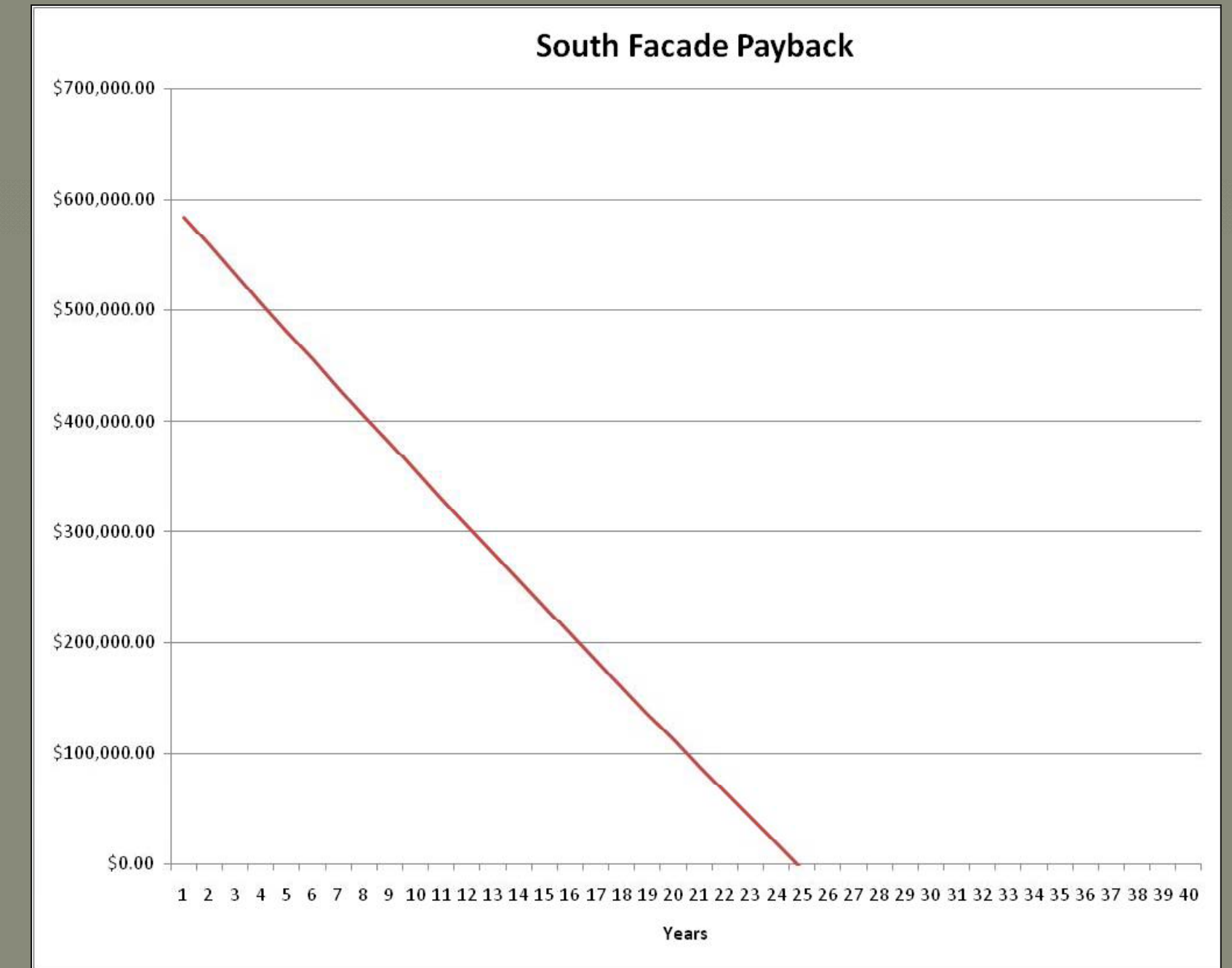
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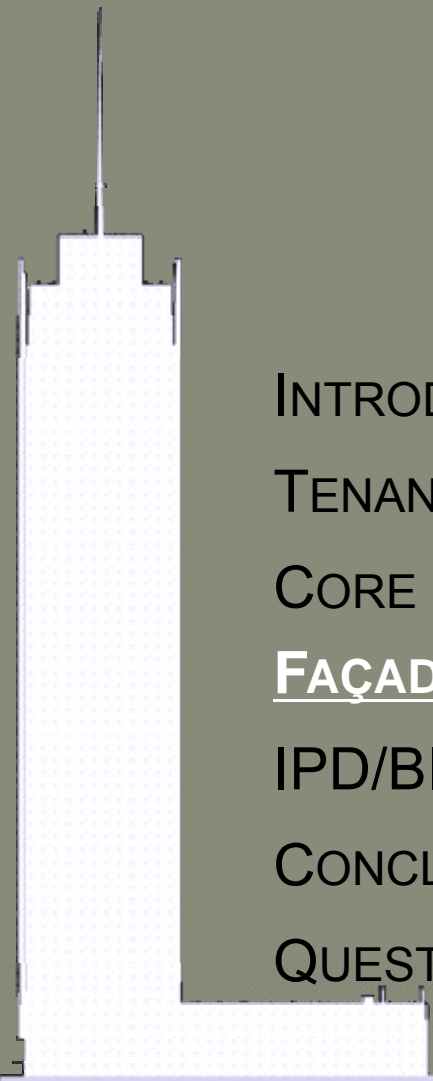
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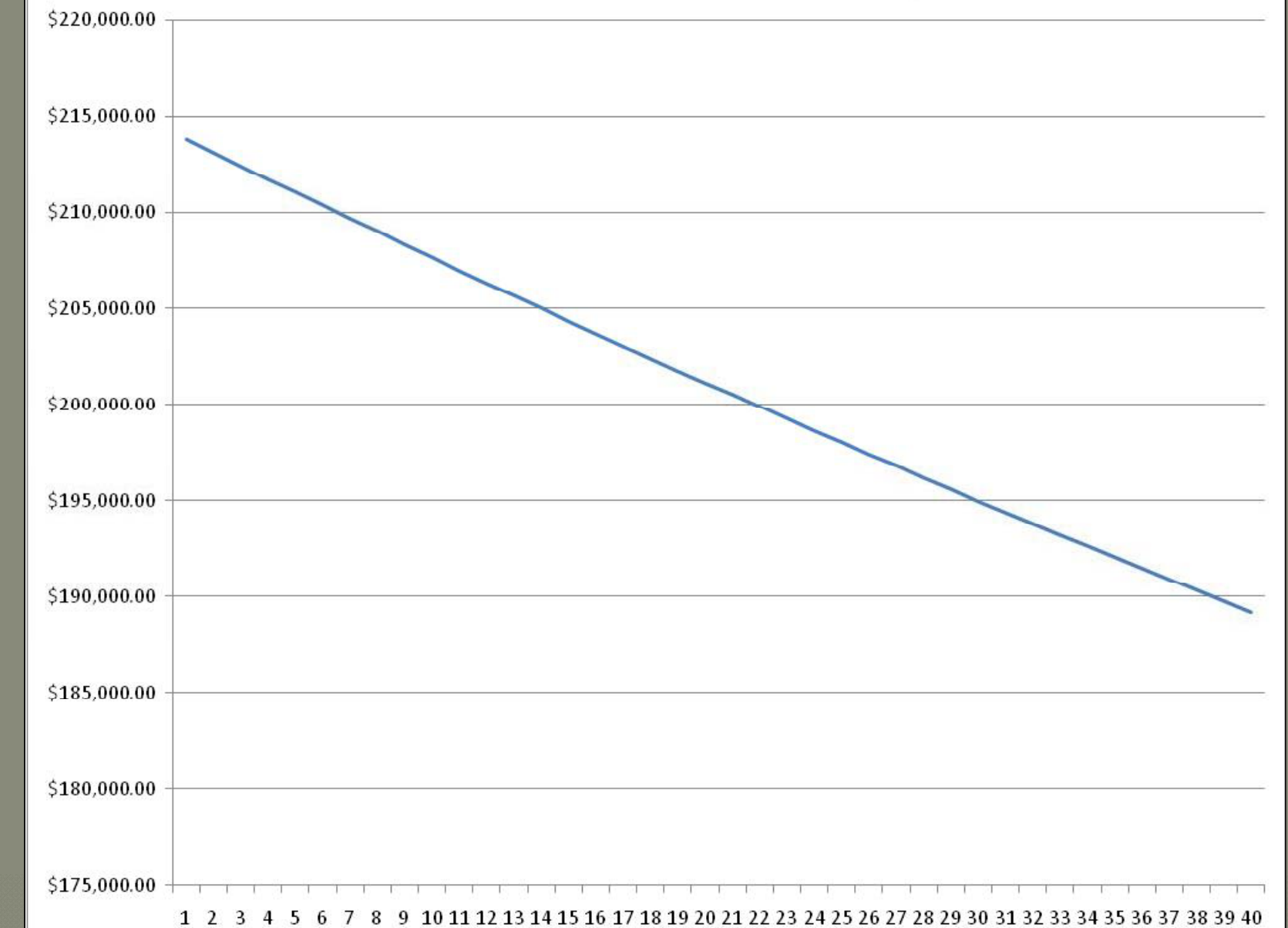
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East Facade Bottom Floors Payback



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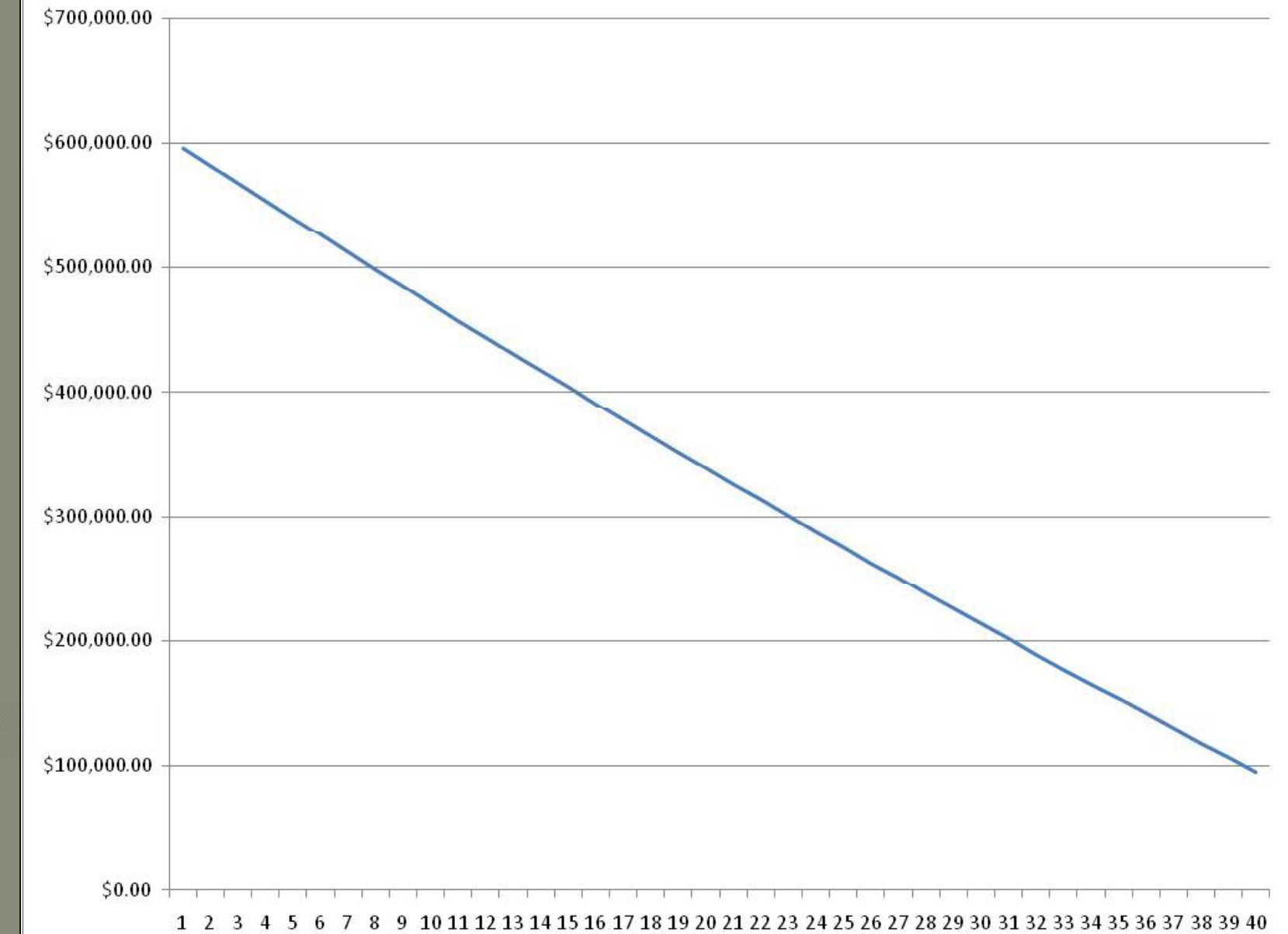
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East Facade Top Floors Payback



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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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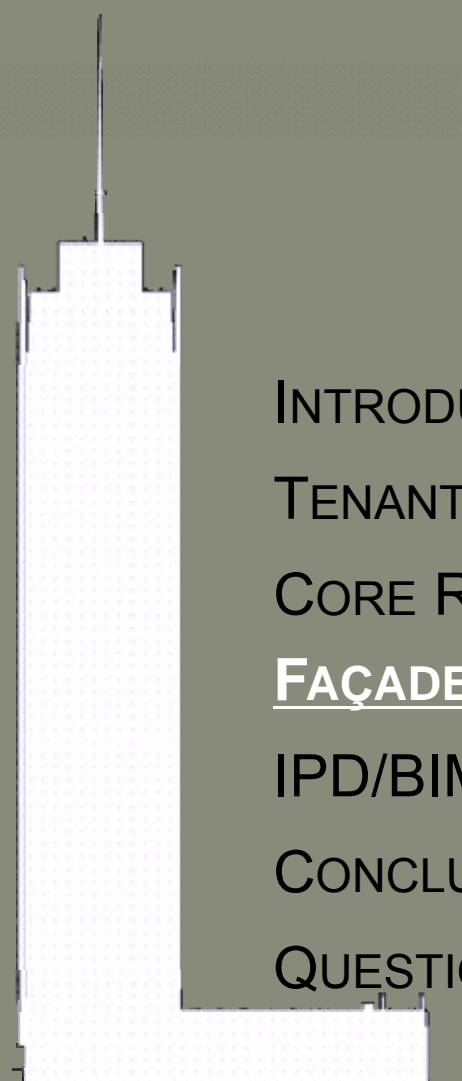
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BIM → IES <VE> MACROFLO INVESTIGATION

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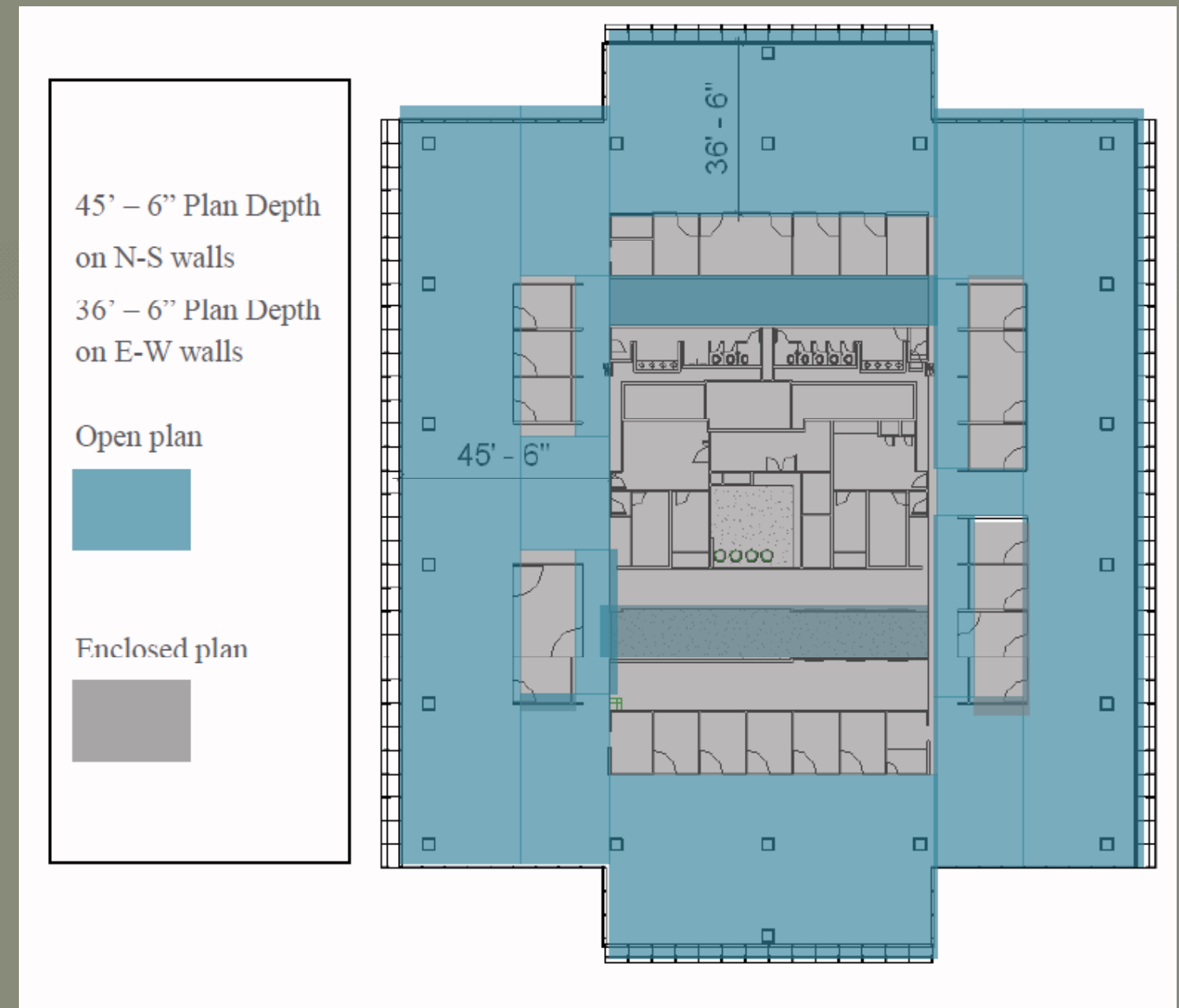
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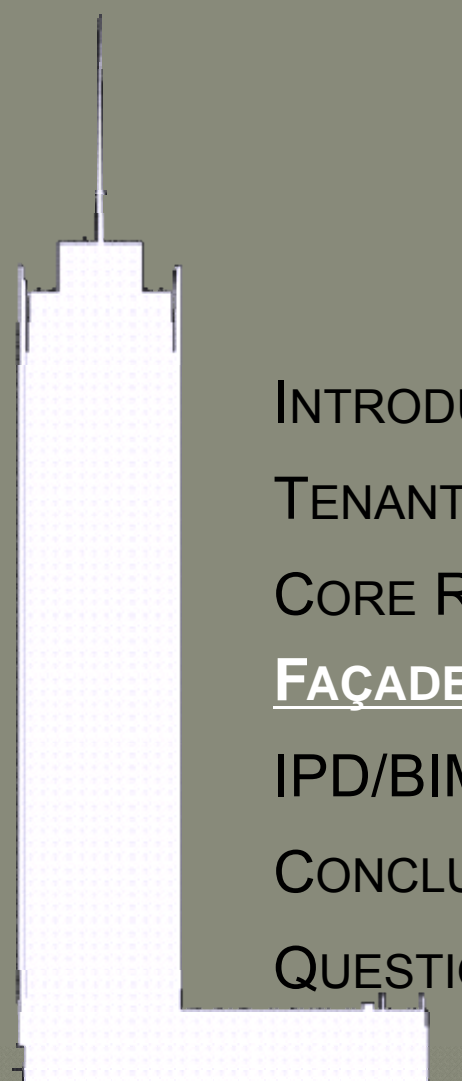
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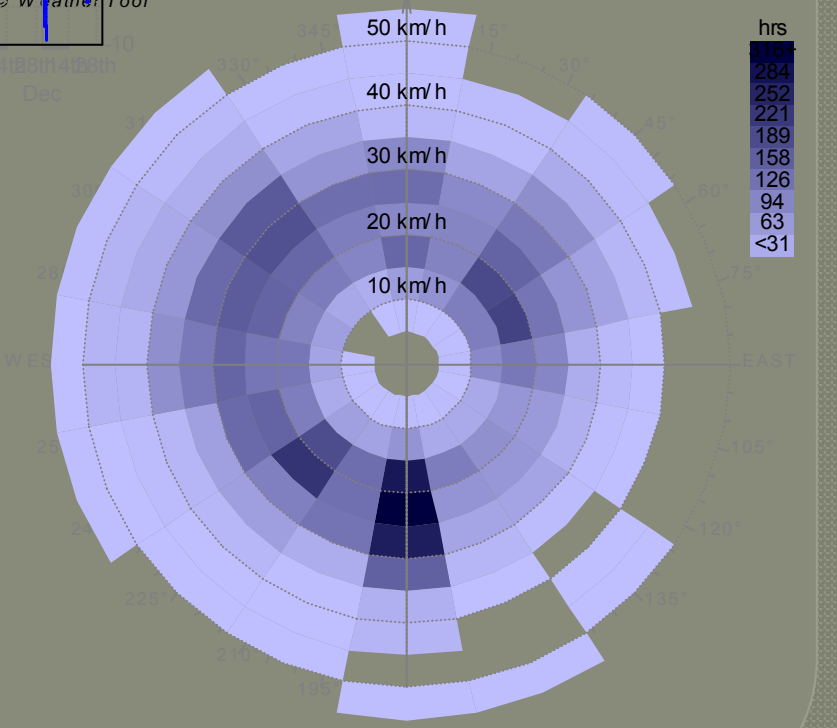
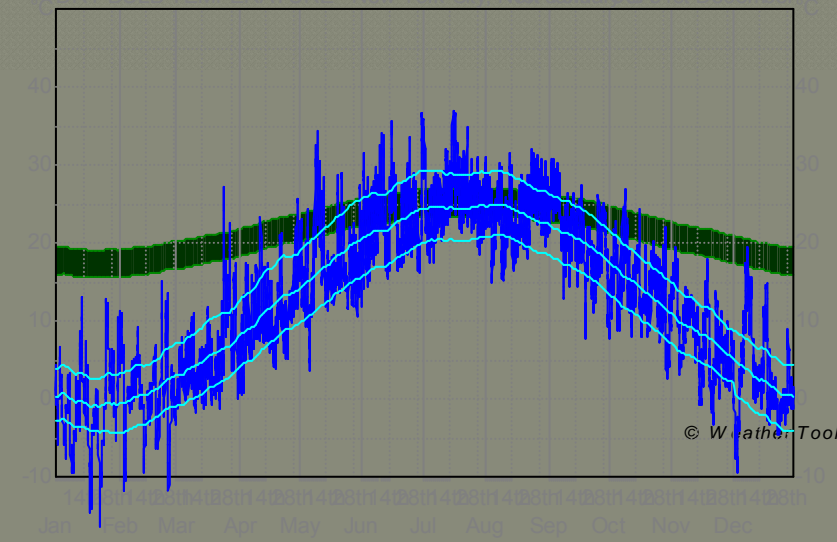


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Colt Coltlite LWI Ventilator, type LWI

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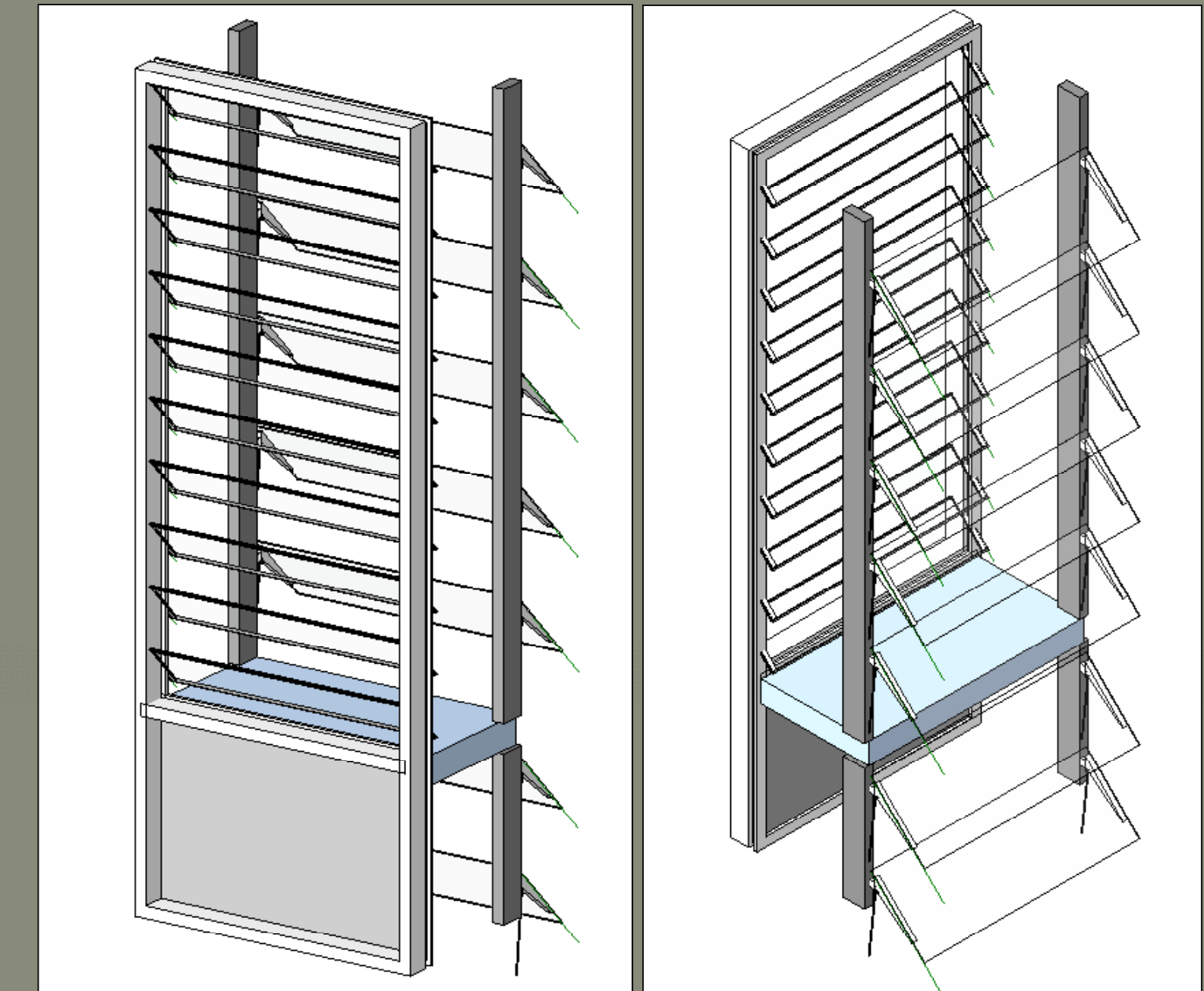
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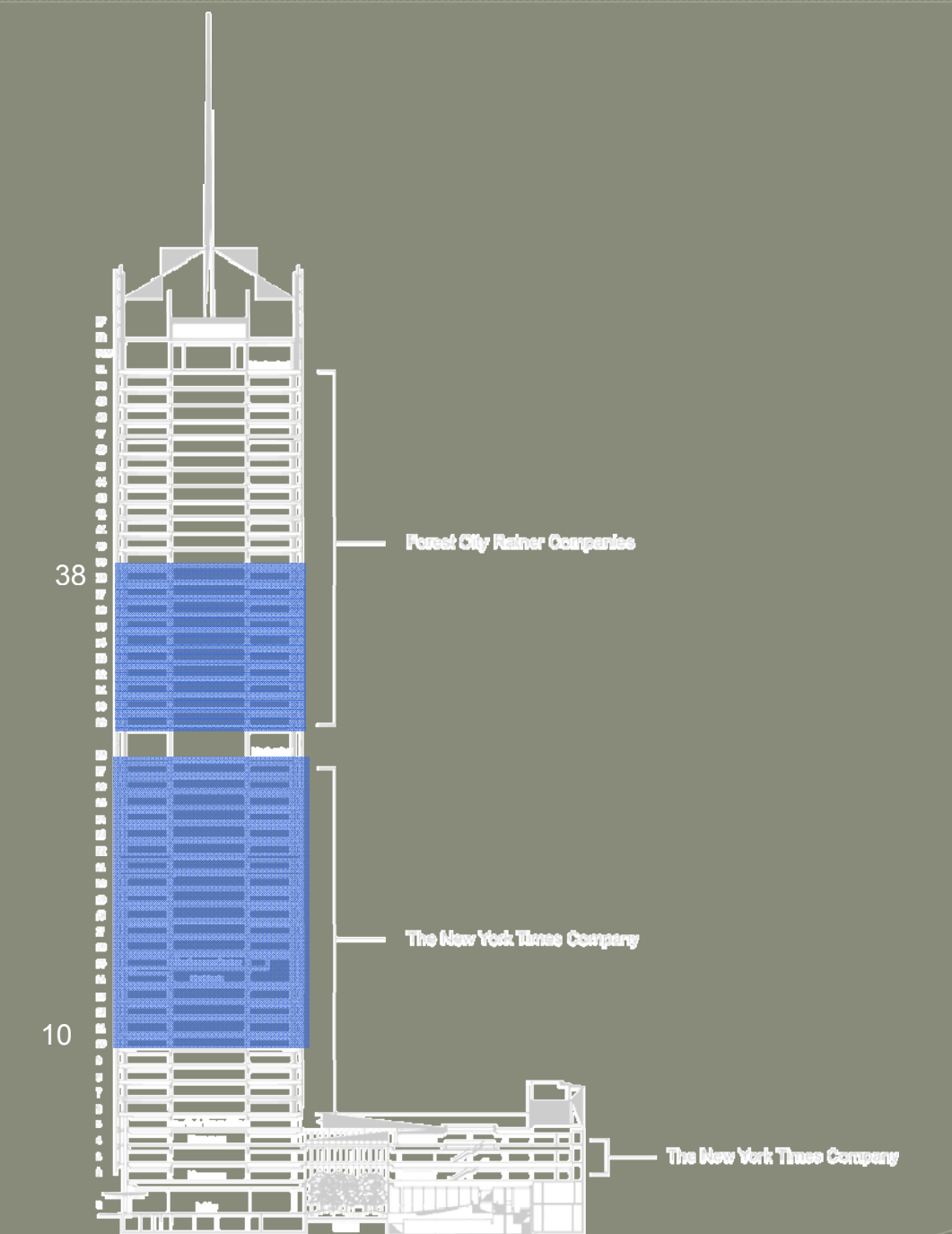
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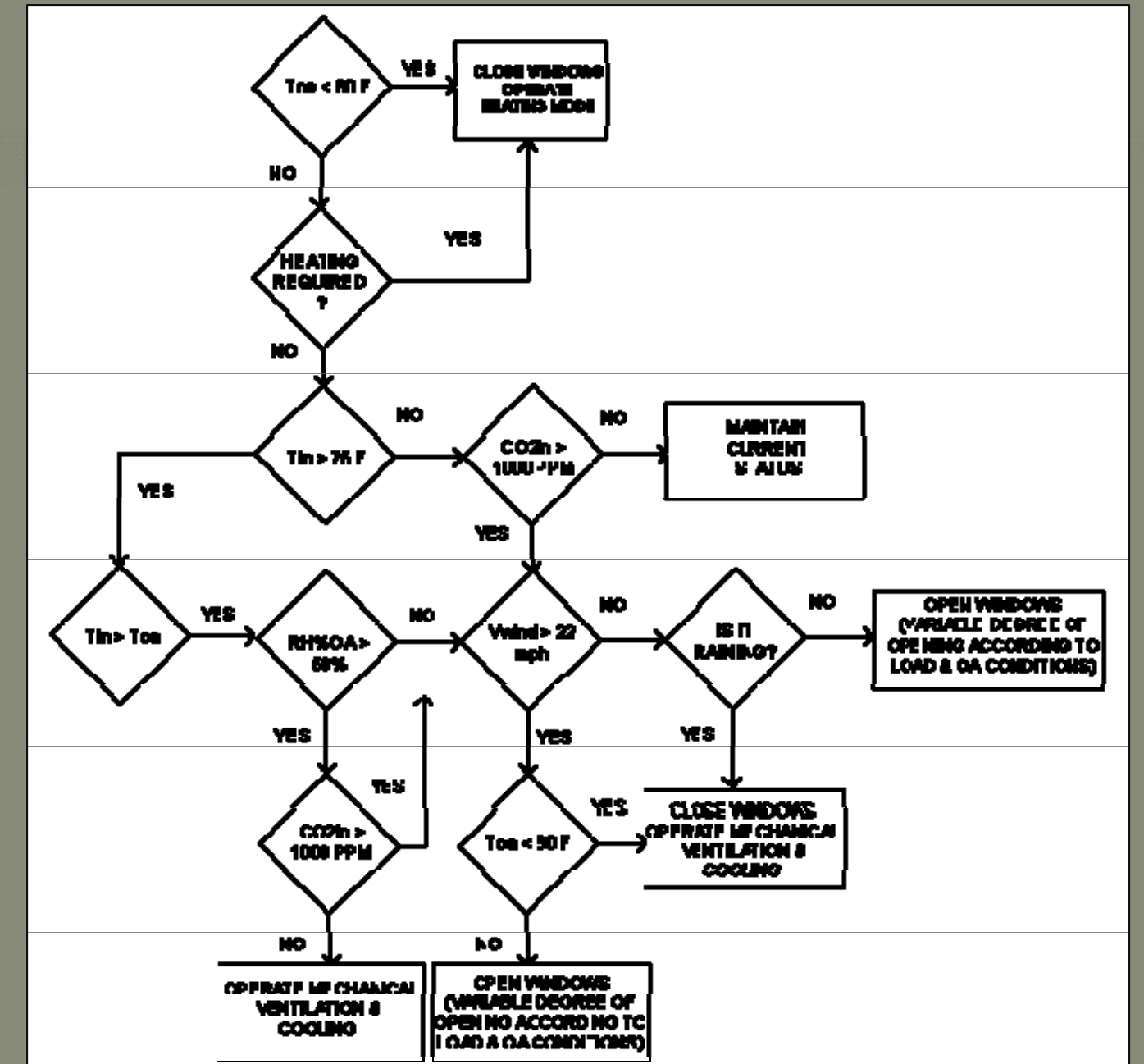
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SINGLE ZONE MODEL

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

350+ HOURS FEASIBLE

10% REDUCTION IN COOLING LOAD

ANNUAL COST SAVINGS OF **\$41,548**

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ENTRANCE LIGHTING DESIGN

- 32W IN-GROUND UPLIGHT
- 51W WIDE FLOOD
- 50W AREA LUMINAIRE

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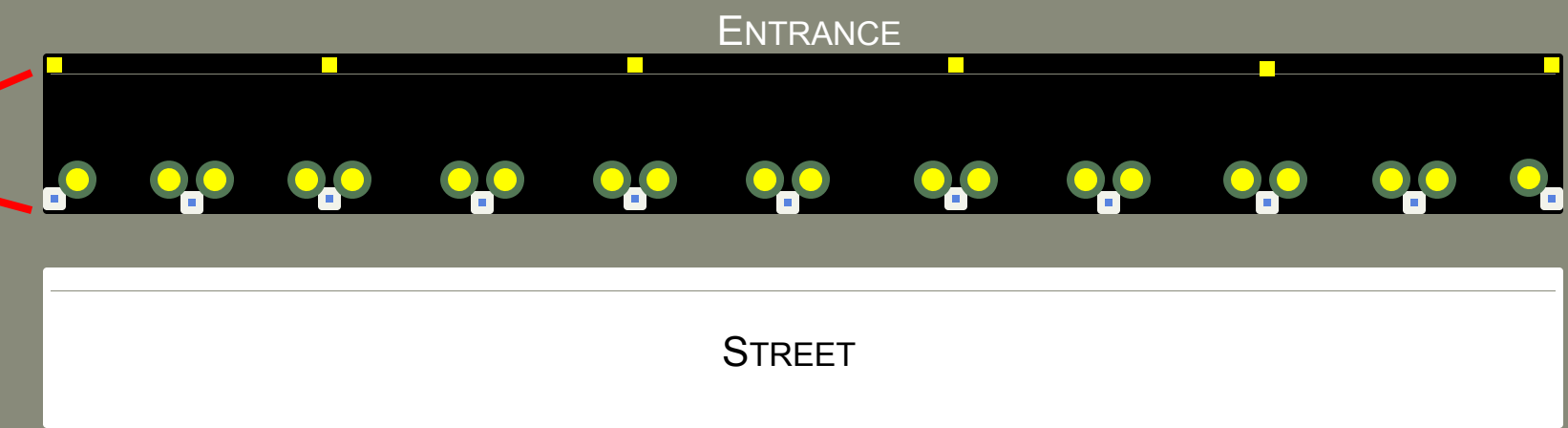
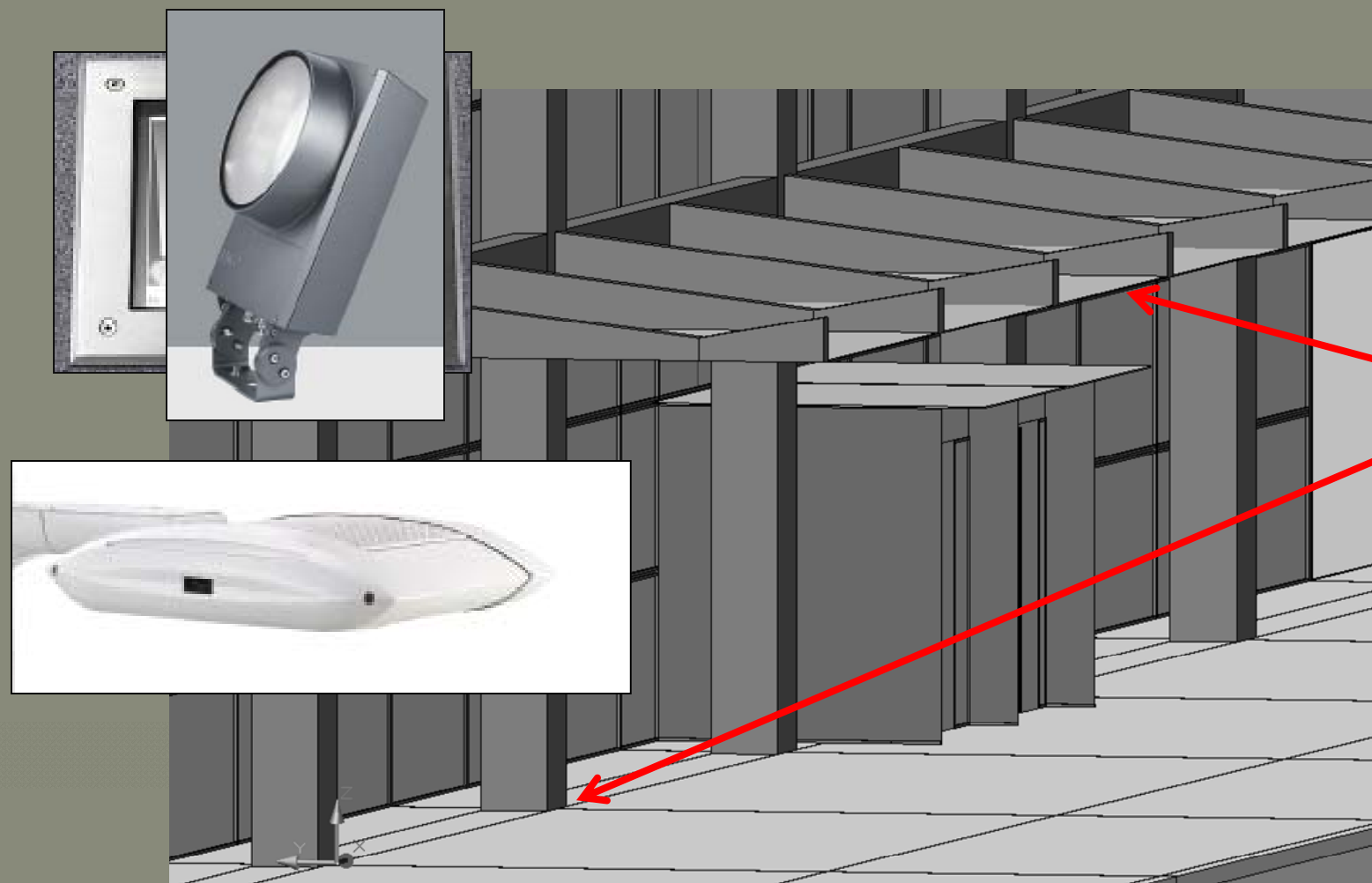
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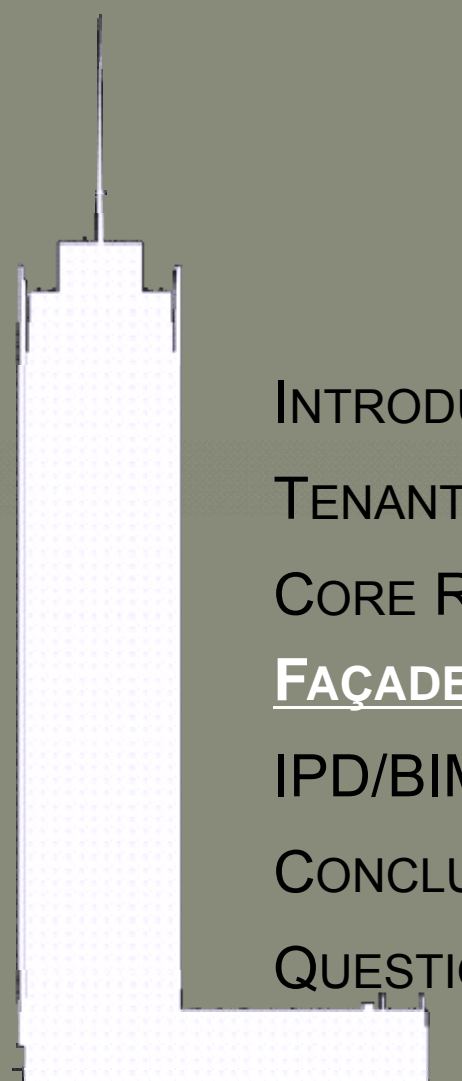
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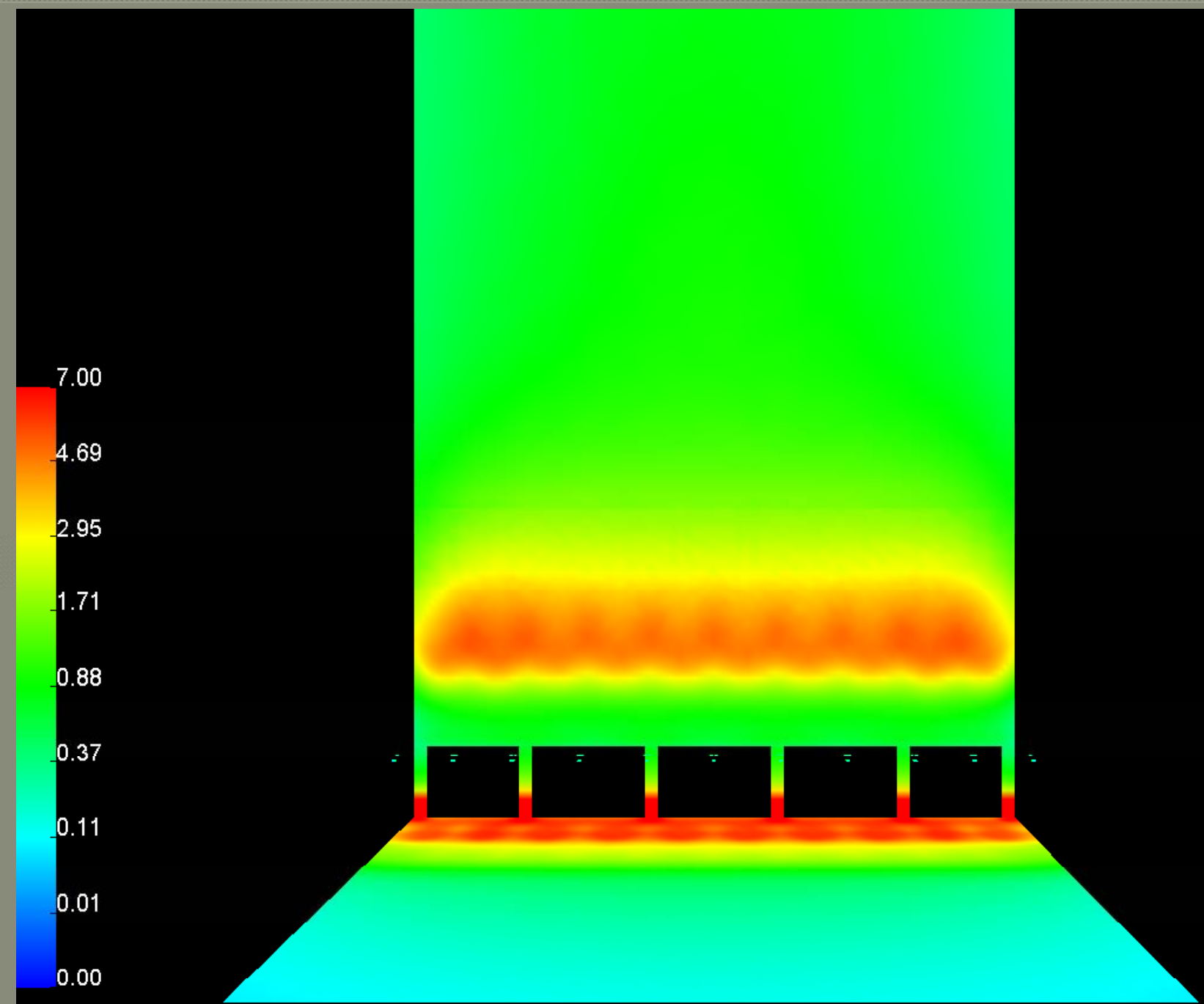
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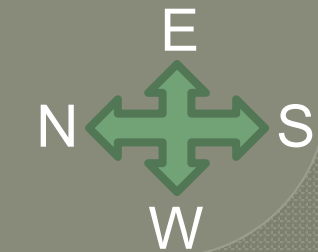
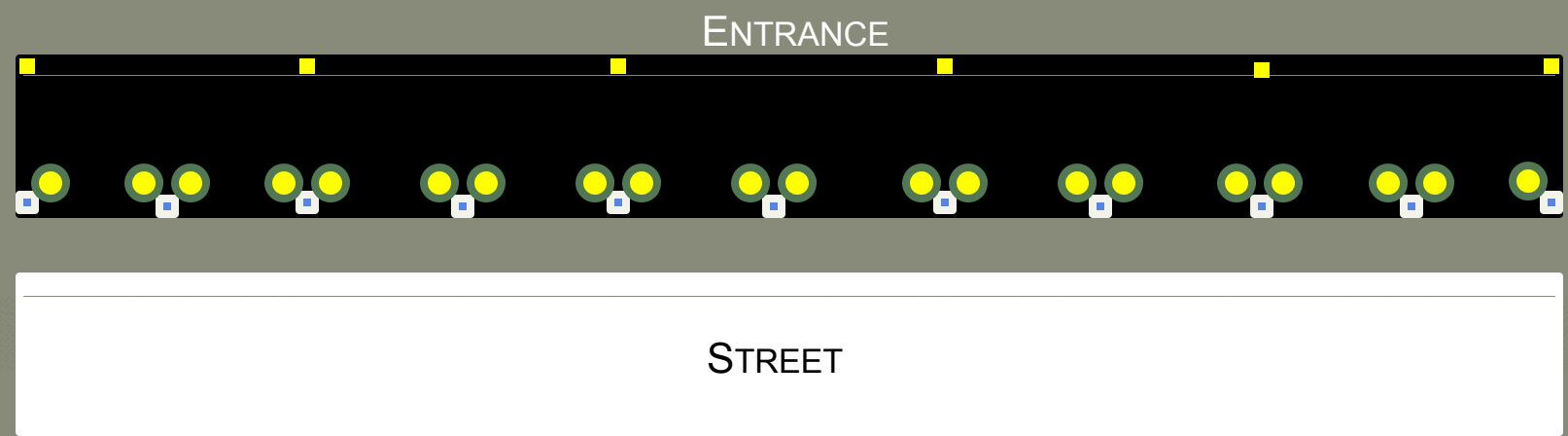
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■ 32W IN-GROUND UPLIGHT

● 51W WIDE FLOOD

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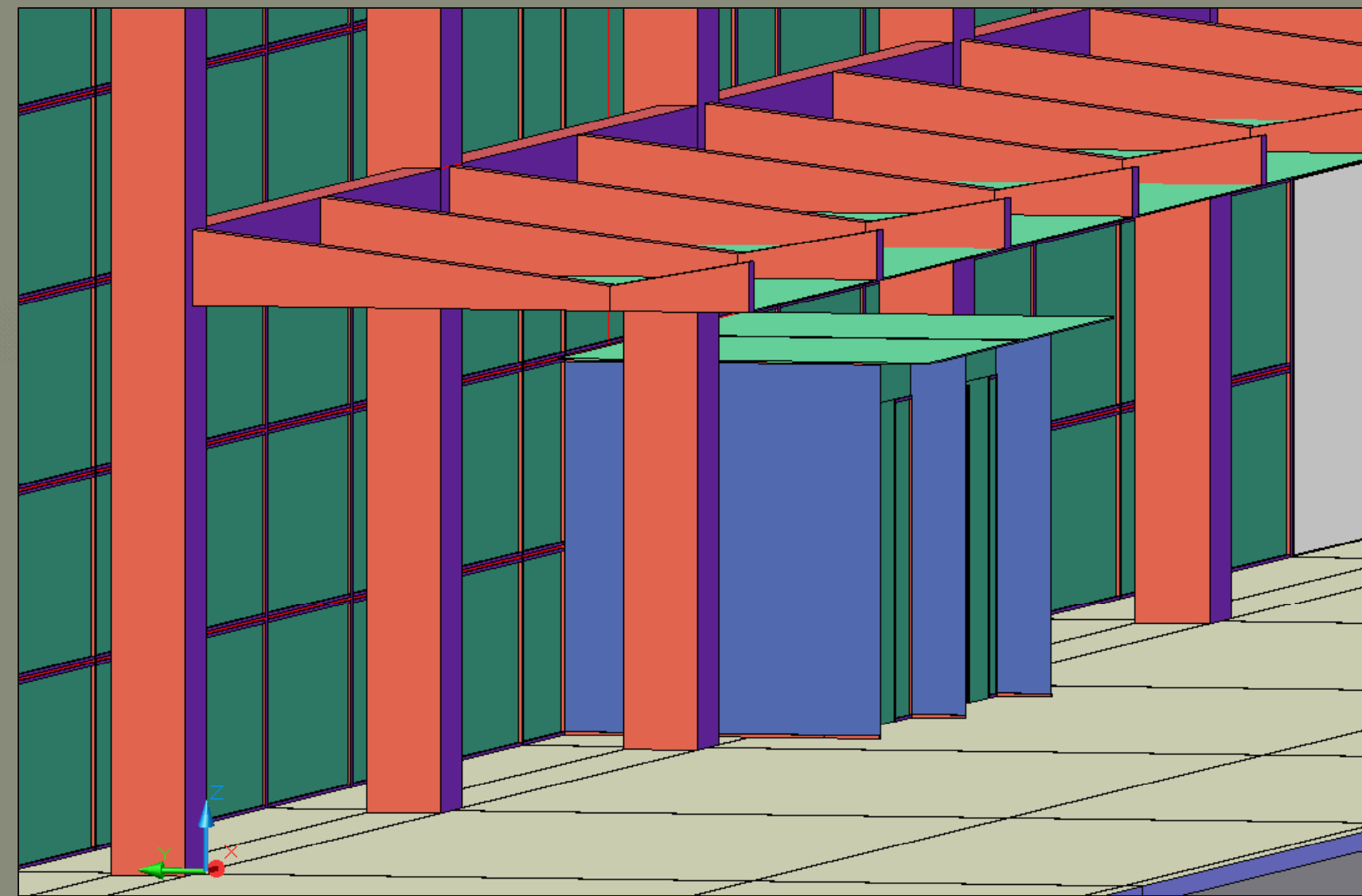
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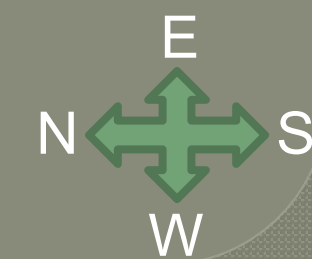
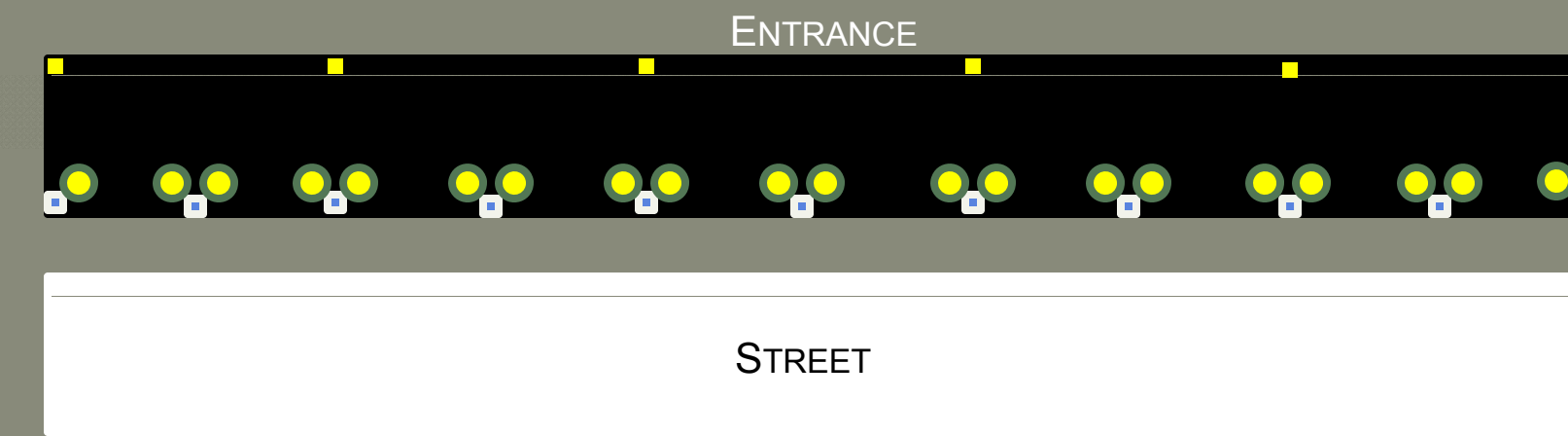
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■ 32W IN-GROUND UPLIGHT

● 51W WIDE FLOOD

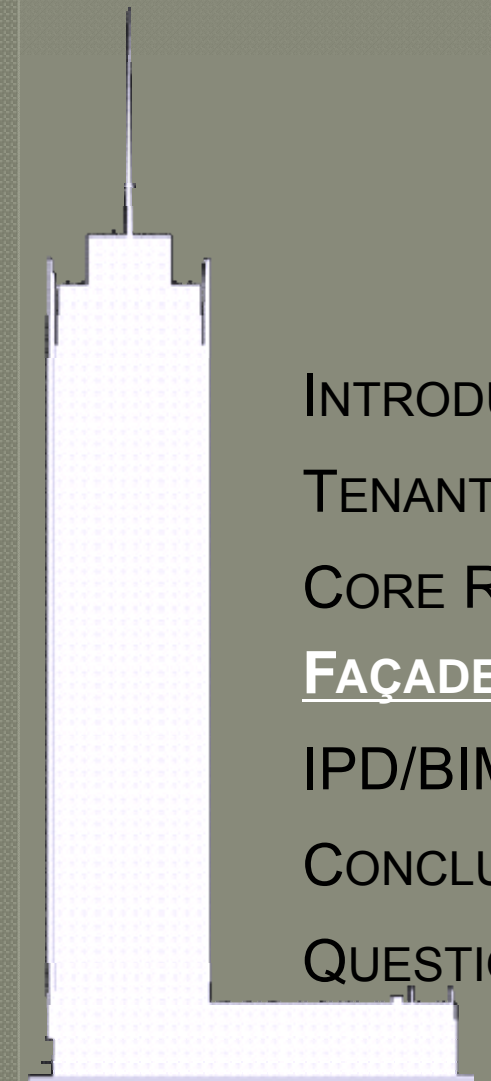
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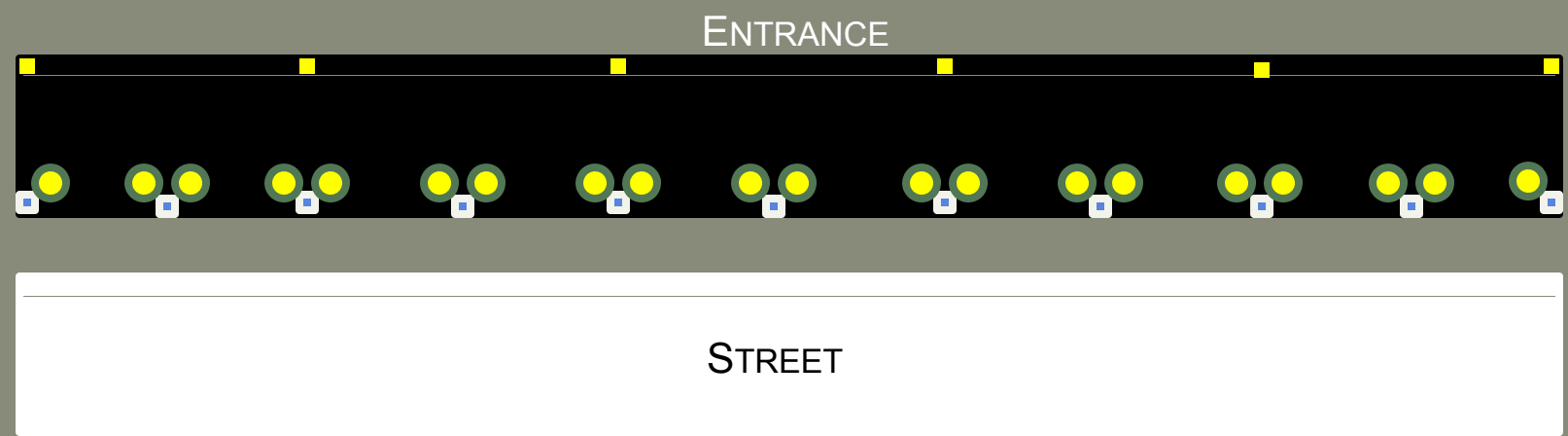
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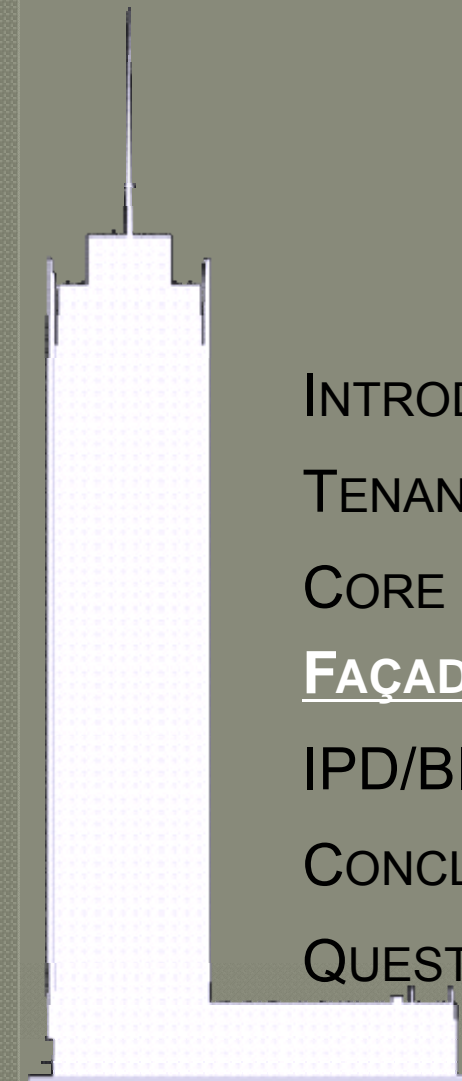
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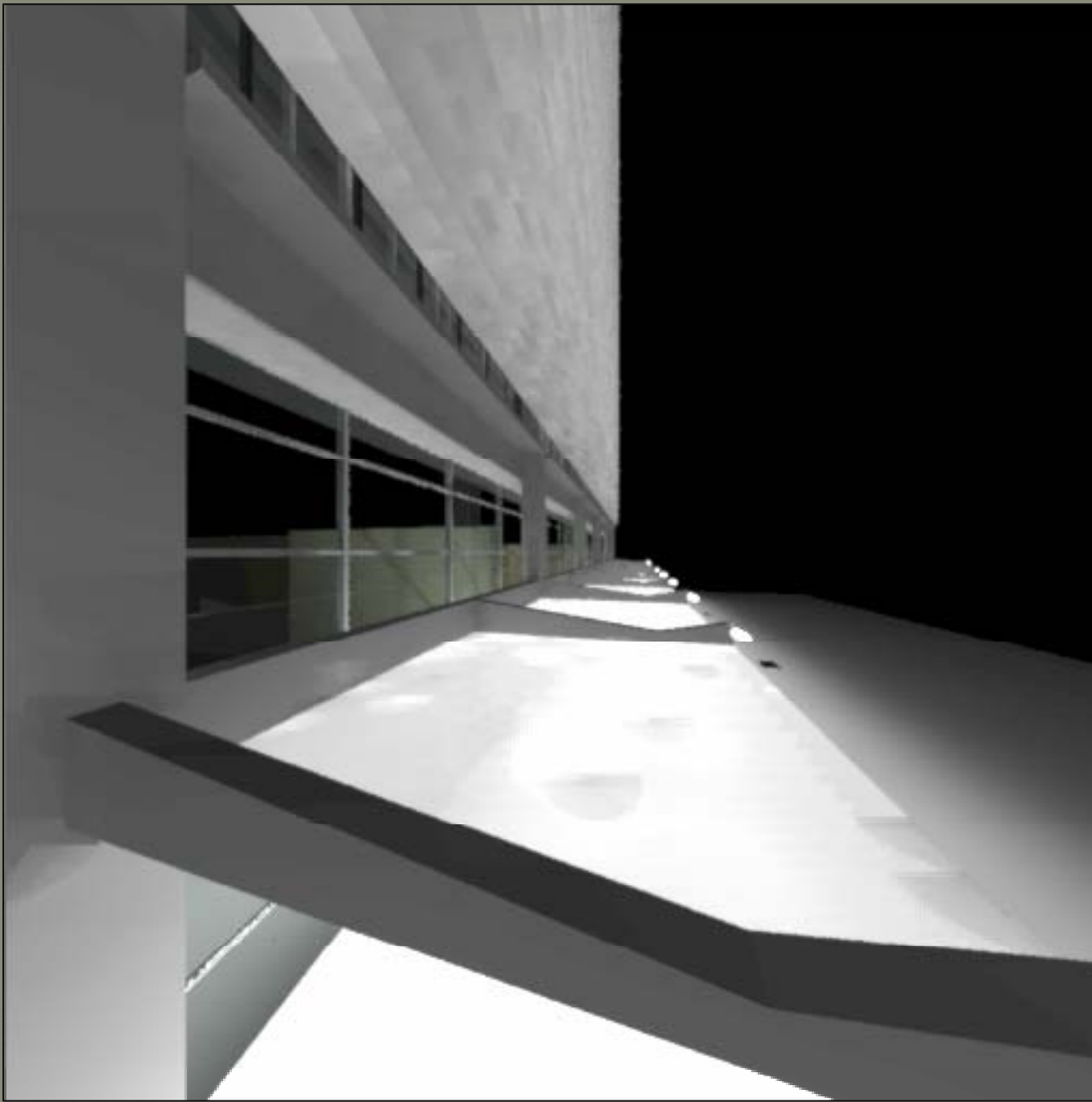
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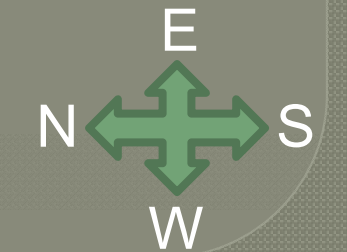
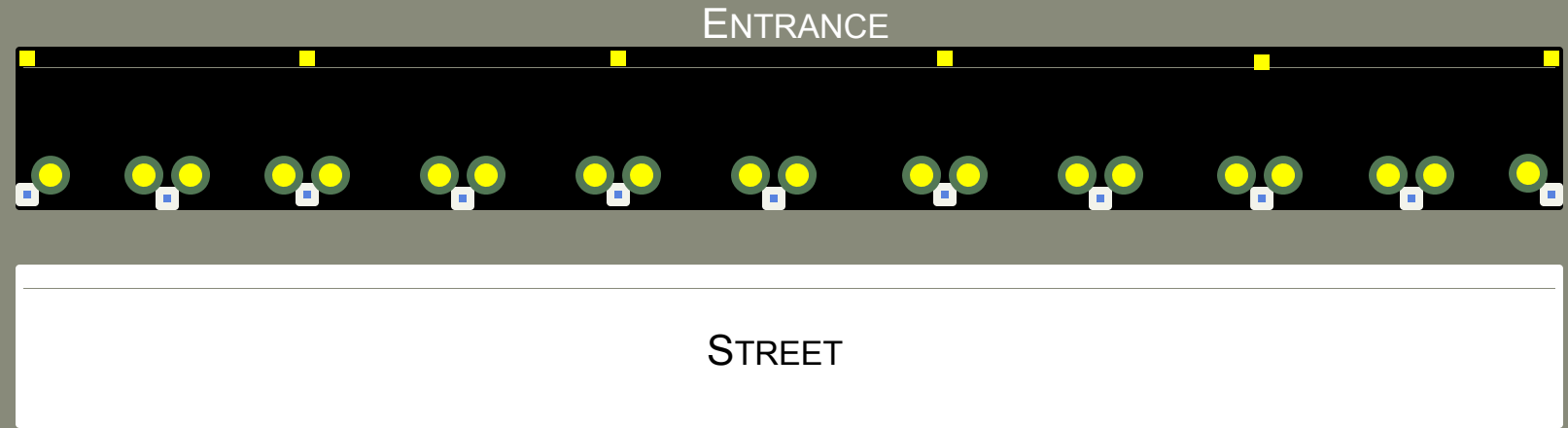
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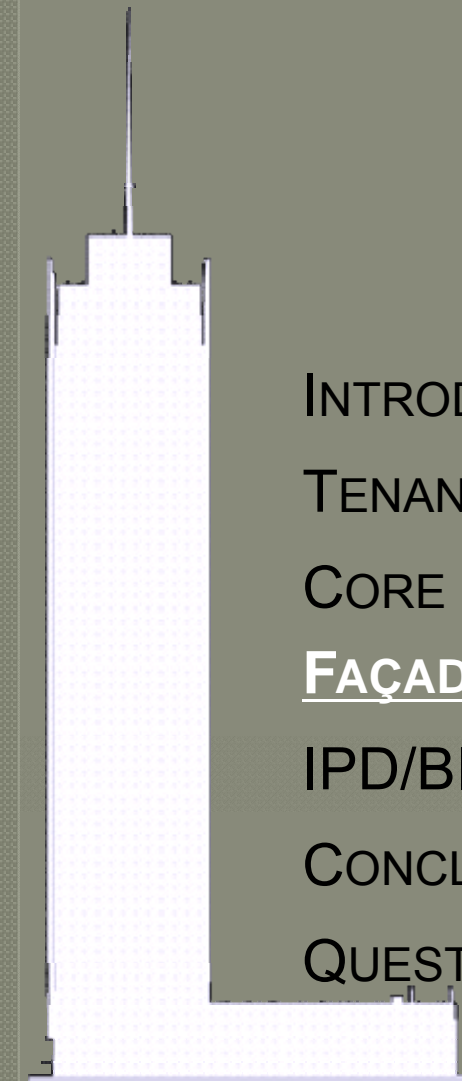
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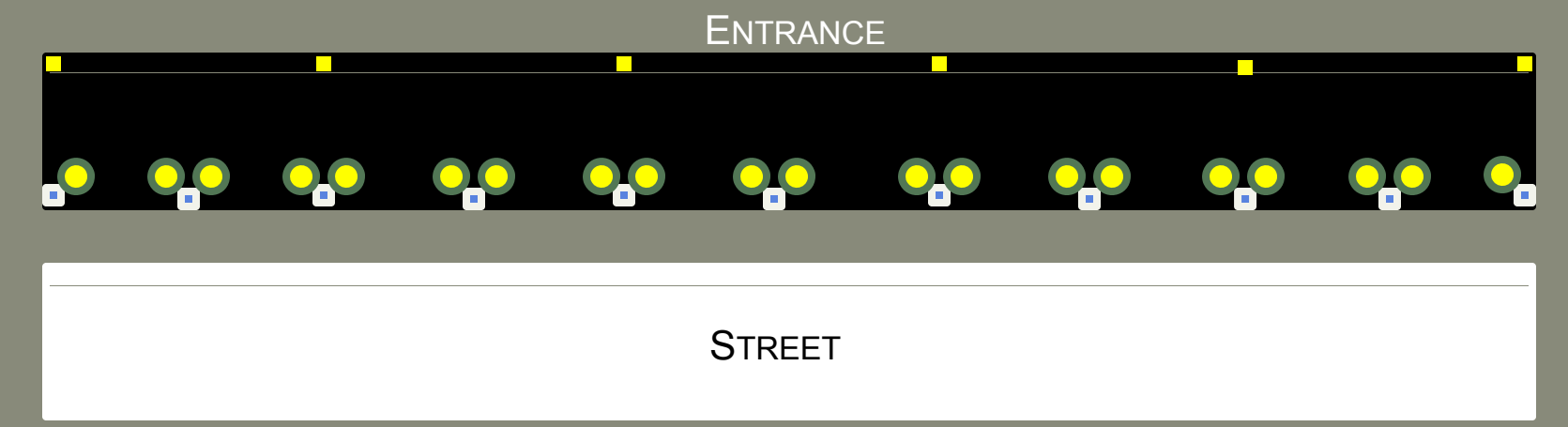
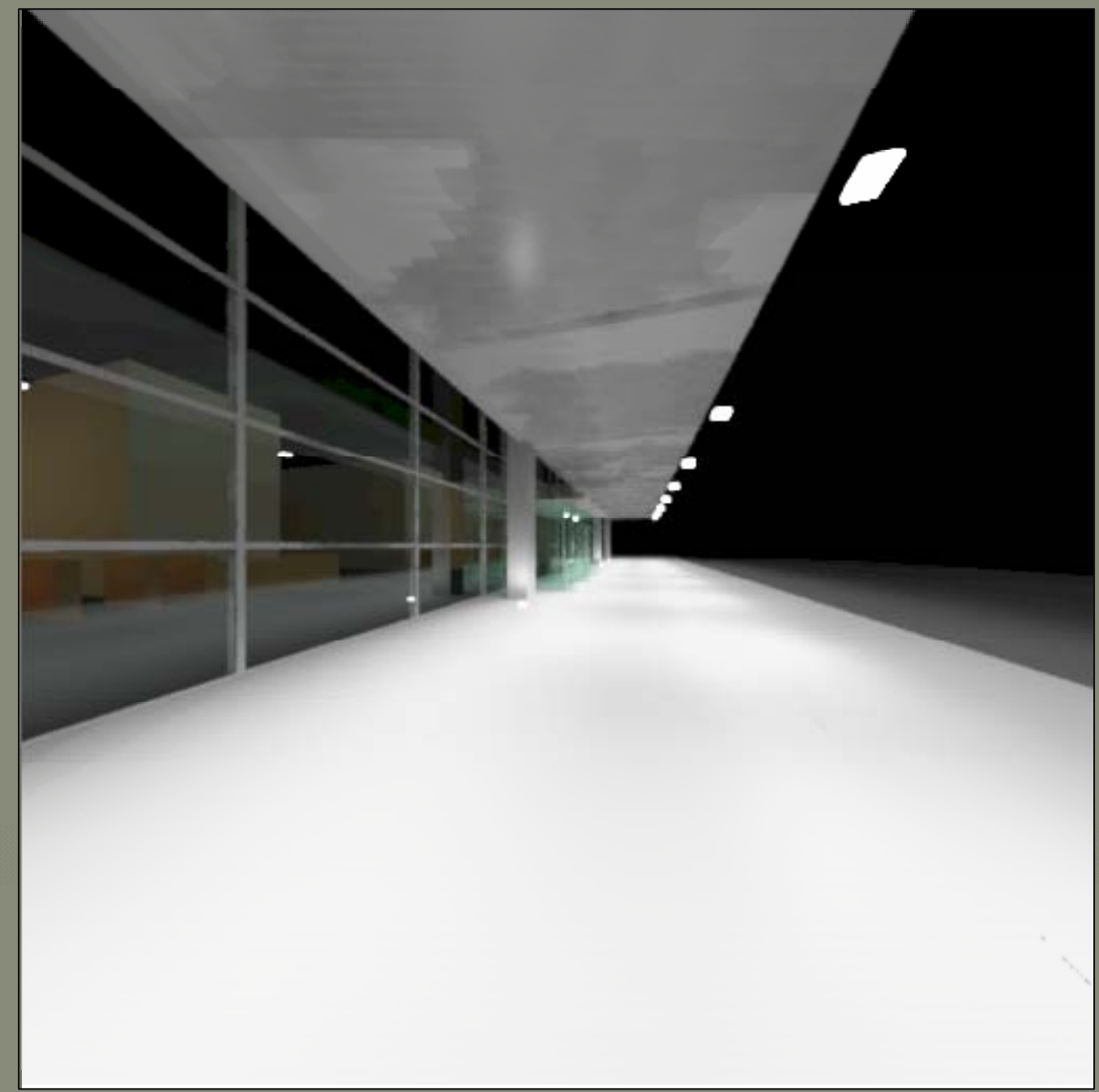
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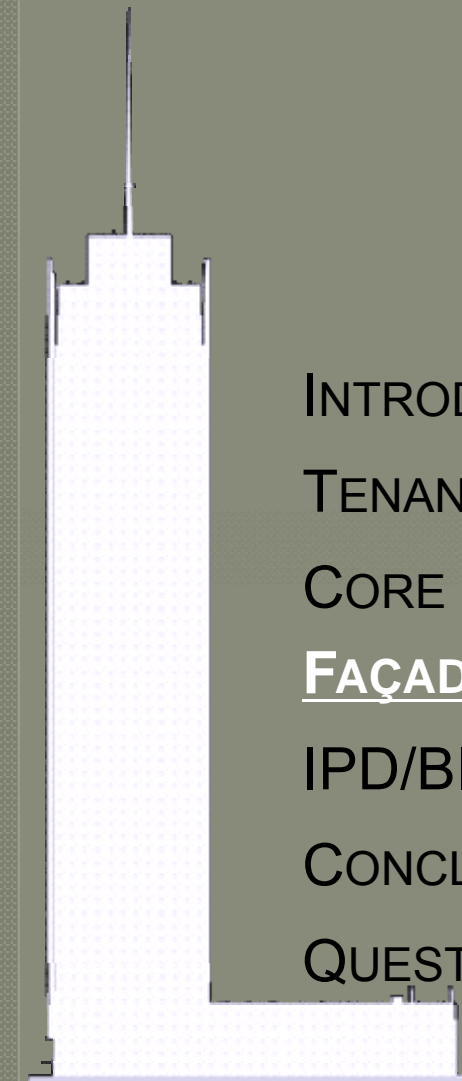
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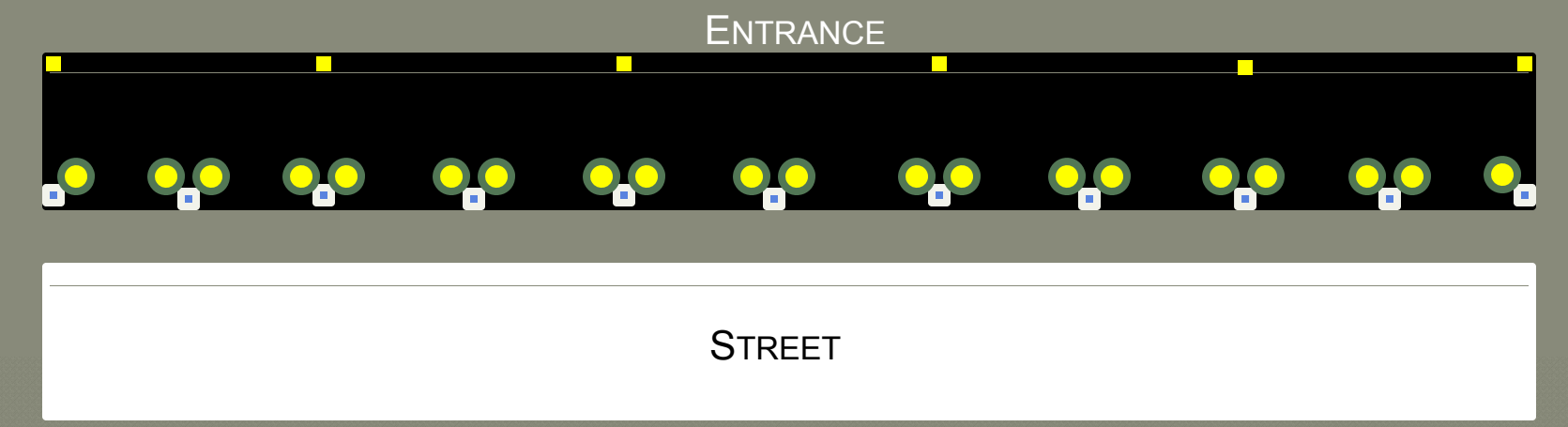
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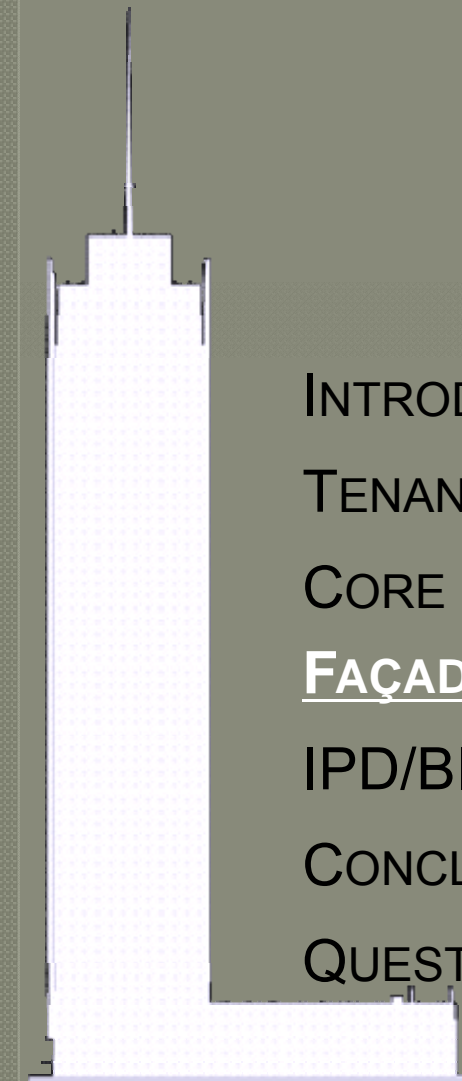


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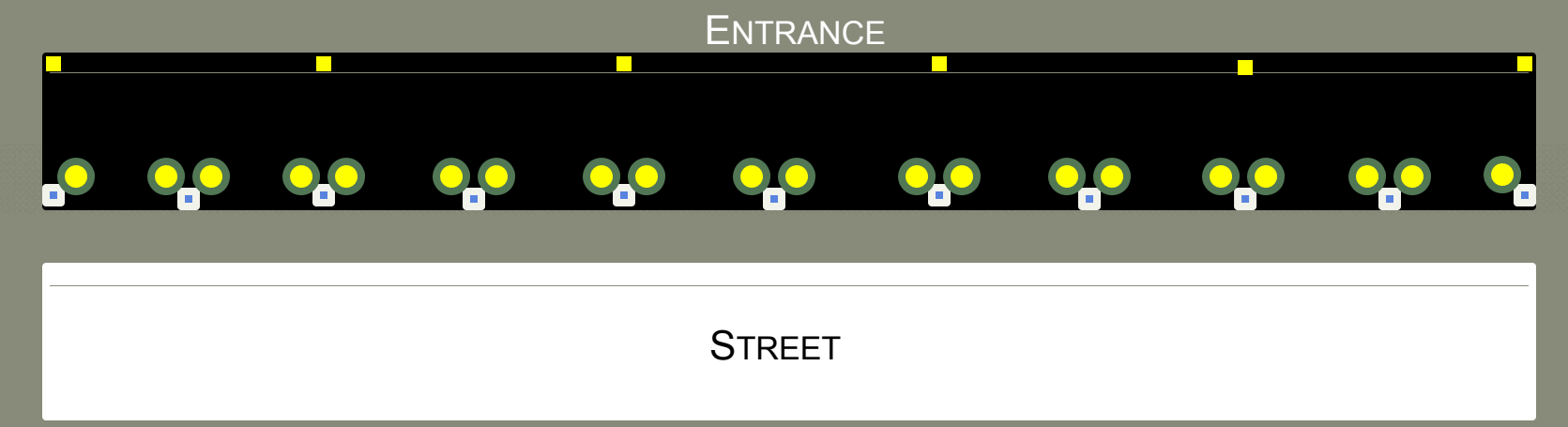
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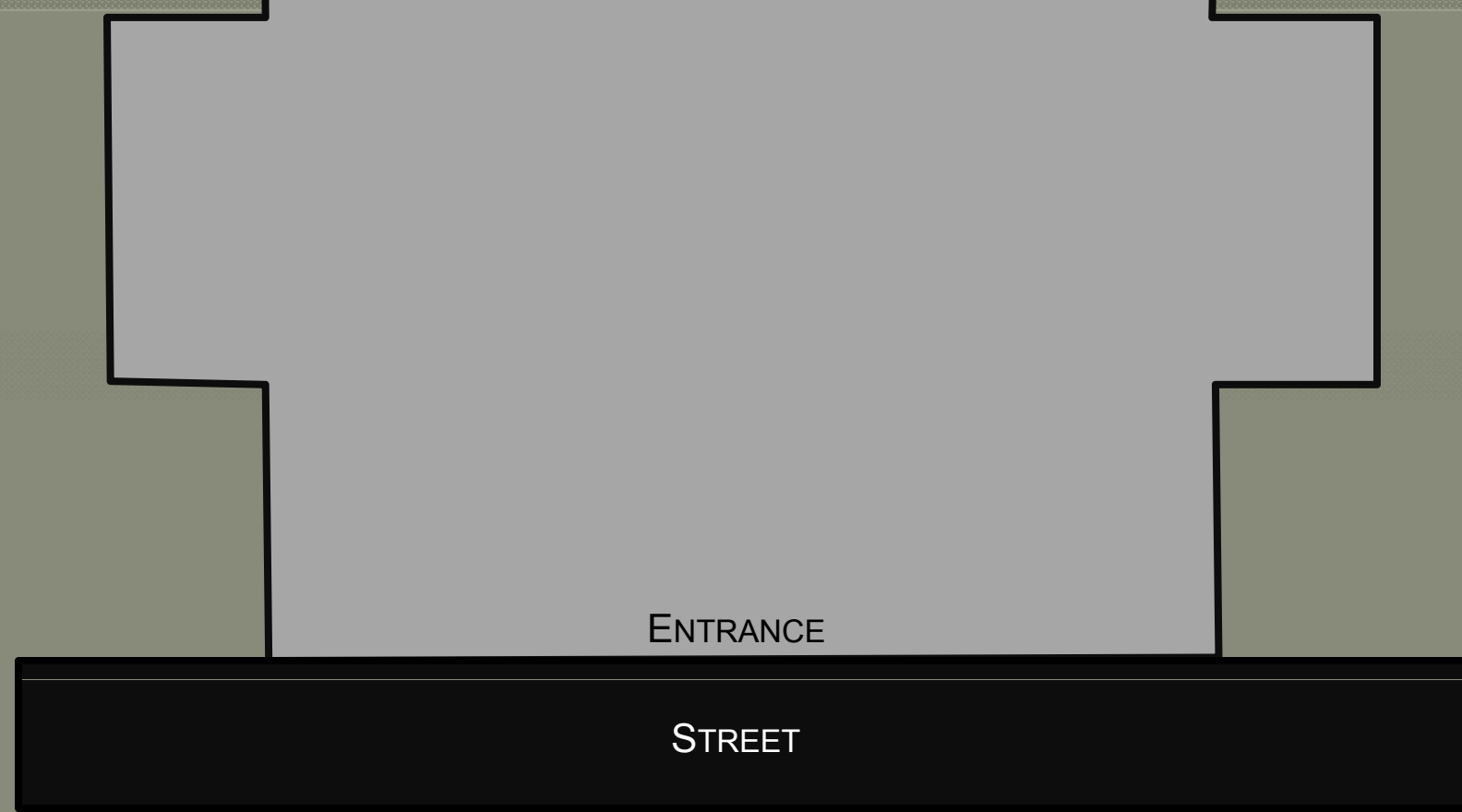
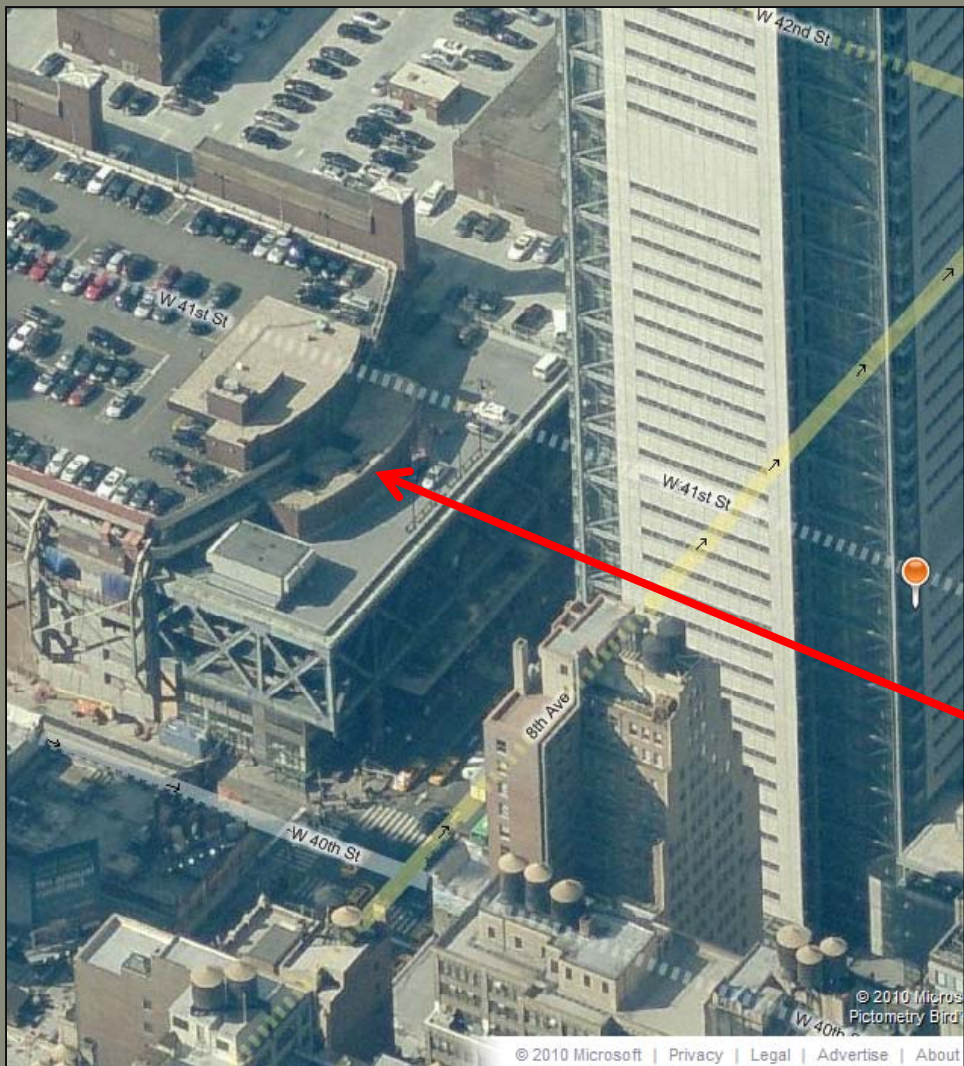
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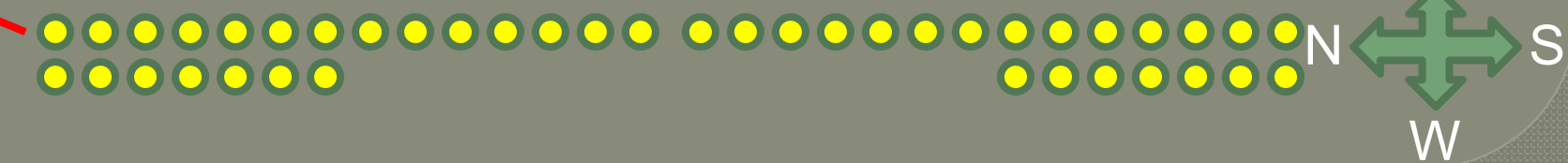
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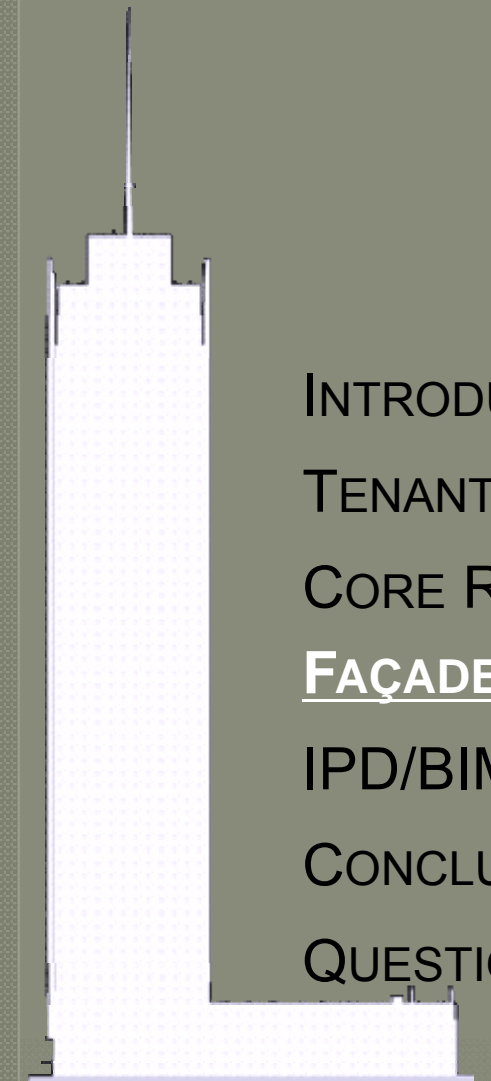


● 51W SPOT, FLOOD, OR WIDE FLOOD



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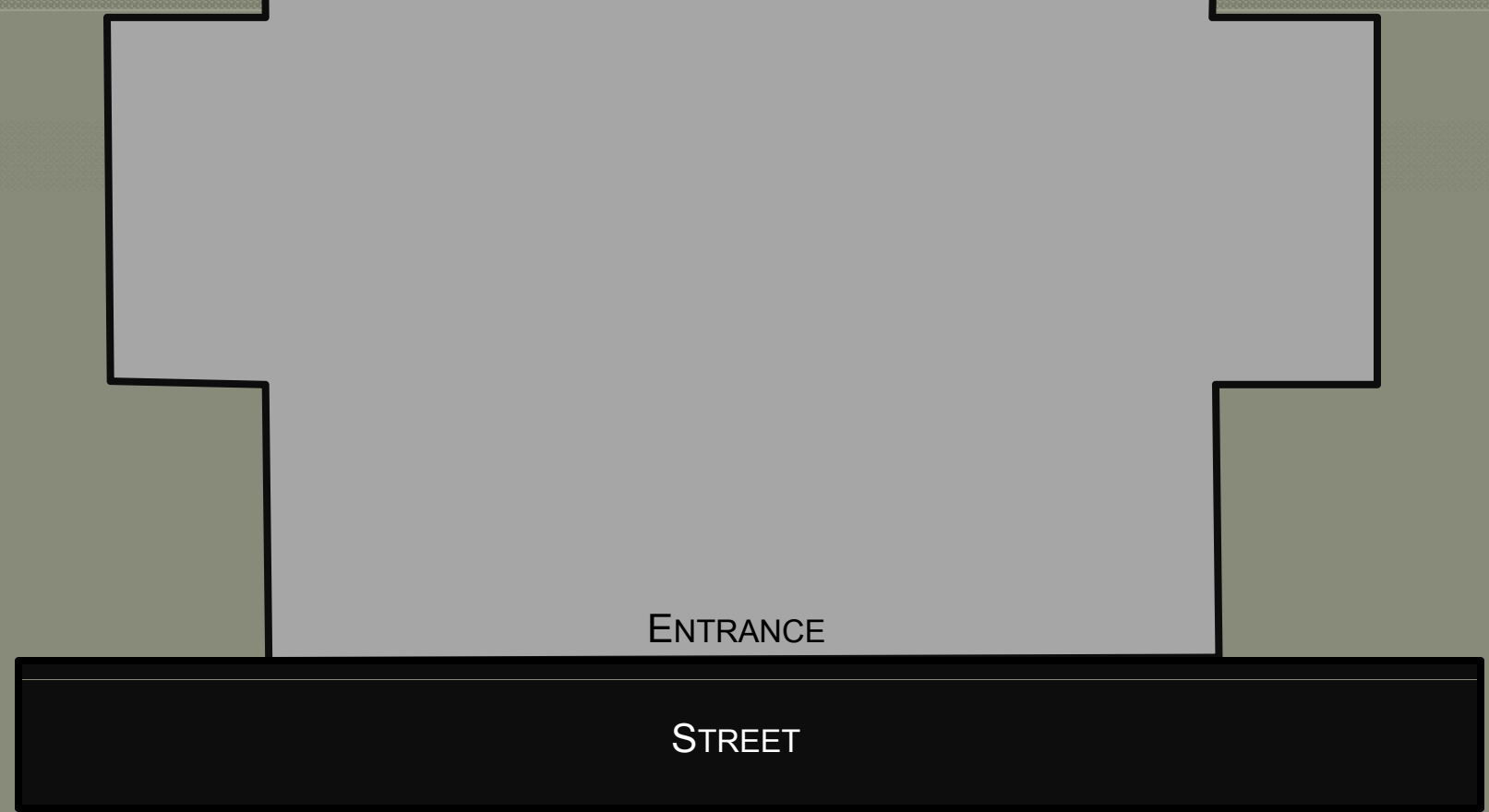
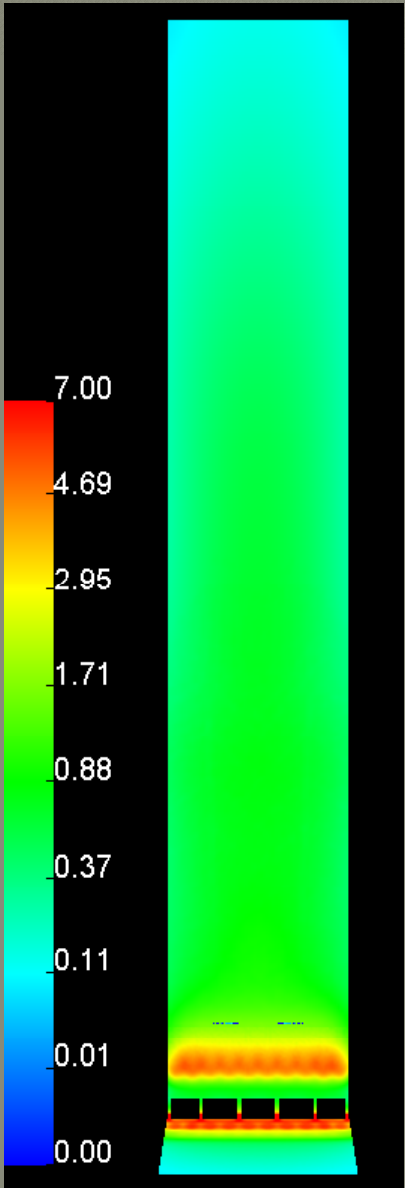
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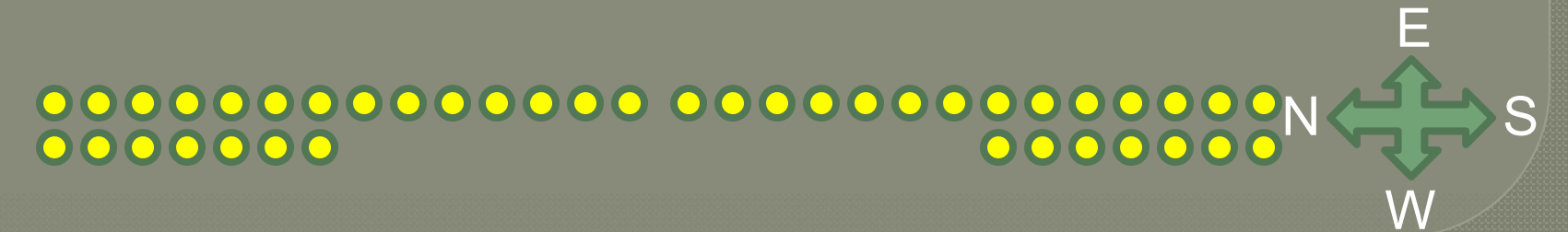
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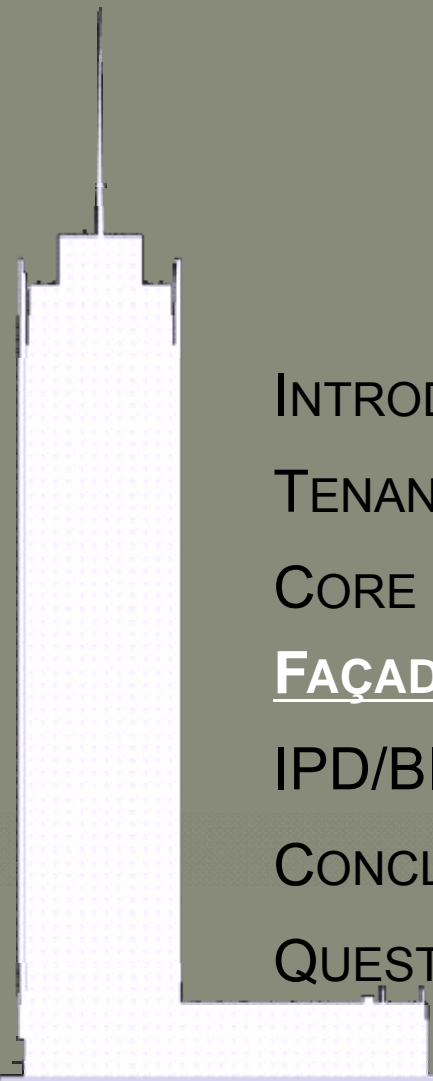


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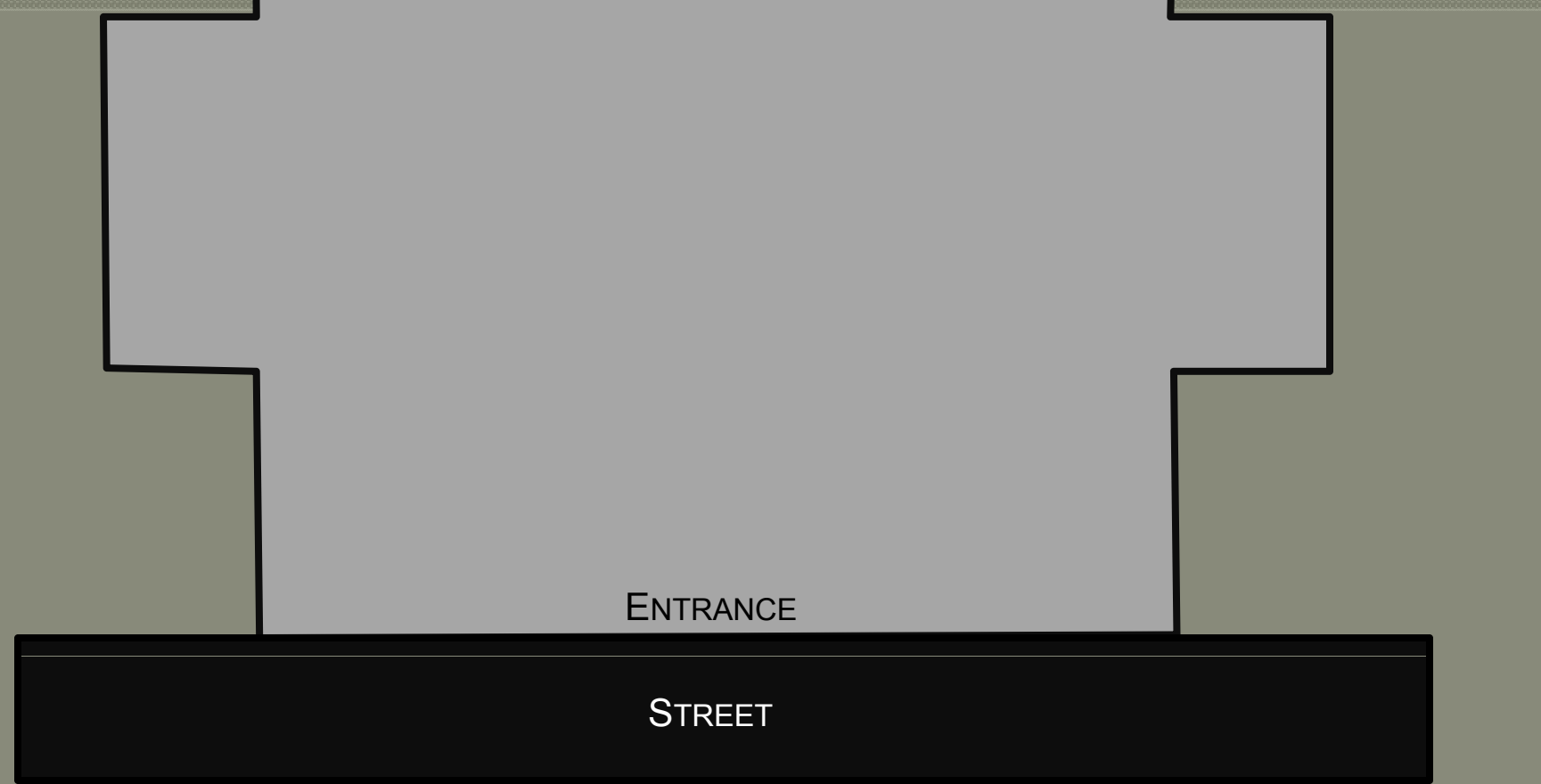
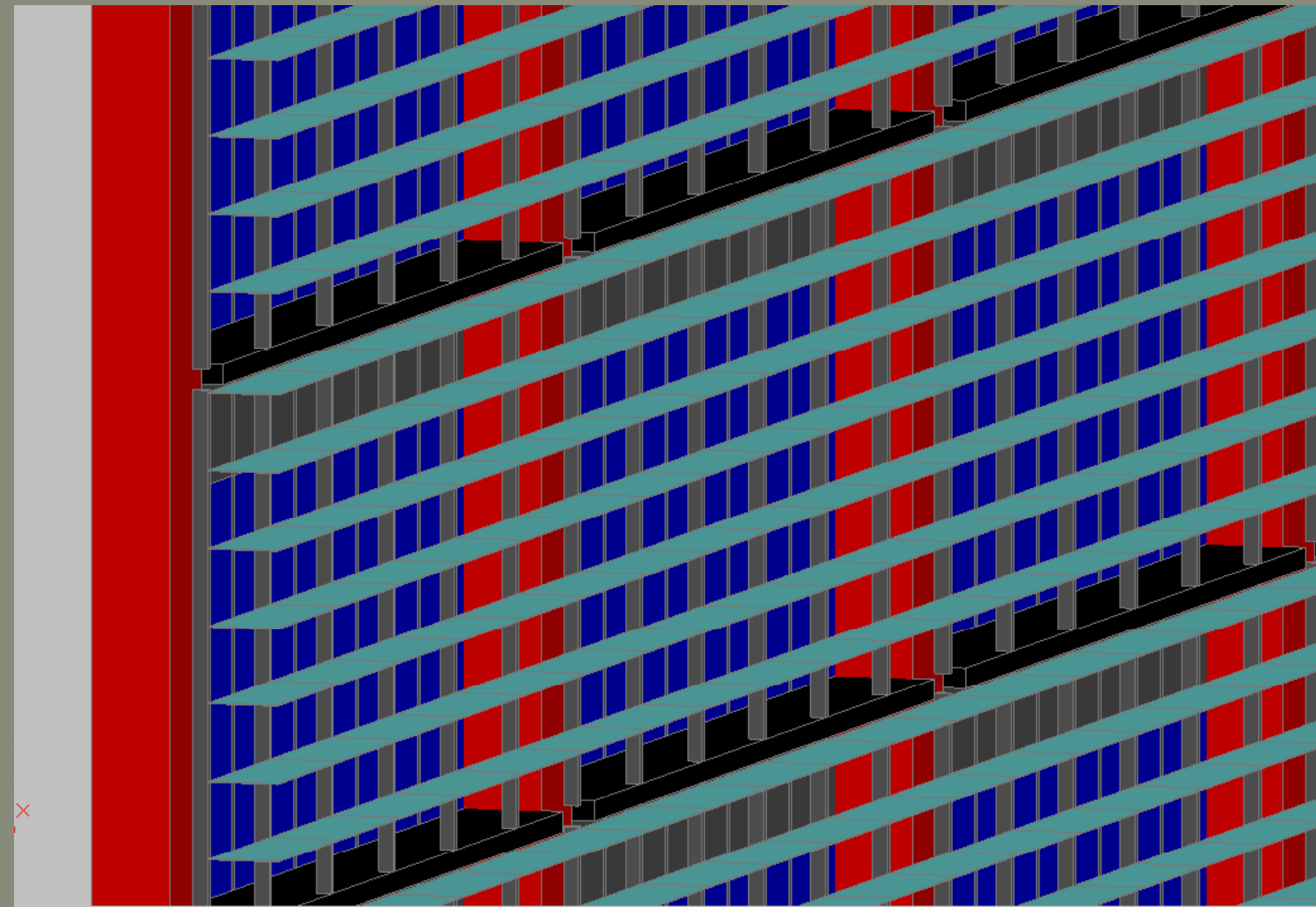
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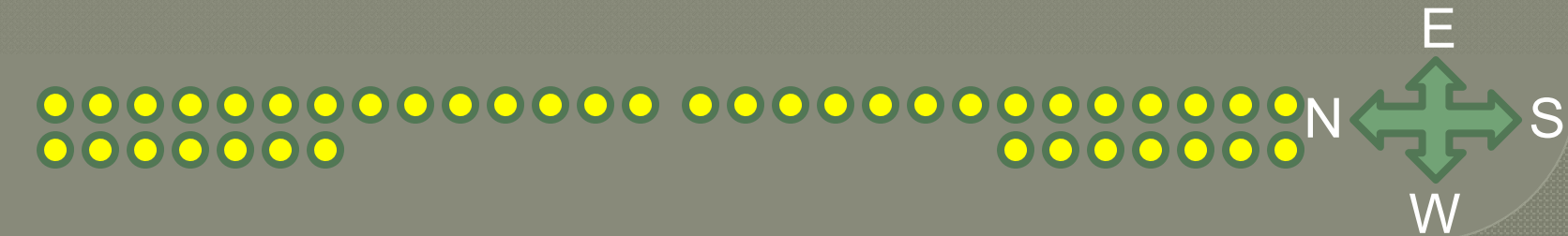
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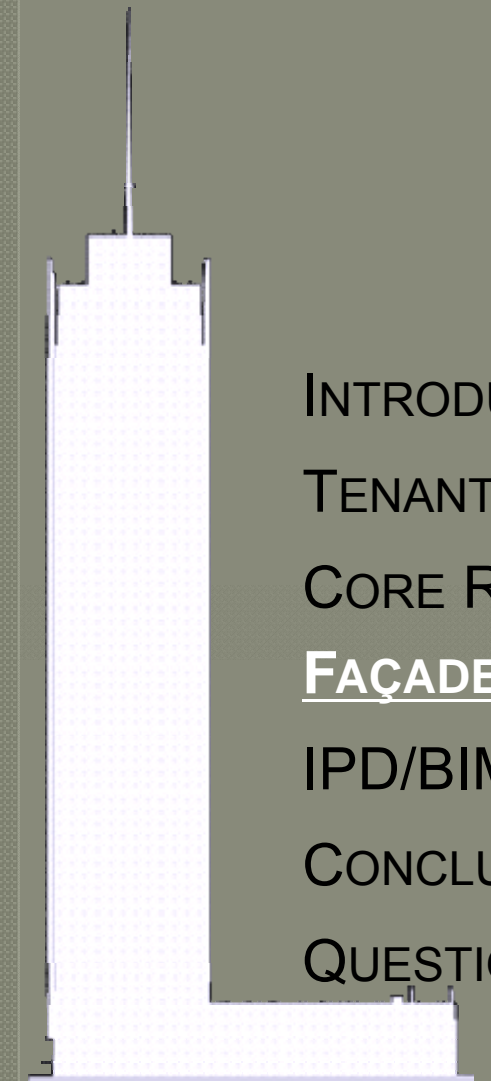


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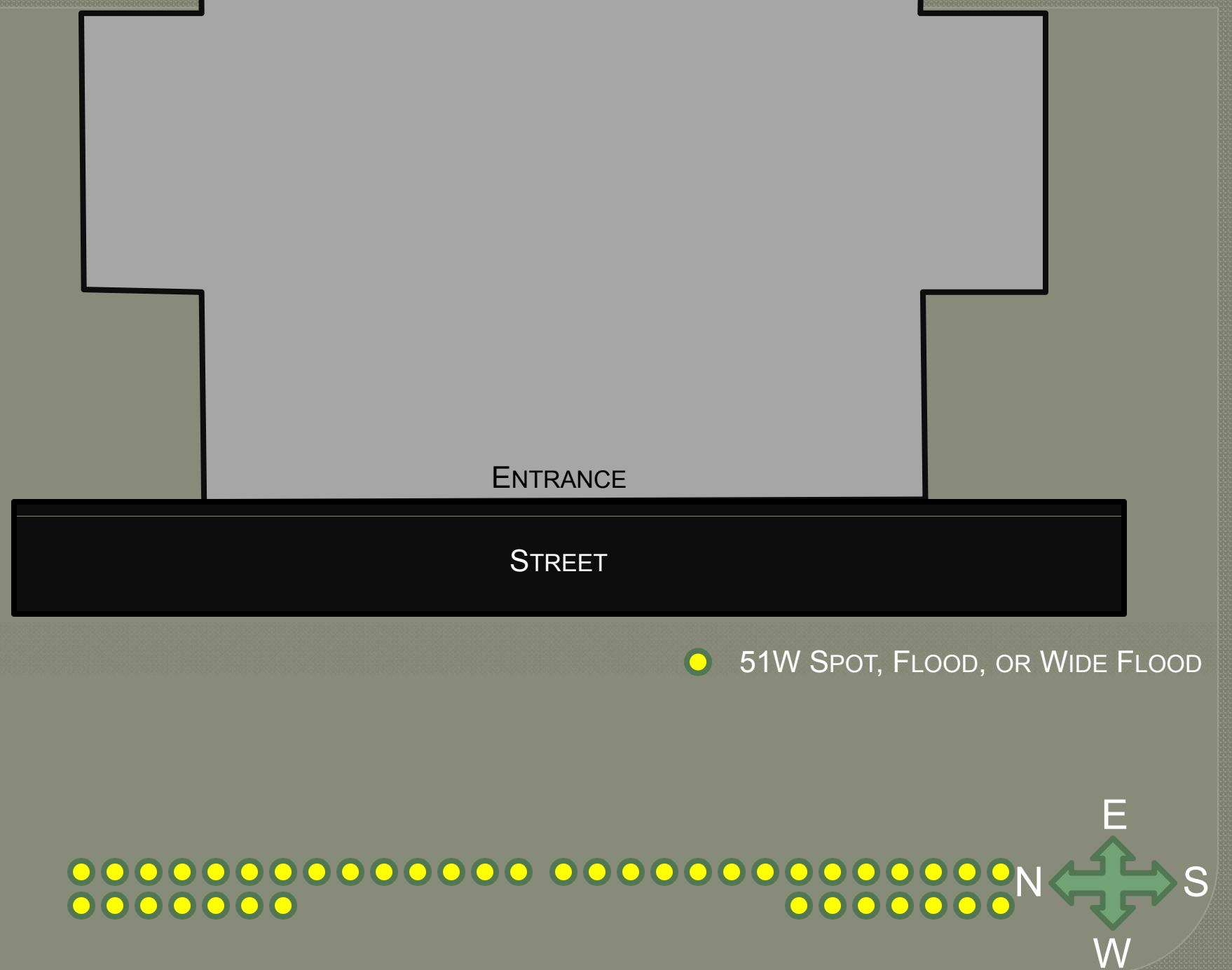
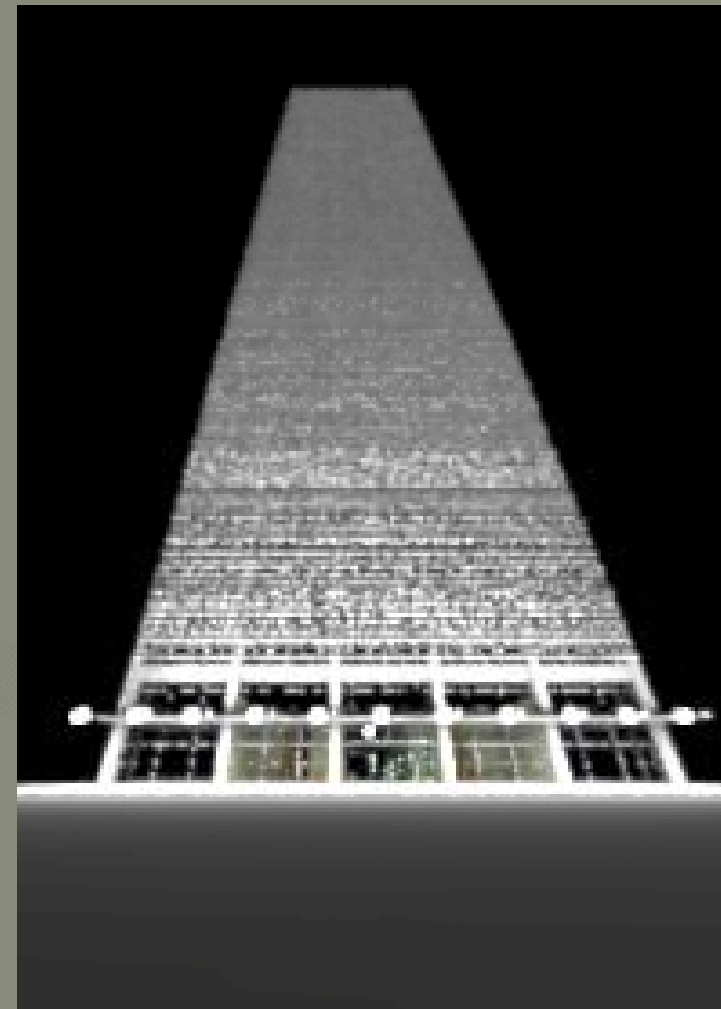
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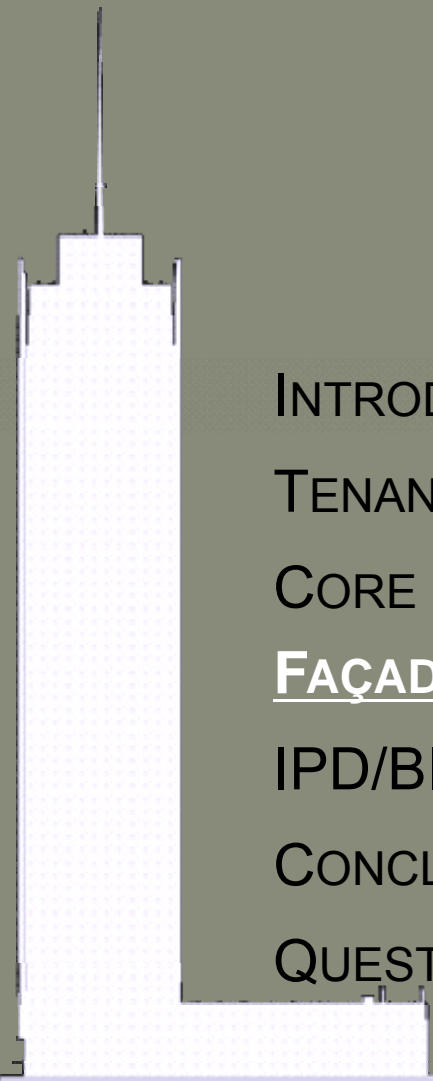
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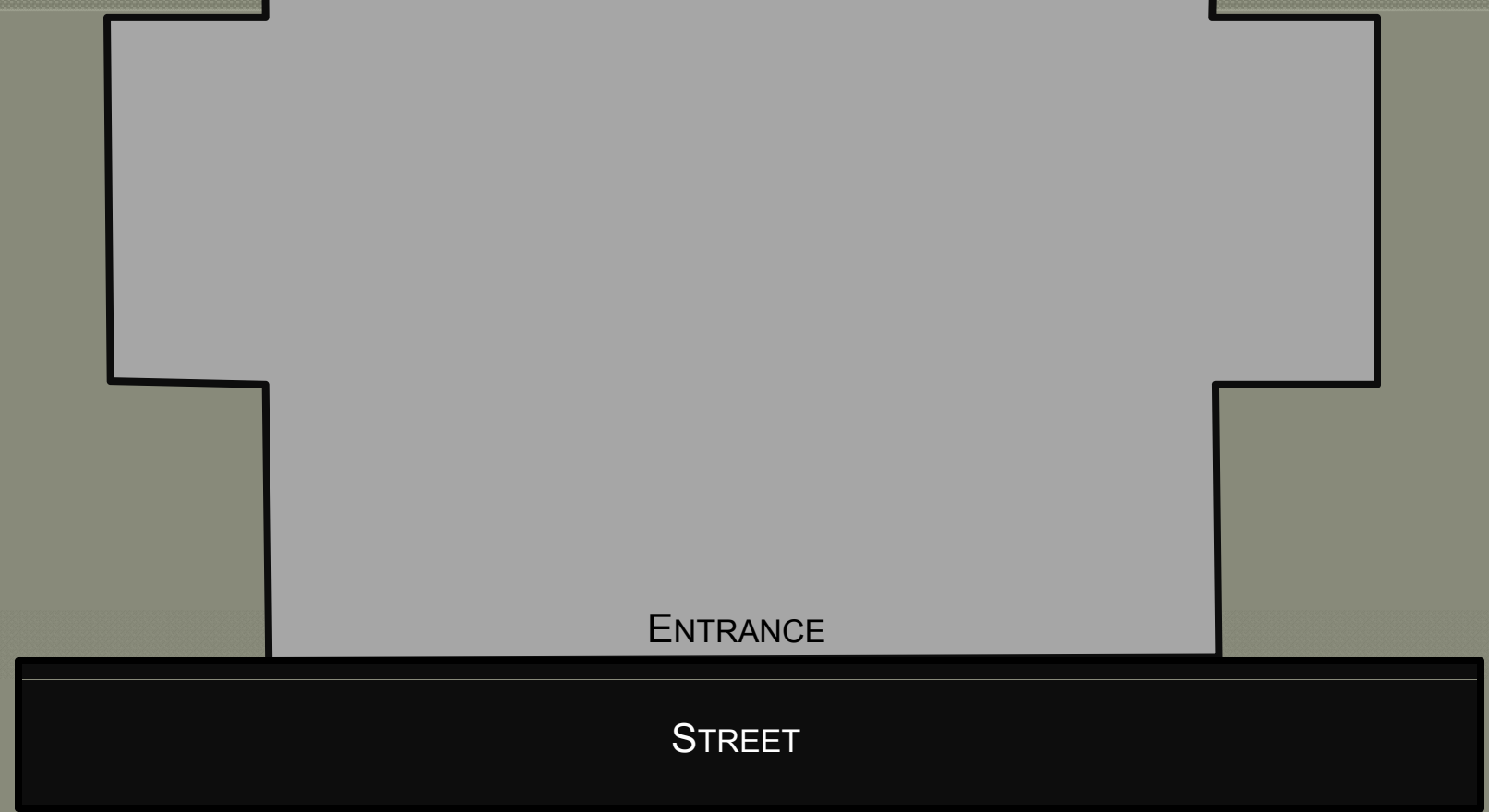
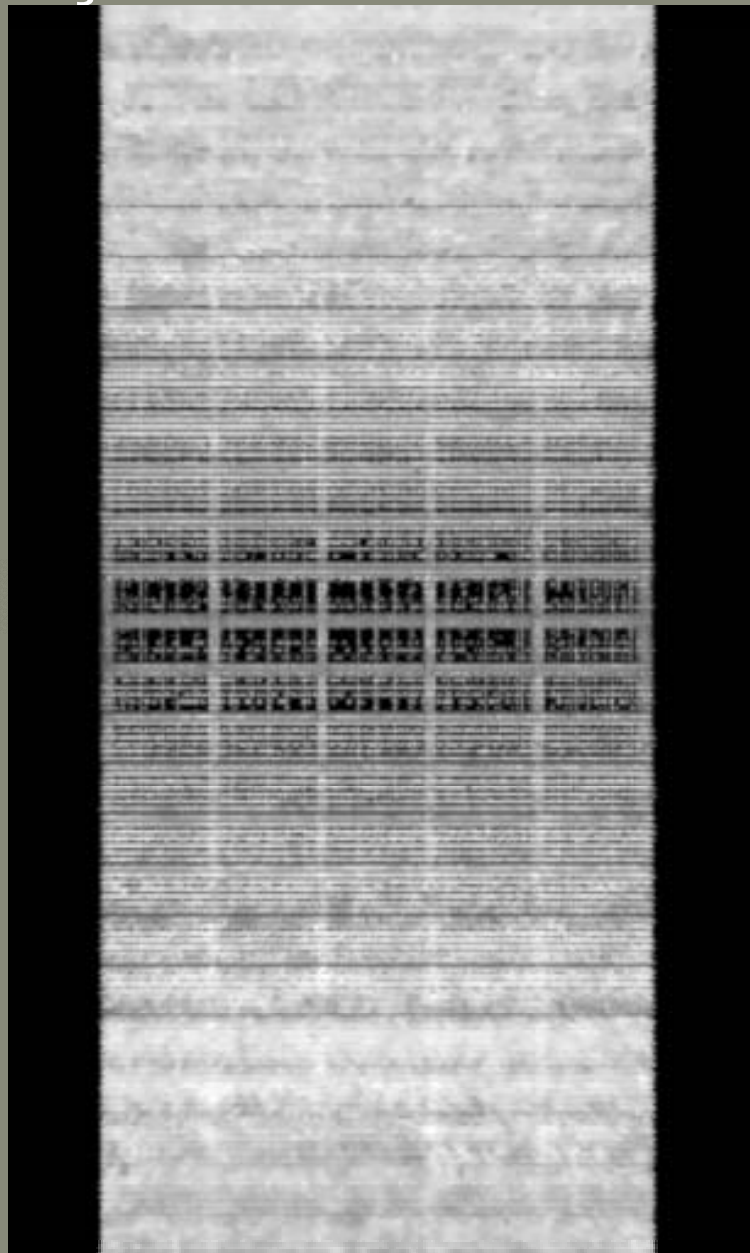
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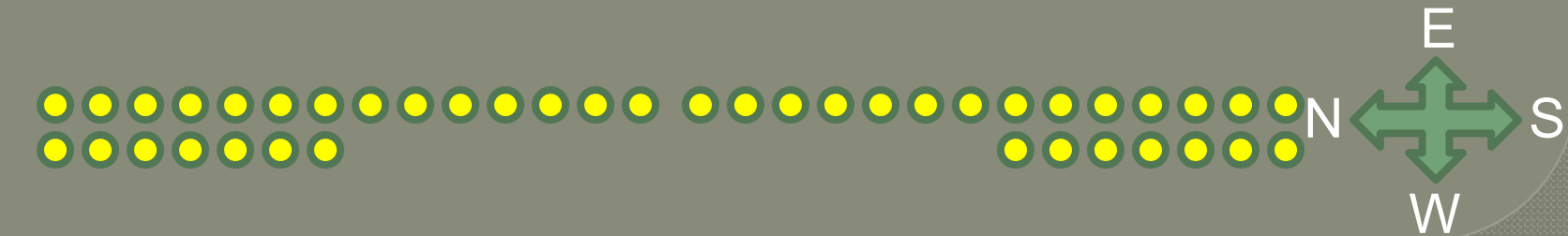
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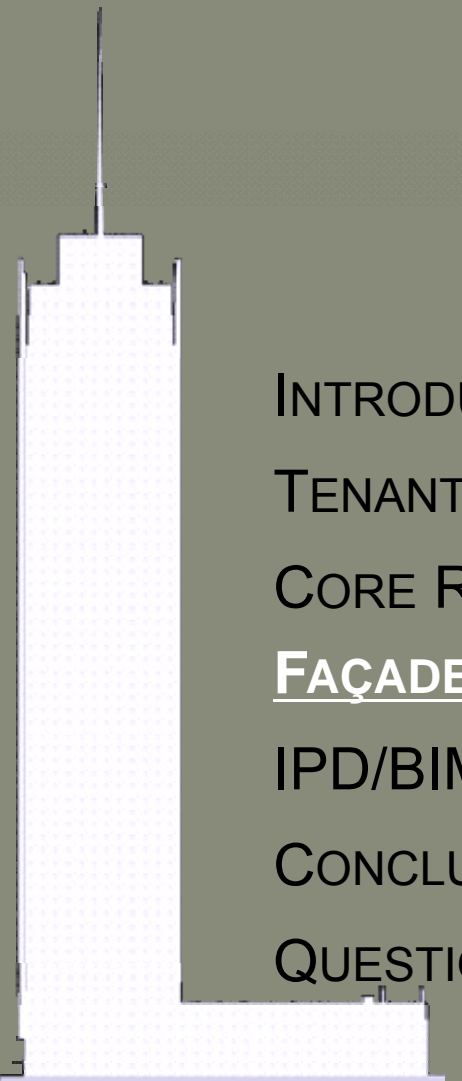
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DESIGN SUMMARY	ORIGINAL DESIGN	ASHRAE ALLOWABLE	PROPOSED REDESIGN
WATTAGE	15,710	24,390	3,898
REDUCTION FROM ALLOWABLE	35.59%	-	84.02%
ENERGY SAVINGS (\$/YEAR)	\$6,082.94	-	\$14,360.79

ASSUMING 8 HOURS OF USE PER NIGHT

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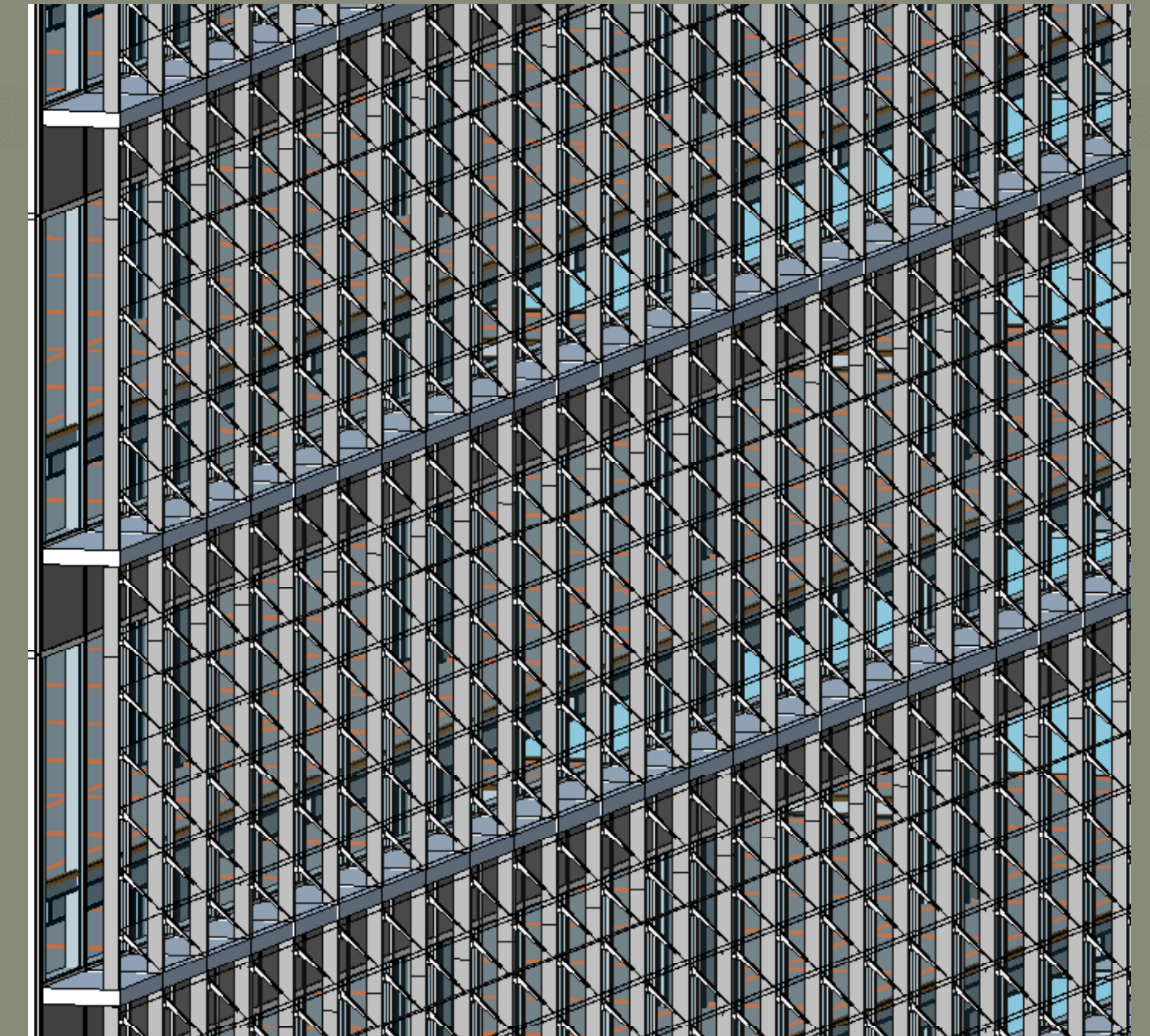
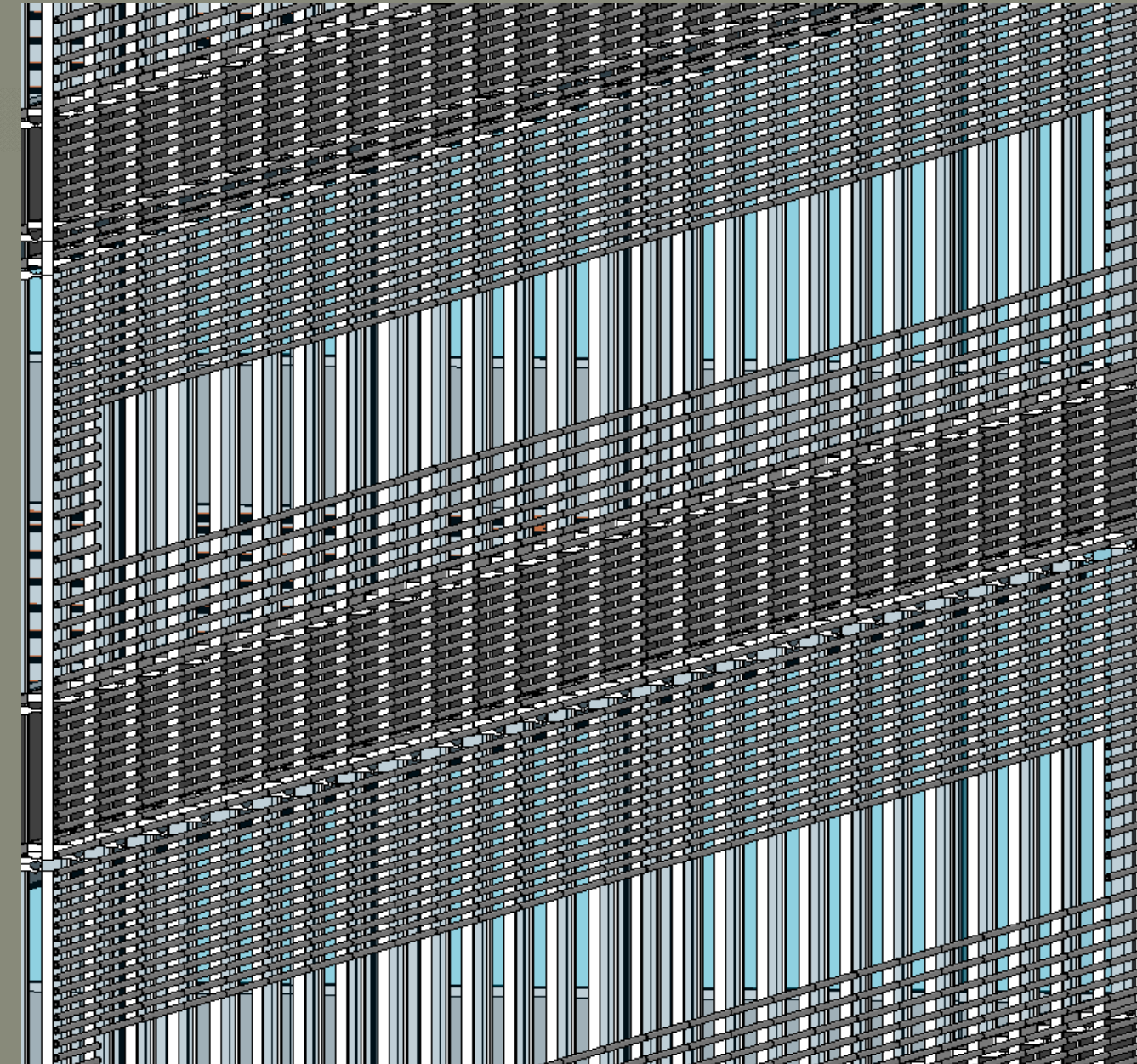
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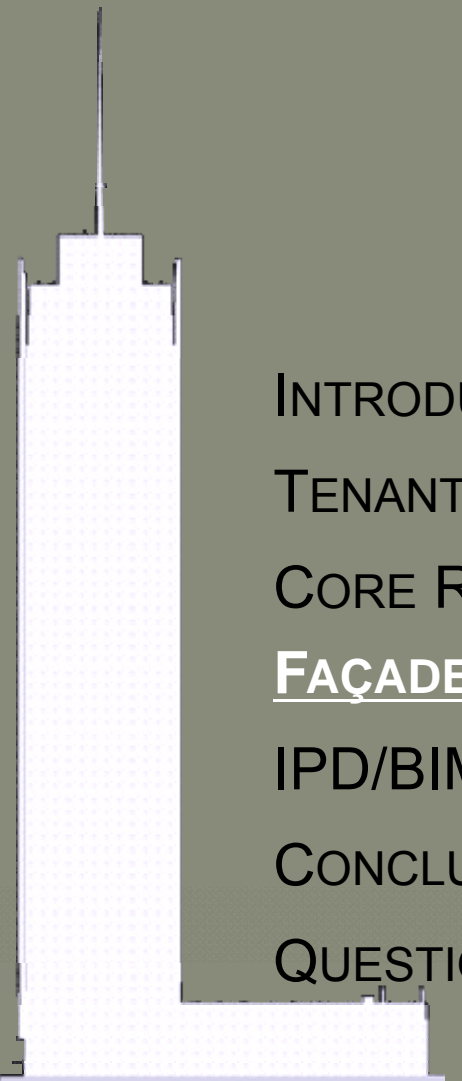
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ENVELOPE AREA TAKE-OFFS FROM MODEL

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

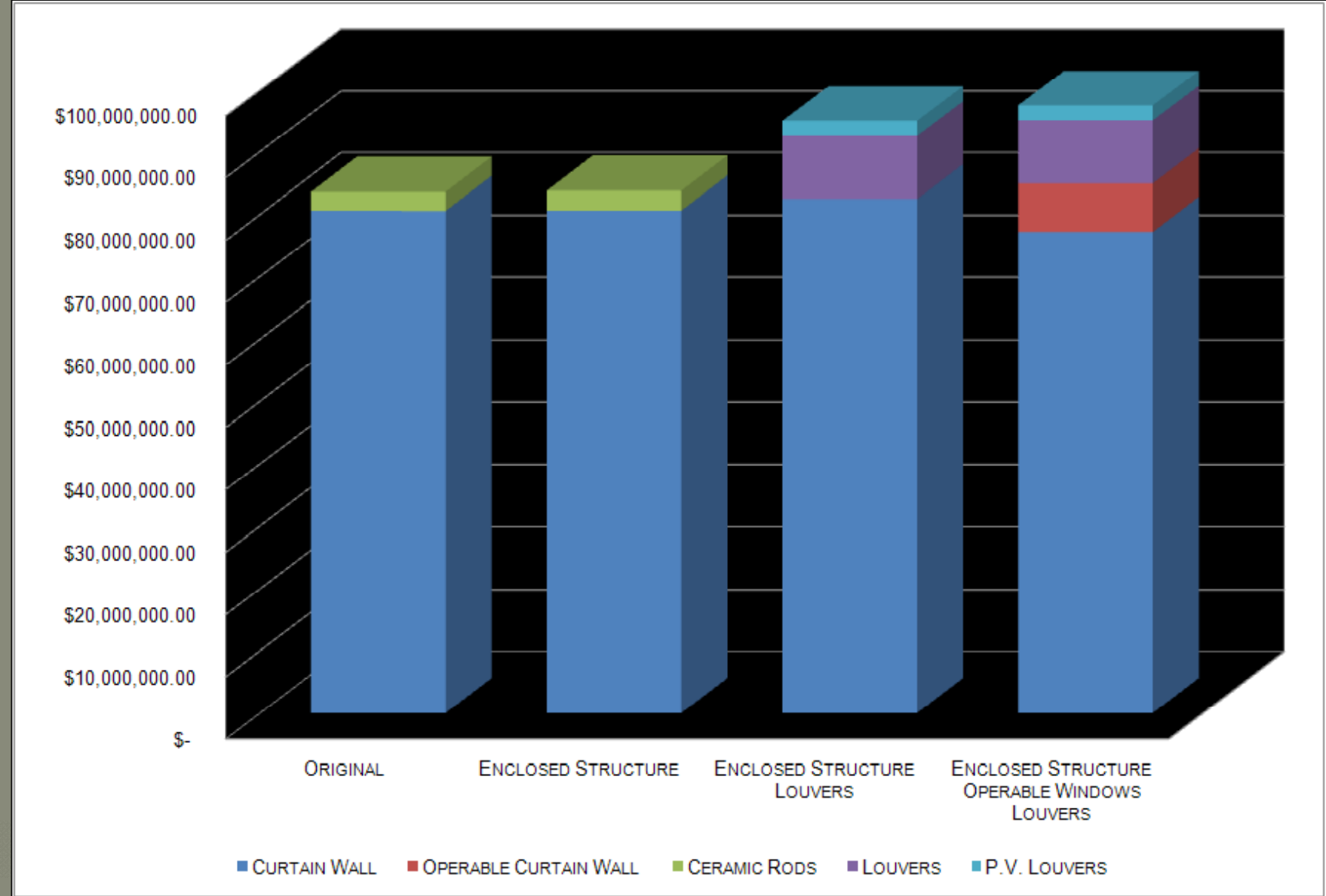
ORIGINAL CURTAIN WALL: \$80,509,220.00

CERAMIC RODS: \$3,023,640.00

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

OPERABLE PANELS: \$7,715,812.50

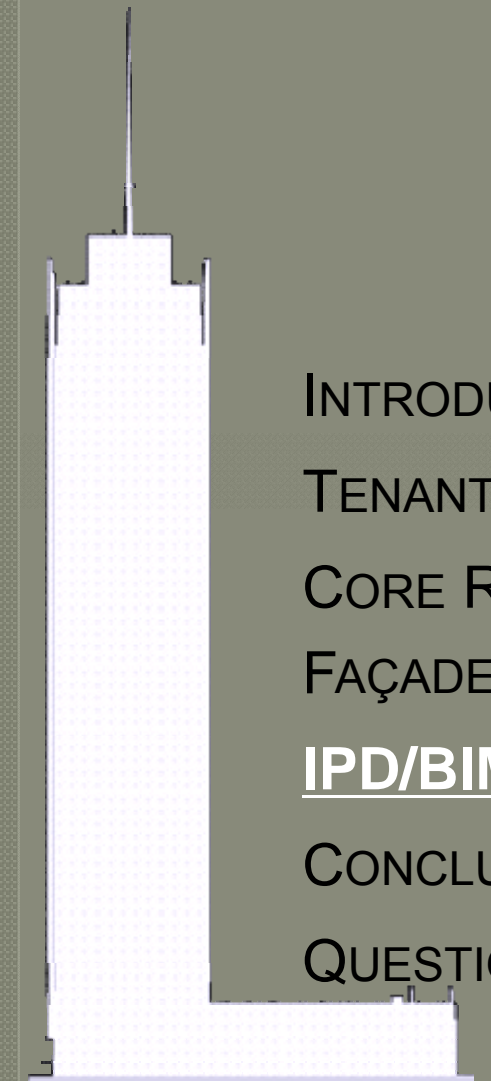
LOUVERS: \$11,563,300.00



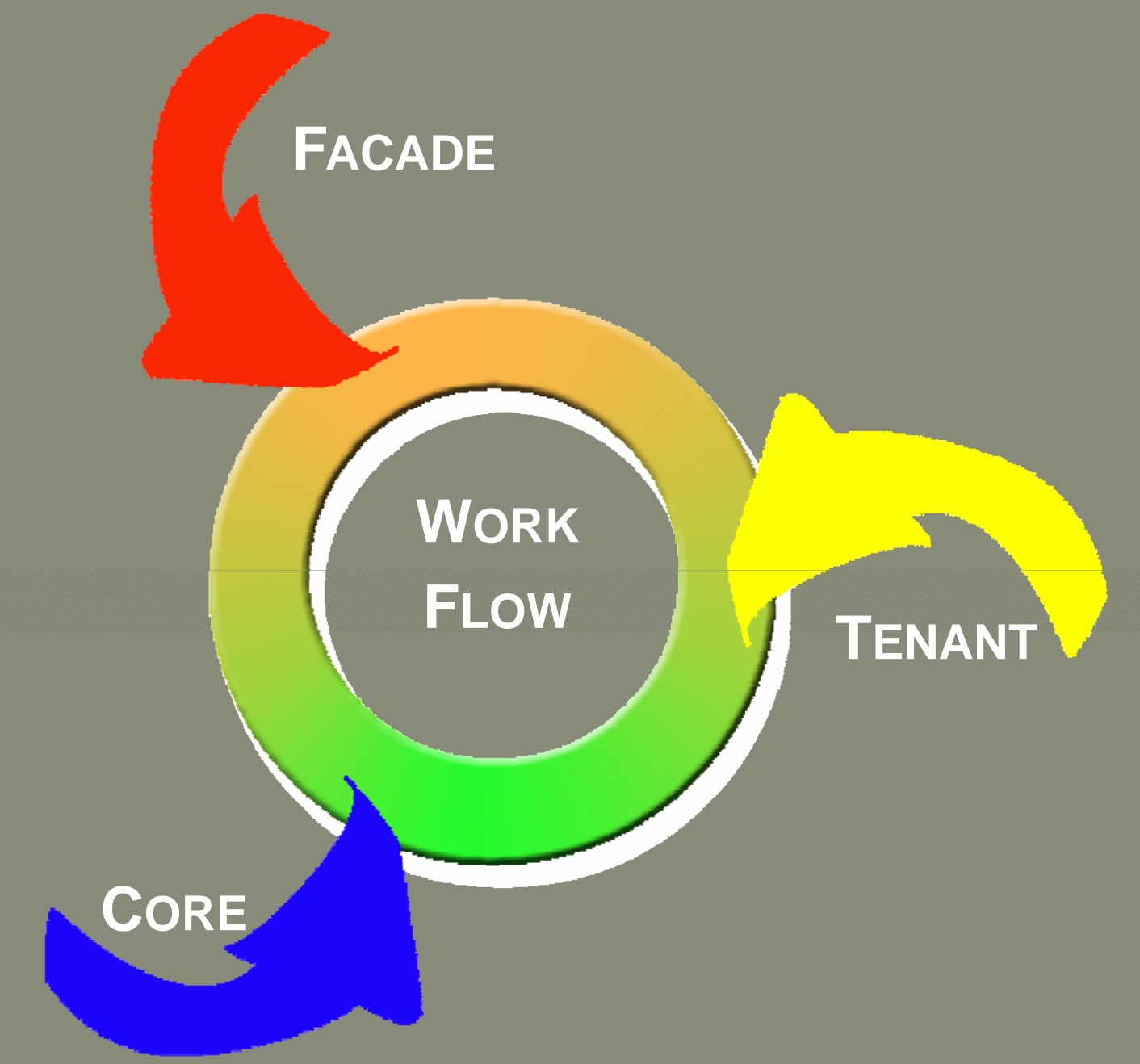
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IPD/BIM LESSONS LEARNED



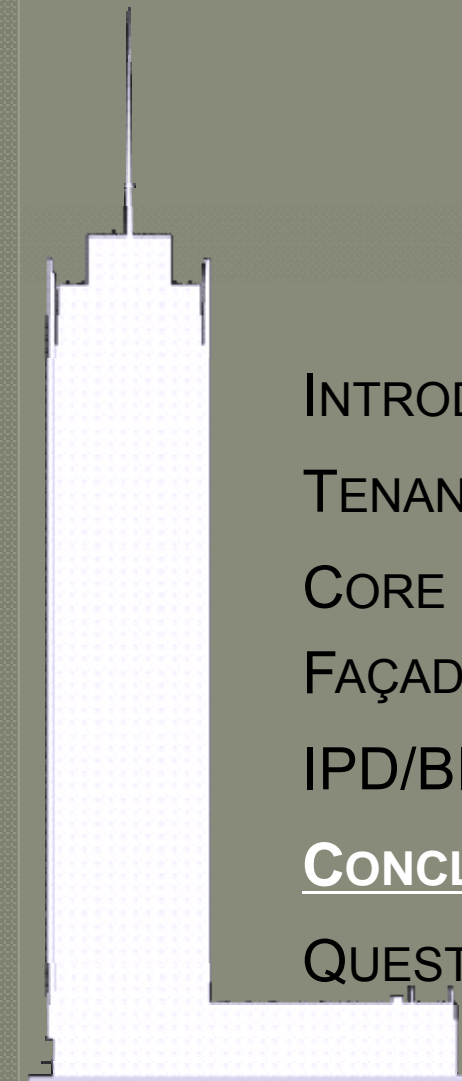
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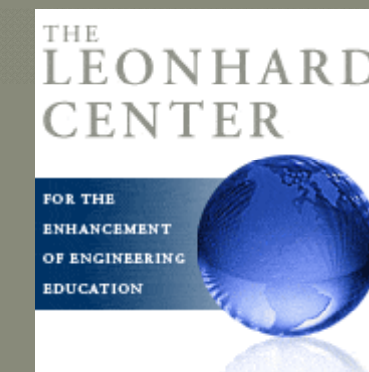


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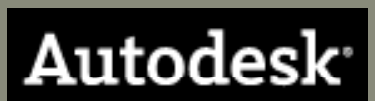
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AE DEPARTMENT & FACULTY

FRIENDS & FAMILY

IPD/BIM TEAM 2

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