

# THE NEW YORK TIMES BUILDING

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

## INTRODUCTION

TENANT REDESIGN

CORE REDESIGN

FAÇADE REDESIGN

IPD/BIM LESSONS

CONCLUSIONS

QUESTIONS

EXISTING CONDITIONS

PROJECT GOALS

TENANT

CORE

ENVELOPE

OVERVIEW

A CASE STUDY FOR THE USE OF  
IPD/BIM  
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:

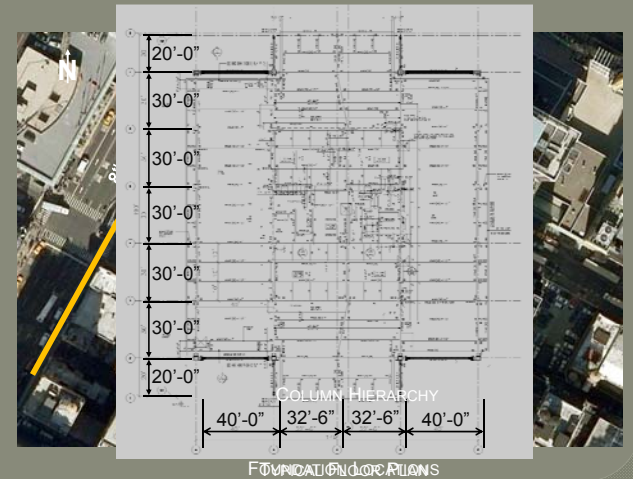
- (7) - 24" DIAMETER CAISSONS WITH 6,000 PSI
- 6,000 PSI SPREAD FOOTINGS EVERYWHERE ELSE

### GRAVITY SYSTEM:

- COMPOSITE STEEL SYSTEM
  - 3" METAL DECKING SPANS 10'
  - 2 1/2" N.W. CONCRETE
- TYPICAL FLOOR-TO-FLOOR HEIGHT IS 13.75'

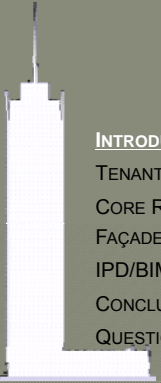
### BUILT-UP COLUMNS:

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



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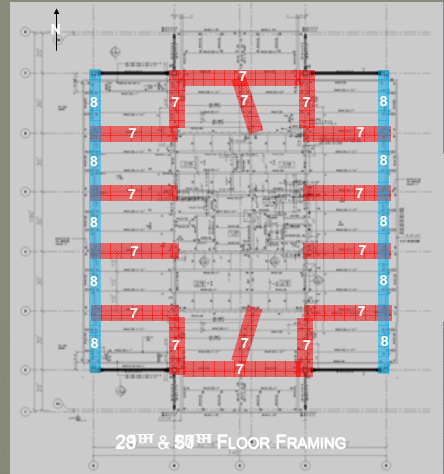
## STRUCTURE

### CANTILEVER BAYS:

- MIDDLE LINE IS A VIERENDEEL 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 28<sup>TH</sup> AND 51<sup>ST</sup> FLOOR (7)
- THERMAL BELT TRUSSES (8)



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## MECHANICAL

### COOLING

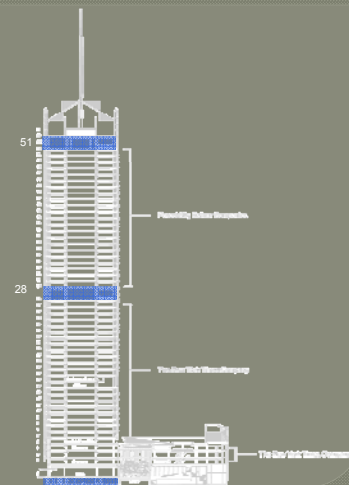
- 6250 TON CHILLED WATER SYSTEM
  - (5) 1,200 TON CENTRIFUGAL CHILLERS
  - (1) 250 TON SINGLE STAGE ABSORPTION CHILLER

### 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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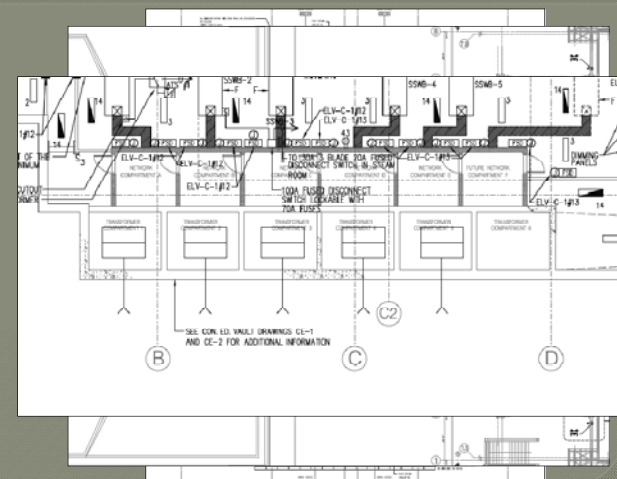
## LIGHTING/ELECTRICAL

### LIGHTING

- INTERIOR (SBLD)
  - 18,000 (2) 14W FLUORESCENT LAMP FIXTURES
  - DIGITALLY ADDRESSABLE BALLASTS
  - COMPLEX DAYLIGHT HARVESTING SYSTEM
  - DESIGNED TO 1.1 W/FT<sup>2</sup>
  - 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

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

## SUMMARY SCHEDULE

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	12/8/2005	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	8/20/2007

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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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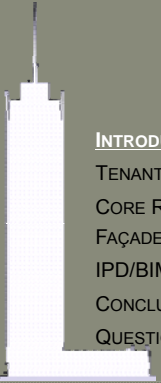
#### **PROJECT GOALS**

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# TENANT

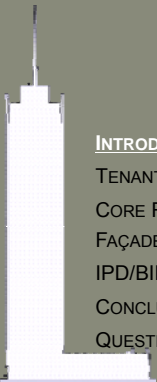
DECREASE THE BUILDING'S LIFE CYCLE COST BY ANALYZING:

- 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 Probability of PERC

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## CORE

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 3-Bracing
Eliminate 2-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

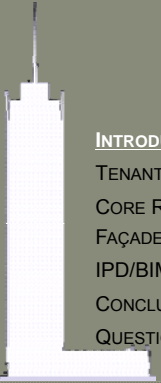
OPTIMIZE THE BUILDING ENVELOPE TO IMPROVE THE INDOOR ENVIRONMENTAL QUALITY AND DECREASE BUILDING ENERGY CONSUMPTION BY ANALYZING:

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

Structural
Eliminate Thermal Bridges
Maintain the Original Architecture including the Cantilevered Bays
Accurate Revit Model Creation
Disengage Columns from Lateral System
Lighting/Electrical
Maintain Architectural Vision of Transparency through Glassy Arch System
Reduce Energy Consumption through Daylight Harvesting
Use Dayism 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
MEP/Systems
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 Position and Orientation of Photovoltaic Panels to Maximize Energy Production
Design of Mixed Mode Ventilation System
Utilize IES-VE Macro for Mixed Mode Design
Construction
Decrease Construction Cost
Maintain Architectural Vision
Shorten/Maintain Construction Schedule
Use Revit Model for Takeoff

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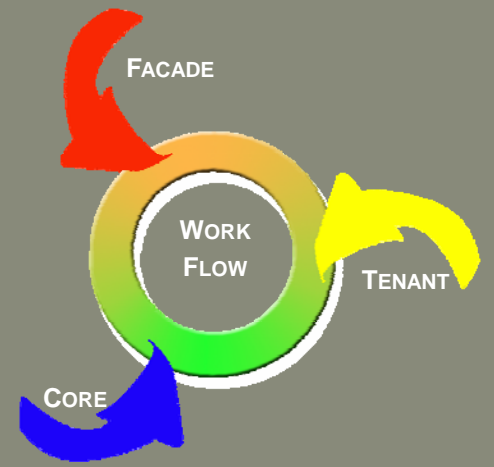


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## OVERVIEW



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## ARCHITECTURAL LAYOUT

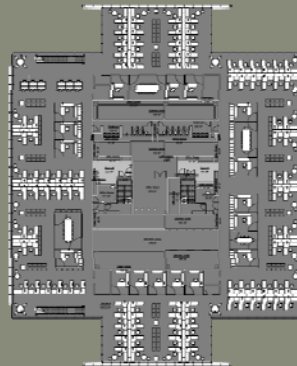
GRAVITY SYSTEM

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

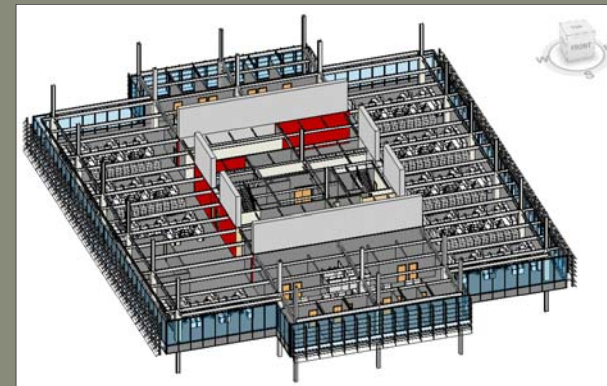
AVG: \$60.58 /FT<sup>2</sup>/YEAR

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 32<sup>ND</sup> FLOOR

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## REDESIGN OF GRAVITY SYSTEM

ITERATIVE DECK AND BEAM DESIGN

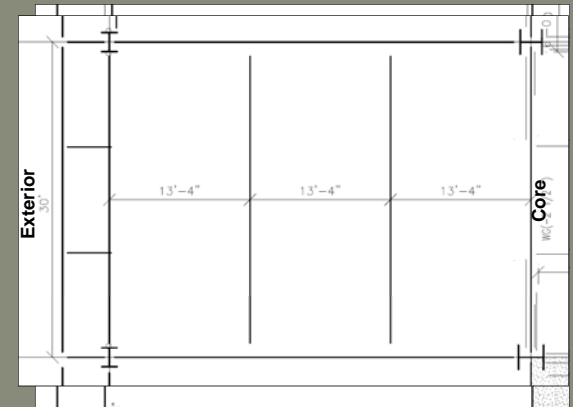
- 14 DIFFERENT SOLUTIONS REDUCED TO ONE POTENTIAL SOLUTION

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:

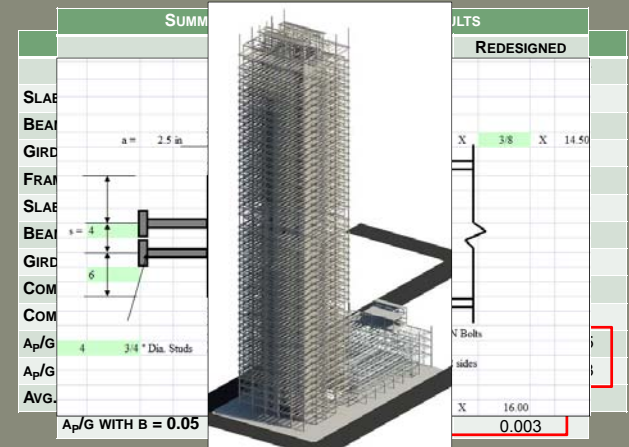
- DESIGN GUIDE 11:
  - BEAM/ JOIST PANEL MODE
  - GIRDER PANEL MODE
- DR. HANAGAN:
  - SLAB PANEL MODE

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





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## INTERIOR LIGHTING DESIGN



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### DESIGN CRITERIA

30 FC

1.1W/FT<sup>2</sup>

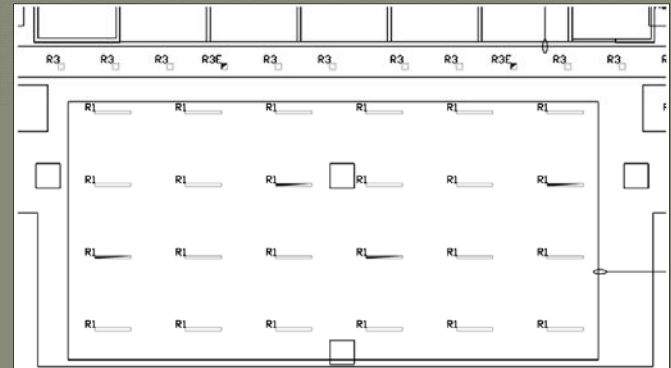
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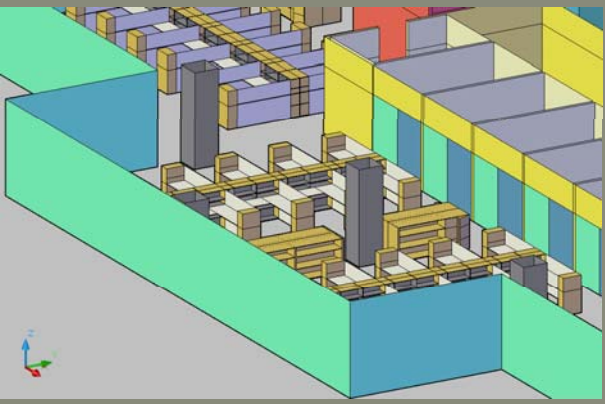
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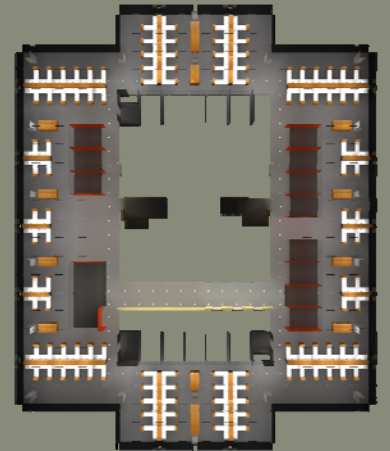
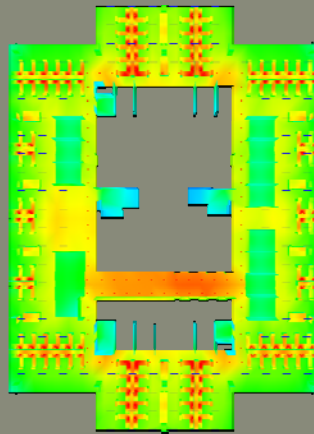
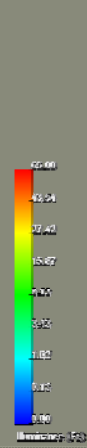
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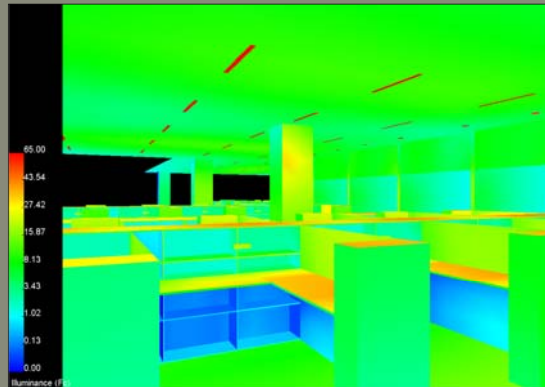
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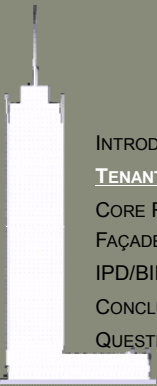
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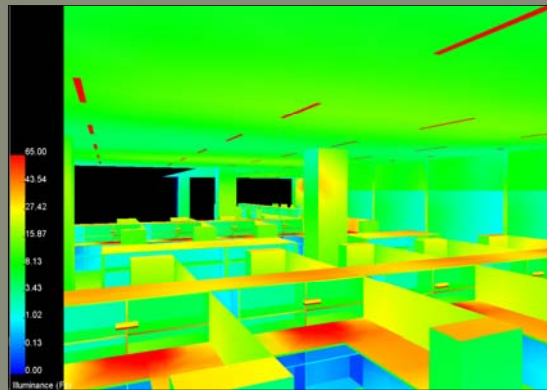
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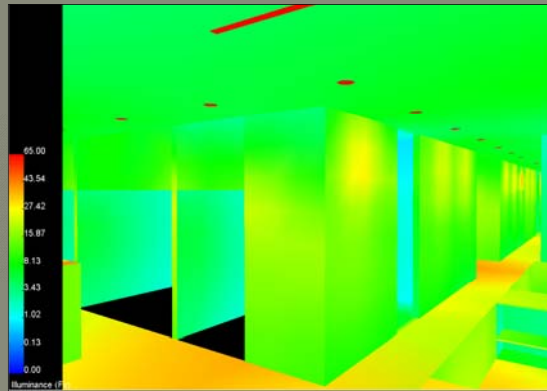
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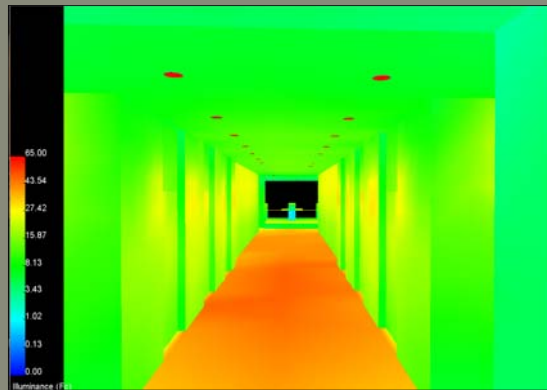
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## INTERIOR LIGHTING DESIGN





# THE NEW YORK TIMES BUILDING

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

## INTERIOR LIGHTING DESIGN SUMMARY



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FAÇADE REDESIGN

IPD/BIM LESSONS

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GRAVITY SYSTEM

**INTERIOR LIGHTING**

UFAD → DV

CONCLUSIONS

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

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## AIR DISTRIBUTION REDESIGN



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OBJECTIVES:

IMPROVE UPON INDOOR ENVIRONMENTAL QUALITY FOR BUILDING OCCUPANTS

ACCESS BIM TOOLS FOR MECHANICAL SYSTEM DESIGN AND COORDINATION

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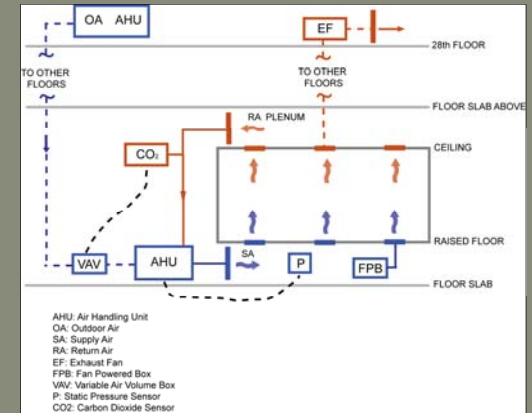
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## AIR DISTRIBUTION REDESIGN

### EXISTING UNDERFLOOR AIR DISTRIBUTION SYSTEM (UFAD)



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## AIR DISTRIBUTION REDESIGN

### PROPOSED DISPLACEMENT VENTILATION (DV) SYSTEM

DUCTED SYSTEM

MORE EFFECTIVE STRATIFICATION

ORIGINAL DESIGN INTENT SATISFIED ✓

HIGH-PROFILE SUSTAINABILITY

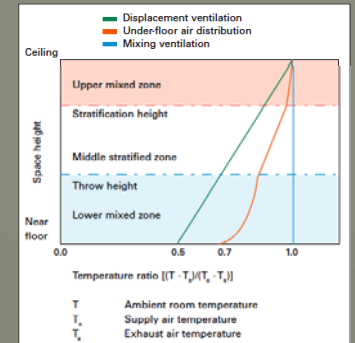
COST-EFFECTIVENESS

RAISED-FLOOR



SOURCE: PRICE

### TEMPERATURE PROFILE COMPARISON

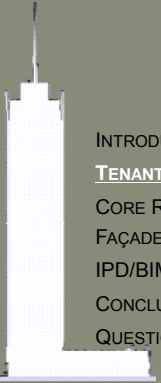


SOURCE: HALTON

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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

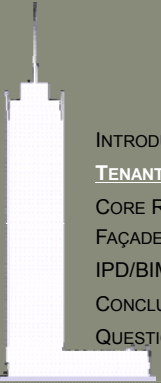
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### DESIGN OF DV SYSTEM

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- 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

*Load factors determined by ASHRAE RP-949*

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### DESIGN OF DV SYSTEM

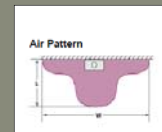
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Space (add tag)	Unit Type	# of Diffusers per Zone	Unit Size Face Area, ft <sup>2</sup> , W x H	Inlet Size	Face Velocity FPM	Airflow CFM	Total Pressure in-w.g.	Static Pressure in-w.g.	Noise Criteria NC	Adjacent Zone			
										ΔT = 9°F Length Ft, Width Ft	ΔT = 10°F Length Ft, Width Ft	ΔT = 12°F Length Ft, Width Ft	
Zone 1 - NW Perimeter Open Office	OP-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	OP-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	29	11	20	14	28
Zone 3 - W Perimeter Open Office	OP-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	29	11	20	14	28
Zone 4 - E Perimeter Open Office	OP-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	29	11	20	14	28
Zone 5 - S Perimeter Open Office	OP-3 Series	4	24 x 48 x 13	16 x 8	40	633	0.1	0.03	29	11	20	14	28
Zone 6 - SE Perimeter Open Office	OP-3 Series	1	24 x 48 x 13	16 x 8	30	475	0.06	0.02	---	10	20	14	28
Zone 6 - SE Perimeter Open Office	OP-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	OP-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	OP-3 Series	18	24 x 24 x 13	20	20	155	---	---	---	7	14	10	22
Zone 9 - Conference	OP-3 Series	1	24 x 24 x 13	20	20	155	---	---	---	7	14	10	22



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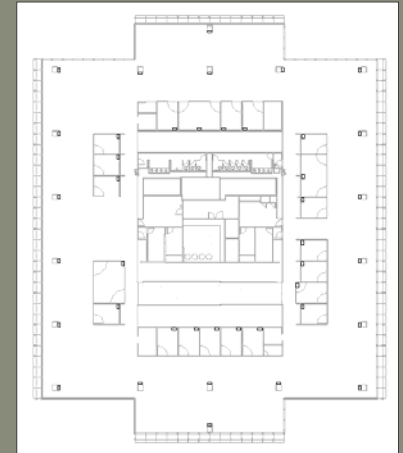
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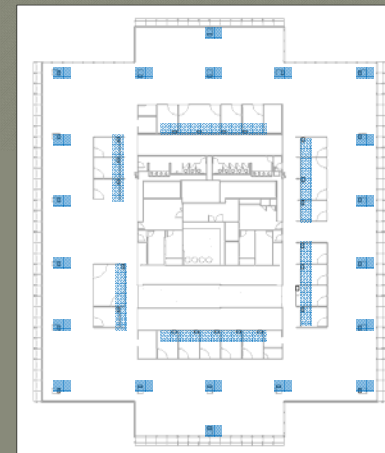
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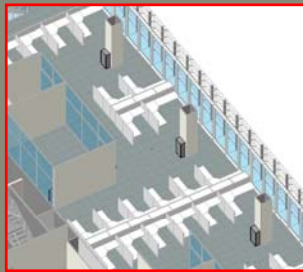
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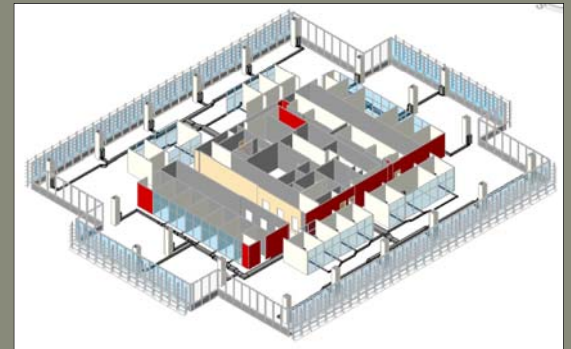
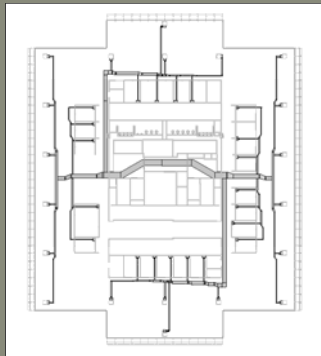
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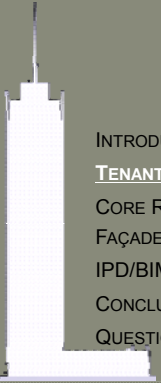
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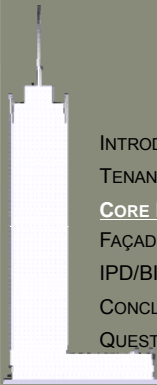
UFAD → DV

**CONCLUSIONS**

Tenant Goals		Achieved Goal	Reduced Payback Period	Increase Occupant Comfort
<input checked="" type="checkbox"/>	Yes			
<input checked="" type="checkbox"/>	No			
<input type="checkbox"/>	Non-Applicable			

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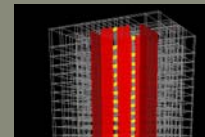
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## STRUCTURE

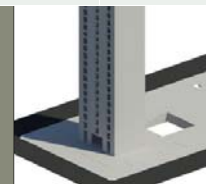
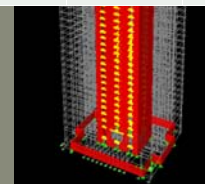
- ARCHITECTURE
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## REDESIGN OF CORE

- 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 <sub>NS</sub>	3450 KIPS	4075 KIPS	8995 KIPS	3968 KIPS
V <sub>WE</sub>	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:

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

DRIFT & DYNAMIC ANALYSIS SUMMARY		
		TARGET
MEAN HOURLY ROOF WIND SPEED	63.3 MPH	
H/B	4.63	
T <sub>L</sub> (WE)	6.46 SEC	6.25 SEC
T <sub>D</sub> (NS)	6.64 SEC	6.75 SEC
T <sub>0</sub>	4.41 SEC	
G <sub>P</sub>	3.75	
A <sub>D</sub> (Z)	1.86 MILLI-G	
A <sub>L</sub> (Z)	2.72 MILLI-G	
BA <sub>0</sub> /SQRT(2)	2.09 MILLI-G	
A <sub>R</sub>	3.90 MILLI-G	
A <sub>PEAK</sub>	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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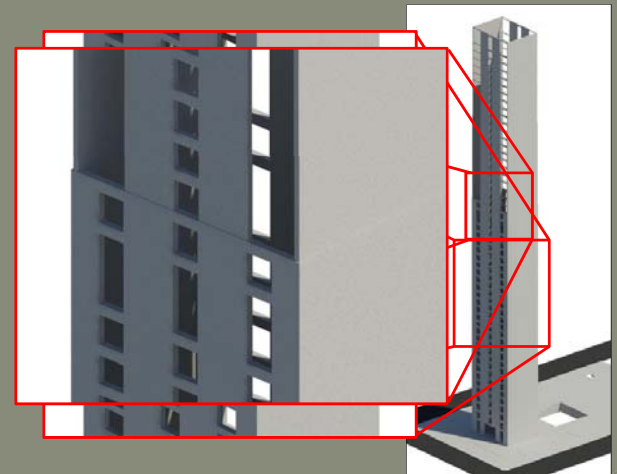
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## REDESIGN OF CORE

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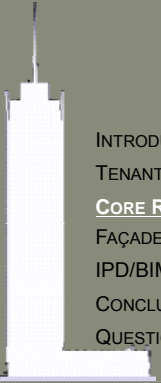
- PROVIDES:
  - MEP ACCESS BETWEEN THE CORE AND TENANT SPACE
- ELIMINATES:
  - OUTRIGGERS
  - X-BRACING RODS





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## REDESIGN OF CORE

- FINAL DESIGN:
- MAINTAINS:
    - ARCHITECTURAL DESIRES:
      - OPENNESS
      - TRANSPARENCY
    - STRUCTURAL NEEDS:
      - LATERAL STRENGTH

SHEAR WALLS  
 COUPLING BEAMS



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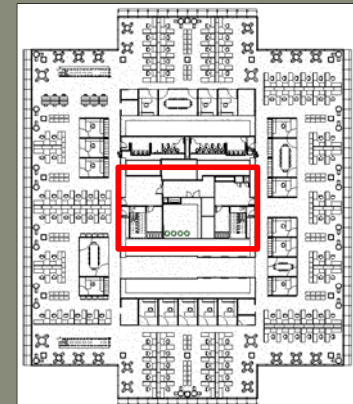
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## REDESIGN OF CORE



ORIGINAL



PROPOSED



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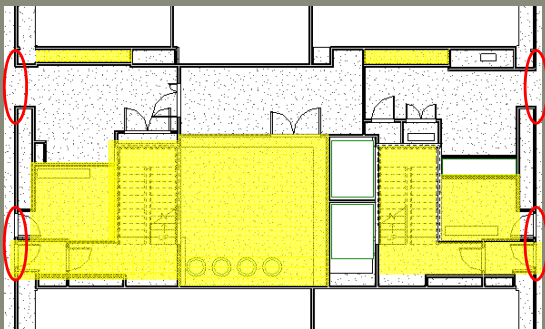
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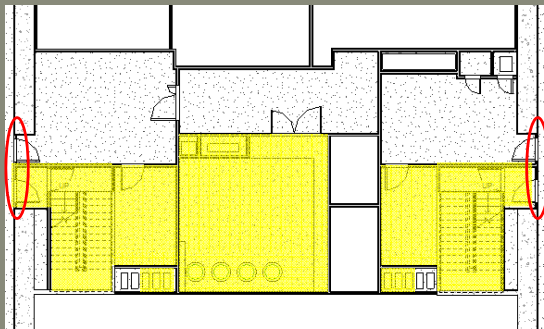
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ACCIDENTAL SPACES

PROPOSED



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## BUS DUCT ANALYSIS



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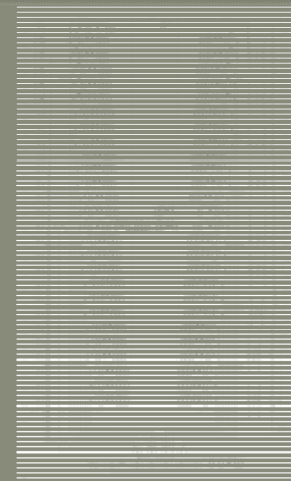
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## BUS DUCT ANALYSIS

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

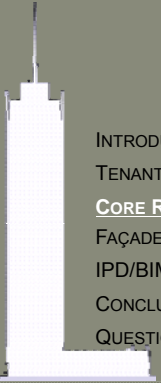
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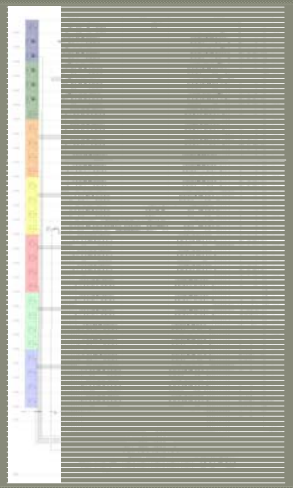
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## BUS DUCT ANALYSIS

(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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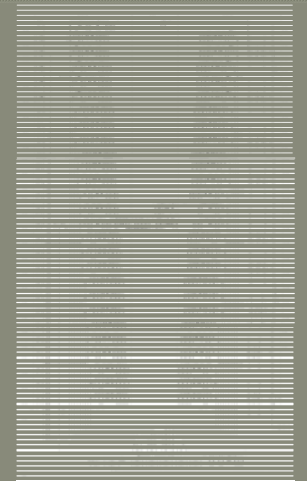
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## BUS DUCT ANALYSIS

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

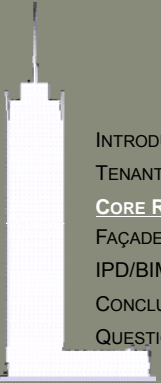
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## BUS DUCT ANALYSIS

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

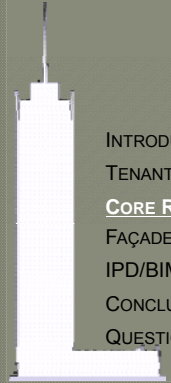
\$141,325.60
\$129,760.43
\$118,195.26
\$106,630.09
\$95,064.91
\$83,499.74
\$71,934.57
\$60,369.40
\$48,804.23





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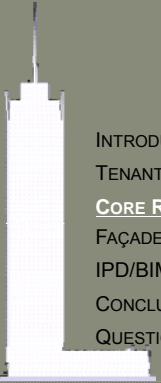
## BUS DUCT ANALYSIS

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



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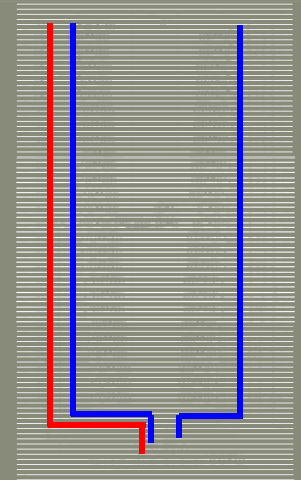
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## BUS DUCT ANALYSIS

### 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
<b>Total</b>			<b>\$448,162.00</b>	<b>Total</b>		<b>\$653,061.50</b>



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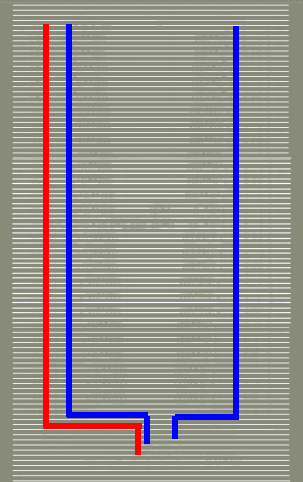


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## BUS DUCT ANALYSIS

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



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NEGATIVES

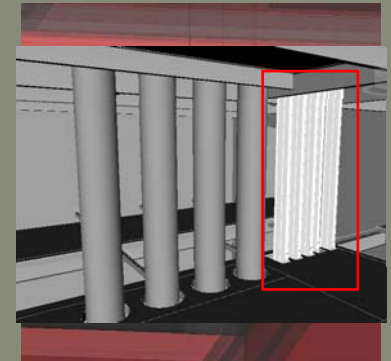
INCREASED COST

\$1,200,000 → \$1,800,000

BENEFITS

FUTURE EXPANSION CAPABILITIES

DECREASED SPACE REQUIRED PER FLOOR



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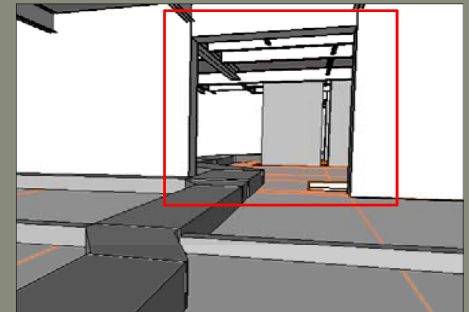
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## MECHANICAL COORDINATION

### 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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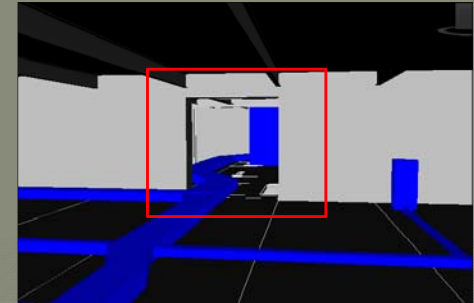
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### CONSTRUCTION IMPLICATIONS

#### STEEL

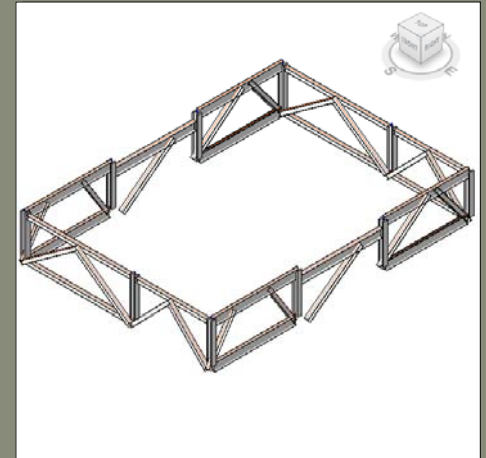
BUILT UP COLUMNS  
 LARGE FRAMING MEMBERS  
 OUTRIGGER SYSTEM IN PLACE

#### 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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## CONSTRUCTION IMPLICATIONS

### 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

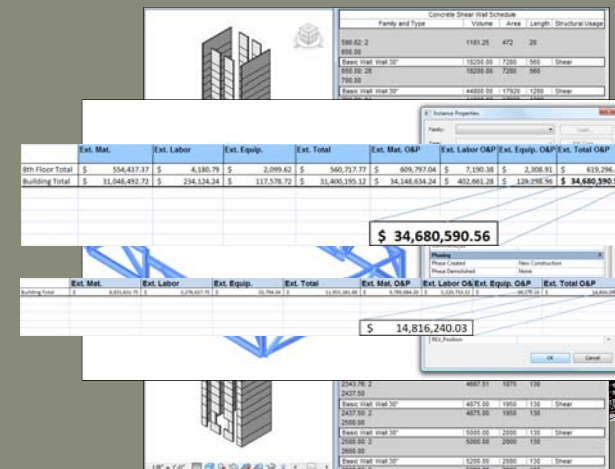
R.S.MEANS CONSTRUCTION DATA APPLIED TO TAKE-OFFS

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





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## CONSTRUCTION IMPLICATIONS

### SCHEDULE CHANGES

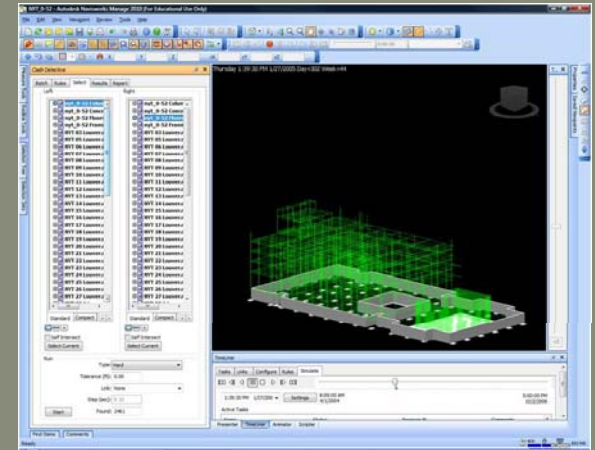
2 MONTH EARLIER START FOR TOWER

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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## CONCLUSIONS

Core Goals		Achieved Goal	Reduced Payback Period	Increase Occupant Comfort
<input checked="" type="checkbox"/>	Yes			
<input checked="" type="checkbox"/>	No			
<input type="checkbox"/>	Non-Applicable			

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### ARCHITECTURAL PRECEDENTS

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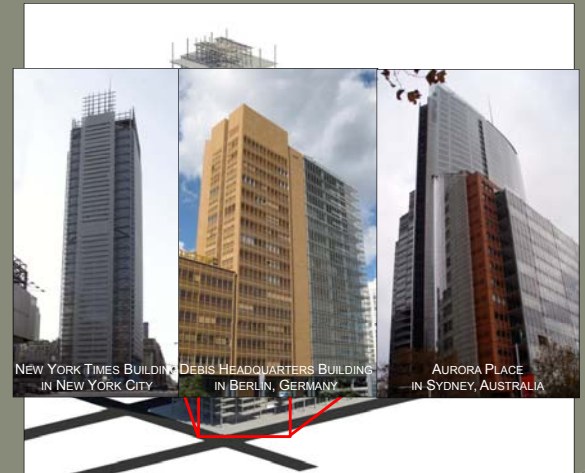
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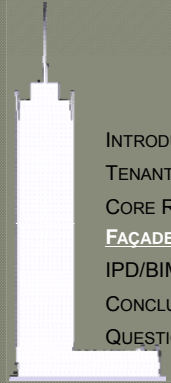
## ARCHITECTURAL PRECEDENTS

- 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



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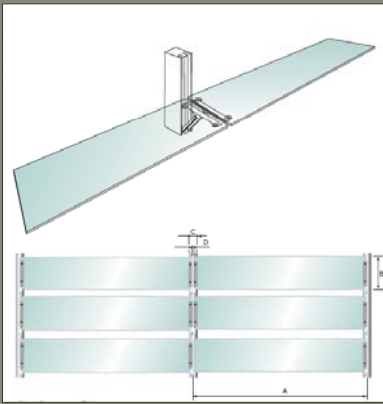
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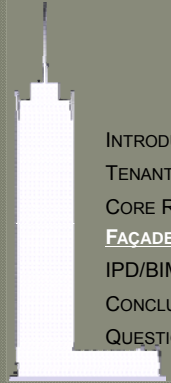
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## DAYLIGHTING ANALYSIS



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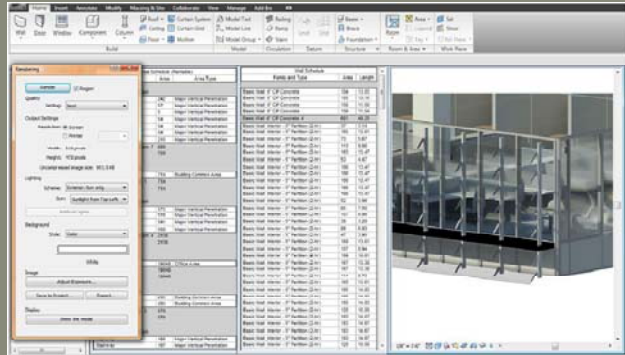
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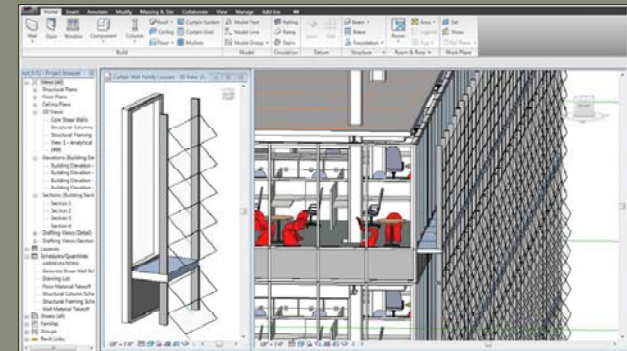
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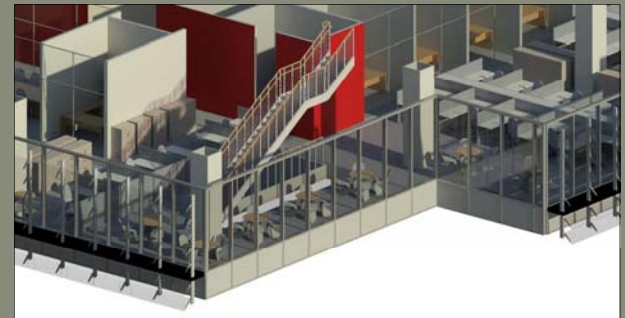
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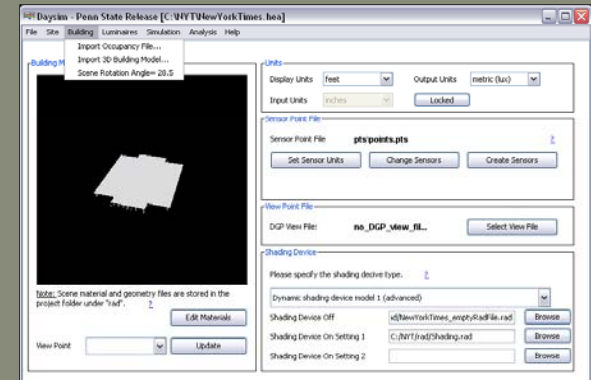
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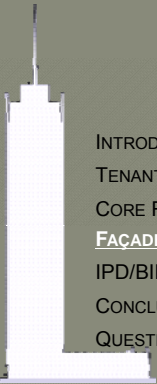
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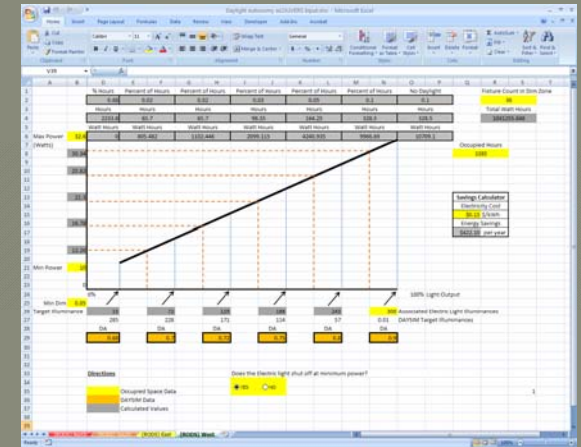
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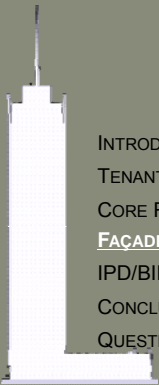
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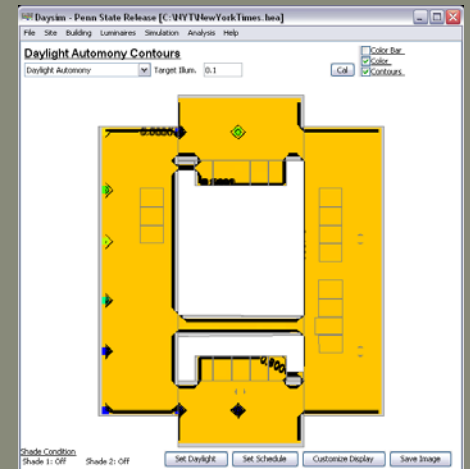
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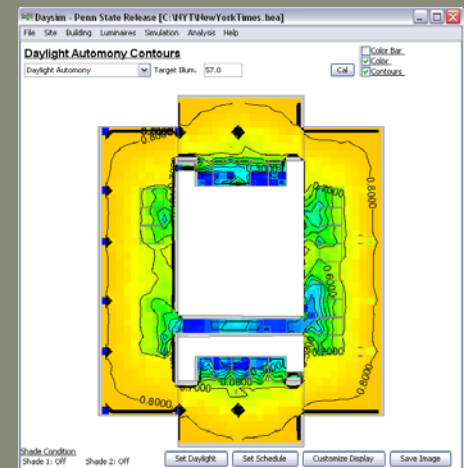
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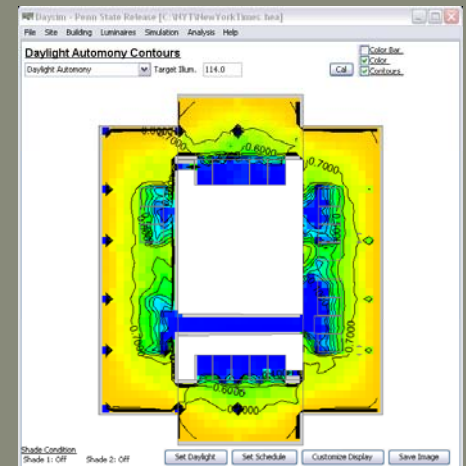
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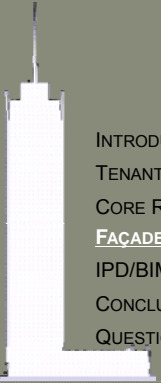
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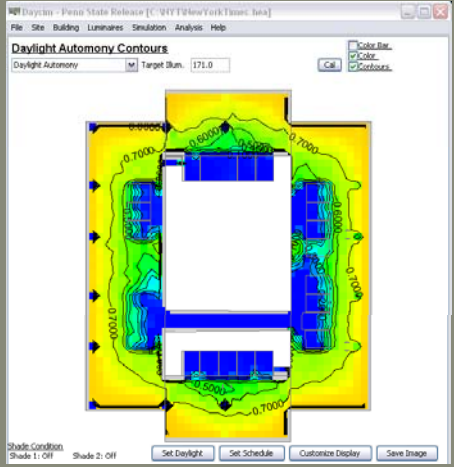
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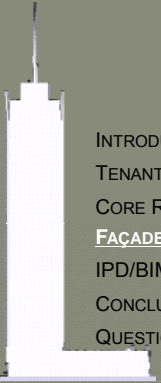
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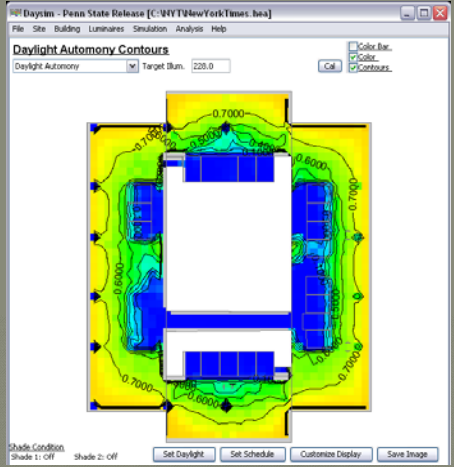
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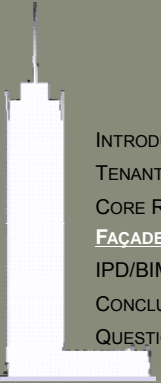
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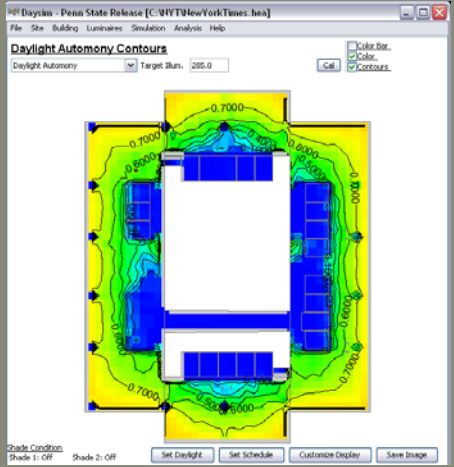
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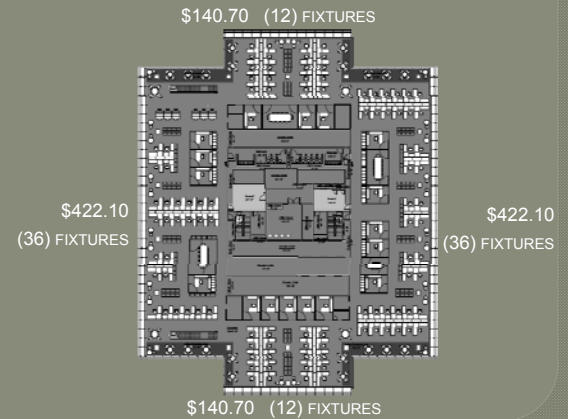
## DAYLIGHTING SUMMARY

TOTAL ENERGY SAVINGS PER YEAR  
\$56,280.00

NEW YORK TIMES BALLAST QUOTES  
NORMAL \$15/PER  
DIMMING \$30-\$75/PER WITH WILLINGNESS TO DECREASE

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

### SAVINGS PER FLOOR PER YEAR





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# BIM FOR PERFORMANCE MODELING



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## BIM FOR PERFORMANCE MODELING

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

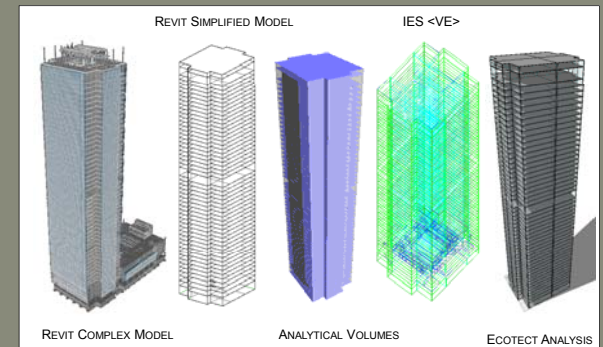
CAREFUL MODEL INSPECTION

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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## THERMAL ANALYSIS

### OBJECTIVE

- AMBIENT LOAD REDUCTION
- ENERGY & COST ANALYSIS

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## ENVELOPE CONSTRUCTION

MODEL INPUT PARAMETER	BASILINE DESIGN INPUT	PROPOSED DESIGN INPUT
SPANDREL PANEL	RECESSED 3/16" ALUMINUM SPANDREL PANEL: UVALUE: 0.08 BTU/FT <sup>2</sup> -F-HR 2-1/2" RIGID INSULATION BEHIND	RECESSED 3/16" ALUMINUM SPANDREL PANEL: UVALUE: 0.08 BTU/FT <sup>2</sup> -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 <sup>2</sup> -F-HR	UVALUE FOR GLAZING: 0.405 BTU/FT <sup>2</sup> -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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## LIGHTING POWER DENSITY REDUCTION



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MODEL INPUT PARAMETER	BASILINE DESIGN INPUT	PROPOSED DESIGN INPUT
INTERIOR LIGHTING POWER DENSITY	1.1 W/M <sup>2</sup>	.46 W/M <sup>2</sup>

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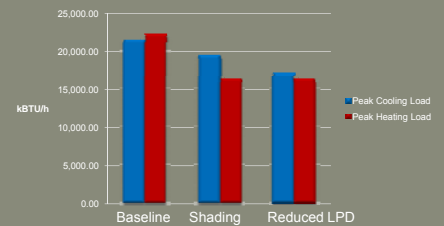


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## SIMULATION RESULTS

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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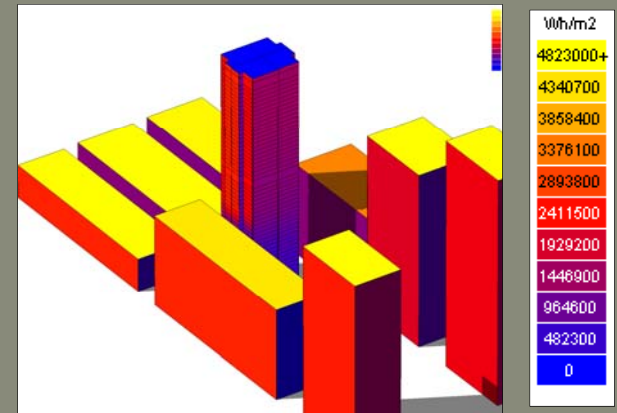
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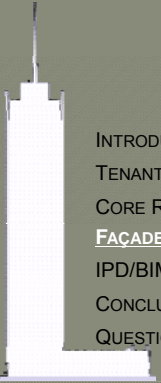
## PV ANALYSIS





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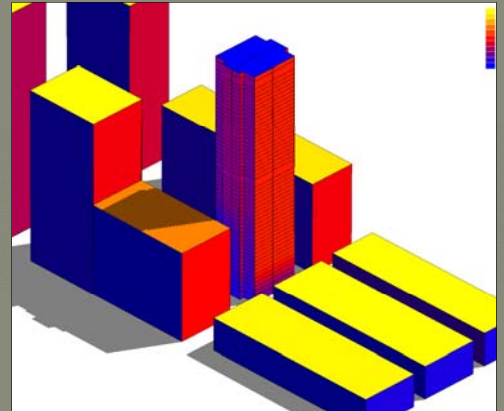
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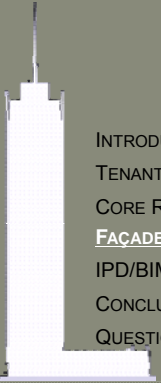
## PV ANALYSIS



Wh/m <sup>2</sup>
4823000+
4340700
3858400
3376100
2893800
2411500
1929200
1446900
964600
482300
0

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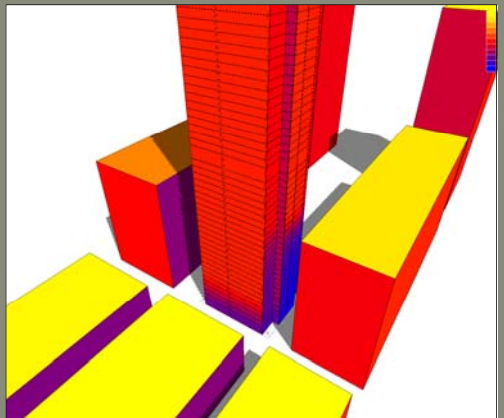
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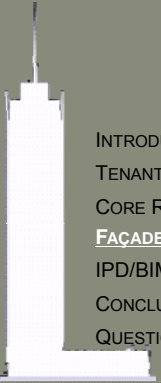


W/m <sup>2</sup>
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2893800
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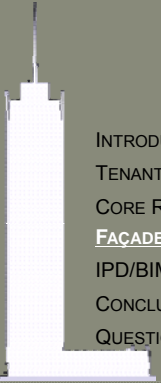
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FAÇADE SECTION	COVERAGE AREA (FT <sup>2</sup> )	PRODUCTION kWh/YEAR	COST
EAST FAÇADE FLOORS:5-17	3,575	10,216.53	\$214,500
EAST FAÇADE FLOORS:18-54	10,175	207,971.7	\$610,500
SOUTH FAÇADE FLOORS:18-54	10,175	381,281.5	\$610,500
WEST FAÇADE FLOORS:8-54	12,925	484,330.5	\$775,500

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

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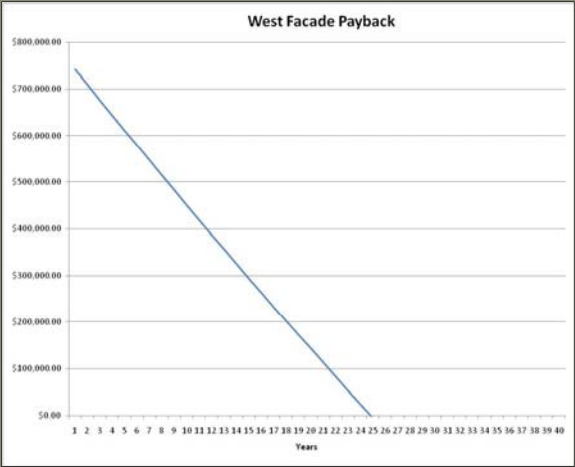


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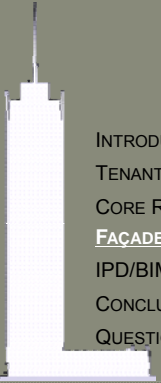
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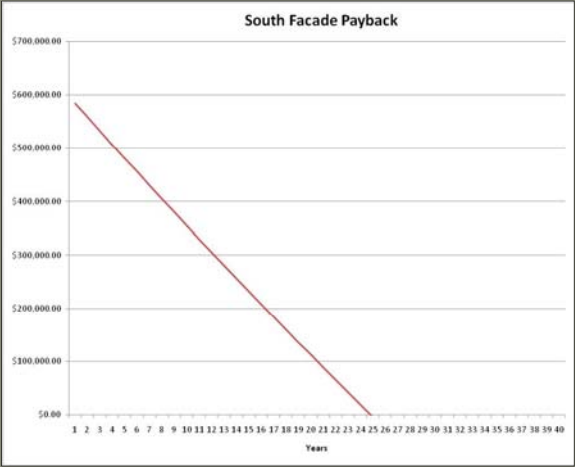


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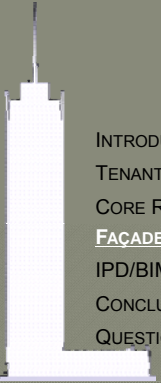
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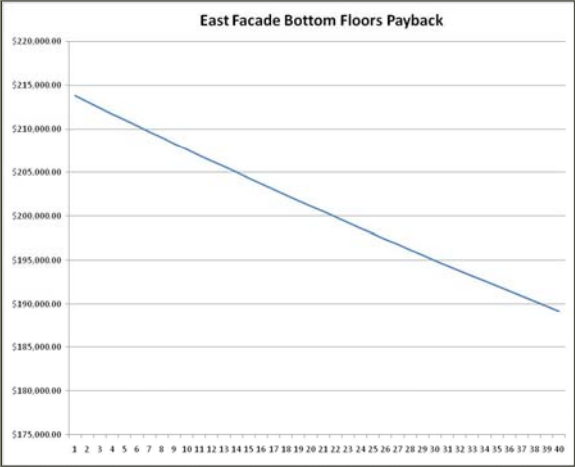


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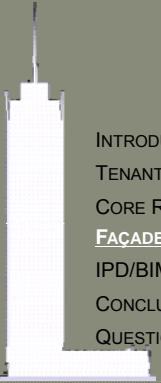
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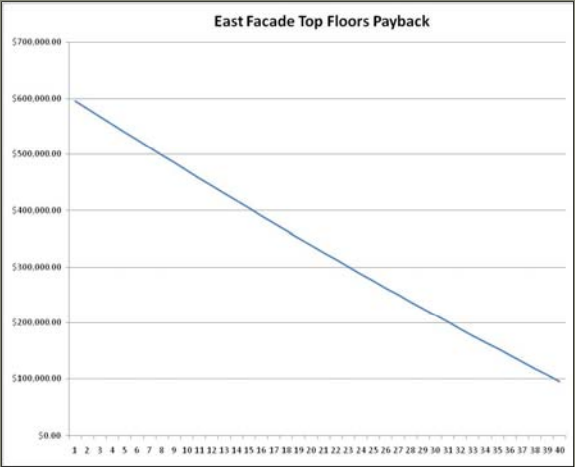


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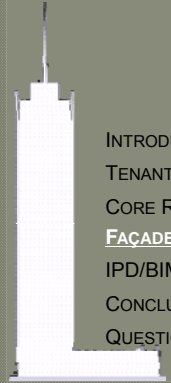
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### OBJECTIVE

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

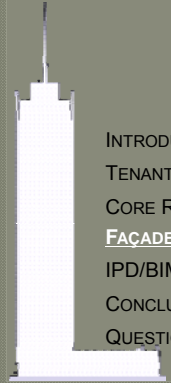
DETERMINE IMPACT OF BIM AND ANALYSIS SOFTWARE FOR MIXED-MODE DESIGN



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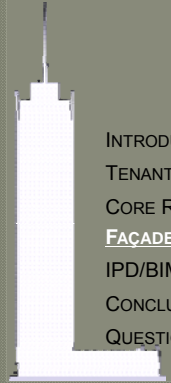
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## PROCESS

- LITERATURE REVIEW
- CASE-STUDIES
- BUILDING CODES & STANDARDS
- SINGLE - ZONE MODEL
- CURTAIN WALL SELECTION
- CONTROL STRATEGY
- ENERGY SAVINGS & PAYBACK ANALYSIS
- CONTROL STRATEGY
- BIM → IES <VE> MACROFLO INVESTIGATION

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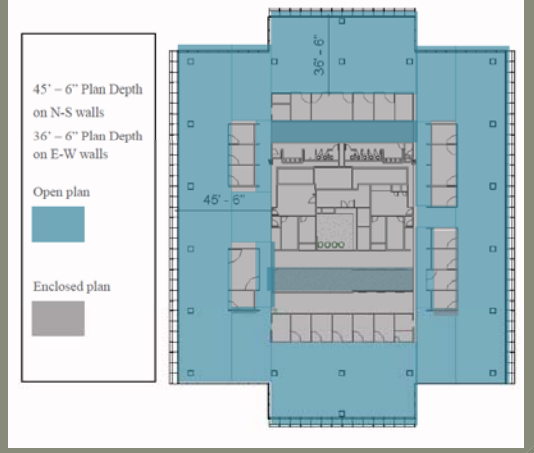
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# HYBRID VENTILATION

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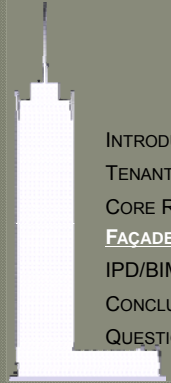
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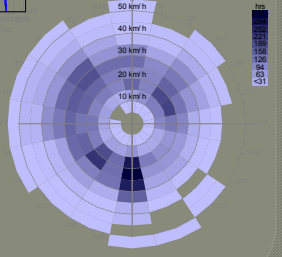
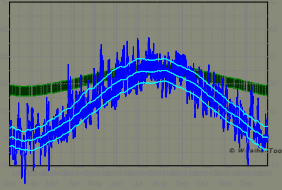


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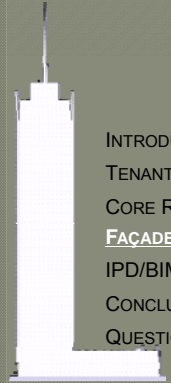
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### PROCESS

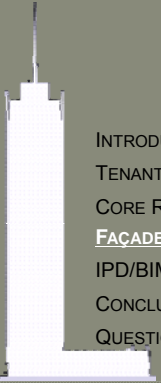
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- CURTAIN WALL SELECTION
- CONTROL STRATEGY
- ENERGY SAVINGS & PAYBACK ANALYSIS
- BIM → IES <VE> MACROFLO INVESTIGATION



COLT COLTLITE LWI VENTILATOR, TYPE LWI

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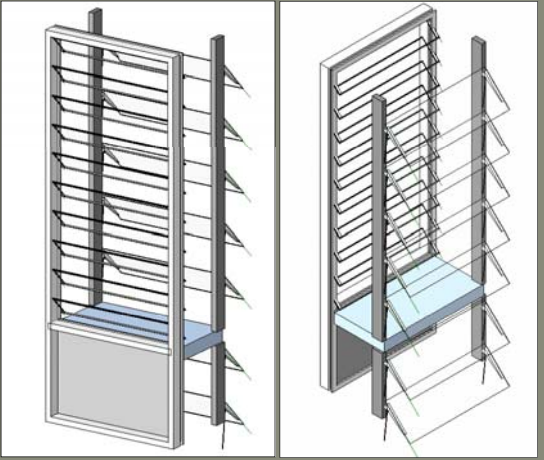
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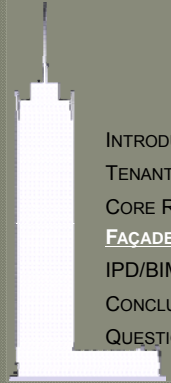
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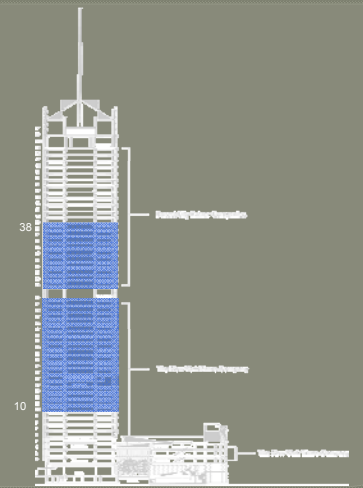


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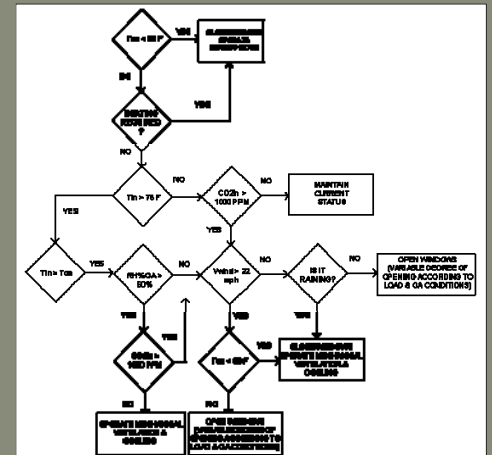
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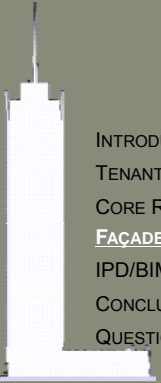
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- SINGLE ZONE MODEL
- HOURLY TMY-2 WEATHER DATA
- LOCAL WIND SPEED DETERMINED
- BUOYANCY (STACK EFFECT) AND WIND FLOW RATES
- COOLING AND VENTILATION LOADS MET

- RESULT
- TOTAL OF 18 OPERABLE GLAZING PANELS PER FLOOR
- 350+ HOURS FEASIBLE

**10% REDUCTION IN COOLING LOAD**  
**ANNUAL COST SAVINGS OF \$41,548**



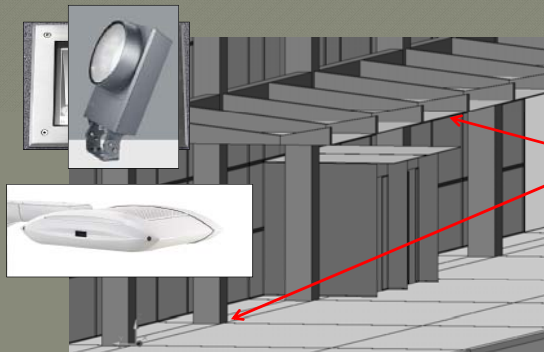
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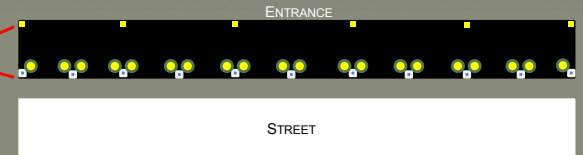
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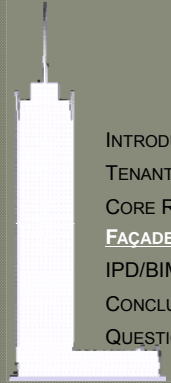


- 32W IN-GROUND UPLIGHT
- 51W WIDE FLOOD
- ▣ 50W AREA LUMINAIRE



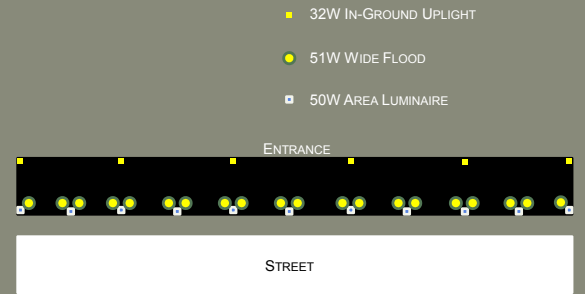
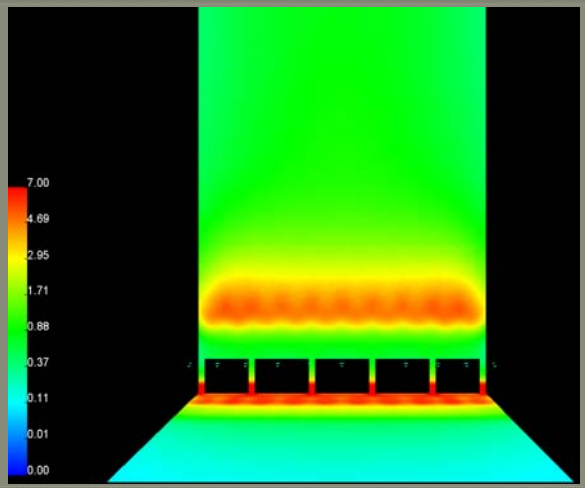
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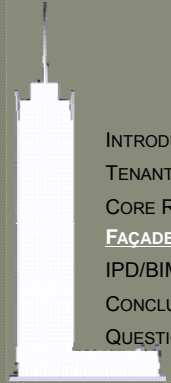


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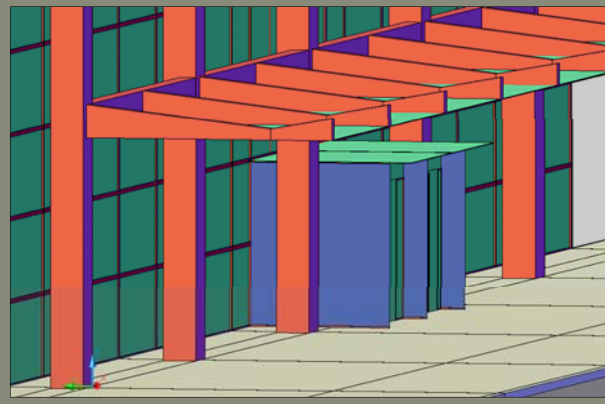
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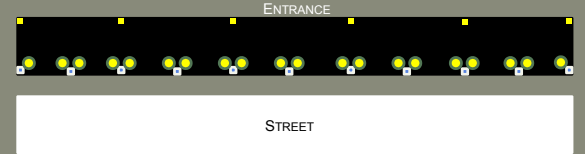
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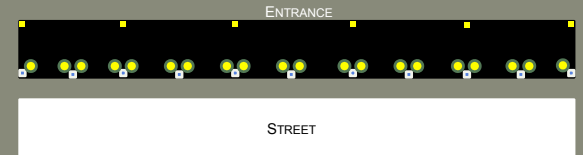
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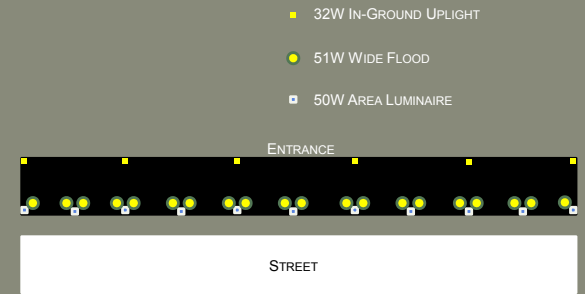
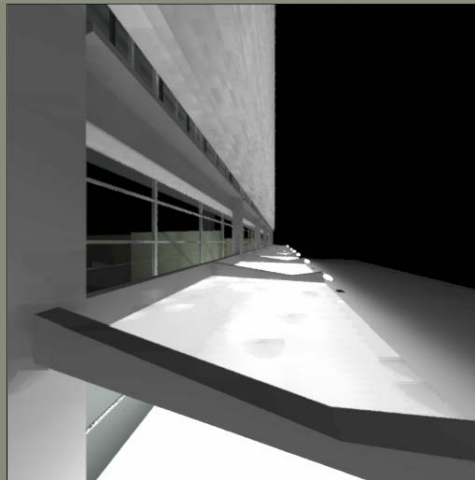
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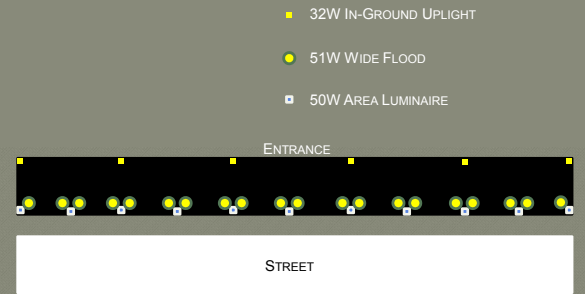
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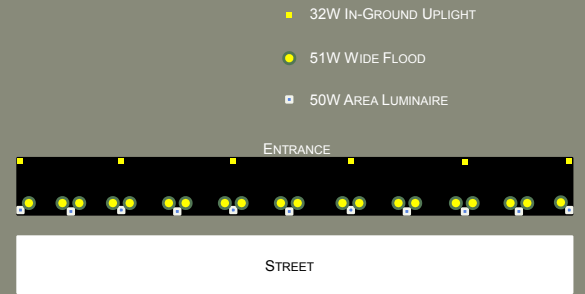
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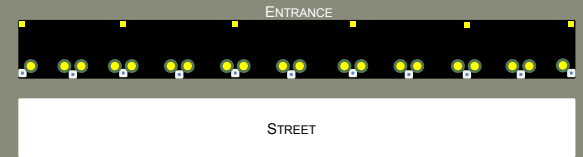
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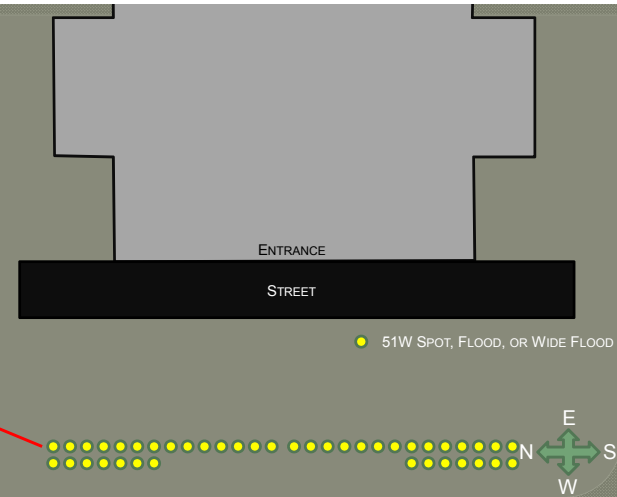
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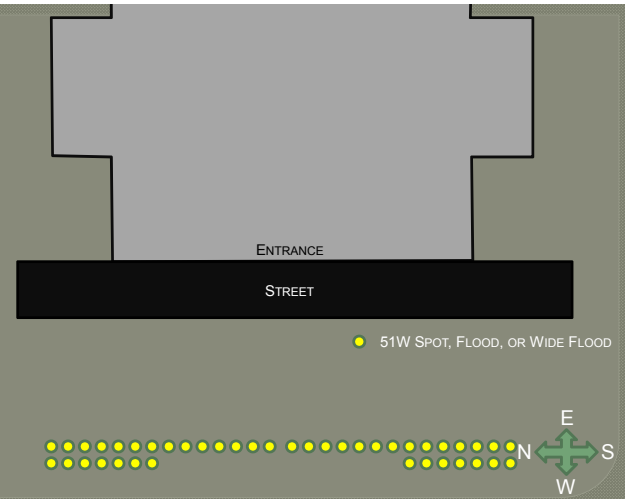
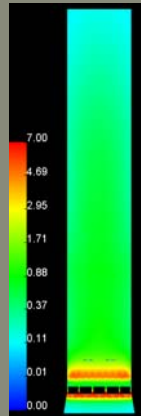
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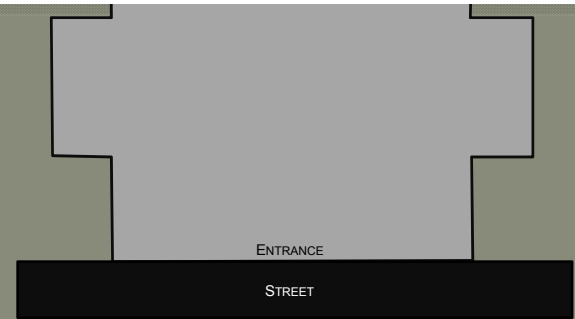
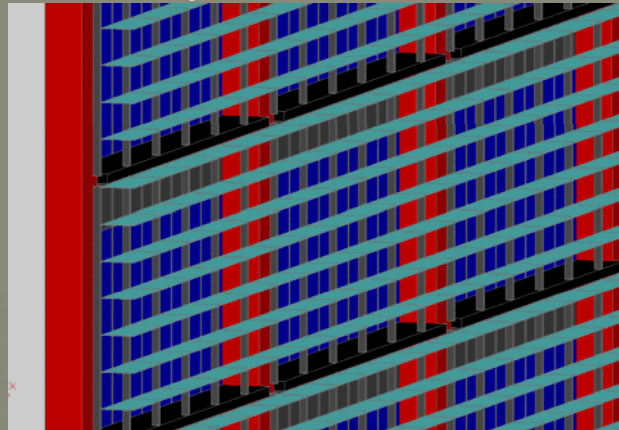
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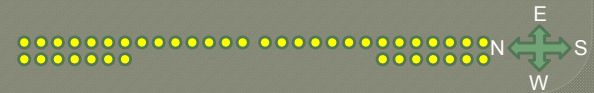
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## FAÇADE LIGHTING DESIGN



● 51W SPOT, FLOOD, OR WIDE FLOOD



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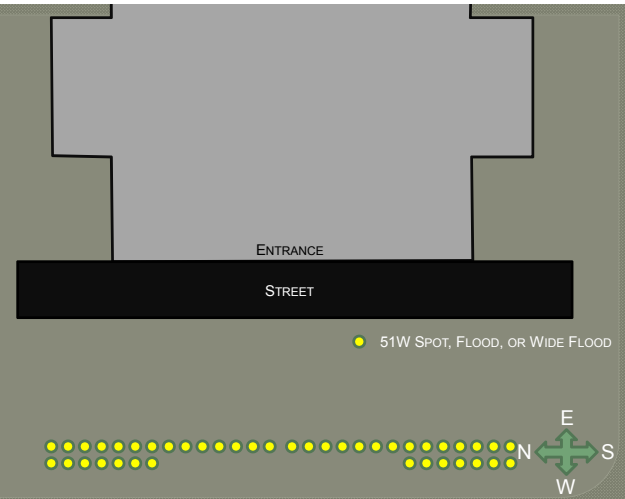
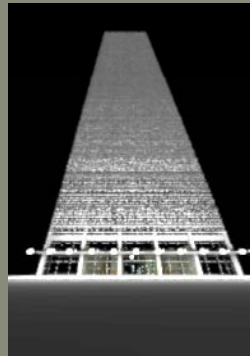
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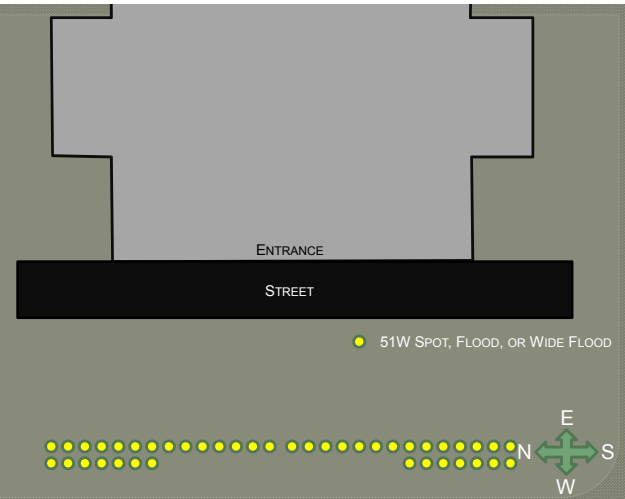
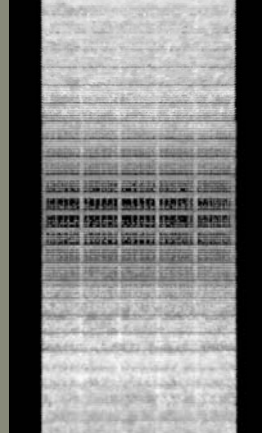
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## FAÇADE LIGHTING DESIGN



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## EXTERIOR LIGHTING DESIGN SUMMARY

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

INTRODUCTION

TENANT REDESIGN

CORE REDESIGN

**FAÇADE REDESIGN**

IPD/BIM LESSONS

CONCLUSIONS

QUESTIONS

ARCHITECTURAL PRECEDENTS

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THERMAL ANALYSIS

PV ANALYSIS

HYBRID VENTILATION

**FAÇADE LIGHTING**

CONSTRUCTION IMPLICATIONS

CONCLUSIONS

ASSUMING 8 HOURS OF USE PER NIGHT

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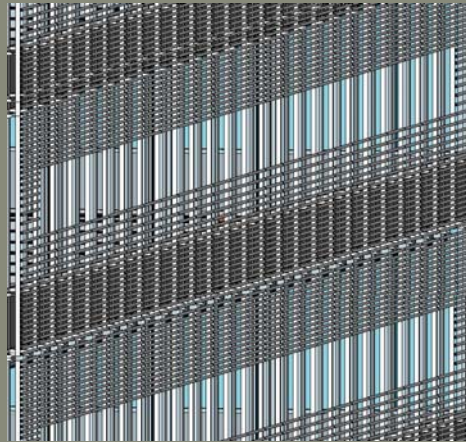
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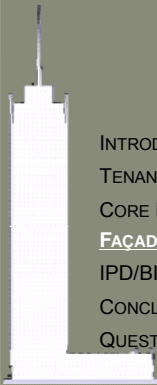
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## CONSTRUCTION IMPLICATIONS

### 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

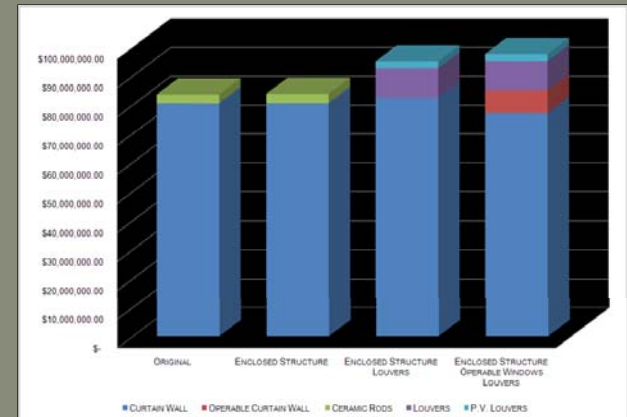
ORIGINAL CURTAIN WALL: \$80,509,220.00

CERAMIC RODS: \$3,023,640.00

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

OPERABLE PANELS: \$7,715,812.50

LOUVERS: \$11,563,300.00





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## FAÇADE CONCLUSIONS

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TENANT REDESIGN	DAYLIGHTING
CORE REDESIGN	THERMAL ANALYSIS
<b>FAÇADE REDESIGN</b>	PV ANALYSIS
IPD/BIM LESSONS	HYBRID VENTILATION
CONCLUSIONS	FAÇADE LIGHTING
QUESTIONS	CONSTRUCTION IMPLICATIONS
	<b>CONCLUSIONS</b>

Envelope Goals		Achieved Goal
✓	Yes	
✗	No	Reduce Payback Period
-	Non-Applicable	Increase Occupant Comfort

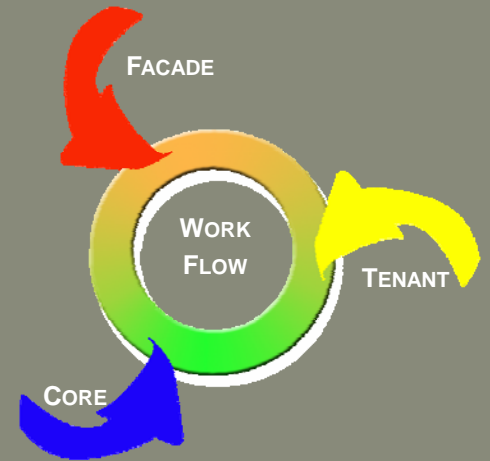


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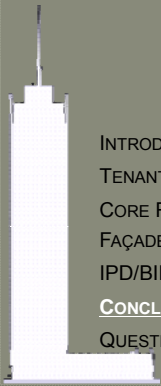
- INTRODUCTION
- TENANT REDESIGN
- CORE REDESIGN
- FAÇADE REDESIGN
- IPD/BIM LESSONS**
- CONCLUSIONS
- QUESTIONS

## IPD/BIM LESSONS LEARNED



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## CONCLUSIONS



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**QUESTIONS**

## QUESTIONS

**Thornton Tomasetti** Foundation



AE DEPARTMENT & FACULTY

FRIENDS & FAMILY

IPD/BIM TEAM 2

IPD/BIM TEAM 3