

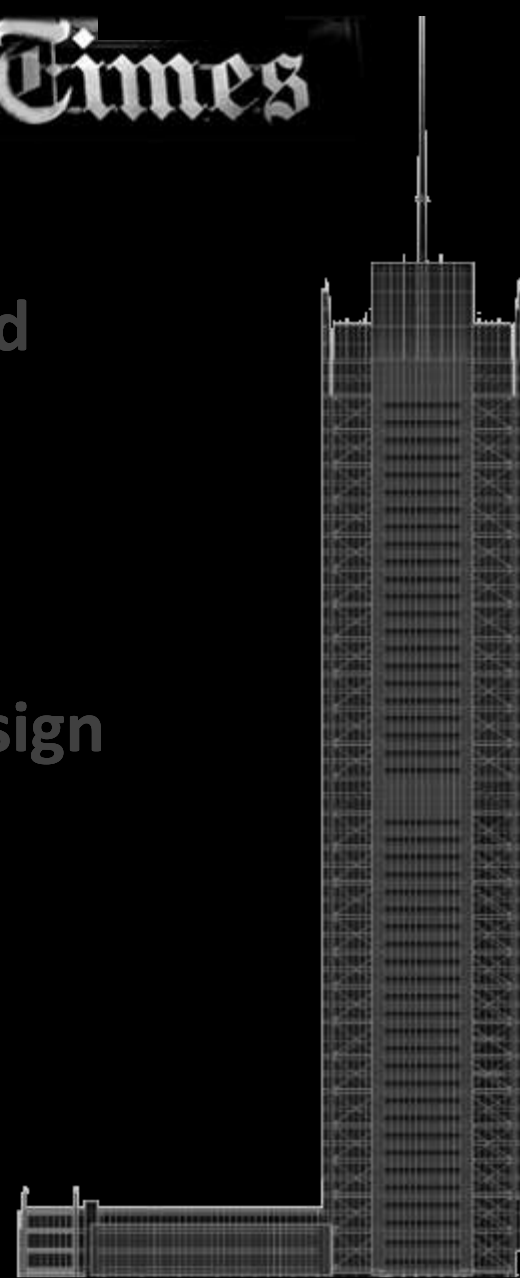
The New York Times

Intro

Building Background
Proposal

Façade Redesign
Floor System Redesign
Core Redesign
CoGen Redesign

BIM/IPD
Metrics of Success



Project Team



BIM/IPD SENIOR THESIS - FINAL PRESENTATION

FALL 2009 / SPRING 2010

MATTHEW S. HEDRICK
KYLE HORST
CASEY LEMAN
ANDRES PEREZ

Intro

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Proposal

Façade Redesign

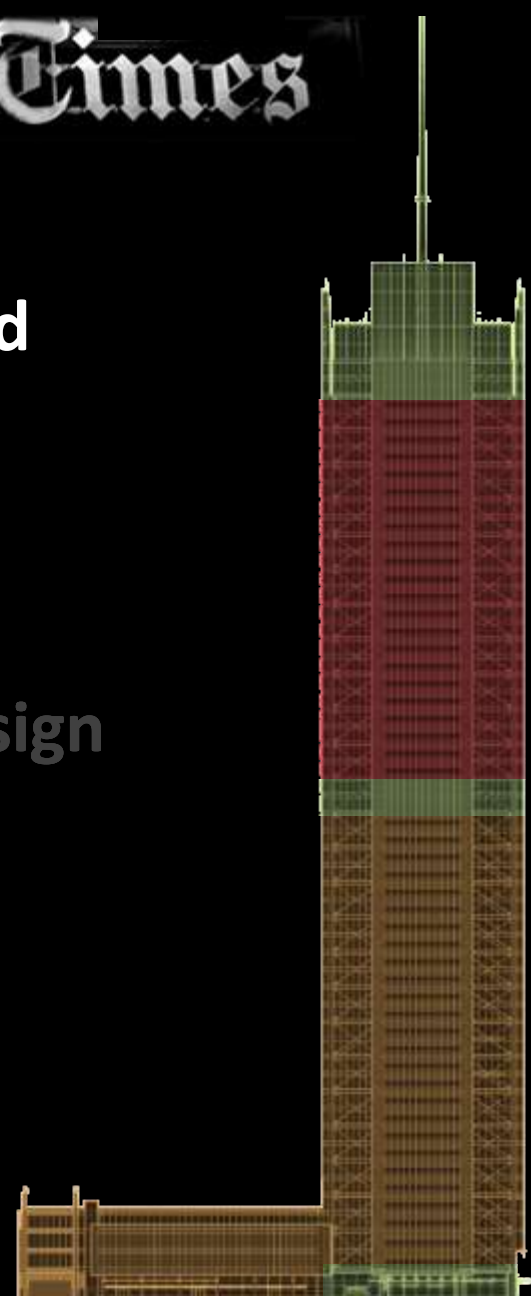
Floor System Redesign

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BIM/IPD

Metrics of Success



Building Statistics



The New York Times Building

- 620 Eighth Ave. Times Square
- Midtown Manhattan, New York, NY

Building Owners

- The New York Times Company: Floors 2 - 27
- Forrest City Ratner Companies: Floors 29 - 50

Building Cost

- Assumed construction cost of \$ 1 billion (2007)
- New York Times Portion: \$ 604 - \$ 624 million

Building Function

- Class A Office Building
- Retail Space on Ground Floor

Intro

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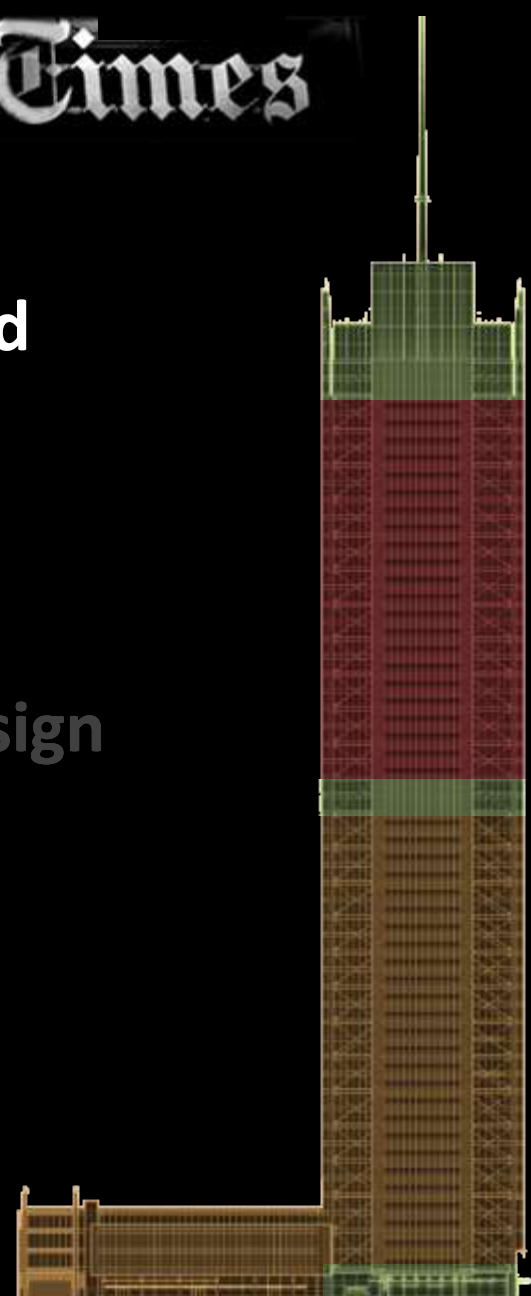
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Metrics of Success



Building Background

Building Architecture

- 52 story office building, 745' tall
- Unique façade with ceramic rod shading system
- 1.5 million square feet

Vertical Transportation

- 28 elevators serving the tower
- High speed “smart” design (1,600 ft/min)
- Cutting edge call system

Mechanical

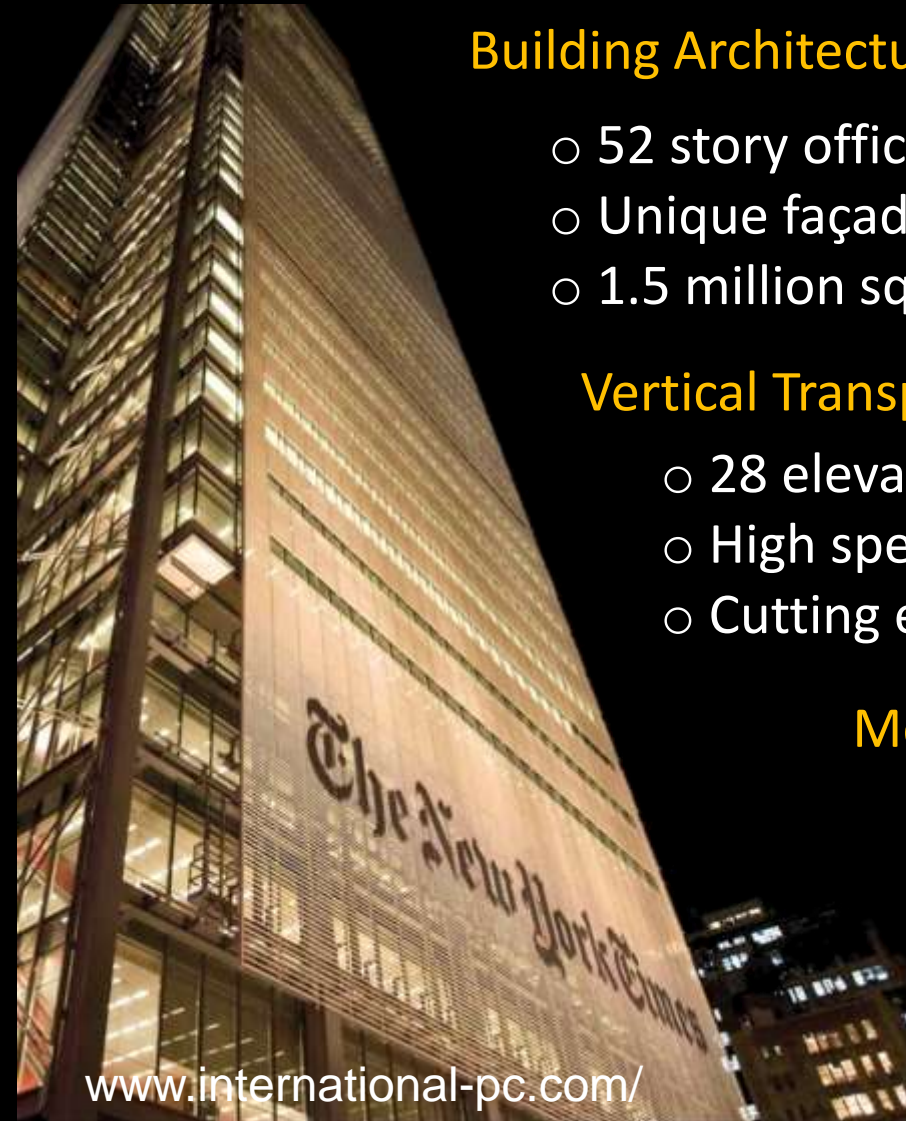
- 6250 ton chilled water system
- 1.4 MW cogeneration system
- District steam heating
- UFAD / VAV air distribution

Lighting/Electrical

- 18,000 Luminaires
- Fixtures Controlled by a Digitally Addressable Lighting Interface (DALI)
- 5 Transformers with Room for Expansion

Structural

- Composite Beam & Girder Floor System
- Steel Braced Frame Lateral Force Resisting System
- Outriggers on 28th & 51st Mechanical Levels
- Exposed Pretension Exterior Steel Rods
- Exposed 30”x30” Built-up Steel Columns
- Thermal Trusses on 51st Mechanical Floors



www.international-pc.com/

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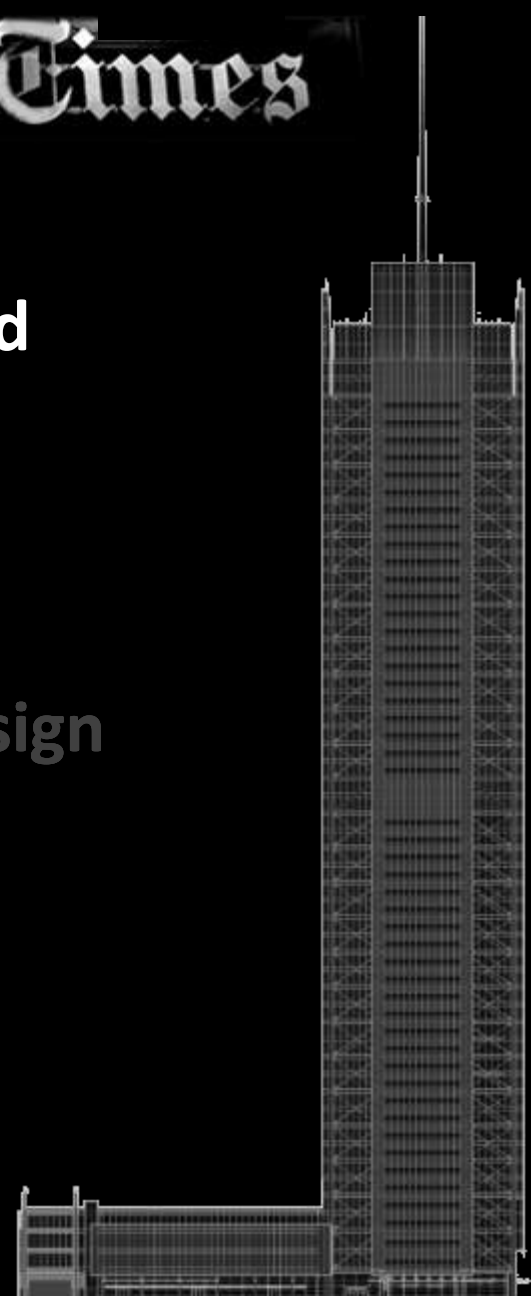
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Metrics of Success



Project Team



Architects

Renzo Piano Building Workshop
FXFOWLE Architects

CM

AMEC Construction Mgmt. (Core & Shell)
Turner Construction (NYT Interiors)

Structural

Thornton Tomasetti

MEP

Flack and Kurtz

www.international-pc.com/

Project Milestones

- August 23, 2004 – Excavation Begins
- July 2006 – Topping Out Ceremony
- November 19, 2007 – Grand Opening of the New York Times Building

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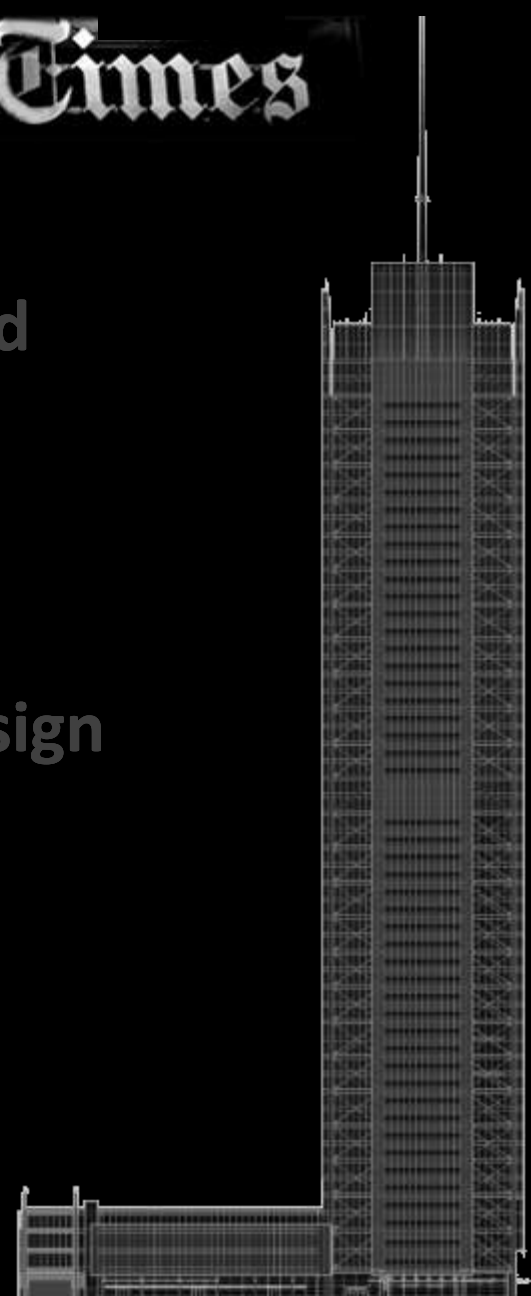
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Redesign Goals



Increased Profitability

- Operating Costs
- Leasable Space

Increased Marketability

- Sustainability
- Iconic Image

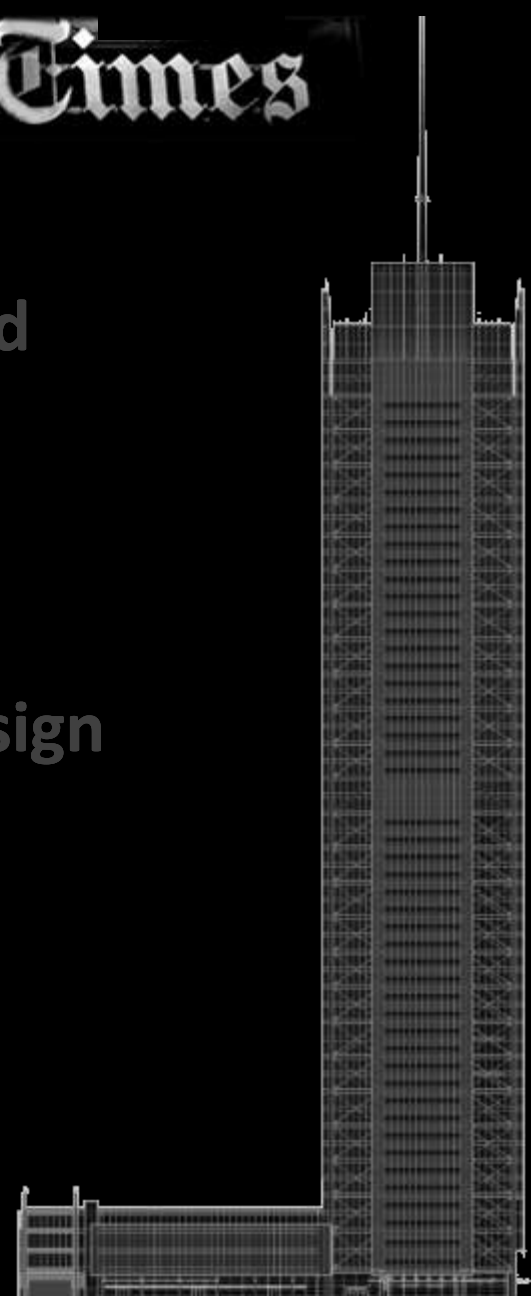
www.international-pc.com/

Redesign Strategies

Decrease floor to floor height to allow for an additional rentable floor

Redesigning core to add additional rentable space on each floor

Improve the sustainability profile



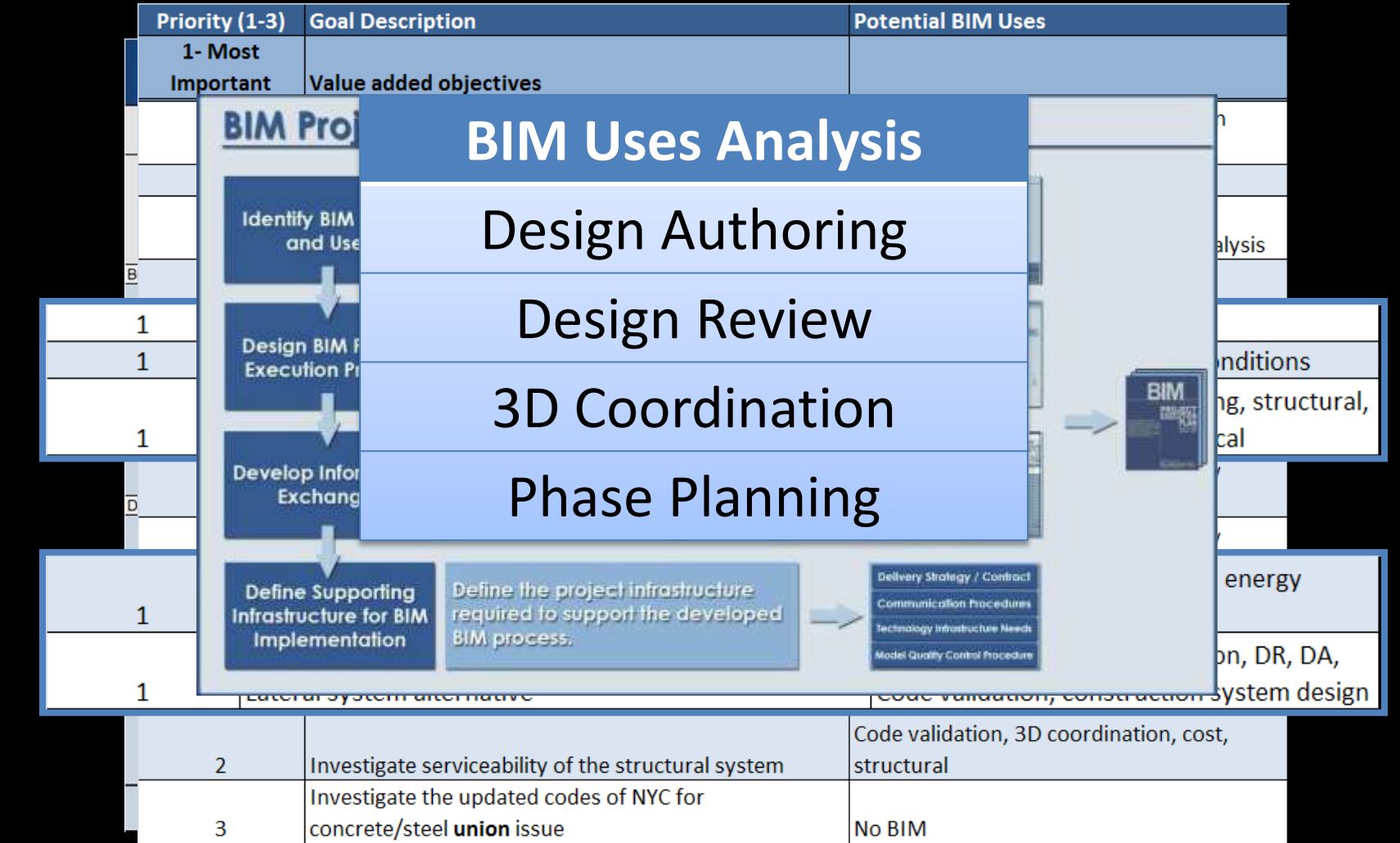
IPD / BIM Goals



www.international-pc.com/

Integrated Project Delivery

- Building Information Modeling (BIM)
- Project Goal Setting
- BIM Use Analysis



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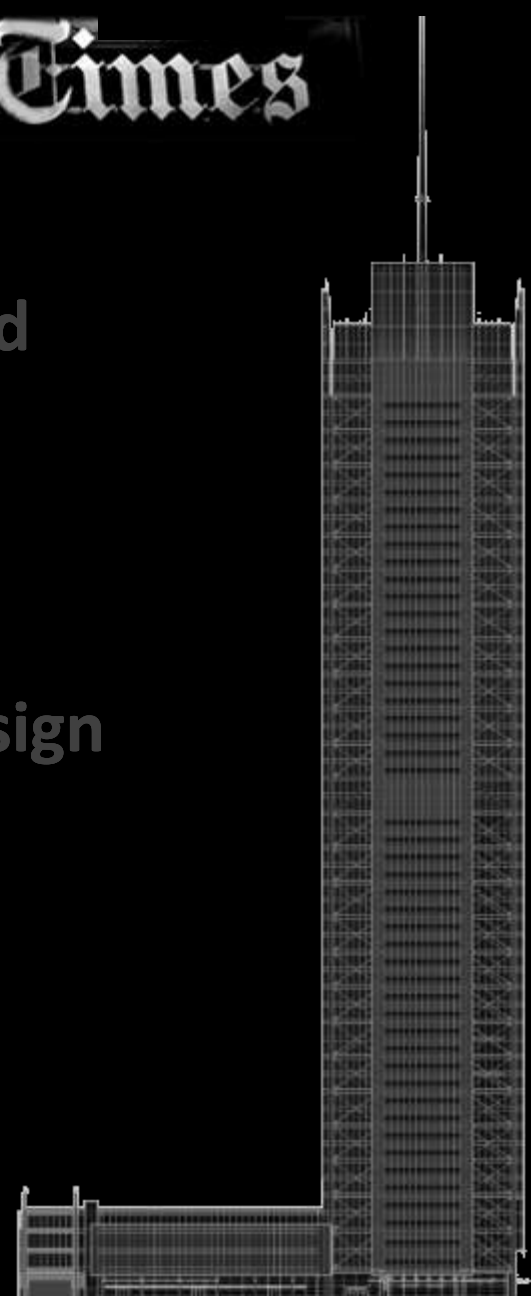
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BIM/IPD

Metrics of Success



Façade Redesign

Façade Goals:

- Increase Thermal Efficiency
- Maintain or Exceed Daylighting Performance
- Maintain Iconic Image

Transparency
Lightness
Innovative Design

Redesign Opportunities:

- Explore Double-Skin Façade
- Explore Alternate Shading Techniques

Maintaining the Image

- Double-Skin Façade of the London Bridge Place

Innovative
Contemporary
Sustainable

- A Glass Tower With a Distinct Identity



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Facade Redesign

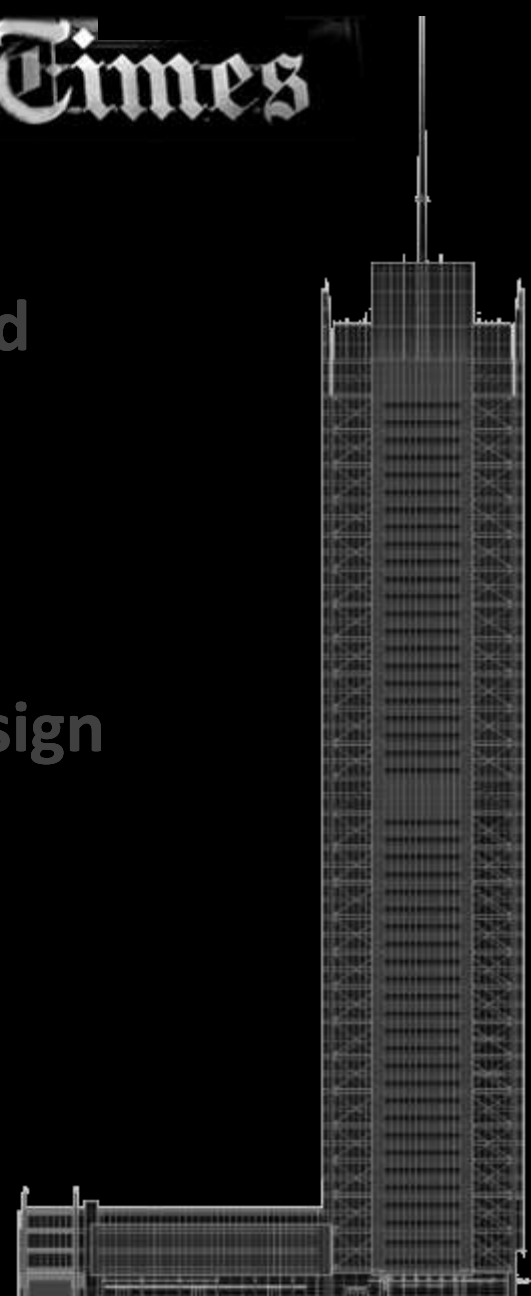
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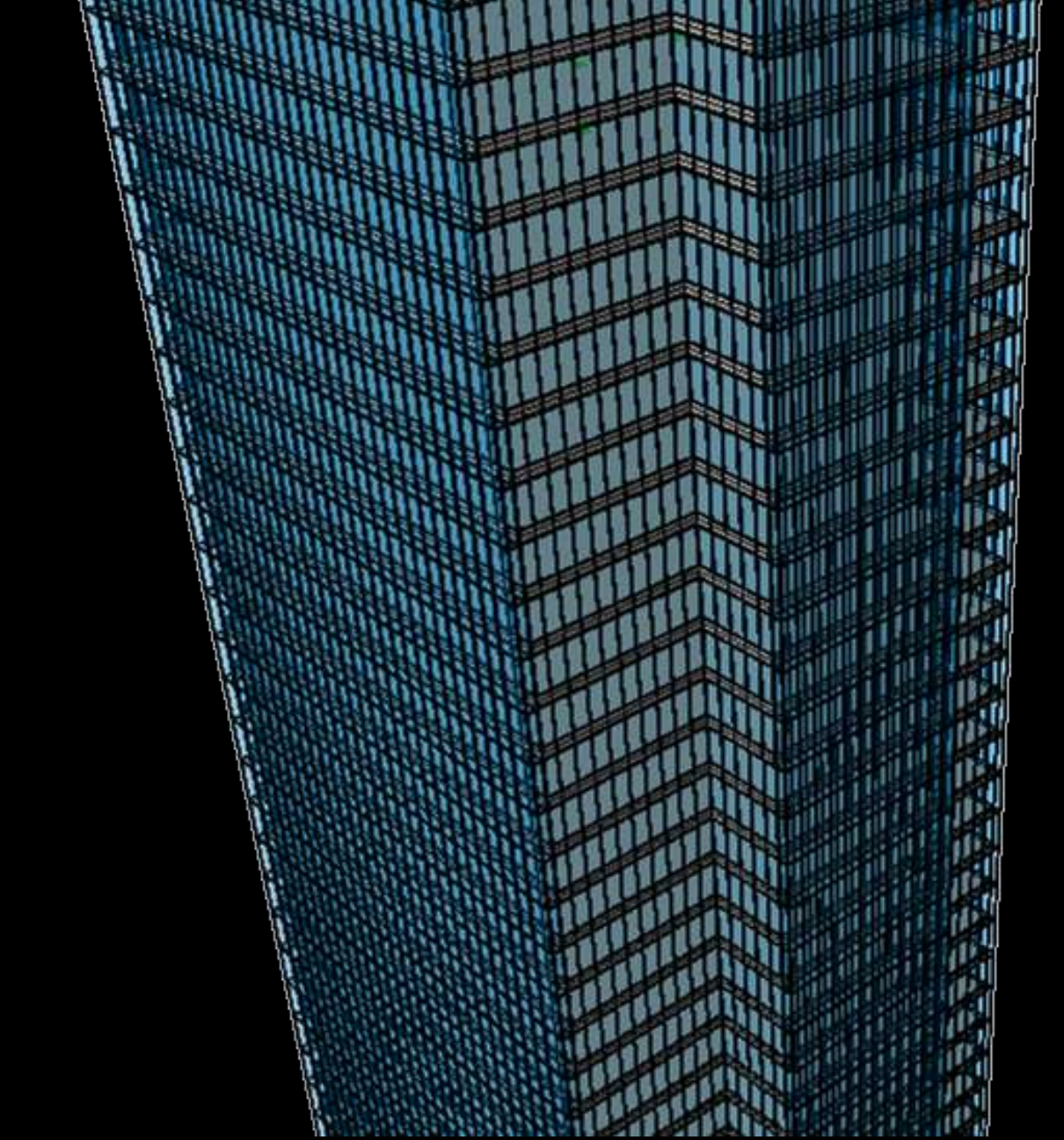
System Description

2' 6" Ventilated Cavity System Using Two Skins of Glass

1" Interior Insulating Glazing Curtain Wall

5/8" Exterior Laminated Glazing Unit

Horizontal Louvered Shading System



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Facade Redesign

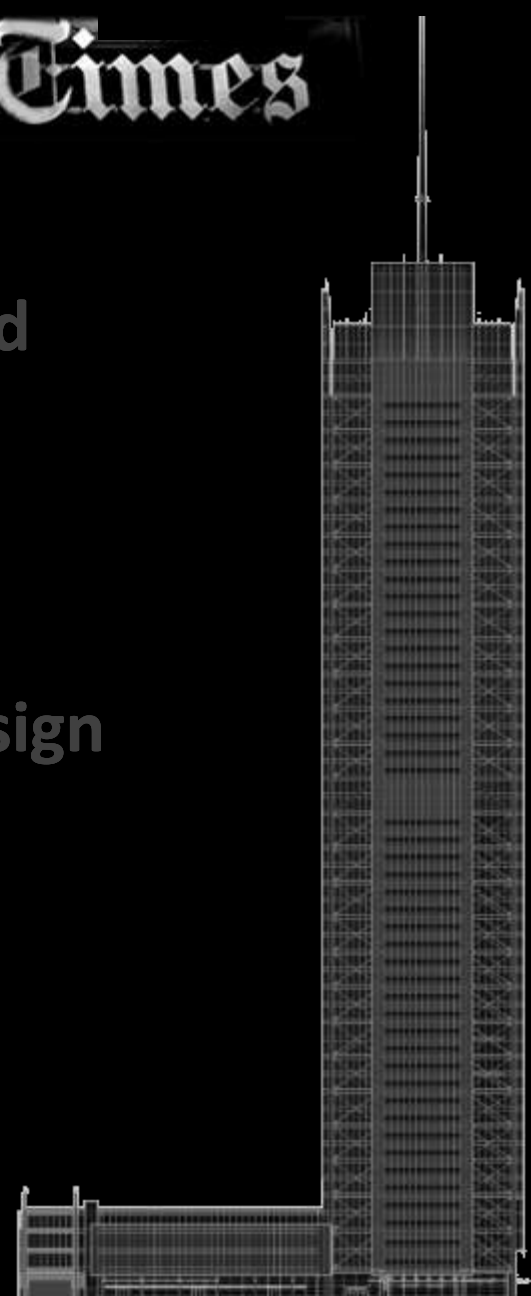
Floor System Redesign

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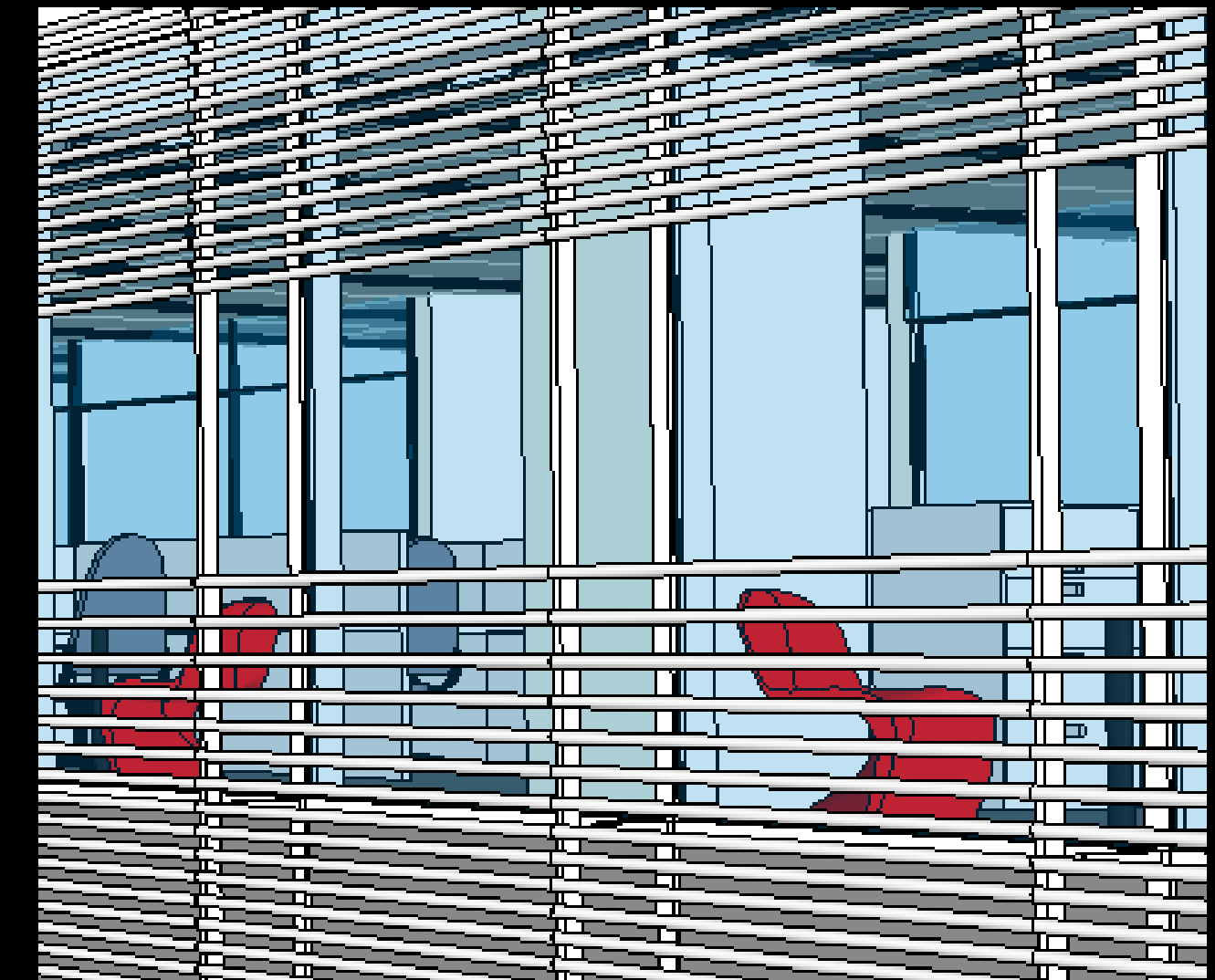
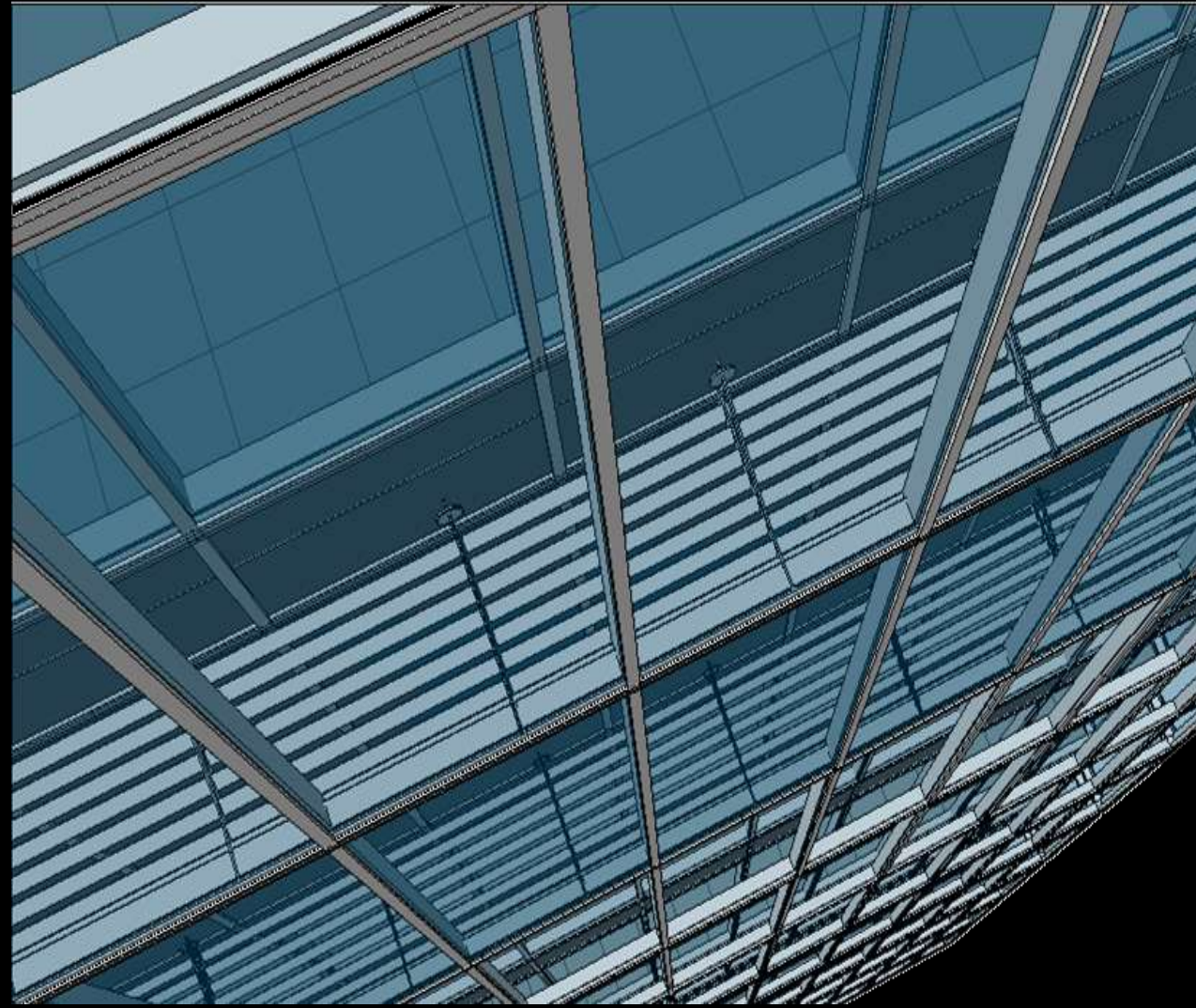
CoGen Redesign

BIM/IPD

Metrics of Success

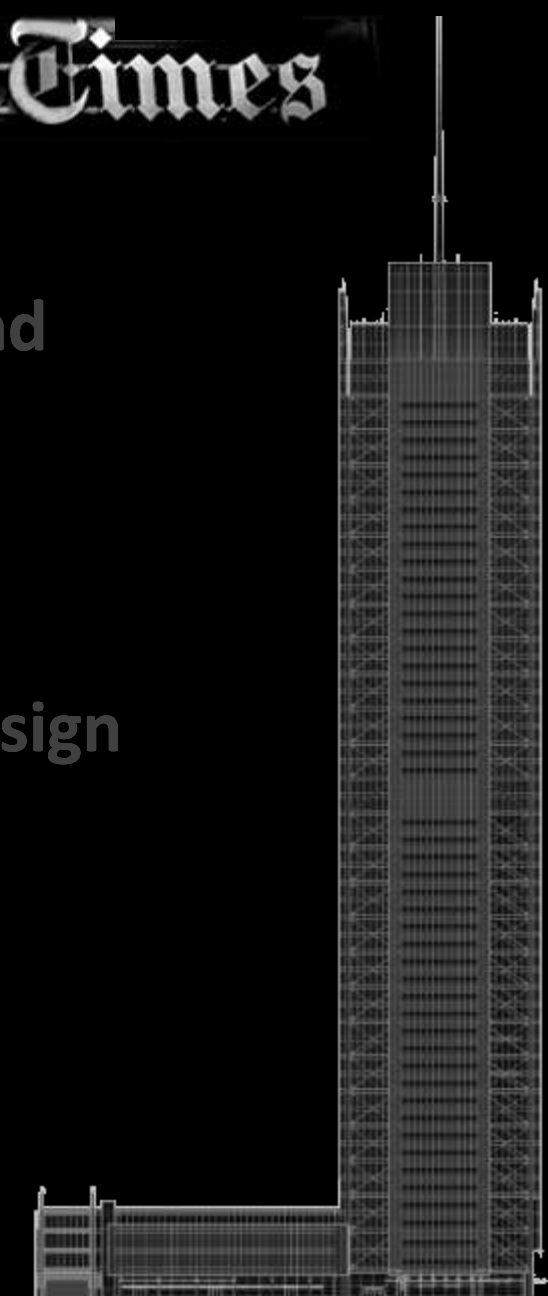


System Description

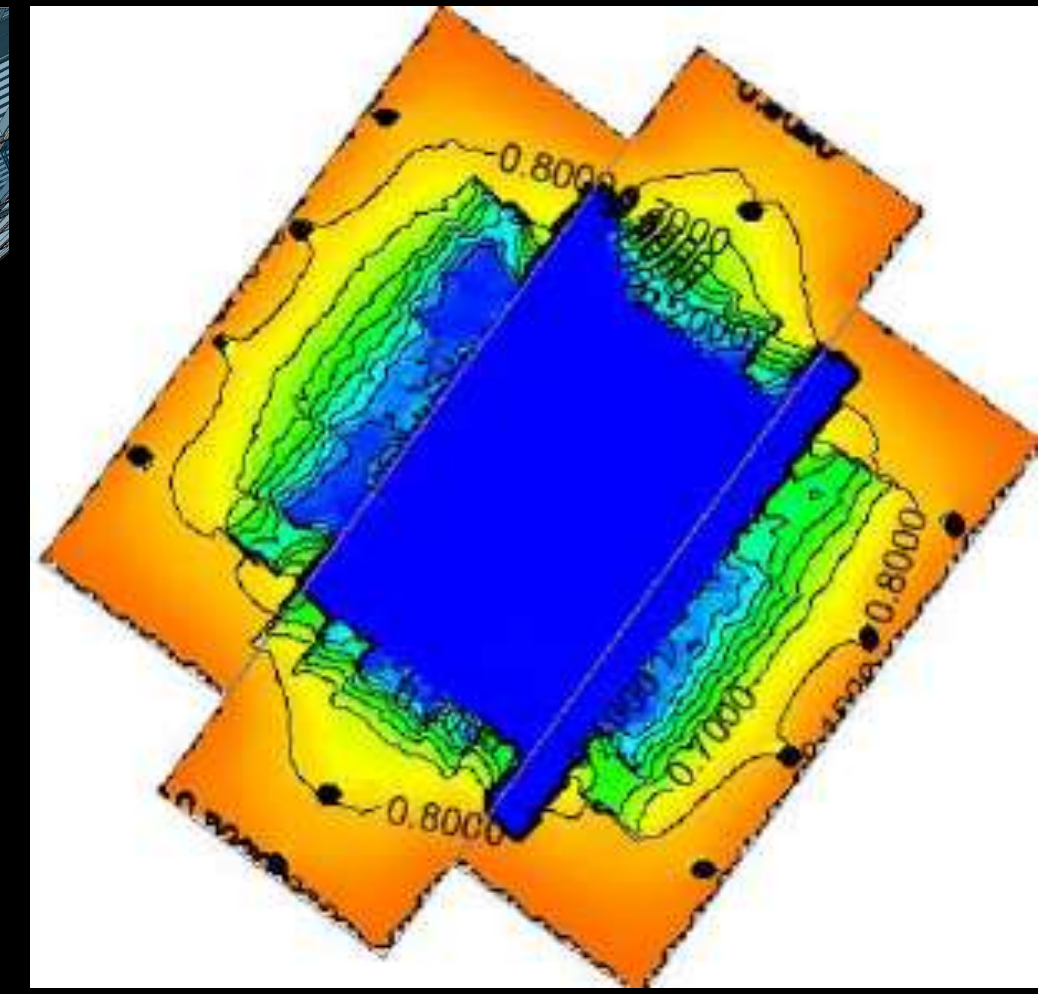
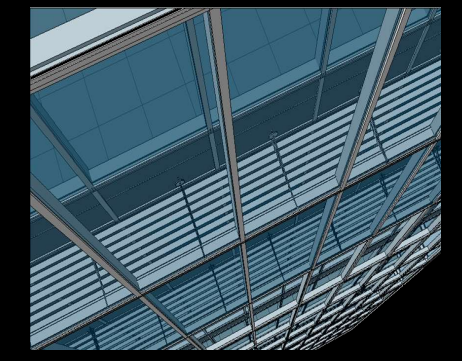


Façade Daylight Analysis

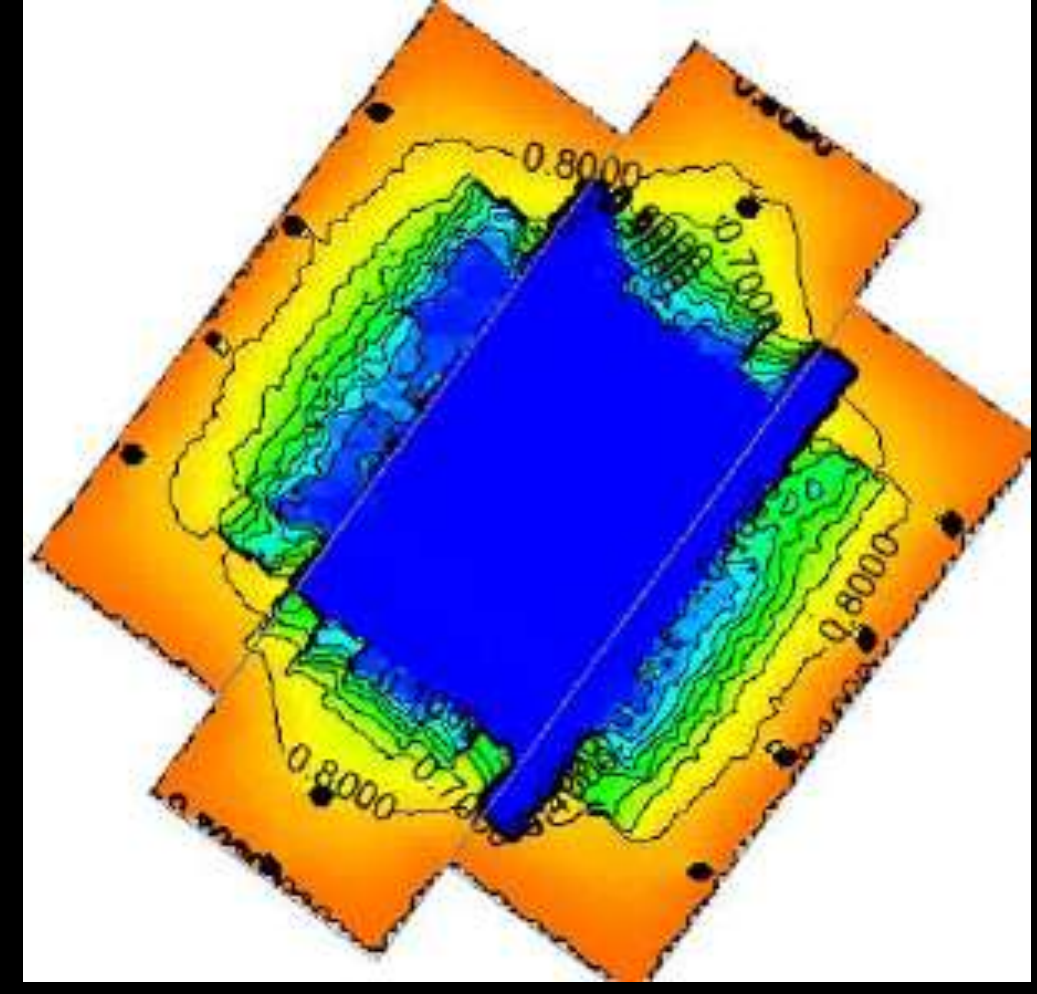
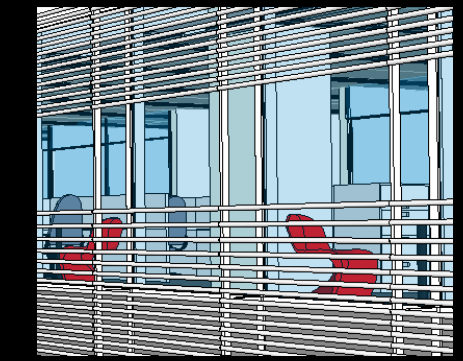
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Daylight Autonomy: Double-Skin with Louvers

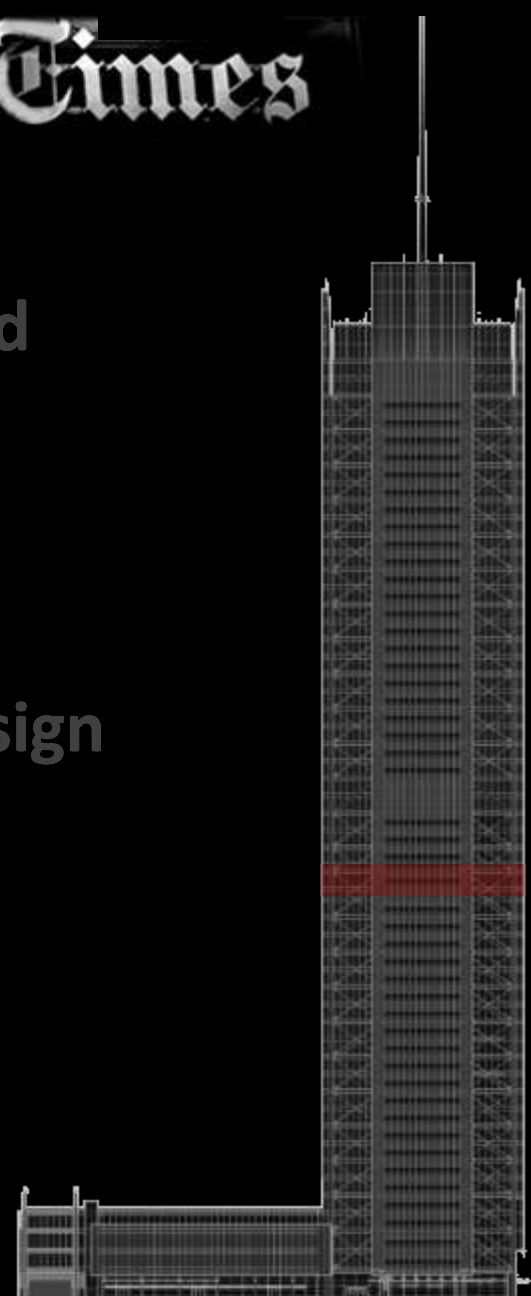


Daylight Autonomy: Ceramic Rods



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Facade Daylight Analysis

Single Floor Lighting Power Consumption

Maximum Potential: 71 kWh

Rod Design: 27 kWh

Louvered Design: 28 kWh

Both Designs: 60% Energy Savings



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Façade Redesign

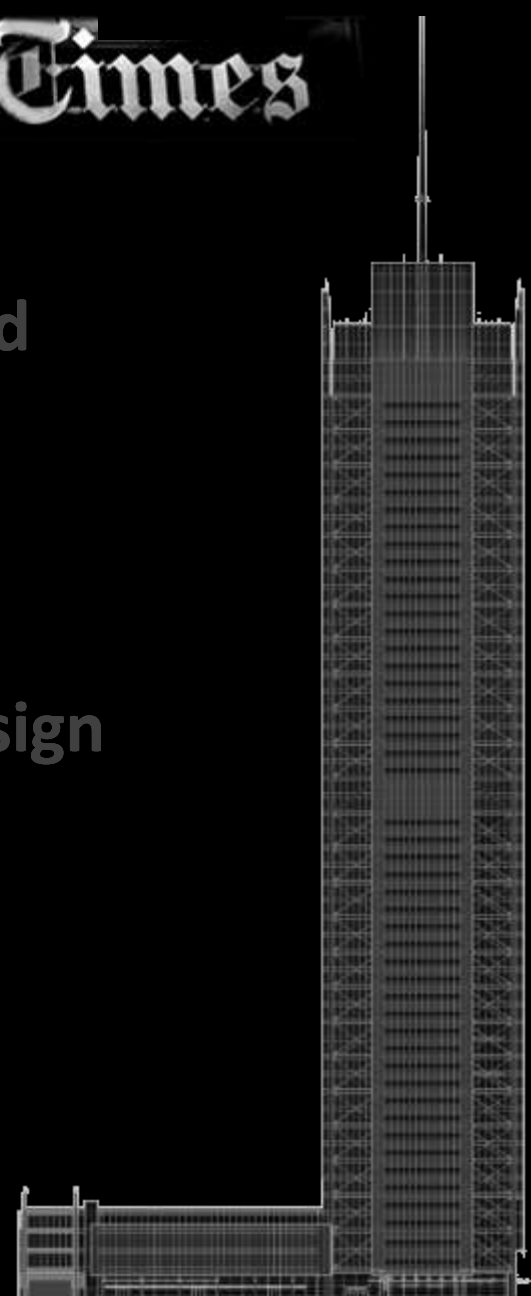
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Thermal Loads

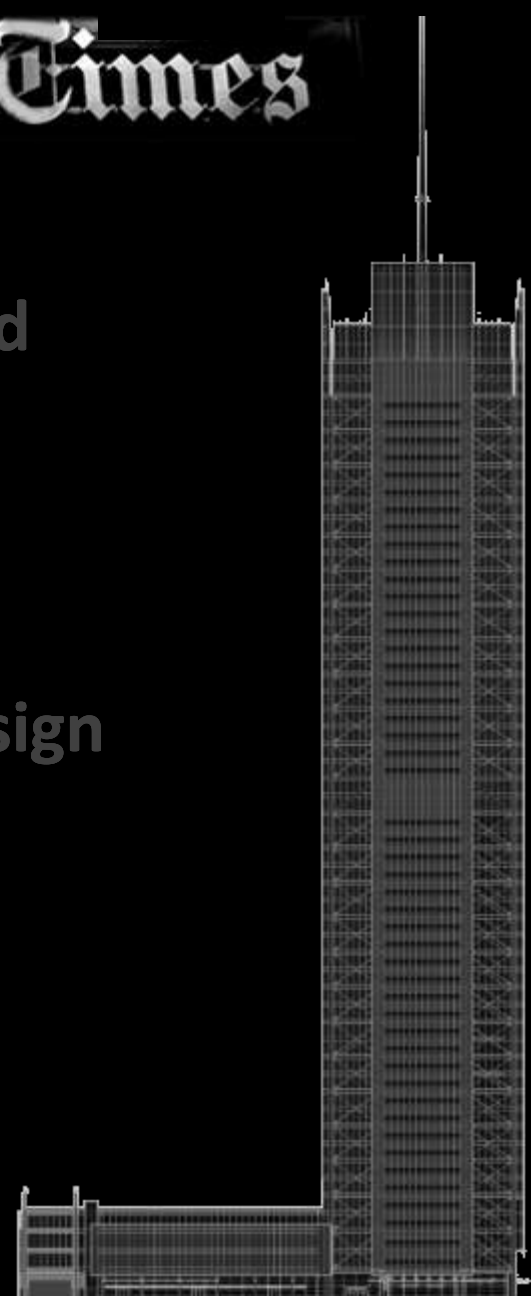
Existing HVAC Envelope Loads:

- Peak cooling: 58%
- Peak heating: 75%

Double-Skin Façade Thermal Efficiency:

- Decreased U-value
- Decreased Shading Coefficient

	Existing Façade	Double-Skin Façade
U-Value	0.625	0.50
Shading Coefficient	0.750	0.38



Thermal Loads

Existing HVAC Envelope Loads:

- Peak cooling: 58%
- Peak heating: 75%

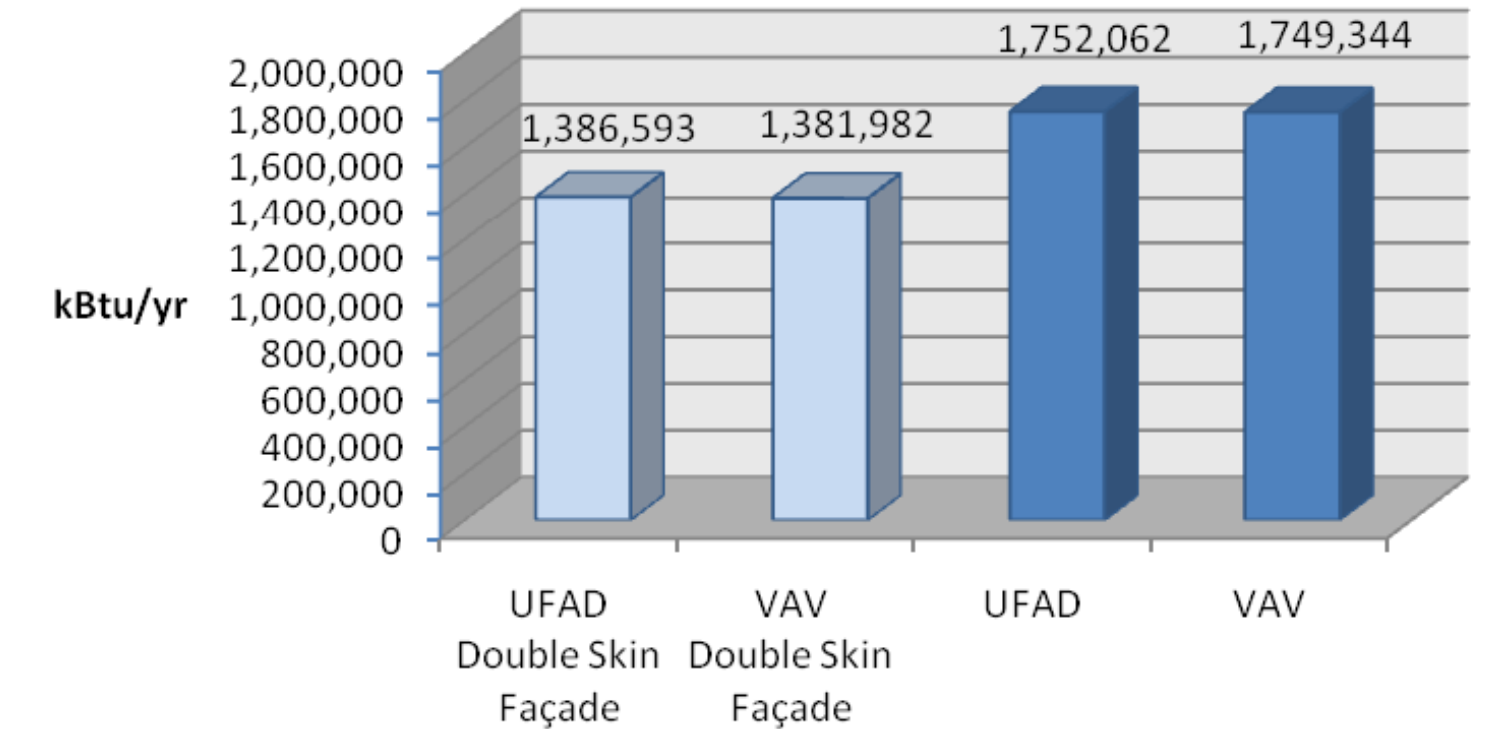
Double-Skin Façade Thermal Efficiency:

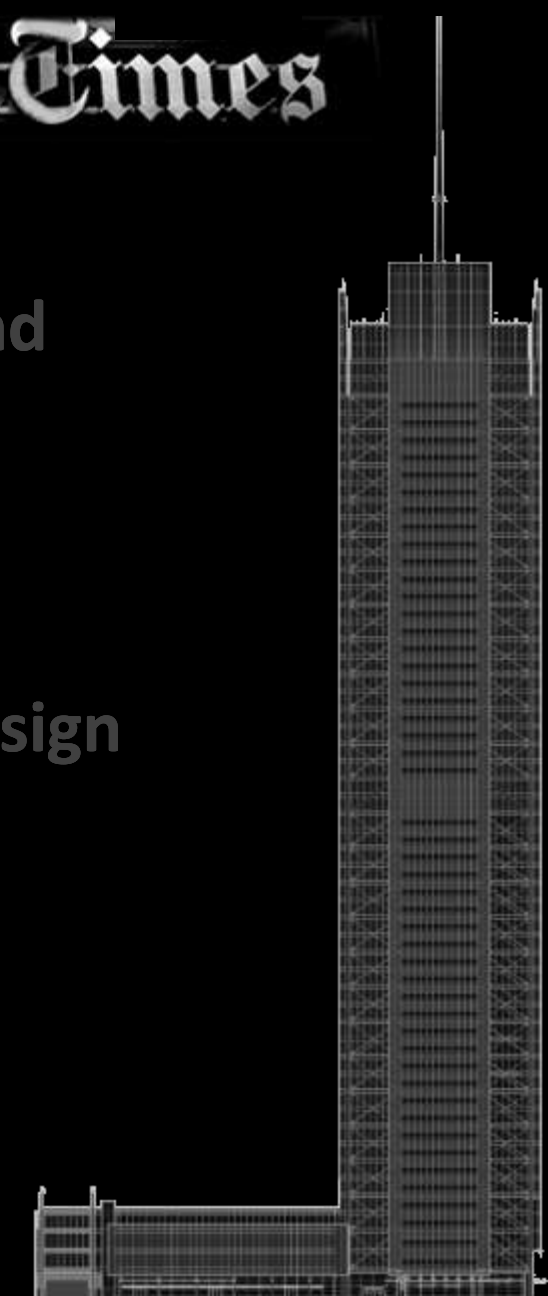
- Decreased U-value
- Decreased Shading Coefficient

Savings:

- Energy (21%)

Yearly Energy Consumption by Floor





Thermal Loads

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- Peak heating: 75%

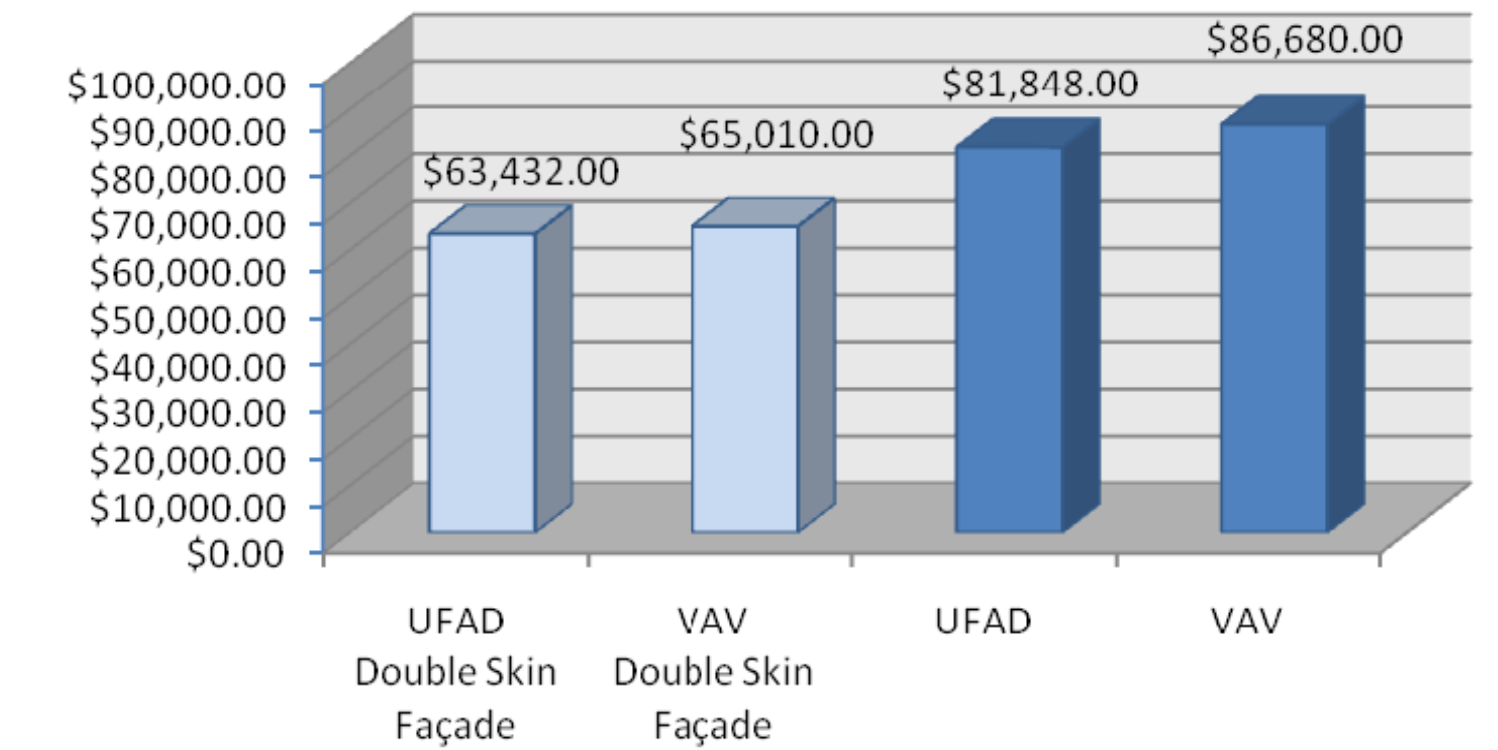
Double-Skin Façade Thermal Efficiency:

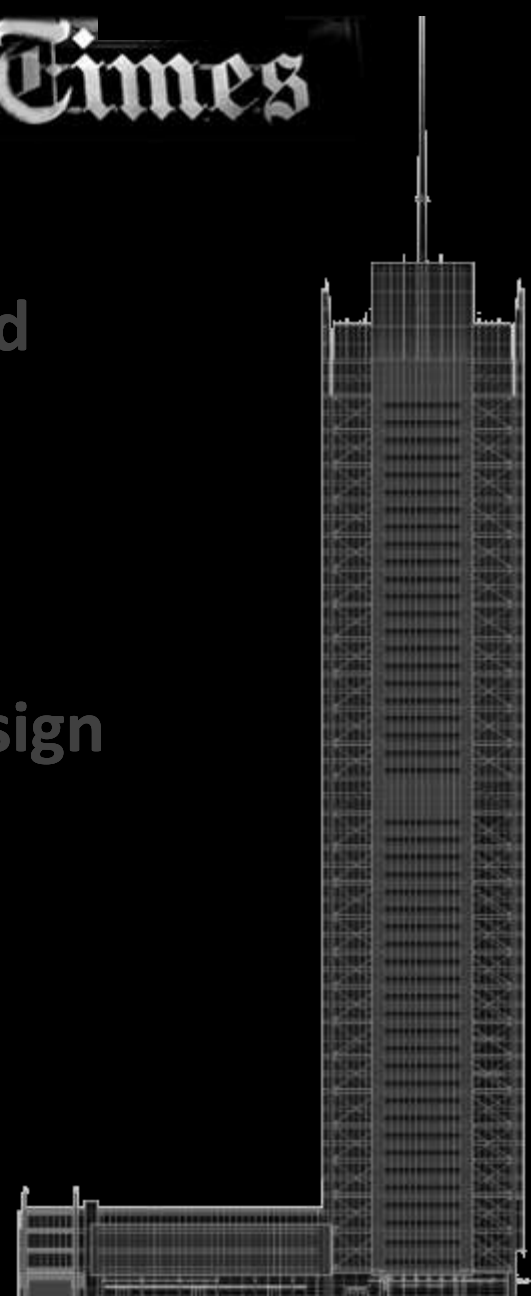
- Decreased U-value
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Savings:

- Energy (21%)
- Cost (\$800,000 / year)

Yearly Energy Costs by Floor





Thermal Loads

Existing HVAC Envelope Loads:

- Peak cooling: 58%
- Peak heating: 75%

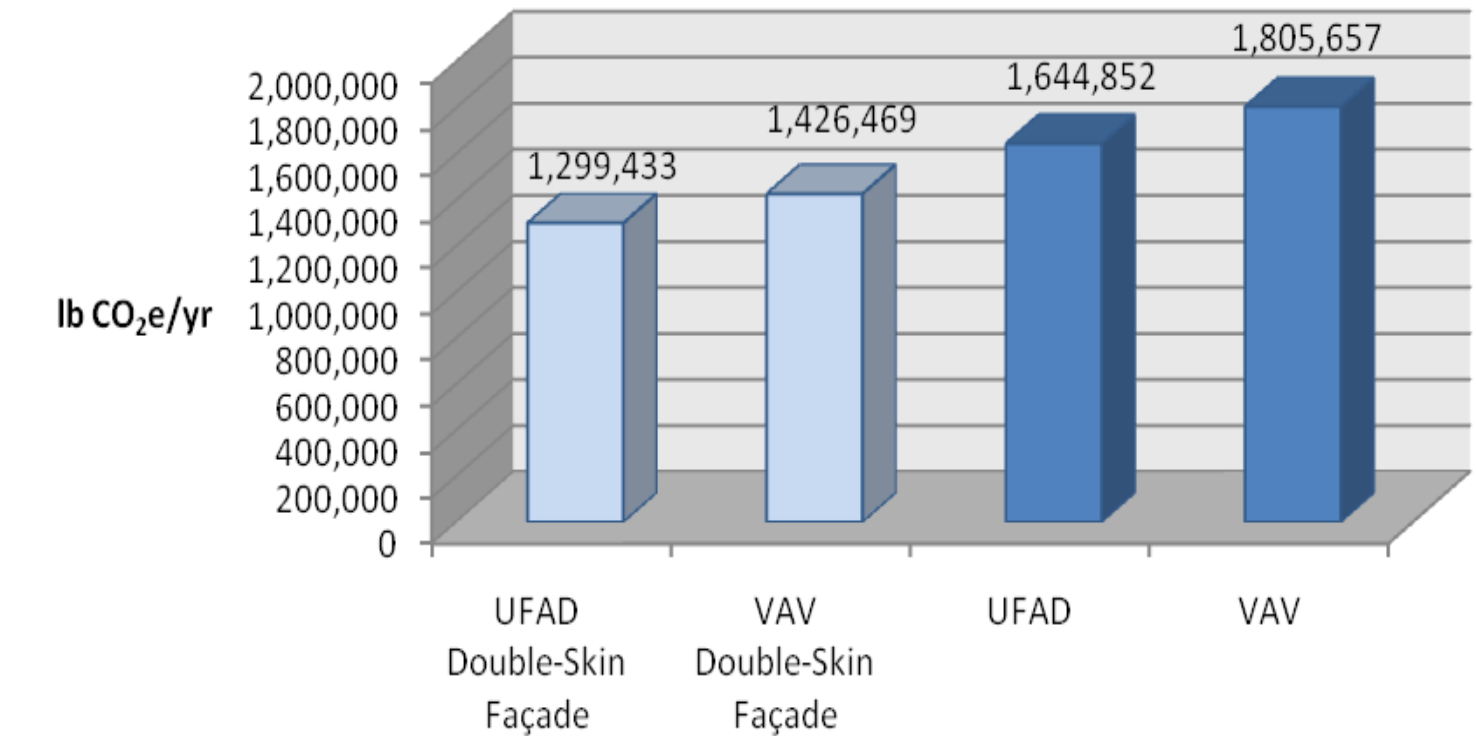
Double-Skin Façade Thermal Efficiency:

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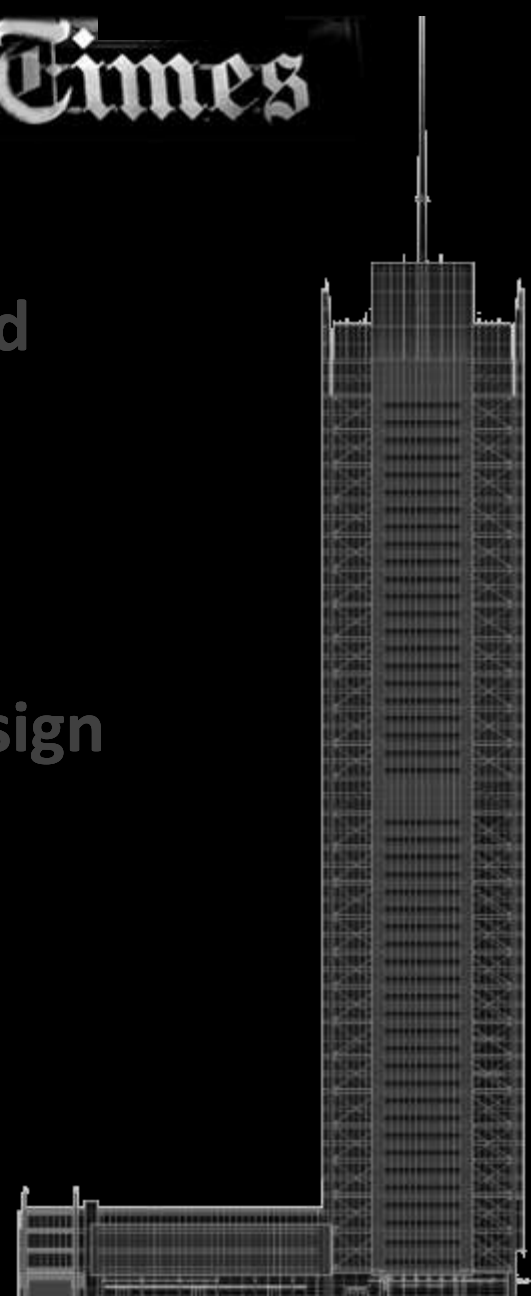
Savings:

- Energy (21%)
- Cost (\$800,000 / year)
- Emissions (23%)

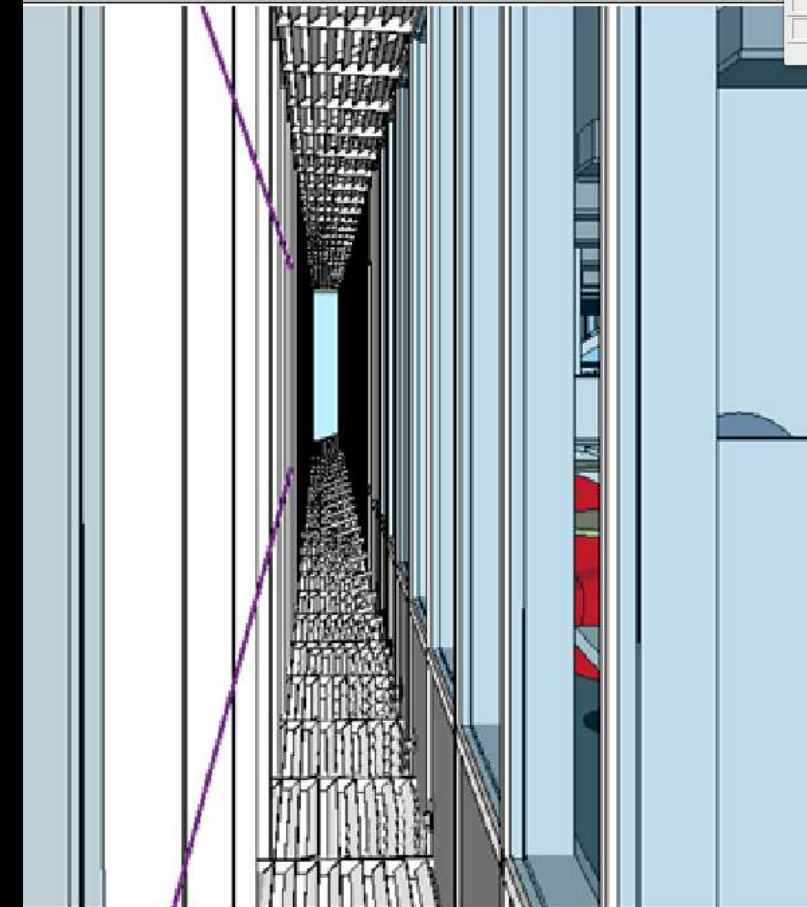
HVAC Associated Emissions by Floor (CO₂e)



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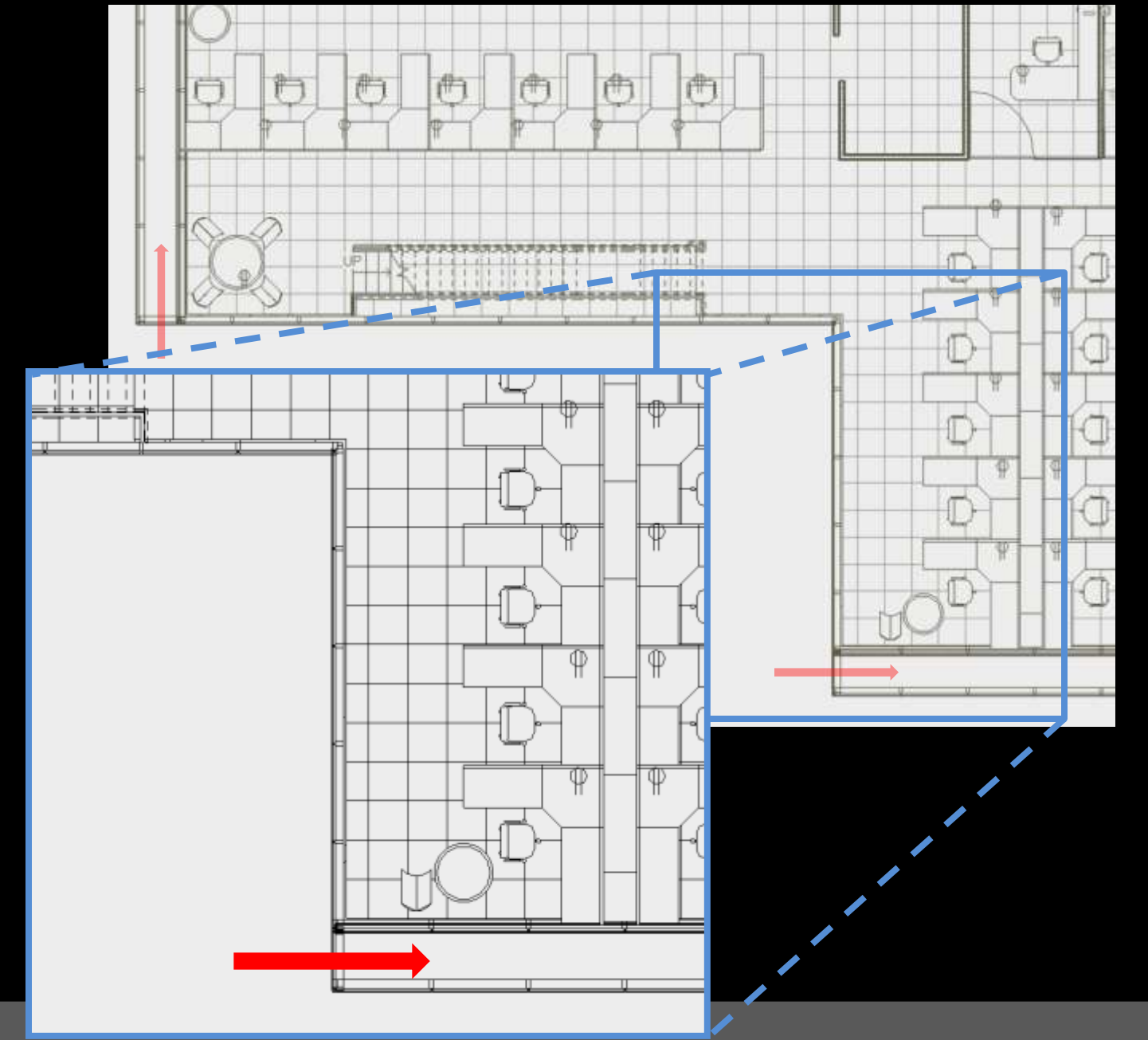


Serviceability and Maintenance



2' 6" accessible cavity

Louvers support walking loads



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Façade Redesign

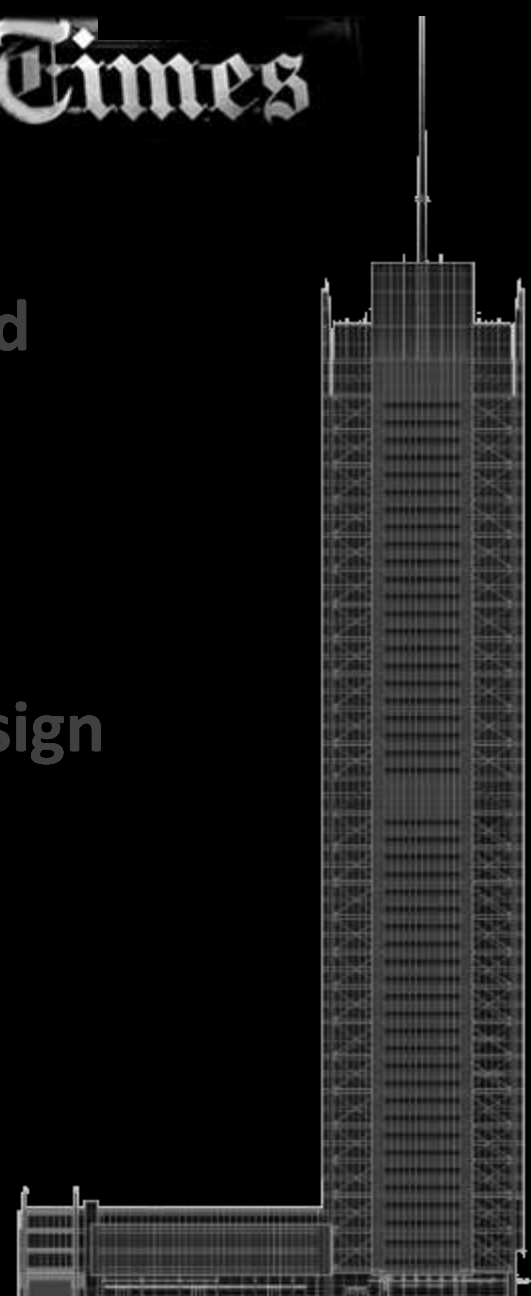
Floor System Redesign

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Cost Comparison:

Double-skin façade up front cost: \$18.7 million increase

Annual energy savings: \$800,000

Simple payback period : 23.43 years

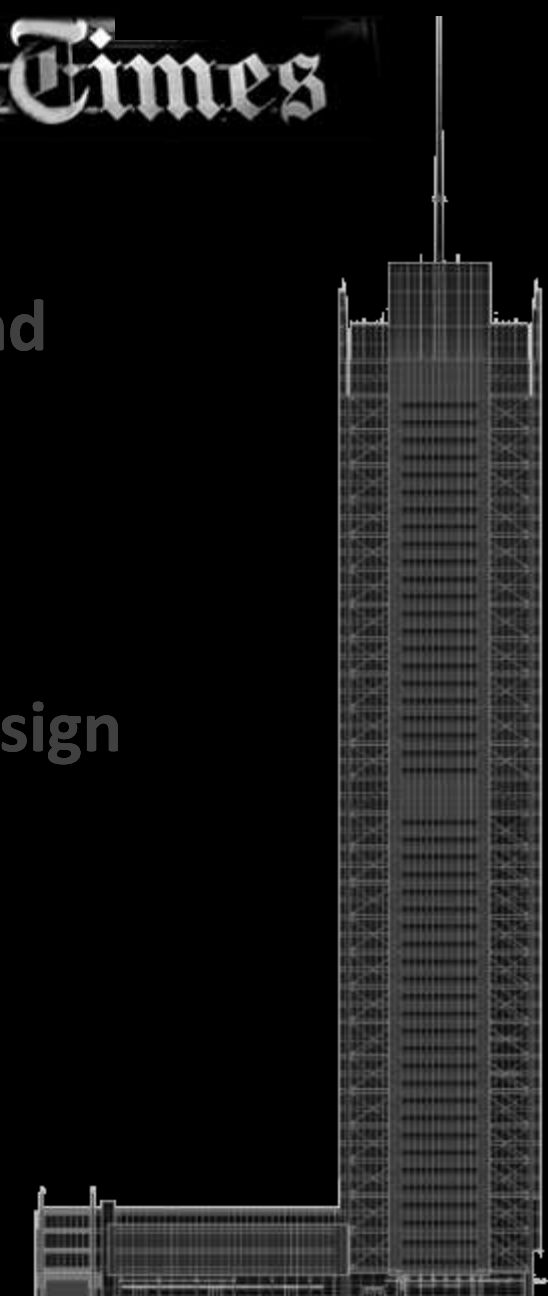
Original Façade System	\$ 83,527,260
Proposed Double Façade	\$ 102,273,745
Upfront Cost Increase	\$ 18,746,485
Annual Energy Savings	\$ (800,000)
Simple Payback Period	23.43 Years

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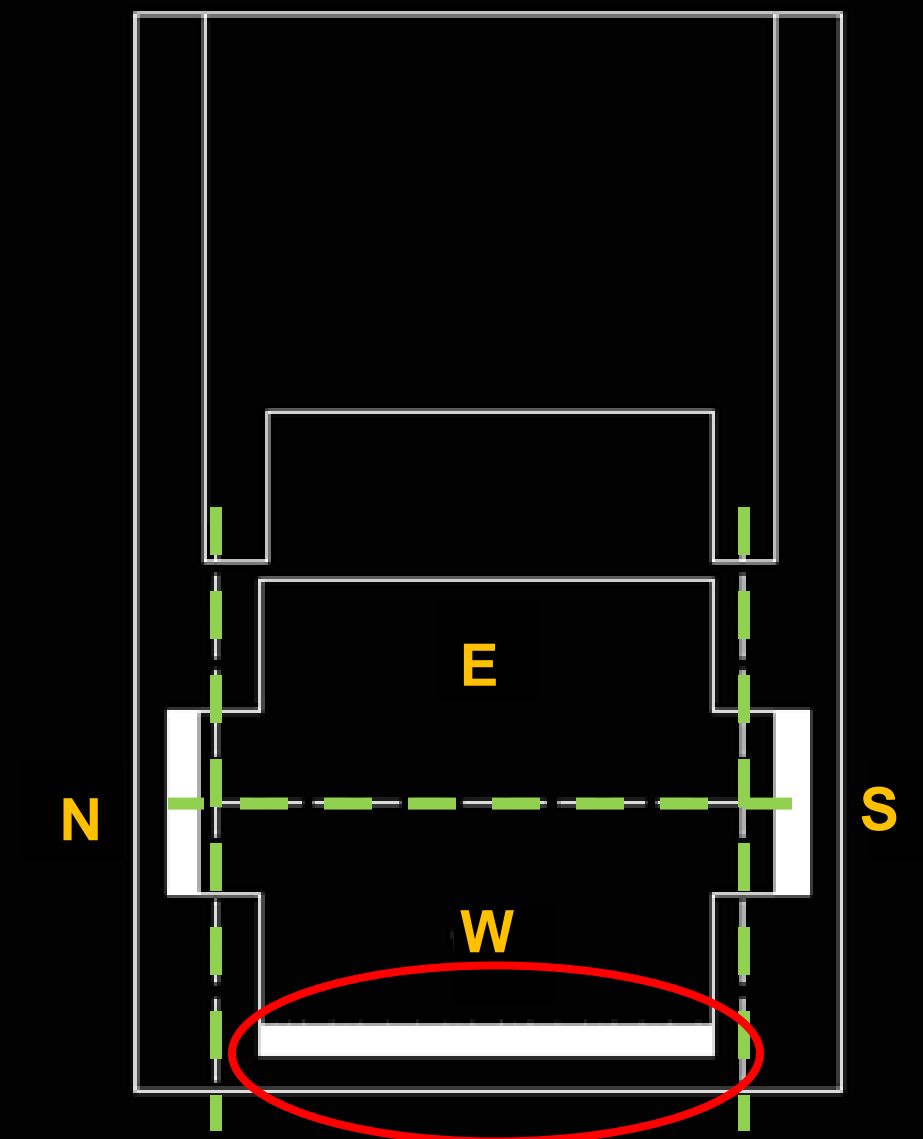
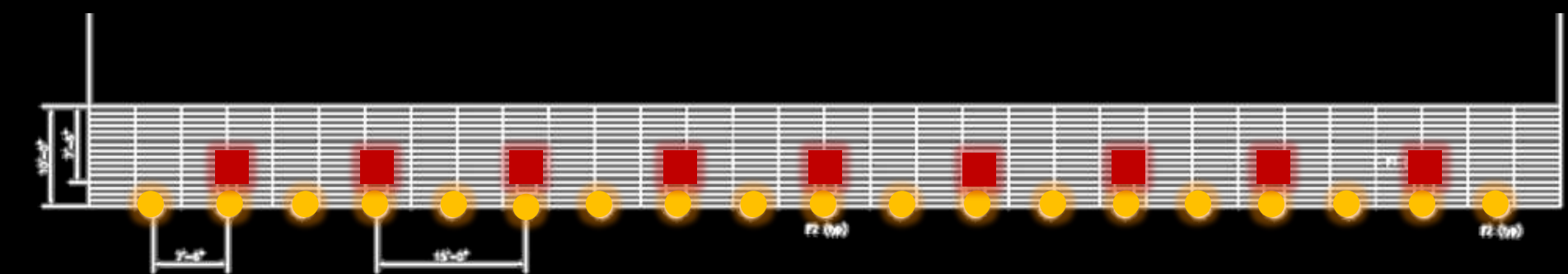
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Façade Lighting Redesign



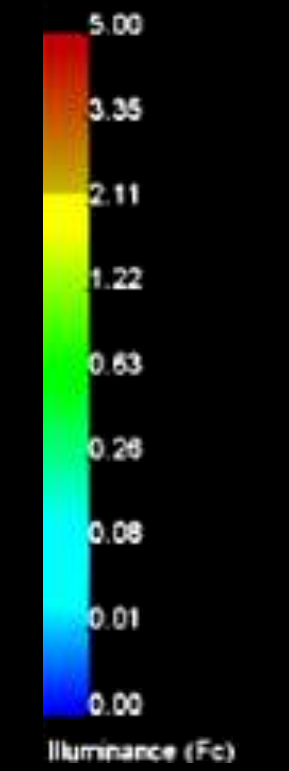
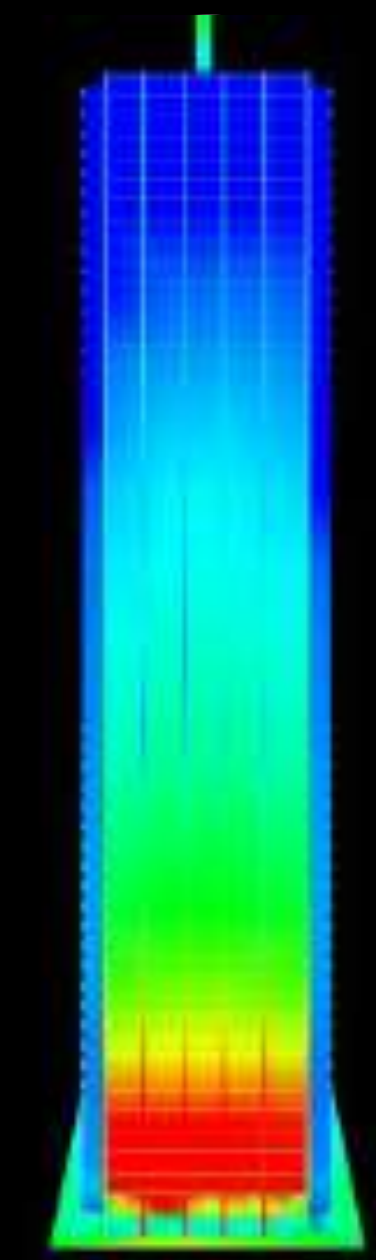
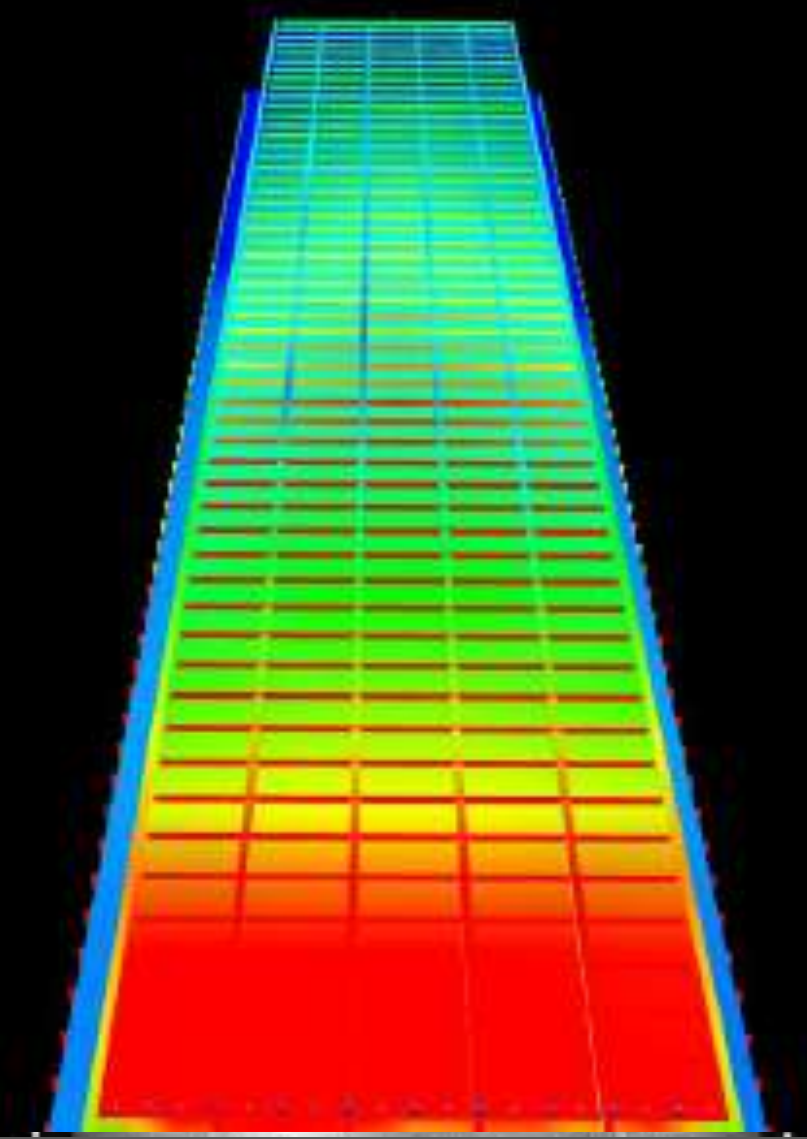
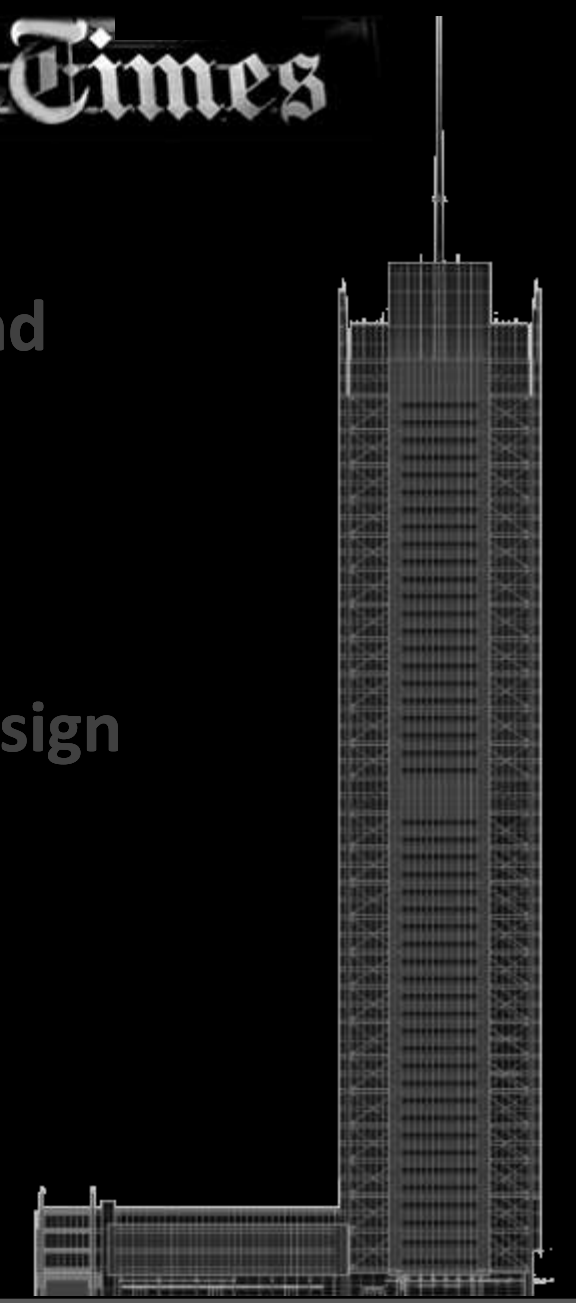
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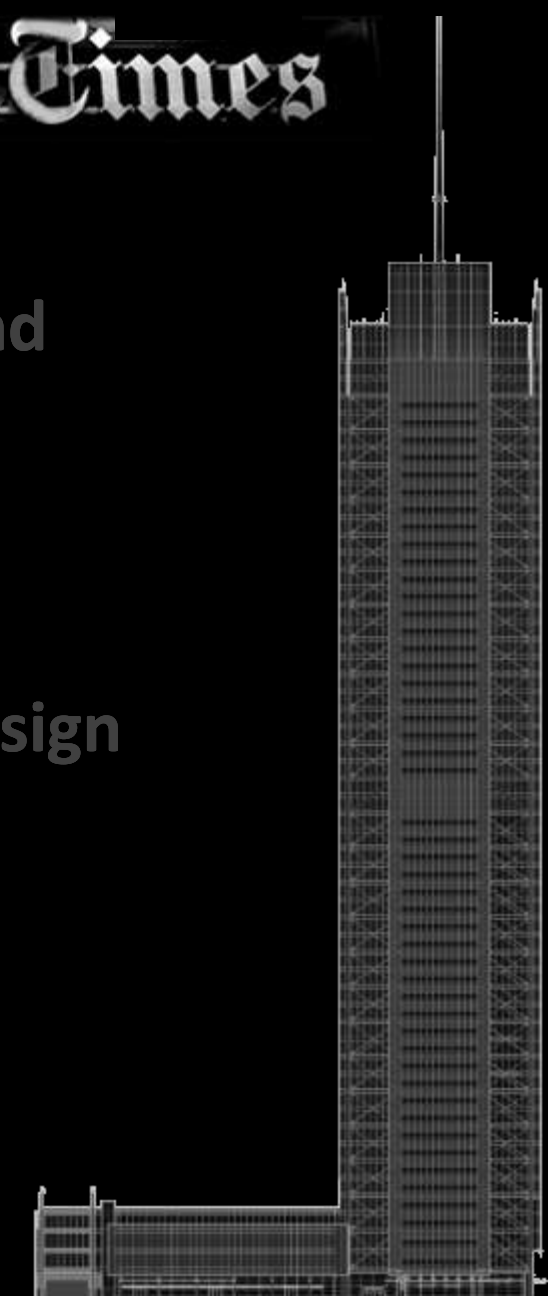


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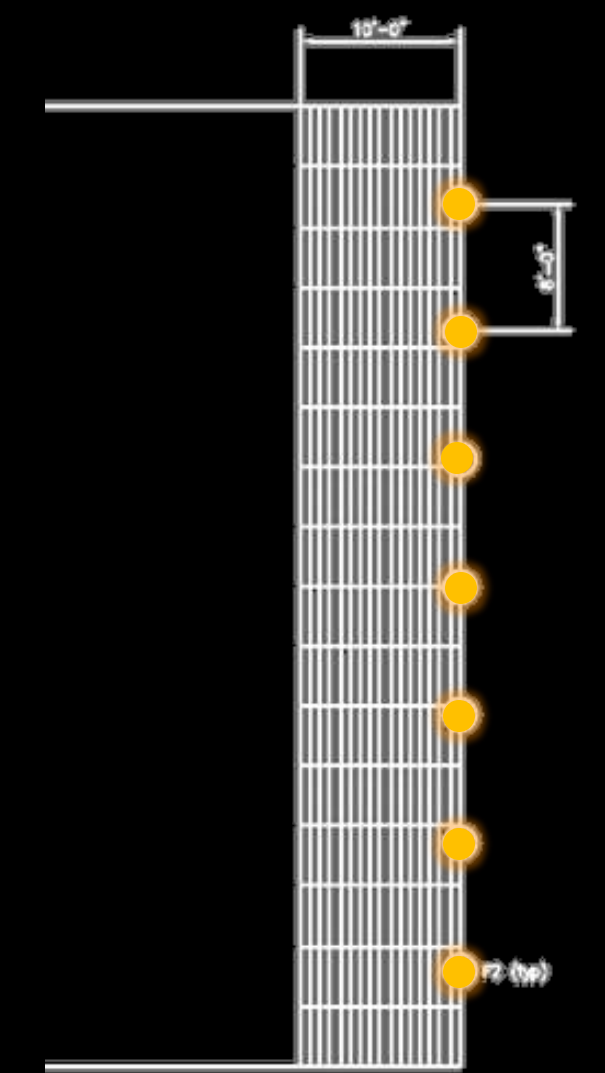
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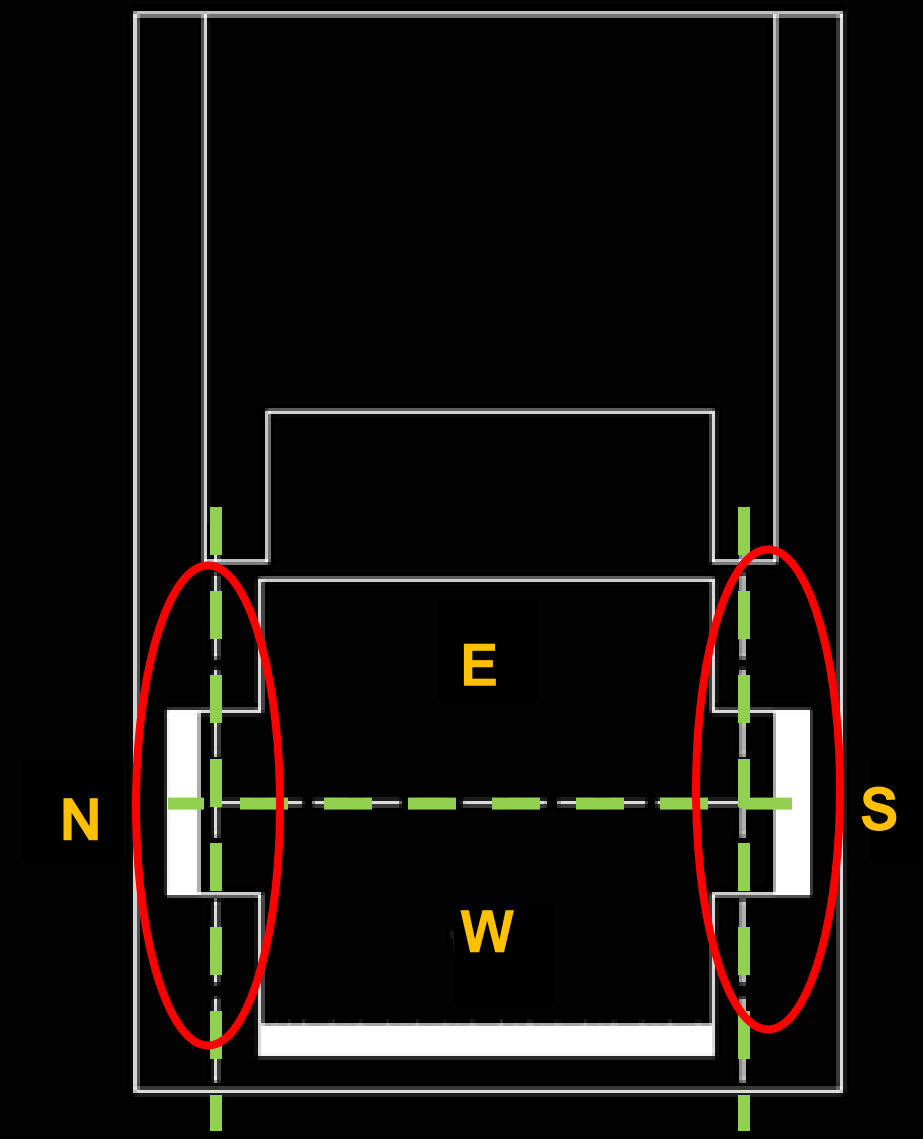
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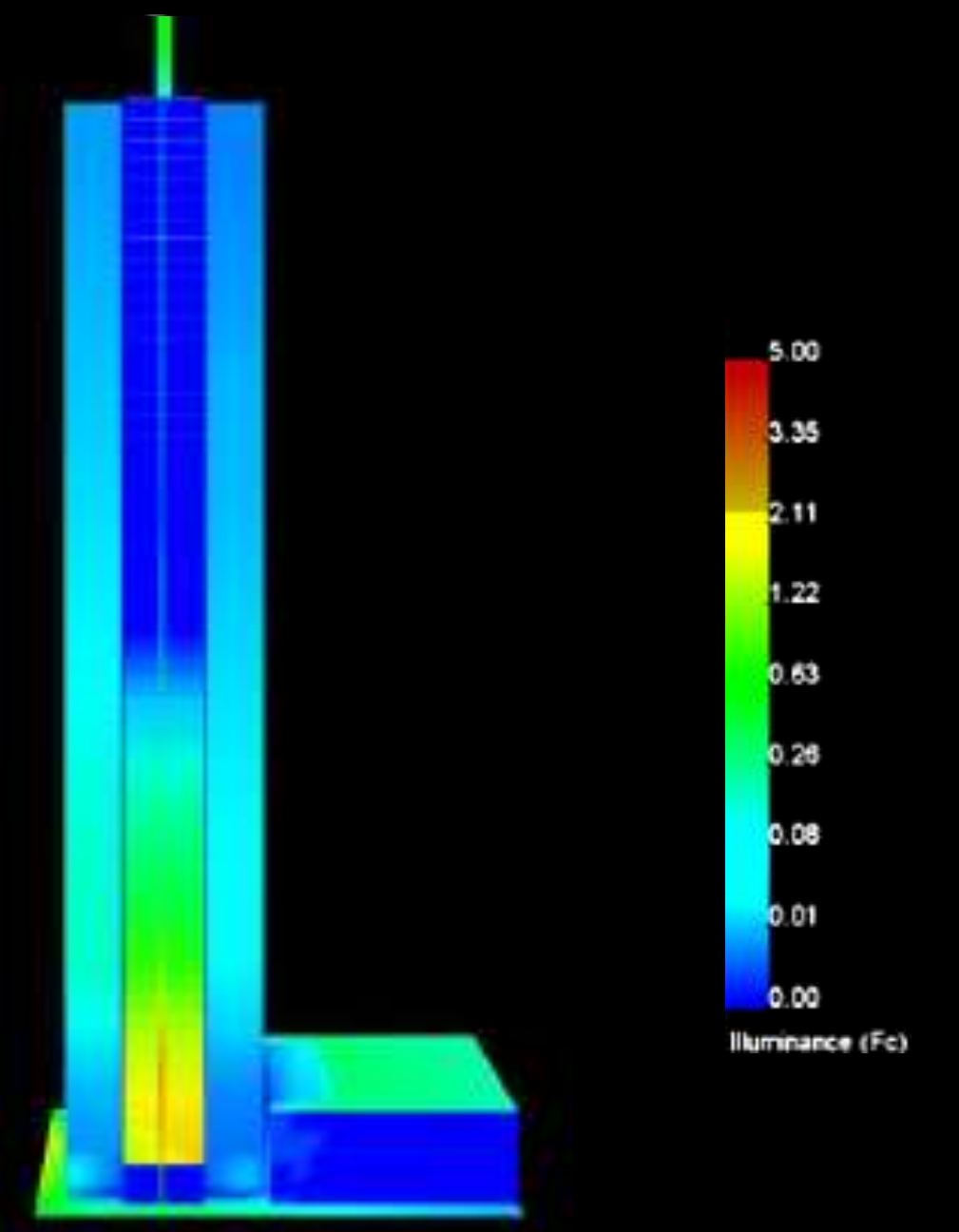
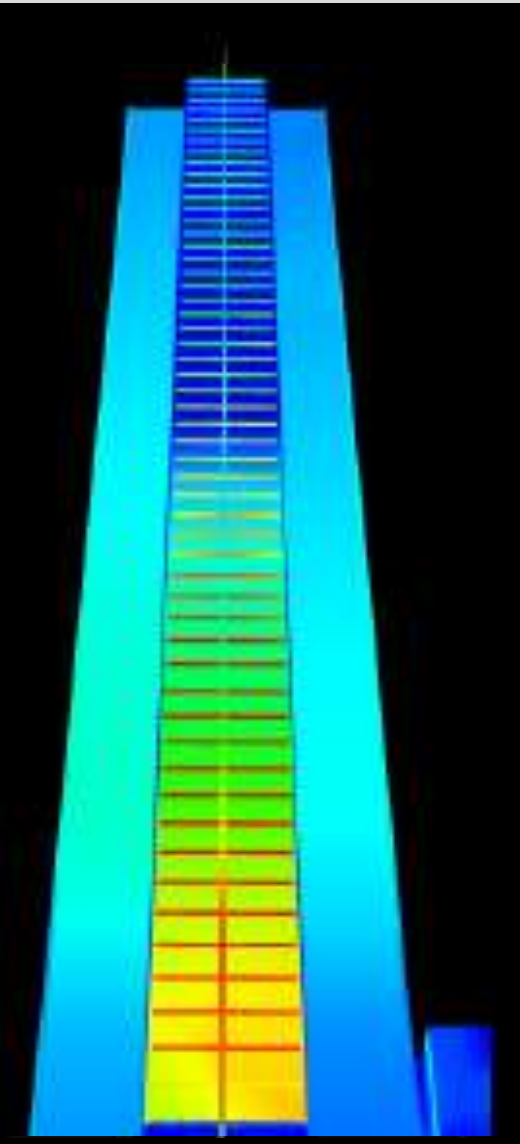
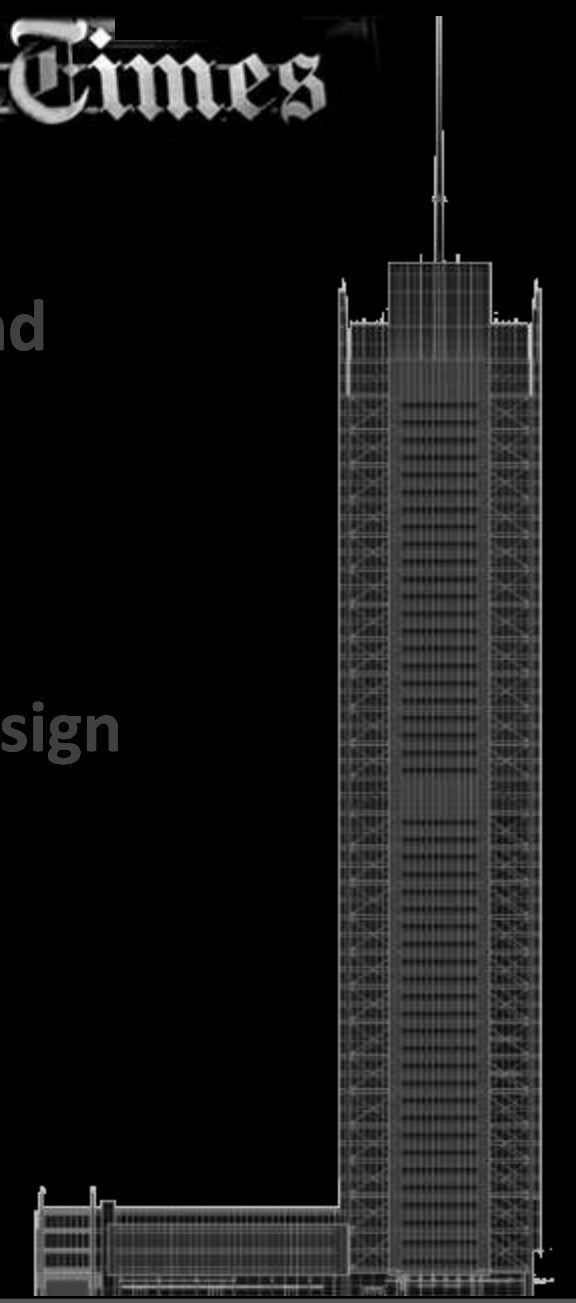


● 400W Floodlight



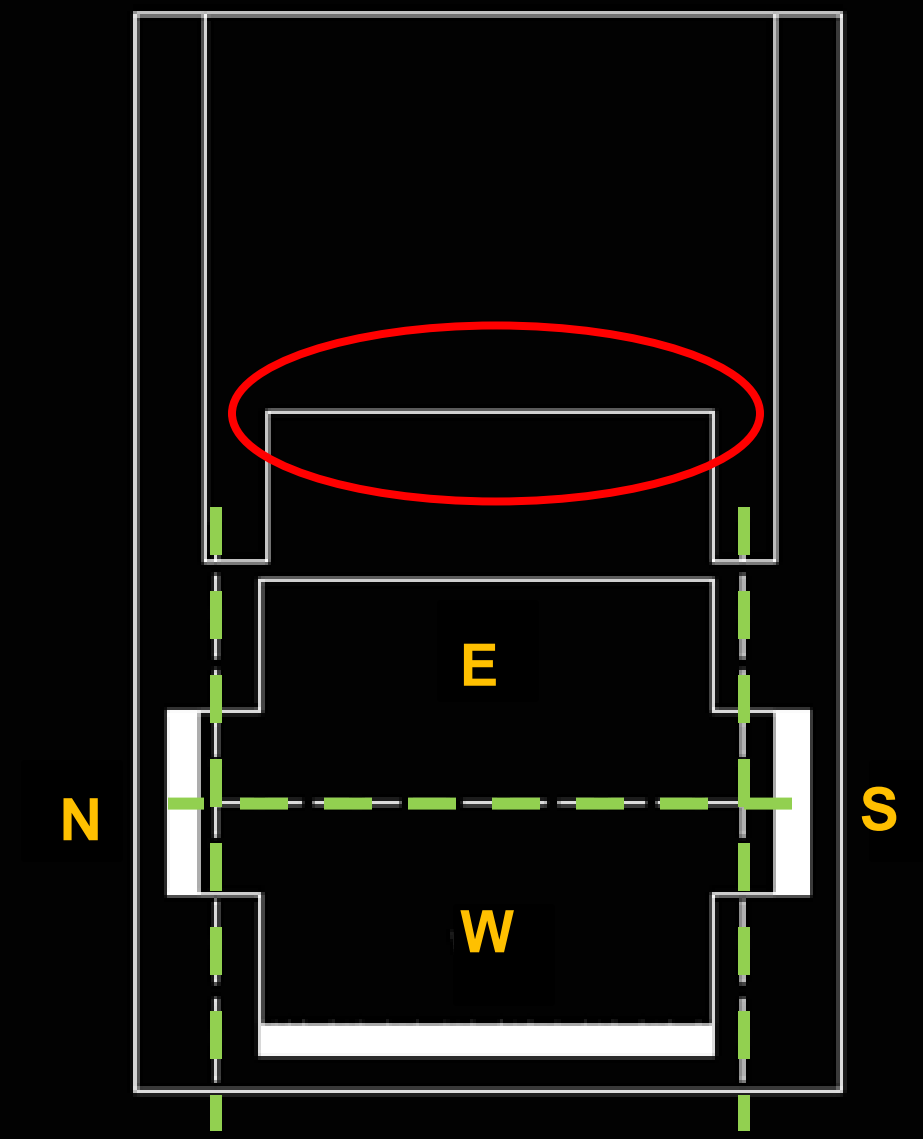
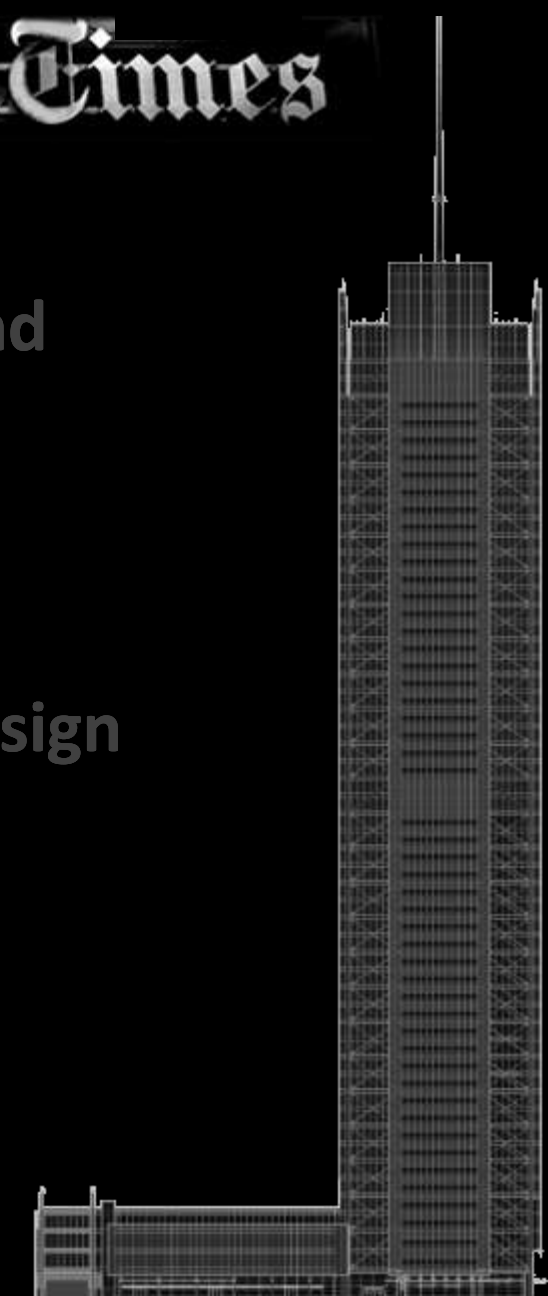
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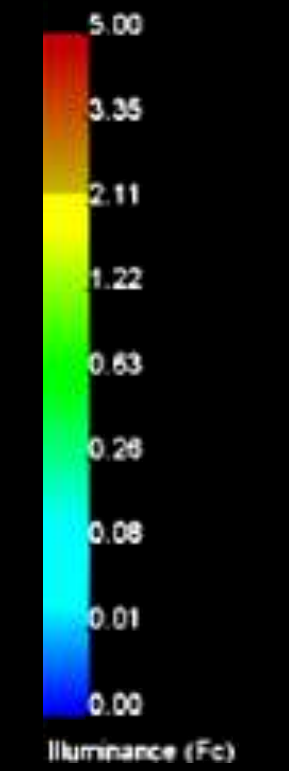
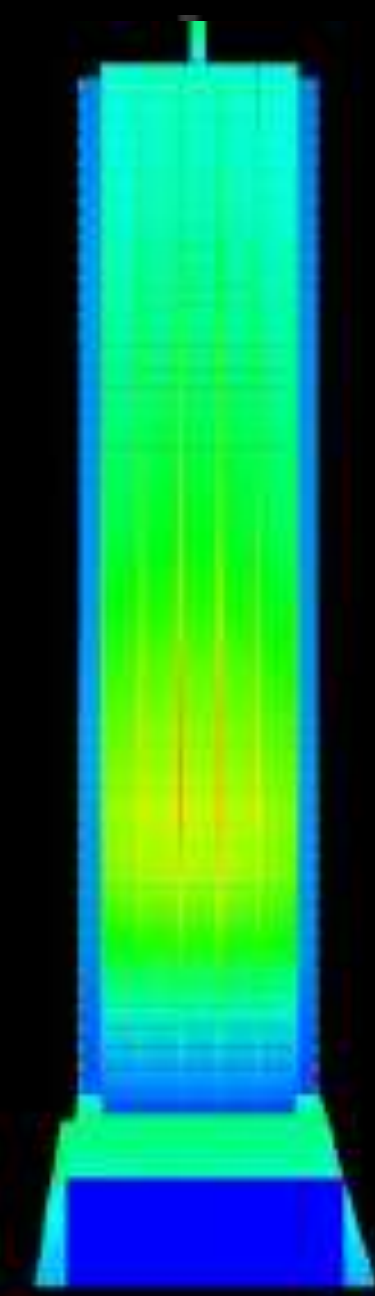
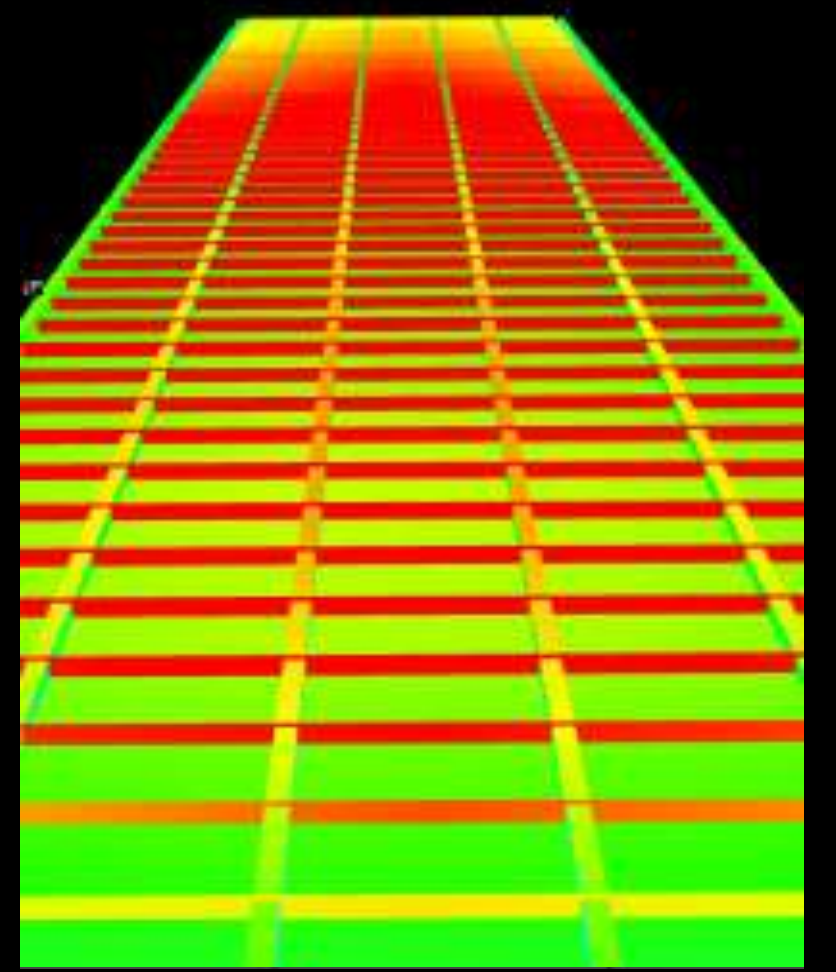
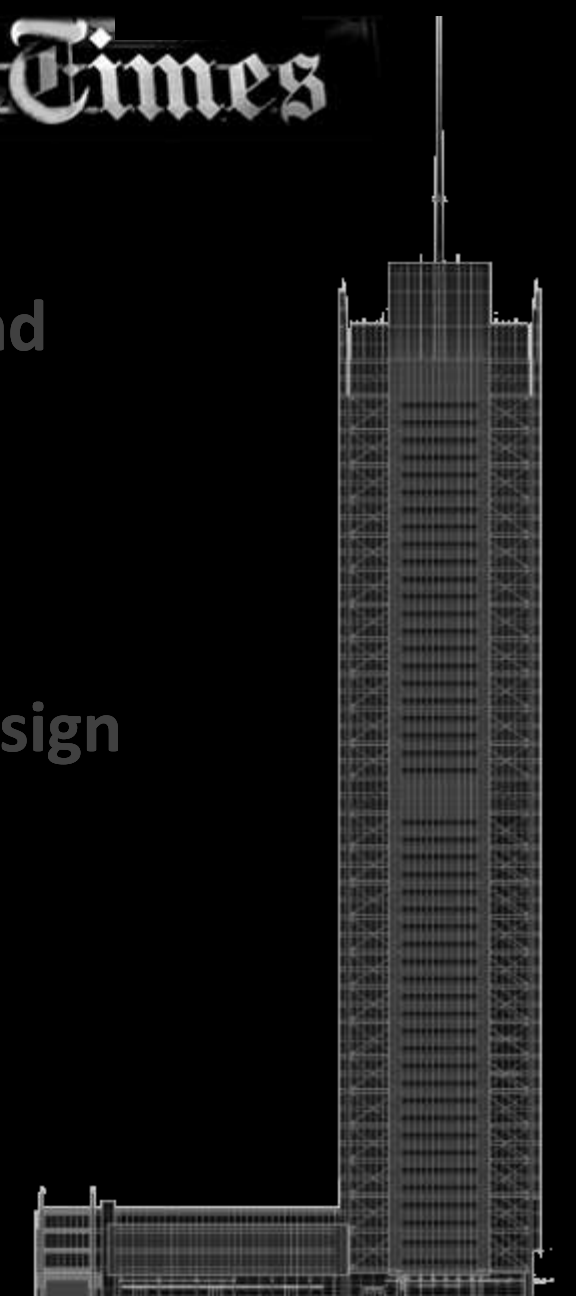
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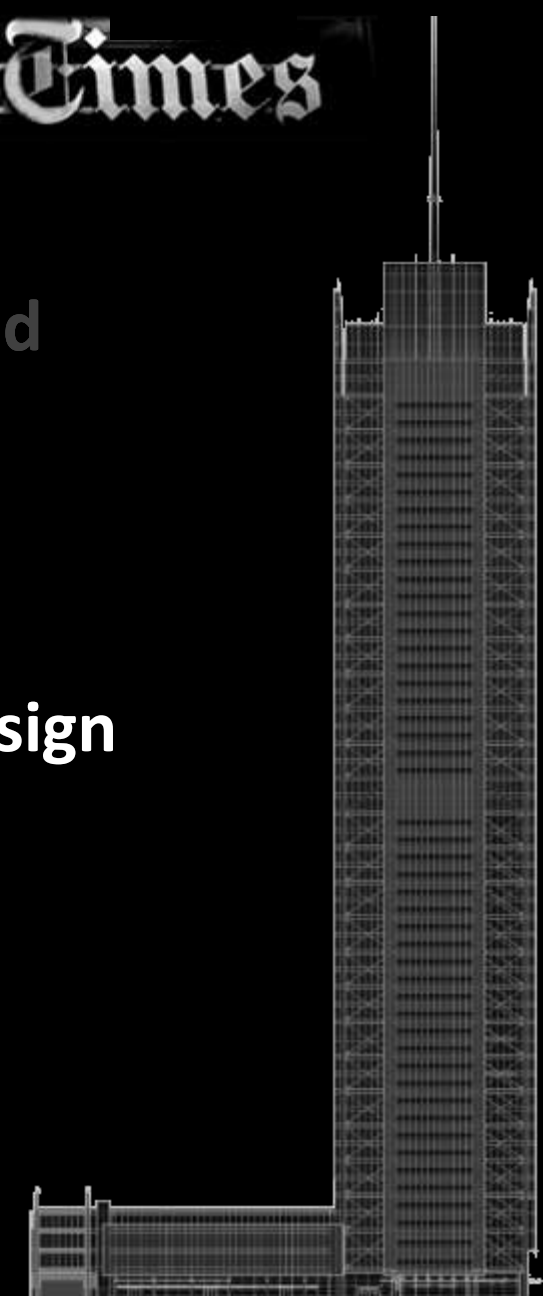
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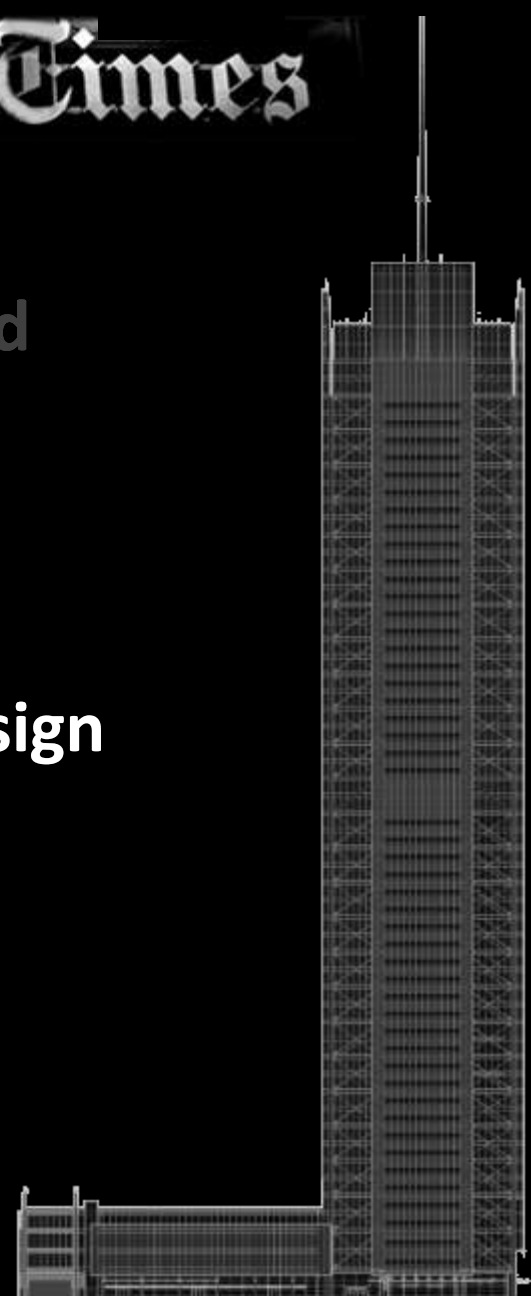
Floor System Redesign

Goals:

- Increase rentable floor space
- Decrease floor-to-floor height

Redesign Opportunities:

- HVAC (UFAD/VAV to Chilled Beams)
- Structural Floor System (Castellated Beams)



Structural Analysis

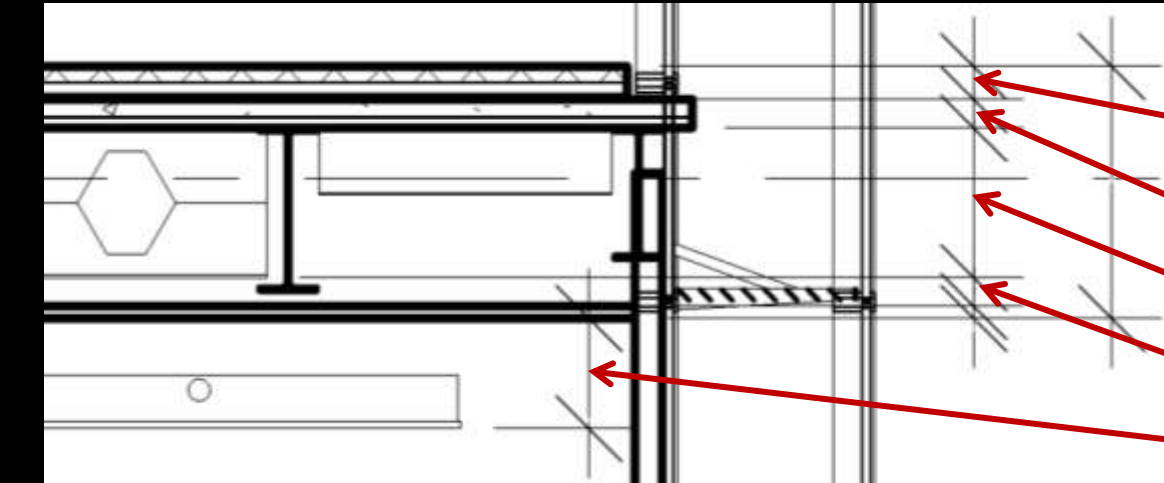
Initial Study

Investigate the required depth for interstitial space

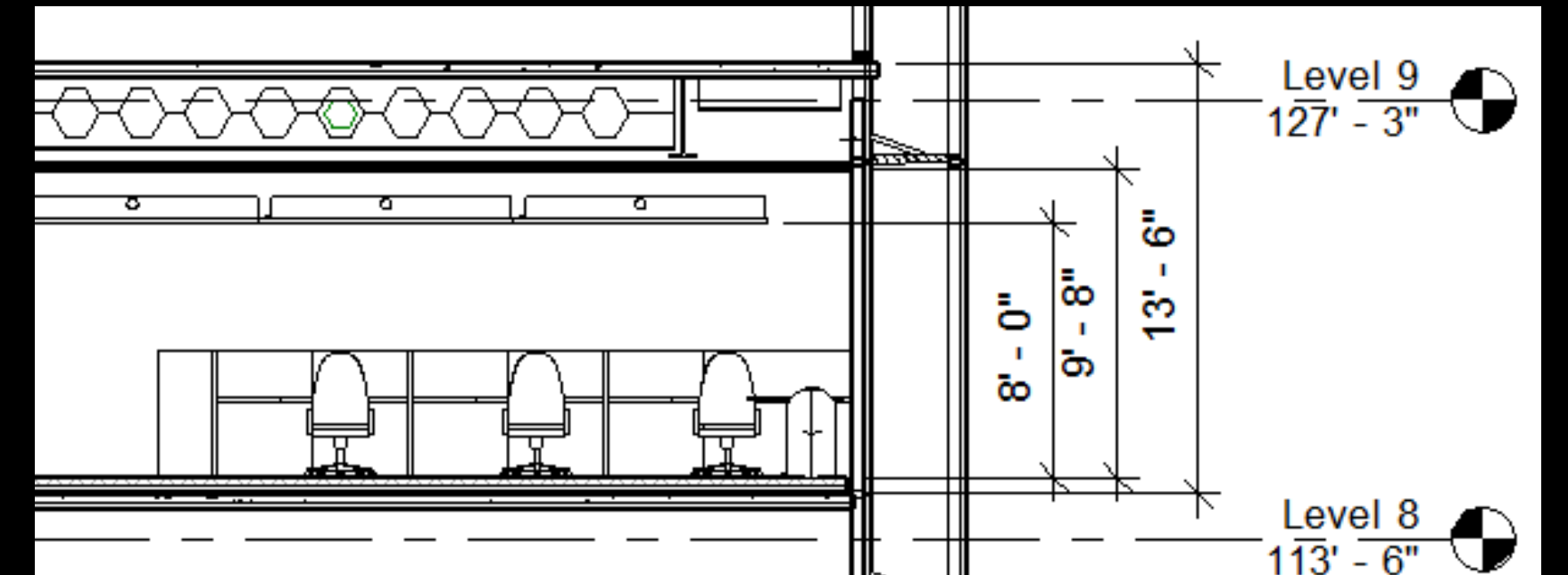
Assumptions:

Loading conditions were the same as in the existing building

UFAD System would be removed



Ceiling Plenum: 3' 10"
Raised Floor: 6"
Concrete Floor: 5 1/4"
Castellated Beam: 28" Max
Clearance: 5"
Ceiling to Chilled Beam: 1' 8"

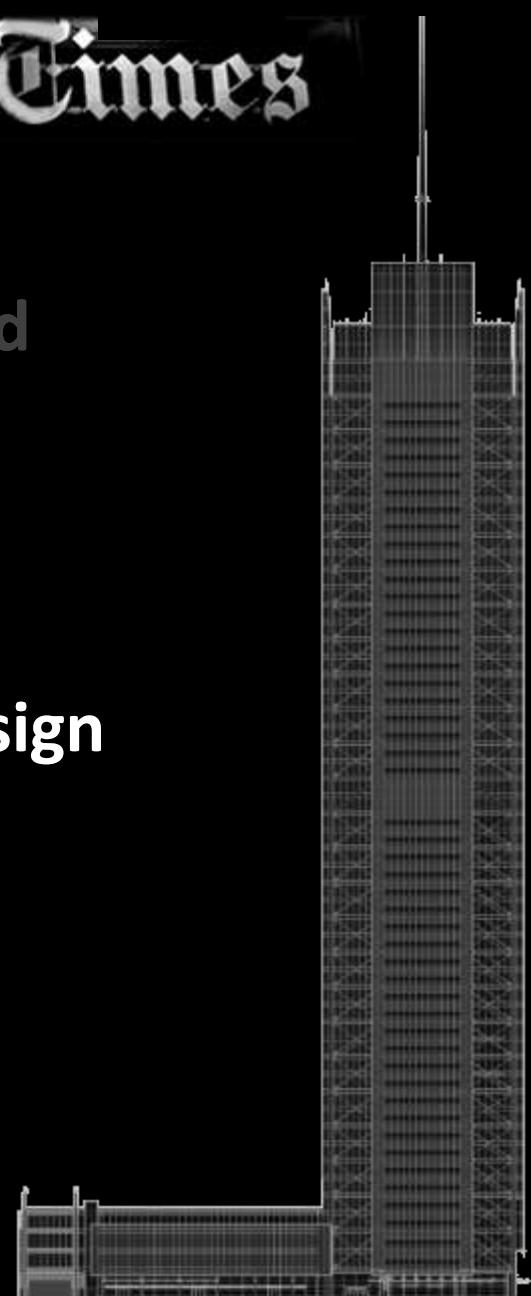


Level 9
127' - 3"

Level 8
113' - 6"

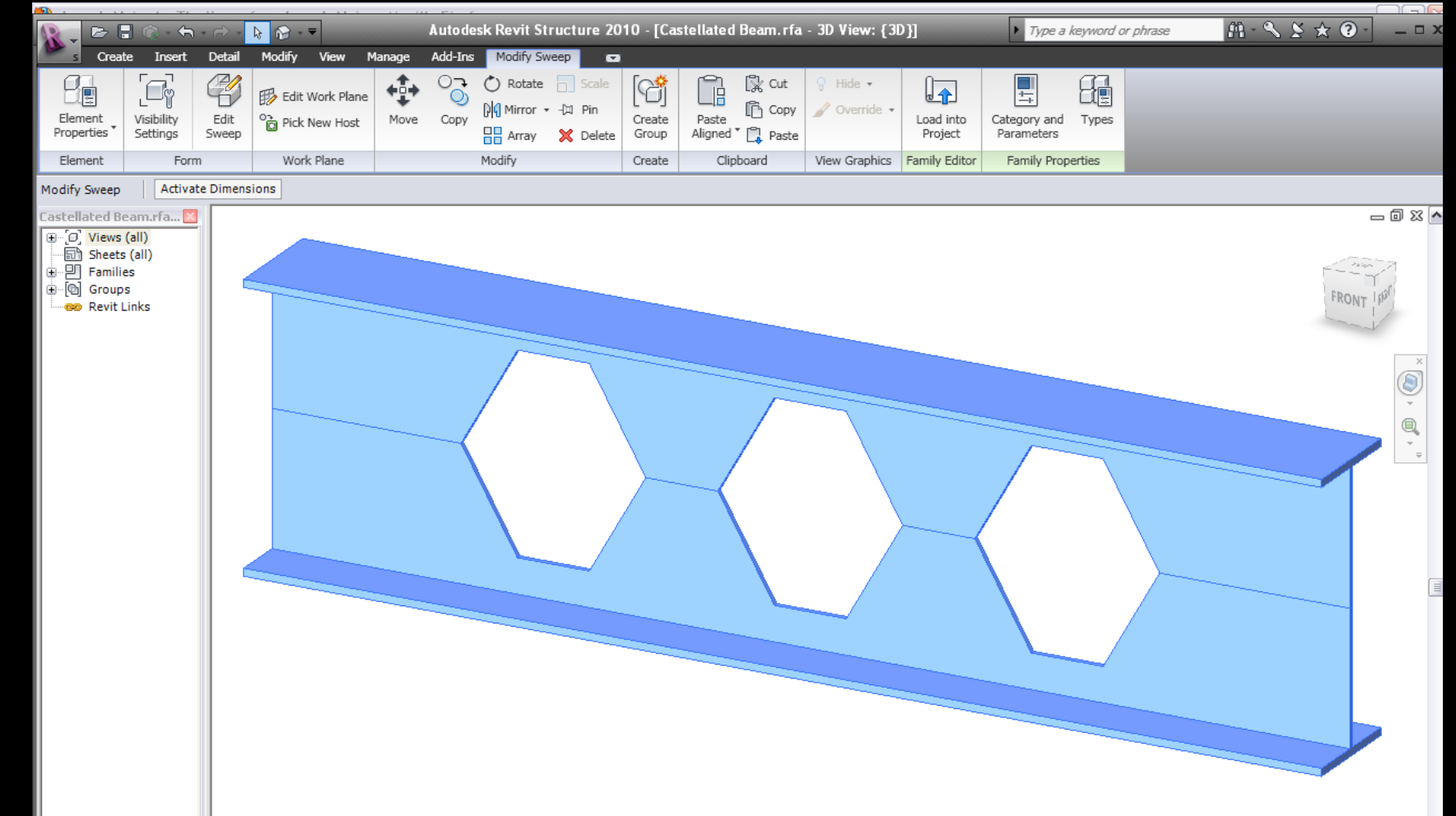
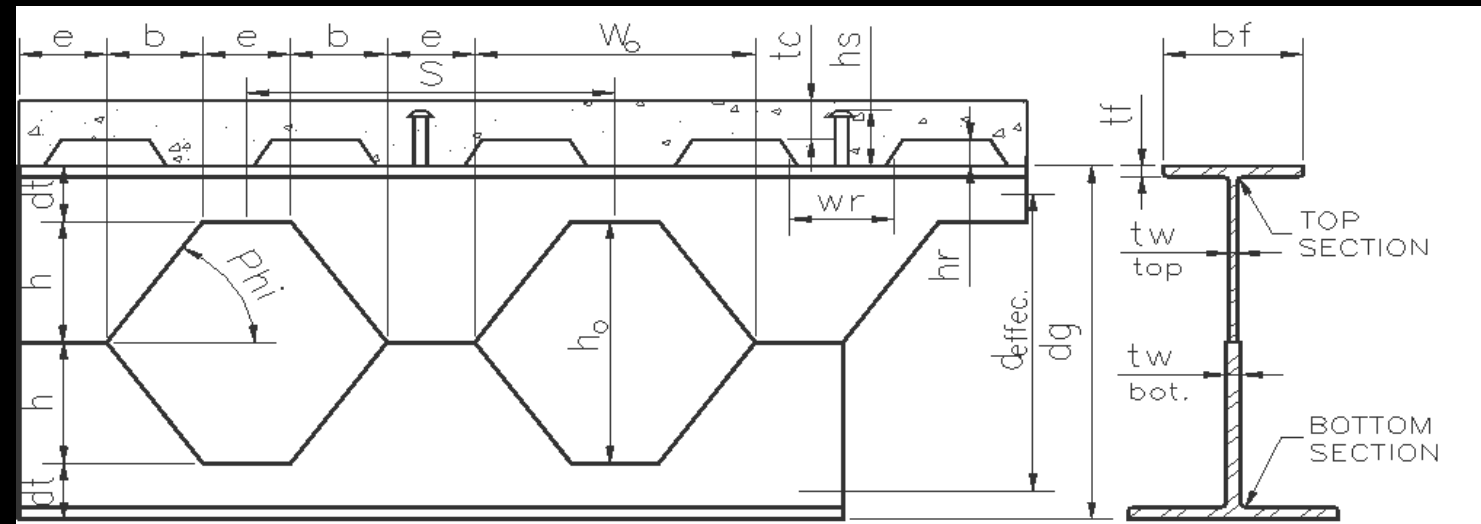
Structural Floor System Redesign

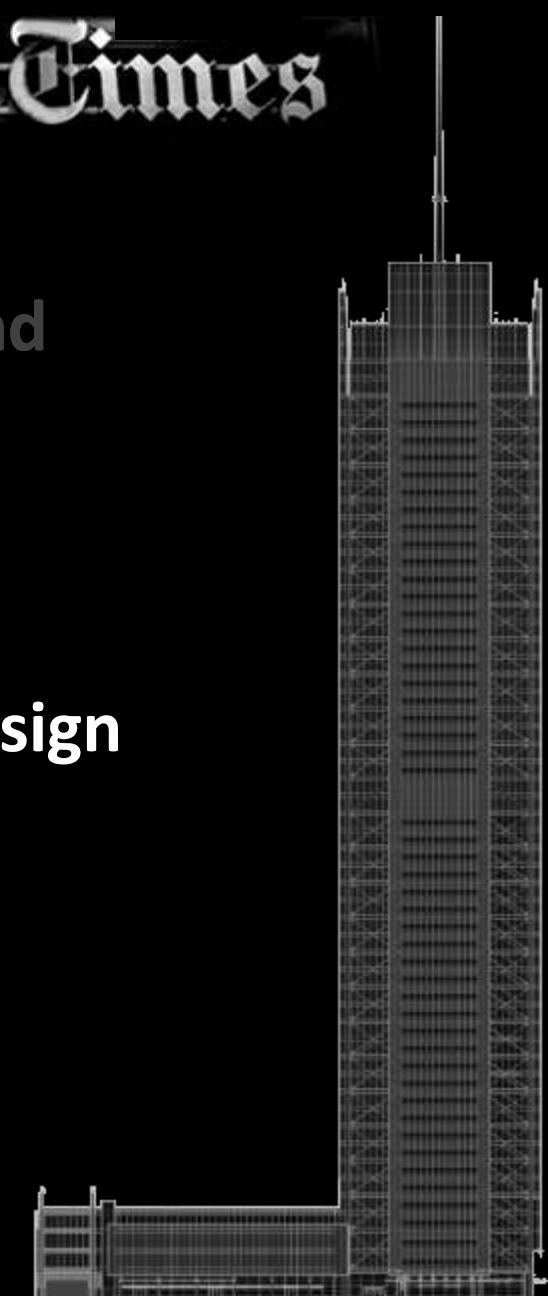
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Composite Castellated Beams

Allow for Coordination within Interstitial space





Structural Floor System Redesign

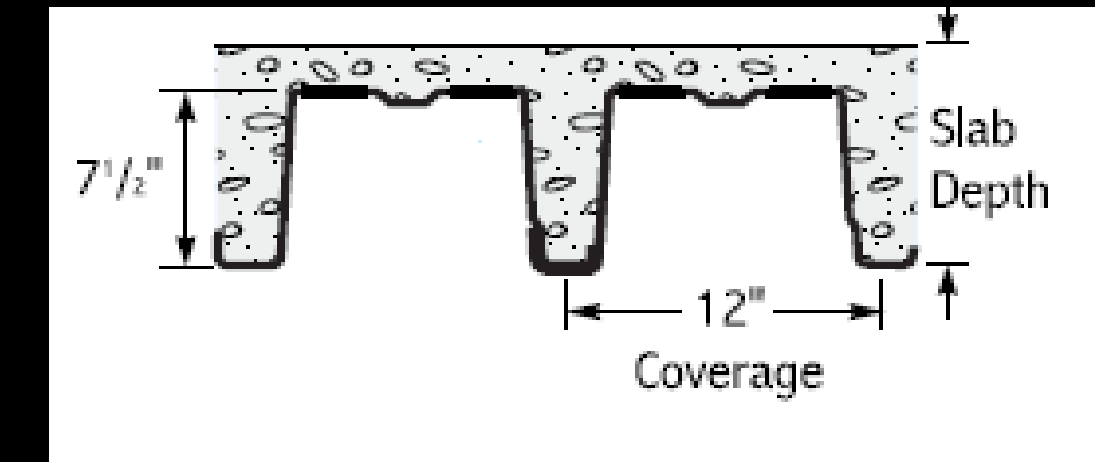
Composite Castellated Beams

Allow for Coordination within Interstitial space

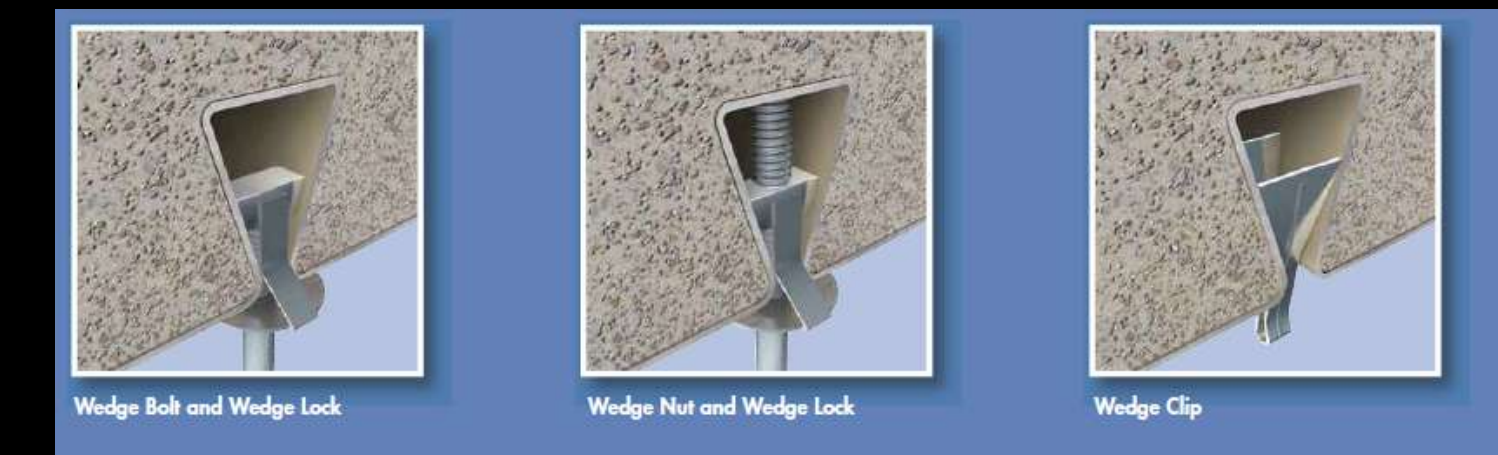
Metal Deck

Long Span Metal Deck

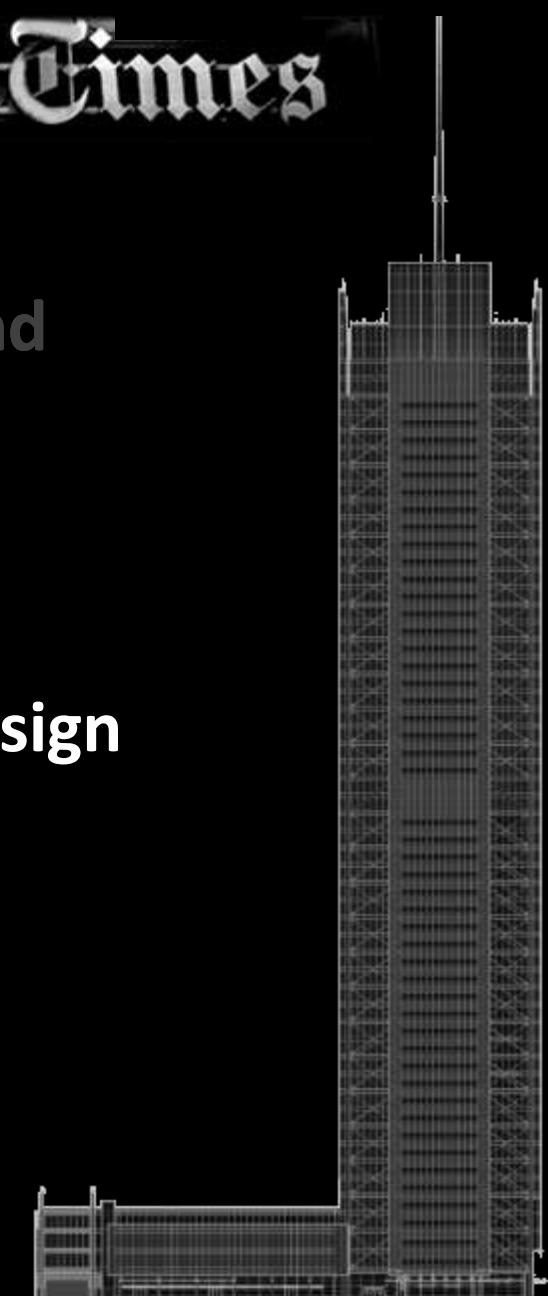
Dovetail Ribbed Composite Metal Deck



Long Span Metal Deck (LS)



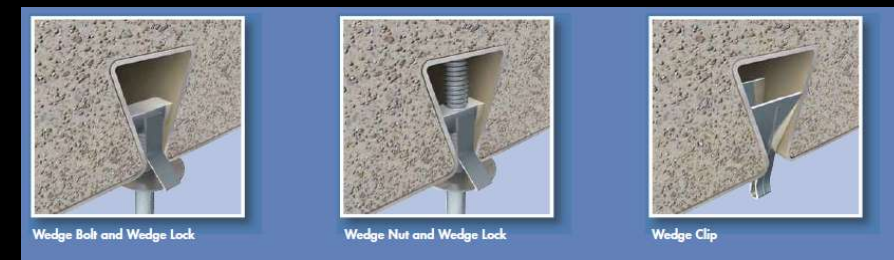
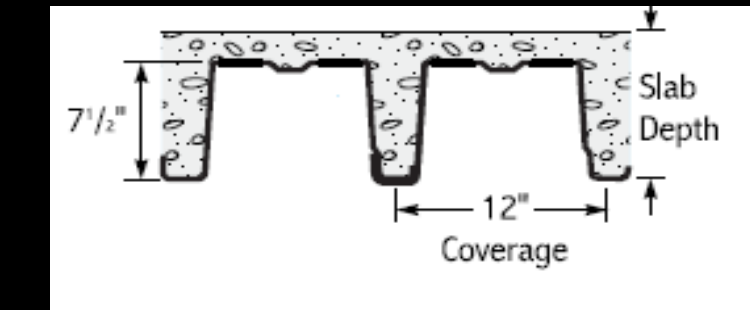
Dovetail Ribbed Composite Metal Deck (DT)



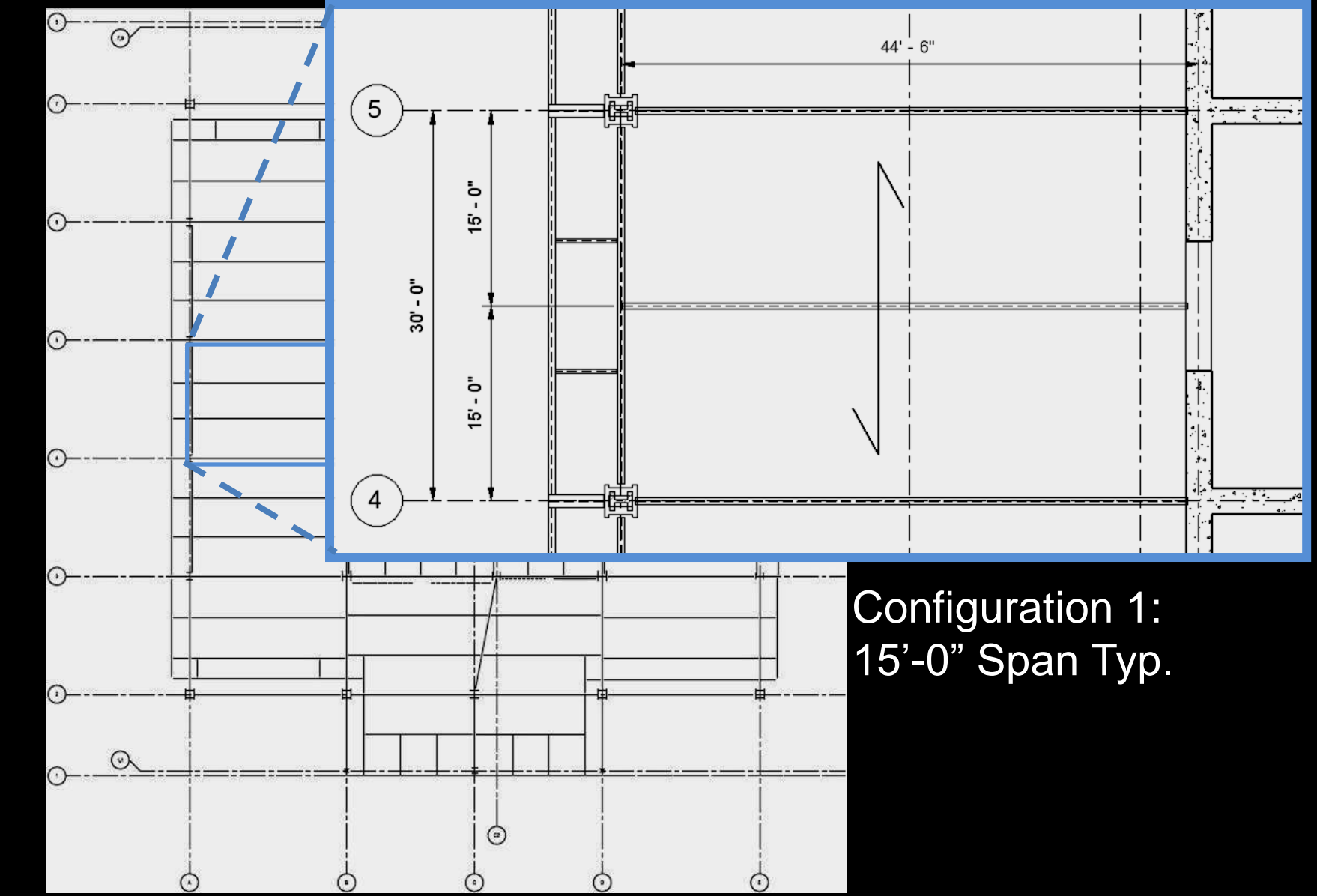
Structural Floor System Redesign

Configuration 1:

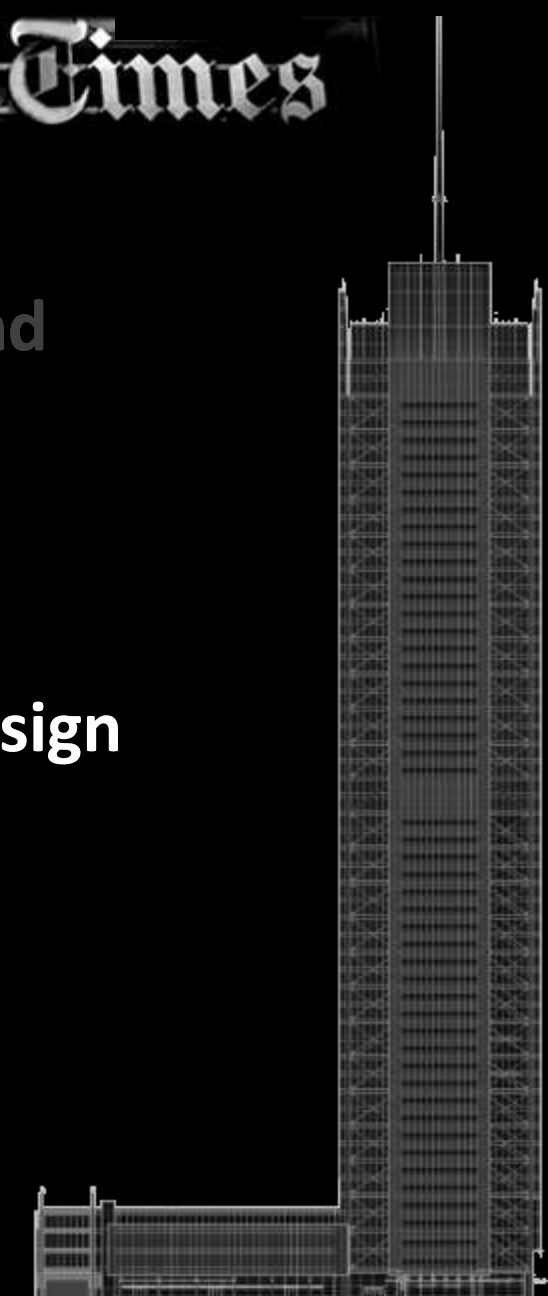
- Maximize Span
- Minimize Number of Members



(Shoring Required)



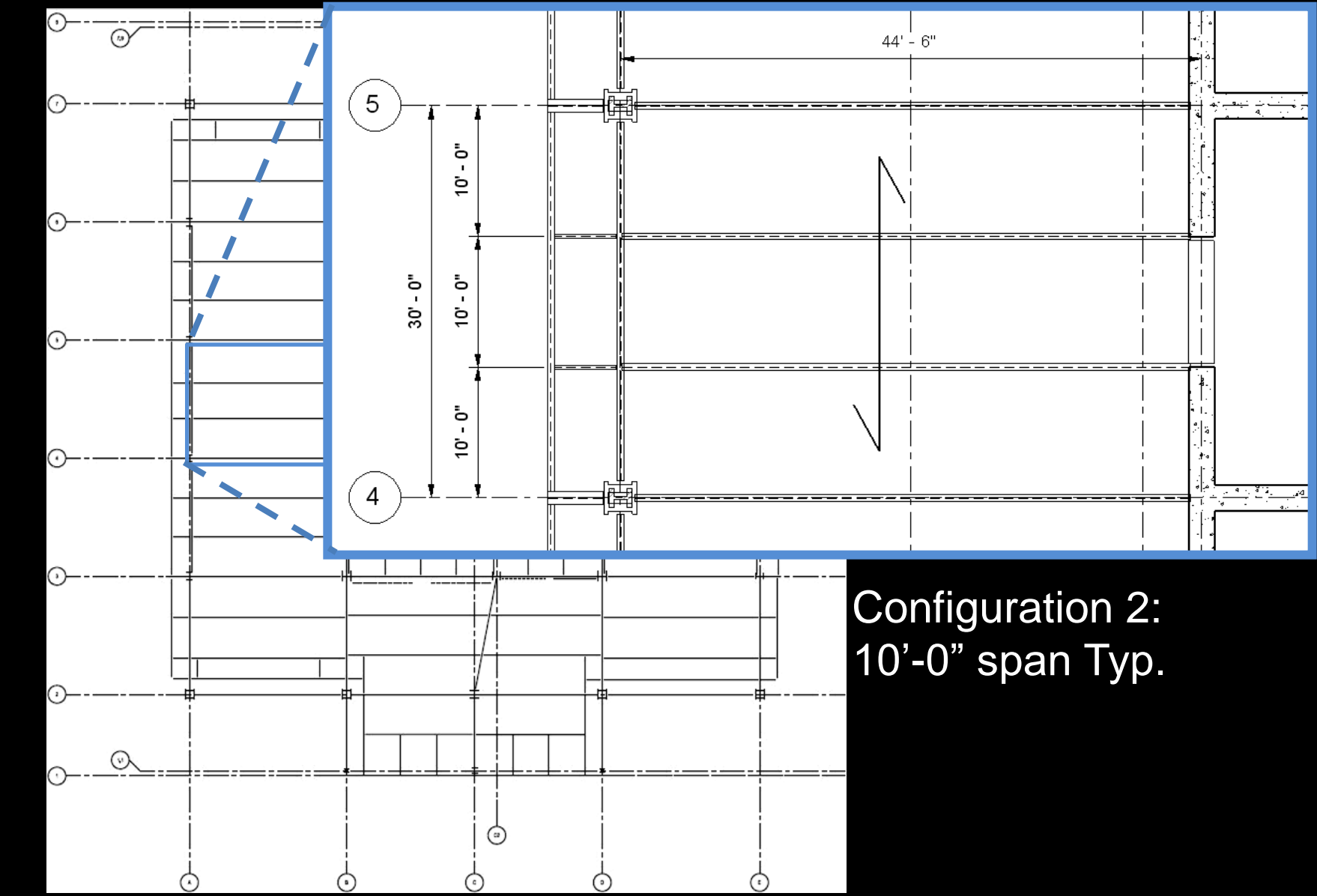
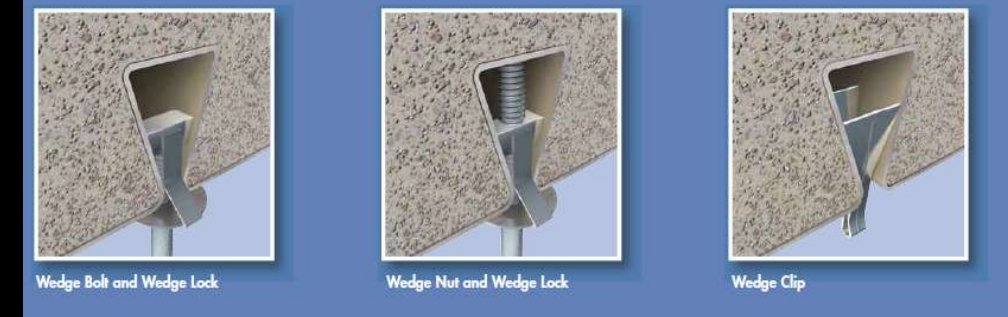
Configuration 1:
15'-0" Span Typ.



Structural Floor System Redesign

Configuration 2:

- Minimize Shoring



Intro

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Façade Redesign

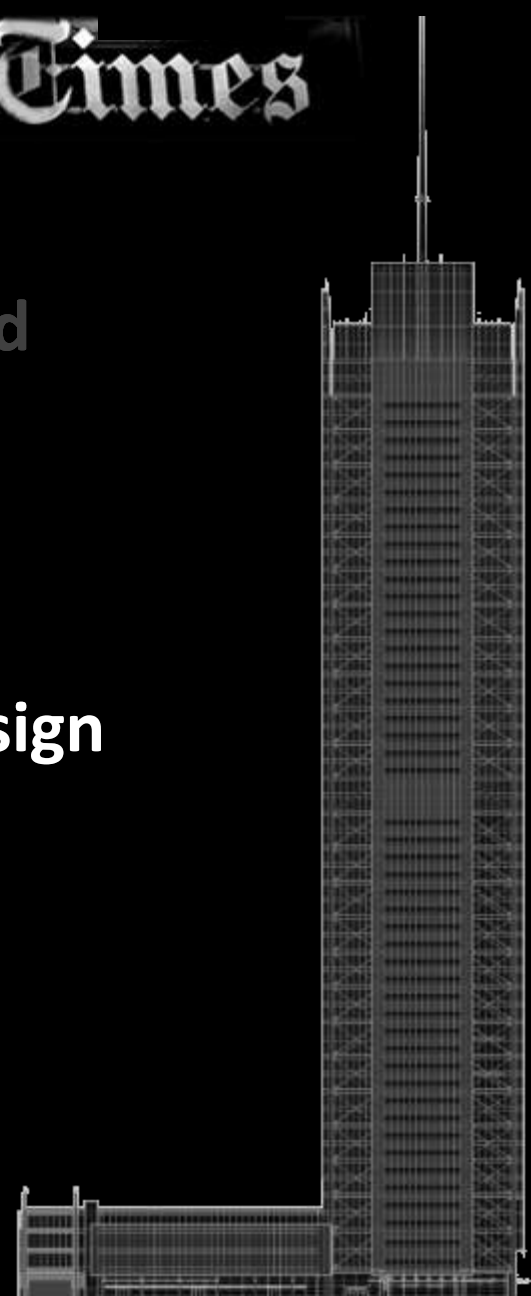
Floor System Redesign

Core Redesign

CoGen Redesign

BIM/IPD

Metrics of Success



Structural Floor System Redesign

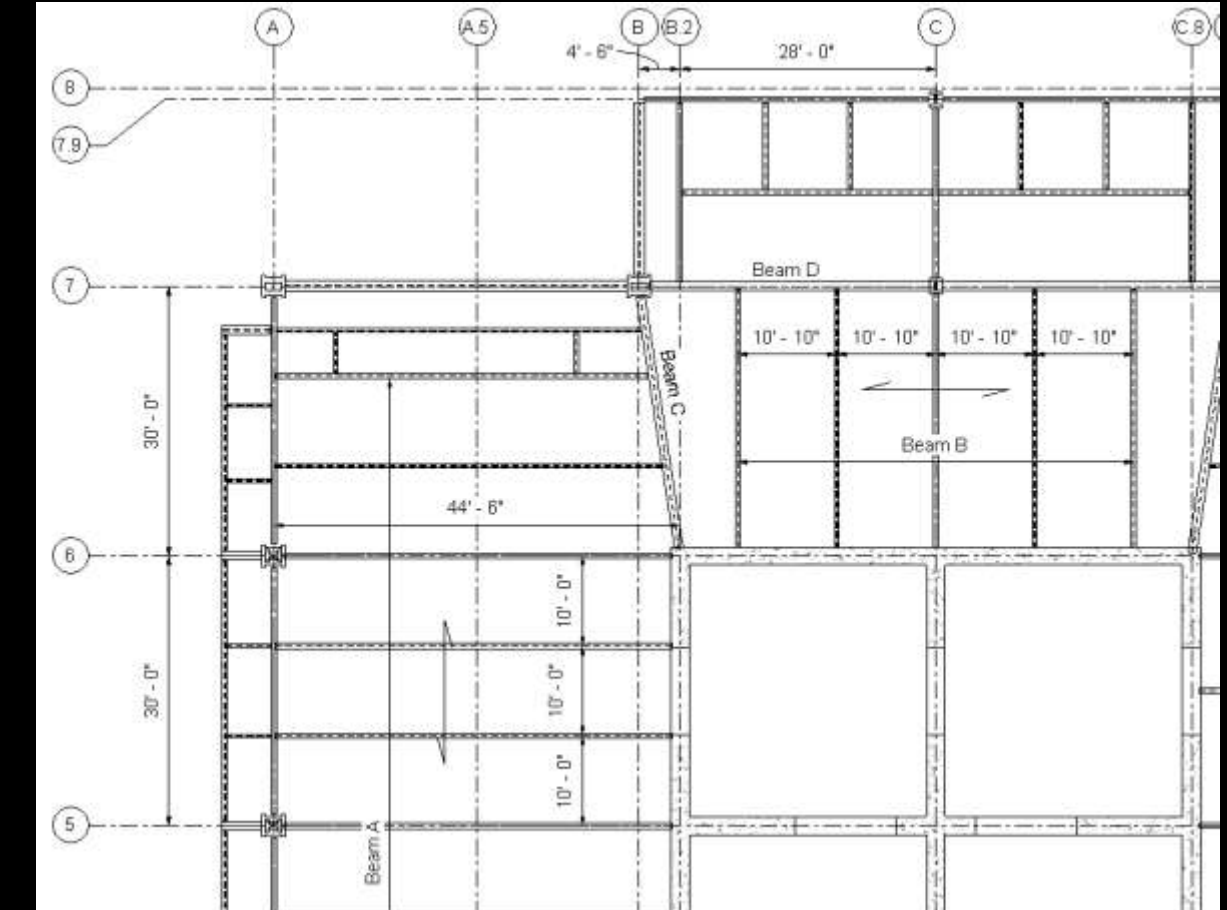
Total of 6 Main Option Investigated

Typical Gravity Loading

- Superimposed Dead Load - 20 psf
- Live Load – 50 psf (+ 20 psf partitions)

Member Depth

- All Met 28" Depth Parameter



Structural Floor System Redesign

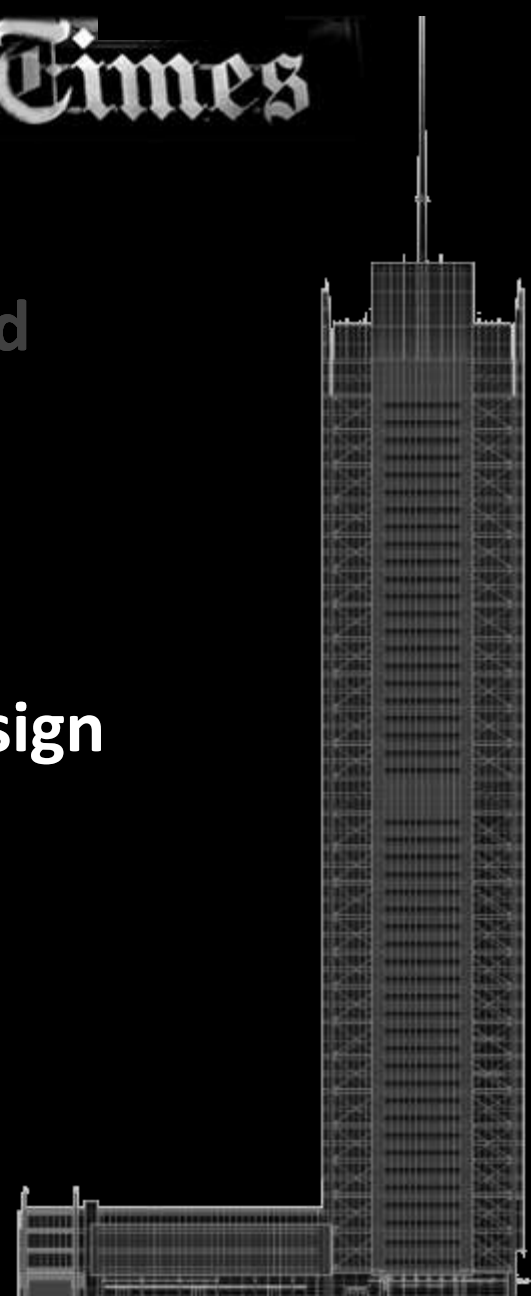
- Intro
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Façade Redesign

Floor System Redesign

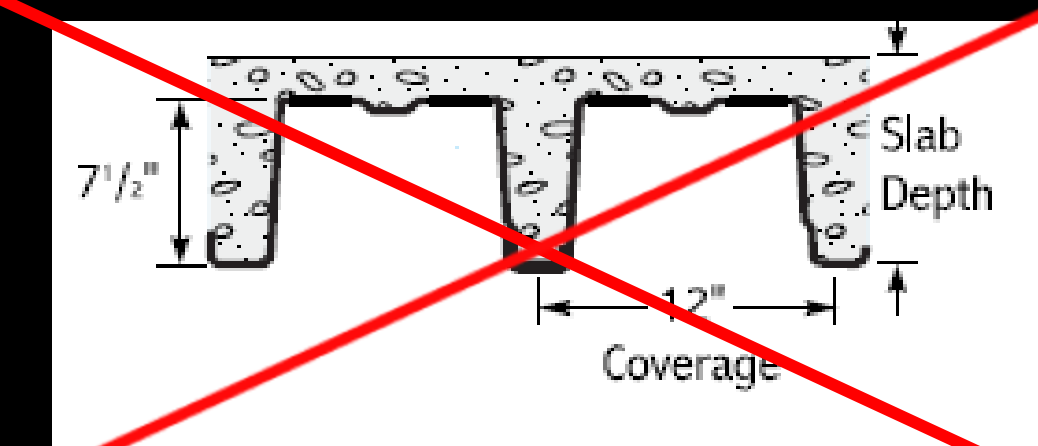
- Core Redesign
- CoGen Redesign

- BIM/IPD
- Metrics of Success



Floor Vibrations Due to Human Activity:

- 0.5% g Peak Acceleration (AISC Design Guide 11)

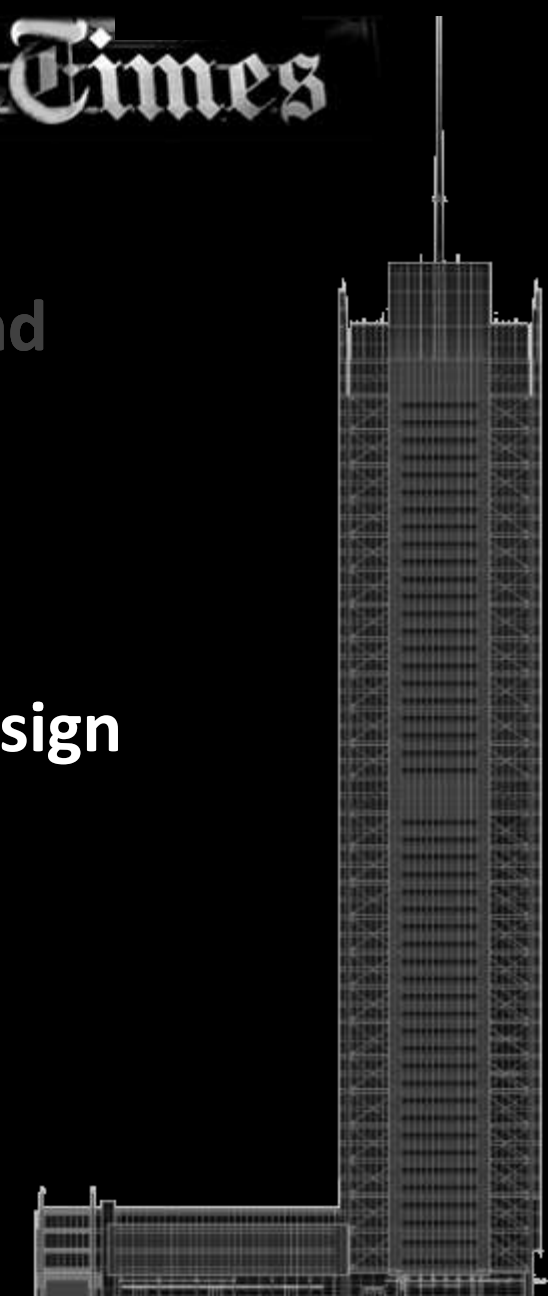


Option	Deck	f'c (psi)	Slab t (in)		Slab Weight (psf)	Peak Accel. (% g)
			Overall	Topping		
1	EC450 LWC	4000	7	2.5	39	0.58
2	EC450 NWC	4000	7	2.5	49	0.55
3	0.0358	3000	5.25	3.25	63	0.40
4	0.0474	3000	5.25	3.25	49	0.48
Exist.	3 VL1 22	4000	5.5	2.5	53	0.42

Selected Options for Cost Analysis				
Configuration	Option	Deck	Conc	Shoring?
1	3	DT	NWC	Yes
	4	DT	LWC	Yes
2	5	DT	NWC	No
	6	DT	LWC	No

Cost Comparison of Floor Configurations

- Intro
- Building Background
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- Façade Redesign
- Floor System Redesign**
- Core Redesign
- CoGen Redesign
- BIM/IPD
- Metrics of Success



System	Steel Framing	Concrete Floor	Reshoring	Total
Lightweight Concrete - Config. 1	\$ 7,920,000	\$ 82,160,000	\$ 2,490,000	\$ 92,580,000
Normalweight Concrete - Config. 1	\$ 7,920,000	\$ 61,950,000	\$ 2,490,000	\$ 72,370,000
Lightweight Concrete - Config. 2	\$ 8,540,000	\$ 82,160,000	\$ -	\$ 90,700,000
Normalweight Concrete - Config. 2	\$ 8,540,000	\$ 61,950,000	\$ -	\$ 70,490,000

Floor Configurations Conclusions

Existing Floor Configuration

- Configuration #2 – 10 ft. typical spans
- Wide-flange Beams
- Typical Composite Metal Deck

New Floor Configuration

- Castellated Beams
- Configuration #2 – 10 ft. typical spans
- Dovetail deck



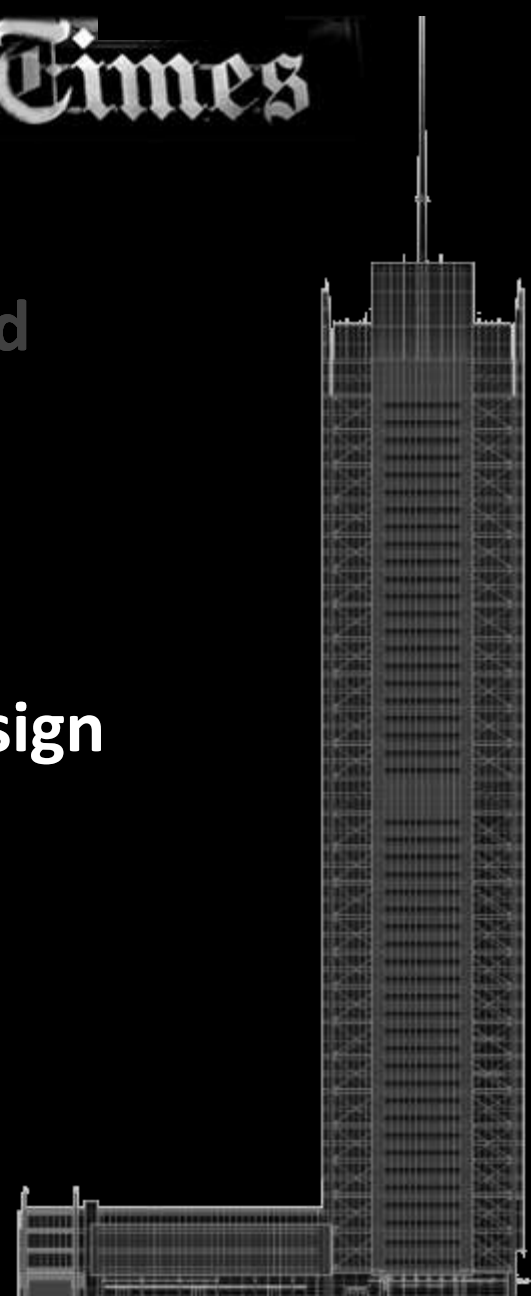
Structural Floor System Redesign

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 Metrics of Success

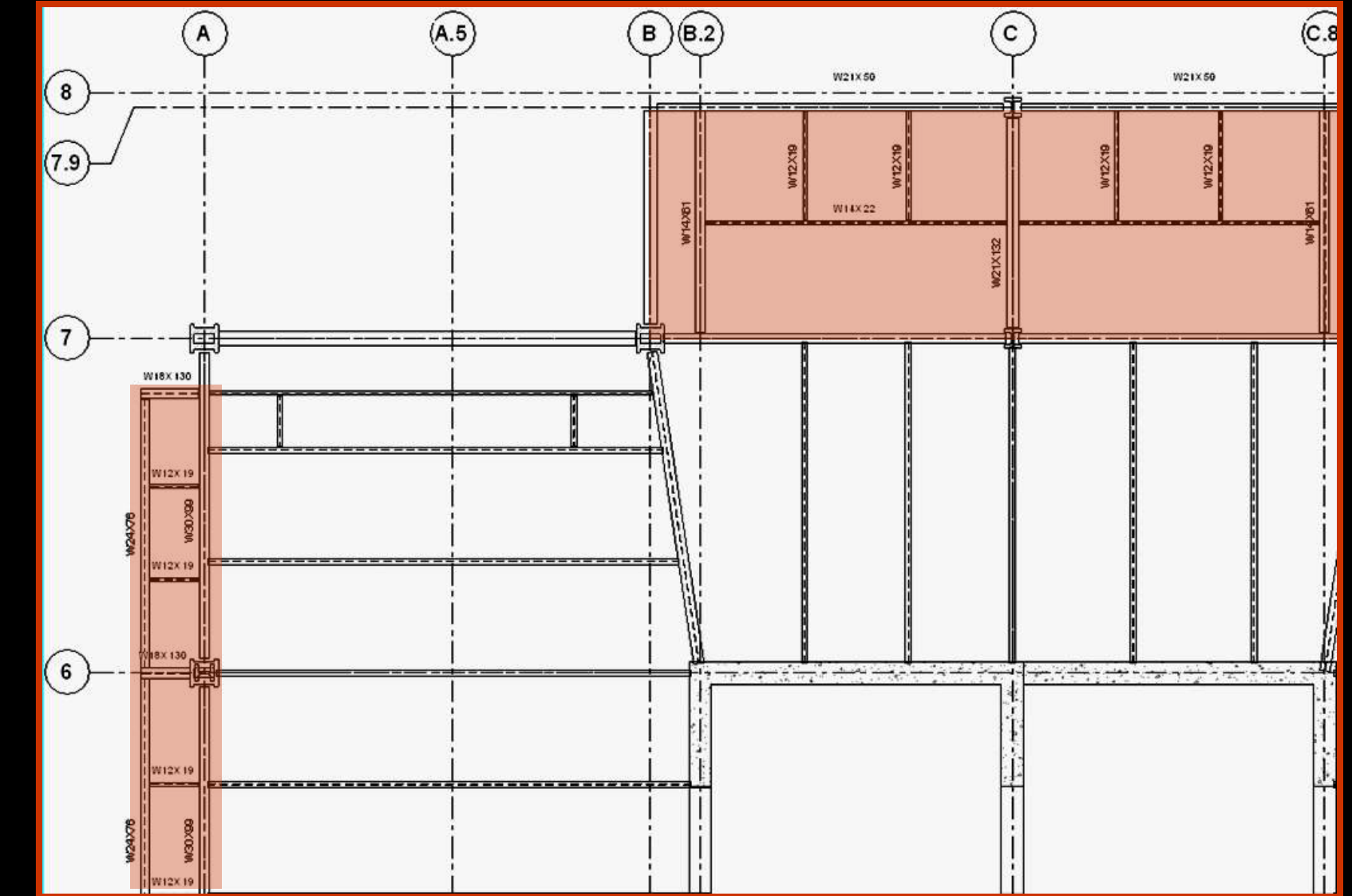


Member Check Cantilever & Overhang

- Used New Loading Conditions
- Verified Existing was Adequate or Resized Appropriately

Beam Check Summary										
Location	Existing Member	New Load		Existing Capacity		Deflection	Adequacy	New Member	New Capacity	
		M_u (k-ft)	V_u (k)	ϕM_n (k-ft)	ϕV_n (k)				ϕM_n (k-ft)	ϕV_n (k)
Cant.	W12x19	28.47	10.98	92.6	85.7	ok	OK	W12x19	92.6	85.7
Cant.	W14x22 (int)	259.3	36	277	85.7	ok	OK	W14x22	277	85.7
Cant.	W14x22 (ext)	372.56	36	125	94.8	----	NG	W14x61	1250	156
Cant.	W21x132	745.1	72	1250	426	ok	OK	W21x132	1250	426
Cant.	W21x50	63.03	18.73	413	237	ok	OK	W21x50	413	237
Edge	W12x19	7.21	2.77	92.6	85.7	ok	OK	W12x19	92.6	85.7
Edge	W18x130	96.39	25.55	1090	387	ok	OK	W18x130	1090	387
Edge	W24x76	117.2	13.51	750	316	ok	OK	W24x76	750	316
Edge	W18x40	577	57.7	294	169	ng	NG	W30x99*	1170	463

*Selected to eliminate the coping of castellated members

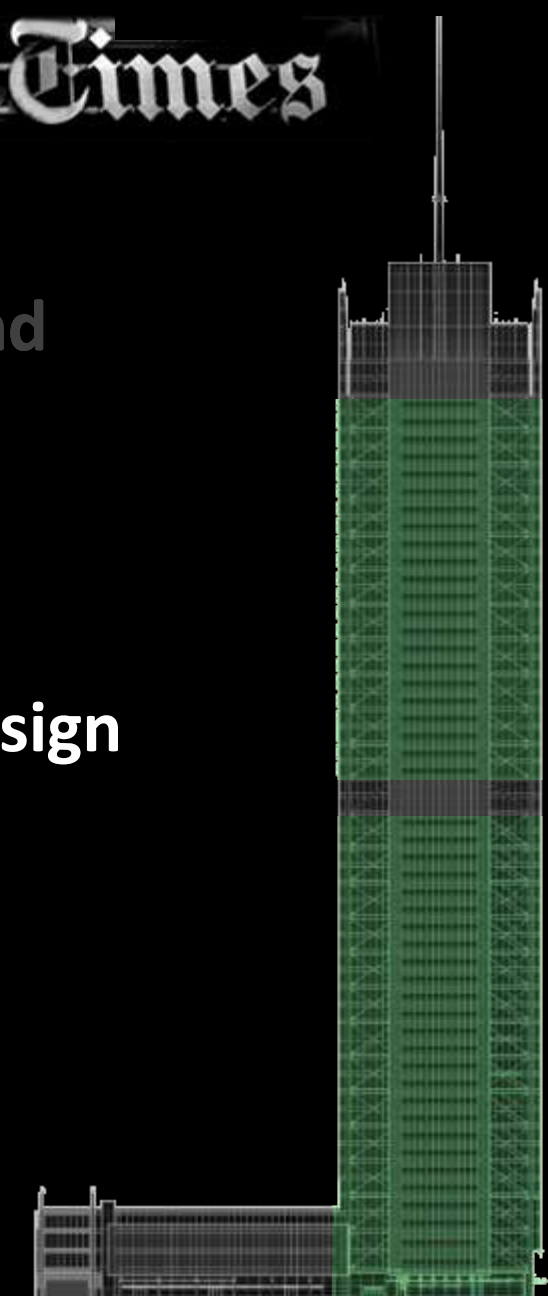


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- Façade Redesign
- Floor System Redesign**

- Core Redesign
- CoGen Redesign

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HVAC Redesign

- Multiservice Chilled Beams:
 - o Integrated design



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Intro

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Façade Redesign

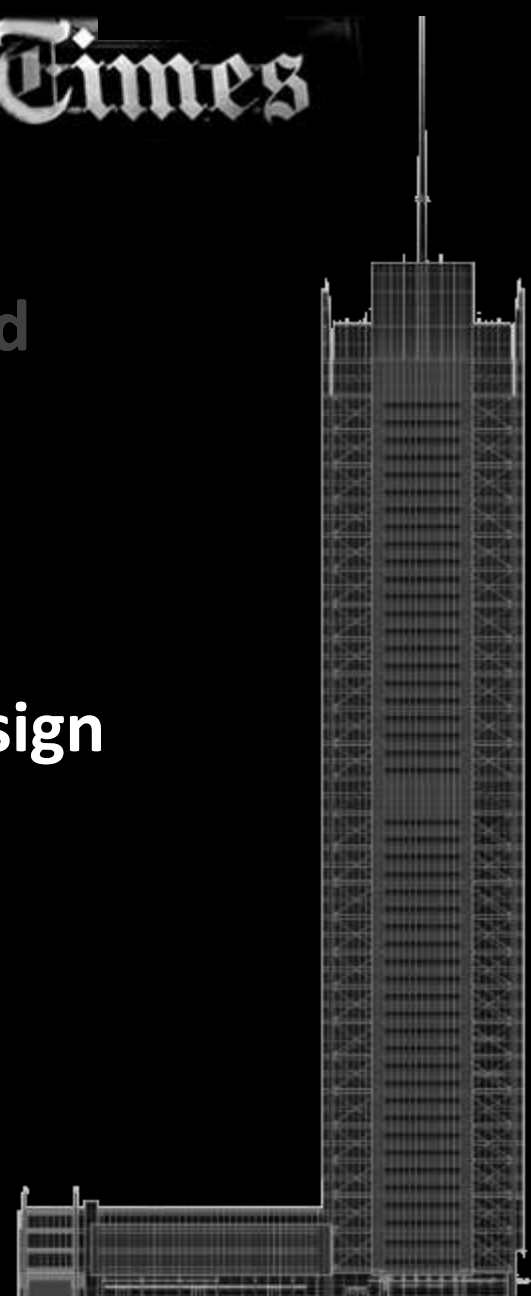
Floor System Redesign

Core Redesign

CoGen Redesign

BIM/IPD

Metrics of Success



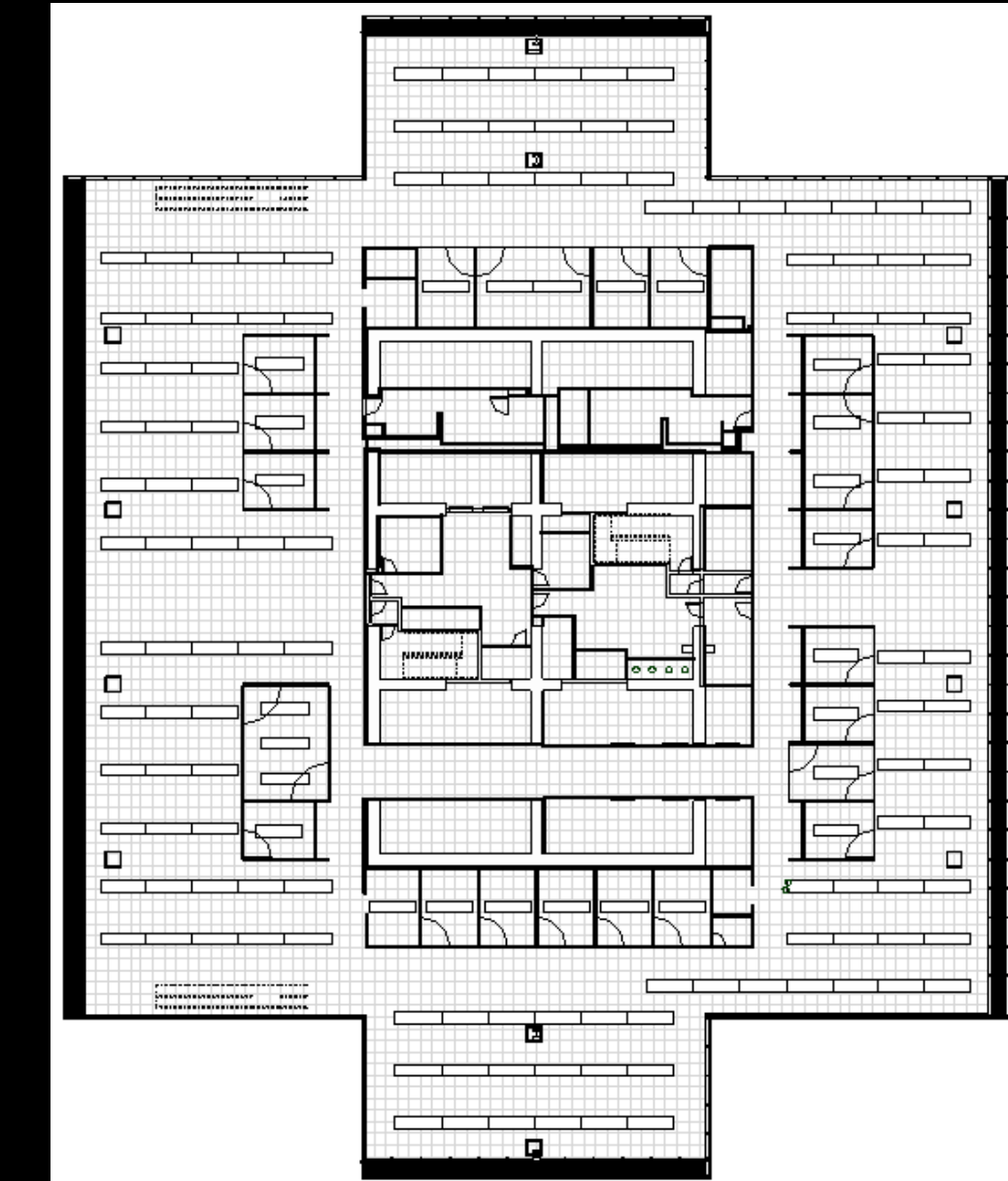
HVAC Redesign

Multiservice Chilled Beams:

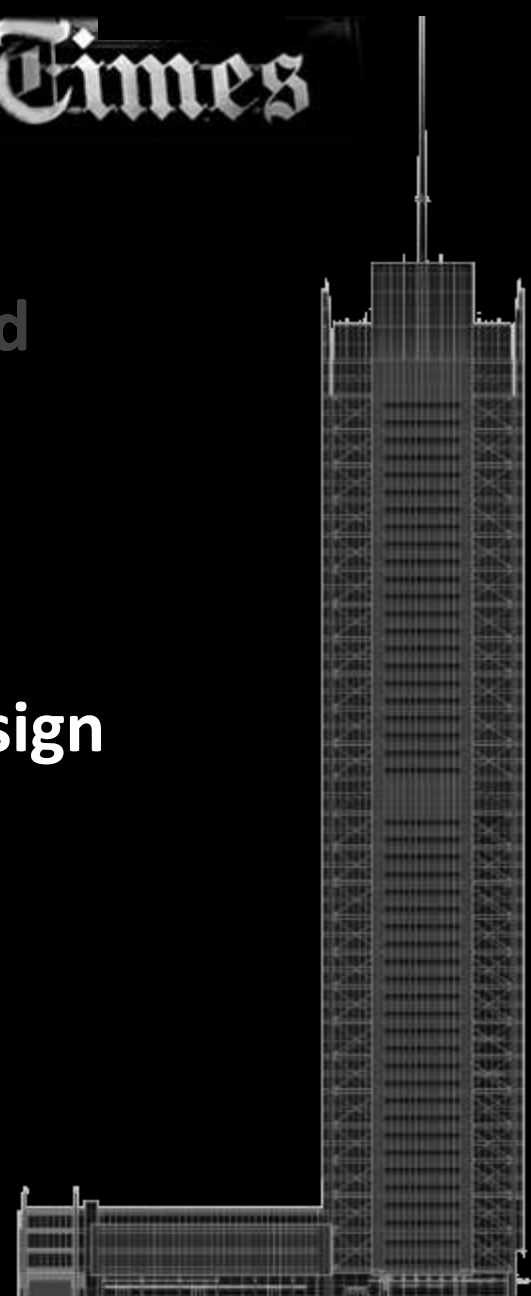
- Integrated design

Typical Layout:

- 155 beams per floor



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HVAC Redesign

Multiservice Chilled Beams:

- Integrated design

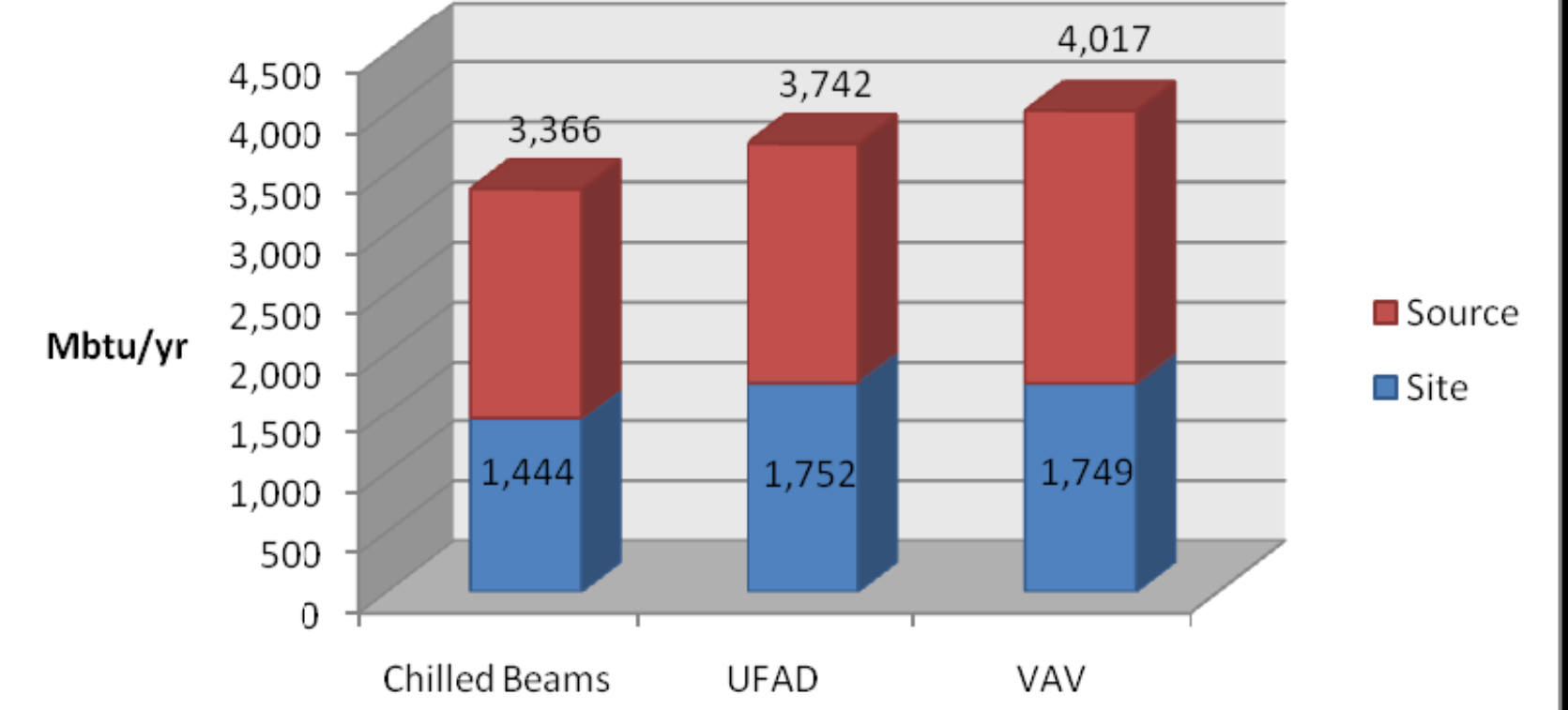
Typical Layout:

- 155 beams per floor

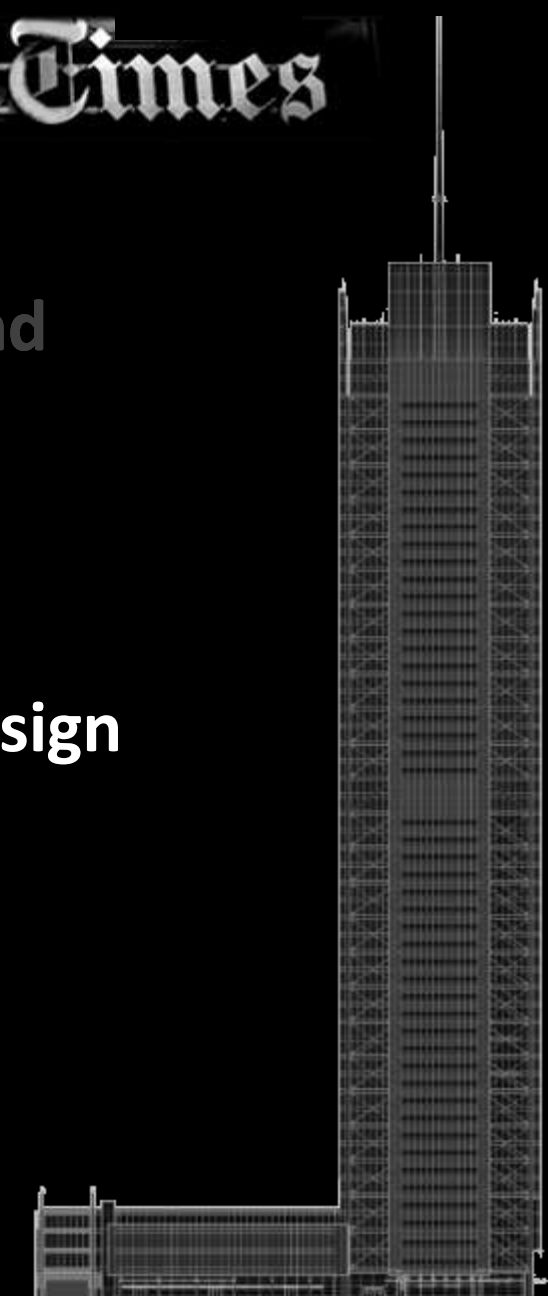
Savings:

- Energy (10-16%)

Energy Consumption by Floor



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HVAC Redesign

Multiservice Chilled Beams:

- Integrated design

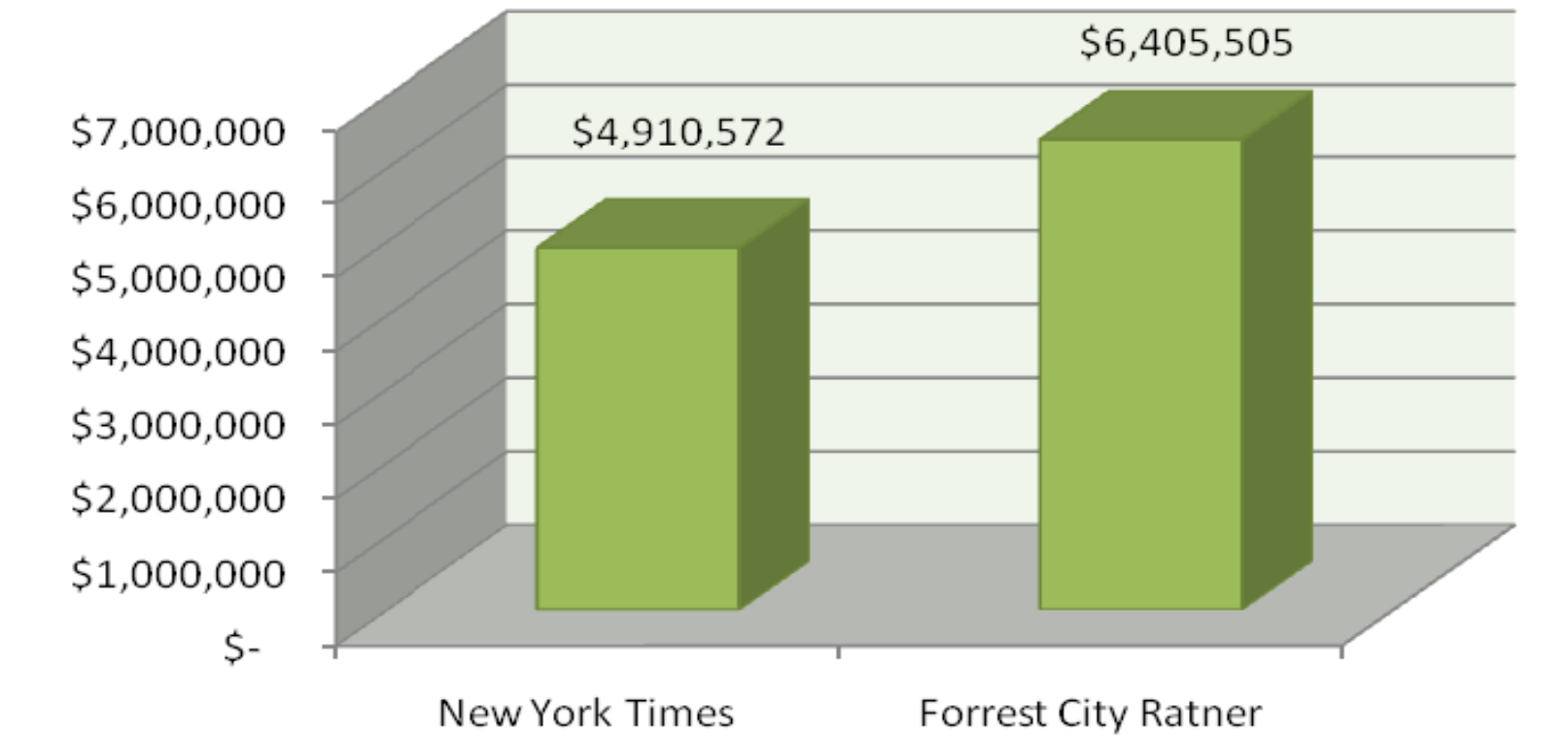
Typical Layout:

- 155 beams per floor

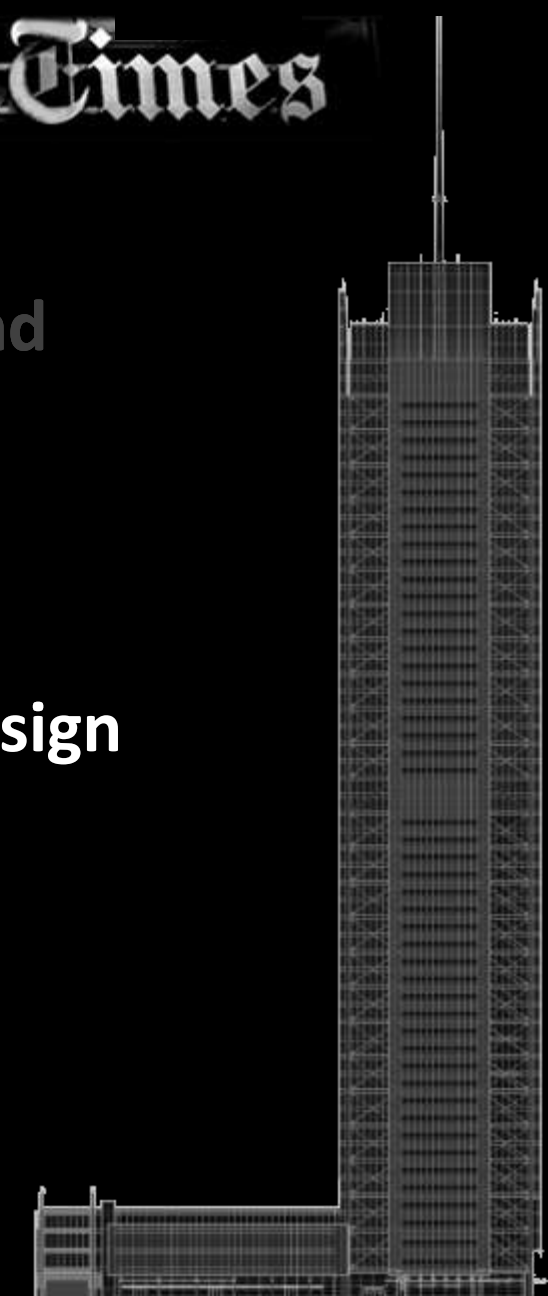
Savings:

- Energy (10-16%)
- Cost (\$47,000 / month)

20-Year Lifecycle Cost Savings



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HVAC Redesign

Multiservice Chilled Beams:

- Integrated design

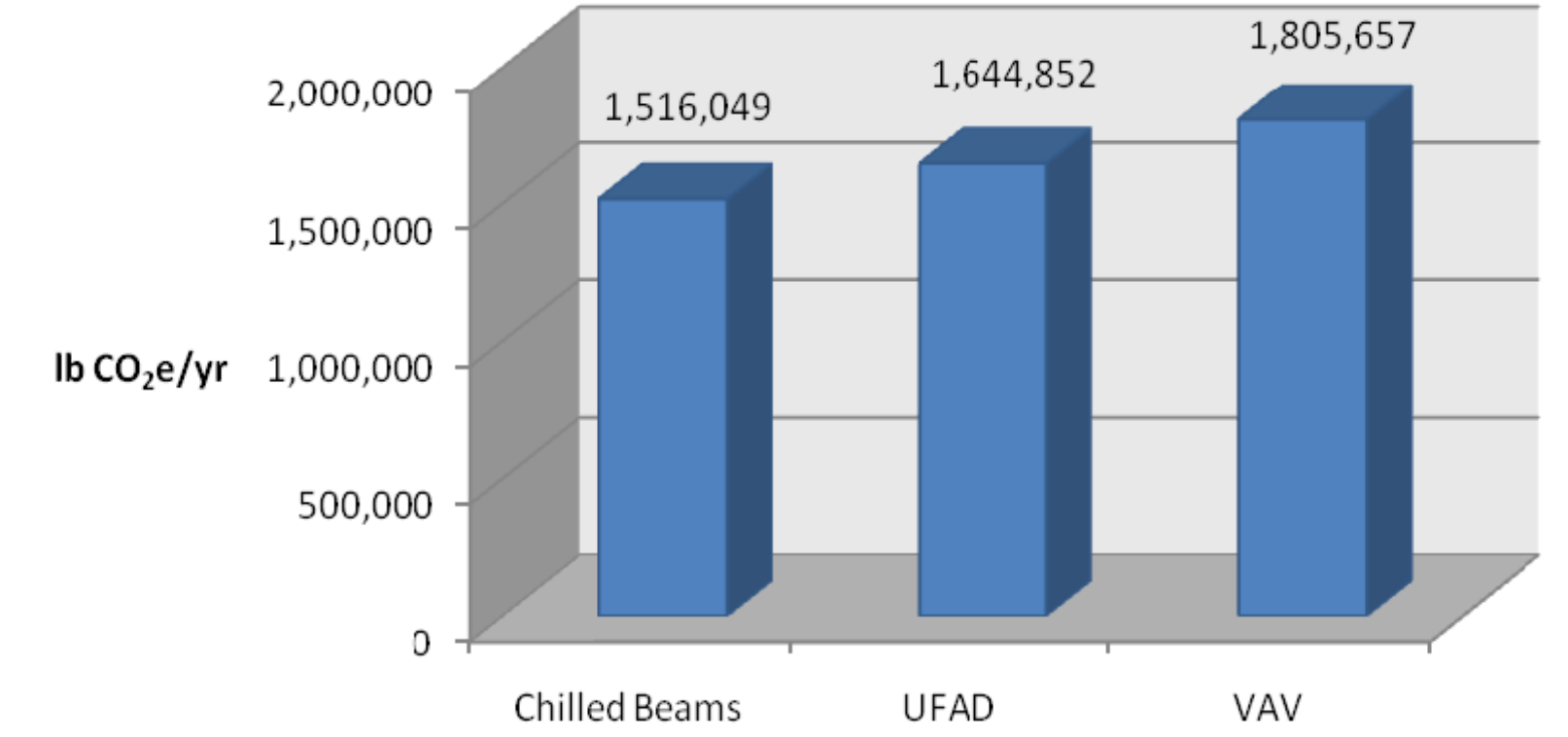
Typical Layout:

- 155 beams per floor

Savings:

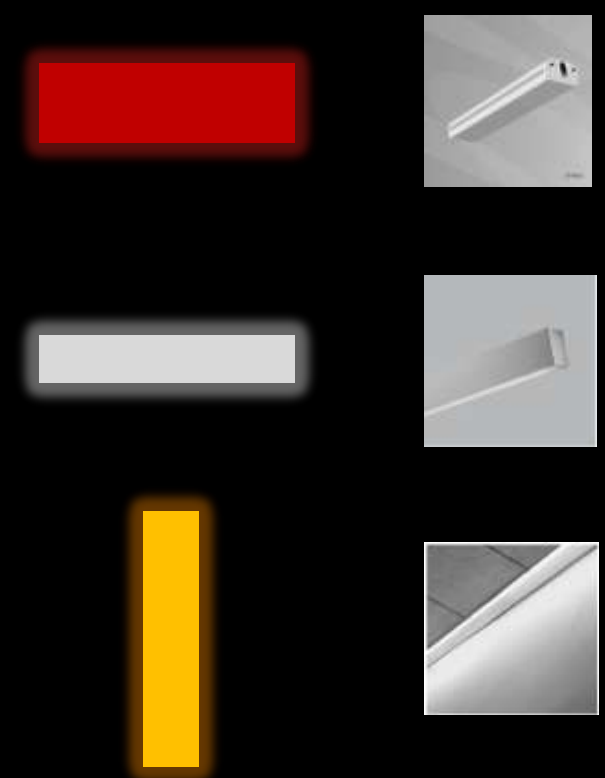
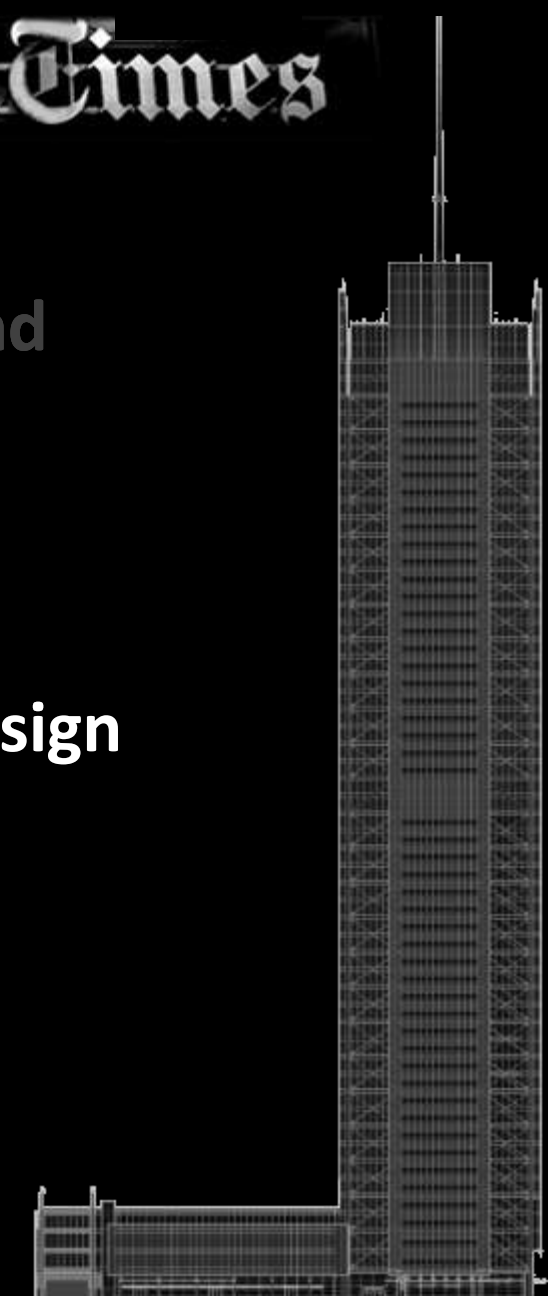
- Energy (10-16%)
- Cost (\$47,000 / month)
- Emissions (8-16%)

HVAC Associated Emissions by Floor (CO₂e)



Office Lighting Redesign

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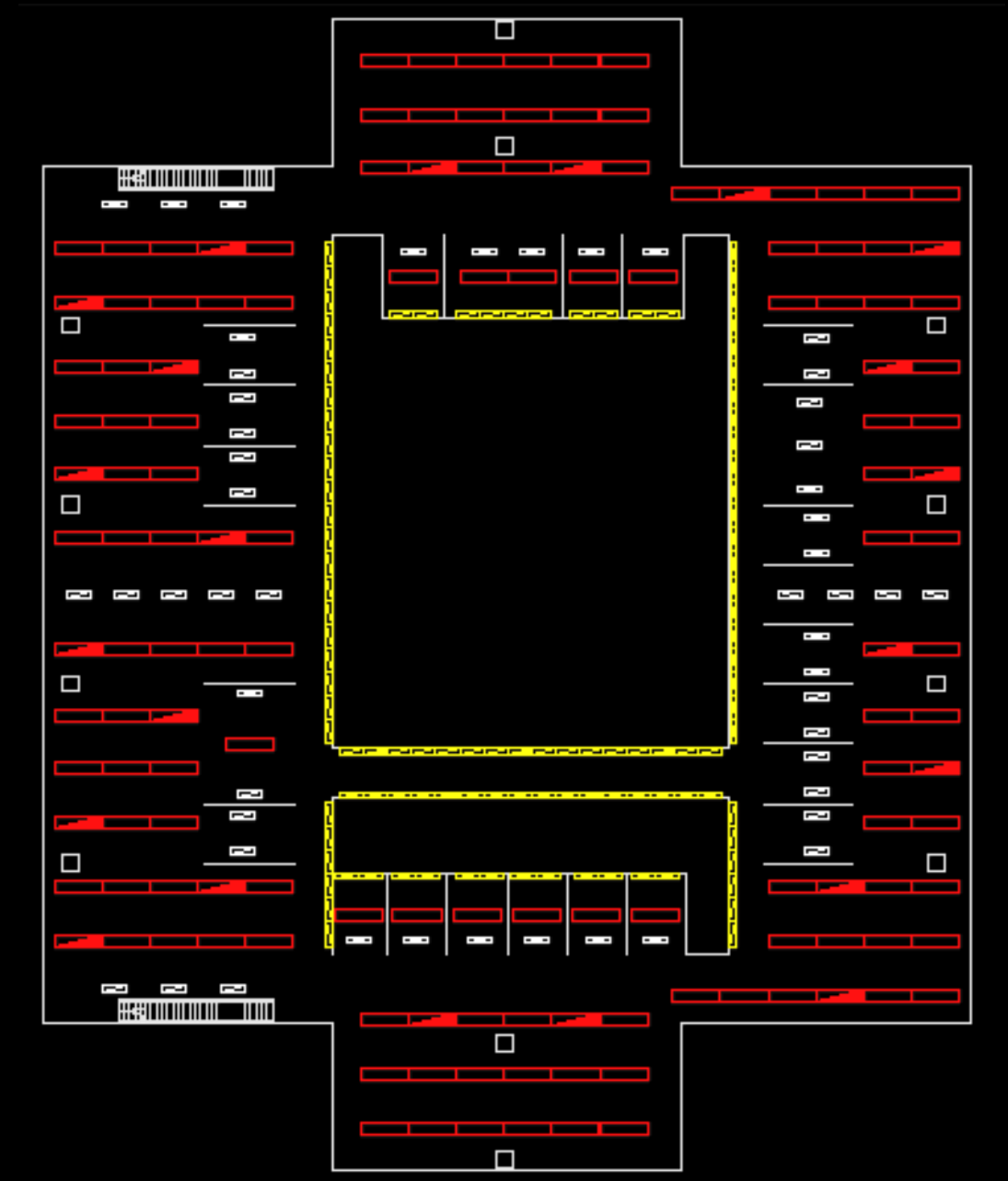


Integrated 35W T5 Direct Pendant

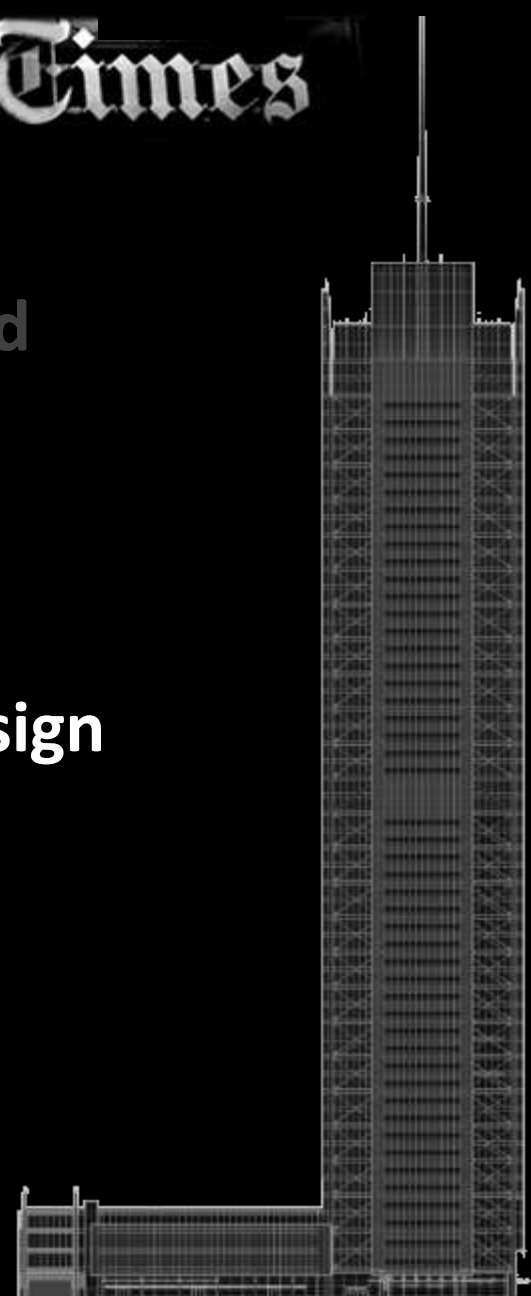
4' T5HO Direct/Indirect Pendant

4' Recessed Cove

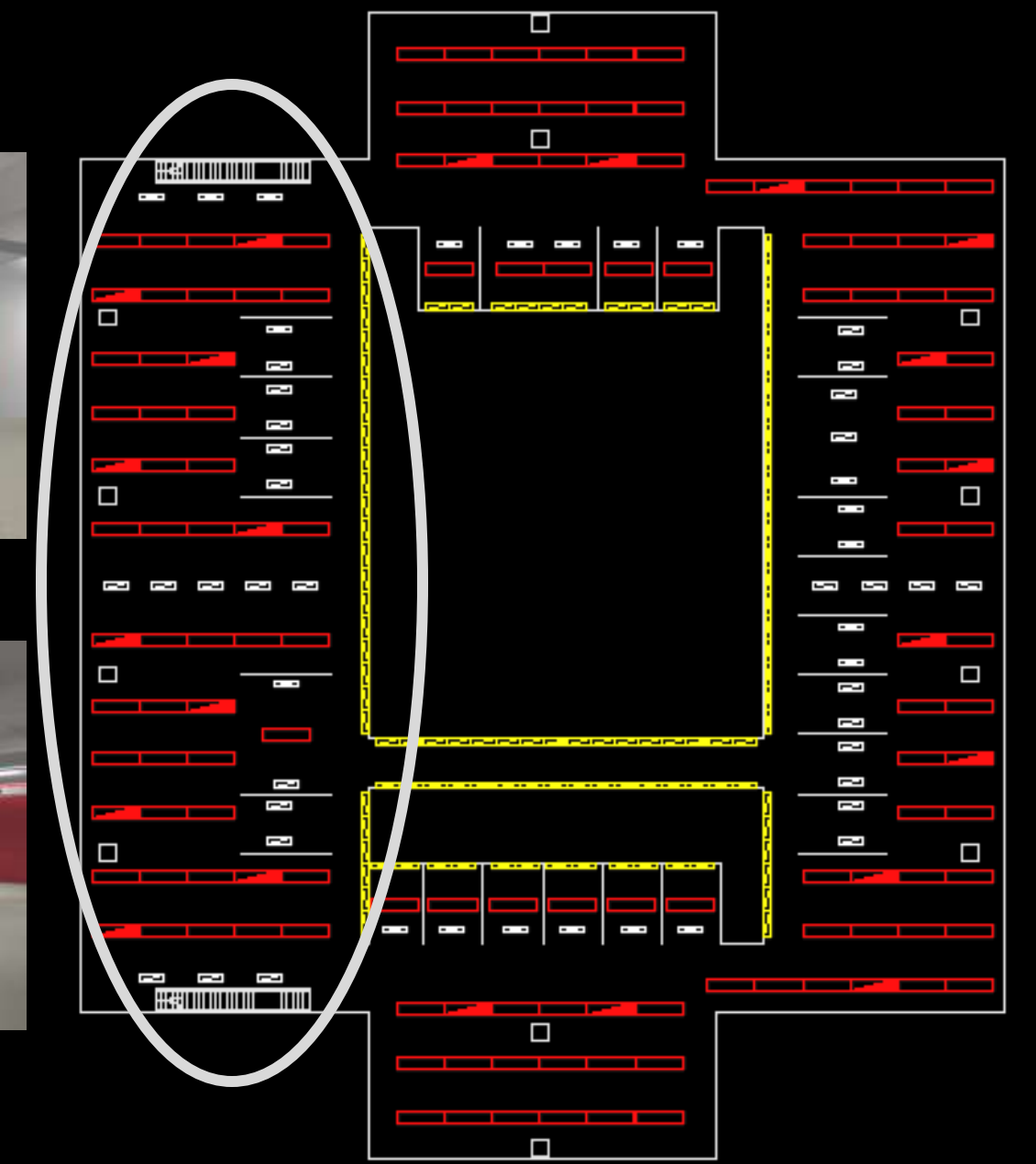
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Office Lighting Redesign

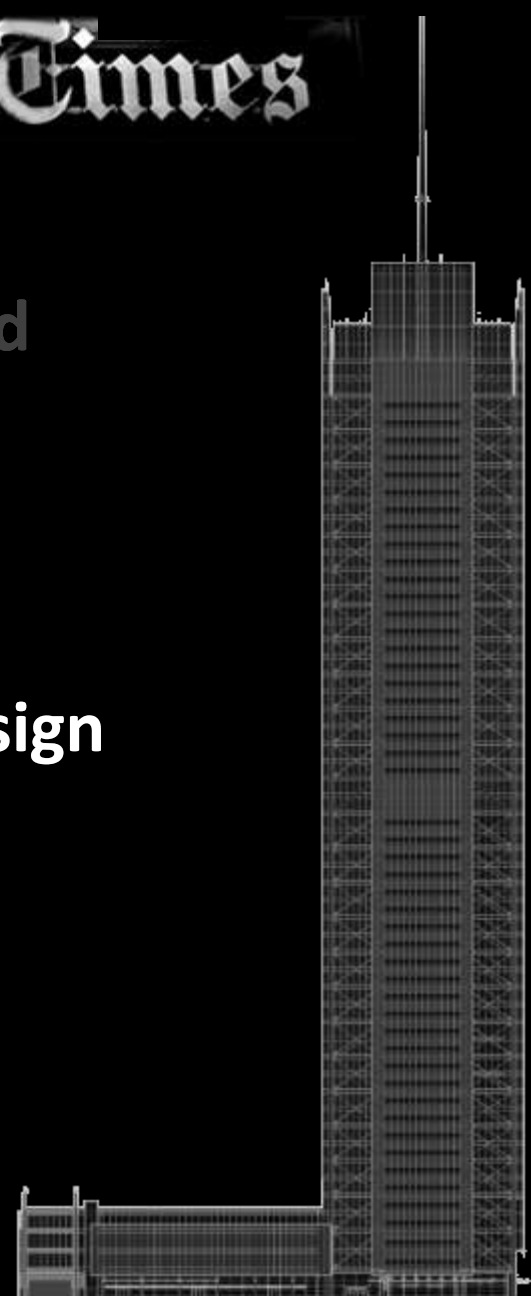


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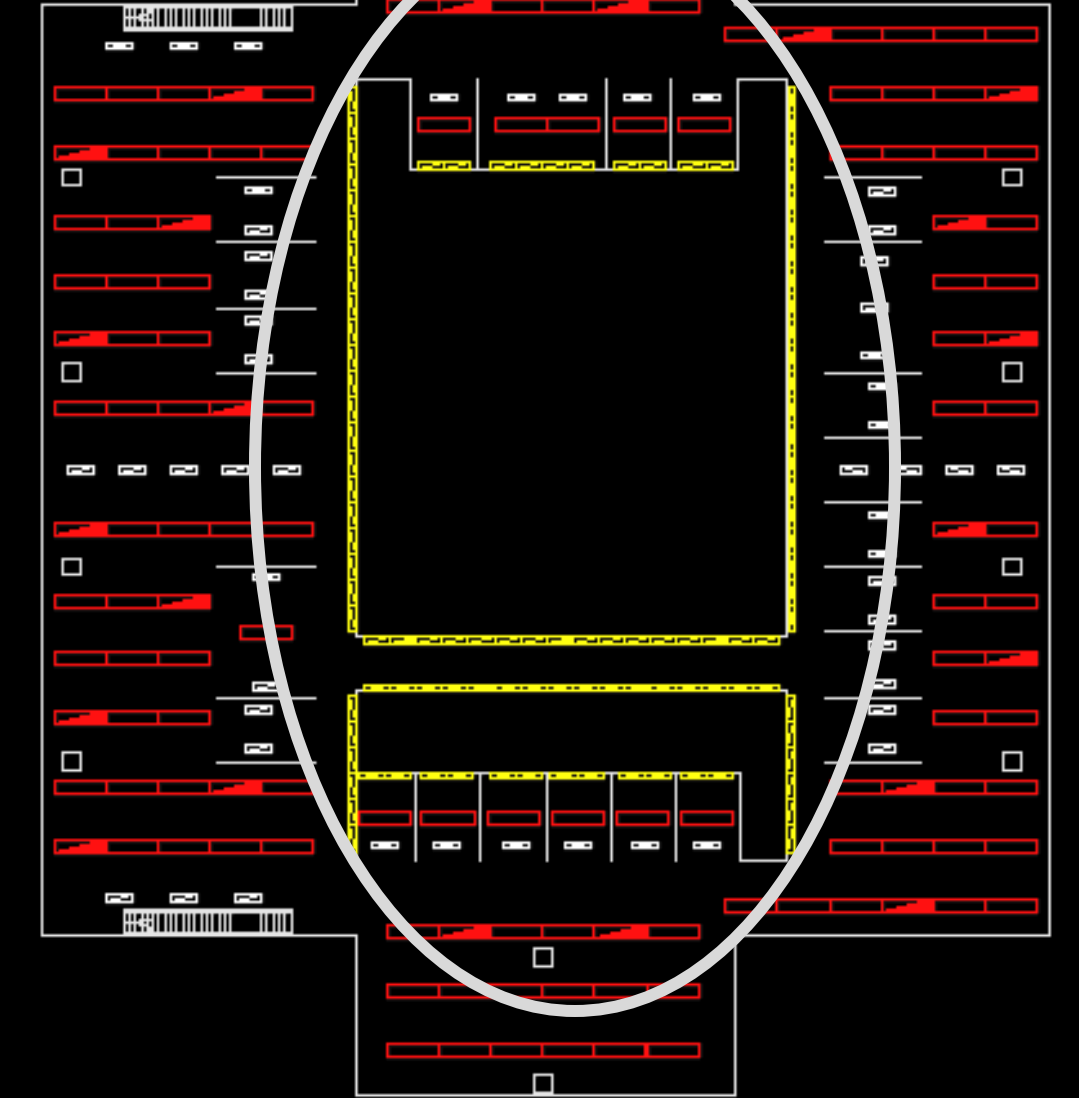
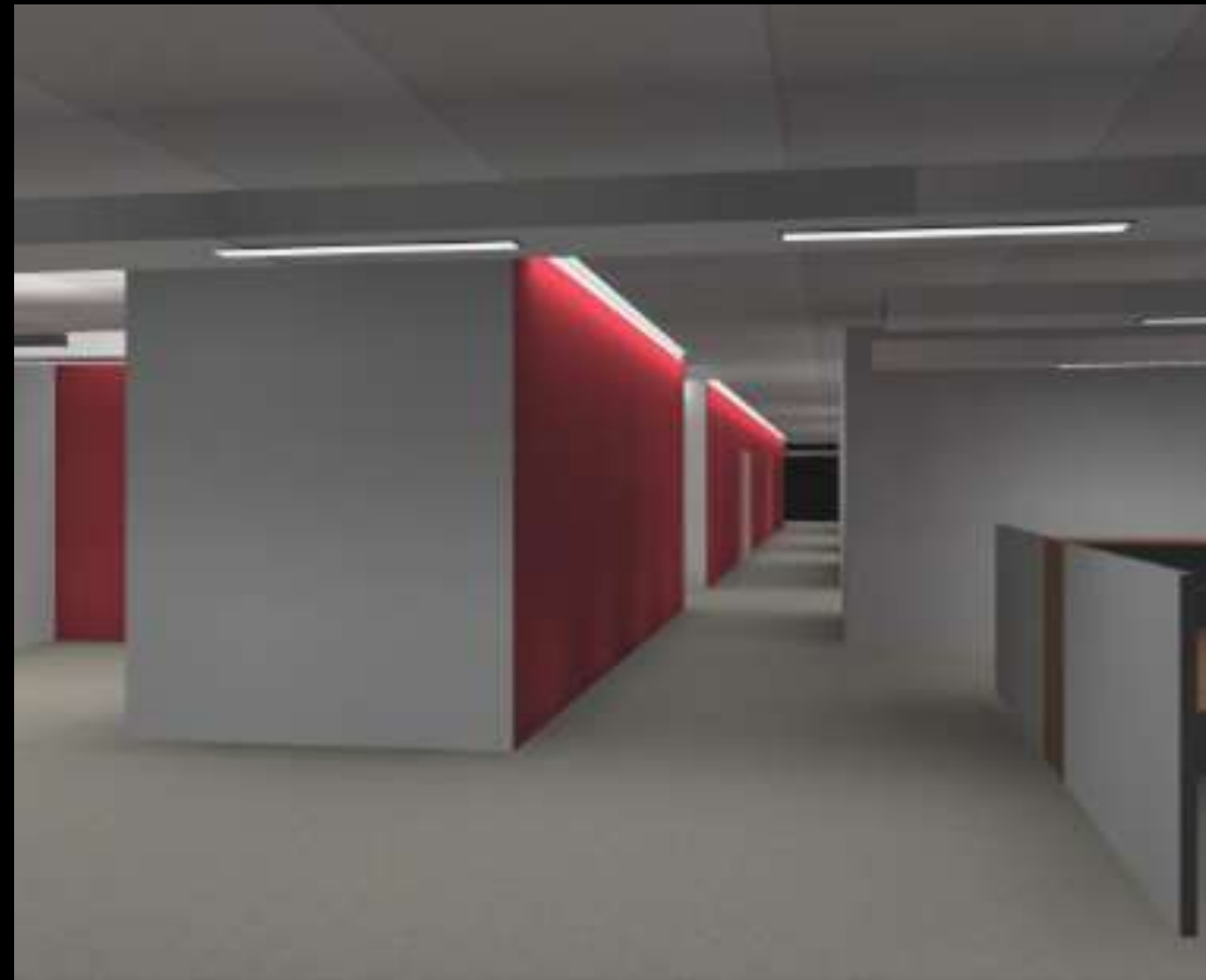
Façade Redesign
Floor System Redesign

Core Redesign
CoGen Redesign

BIM/IPD
Metrics of Success



Office Lighting Redesign

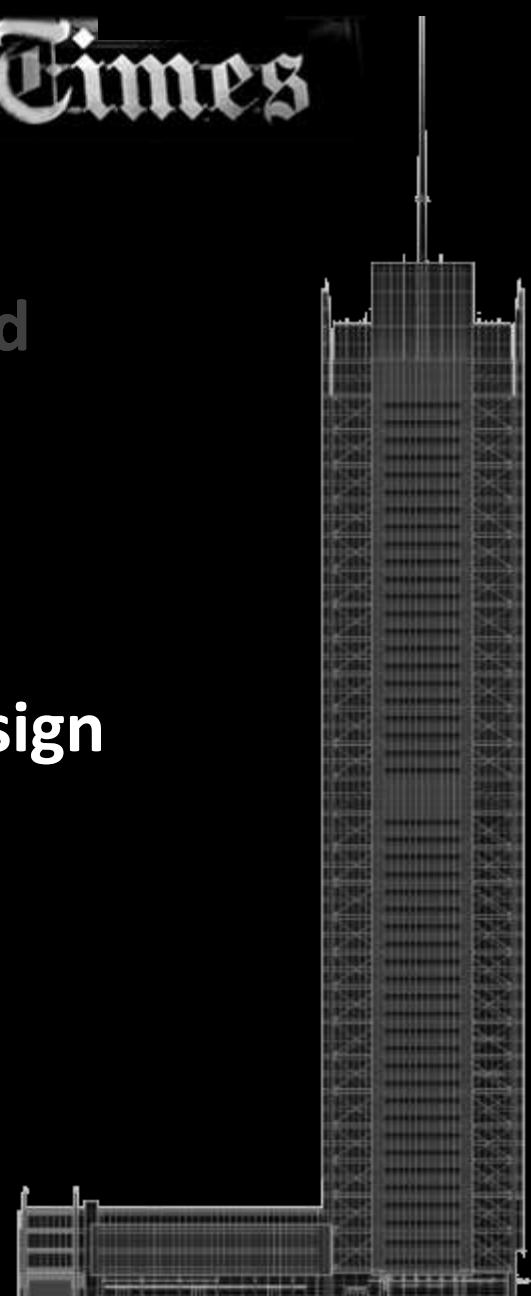


Intro
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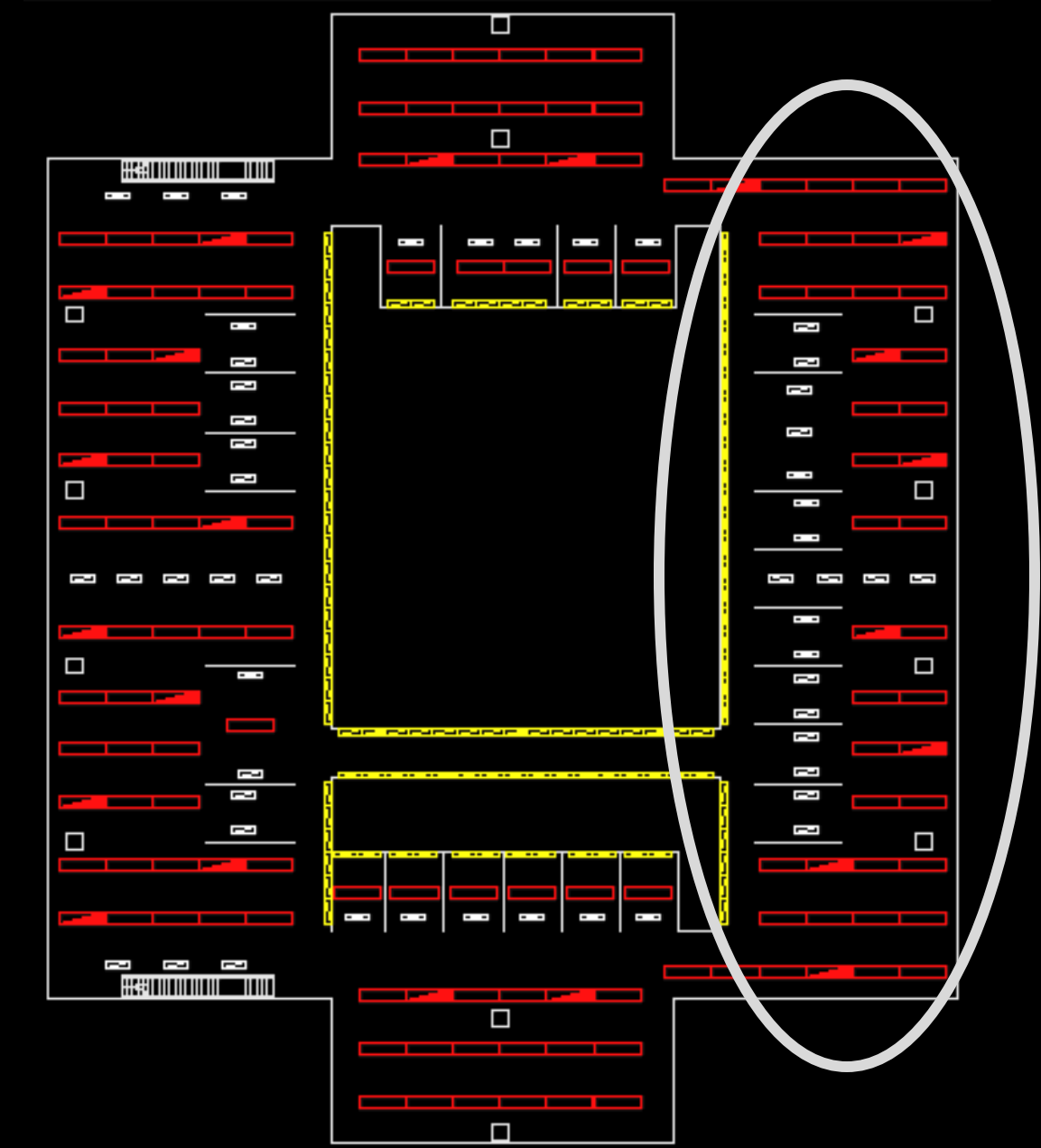
Façade Redesign
Floor System Redesign

Core Redesign
CoGen Redesign

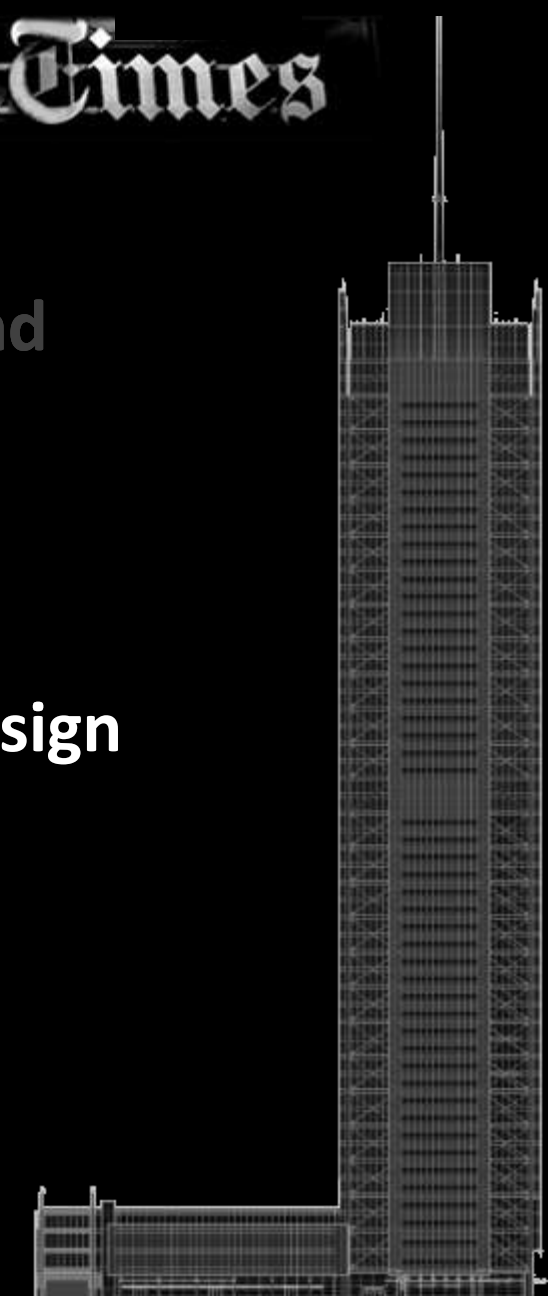
BIM/IPD
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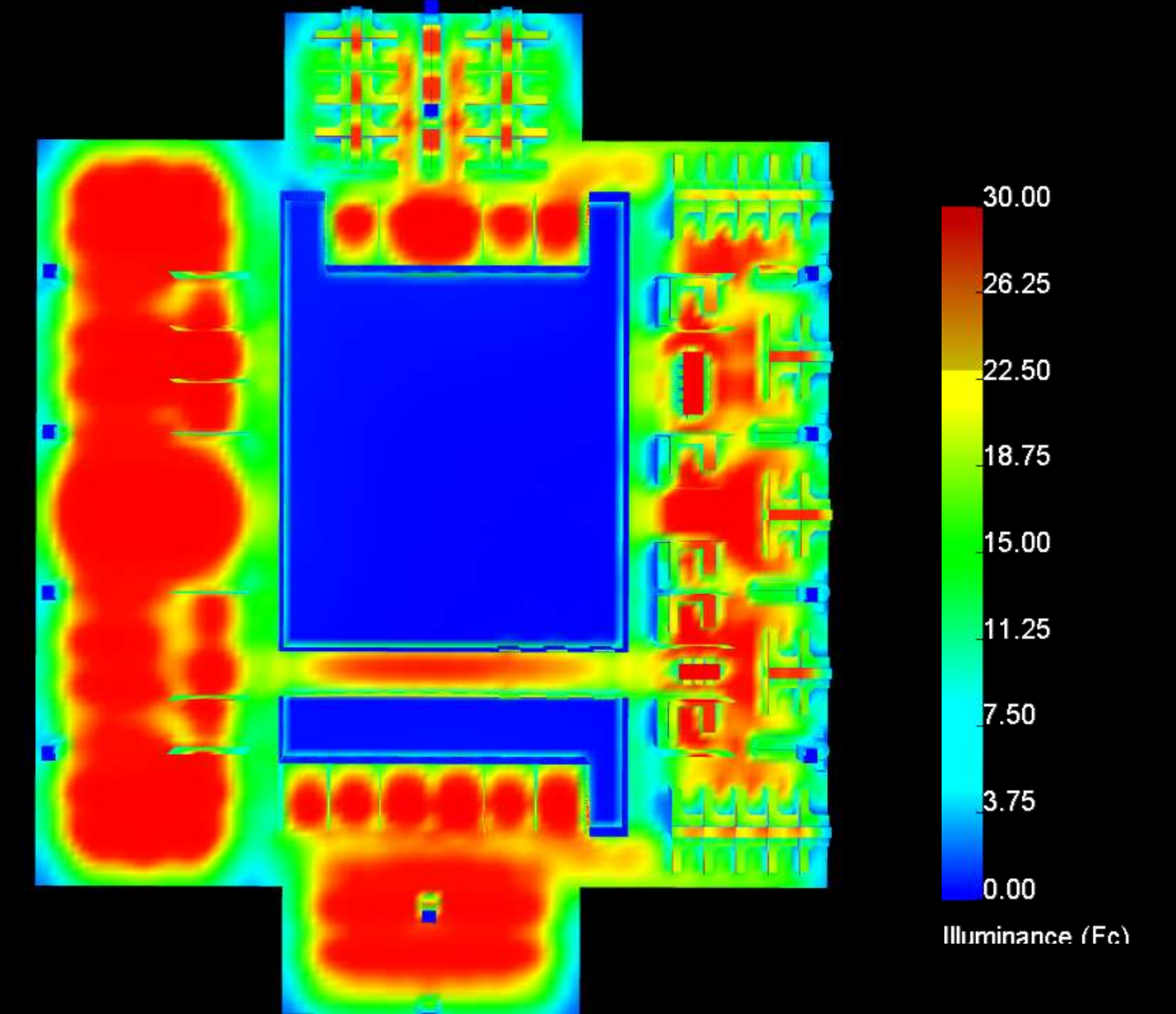
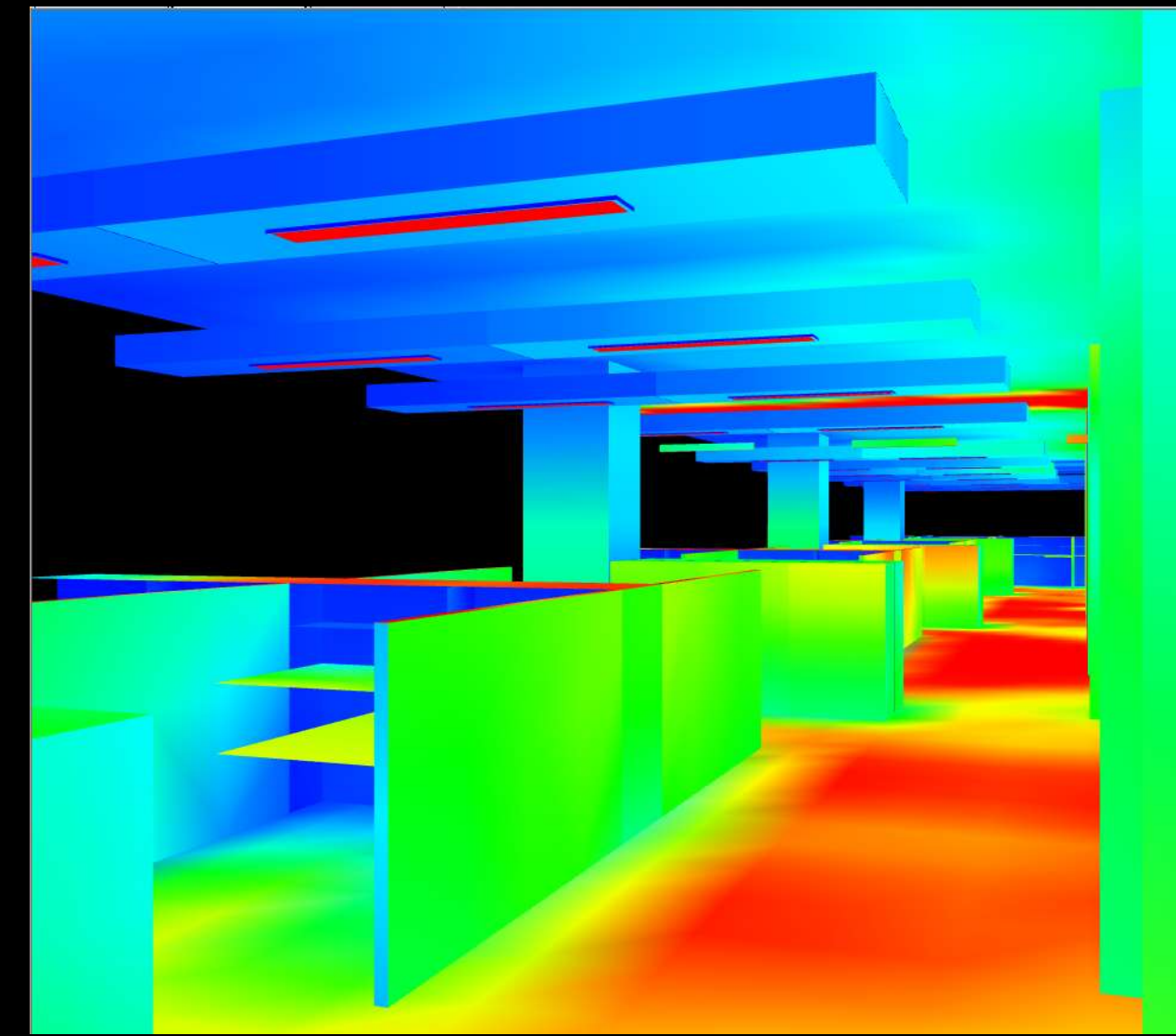
Office Lighting Redesign



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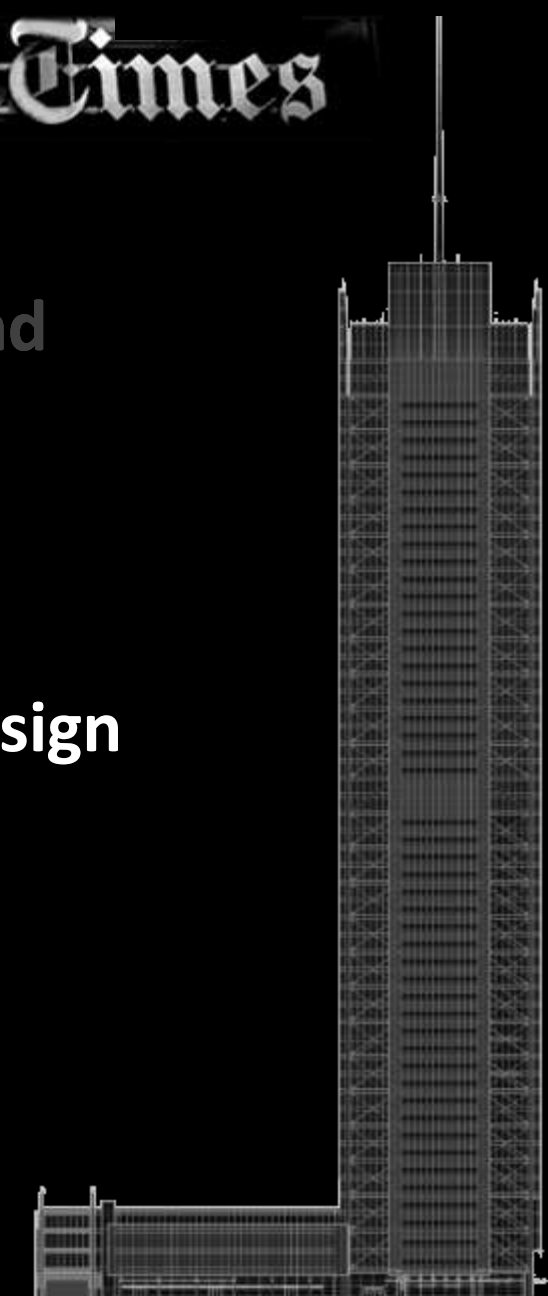


Office Lighting Redesign



Cost of Proposed Floor System

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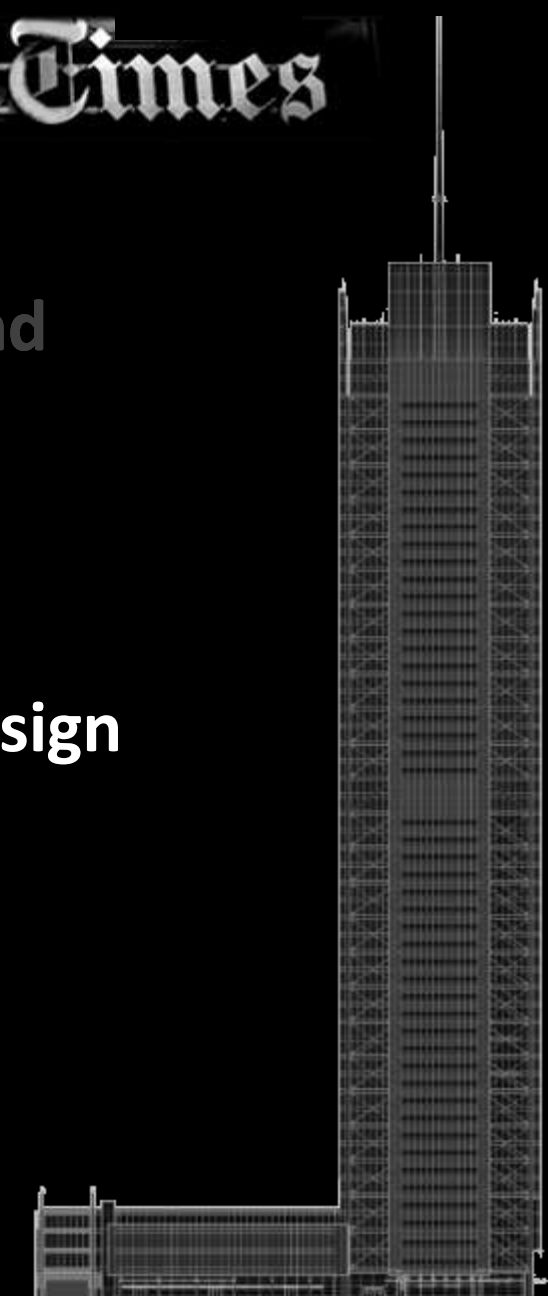
- o Cost addition of extra floor

	New Floor System
Structure	\$ 2,988,000.00
Raised Floor	\$ 885,000.00
HVAC Cost	\$ 3,328,000.00
Plumbing Cost	\$ 303,000.00
Electrical Cost	\$ 2,915,000.00
Communications	\$ 1,027,000.00
Interiors	\$ 607,000.00
Furnishing	\$ 215,000.00
	\$ 12,268,000.00

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Cost of Proposed Floor System

- Cost addition of extra floor
- Additional SF of leasable area

Additional Rent Annually	21,000 SF	<u>\$ 60 / SF</u> Year	\$ 1.26 million Year
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Intro

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Façade Redesign

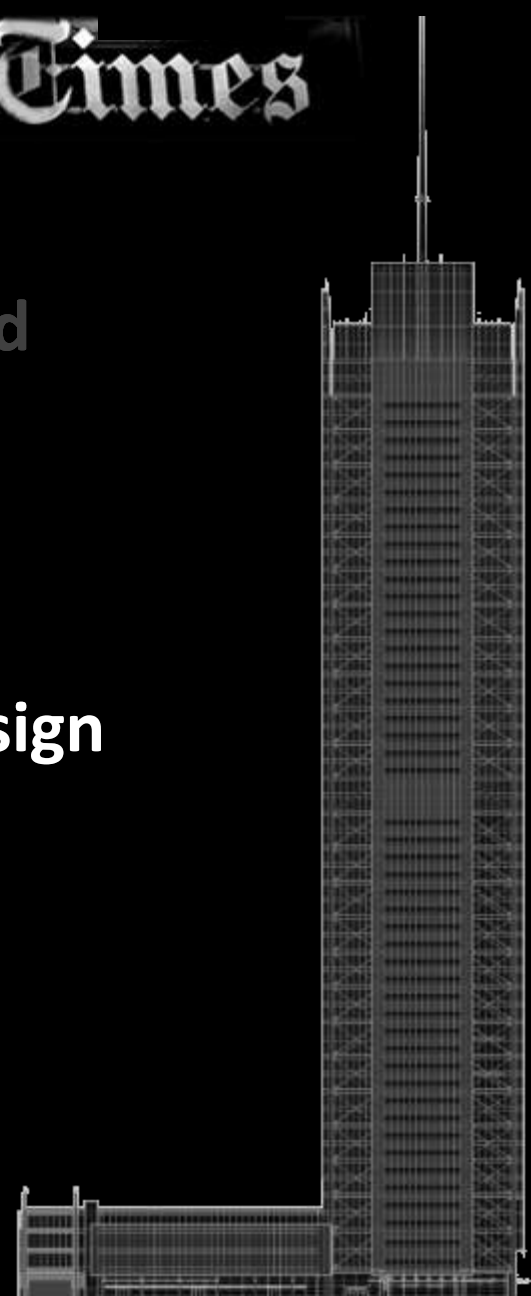
Floor System Redesign

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CoGen Redesign

BIM/IPD

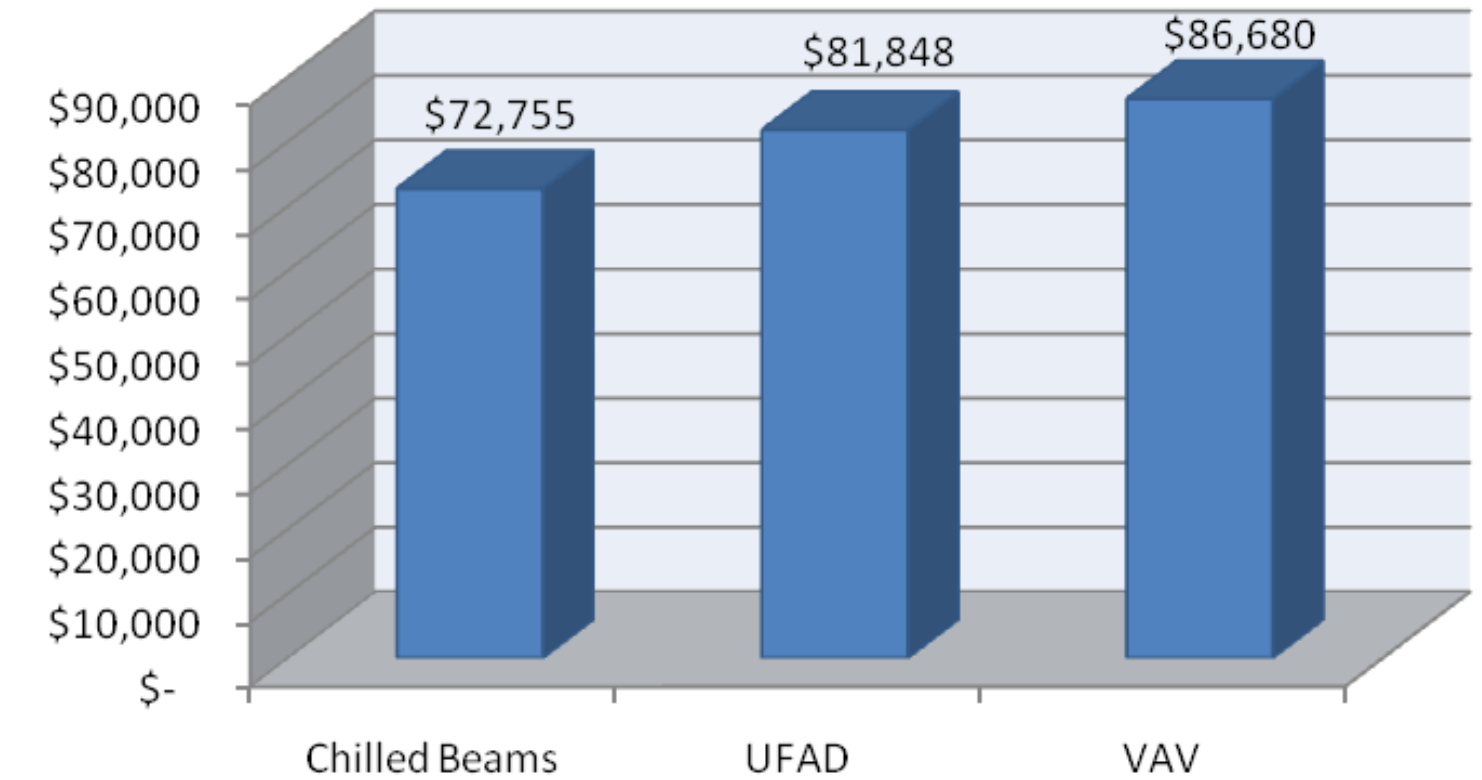
Metrics of Success



Cost of Proposed Floor System

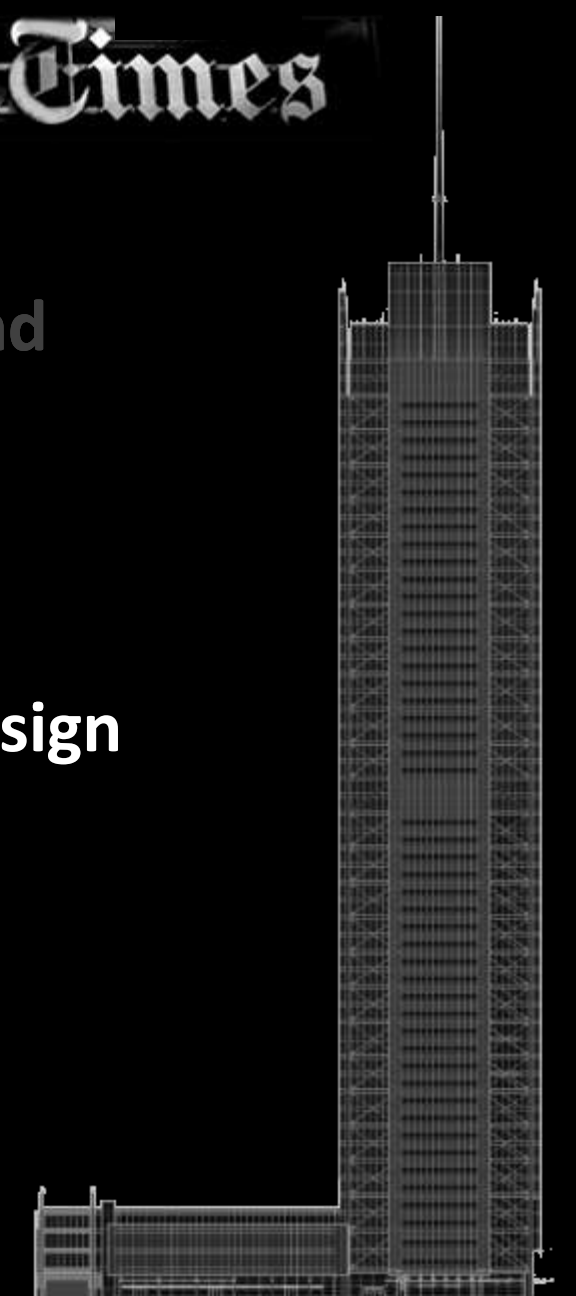
- Cost addition of extra floor
- Additional SF of leasable area
- Chilled beam cost savings

Yearly Energy Costs by Floor



Cost of Proposed Floor System

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- Cost addition of extra floor
- Additional SF of leasable area
- Chilled beam cost savings
- Overall cost comparison

Additional System Cost	\$ 12,268,000
Additional Rent	\$ 1,260,000
Energy Savings	\$ 565,800
Payback Period	6.72 years

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Façade Redesign

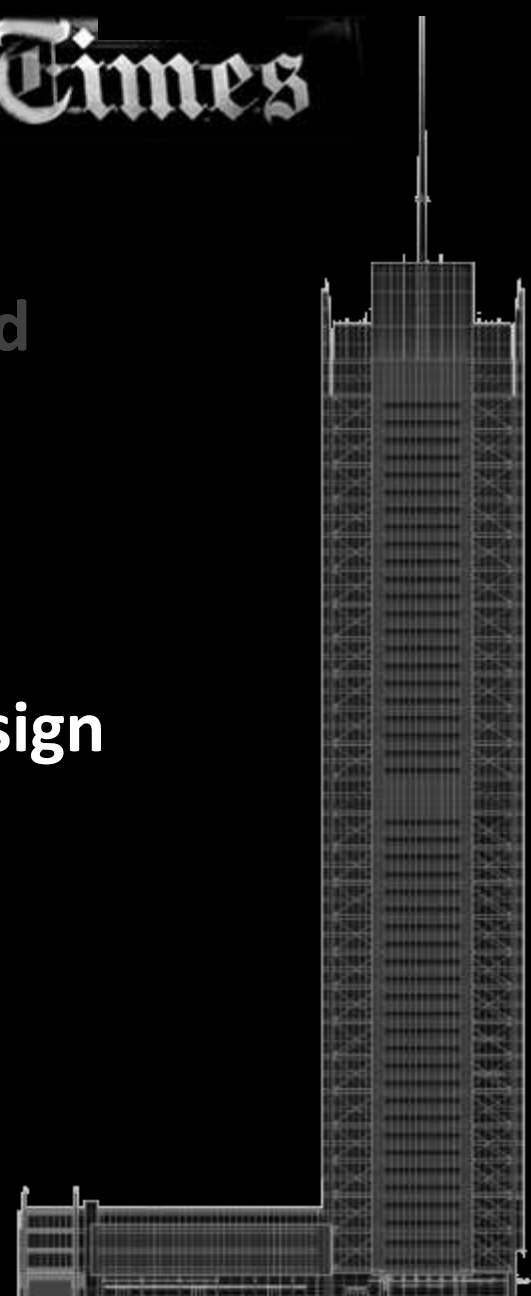
Floor System Redesign

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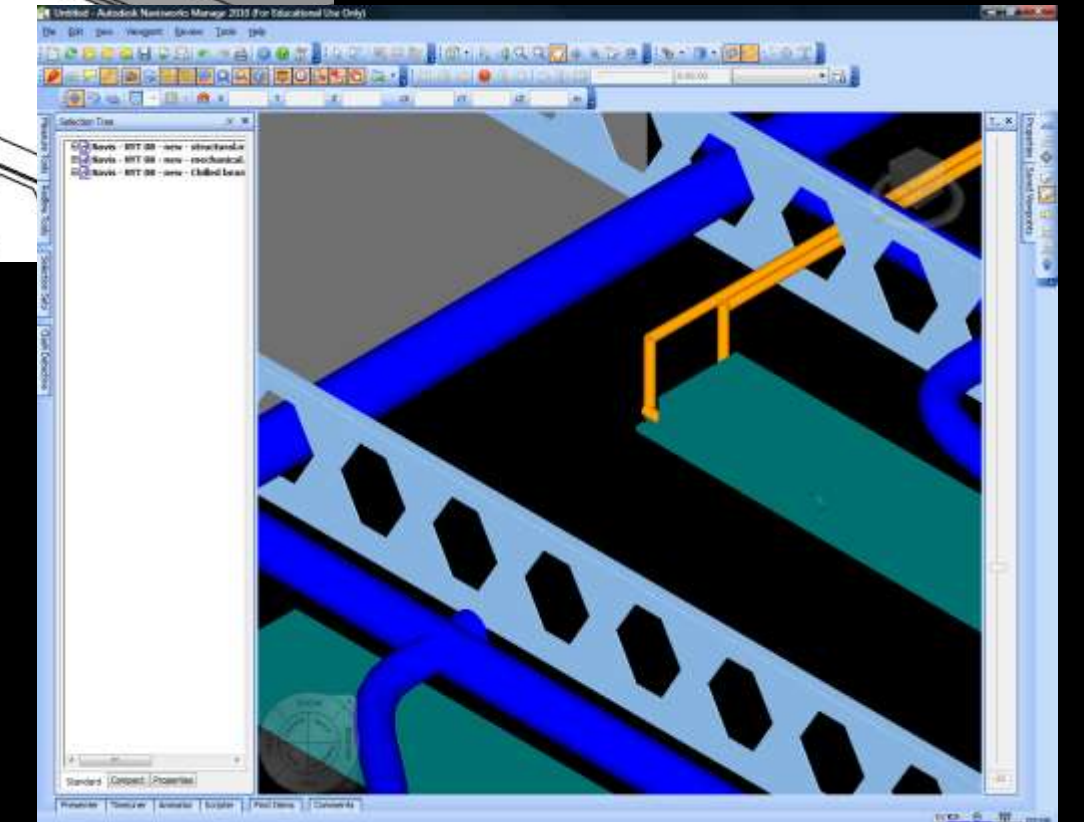
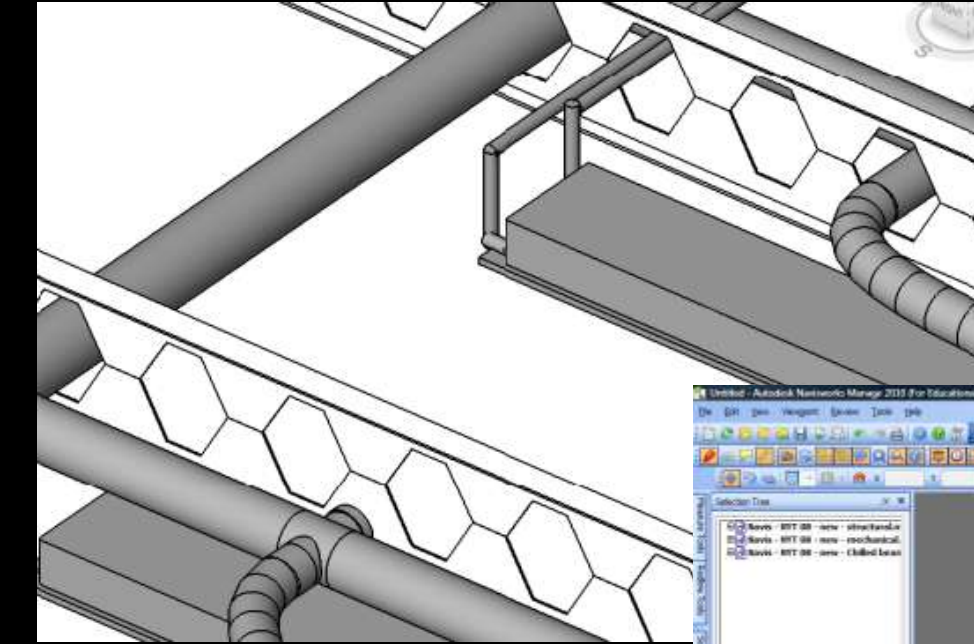
BIM/IPD

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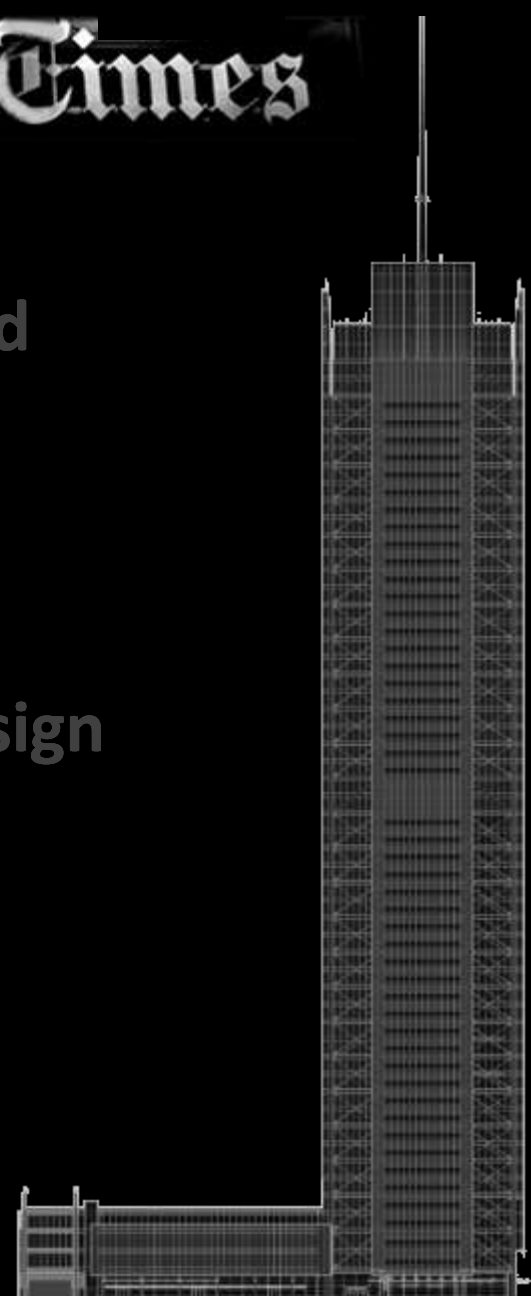


Integrated Design

- Constructability
- BIM Use Analysis
 - 3D Coordination
- Parties Involved
 - Structural
 - Mechanical
 - Lighting / Electrical
 - Construction Management
- Outcome



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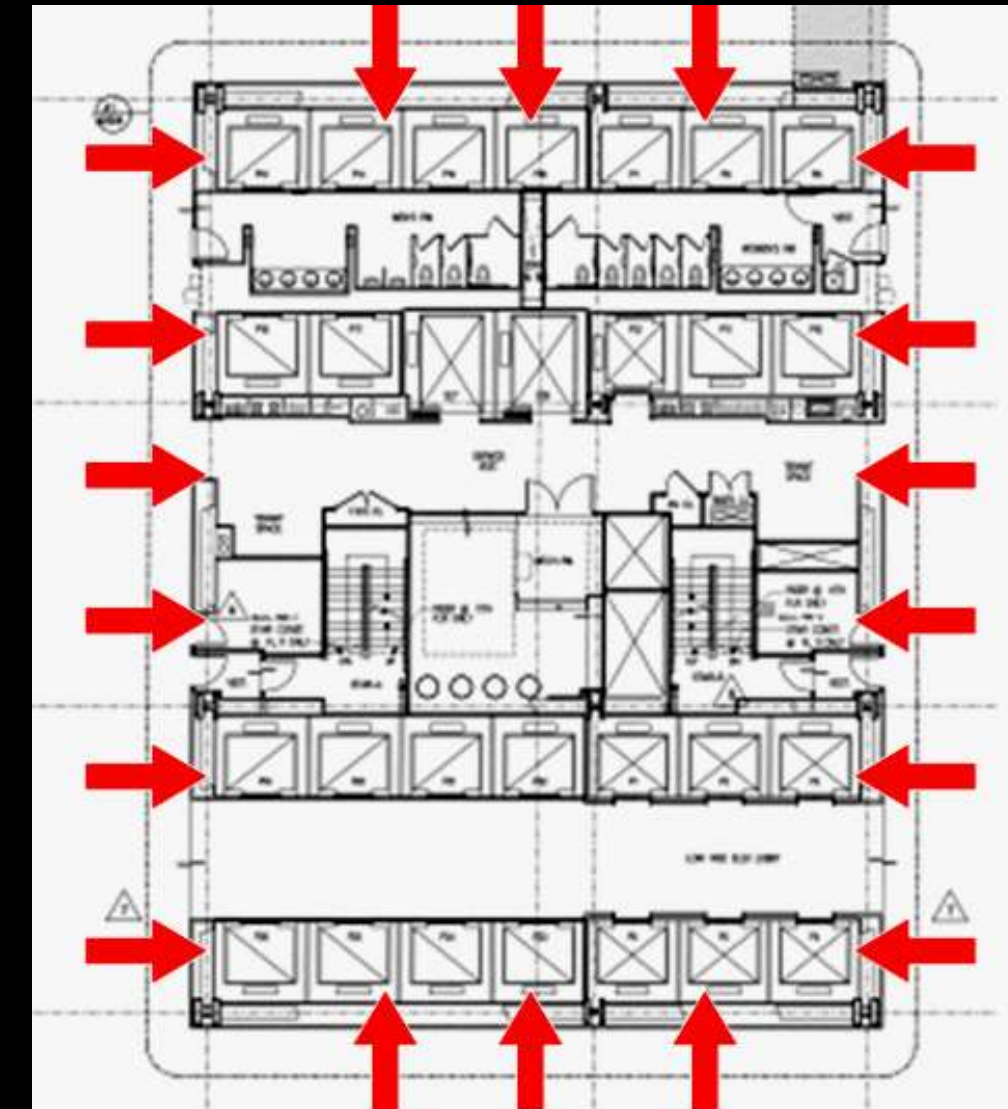
Core Redesign

Goals:

- Increase rentable floor space
- Explore trade issues (Concrete vs. Steel Core)
- Explore cost for core redesign

Redesign Opportunities:

- Reconfigure core layout structurally and architecturally
- Decrease footprint of the structural core
- Service Spaces



Intro

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Façade Redesign

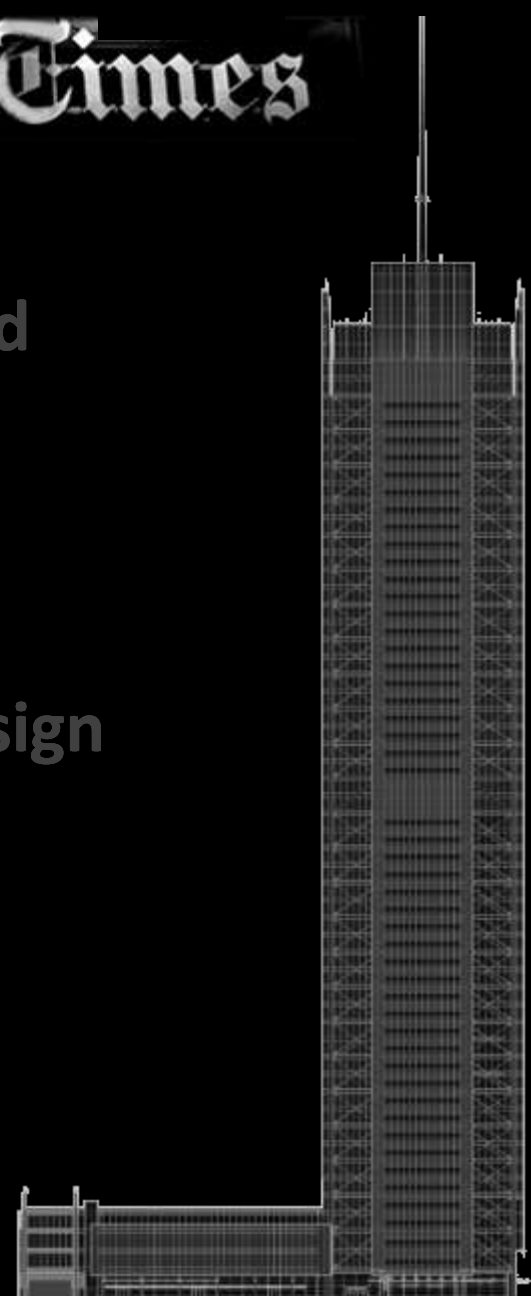
Floor System Redesign

Core Redesign

CoGen Redesign

BIM/IPD

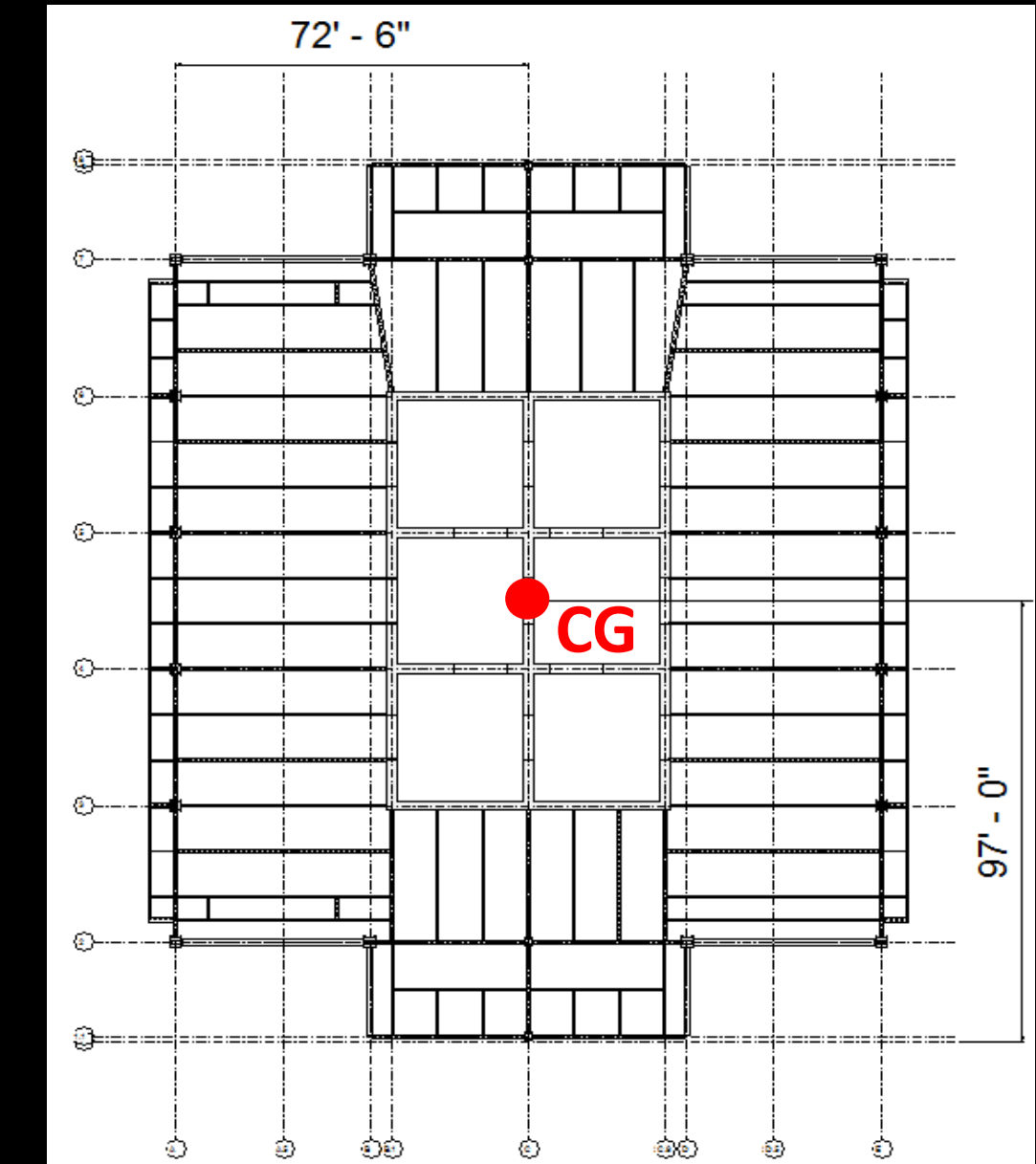
Metrics of Success



Core Configuration

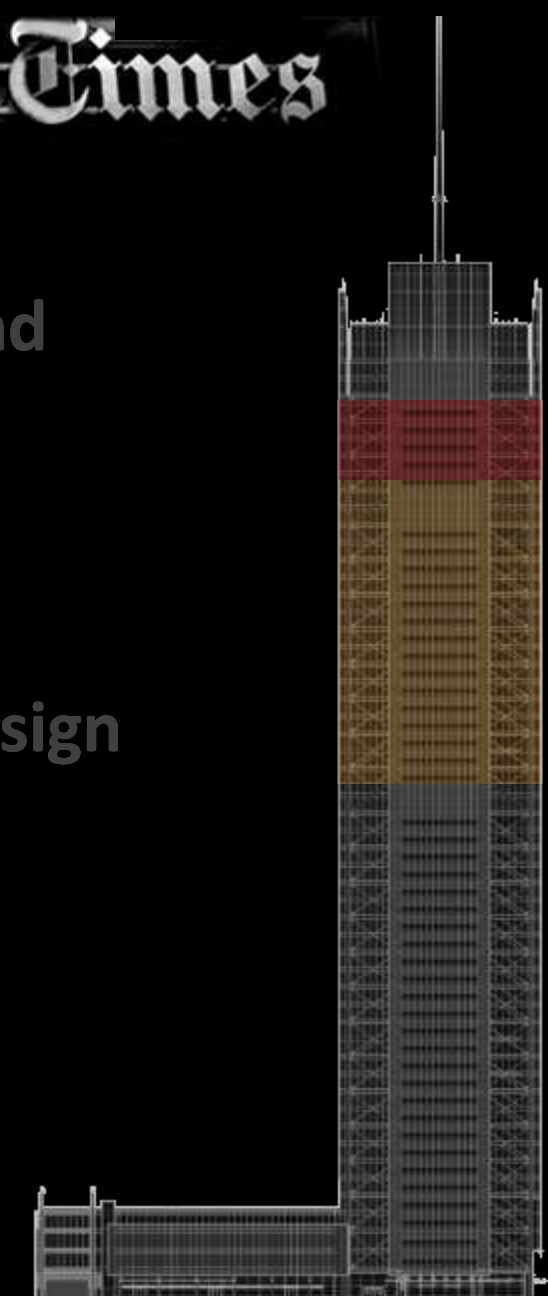
Maintain structural symmetry

- Reduces torsional effects due to lateral loads
- Center of geometry converges with center of pressure, center of mass, and center of rigidity



Core Configuration

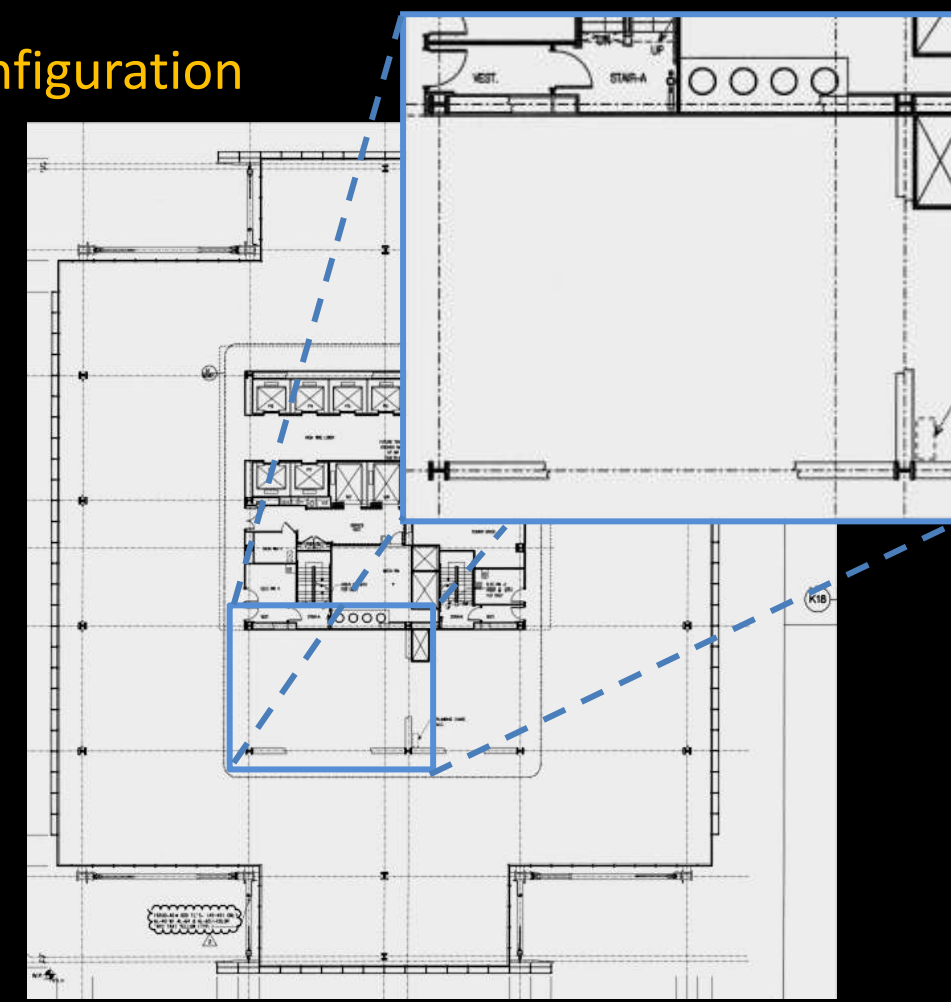
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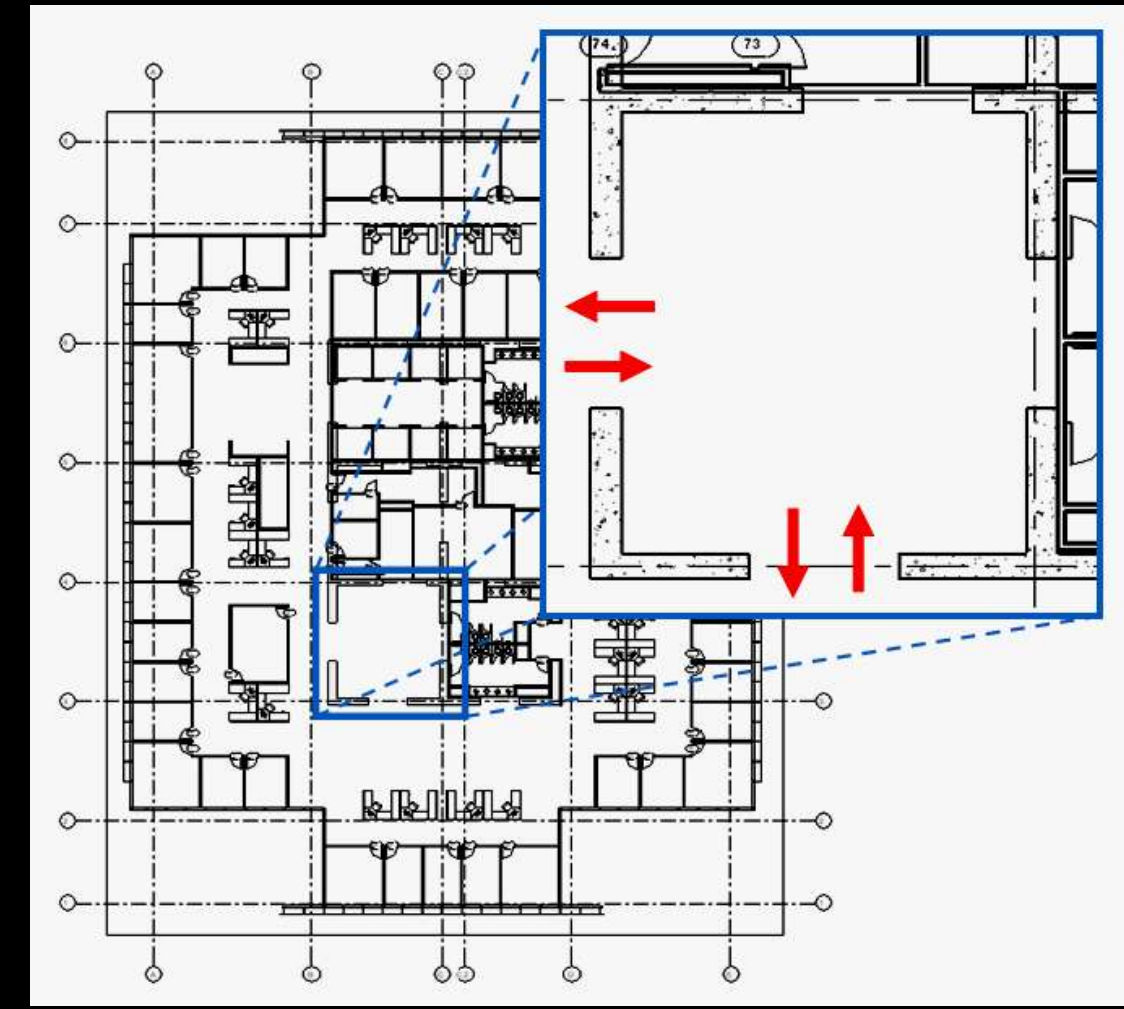
Maintain flexibility of space

Example: Floors 46 - 50

Existing Configuration



New Configuration



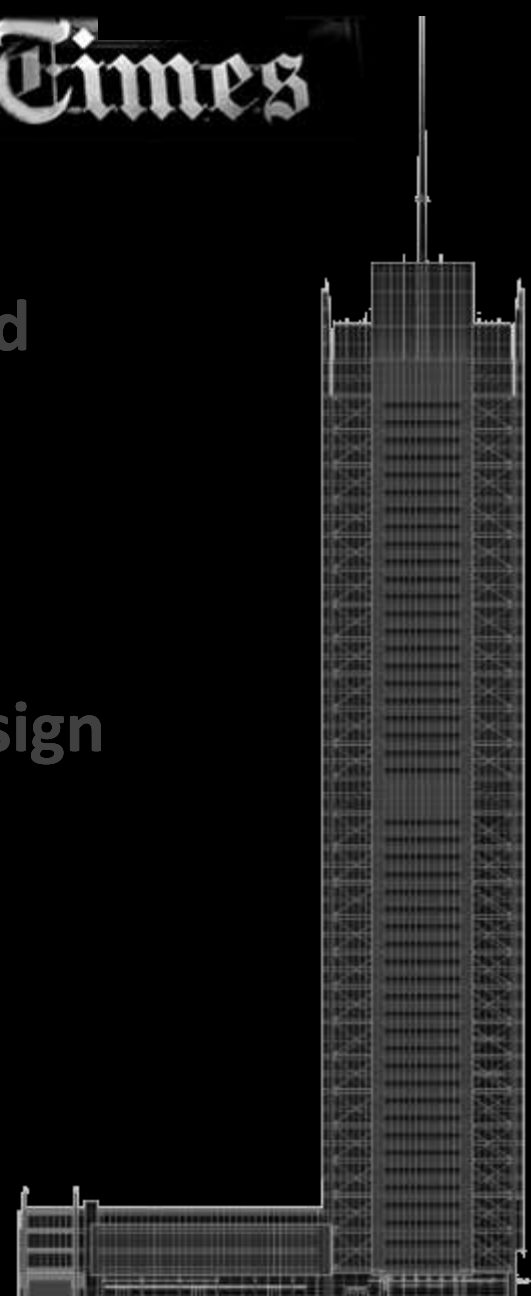
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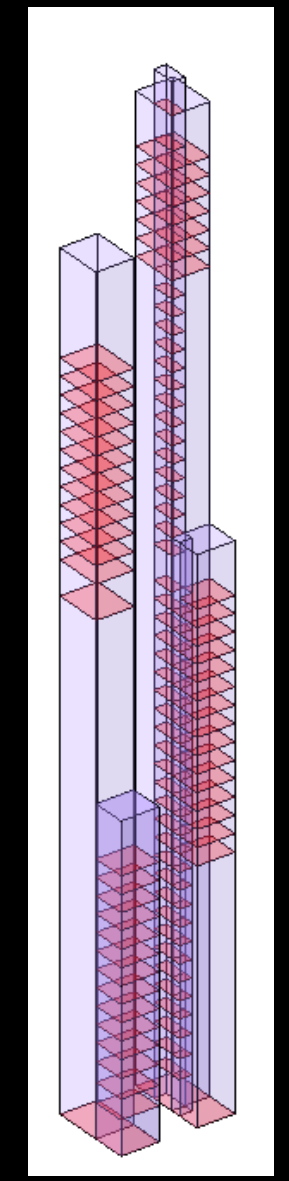
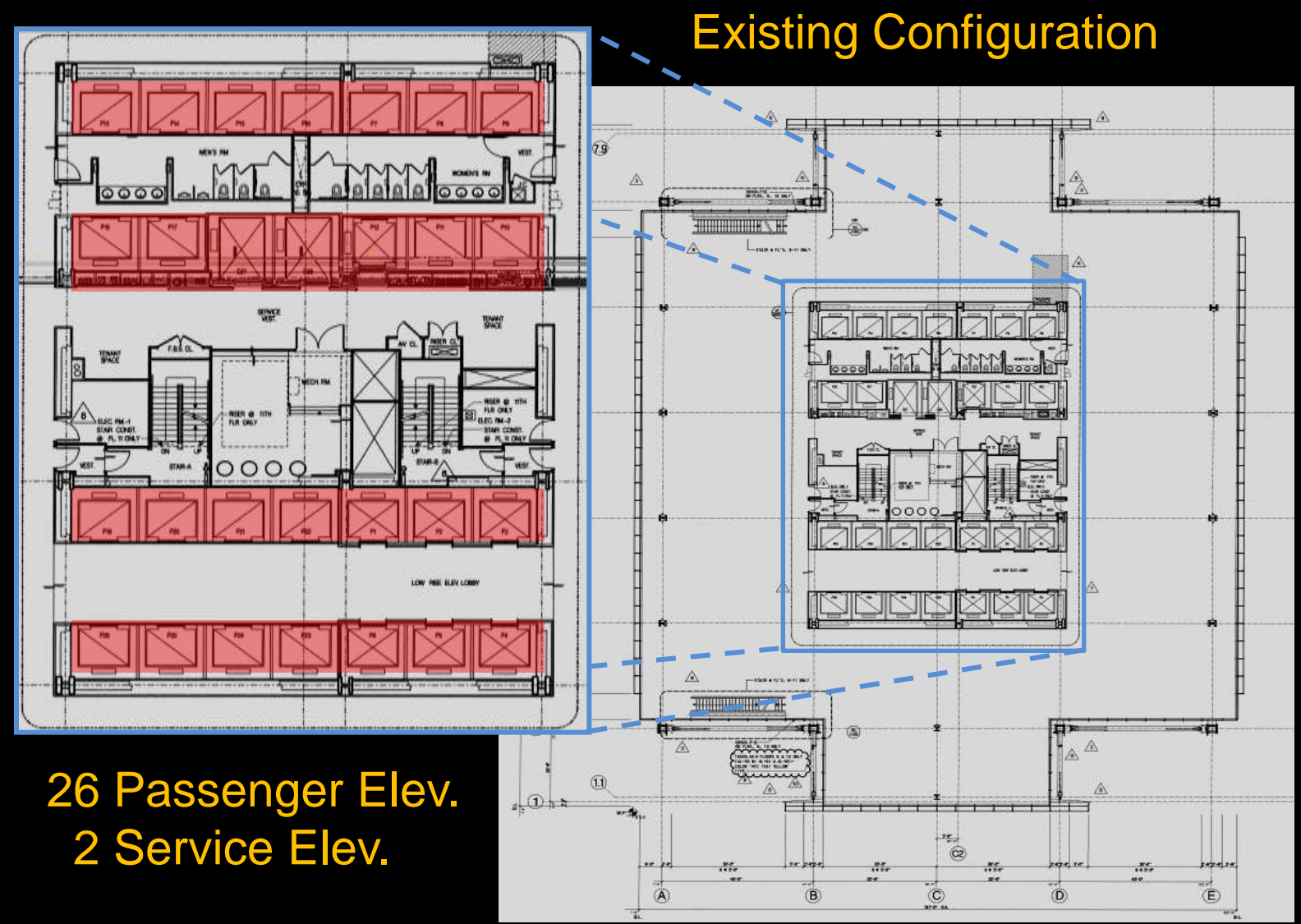
Core Redesign

CoGen Redesign

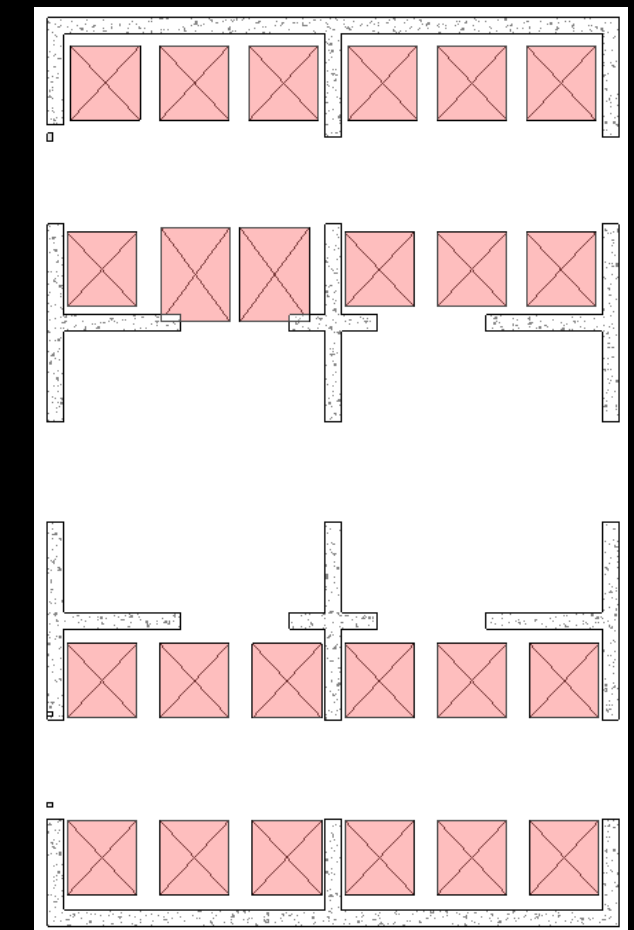
BIM/IPD
Metrics of Success



Elevator Configuration

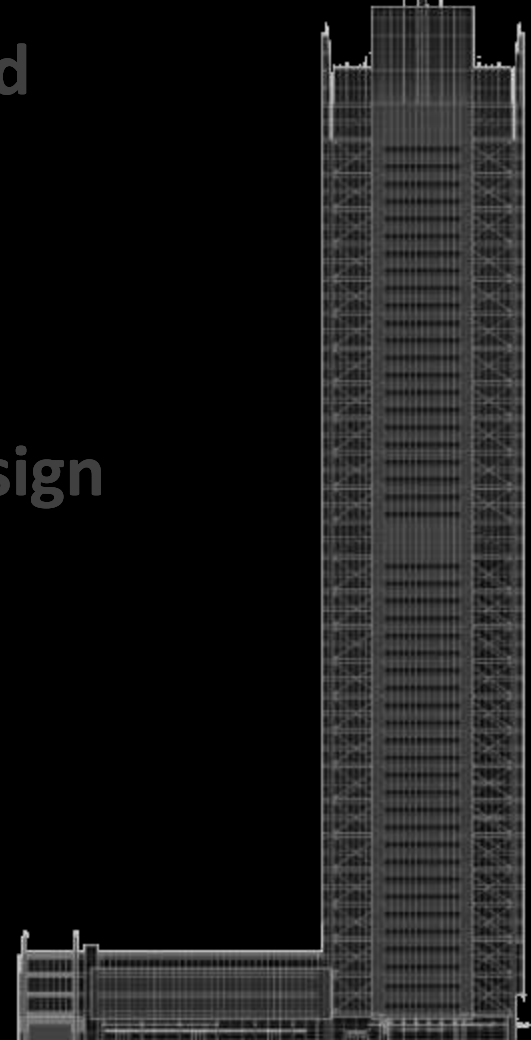


Feasibility Study: Elevator Reduction

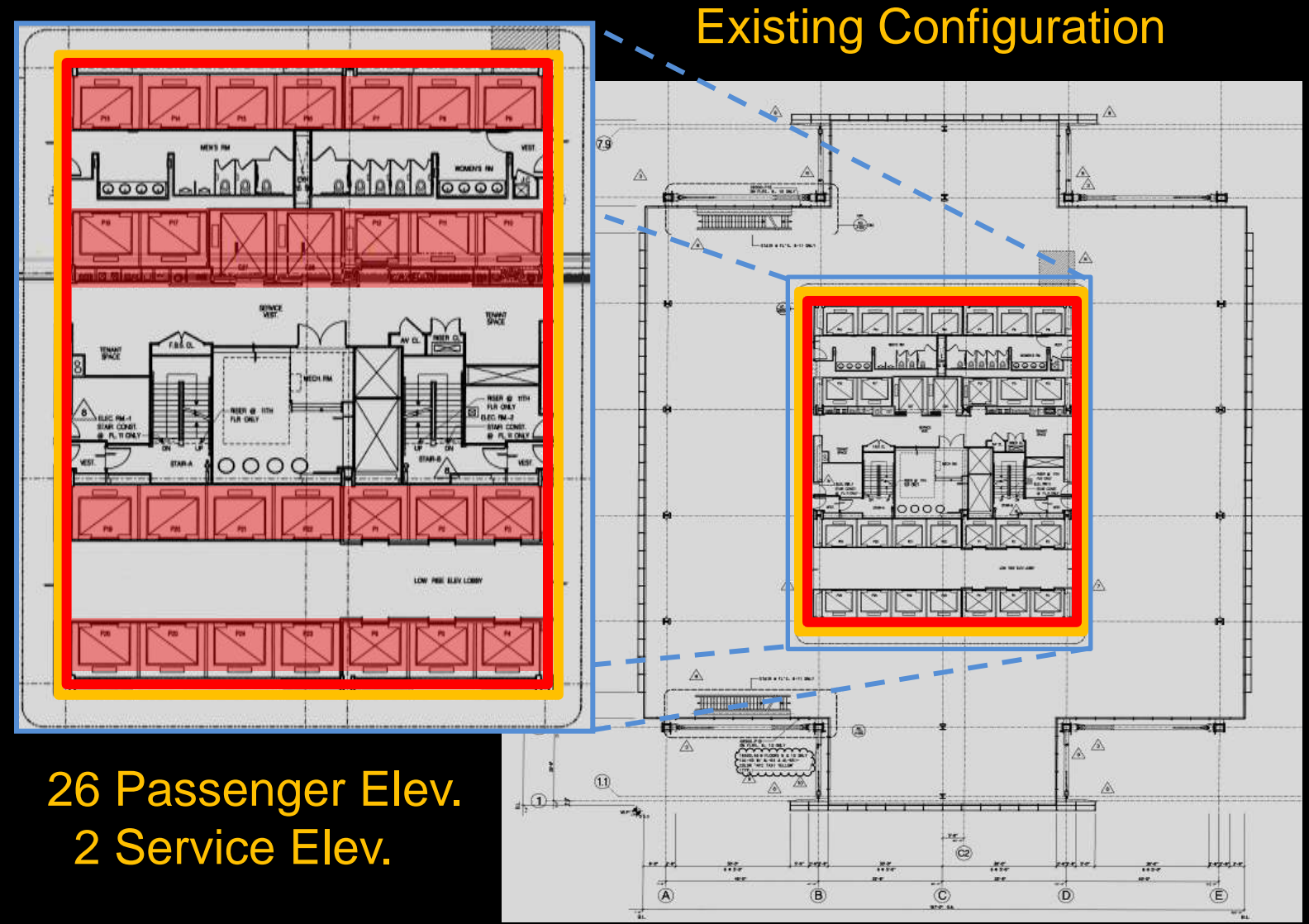


22 Passenger Elev.
2 Service Elev.

- Intro
- Building Background
- Proposal
- Façade Redesign
- Floor System Redesign
- Core Redesign**
- CoGen Redesign
- BIM/IPD
- Metrics of Success

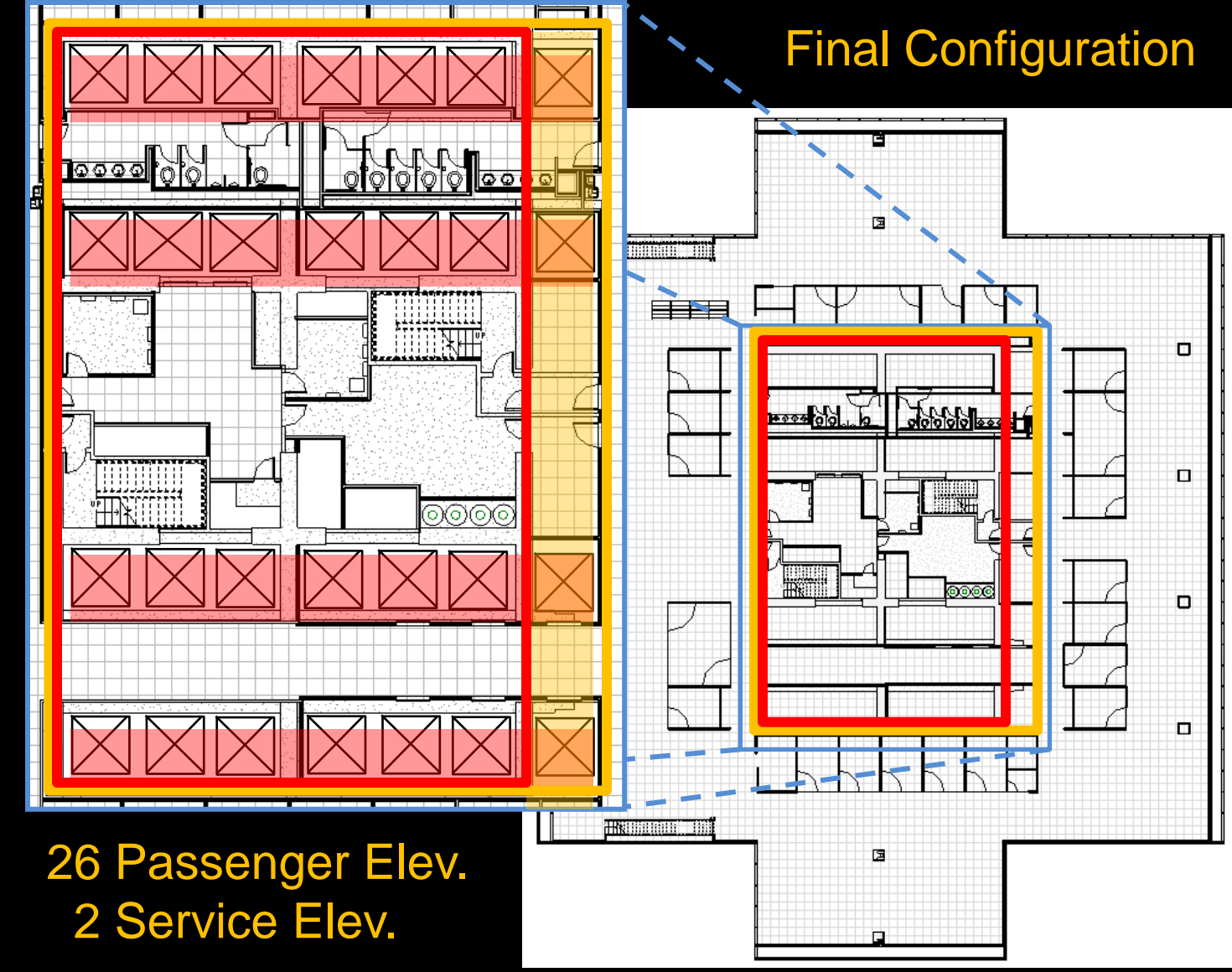


Core Configuration



26 Passenger Elev.
2 Service Elev.

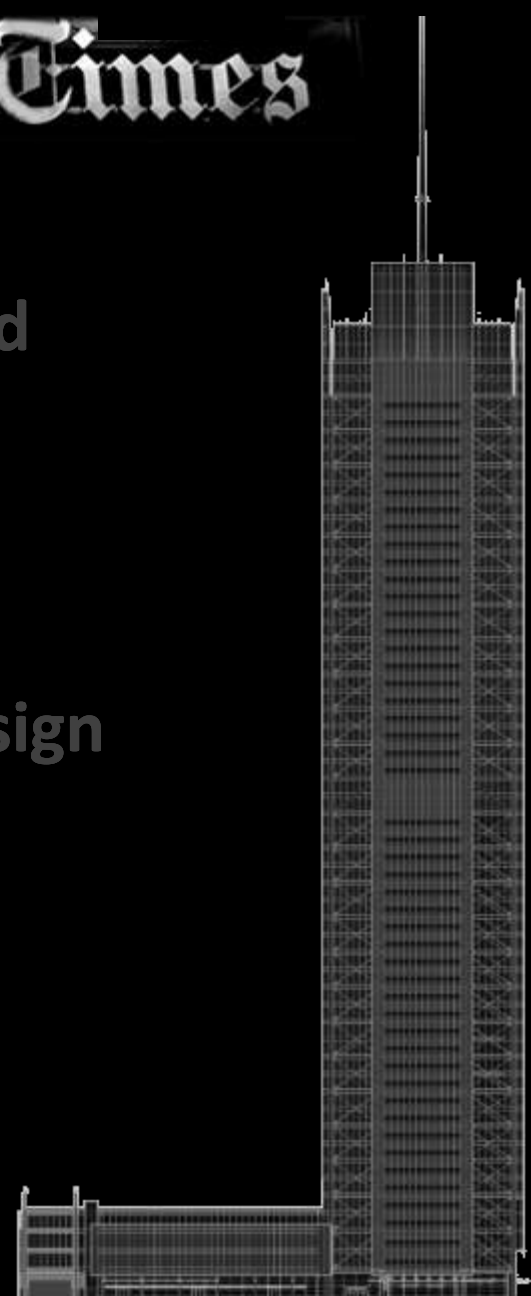
Existing Configuration



26 Passenger Elev.
2 Service Elev.

Final Configuration

- Intro
- Building Background
- Proposal
-
- Façade Redesign
- Floor System Redesign
- Core Redesign**
- CoGen Redesign
-
- BIM/IPD
- Metrics of Success



Architectural Configuration

Floor	Occupant	Existing Leasable Area (SF)	New Leasable Area (SF)	Difference (SF)
50	FCRC	21,943	22,126	183
49	FCRC	21,943	22,126	183
48	FCRC	21,943	22,126	183
47	FCRC	21,943	22,126	183
46	FCRC	21,943	22,126	183
45	FCRC	21,943	22,126	183
44	FCRC	21,650	22,126	476
43	FCRC	21,650	22,126	476
42	FCRC	21,650	22,126	476
41	FCRC	21,650	22,126	476
40	FCRC	21,244	21,456	212
39	FCRC	21,244	21,456	212
38	FCRC	21,244	21,456	212
37	FCRC	21,244	21,456	212
36	FCRC	21,244	21,456	212
35	FCRC	21,244	21,456	212
34	FCRC	21,244	21,456	212
33	FCRC	21,244	21,456	212
32	FCRC	21,244	21,456	212
31	FCRC	21,244	21,456	212
30	FCRC	21,244	21,456	212
29	FCRC	20,429	20,959	530
		472,371SF	478,235 SF	5,864 SF

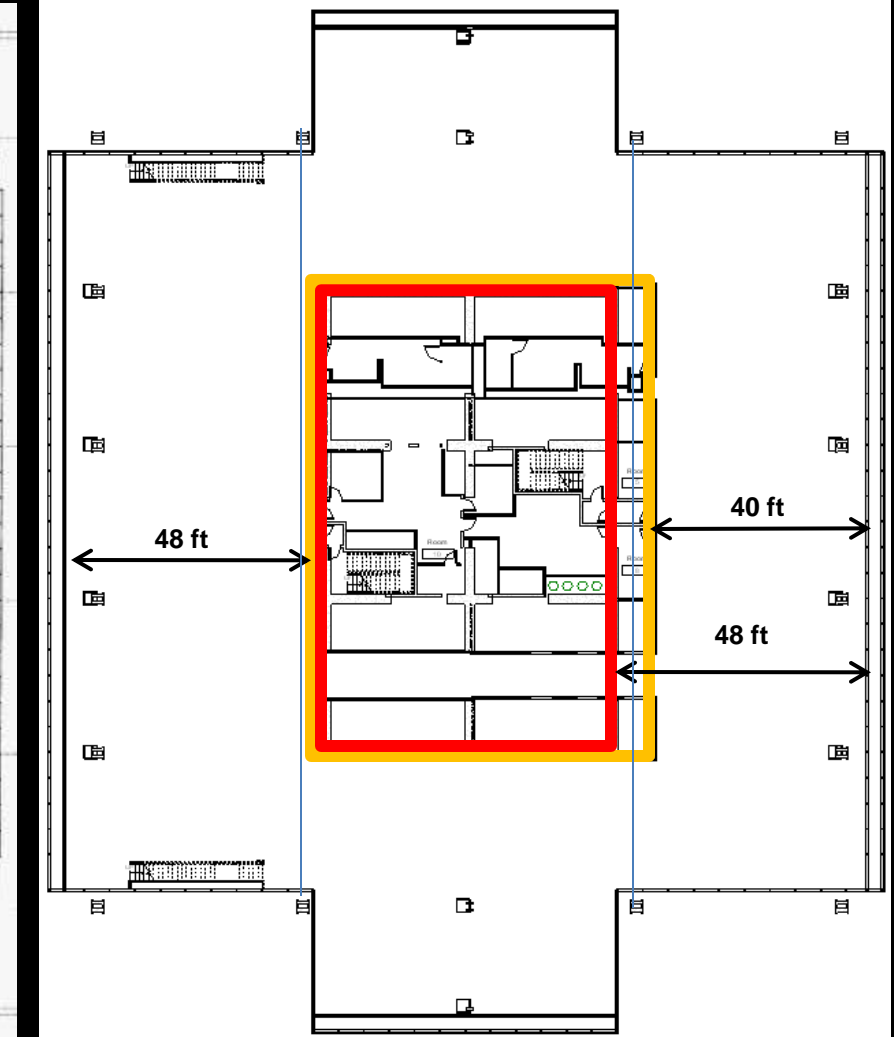
30	FCRC	21,244	21,456	212
29	FCRC	20,429	20,959	530
		472,371SF	478,235 SF	5,864 SF

Additional Rent Annually	5864 SF	\$60 / SF Year	\$ 351,840 Year
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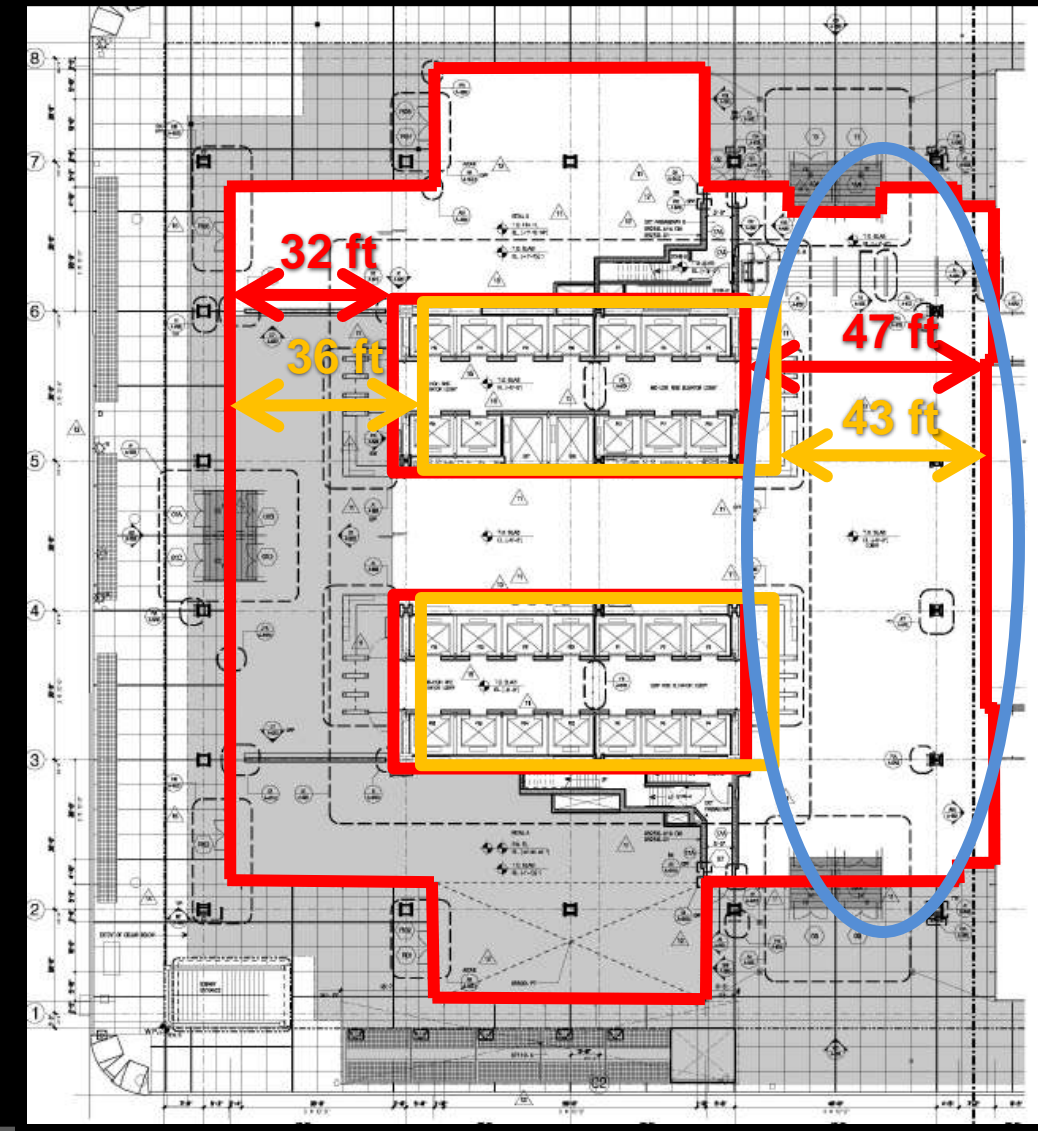
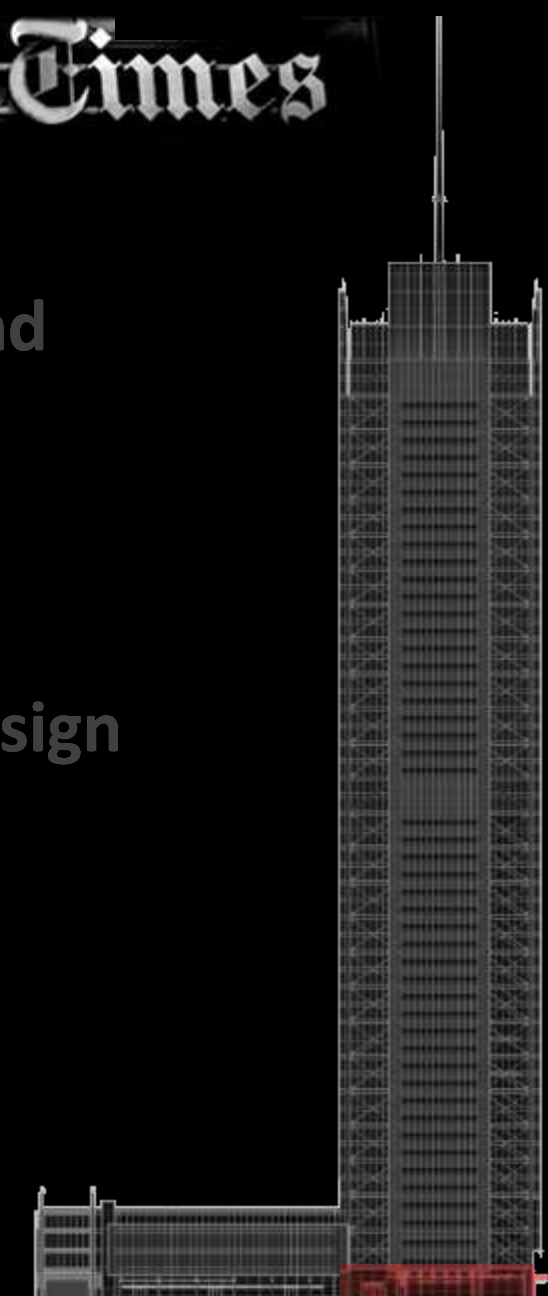
Existing Core Configuration



New Core Configuration



- Intro
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- Core Redesign**
- CoGen Redesign
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- Metrics of Success

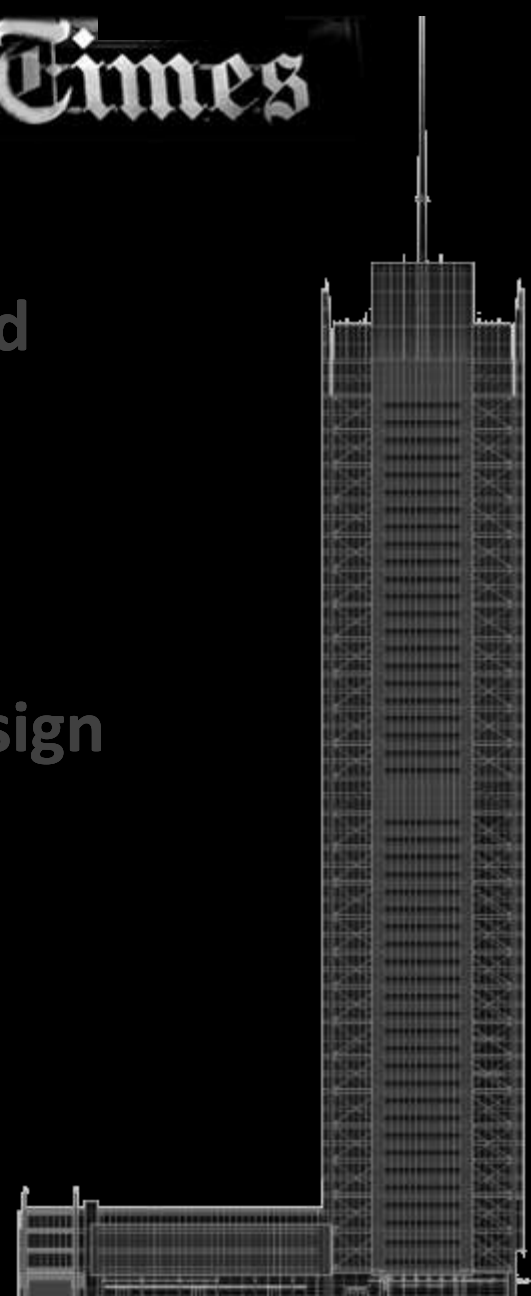


Existing Lobby



New Lobby Rendering

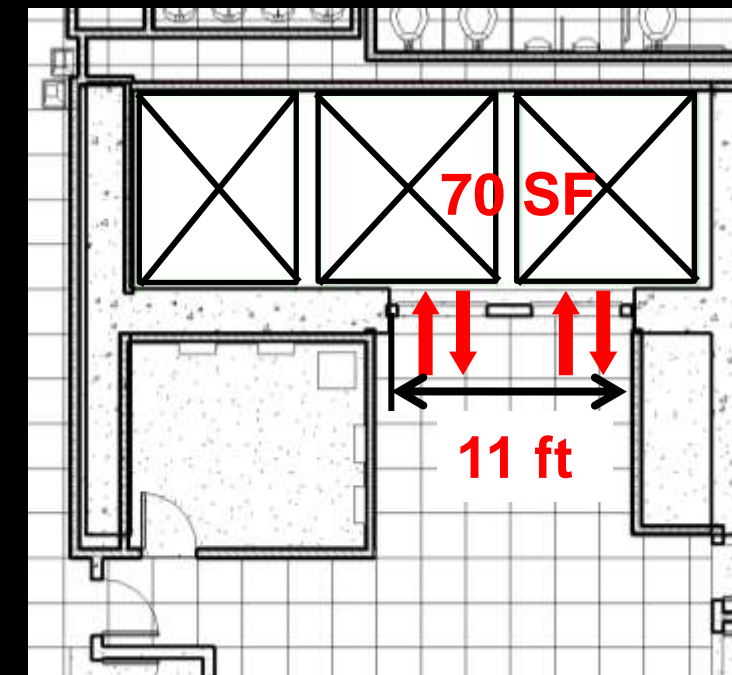
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Service Space Configuration

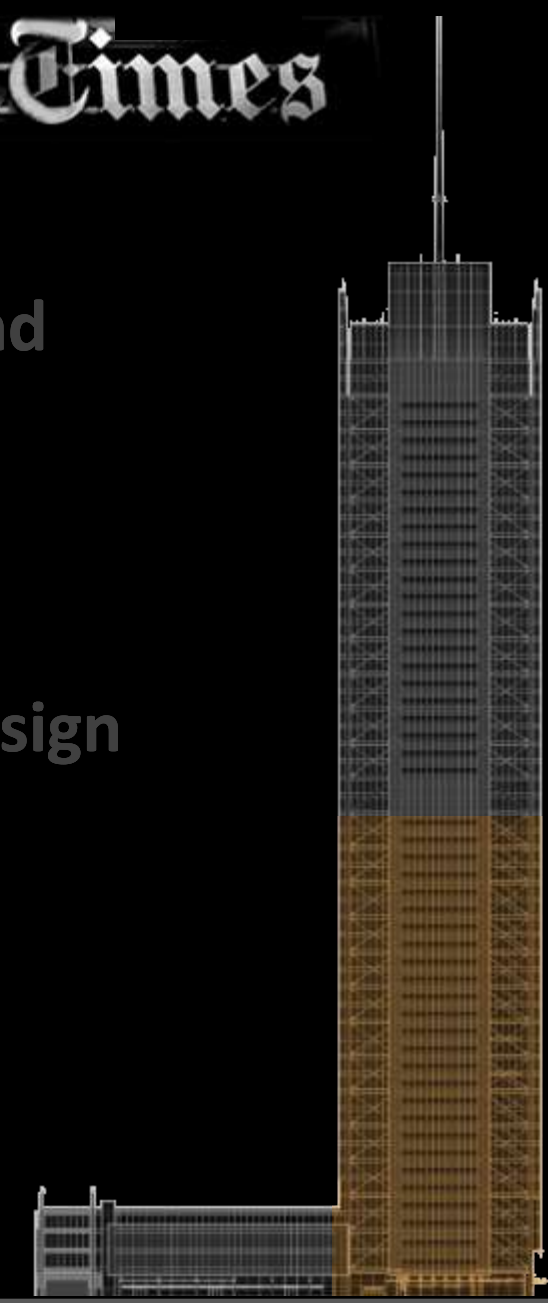
Area	Existing SF	New SF
Mechanical	360 SF	347 SF
Electrical	180 SF	182 SF
Risers	235 SF	206 SF
Stairs	297 SF	303 SF
Tenant Space	277 SF	267 SF

Service Elevators



Service Space Configuration

- Intro
- Building Background
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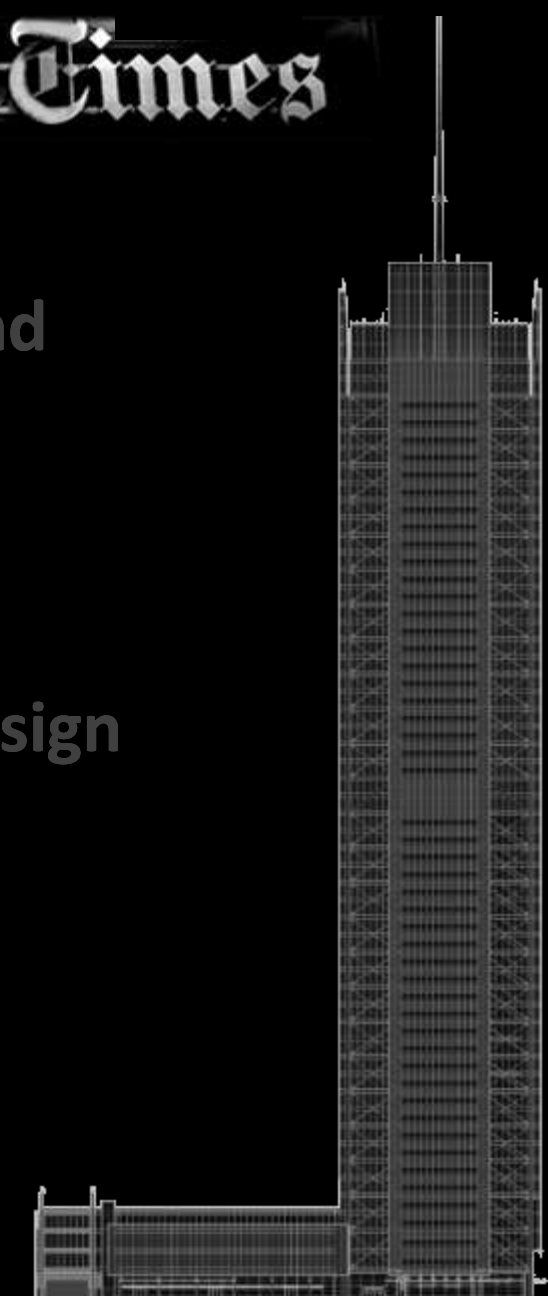
Bus Duct Vs Conduit Analysis	
Existing Conditions in NYT Portion	
18	3 1/2" Conduit Feeders Powers Lighting and Appliance Panels
6	3 1/2" Conduit Feeders Powers Mechanical Equipment Panels
Proposed Redesign	
2	2500 Amp Aluminum Bus Duct Feeders Powers Lighting and Appliance Panels
1	1600 Amp Aluminum Bus Duct Feeder Powers Mechanical Equipment Panels

- Bus Duct V
- Total Cost S
- Co
- Space Com
- Mi
- Benefit of
- Possibility of Expansion Without Adding Additional Feeders

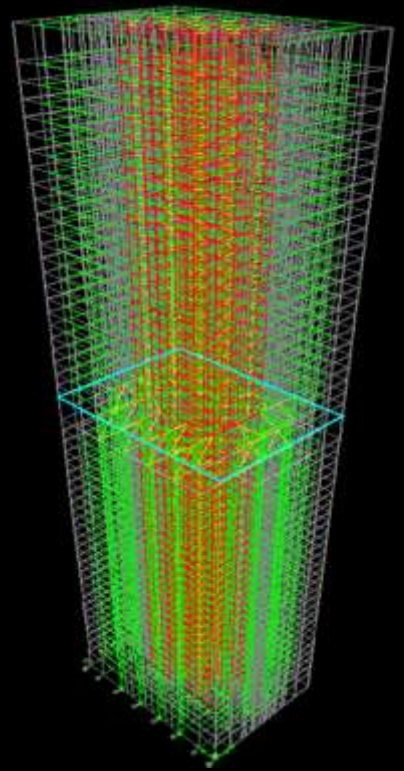
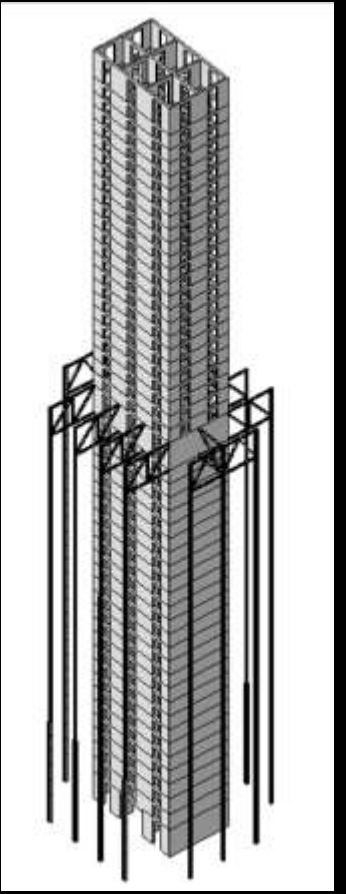


Lateral Force Resisting System

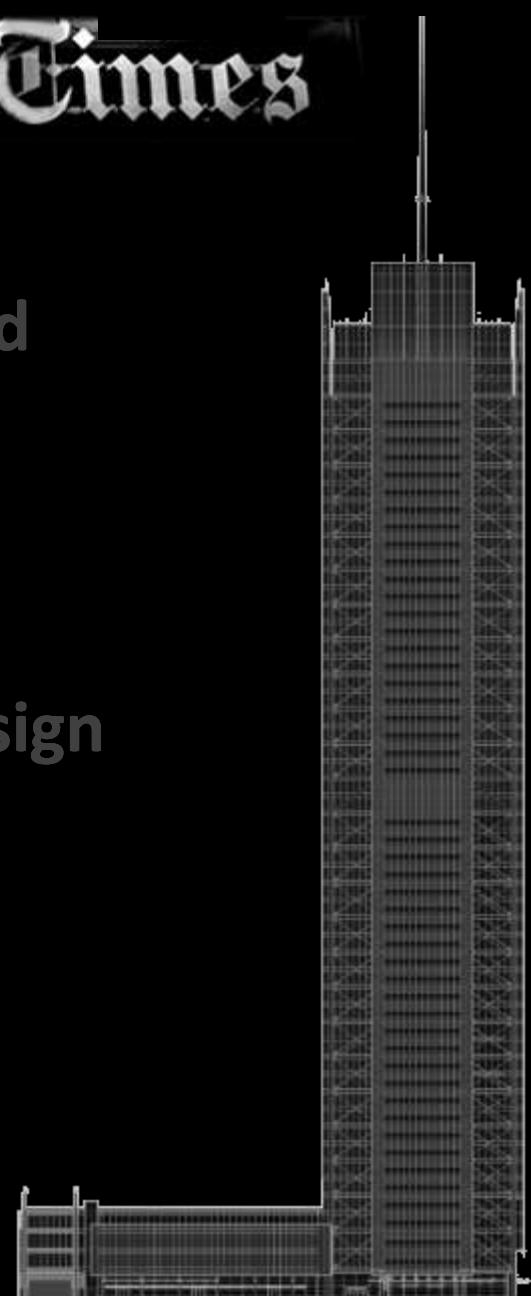
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Concrete Shear Wall Core w/ Outriggers on the 28th Mechanical Floor



- Intro
- Building Background
- Proposal
-
- Façade Redesign
- Floor System Redesign
- Core Redesign**
- CoGen Redesign
-
- BIM/IPD
- Metrics of Success



Lateral Force Resisting System

Initial Design Parameters

Assumed Serviceability Governed Design

SRSS – Period of Vibration

- 10% of 10.8s (Existing Design)

*Serviceability Limit States Under Wind Load -
Lawrence G. Griffis (AISC 1993)*

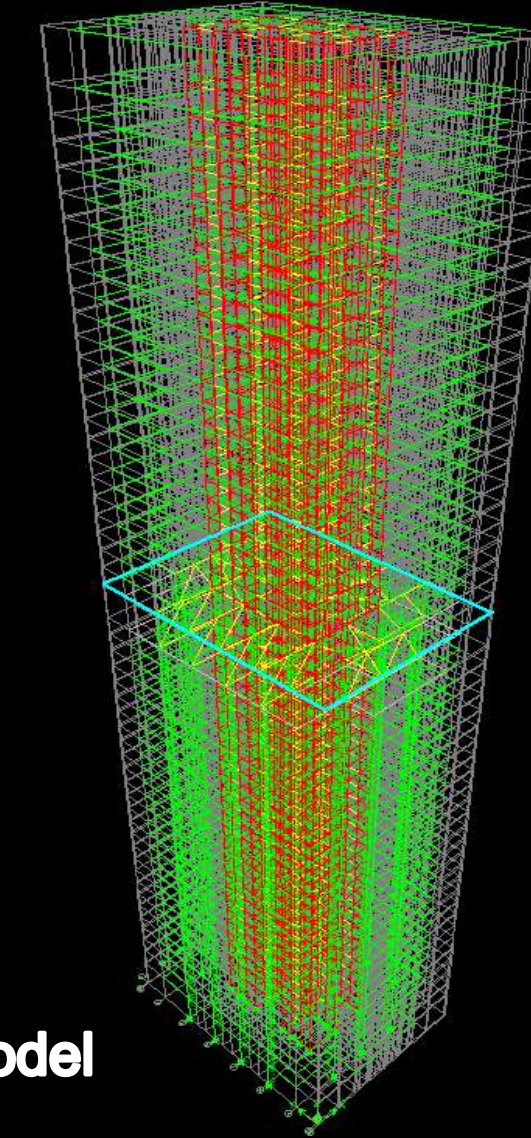
Lateral Drift & Deflection

- Wind - $H/450 = 19.88''$ (Existing Design)
D+0.5L+0.7W (ASCE 7-05, CC.1.2)
- Seismic – $0.015h_{sx}$
1.0 E

Design checked for Strength

Existing Period of Vibration	
N/S	6.8 s
E/W	6.2 s
Tors. *	5.6 s
* Assumed	

ETABS Analytical Model



- Intro
- Building Background
- Proposal
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Lateral Force Resisting System

Concrete Compressive Strength

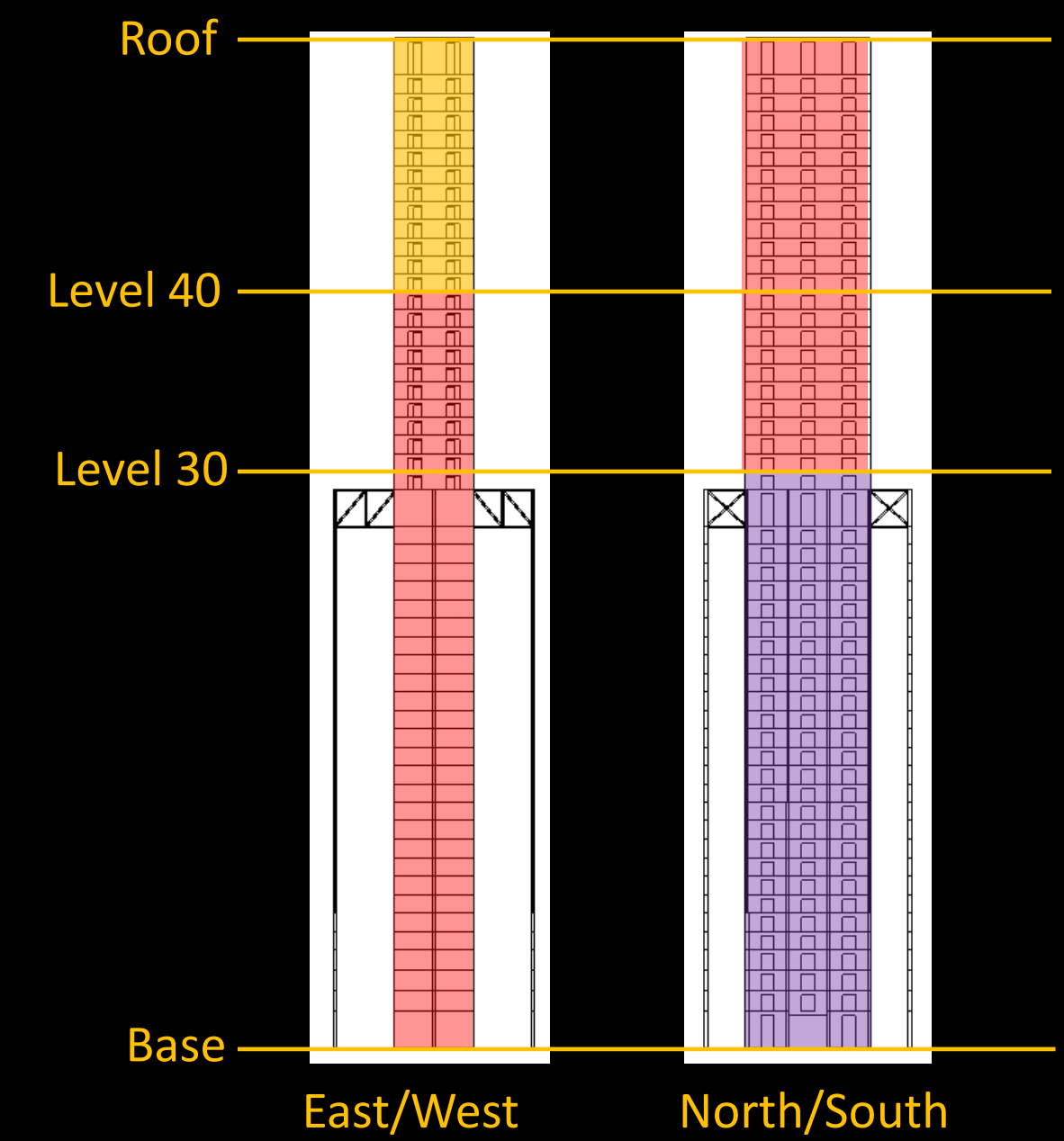
- 8 ksi
- 10 ksi

Shear Wall Thickness

- 20"
- 24"
- 30"

Coupling Beams

- 36" Depth
- Width Dependent upon Support



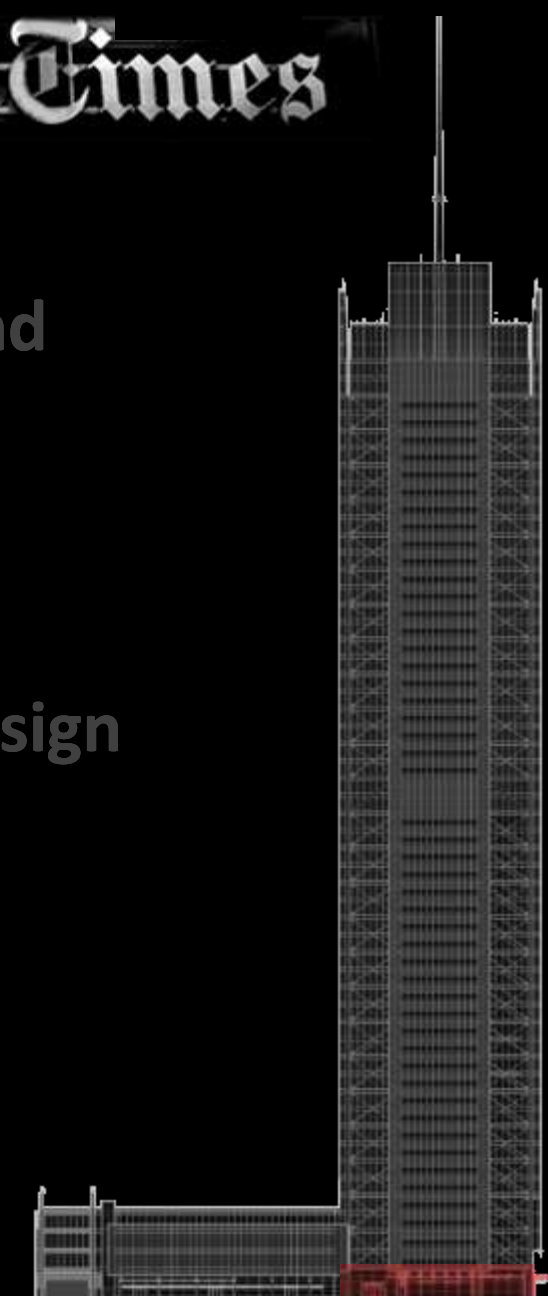
- Intro
- Building Background
- Proposal

- Façade Redesign
- Floor System Redesign

Core Redesign

- CoGen Redesign

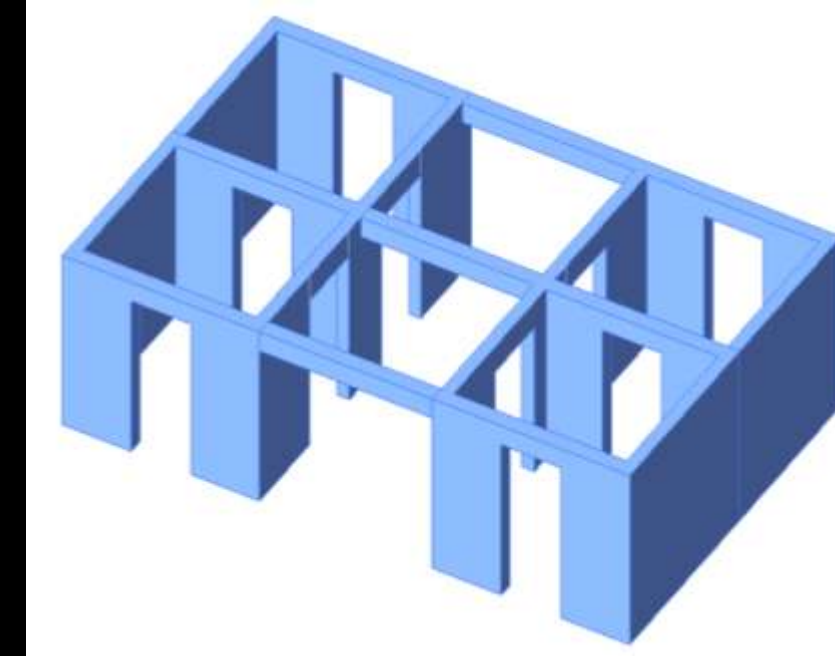
- BIM/IPD
- Metrics of Success



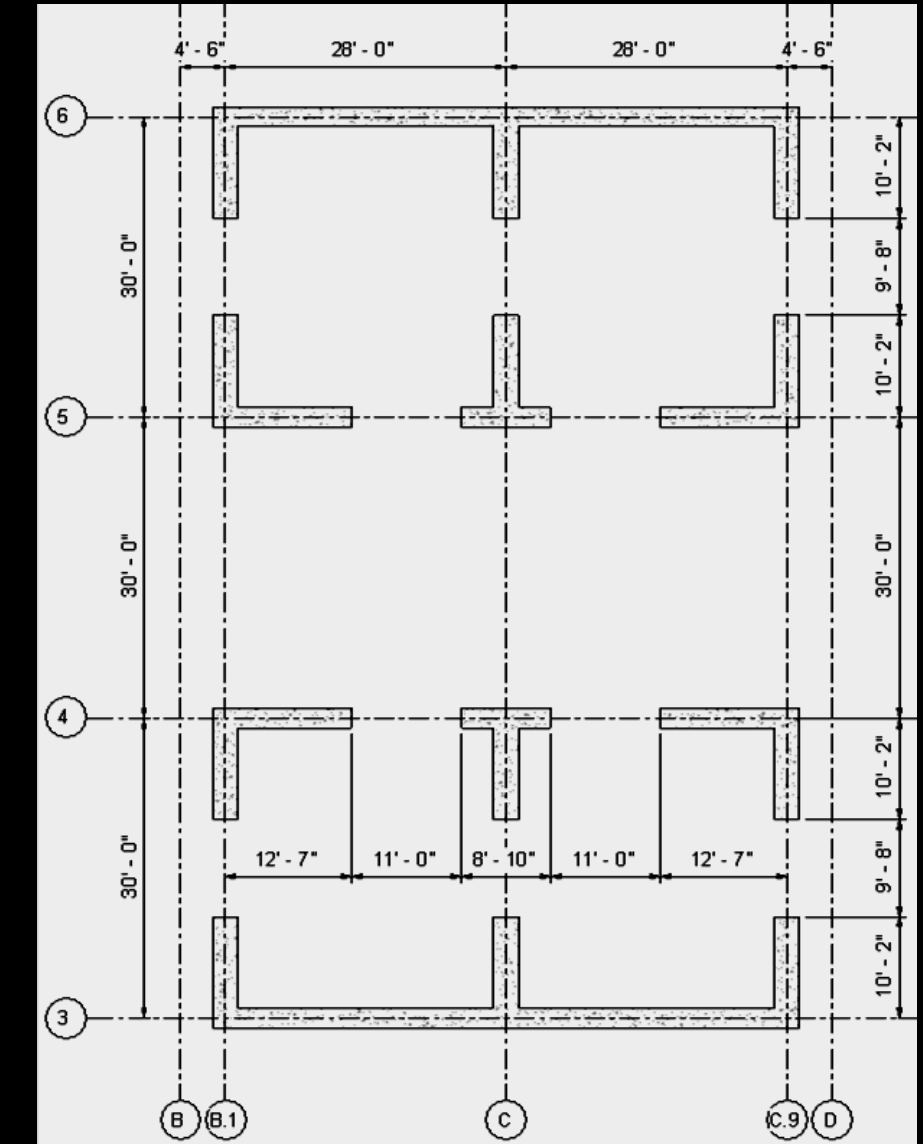
Lateral Force Resisting System

Shear Wall Design: Lobby Level

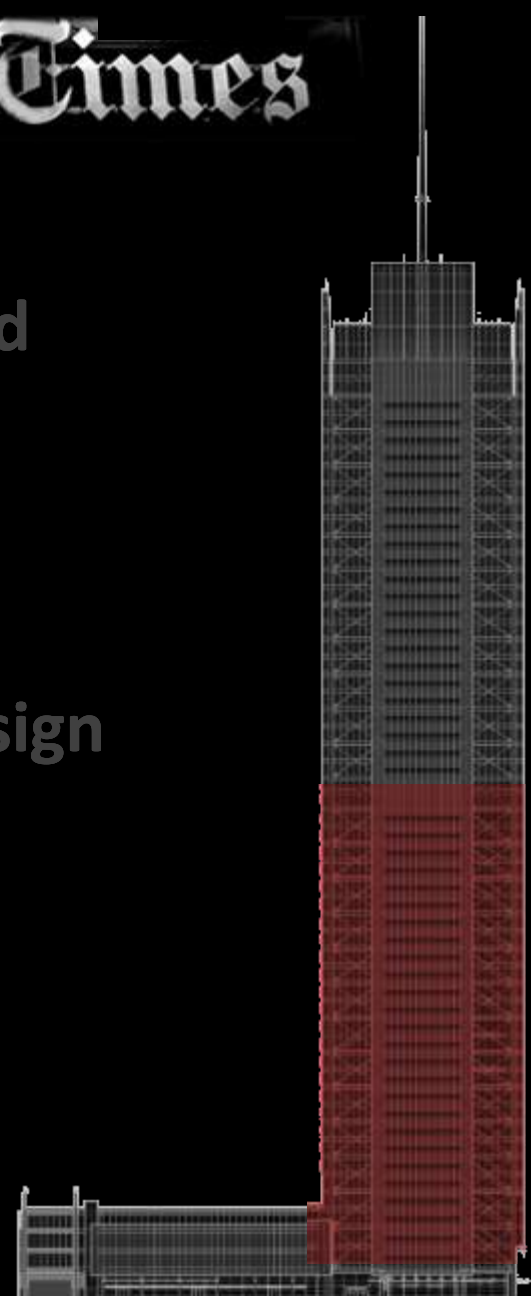
Level	f'_c (ksi)	Wall t, E/W Direction (in)	Wall t, N/S Direction (in)
Base - 30	10	24	30
31-40	8	24	24
41-53	8	20	24



W N
S E



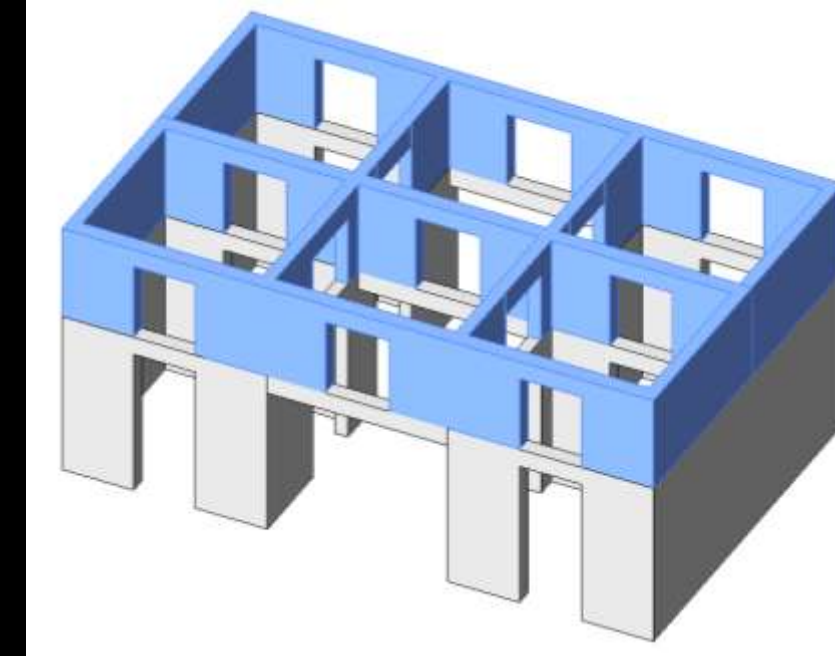
- Intro
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 - Core Redesign**
 - CoGen Redesign
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- Metrics of Success



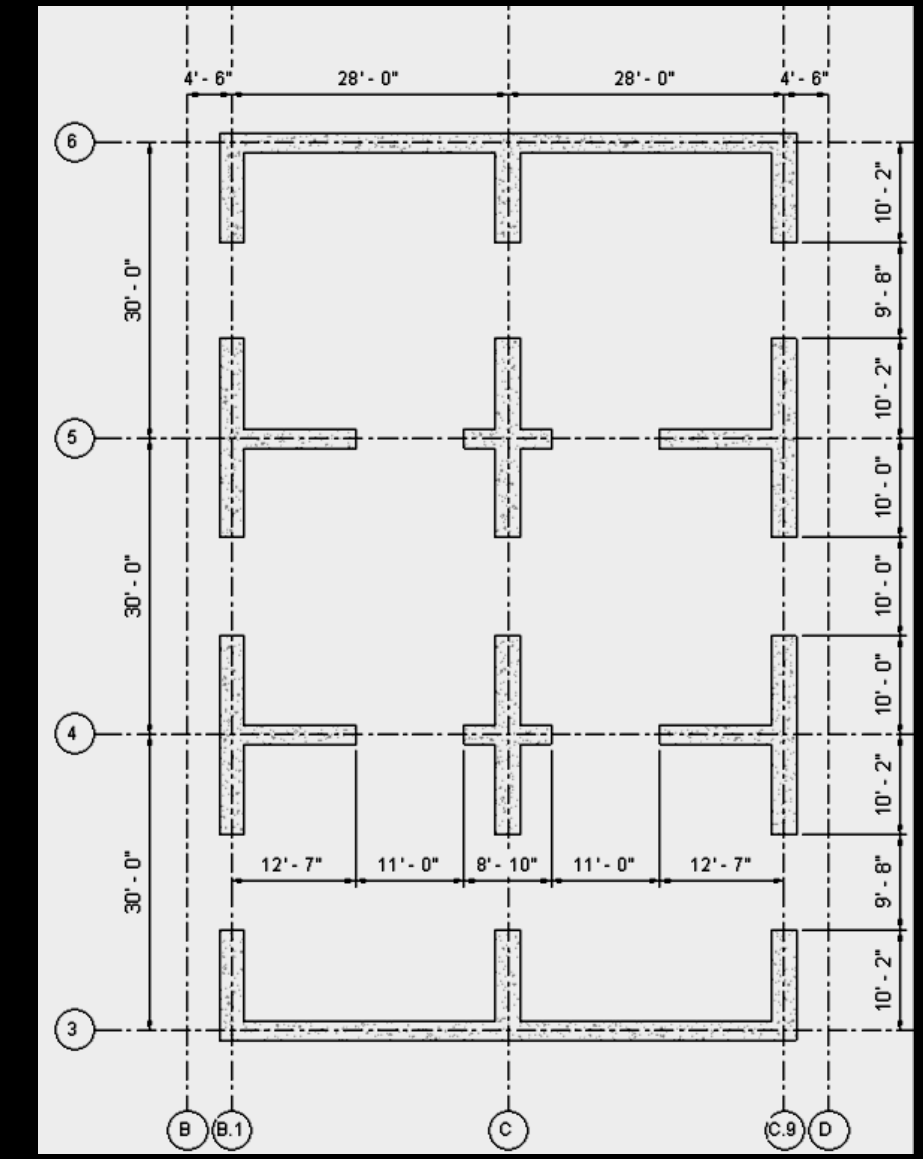
Lateral Force Resisting System

Shear Wall Design: Level 2 – Level 28

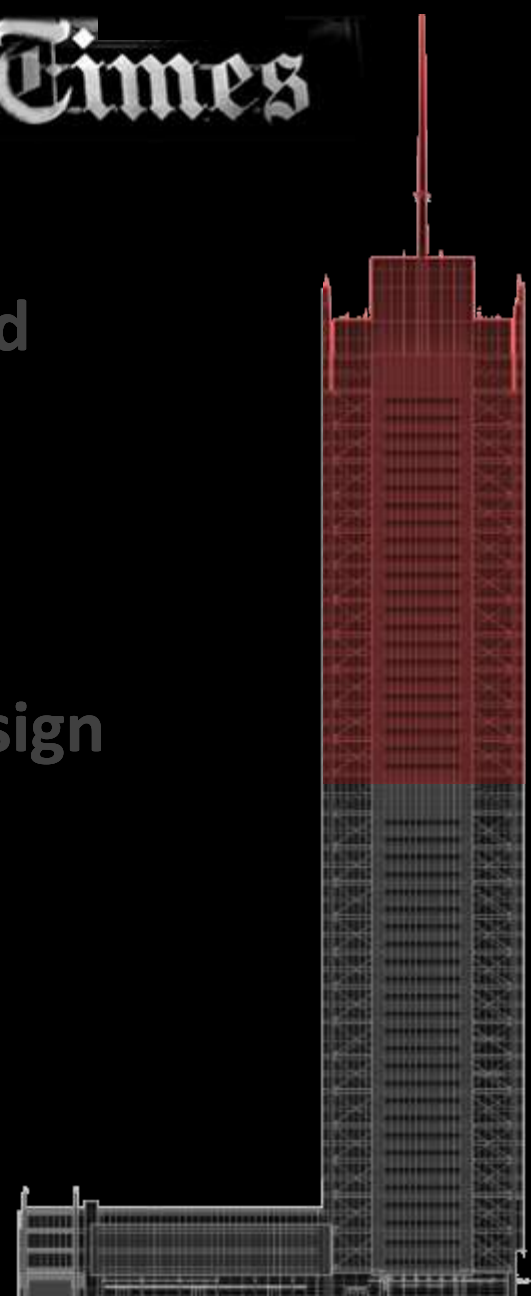
Level	f'_c (ksi)	Wall t, E/W Direction (in)	Wall t, N/S Direction (in)
Base - 30	10	24	30
31-40	8	24	24
41-53	8	20	24



N
 W E
 S



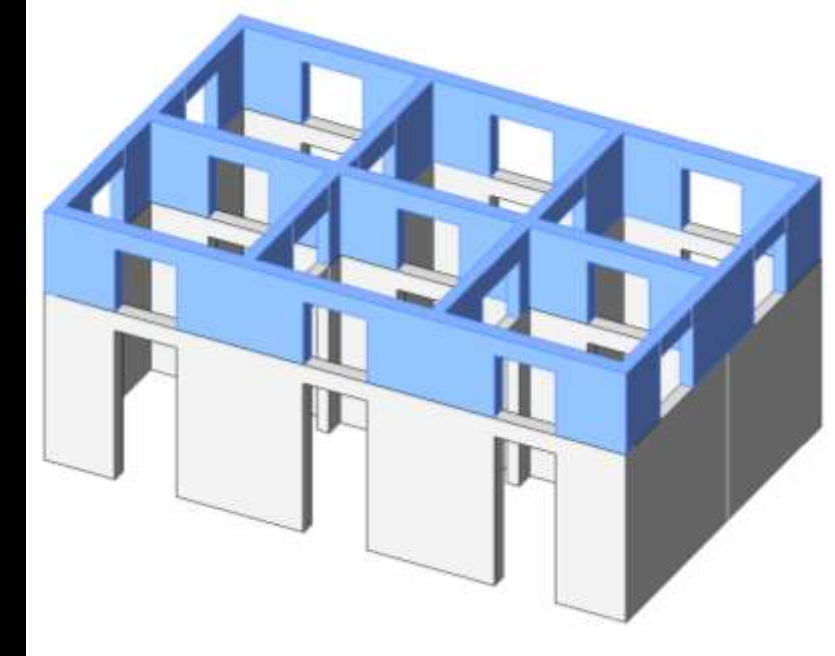
- Intro
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- Metrics of Success



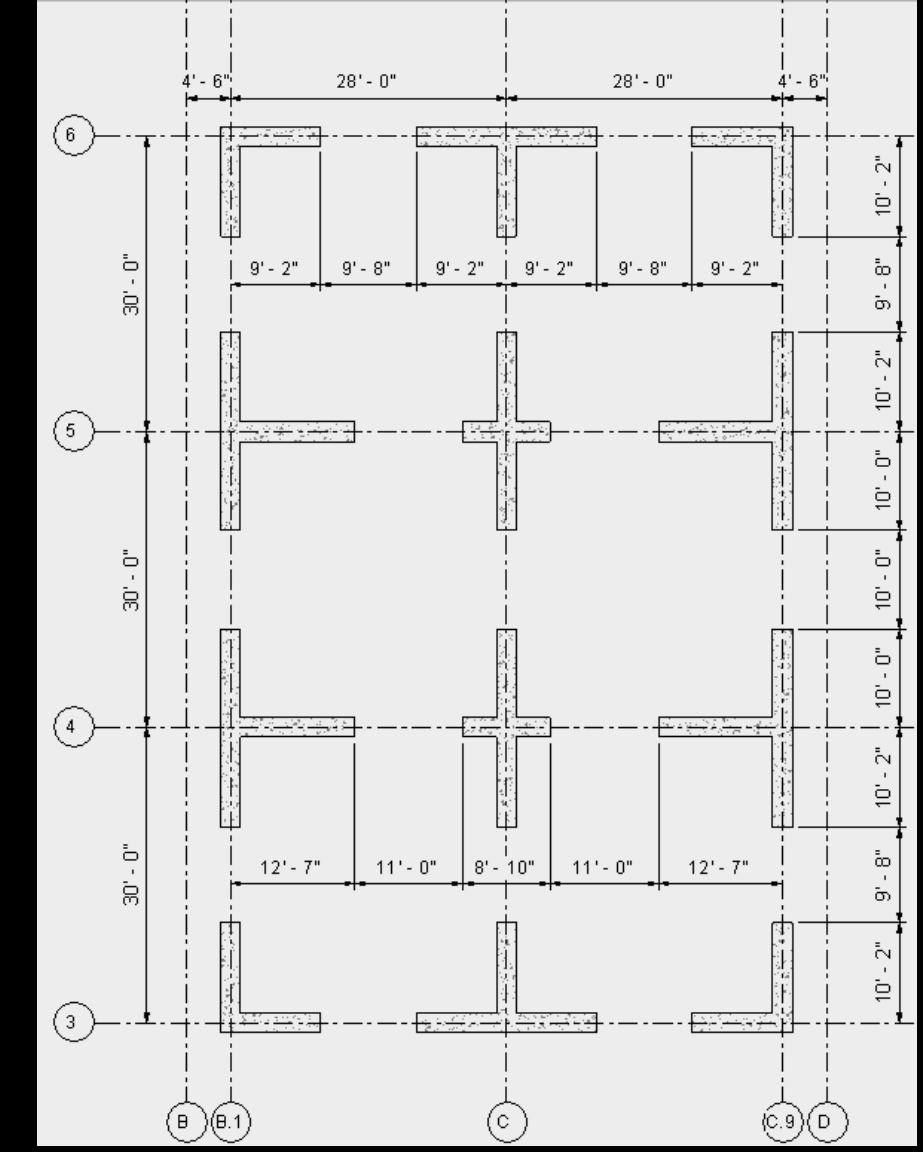
Lateral Force Resisting System

Shear Wall Design: Level 29 – Roof

Level	f'_c (ksi)	Wall t, E/W Direction (in)	Wall t, N/S Direction (in)
Base - 30	10	24	30
31-40	8	24	24
41-53	8	20	24

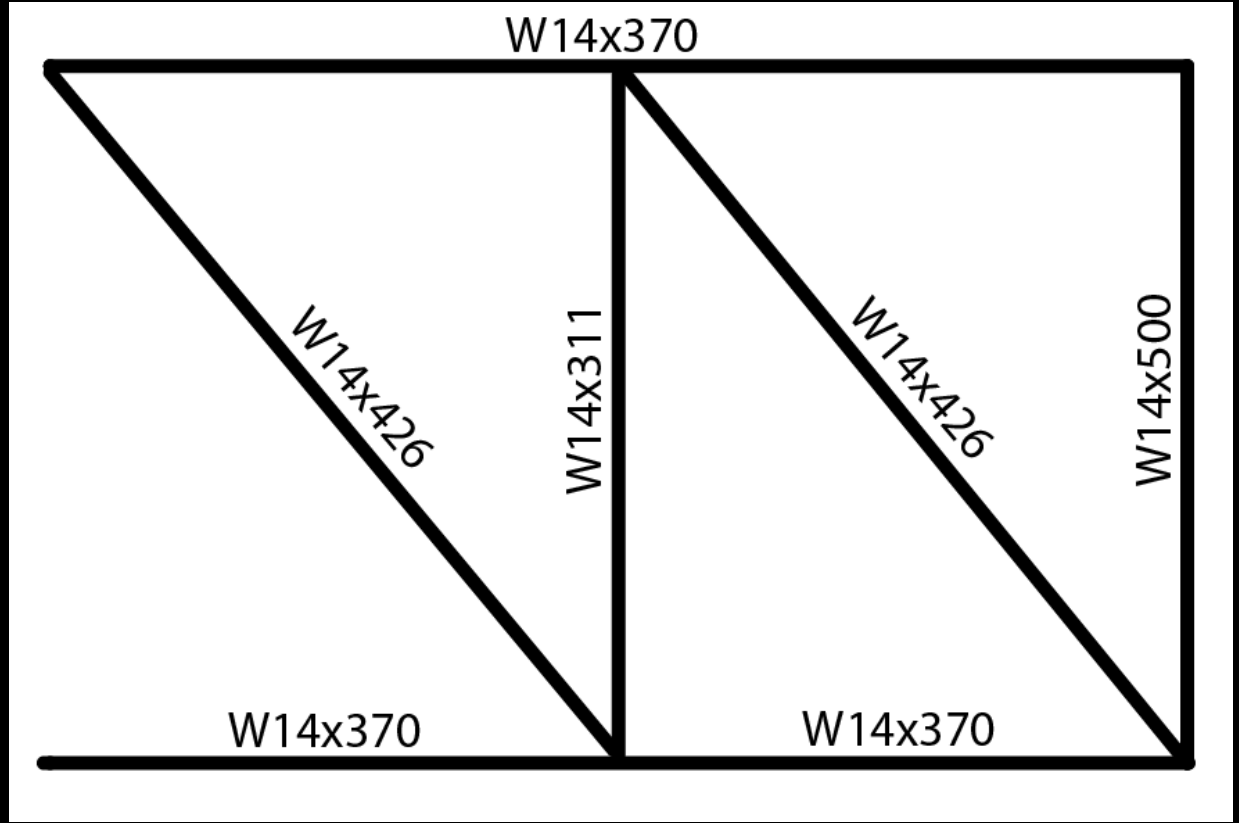
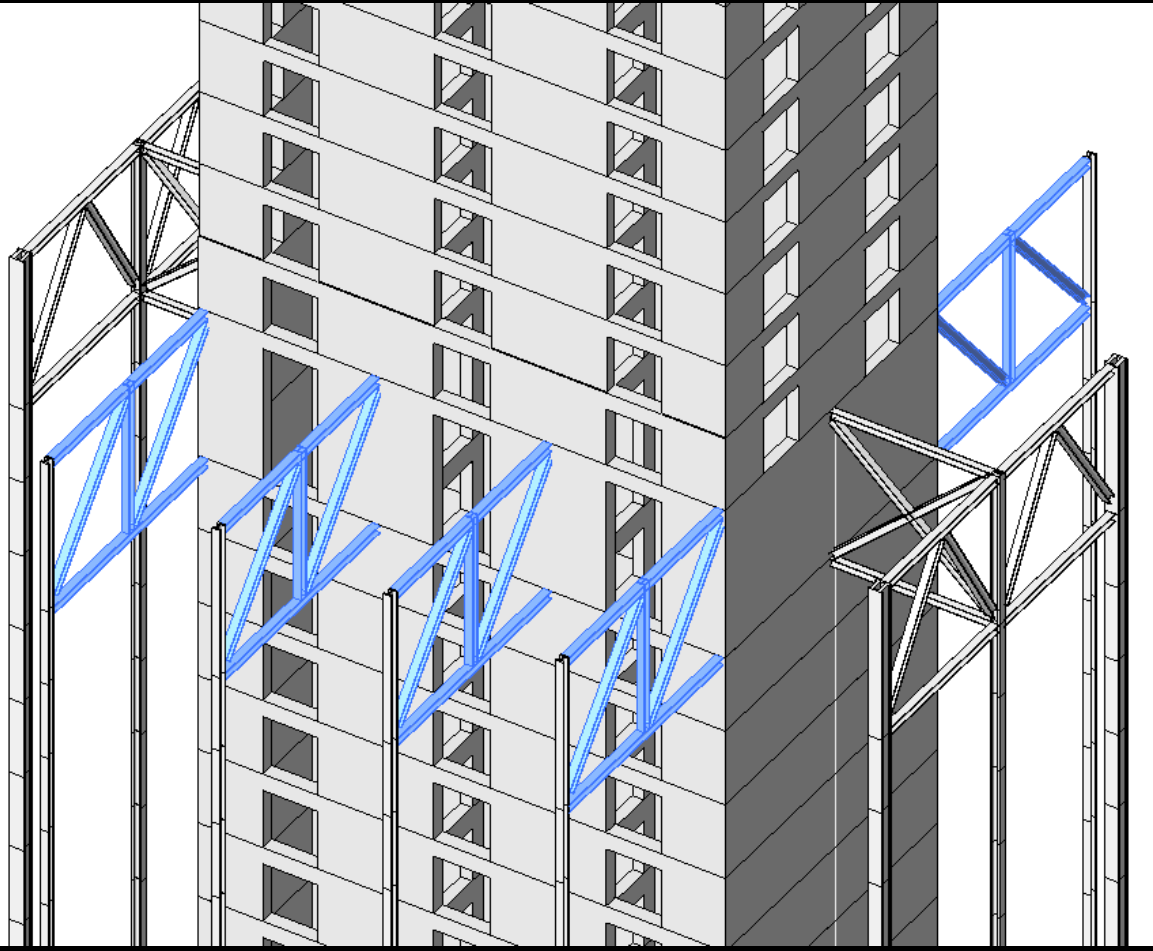


W N
S E



Lateral Force Resisting System

Outrigger Design: 28th Mechanical Floor



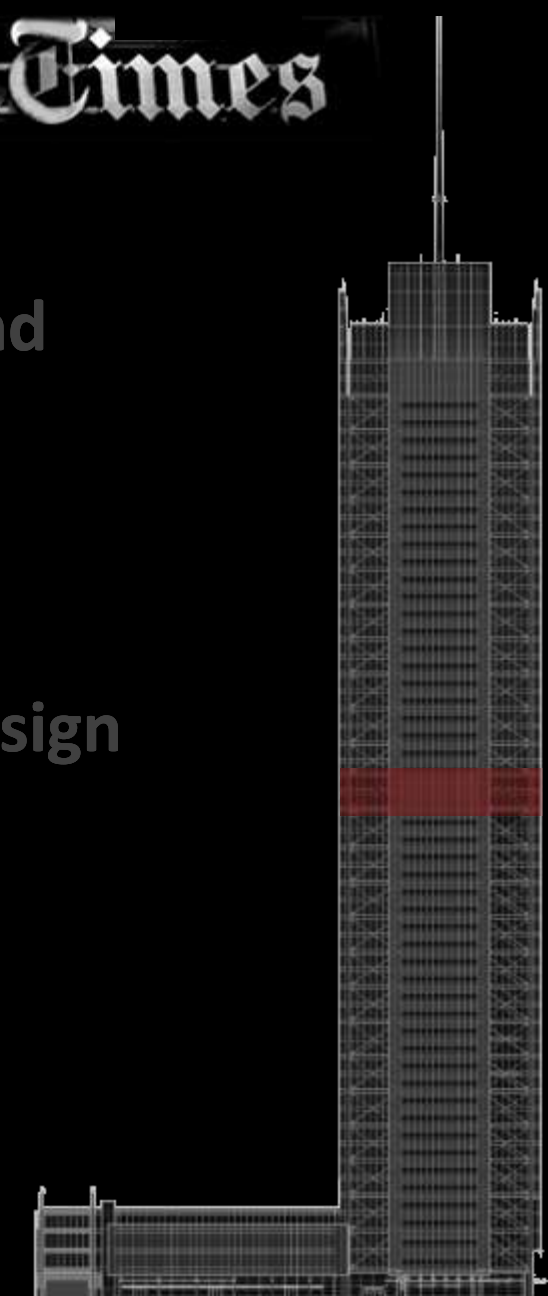
- Intro
- Building Background
- Proposal

- Façade Redesign
- Floor System Redesign

Core Redesign

- CoGen Redesign

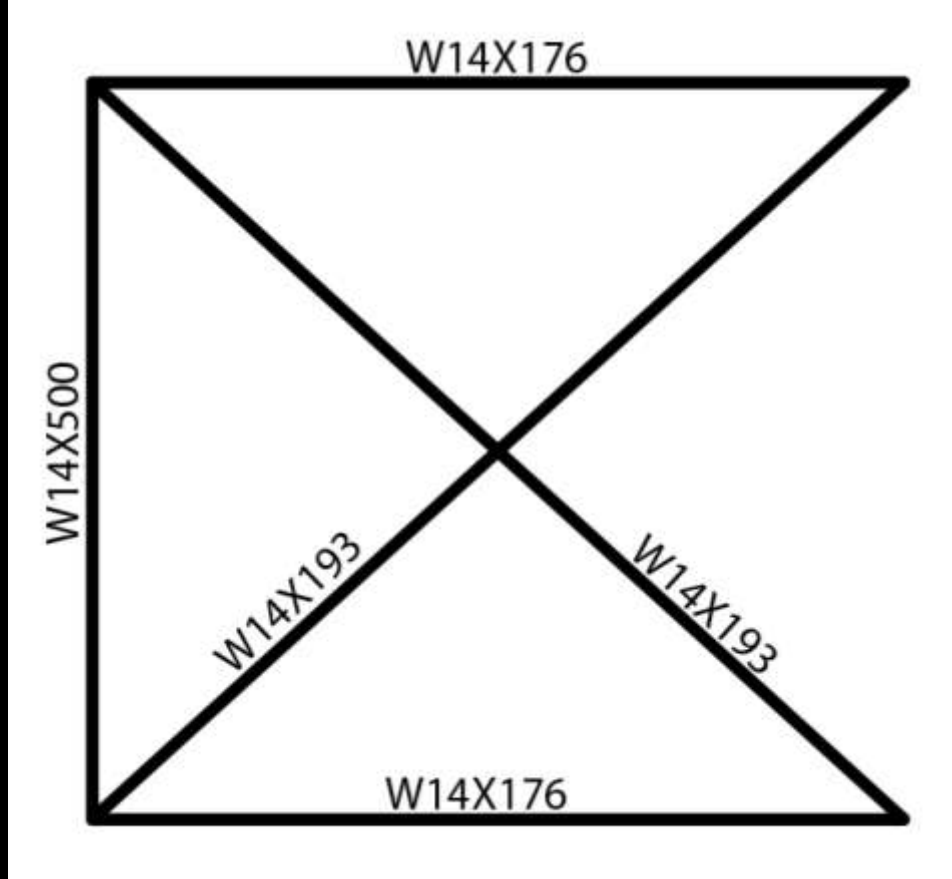
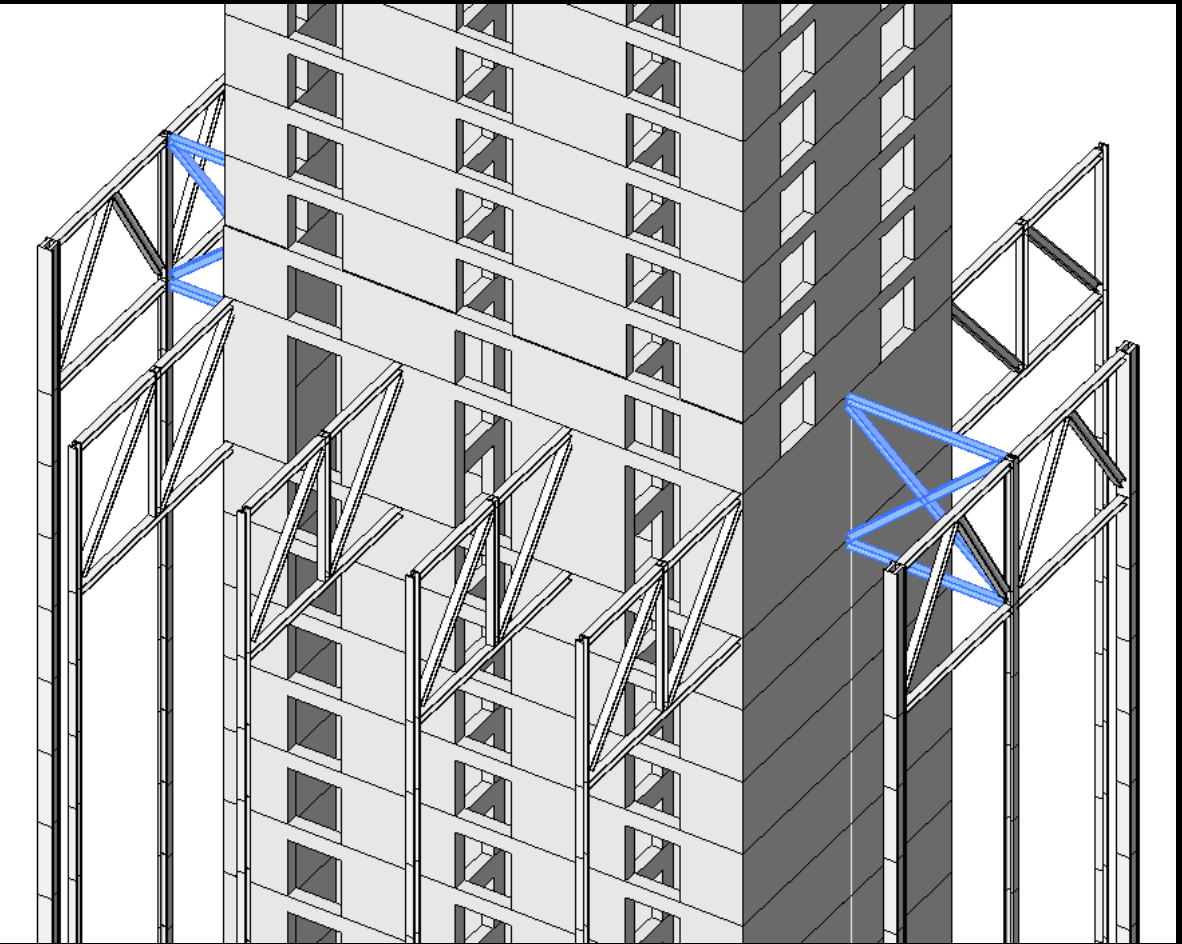
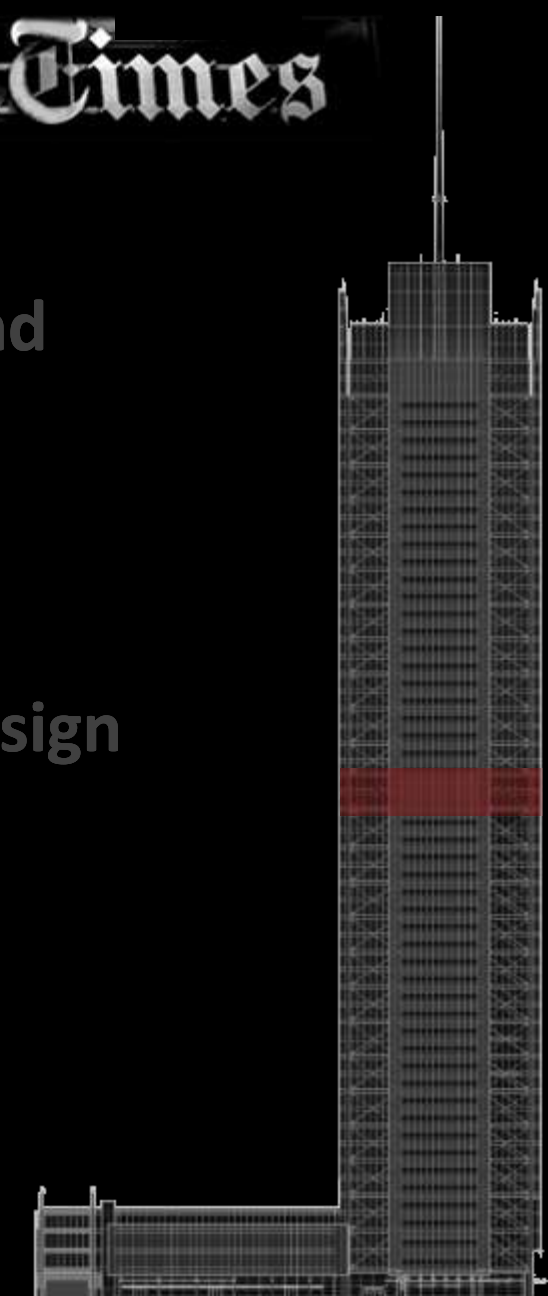
- BIM/IPD
- Metrics of Success



Lateral Force Resisting System

Outrigger Design: 28th Mechanical Floor

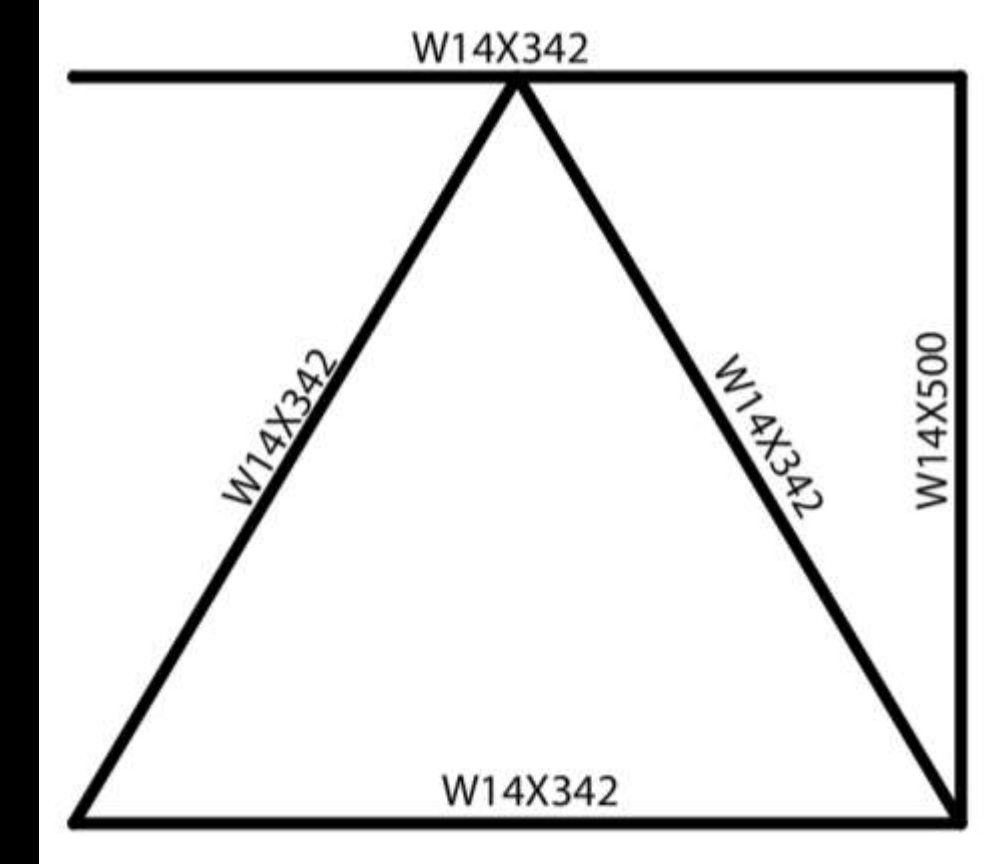
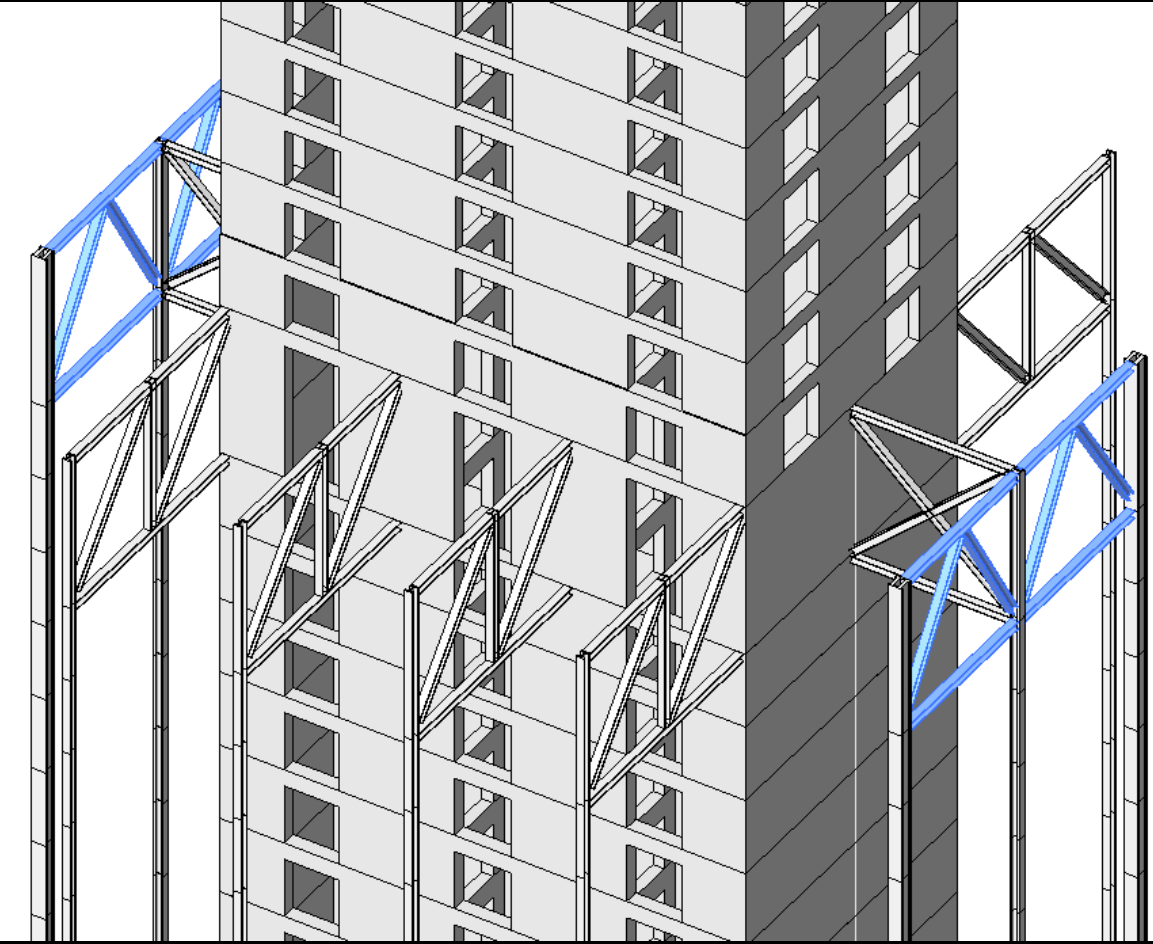
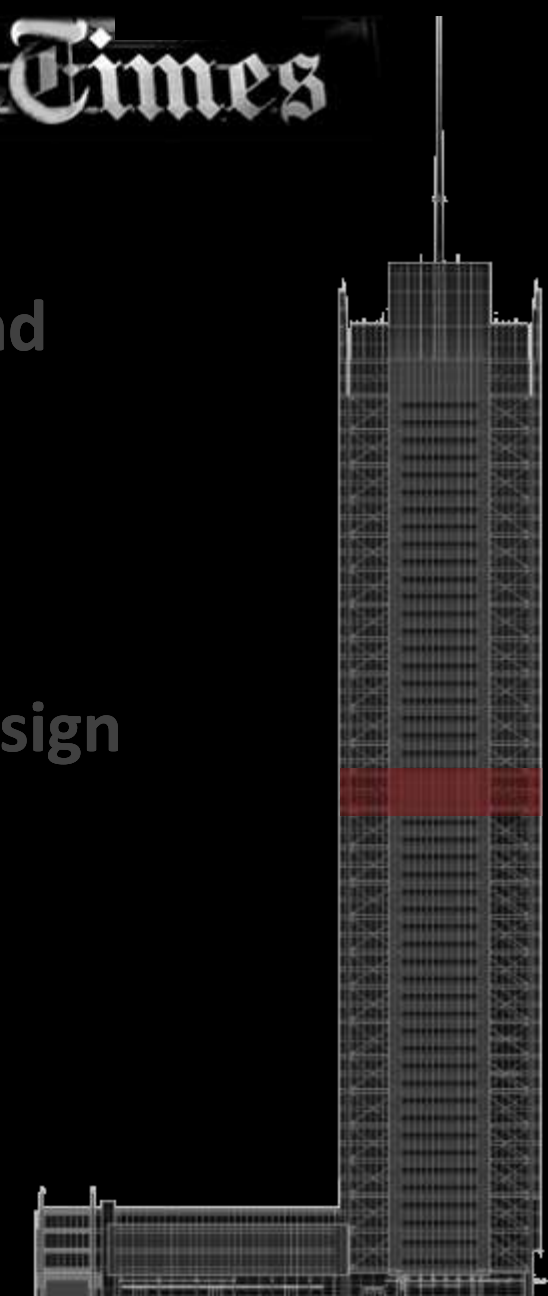
- Intro
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- Proposal
- Façade Redesign
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- Core Redesign**
- CoGen Redesign
- BIM/IPD
- Metrics of Success



Lateral Force Resisting System

Outrigger Design: 28th Mechanical Floor

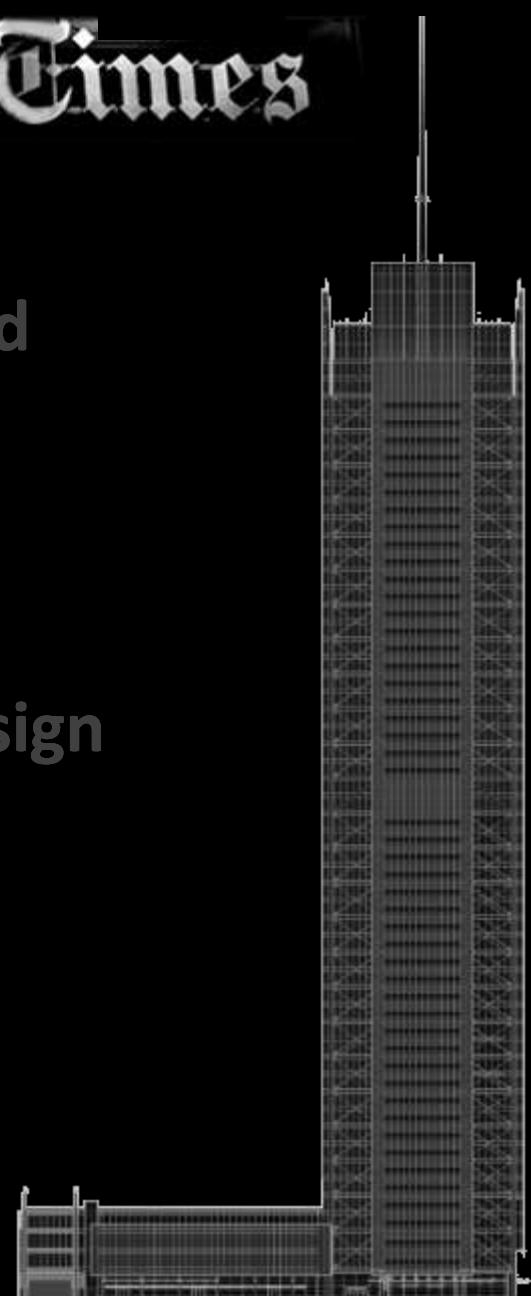
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- Intro
- Building Background
- Proposal

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- Metrics of Success



Lateral Force Resisting System

Serviceability Governed Design – Assumption Confirmed

SRSS – Period of Vibration

- 10% of 10.8s (Existing Design) ✓

Mode	Direction	T(sec.)
1	E/W	7.31
2	N/S	6.57
3	Tor	5.51
SRSS		11.2677
% of Existing		4.417

Lateral Drift & Deflection

- Wind - $H/450 = 19.88''$ (Existing Design) ✓
- Seismic – $0.015h_{sx}$ ✓

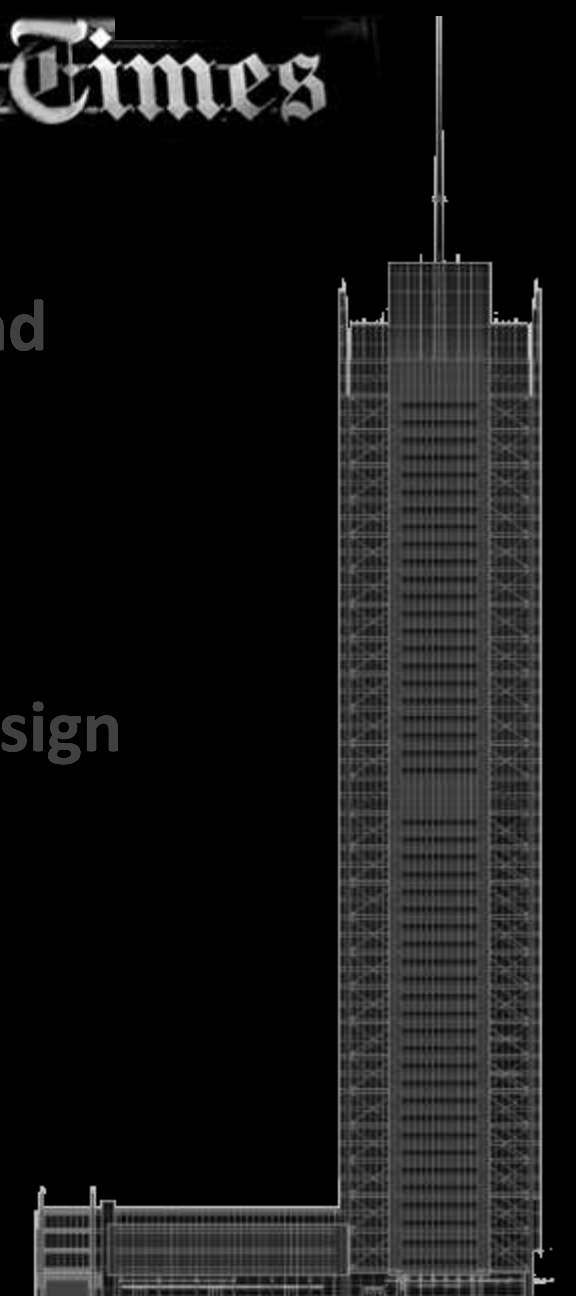
Direction	Displ. (in)	H/450 (in)	Compliance?
N/S	10.9	19.88	ok
E/W	7.1	19.88	ok

Direction	Level	h_{sx} (ft)	Seismic			Wind		
			$0.015 h_{sx}$	Calculated SD	Compliance ?	$h/450$	SD from ETABS	Compliance ?
E/W	41	13.26	0.1989	0.0125	ok	0.029467	0.0009	ok
N/S	37	13.26	0.1989	0.009	ok	0.029467	0.001	ok

Strength Check – Members Adequate

Cost and Schedule Changes

- Intro
- Building Background
- Proposal
- Façade Redesign
- Floor System Redesign
- Core Redesign**
- CoGen Redesign
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- Metrics of Success



Cost of concrete core vs. existing steel core

- #### General conditions changes
- Superstructure schedule
 - GC cost changes
 - Constructability

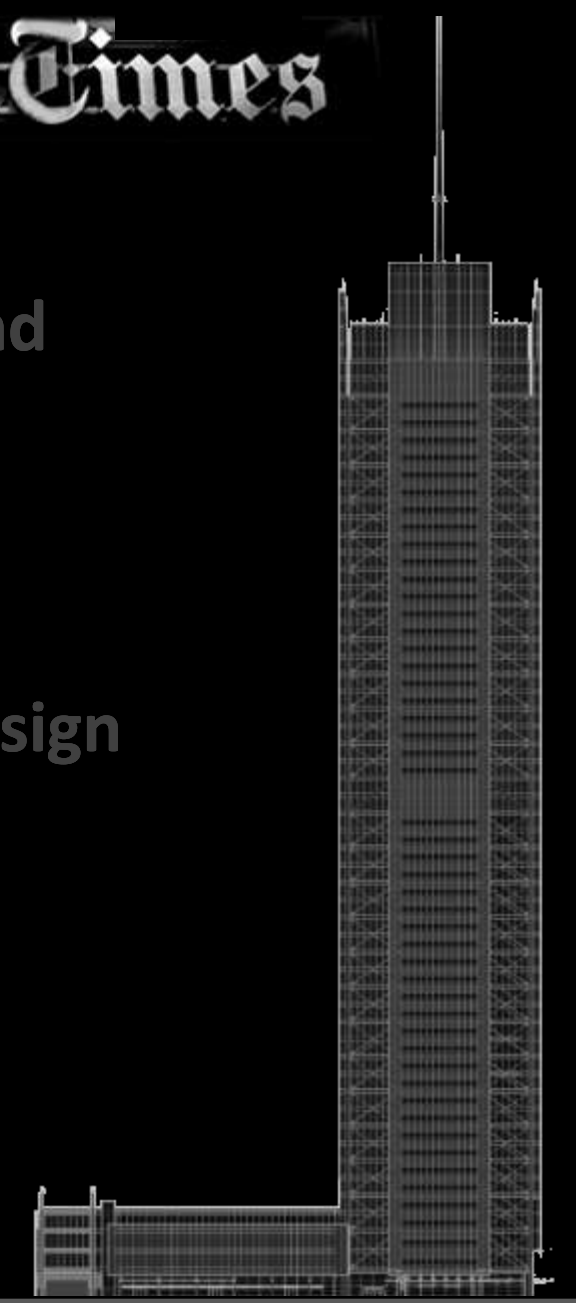
Overall Cost Analysis

Item	Quantity	Cost
Steel Core		\$ (37,171,395)
Concrete Core	21,500 CY	\$ 18,676,730
Crane Addition	2.5 Month	\$ 81,700
Temporary Heating	2 Winters	\$ 4,000,000
Upfront Savings		\$ (14,412,965)
*Additional Rent Annually	5,864 SF	\$ 351,840 per year

Cost and Schedule Changes

01/01/05

- Intro
- Building Background
- Proposal
- Façade Redesign
- Floor System Redesign
- Core Redesign**
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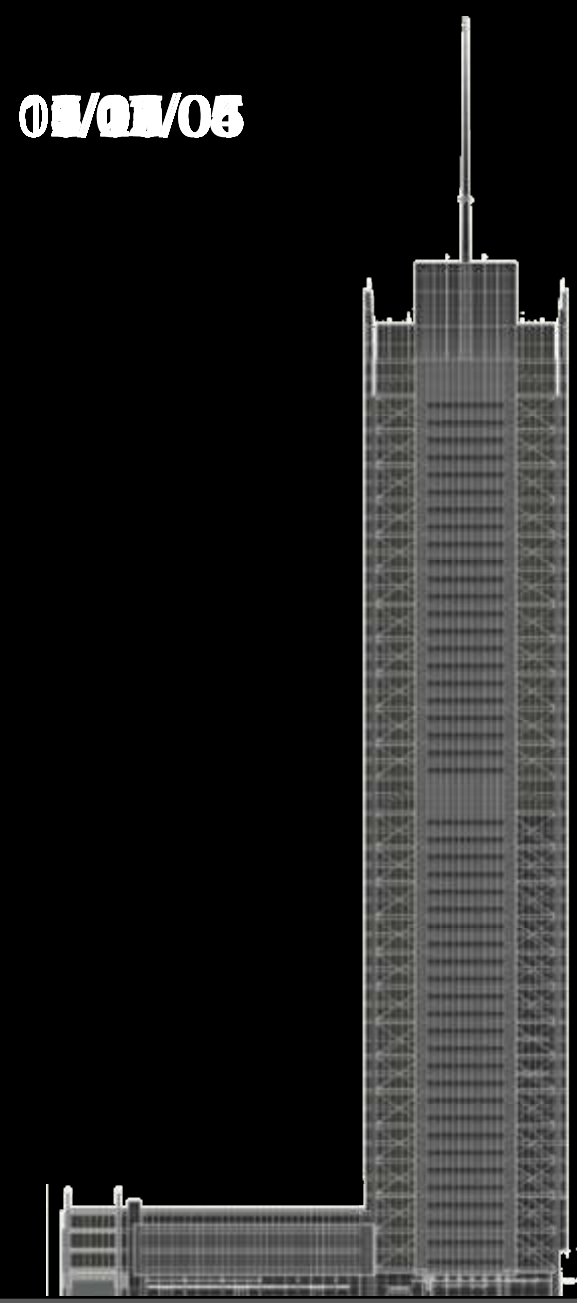


Cost of concrete core vs. existing steel core

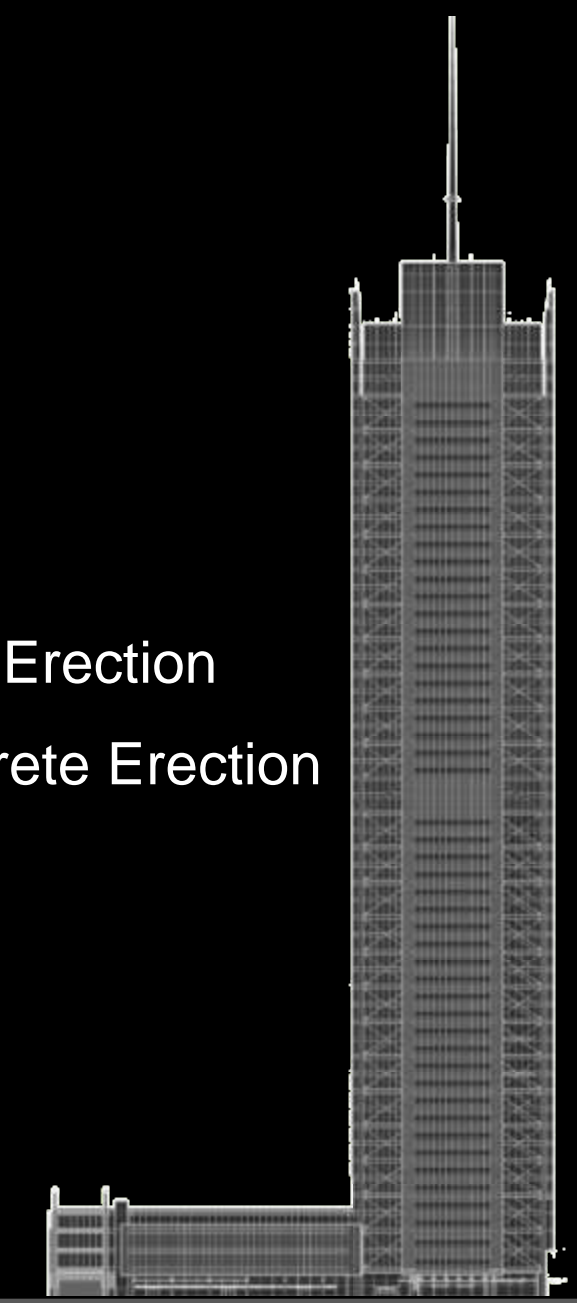
General conditions changes

- Superstructure schedule
- GC cost changes
- Constructability

Overall Cost Analysis



Steel Erection
Concrete Erection

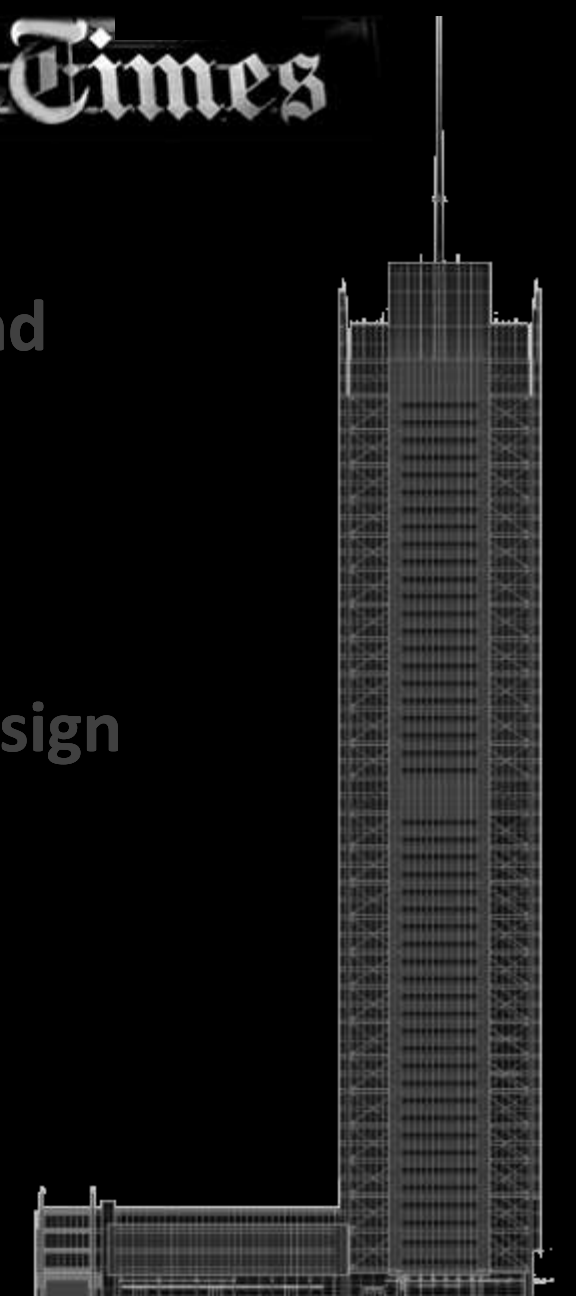


Existing Steel Core

Proposed Concrete Core

Cost and Schedule Changes

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- Building Background
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- Façade Redesign
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Cost of concrete core vs. existing steel core

General conditions changes

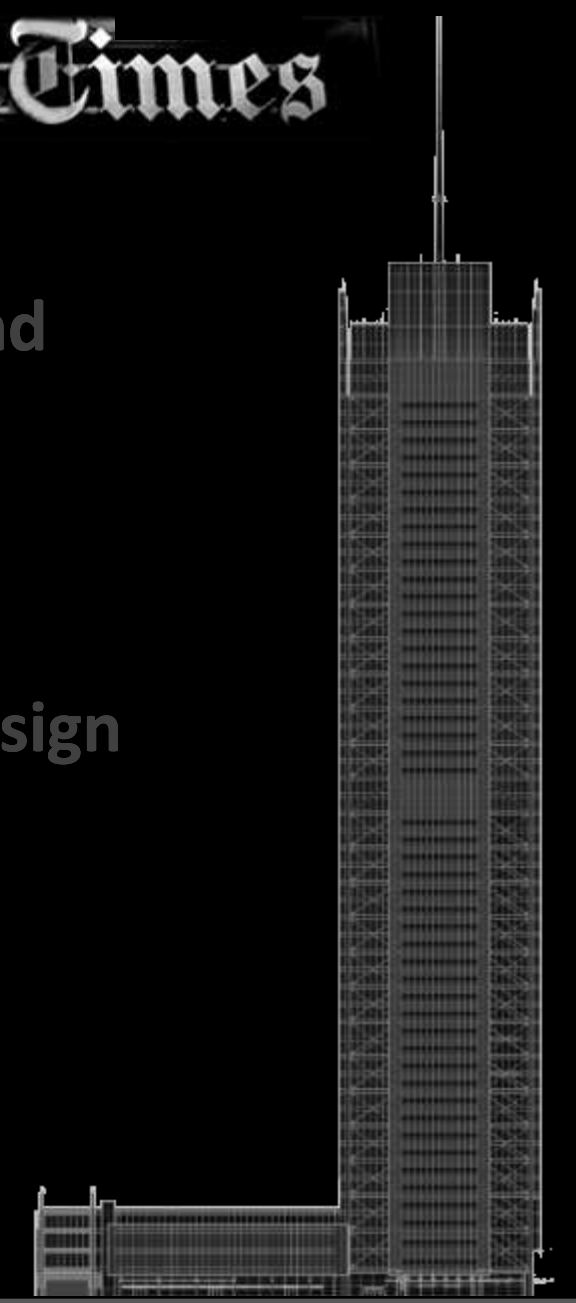
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Upfront Savings		\$ (14,412,965)
*Additional Rent Annually	5,8464 SF	\$ 351,840 per year

Cost and Schedule Changes

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Cost of concrete core vs. existing steel core

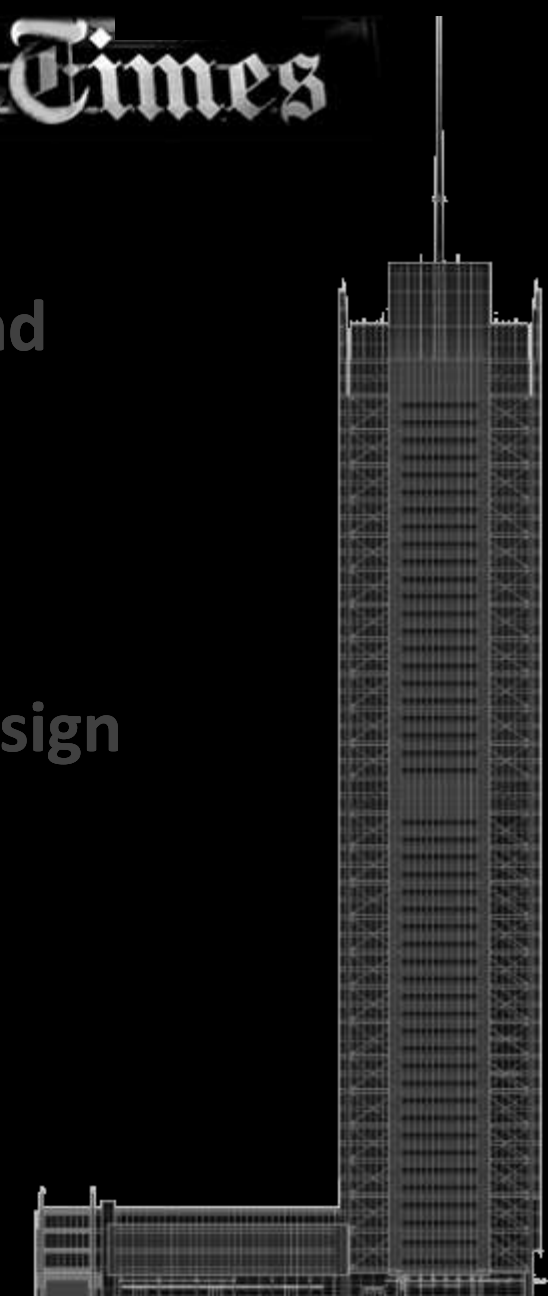
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Overall Cost Analysis

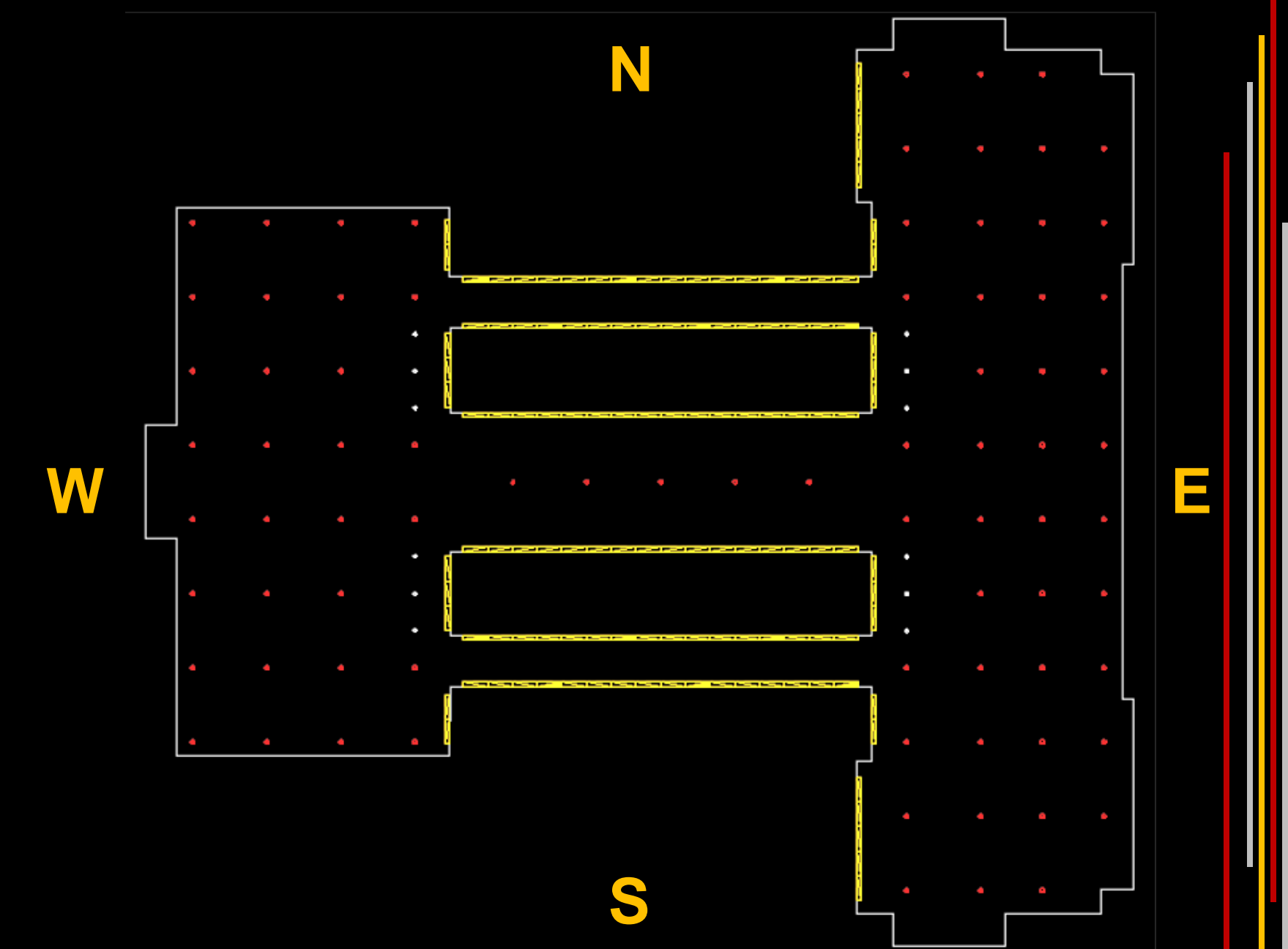
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Lobby Lighting Redesign

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- Building Background
- Proposal
- Façade Redesign
- Floor System Redesign
- Core Redesign**
- CoGen Redesign
- BIM/IPD
- Metrics of Success

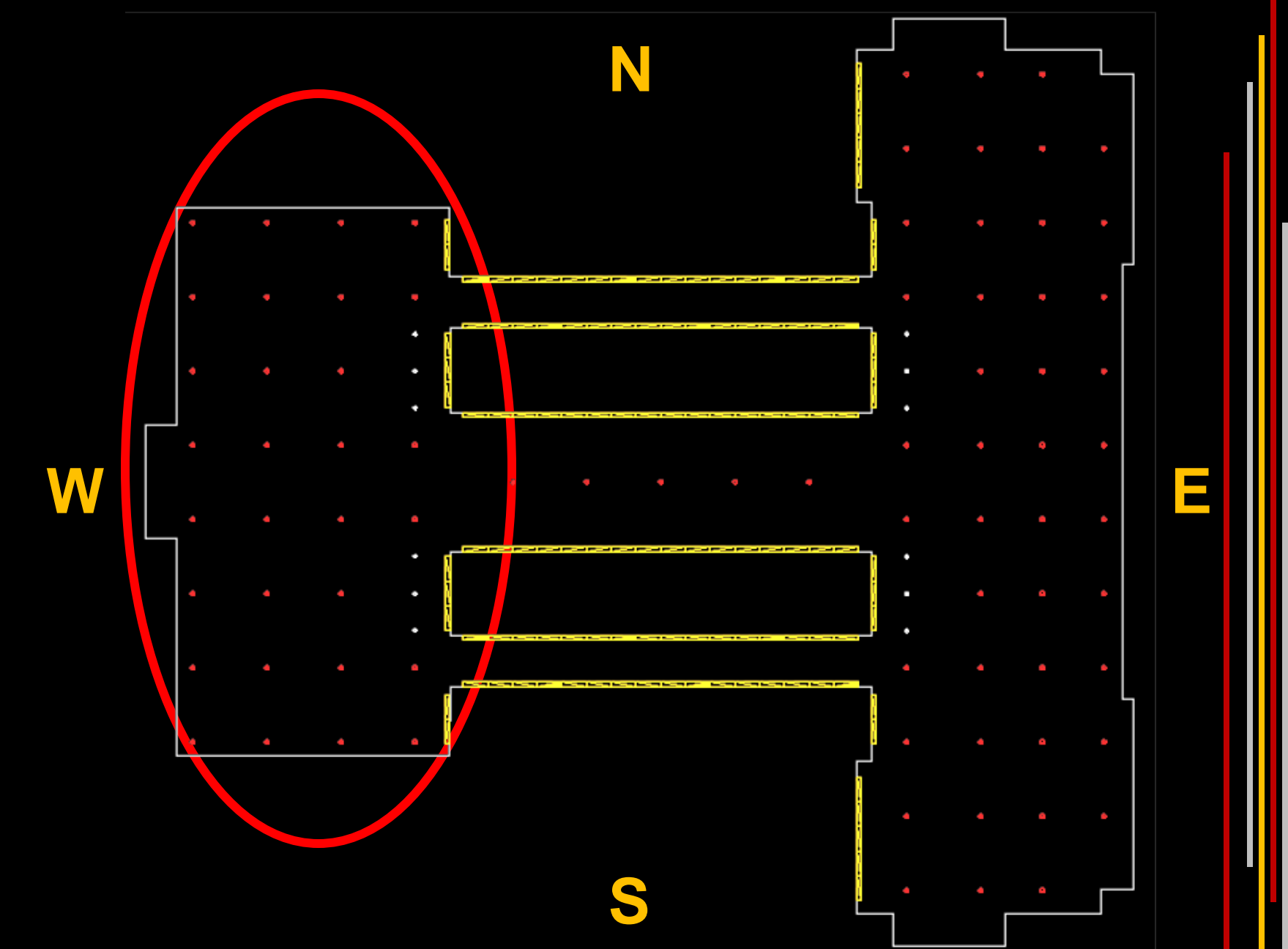
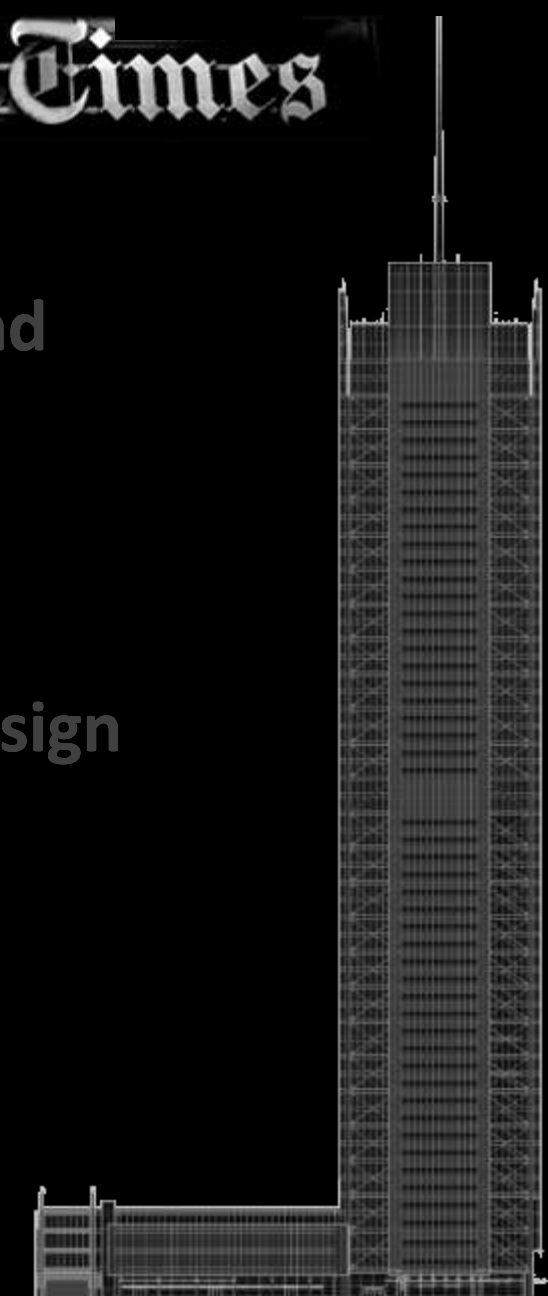


-   9" Recessed Downlight
-   8" Recessed Directional Downlight
-   4' Recessed Cove



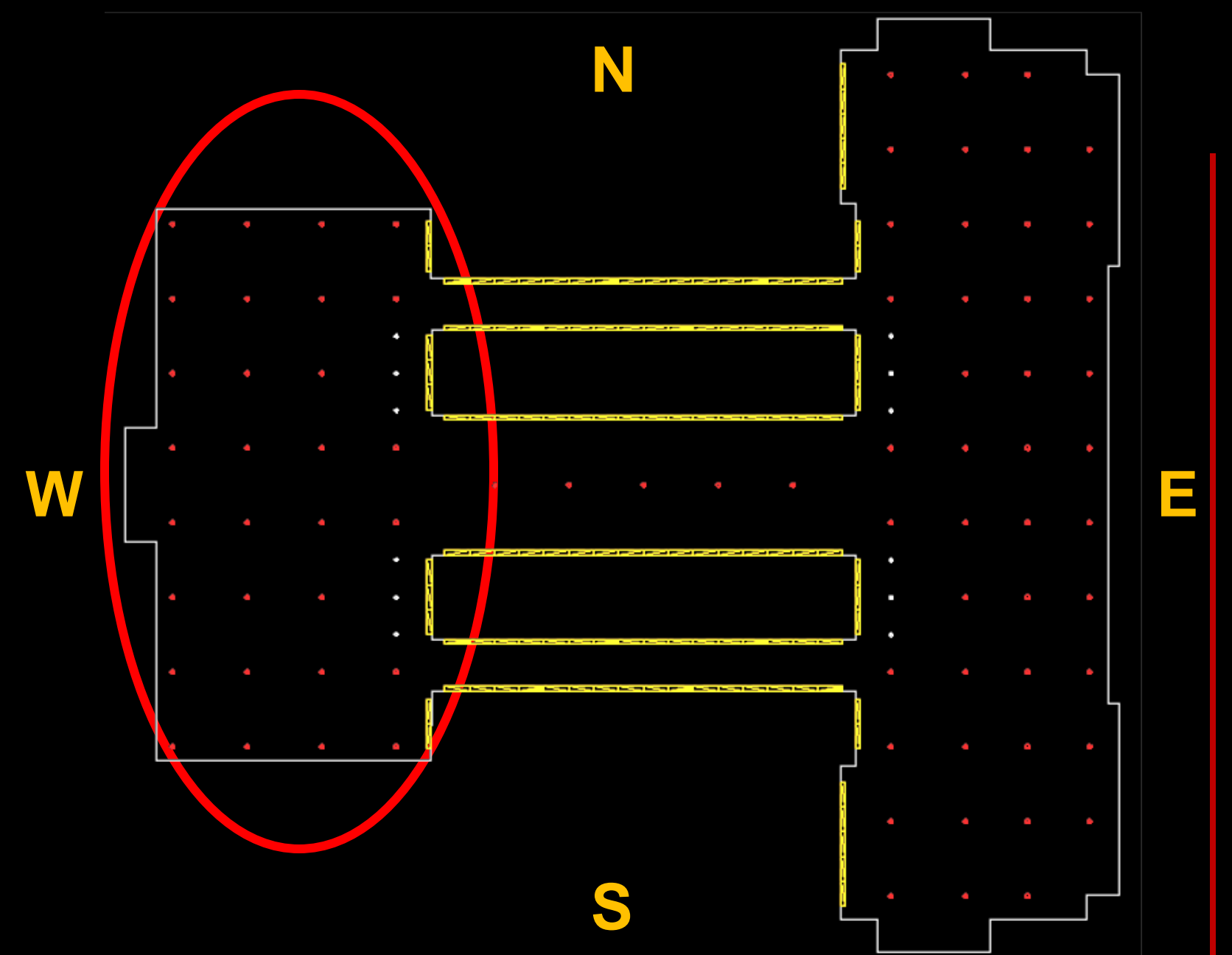
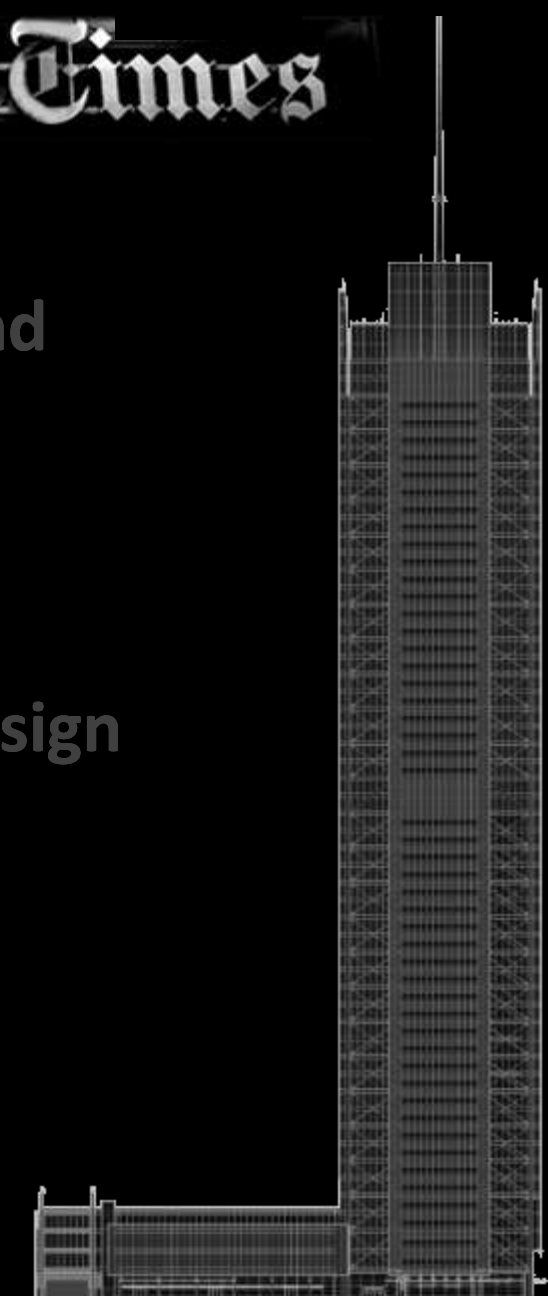
Lobby Lighting Redesign

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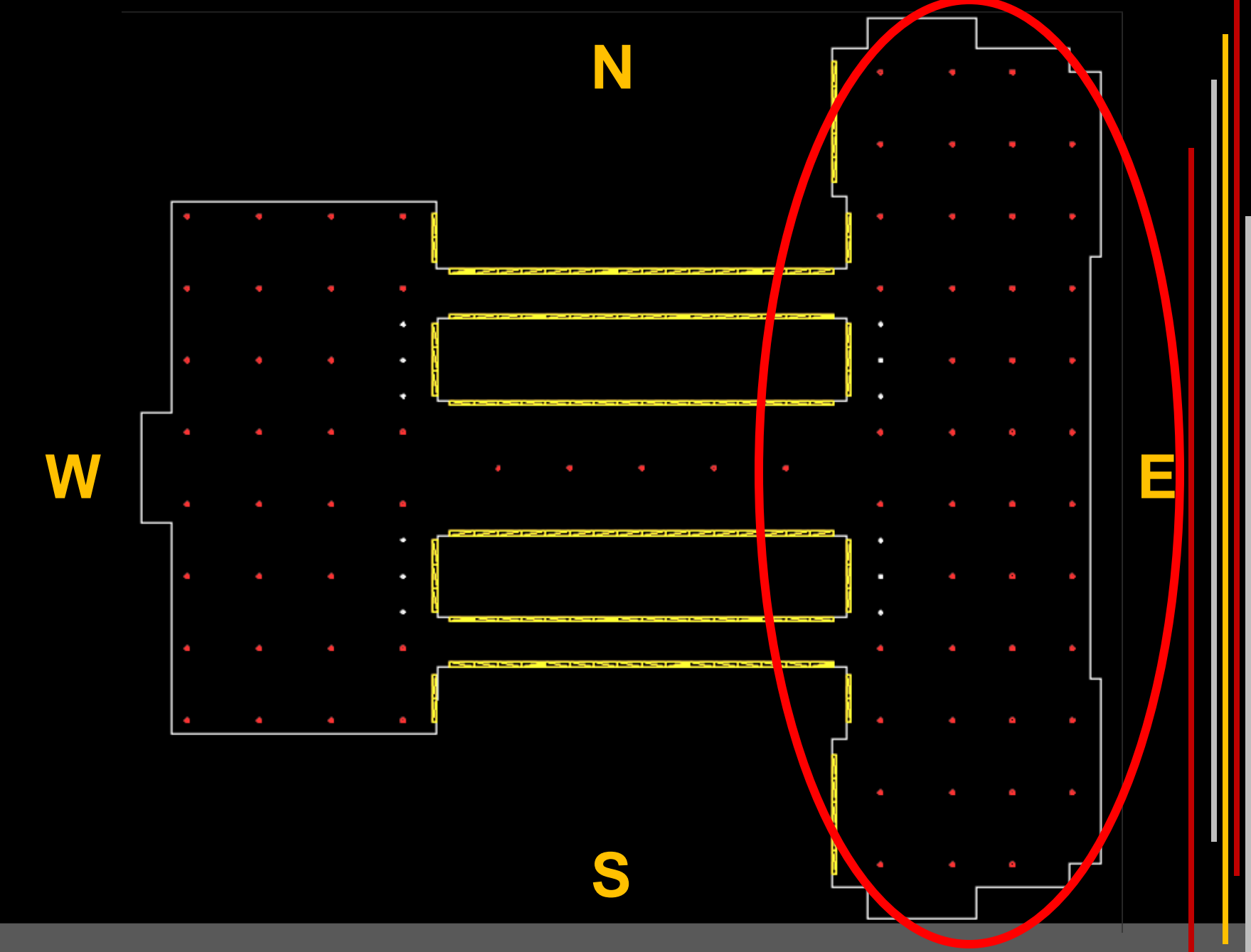
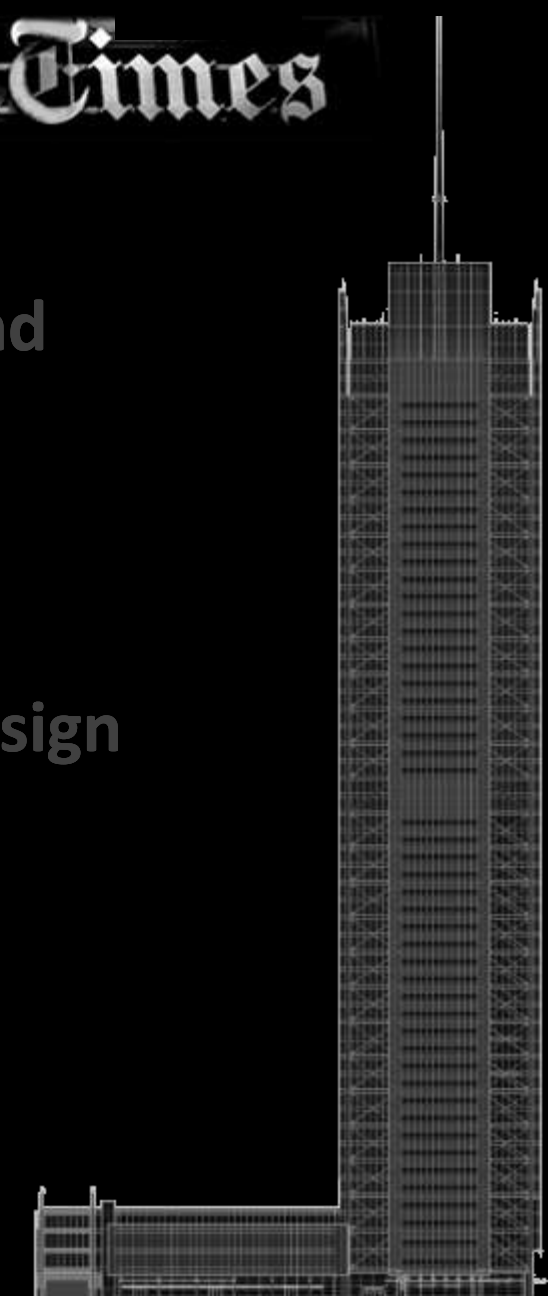
Lobby Lighting Redesign

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- Metrics of Success



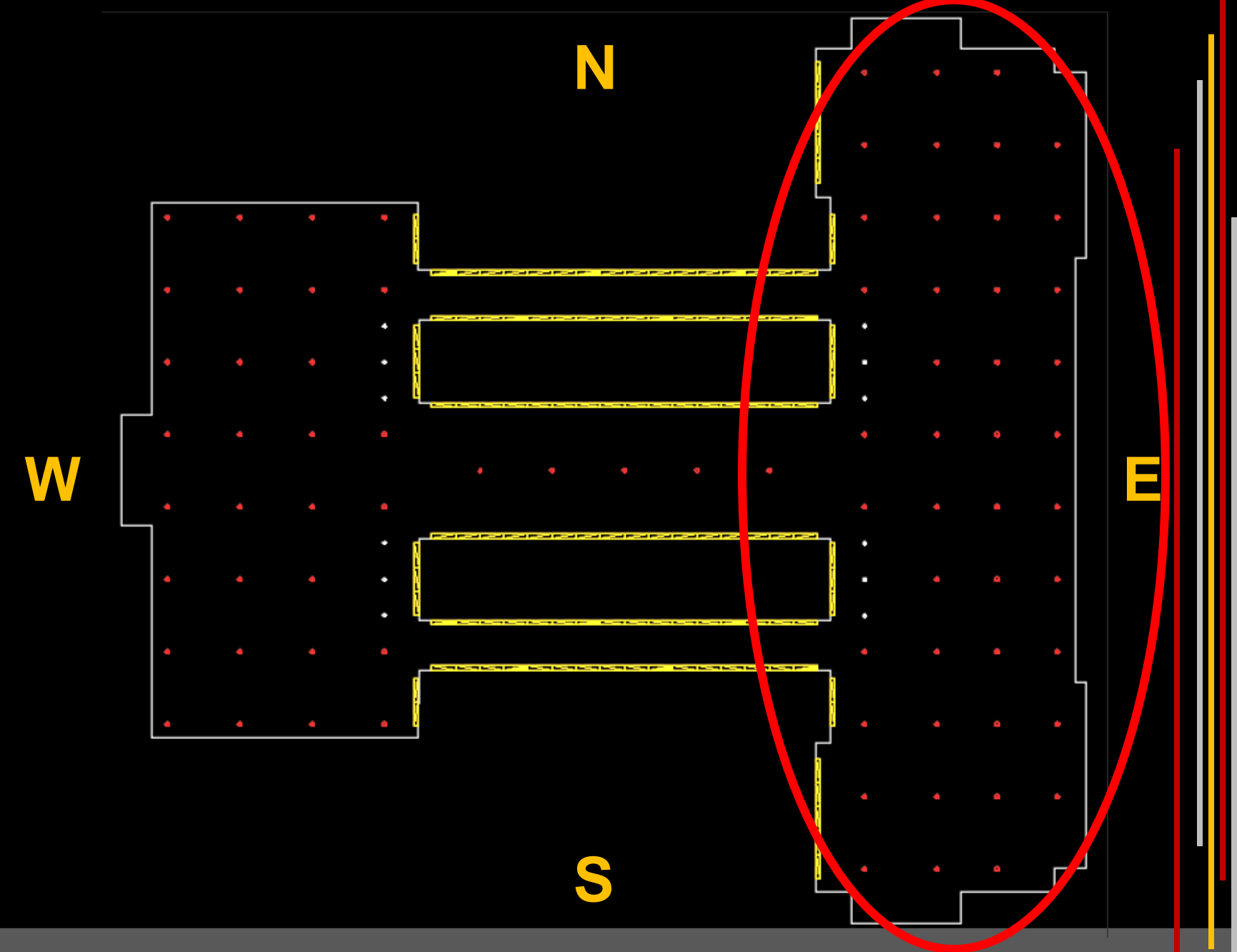
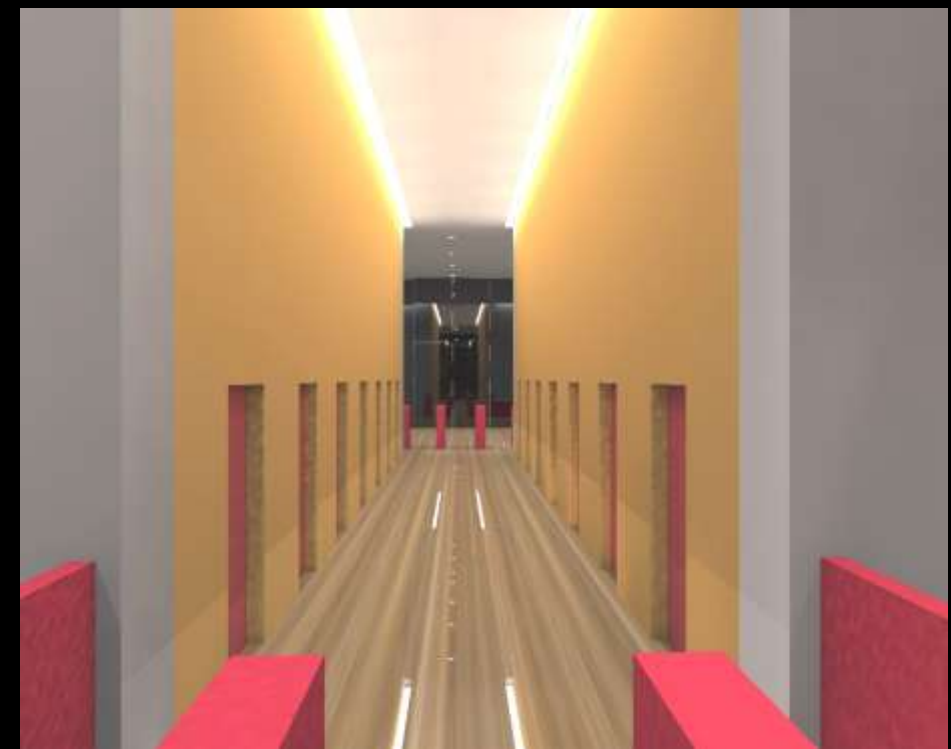
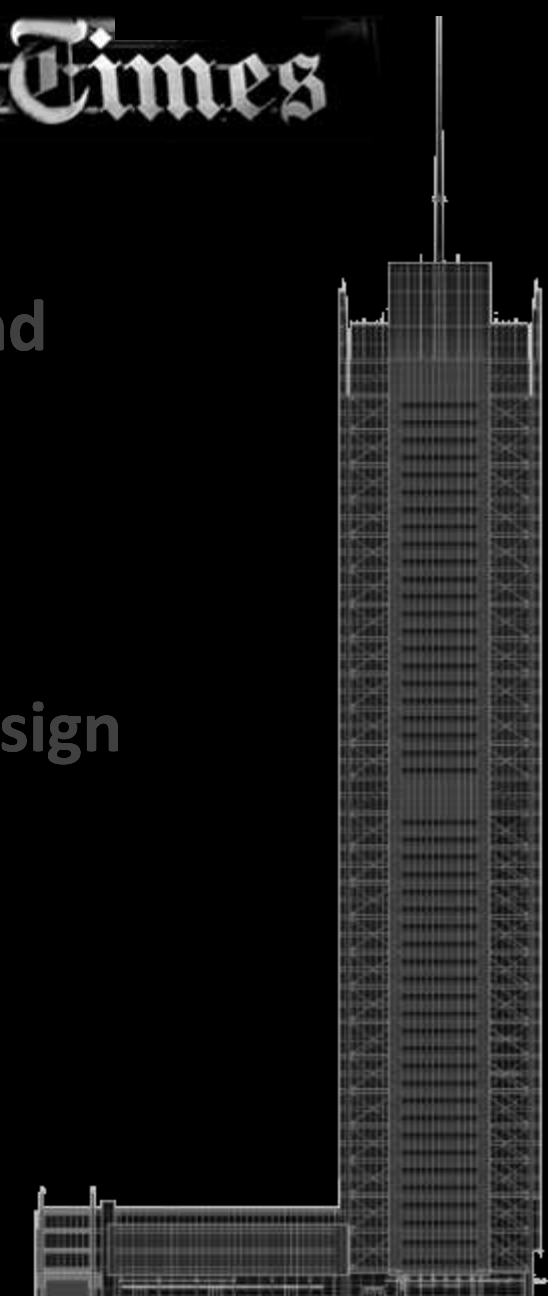
Lobby Lighting Redesign

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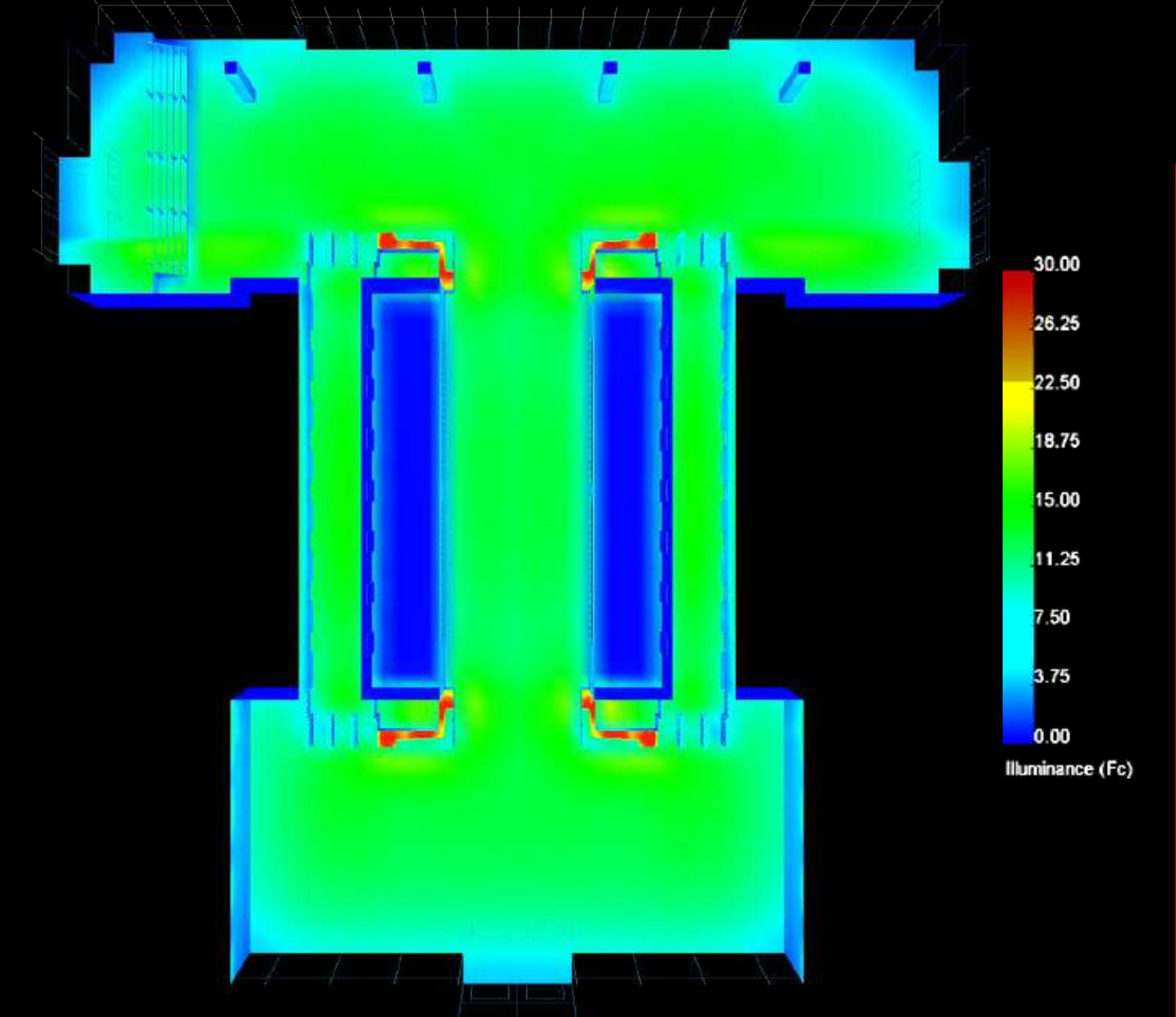
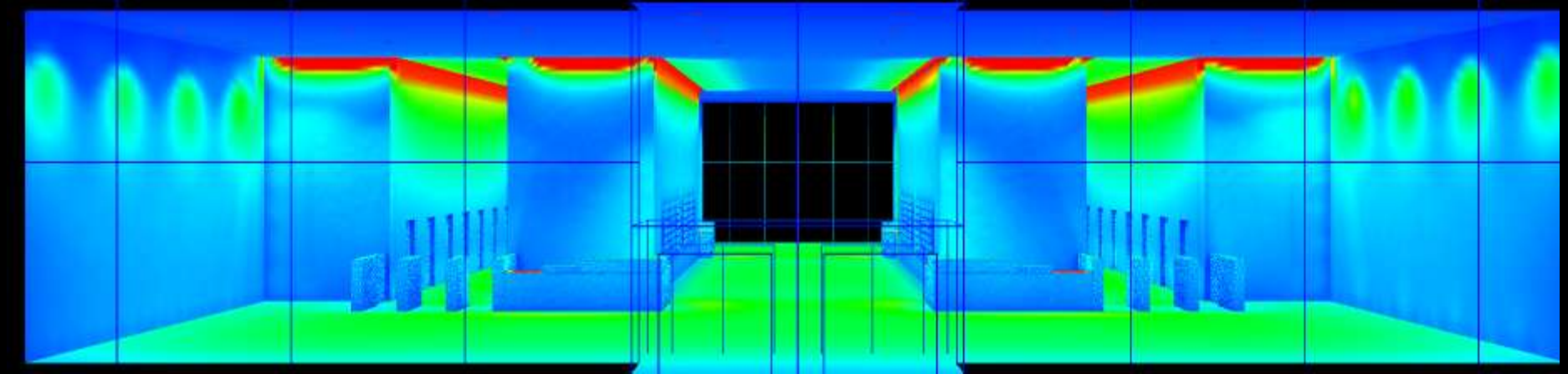
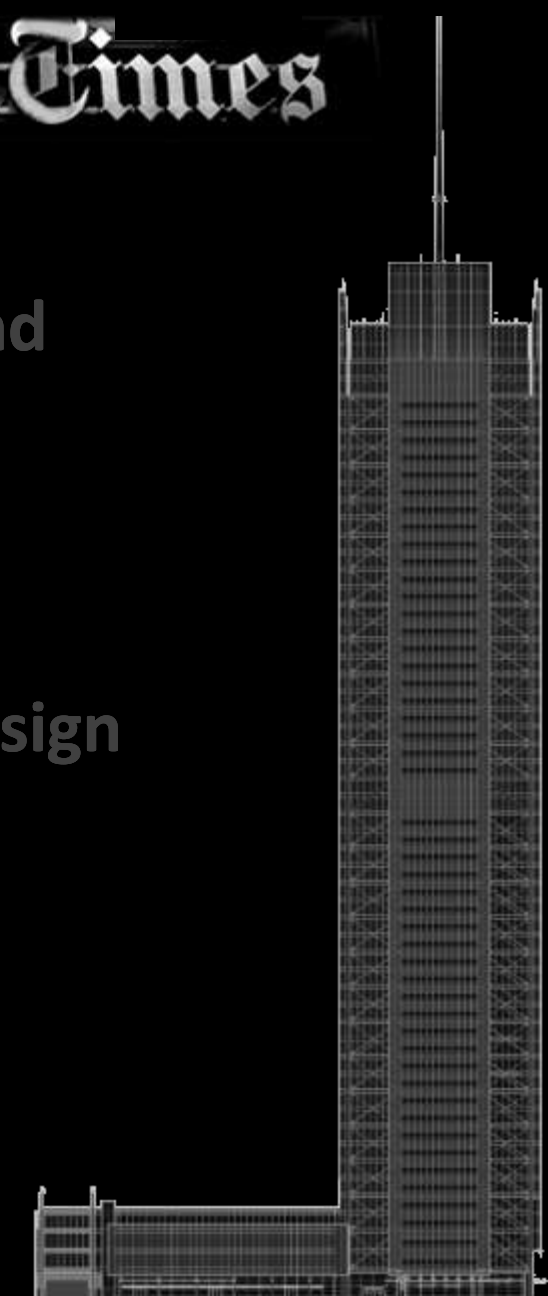
Lobby Lighting Redesign

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Lobby Lighting Redesign

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Intro

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Façade Redesign

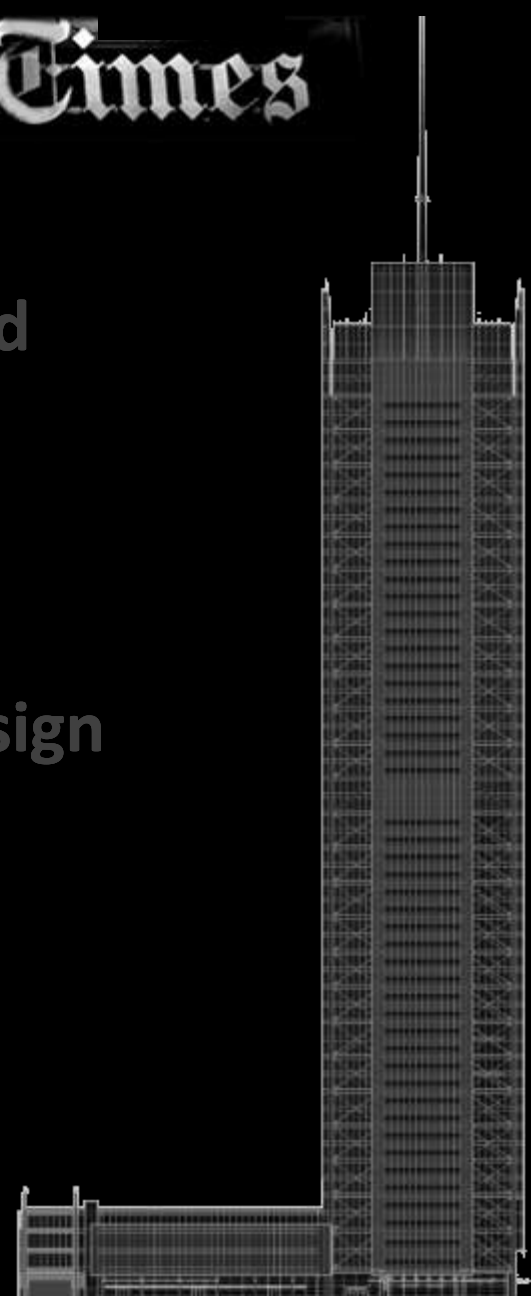
Floor System Redesign

Core Redesign

CoGen Redesign

BIM/IPD

Metrics of Success



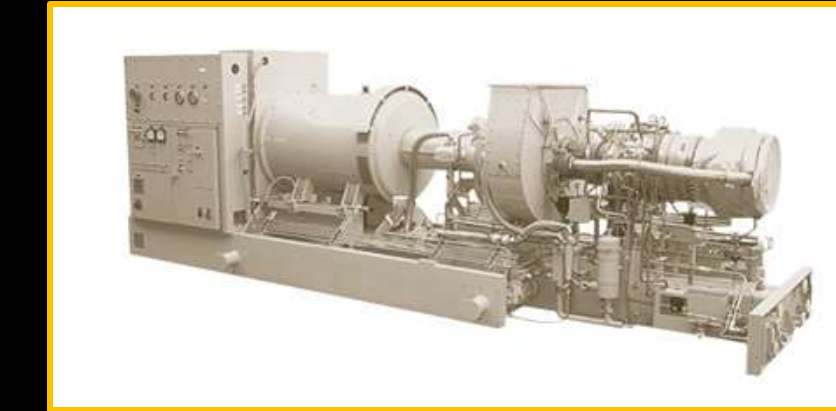
Existing System / Goals

Existing System:

- 1.4 MW Internal Combustion
- 40% power capacity for NYT
- 250 ton absorption chiller

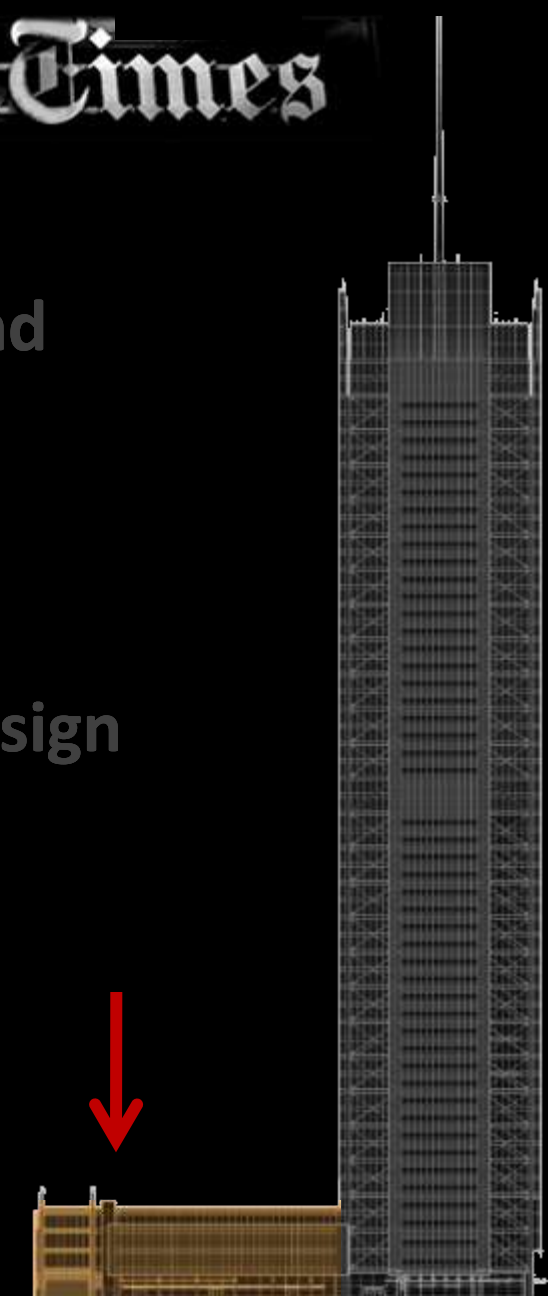
Redesign Goals:

- 100% power capacity for NYT
- Increased energy cost savings
- Decreased energy associated emissions
- **All met!**



Redesign Considerations

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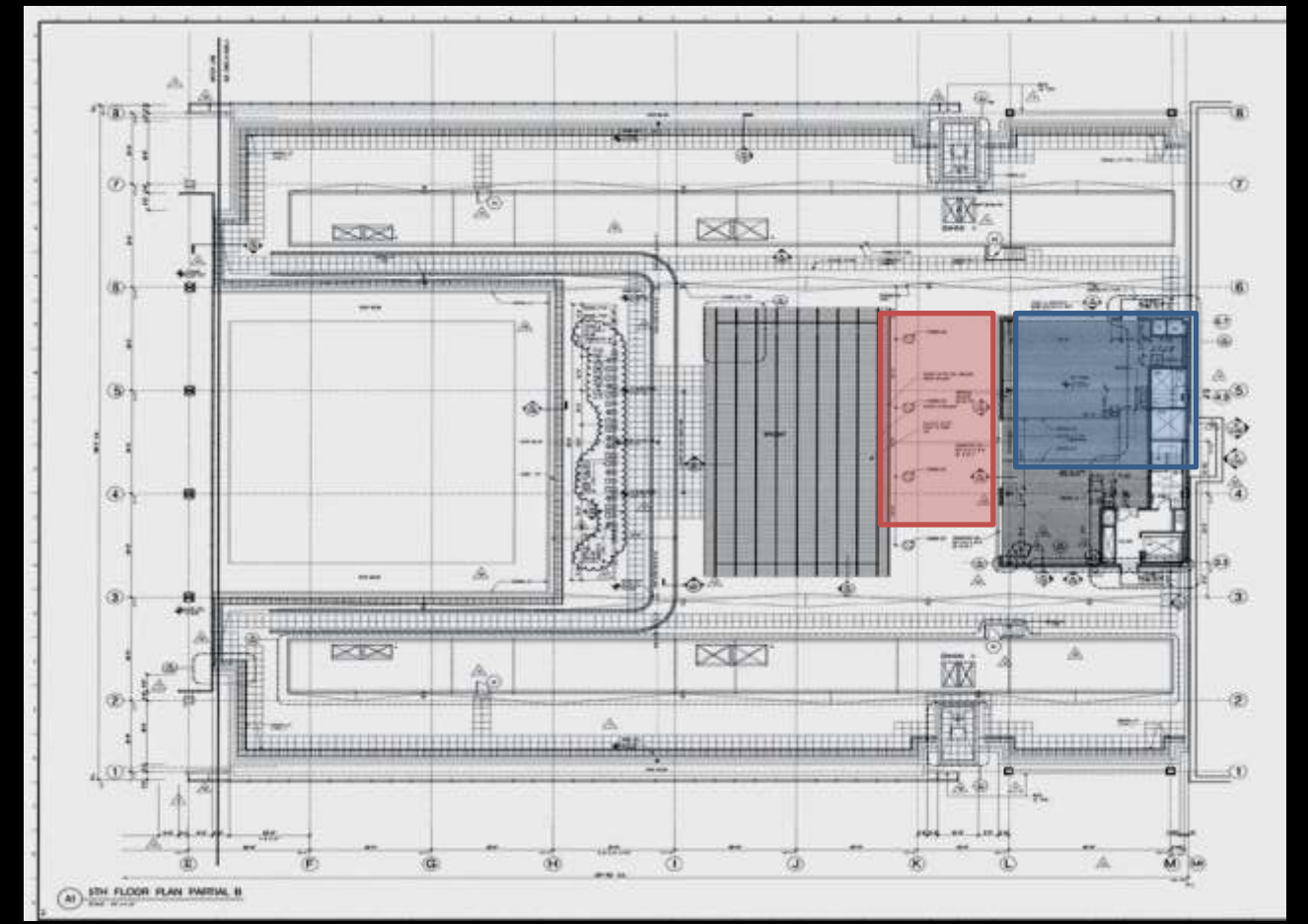


Utility Data / Spark Gap

Utility	Yearly \$/Unit	Reference
Natural Gas	\$1.392/Ccf	New York State Public Service Commission
Electric	\$0.249/kWh	New York State Public Service Commission
Steam	\$18.36/Mlb	Consolidated Edison
Water	\$2.31/per(748gals)	New York City Water Board

Spark Gap	
Fuel	Cost / (MMbtu)
Natural Gas	\$ 11.27
Electricity	\$ 72.97
Steam	\$ 15.40
Gap	\$ 61.70

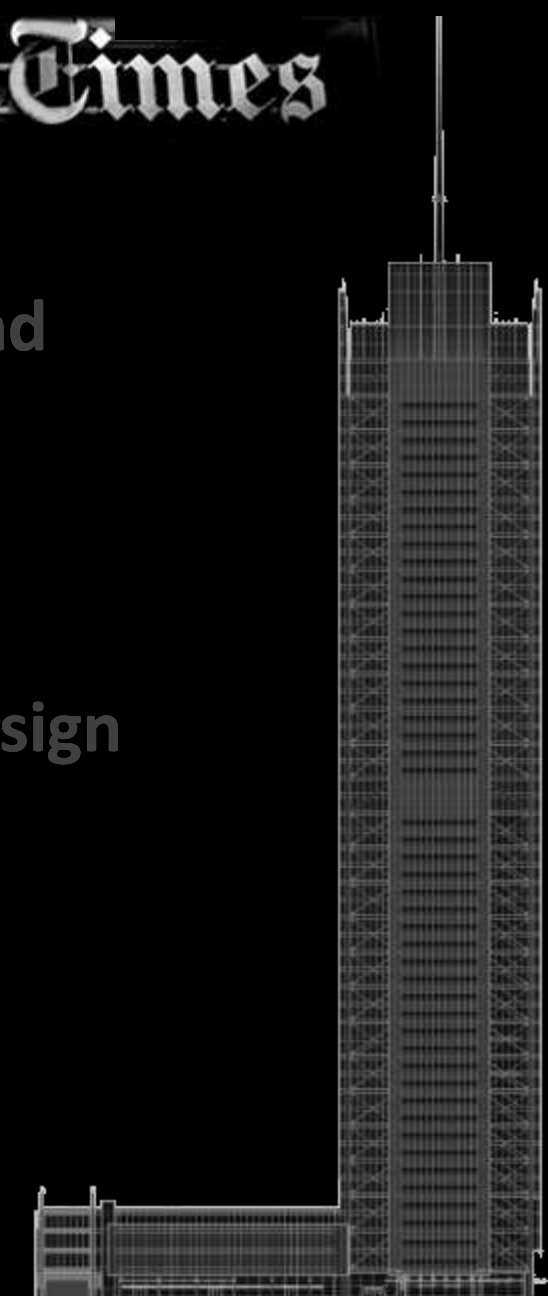
Space Constraints (3000 ft² total)



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CoGen Redesign

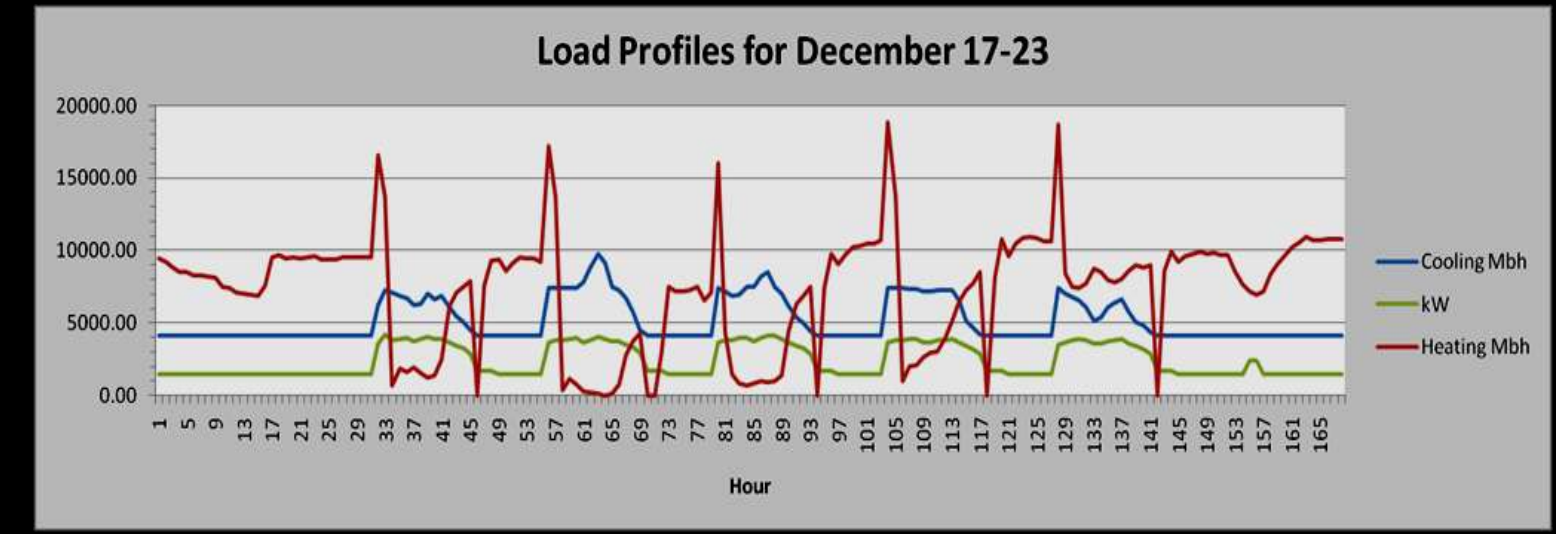
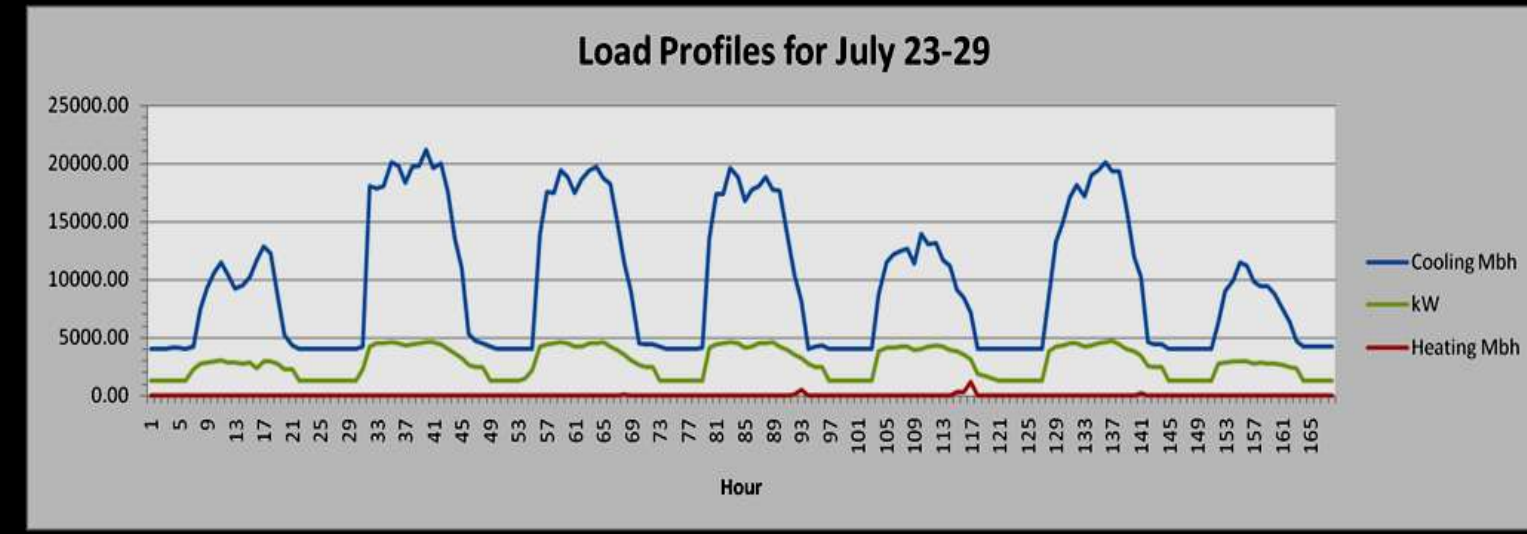
BIM/IPD
Metrics of Success

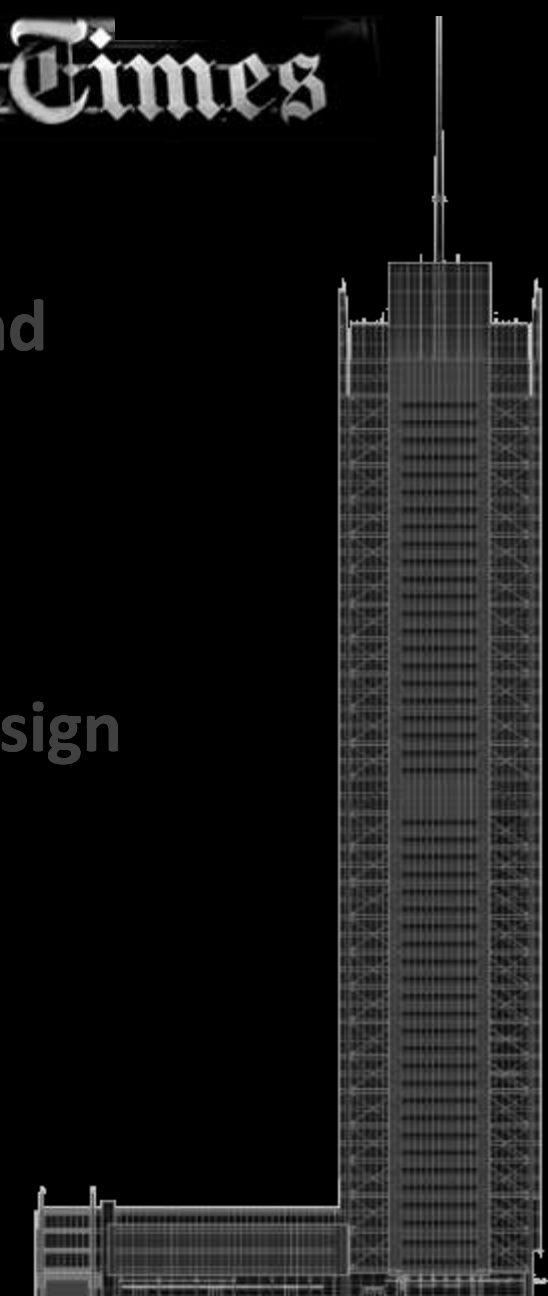


Redesign Consideration

Redesign Considerations:

- Building thermal and electrical loads



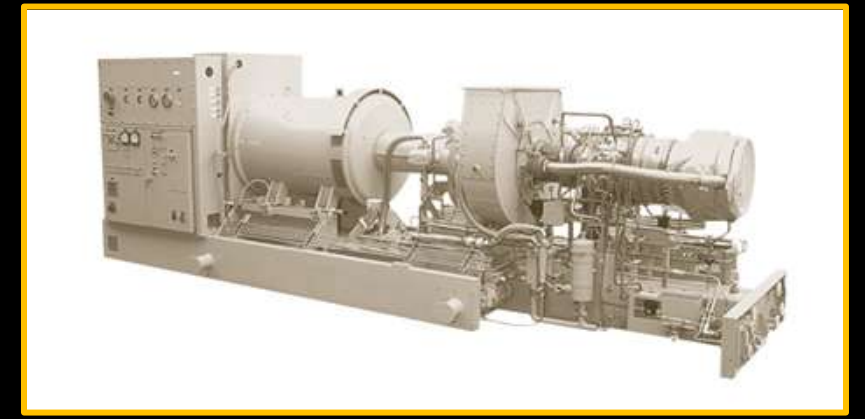


Redesign Alternatives

Prime Movers

CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Prime Movers				
Recipricating Engine(s)	2 - 700 kW	6 - 700 kW	2 - 700 kW 1 - 1300kW	2 - 700 kW
Gas Turbine(s)	-	-	-	1 - 1300kW
Make, Model	Caterpillar, G3516 LE	Caterpillar, G3516 LE	Caterpillar, G3516 LE Caterpillar, DM5496	Caterpillar, G3516 LE Solar, Saturn 20
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Total Floor Area (ft ²)	1,600	4,800	2,970	2,735
Total Weight (lbs)	35,340	106,020	63,720	50,340

Gas Turbines



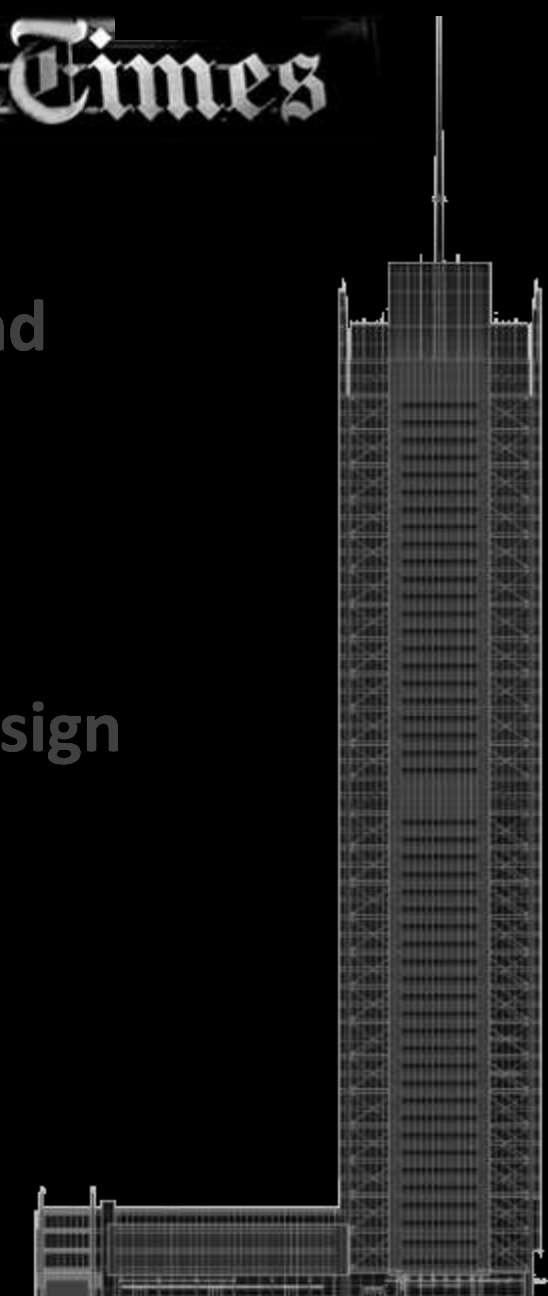
IC Engines



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Redesign Alternatives

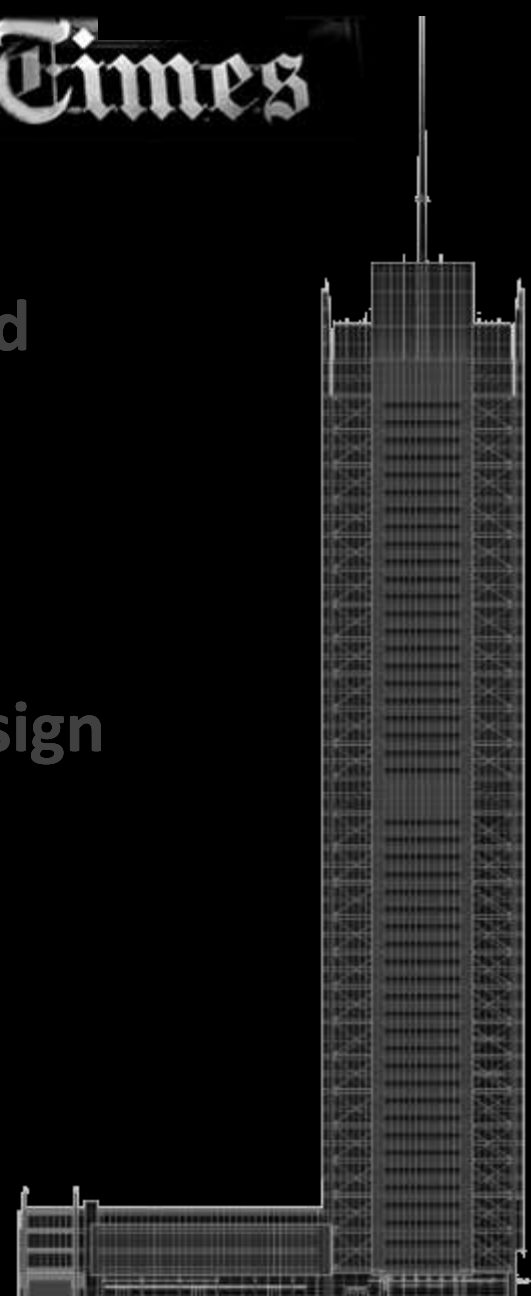
Prime Movers

CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Prime Movers				
Recipricating Engine(s)	2 - 700 kW	6 - 700 kW	2 - 700 kW 1 - 1300kW	2 - 700 kW
Gas Turbine(s)	-	-	-	1 - 1300kW
Make, Model	Caterpillar, G3516 LE	Caterpillar, G3516 LE	Caterpillar, G3516 LE Caterpillar, DM5496	Caterpillar, G3516 LE Solar, Saturn 20
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Total Floor Area (ft ²)	1,600	4,800	2,970	2,735
Total Weight (lbs)	35,340	106,020	63,720	50,340

Existing System: 1,400 kW



IC Engines



Redesign Alternatives

Prime Movers

CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Prime Movers				
Recipricating Engine(s)	2 - 700 kW	6 - 700 kW	2 - 700 kW 1 - 1300kW	2 - 700 kW
Gas Turbine(s)	-	-	-	1 - 1300kW
Make, Model	Caterpillar, G3516 LE	Caterpillar, G3516 LE	Caterpillar, G3516 LE Caterpillar, DM5496	Caterpillar, G3516 LE Solar, Saturn 20
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Total Floor Area (ft ²)	1,600	4,800	2,970	2,735
Total Weight (lbs)	35,340	106,020	63,720	50,340

Alternative 1: 4,200 kW

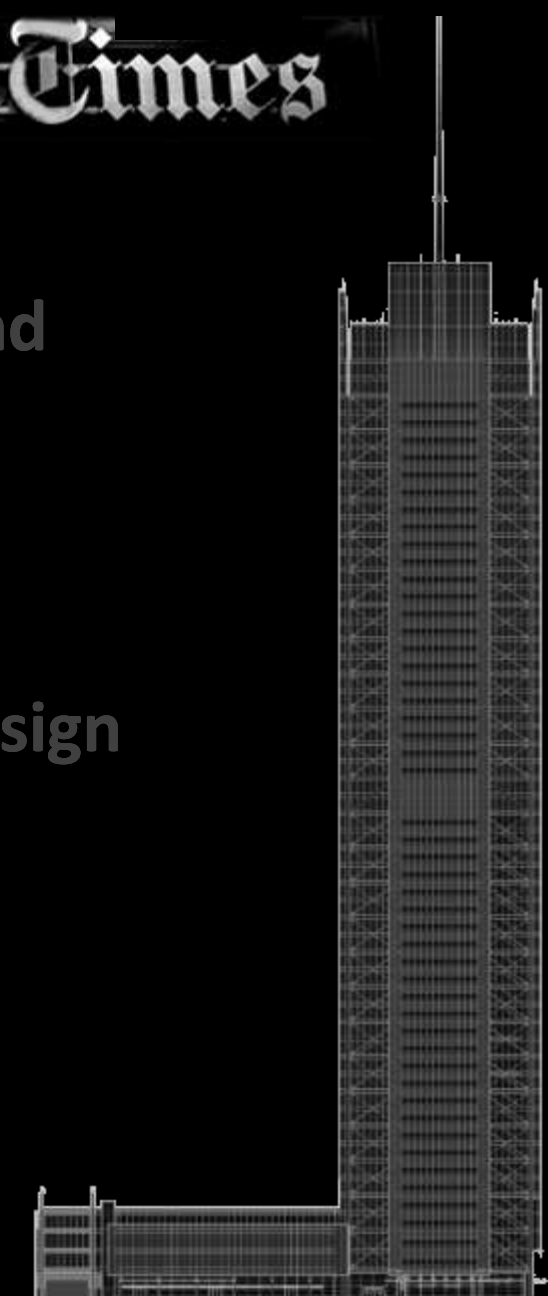


IC Engines

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Redesign Alternatives

Prime Movers

CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Prime Movers				
Recipricating Engine(s)	2 - 700 kW	6 - 700 kW	2 - 700 kW 1 - 1300kW	2 - 700 kW
Gas Turbine(s)	-	-	-	1 - 1300kW
Make, Model	Caterpillar, G3516 LE	Caterpillar, G3516 LE	Caterpillar, G3516 LE Caterpillar, DM5496	Caterpillar, G3516 LE Solar, Saturn 20
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Total Floor Area (ft ²)	1,600	4,800	2,970	2,735
Total Weight (lbs)	35,340	106,020	63,720	50,340

Alternative 2: 2,700 kW

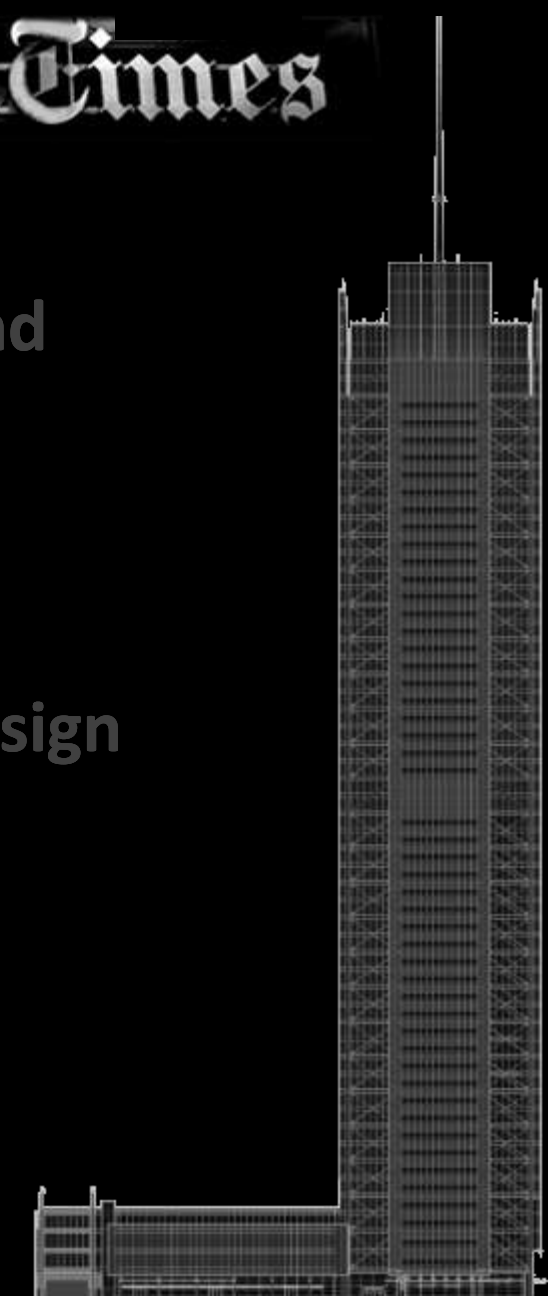


IC Engines

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1,300 kW IC Engine



Redesign Alternatives

Prime Movers

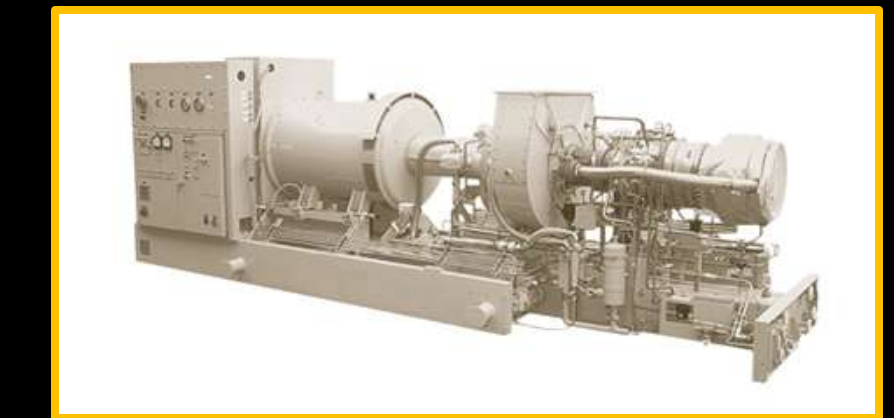
CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Prime Movers				
Recipricating Engine(s)	2 - 700 kW	6 - 700 kW	2 - 700 kW 1 - 1300kW	2 - 700 kW
Gas Turbine(s)	-	-	-	1 - 1300kW
Make, Model	Caterpillar, G3516 LE	Caterpillar, G3516 LE	Caterpillar, G3516 LE Caterpillar, DM5496	Caterpillar, G3516 LE Solar, Saturn 20
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Total Floor Area (ft ²)	1,600	4,800	2,970	2,735
Total Weight (lbs)	35,340	106,020	63,720	50,340

Alternative 3: 2,700 kW



IC Engines

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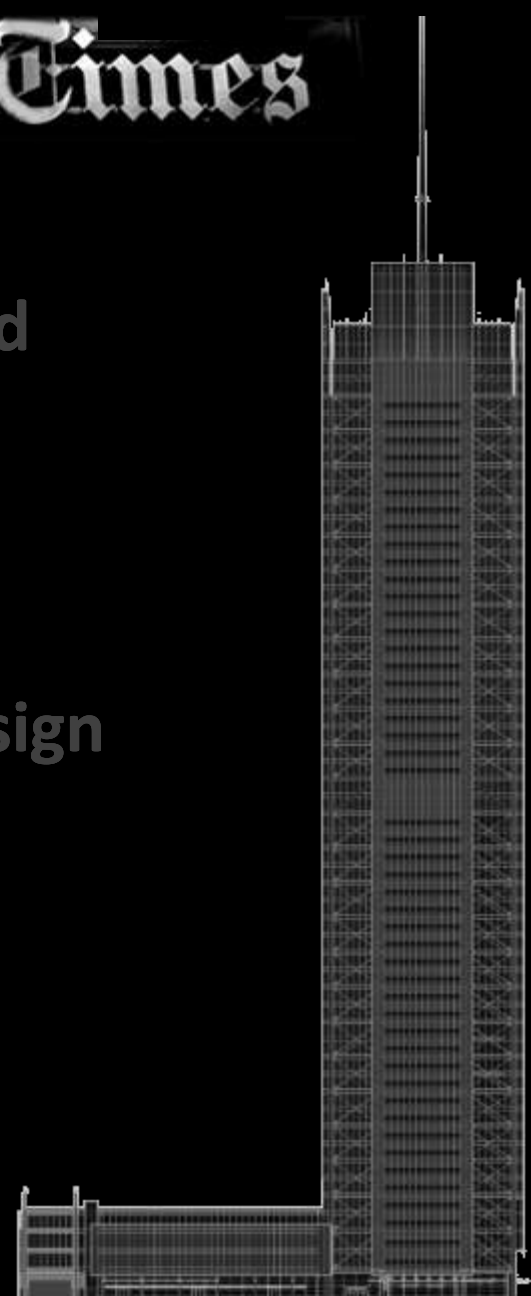


1,300 kW Gas Turbine

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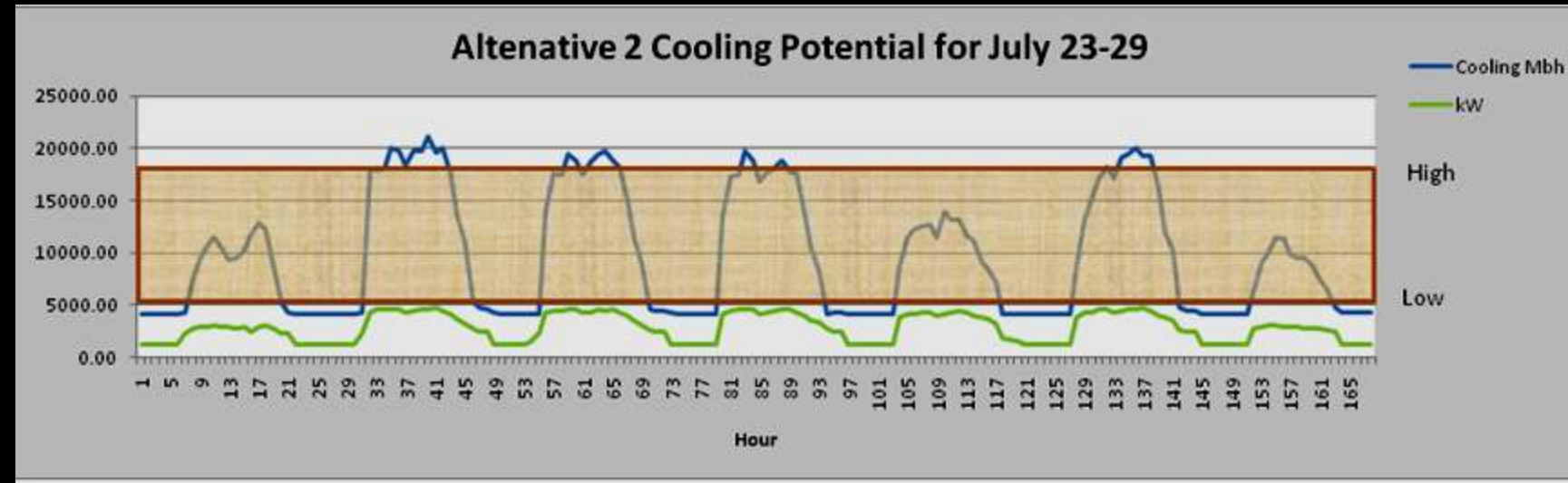
Façade Redesign
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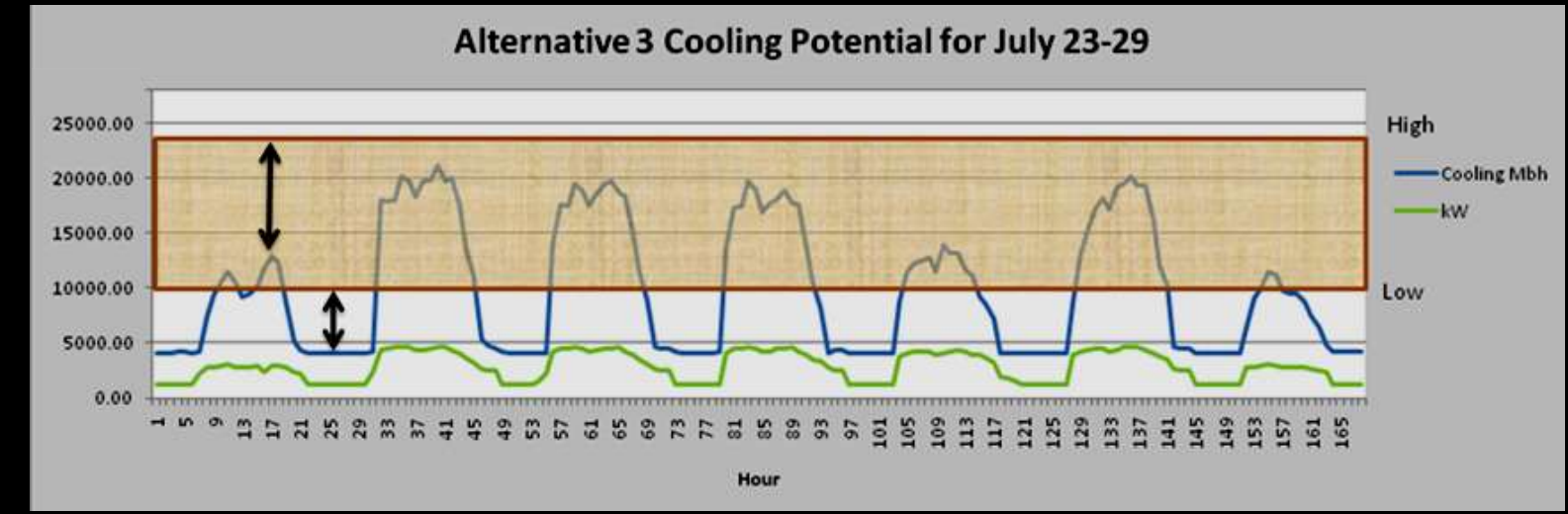
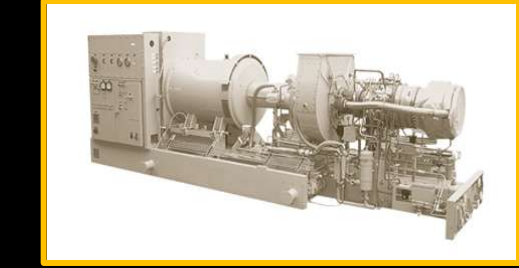


Redesign Alternatives

IC Engine: Cooling Load Potential



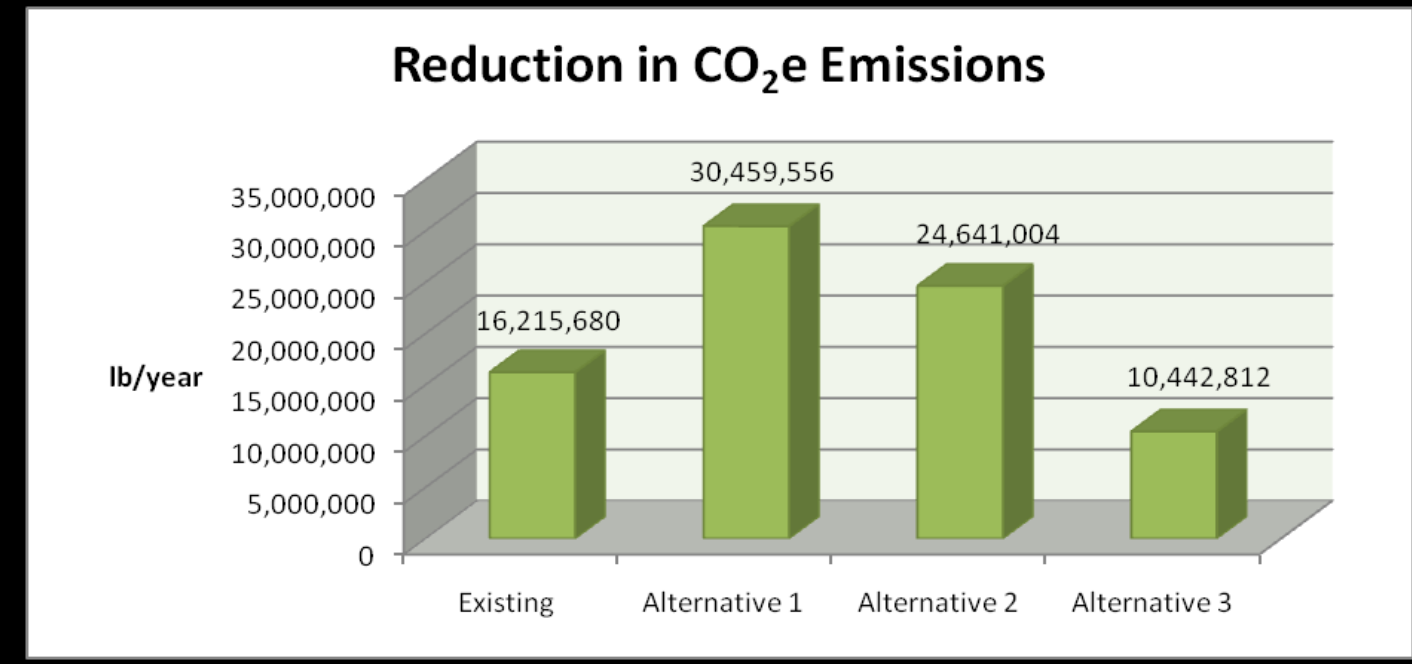
Gas Turbine: Excess Thermal



Redesign Alternatives

Energy / Emissions

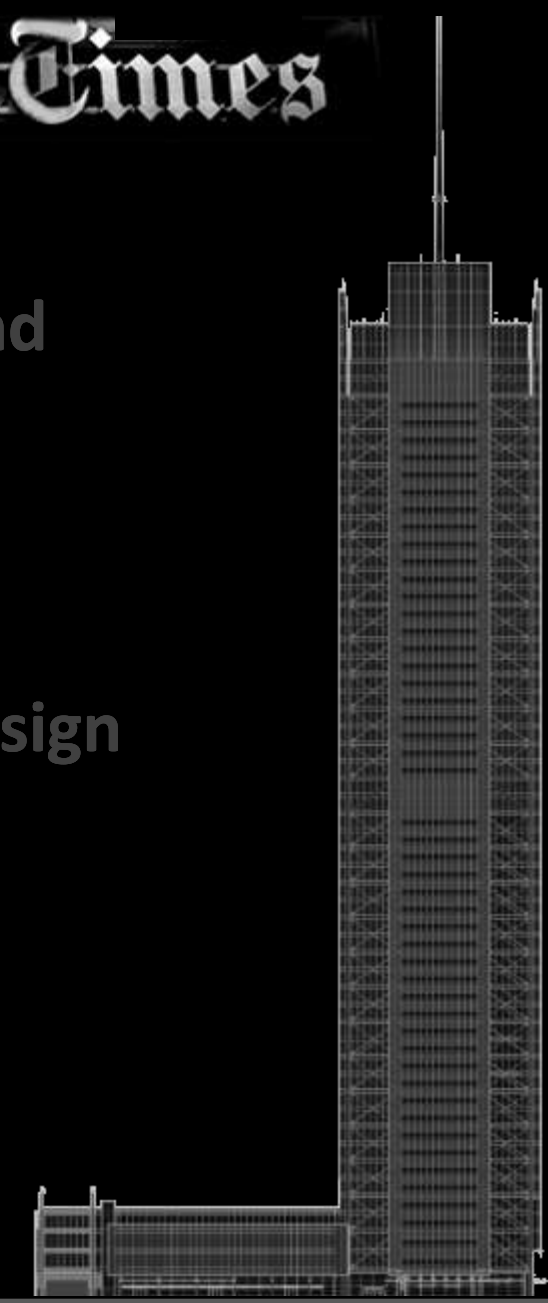
CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Energy / Emissions				
Max Power Output (kW)	1,400	4,200	2,700	2,700
Yearly Power Output (kWh)	12,101,254	22,731,012	18,388,809	7,030,255
Max Thermal Rejection (Mbh)	9,340	28,020	15,240	18,940
Usable Heat Rejection (Mbh/year)	66,509,219	80,267,534	73,141,027	81,940,305
Fuel Consumption (scf/kWh)	12.49	12.49	12.11	13.35
Max Fuel Consumption (scf/hr)	17,485	52,455	32,692	36,045
Emissions Reduction (lbs CO ₂ e/year)	16,215,680	30,459,556	24,641,004	10,442,812



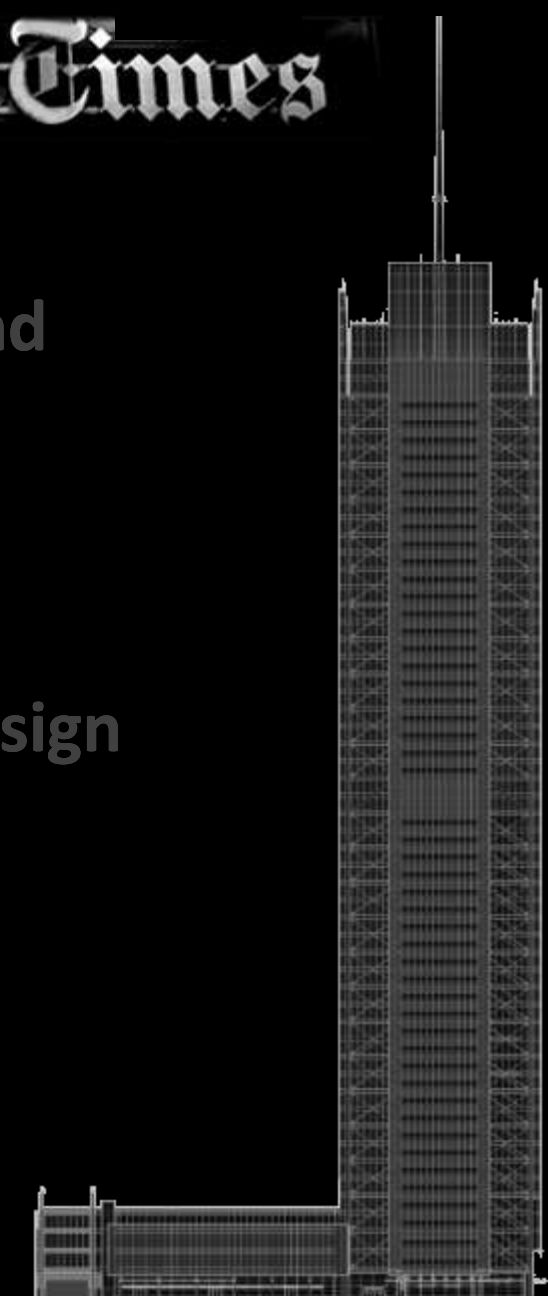
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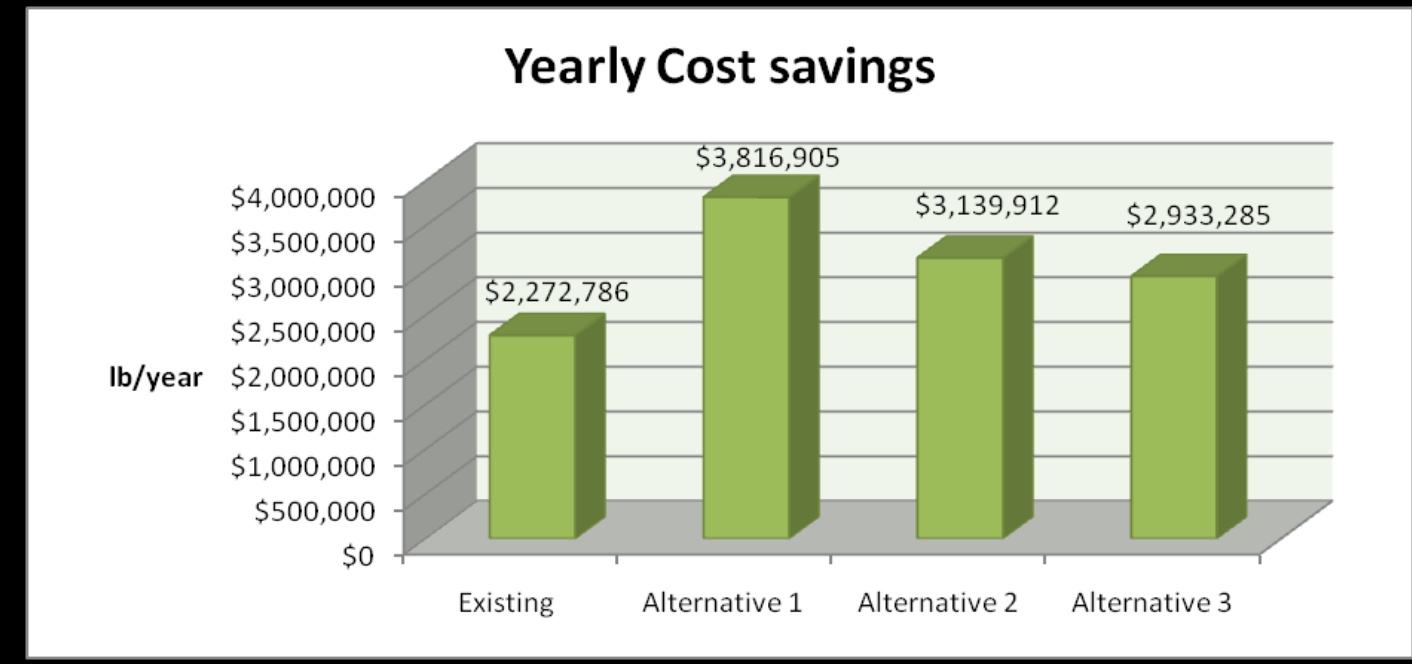
Redesign Alternatives

Energy Costs

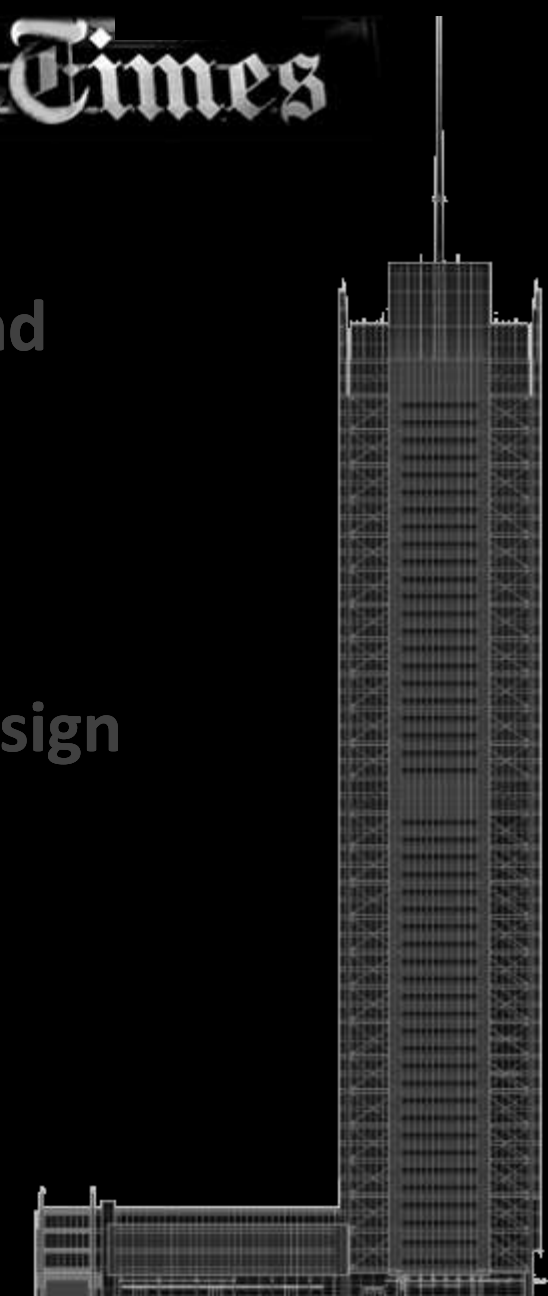
CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Costs				
Installed Costs (\$)	\$5,600,000	\$16,800,000	\$10,800,000	\$12,100,000
Maintenance Costs (\$/kWh)	\$0.005	\$0.005	\$0.005	\$0.015
Maintenance Costs (\$/year)	\$60,506	\$113,655	\$91,944	\$205,530
Building Energy Costs (\$/year)	\$11,310,248	\$9,766,130	\$10,443,122	\$10,649,749
Total Energy Cost Savings (\$/year)	\$2,272,786	\$3,816,905	\$3,139,912	\$2,933,285
Payback Period (years)	0.00	7.83	6.71	14.29



Total Energy Costs: \$13.5 million for SHP



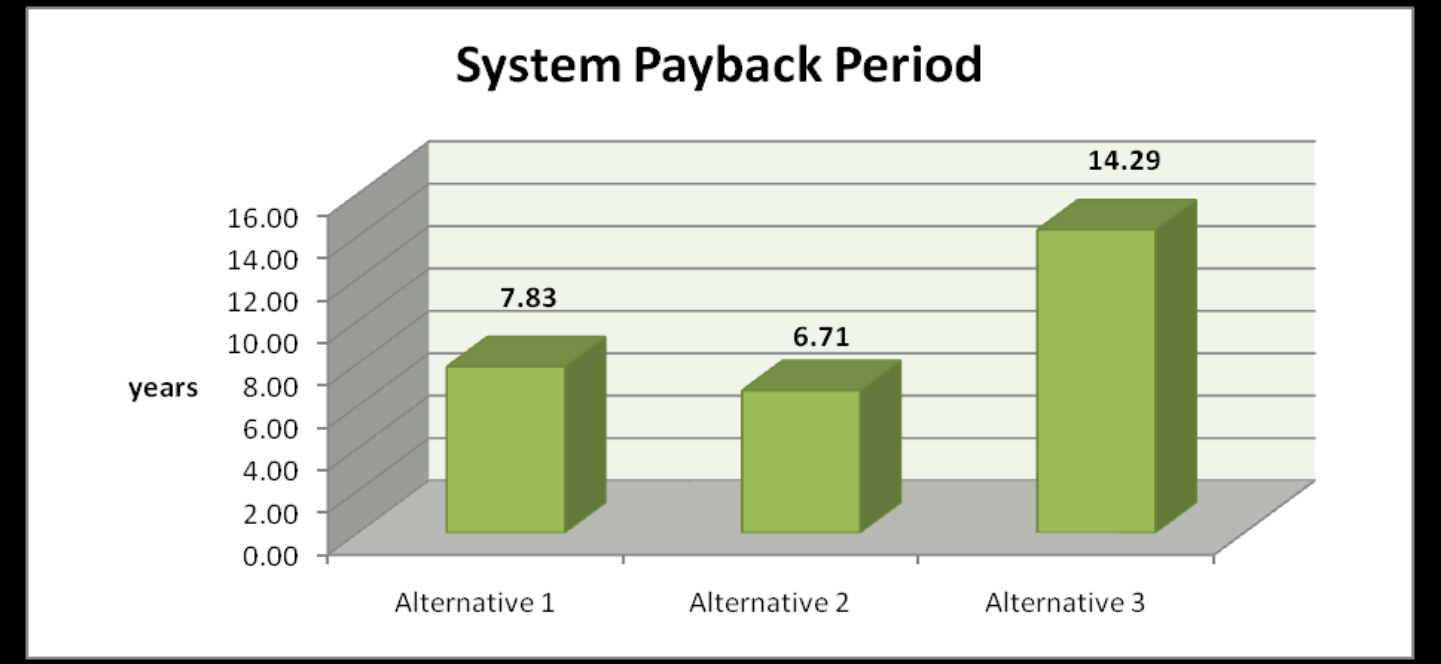
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Redesign Alternatives

Simple Payback Period

CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Costs				
Installed Costs (\$)	\$5,600,000	\$16,800,000	\$10,800,000	\$12,100,000
Maintenance Costs (\$/kWh)	\$0.005	\$0.005	\$0.005	\$0.015
Maintenance Costs (\$/year)	\$60,506	\$113,655	\$91,944	\$205,530
Building Energy Costs (\$/year)	\$11,310,248	\$9,766,130	\$10,443,122	\$10,649,749
Total Energy Cost Savings (\$/year)	\$2,272,786	\$3,816,905	\$3,139,912	\$2,933,285
Payback Period (years)	0.00	7.83	6.71	14.29

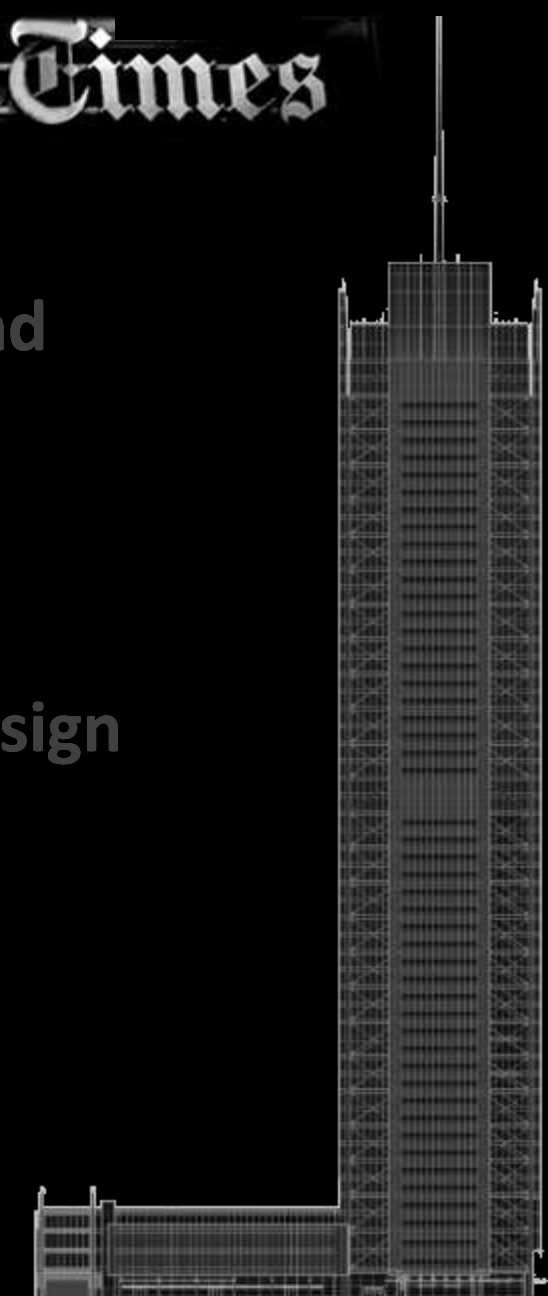


Redesign Alternatives

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- CoGen Redesign**

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Summary

Overall Comparison	Existing	Alternative 1	Alternative 2	Alternative 3
Energy Cost	✘	😊	😊	😊
Source Energy Emissions	✘	😊	😊	😊
Payback Period	😊	😊	😊	✘
System Footprint	😊	✘	😊	😊

Alternative 2: 2,700 kW



IC Engines

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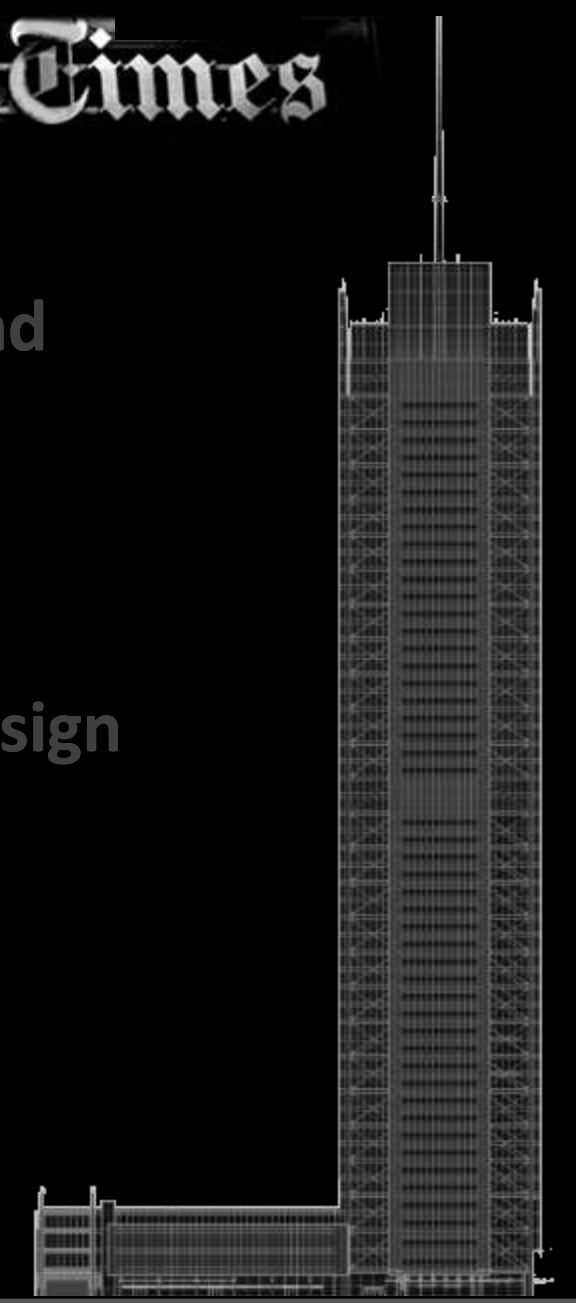
1,300 kW IC Engine

Redesign Alternatives

- Intro
- Building Background
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- Façade Redesign
- Floor System Redesign
- Core Redesign
- CoGen Redesign**

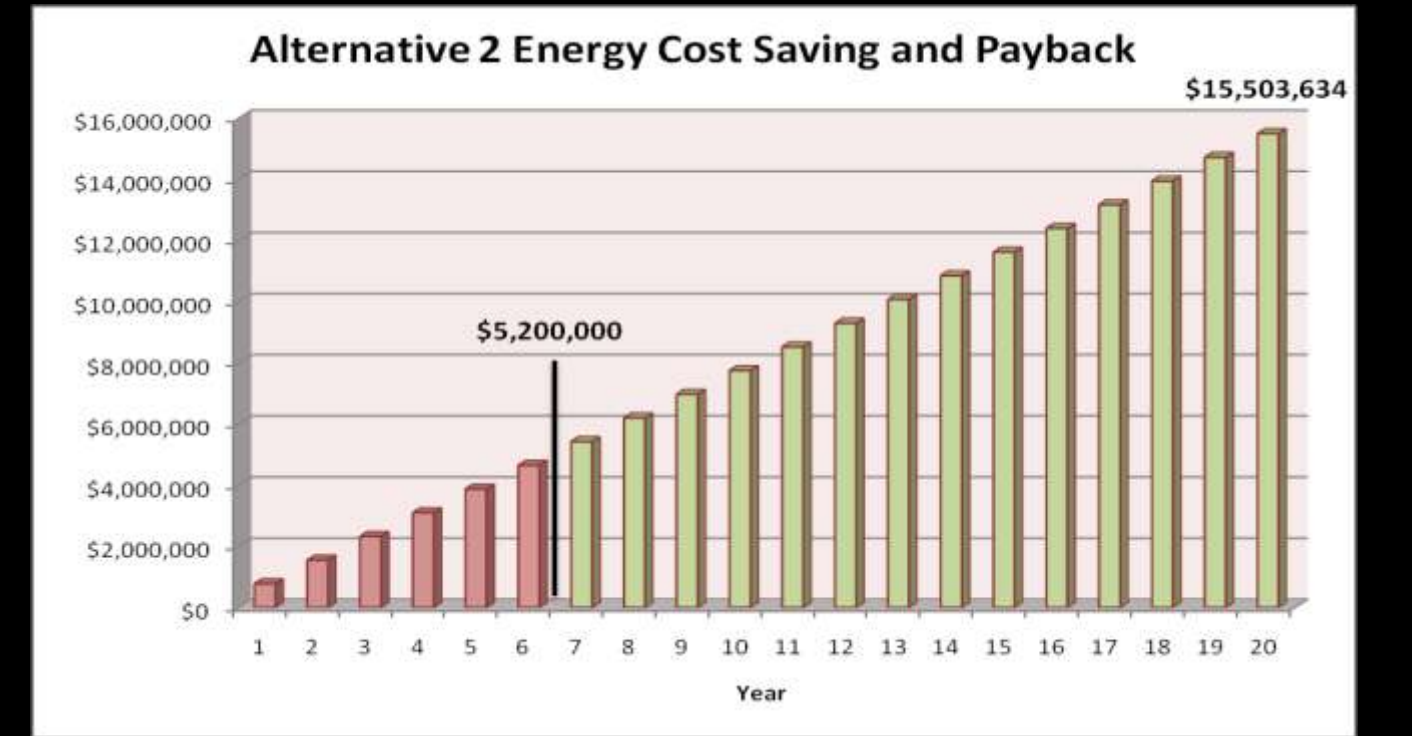
- BIM/IPD
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Summary

Overall Comparison	Existing	Alternative 1	Alternative 2	Alternative 3
Energy Cost	✘	😊	😊	😊
Source Energy Emissions	✘	😊	😊	😊
Payback Period	😊	😊	😊	✘
System Footprint	😊	✘	😊	😊

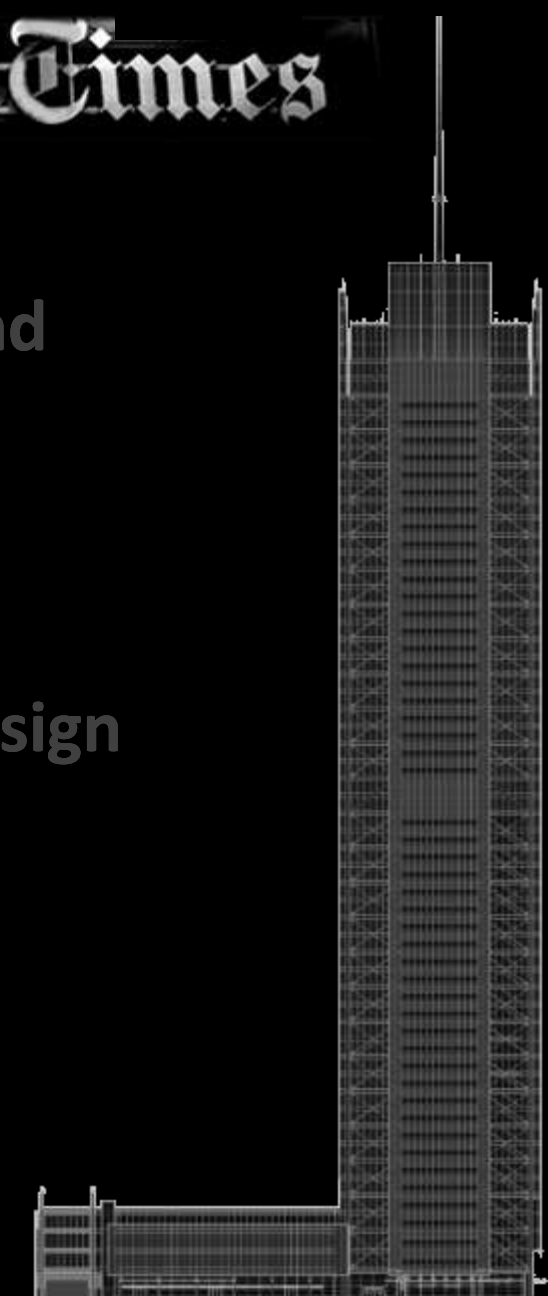
Alternative 2: \$10 million in savings over 20 years



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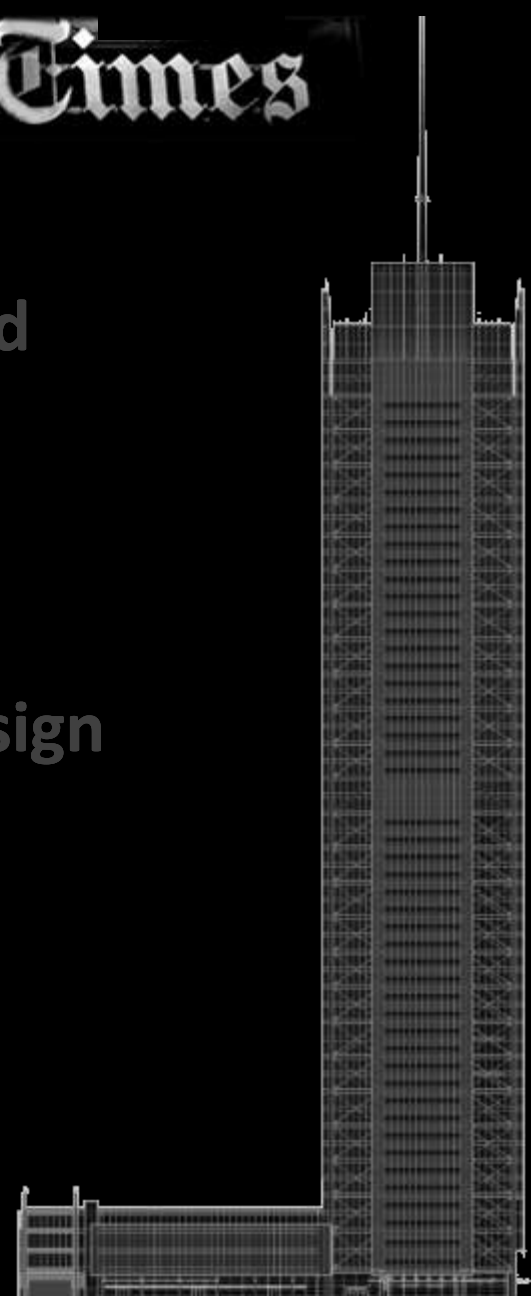
BIM/IPD
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BIM Goals

Building Information Modeling Process:

BIM Goals

Group Goals:

- Enhance communication and information flow
- Visualize project changes

BIM Use Analysis

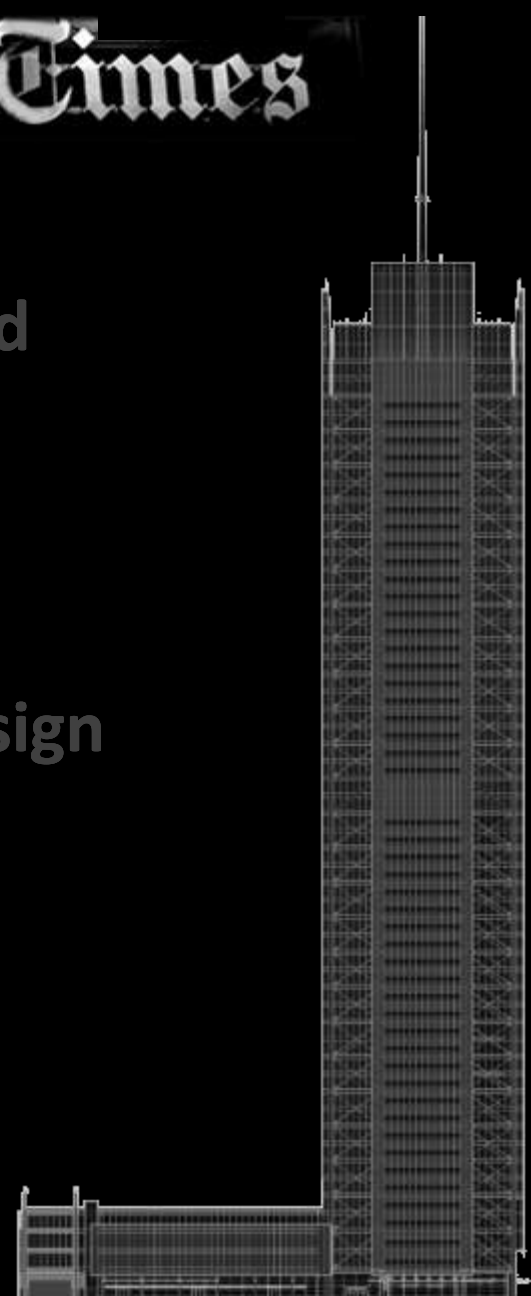
Workflows



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BIM Goals

Building Information Modeling Process:

BIM Goals

Group Goals:

- Enhance communication and information flow
- Visualize project changes

BIM Use Analysis

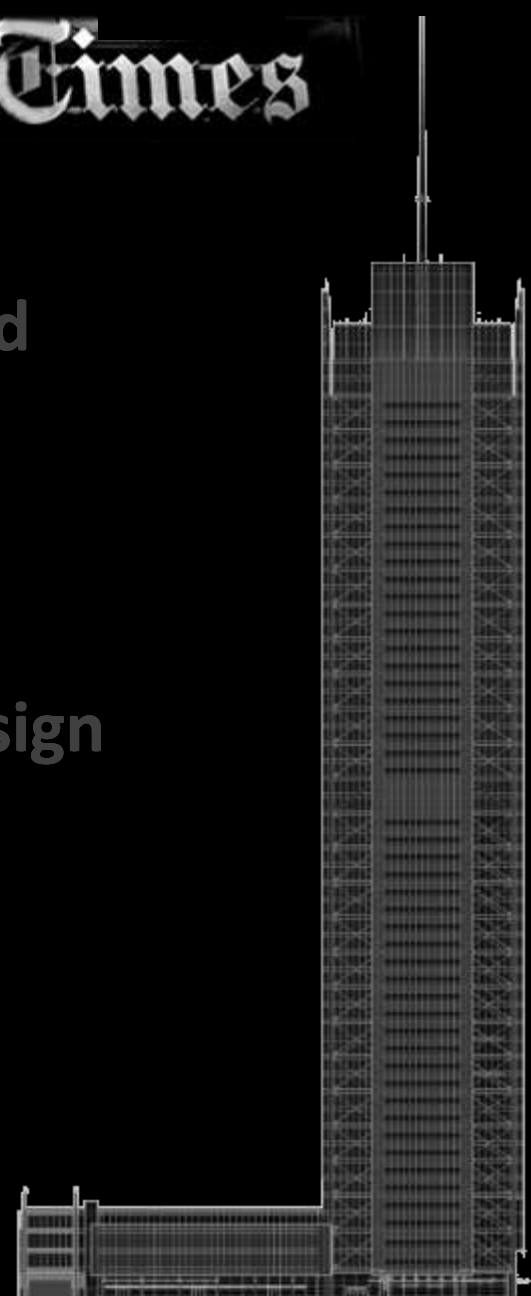
Workflows



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BIM Use Analysis

Building Information Modeling Process:

BIM Goals

Group Goals:

- Enhance communication and information flow
- Visualize project changes

BIM Use Analysis

Workflows

BIM Uses Analysis

Design Authoring

Design Review

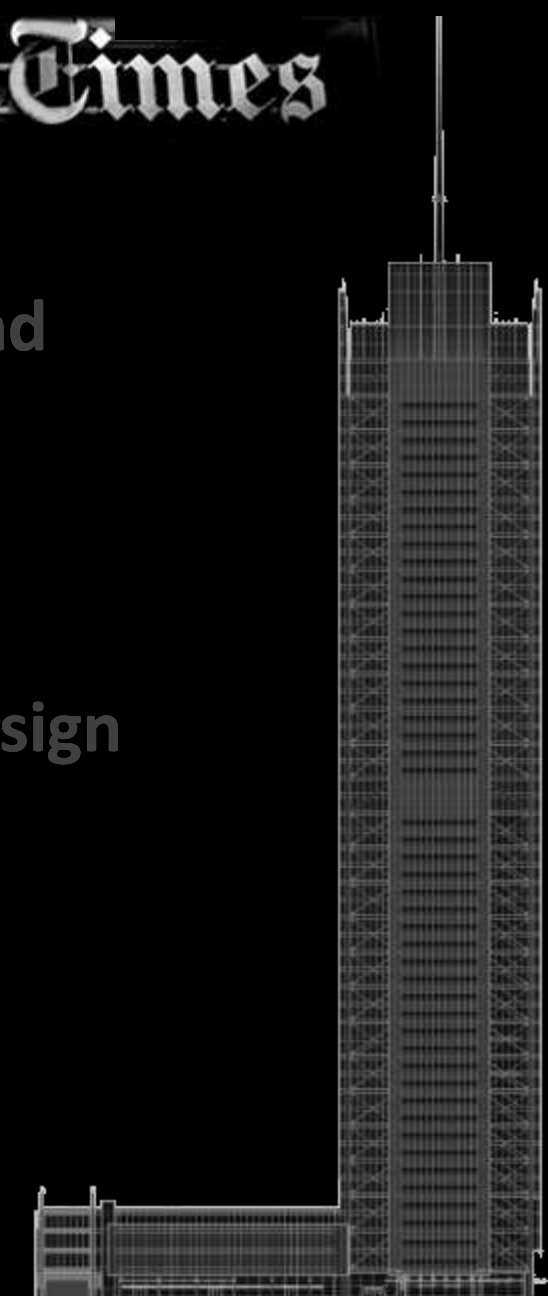
3D Coordination

Phase Planning

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BIM Workflows

Building Information Modeling Process:

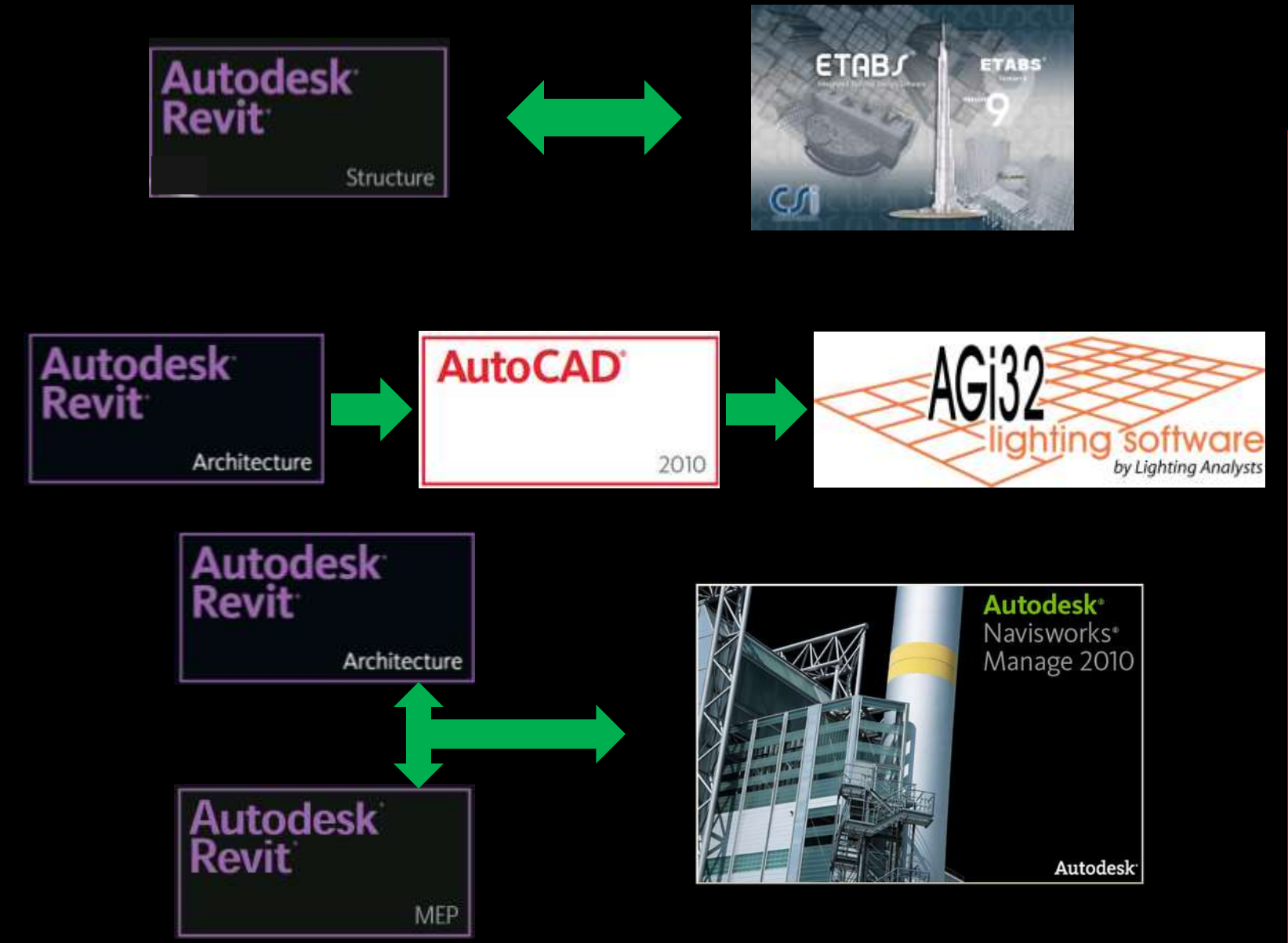
BIM Goals

Group Goals:

- Enhance communication and information flow
- Visualize project changes

BIM Use Analysis

Workflows



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Façade Redesign

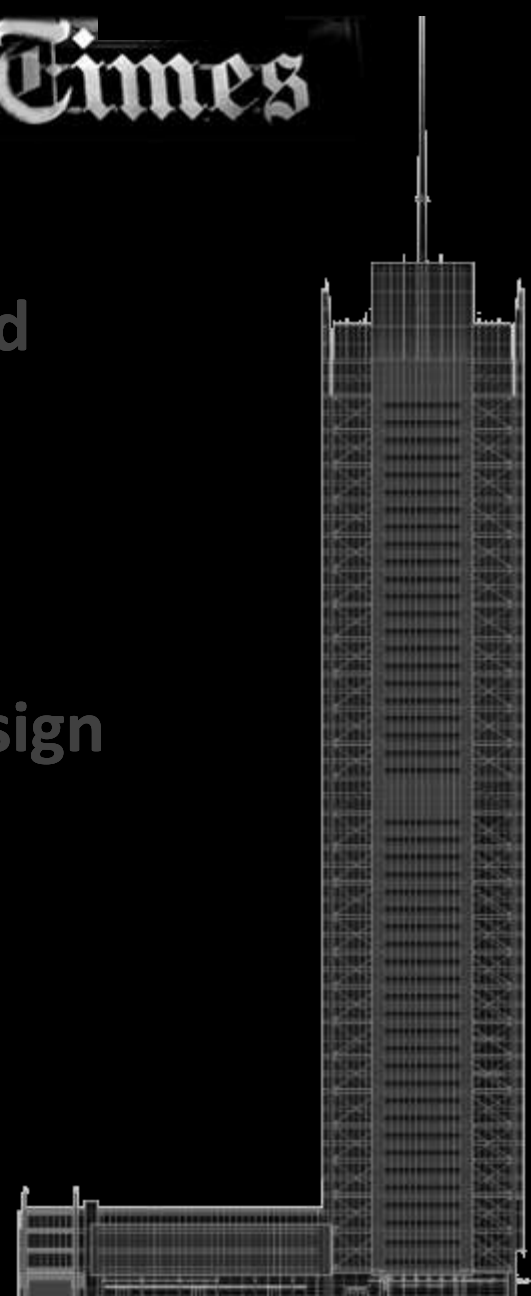
Floor System Redesign

Core Redesign

CoGen Redesign

BIM/IPD

Metrics of Success



Metrics of Success



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Increased Profitability

- Operating Costs
- Leasable Space

Increased Marketability

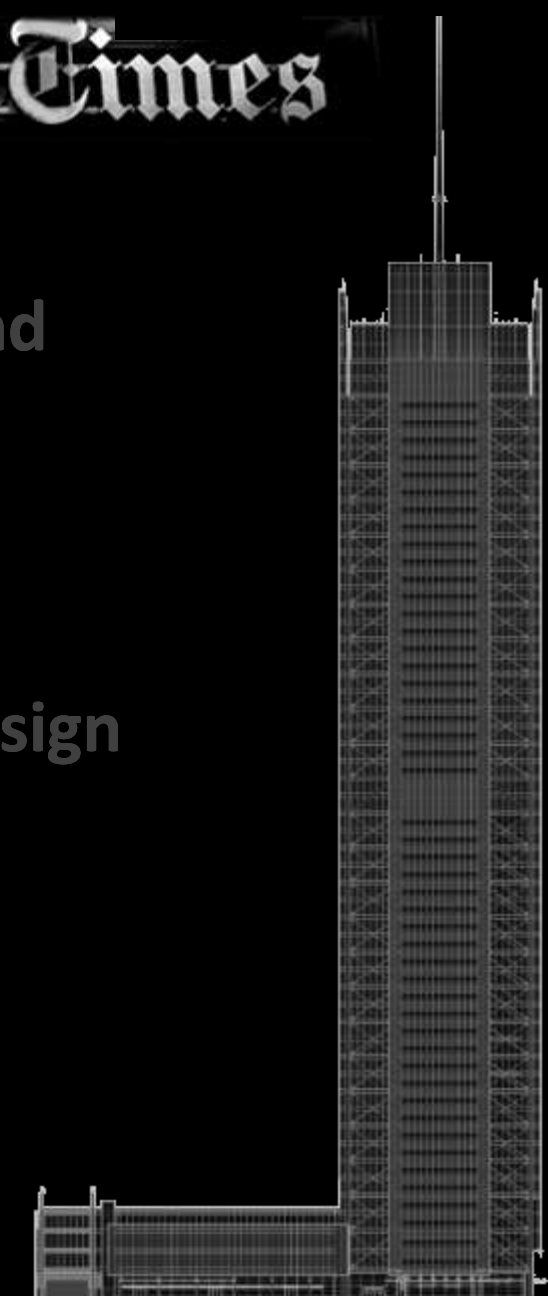
- Sustainability
- Iconic Image

Yearly Energy Cost Savings by Category



Metrics of Success

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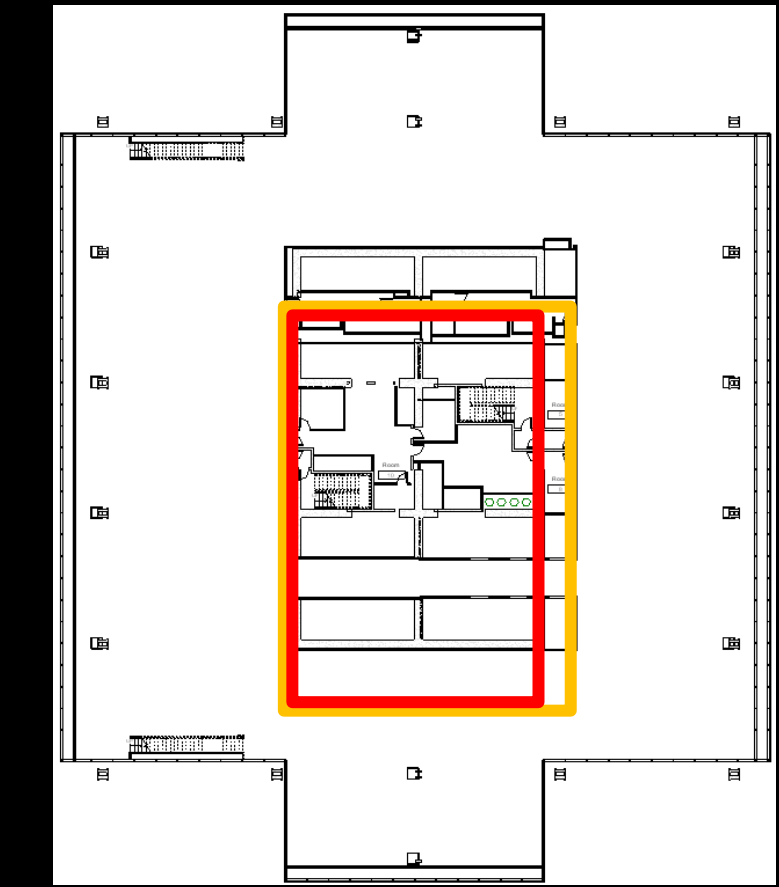
Increased Profitability

- Operating Costs
- Leasable Space

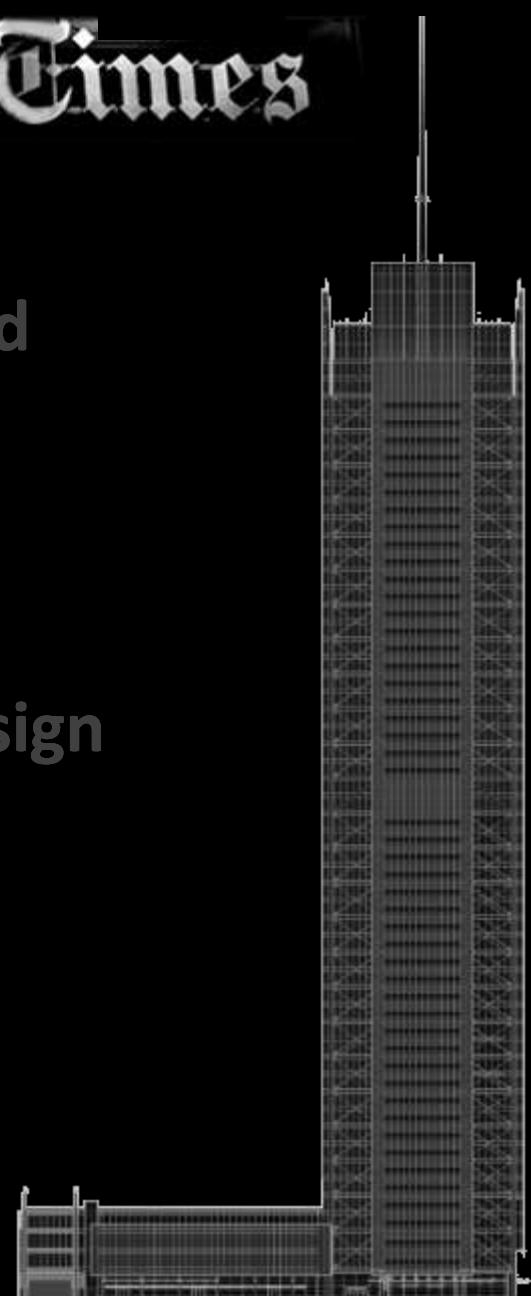
Increased Marketability

- Sustainability
- Iconic Image

Additional Square Footage	26,864 SF
Additional Rent	\$ 1,601,840



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- Floor System Redesign
- Core Redesign
- CoGen Redesign
- BIM/IPD
- Metrics of Success**



Metrics of Success



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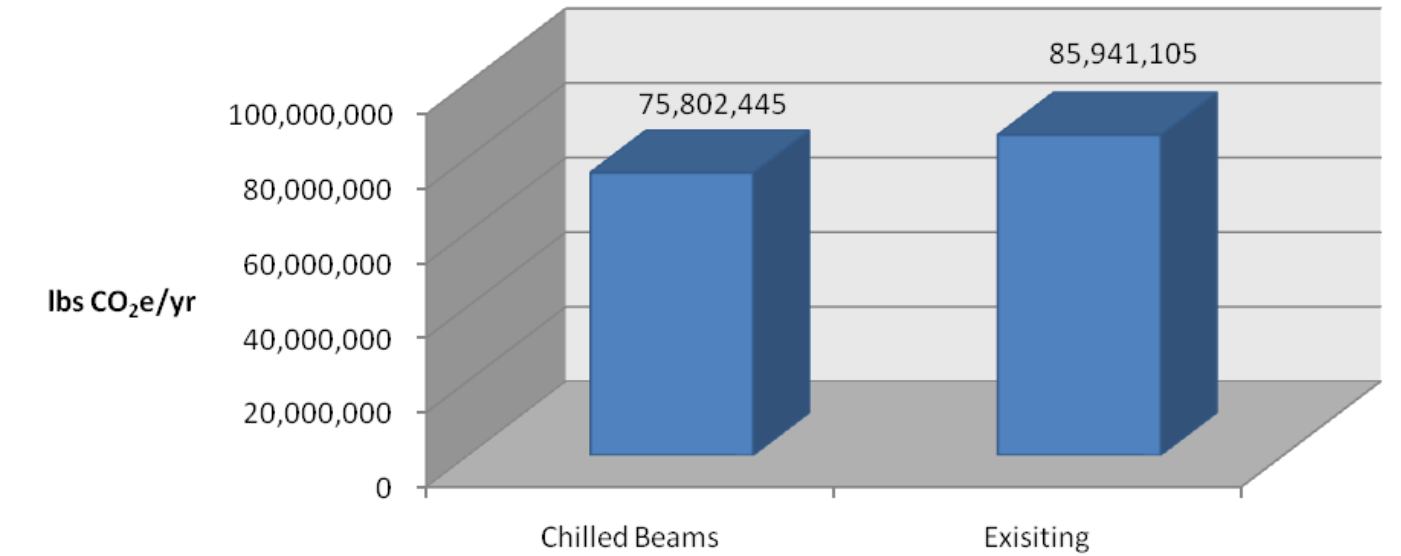
Increased Profitability

- Operating Costs
- Leasable Space

Increased Marketability

- Sustainability
- Iconic Image

Building Energy Use Associated Emissions (CO₂e)



35% Energy Reduction

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Façade Redesign

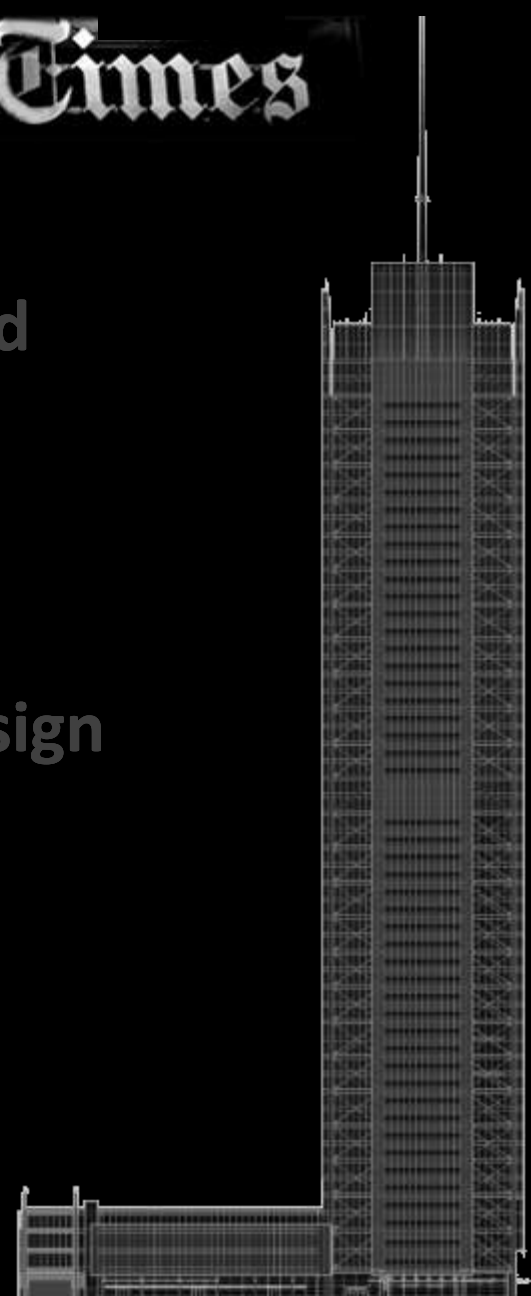
Floor System Redesign

Core Redesign

CoGen Redesign

BIM/IPD

Metrics of Success



Metrics of Success



Increased Profitability

- Operating Costs
- Leasable Space

Increased Marketability

- Sustainability
- Iconic Image



Intro

Building Background

Proposal

Façade Redesign

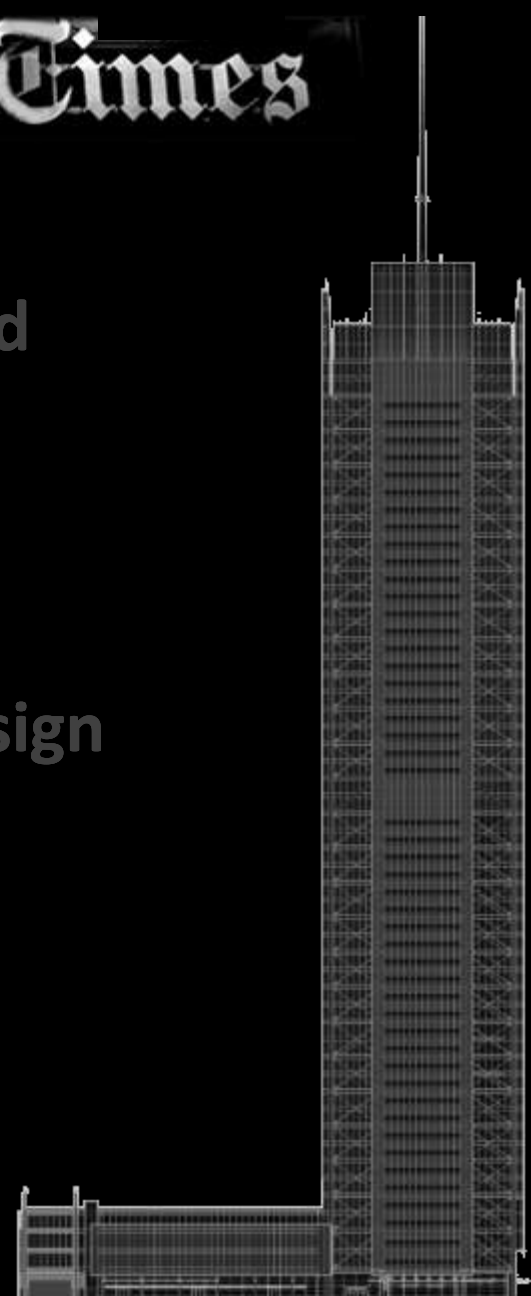
Floor System Redesign

Core Redesign

CoGen Redesign

BIM/IPD

Metrics of Success



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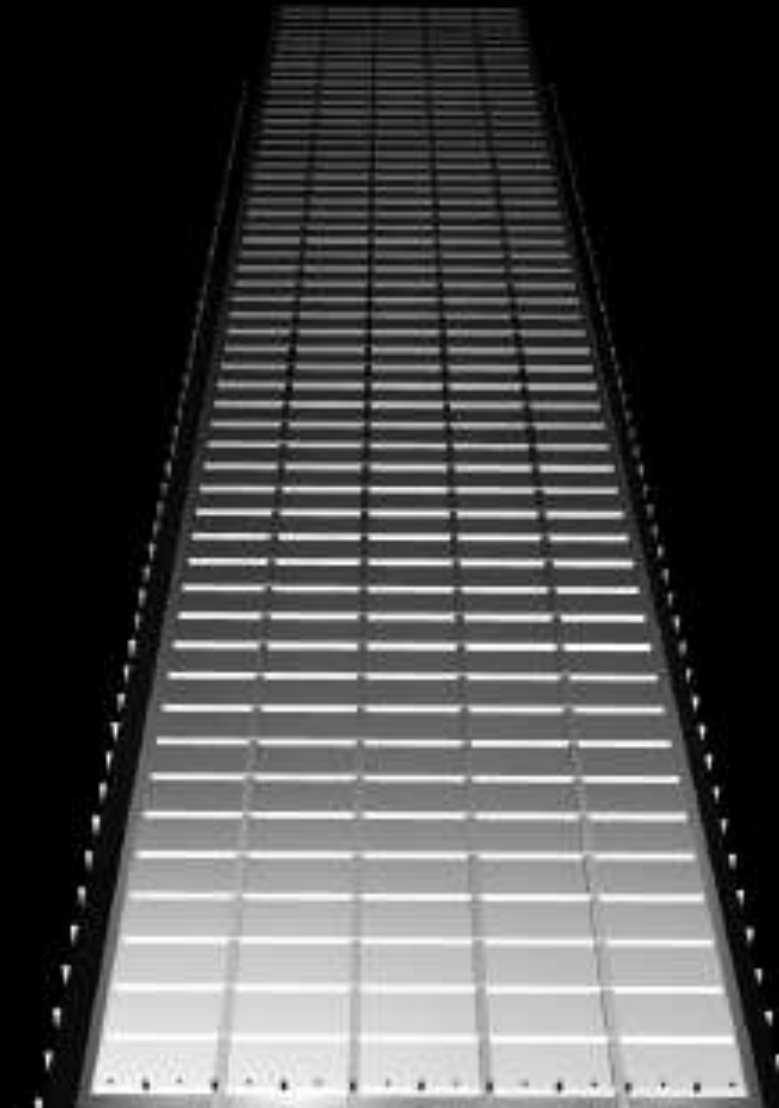
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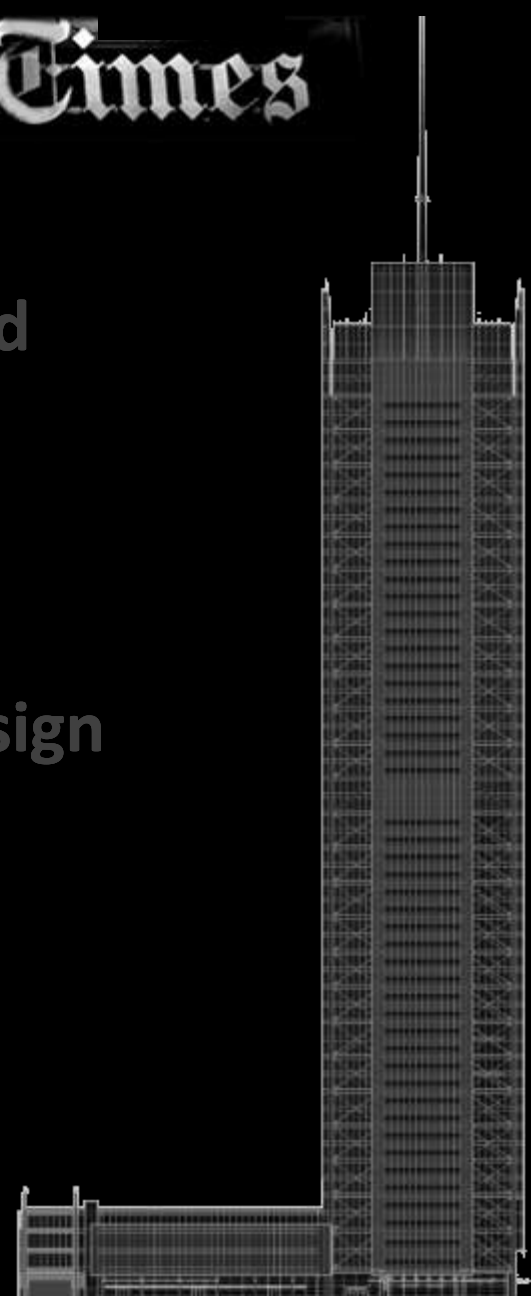
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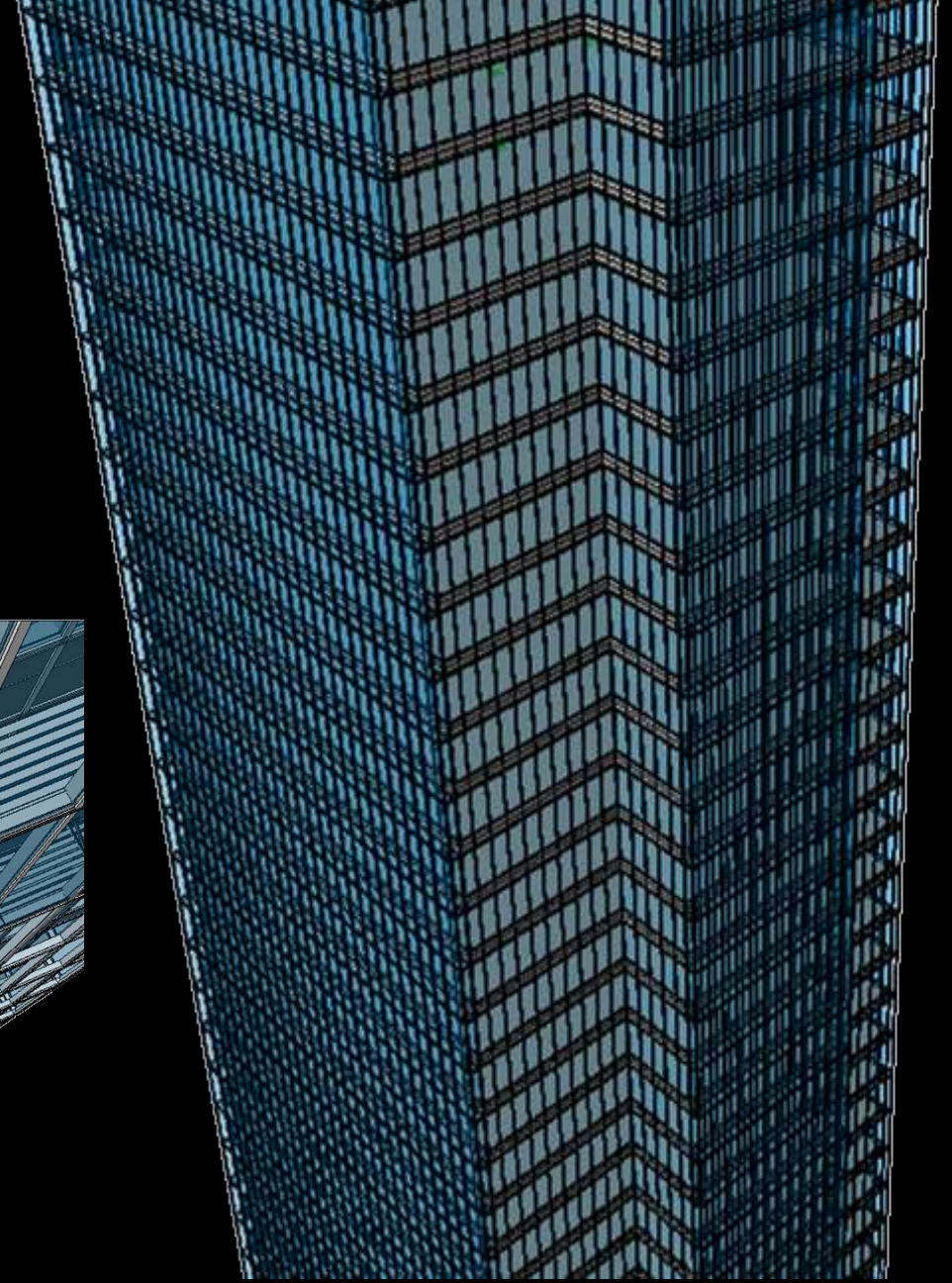
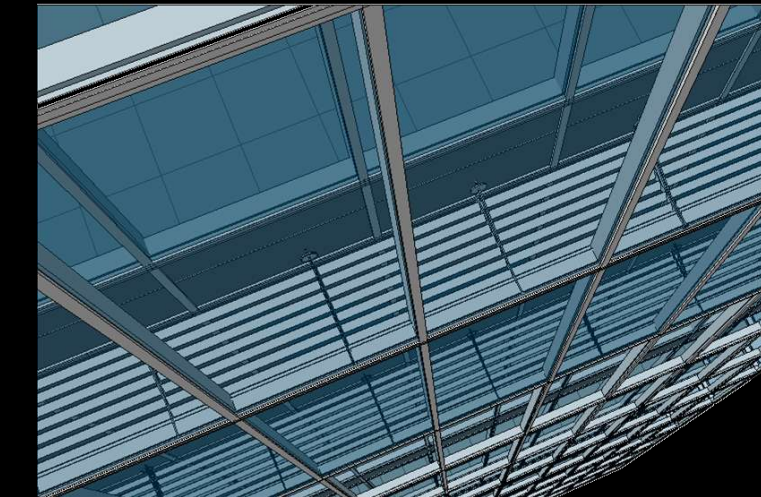
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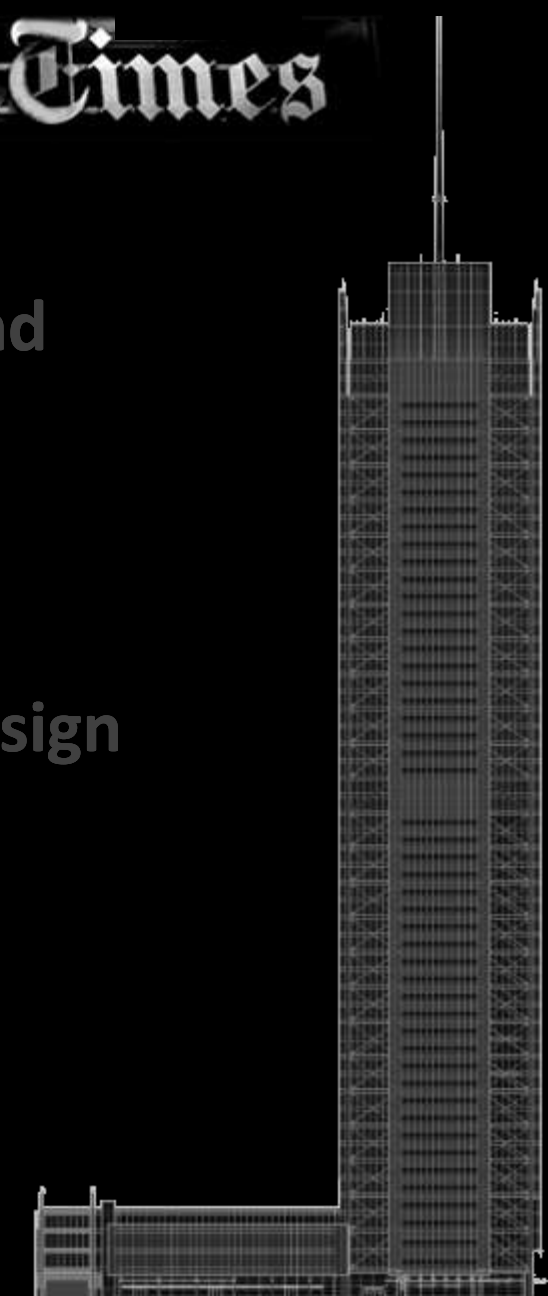
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Façade	
Upfront Cost	\$ 18.7 million
Annual Energy Savings	\$ 800,000
Payback Period	23.4 years

Floor System	
Upfront Cost	\$ 12.3 million
Annual Energy Savings	\$ 565,800
Annual Added Rent	\$ 1.24 million
Payback Period	6.72 years

Core	
Upfront Cost	(\$ 14.4 million)
Annual Added Rent	\$ 351,840
Payback Period	NA

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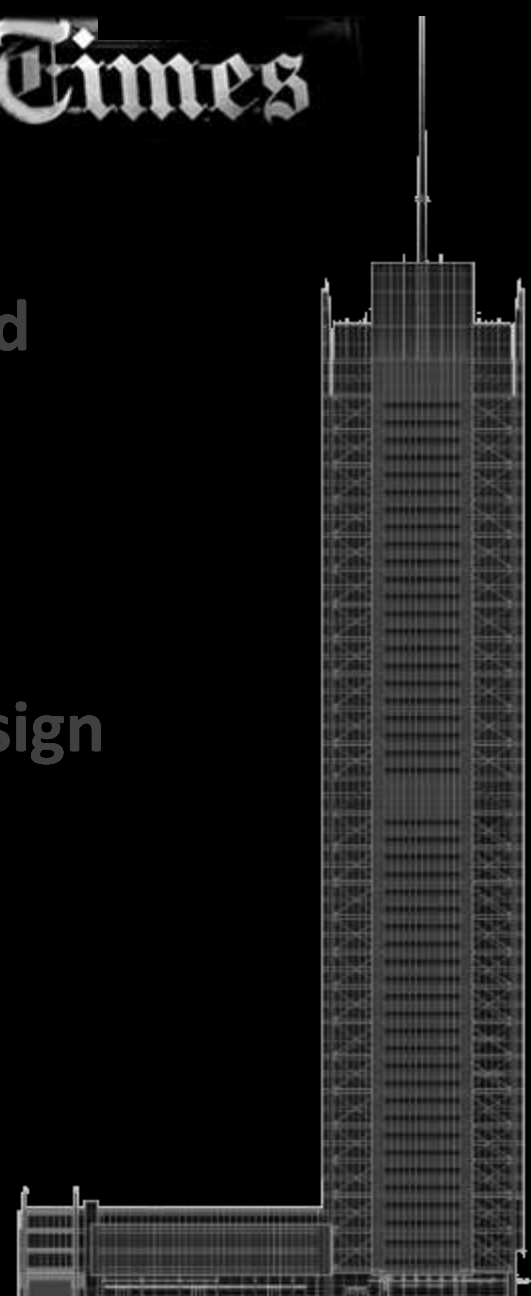
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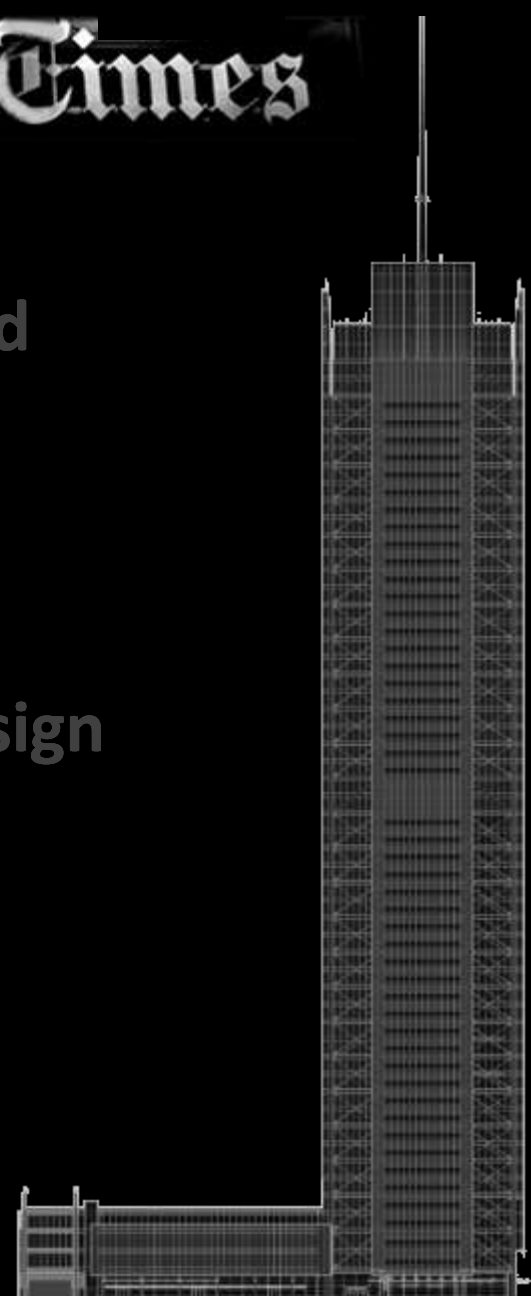
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Overall Building	
Upfront Cost	\$ 17 million
Annual Added Rent	\$ 1.6 million
Annual Energy Savings	\$ 2.2 million
Payback Period	4.5 years

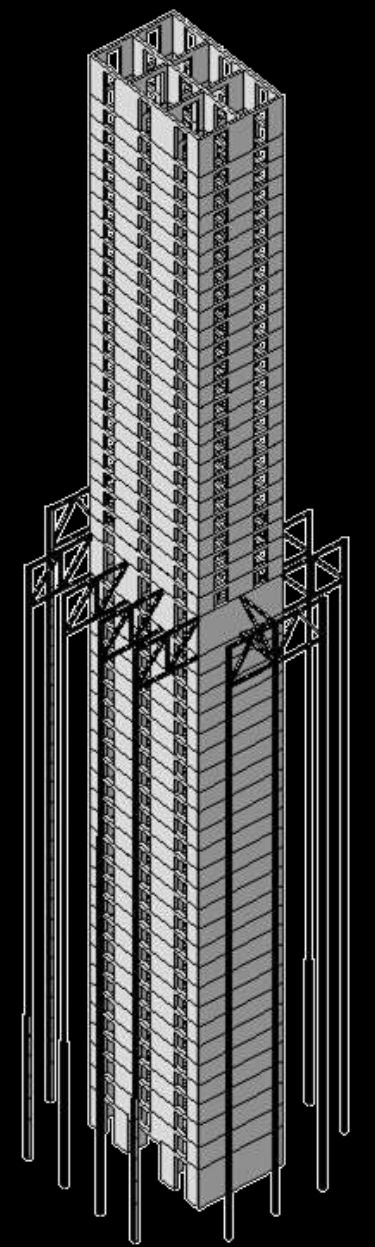
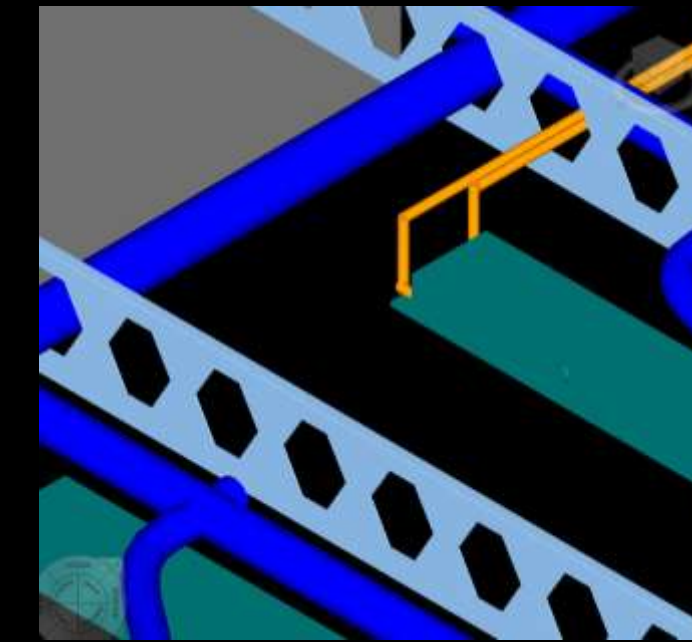
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Lessons Learned



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Questions/Comments
