The New York Times

Project Team

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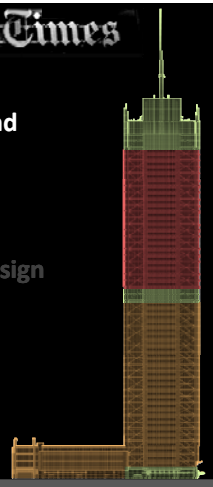
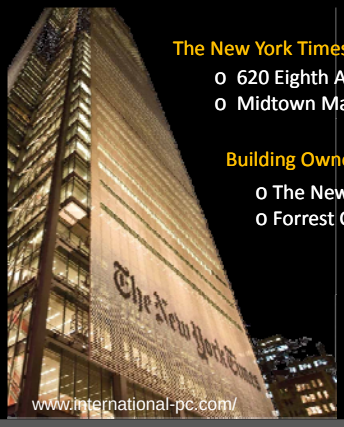
- **Building Background**
- Proposal

- Façade Redesign
- Floor System Redesign
- Core Redesign
- CoGen Redesign

- BIM/IPD
- Metrics of Success



Building Statistics



www.international-pc.com/

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

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

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

Building Function
- o Class A Office Building
- o Retail Space on Ground Floor

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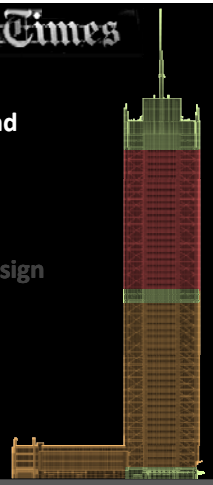

Building Background

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

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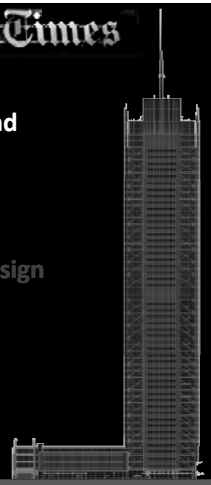

Project Team

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Architects	Renzo Piano Building Workshop FXFOWLE Architects
CM	AMEC Construction Mgmt. (Core & Shell) Turner Construction (NYT Interiors)
Structural	Thornton Tomasetti
MEP	Flack and Kurtz

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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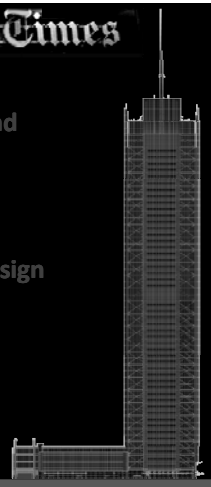

Redesign Goals

Increased Profitability
- Operating Costs
- Leasable Space

Increased Marketability
- Sustainability
- Iconic Image

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

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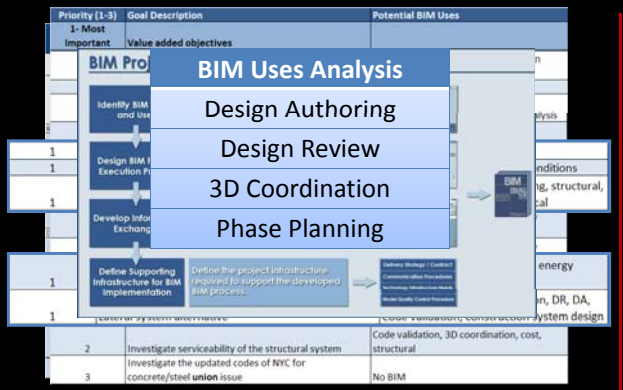
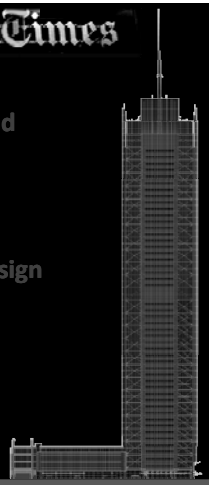
IPD / BIM Goals

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





Façade Redesign

Façade Goals:

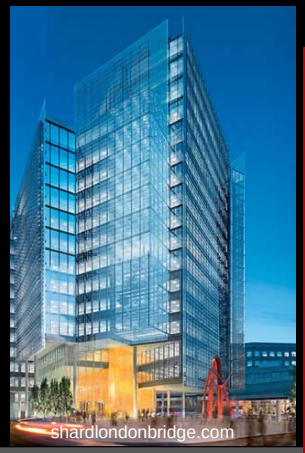
- Increase Thermal Efficiency
- Maintain or Exceed Daylighting Performance
- Maintain Iconic Image
  - Transparency
  - Lightness
  - Innovative Design

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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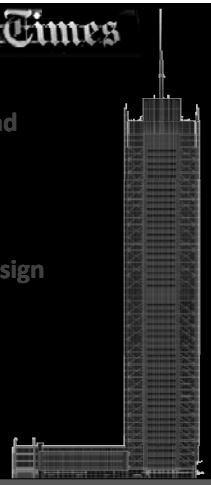


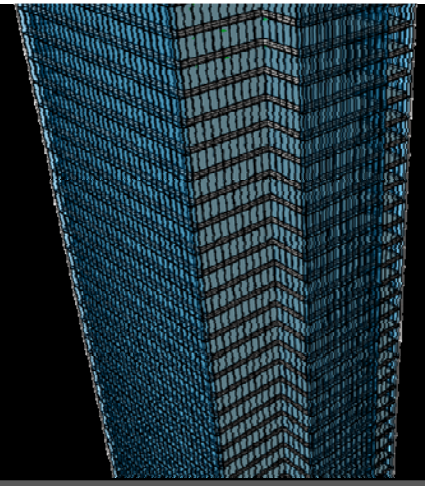
System Description

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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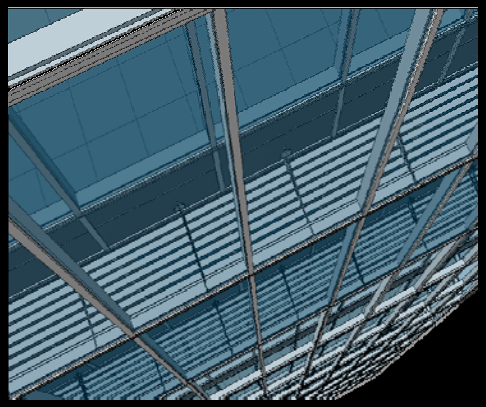

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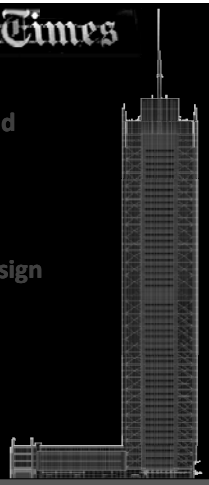
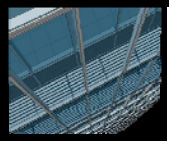
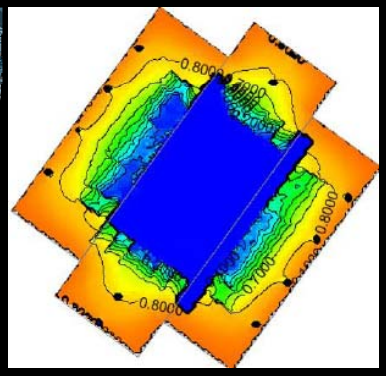


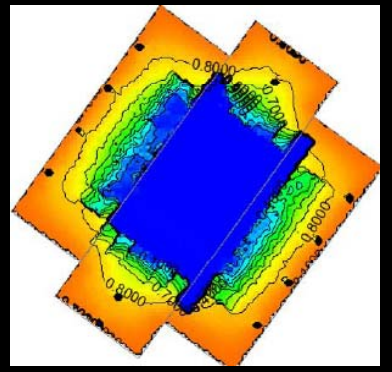
Façade Daylight Analysis

Daylight Autonomy: Double-Skin with Louvers





Daylight Autonomy: Ceramic Rods



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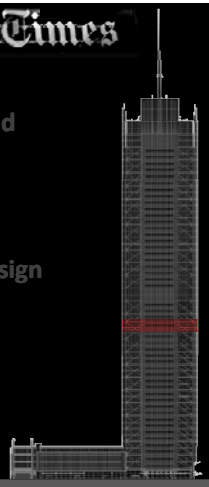

Façade Daylight Analysis

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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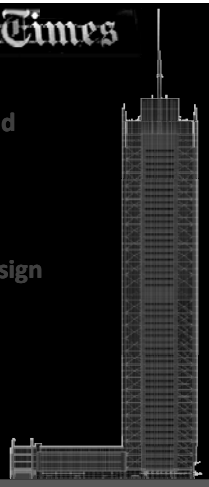

Thermal Loads

Existing HVAC Envelope Loads:

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

Double-Skin Façade Thermal Efficiency:

- o Decreased U-value
- o Decreased Shading Coefficient

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

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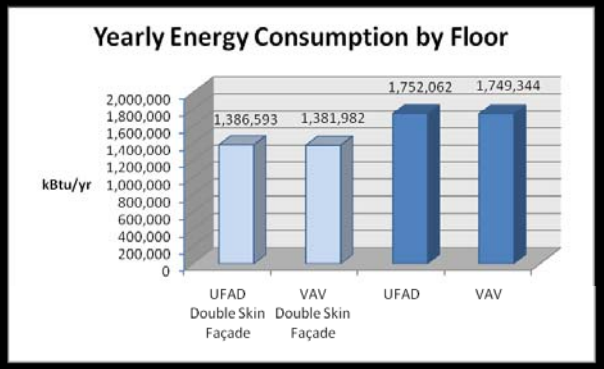
Savings:

- o Energy (21%)



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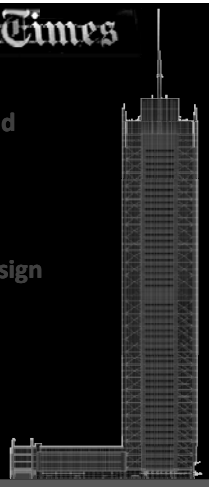

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Savings:
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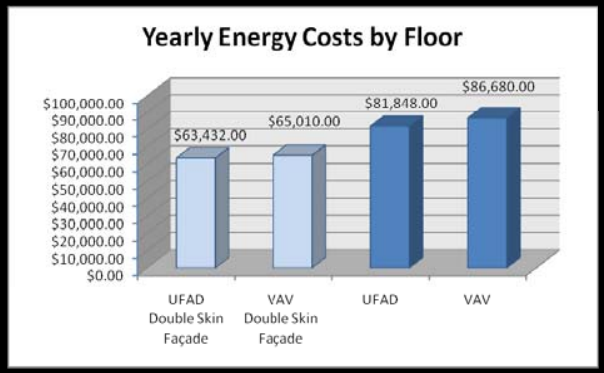
- o Cost ($800,000 / year)



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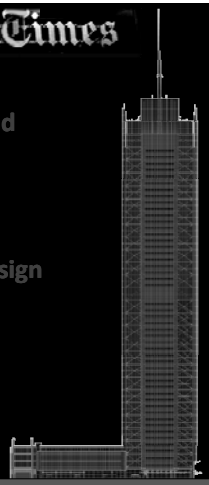

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Double-Skin Façade Thermal Efficiency:
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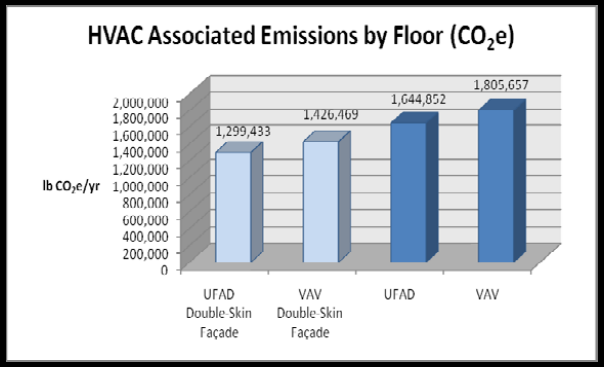
Savings:
- o Energy (21%)
- o Cost ($800,000 / year)
- o Emissions (23%)



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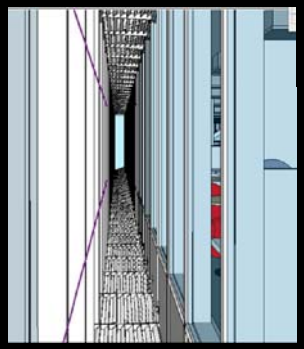
Serviceability and Maintenance



2’ 6” accessible cavity

Louvers support walking loads

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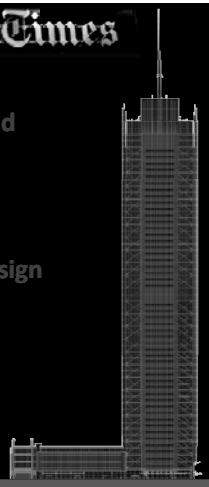

Cost Comparison:

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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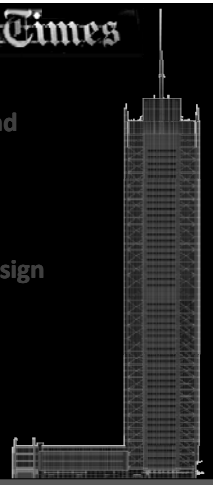
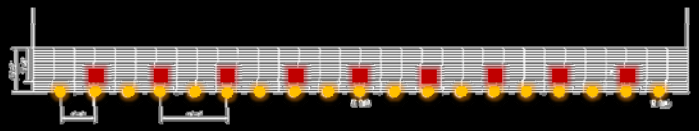
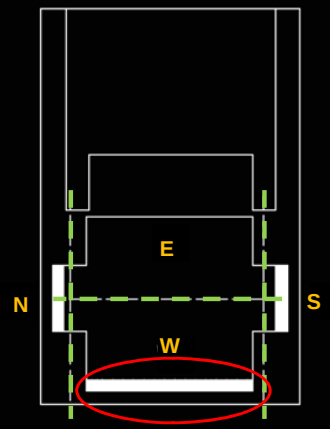


Façade Lighting Redesign



400W Floodlight

250W Floodlight



BIM TEAM 3: MATT HEDRICK | KYLE HORST | CASEY LEMAN | ANDRES PEREZ

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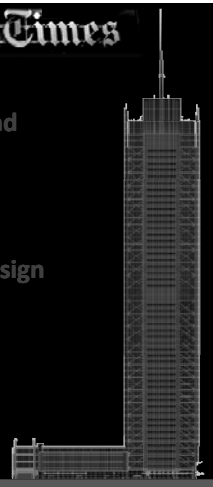

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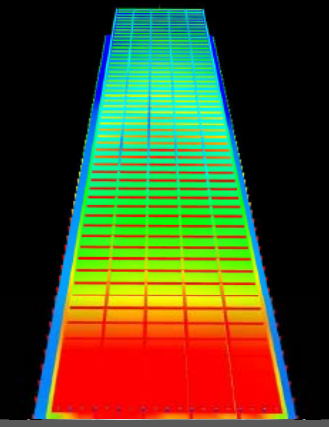

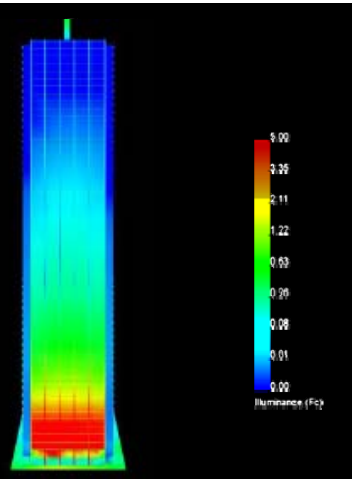

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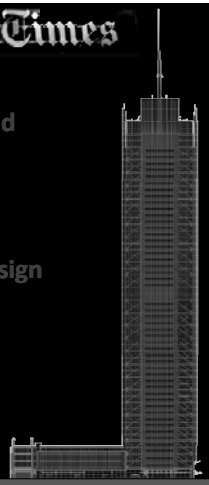

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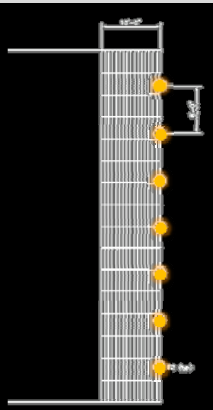

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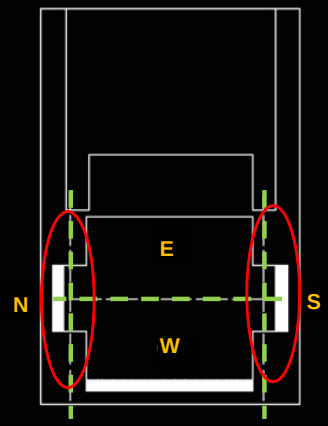

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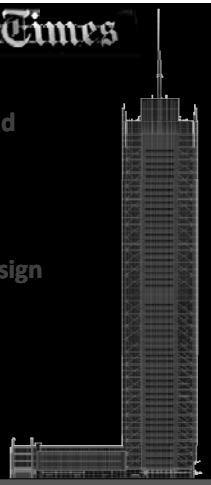

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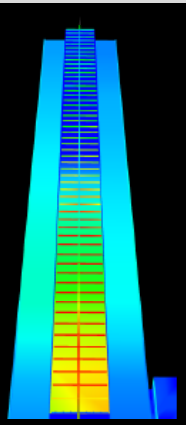

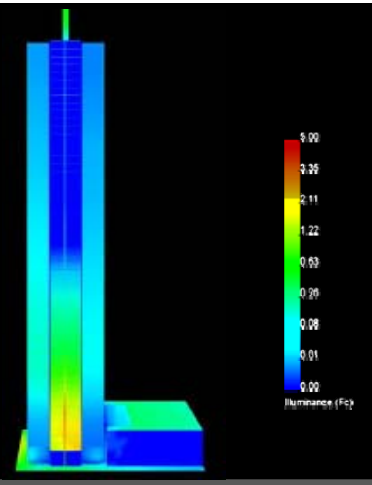

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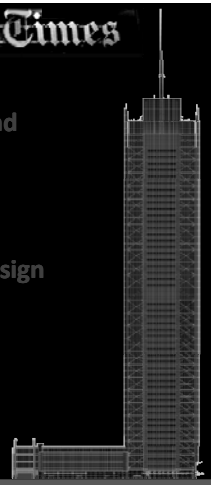

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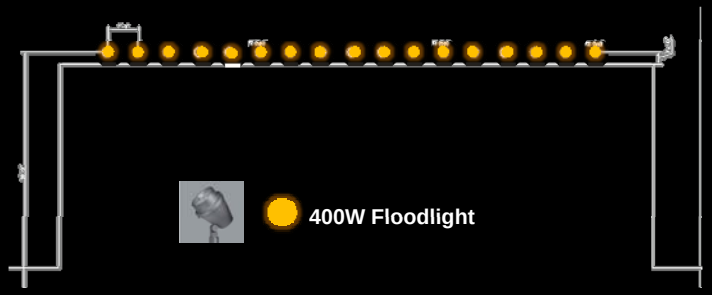

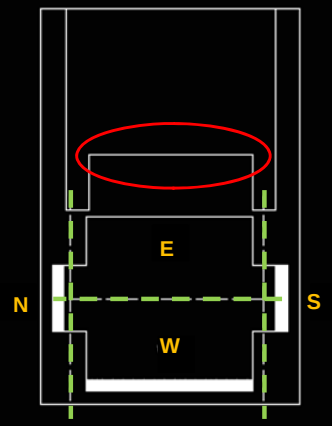

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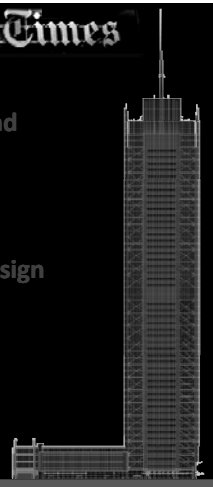

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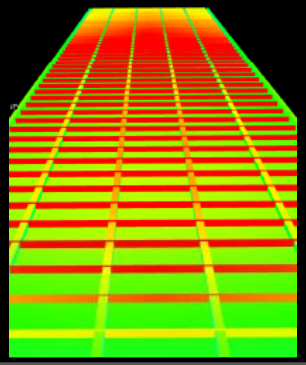

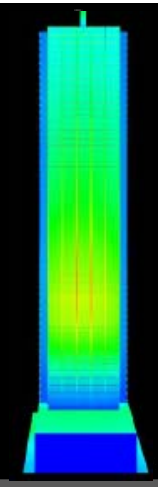

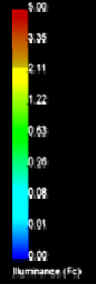

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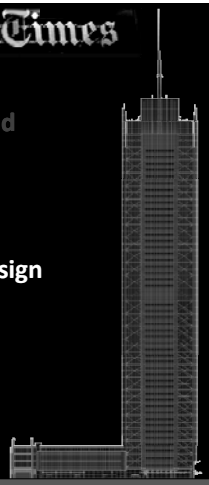


Floor System Redesign

Goals:

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

Redesign Opportunities:

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

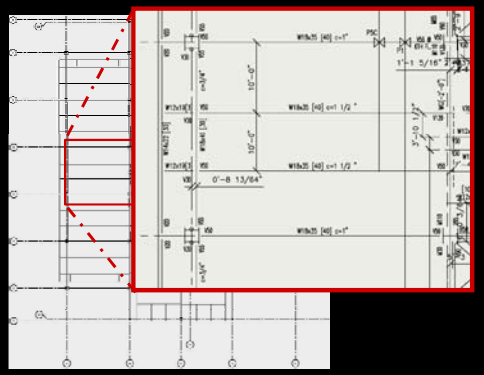
The New York Times

Structural Analysis

Initial Study
- o Investigate the required depth for interstitial space

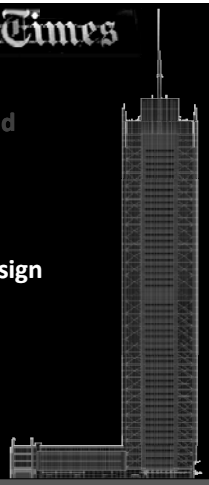
Assumptions:
- o Loading conditions were the same as in the existing building
- o UFAD System would be removed

Result:
- o 28” Deep Castellated Beam Required



Existing 30’-0” x 40’-0” Perimeter Bay

The New York Times



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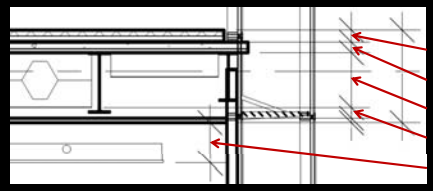

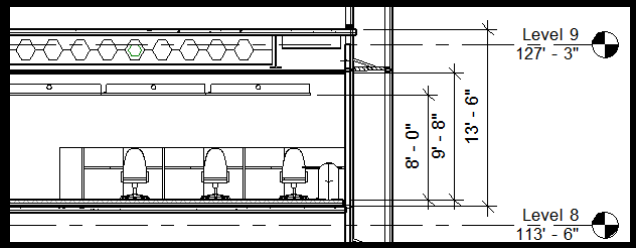

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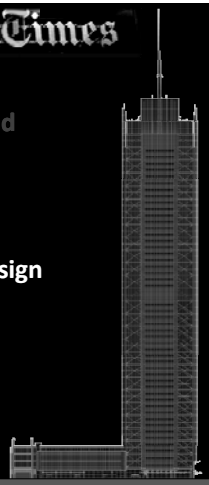
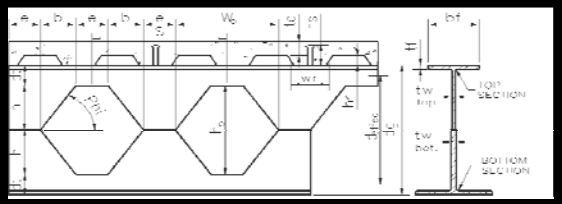
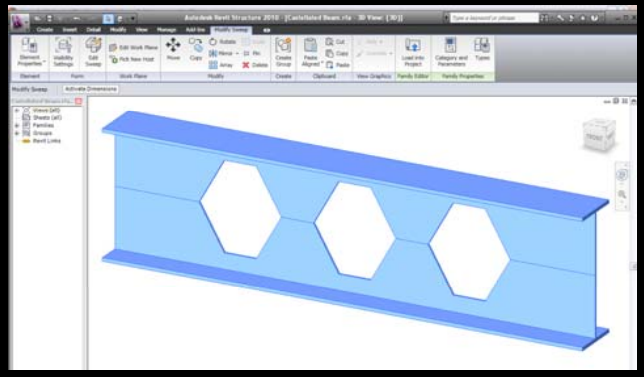


Structural Floor System Redesign

Composite Castellated Beams

Allow for Coordination within Interstitial space





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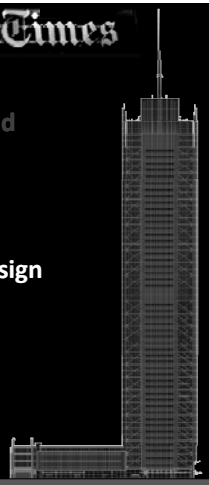


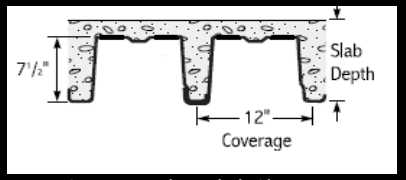
Structural Floor System Redesign

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)

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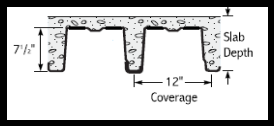
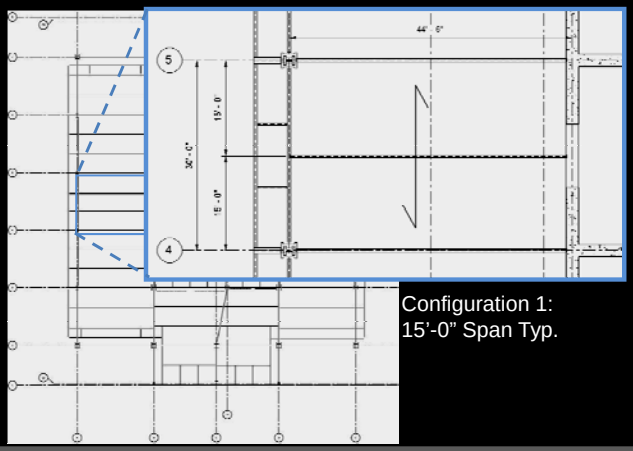
Structural Floor System Redesign

Configuration 1:
- o Maximize Span
- o Minimize Number of Members



(Shoring Required)



Configuration 1:
15'-0" Span Typ.

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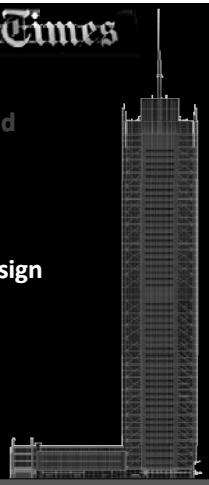
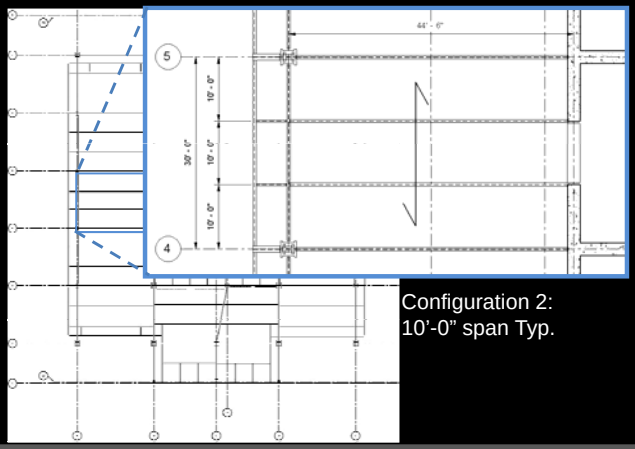


Structural Floor System Redesign

Configuration 2:

- Minimize Shoring



Configuration 2:
10'-0" span Typ.

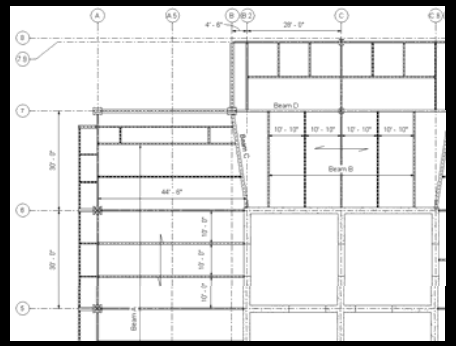
The New York Times

Structural Floor System Redesign

Total of 6 Main Option Investigated

Typical Gravity Loading
- o Superimposed Dead Load - 20 psf
- o Live Load – 50 psf (+ 20 psf partitions)

Member Depth
- o All Met 28" Depth Parameter



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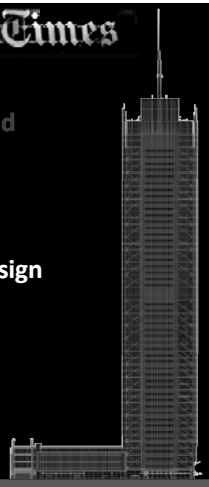
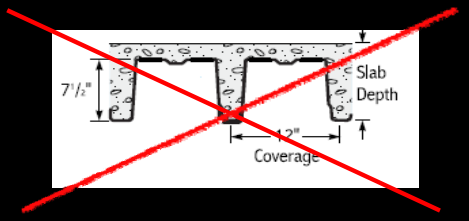


Structural Floor System Redesign

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

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Cost Comparison of Floor Configurations

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

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

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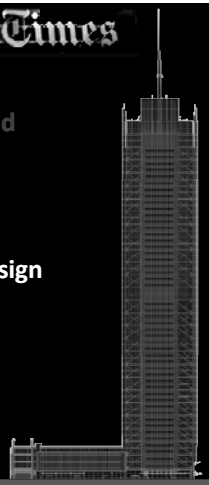


Structural Floor System Redesign

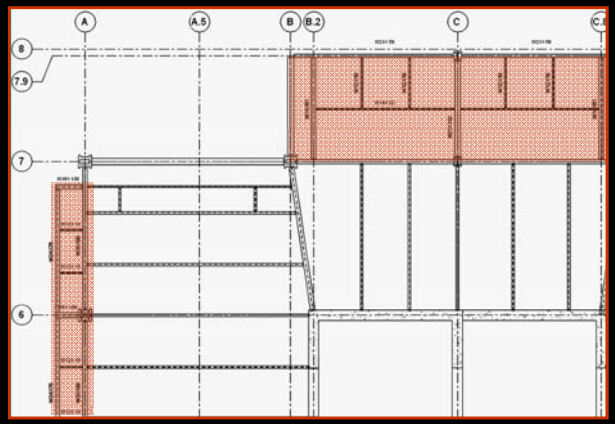
Member Check Cantilever & Overhang

- 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	122	94.8	ok	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	7.77	92.6	85.7	ok	OK	W12x19	92.6	85.7
Edge	W18x130	96.39	25.76	1090	387	ok	OK	W18x130	1090	387
Edge	W24x76	117.2	18.52	750	316	ok	OK	W24x76	750	316
Edge	W18x40	577	57.7	294	169	ng	NG	W30x99*	1170	403

*Redirected to eliminate the capping of cantilevered members.



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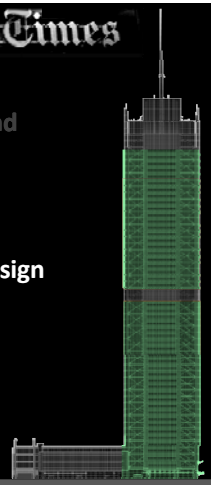

HVAC Redesign

Multiservice Chilled Beams:
- o Integrated design

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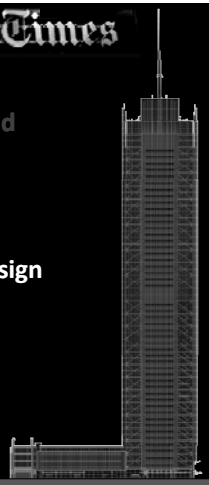
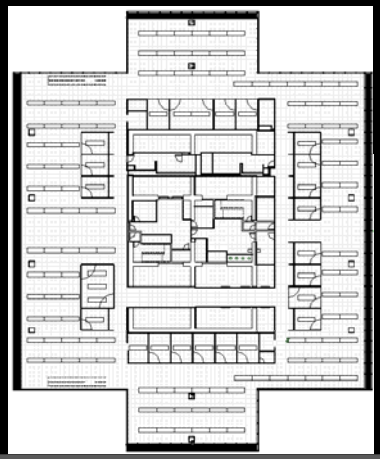


HVAC Redesign

Multiservice Chilled Beams:
- o Integrated design

Typical Layout:
- o 155 beams per floor



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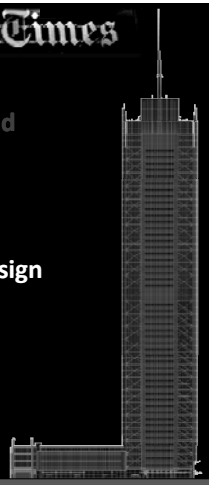

HVAC Redesign

Multiservice Chilled Beams:
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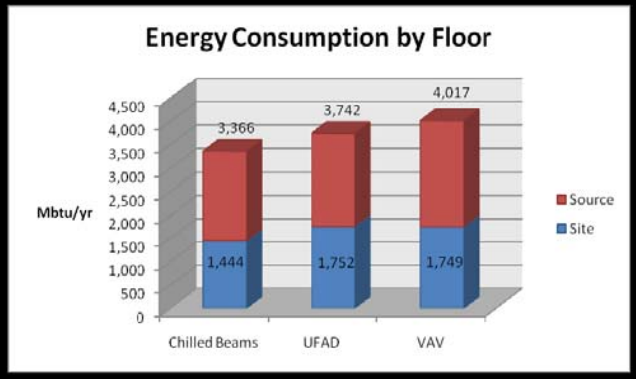
Typical Layout:
- o 155 beams per floor

Savings:
- o Energy (10-16%)



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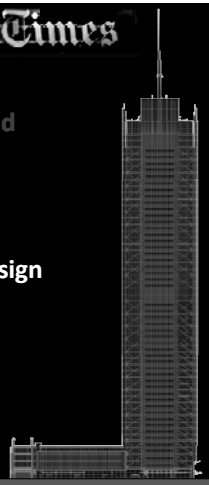

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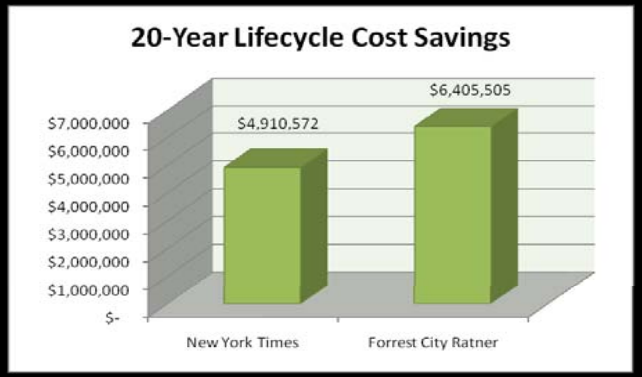
- o Energy (10-16%)
- o Cost ($47,000 / month)



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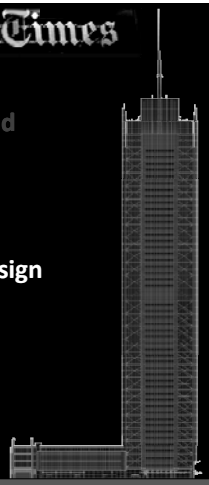

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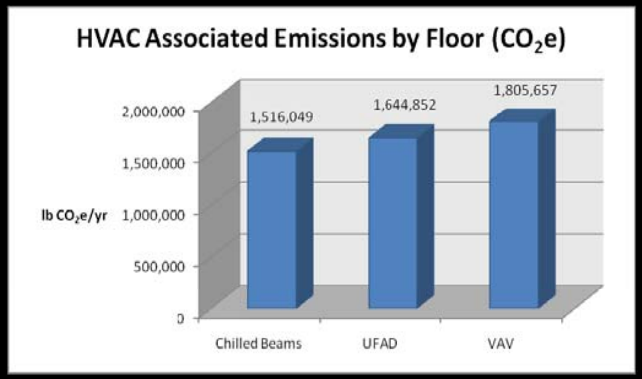
- o Cost ($47,000 / month)
- o Emissions (8-16%)



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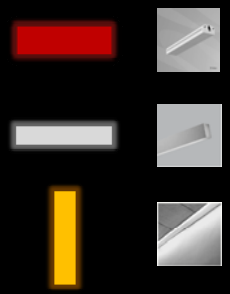
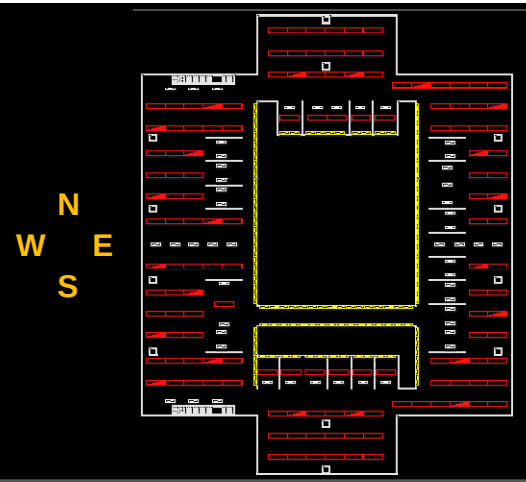
Office Lighting Redesign



Integrated 35W T5 Direct Pendant

4’ T5HO Direct/Indirect Pendant

4’ Recessed Cove



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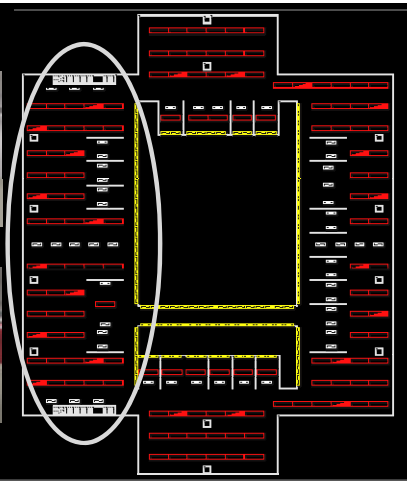
Office Lighting Redesign



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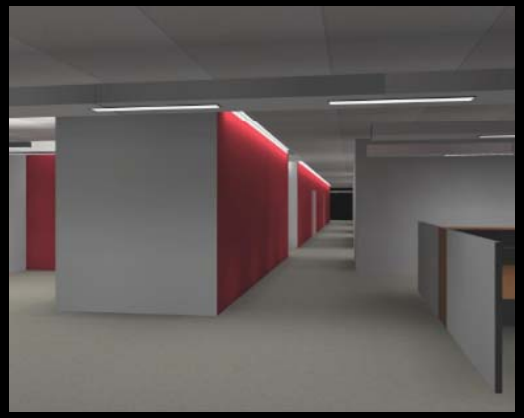

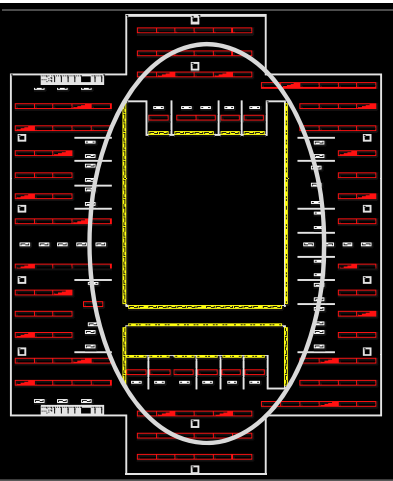

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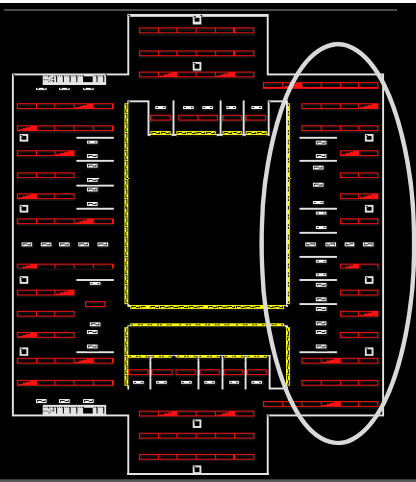
Office Lighting Redesign



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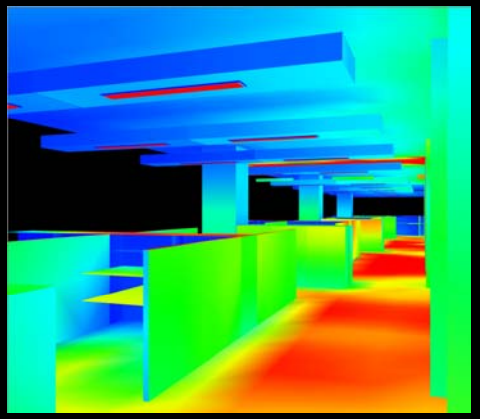

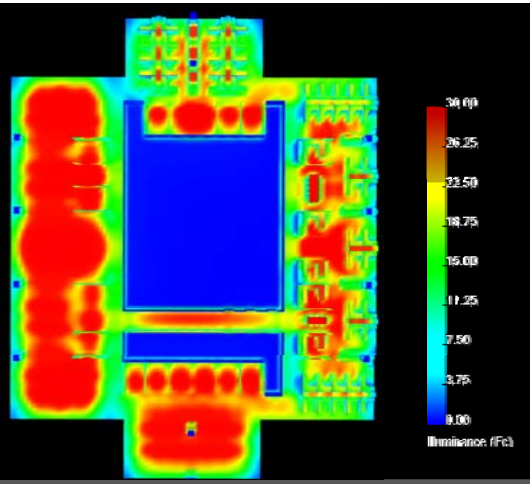

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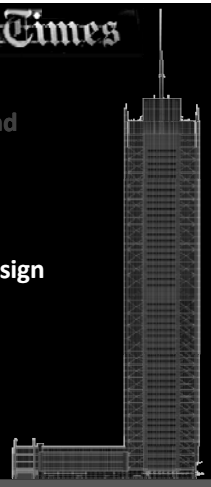

Cost of Proposed Floor System

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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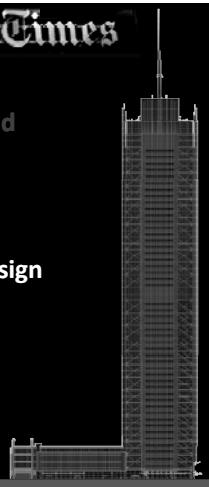

Cost of Proposed Floor System

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

Additional Rent Annually	21,000 SF	$ 60 / SF Year	$ 1.26 million Year

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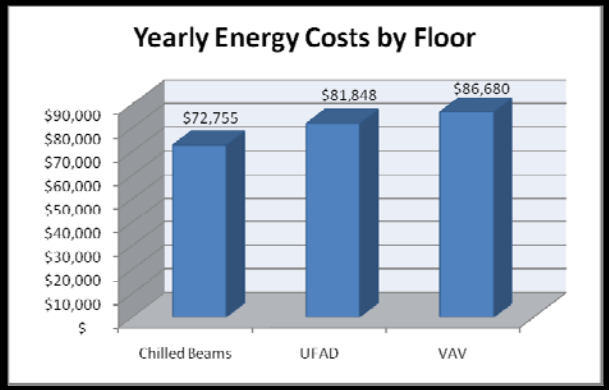
Cost of Proposed Floor System

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



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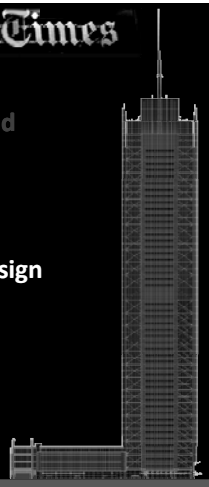

Cost of Proposed Floor System

- 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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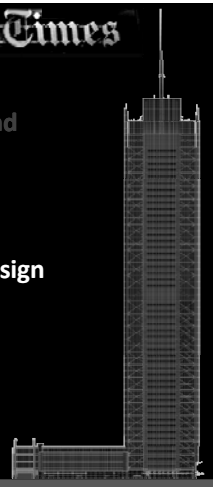
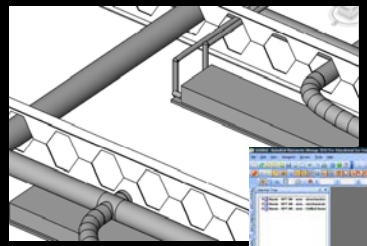
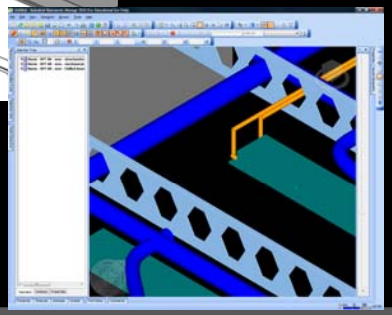


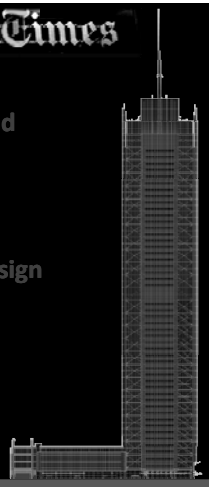
Integrated Design

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





The New York Times



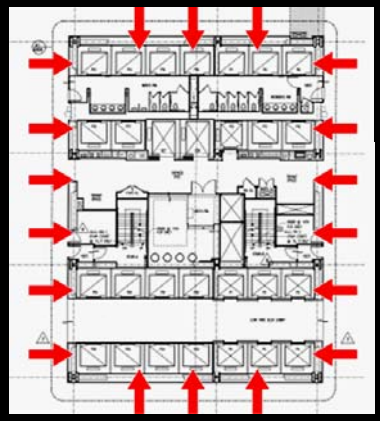
Core Redesign

Goals:

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

Redesign Opportunities:

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



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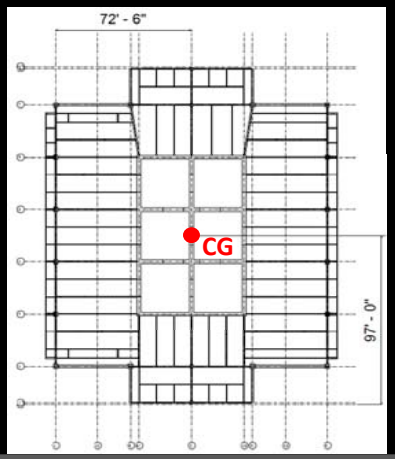
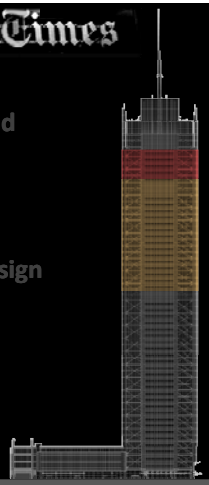
Core Configuration

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



The New York Times

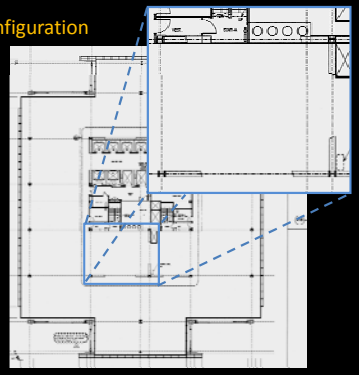


Core Configuration

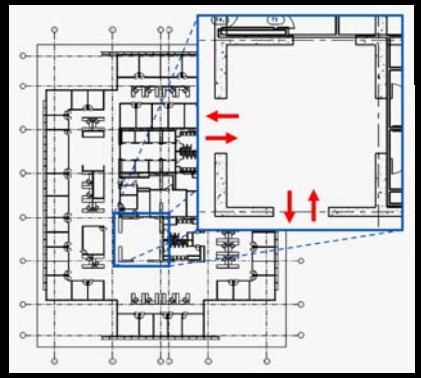
Maintain flexibility of space

Example: Floors 46 - 50

Existing Configuration



New Configuration



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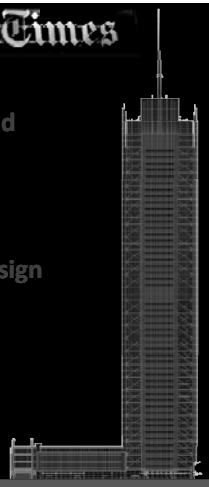
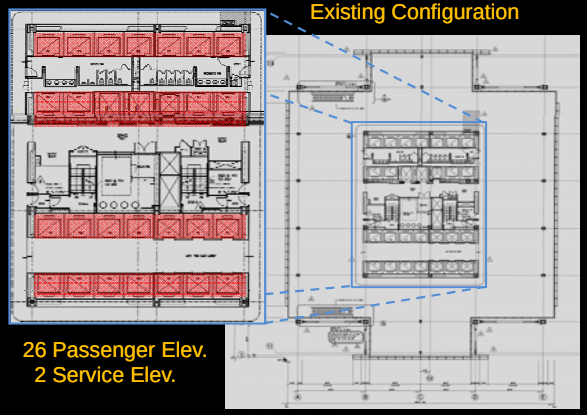
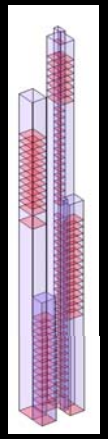


Elevator Configuration

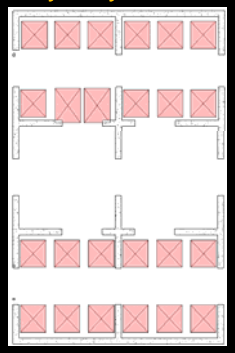
Existing Configuration



26 Passenger Elev.
2 Service Elev.



Feasibility Study: Elevator Reduction



22 Passenger Elev.
2 Service Elev.

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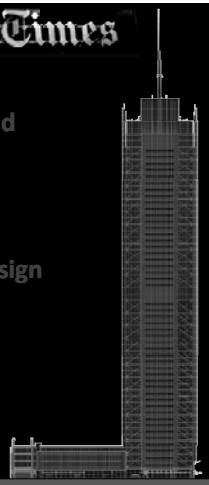
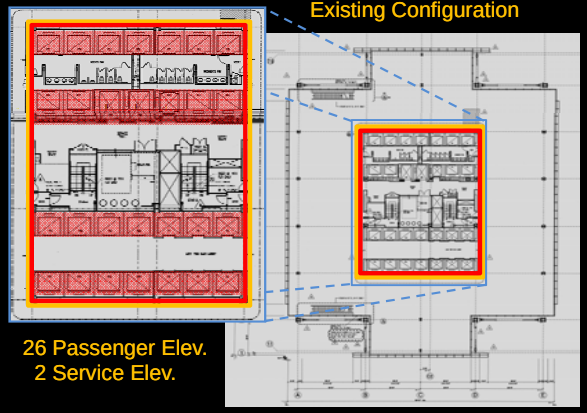


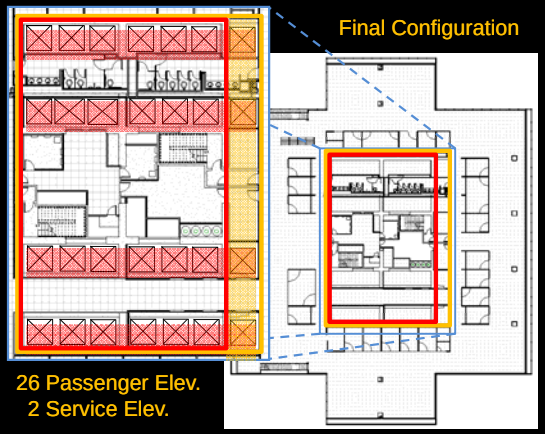
Core Configuration

Existing Configuration



26 Passenger Elev.
2 Service Elev.

Final Configuration



26 Passenger Elev.
2 Service Elev.

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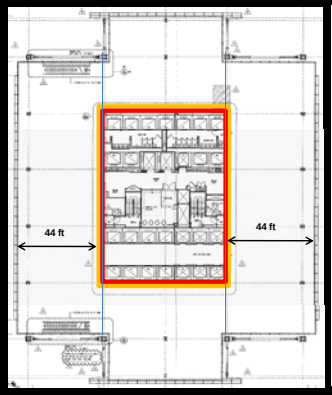
Architectural Configuration

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

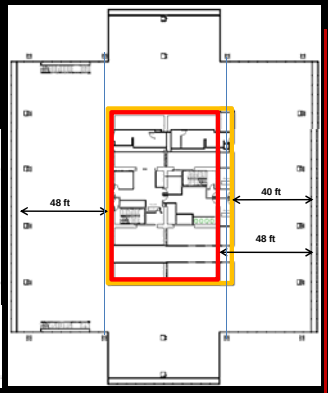
30	FCRC	21,244	21,456	212
29	FCRC	20,429	20,959	530
		472,371SF	478,235 SF	5,864 SF

Additional Rent Annually	5864 SF	$60 / SF Year	$ 351,840 Year

Existing Core Configuration



New Core Configuration



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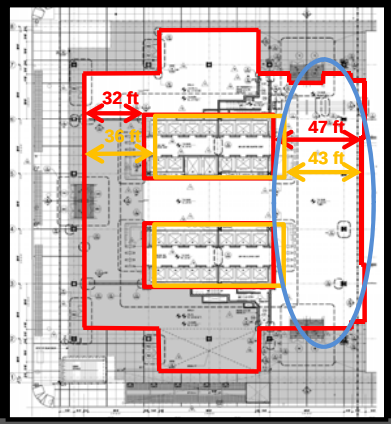
Core Configuration



Existing Lobby

New Lobby Rendering

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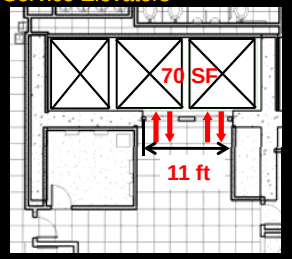
Service Space Configuration

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



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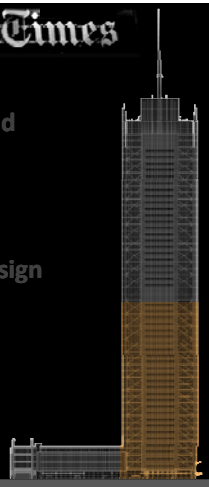


Service Space Configuration

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

Bu illio

Co illion

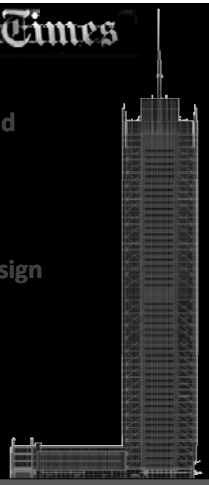
Space Com

Mi ween

Benefit of

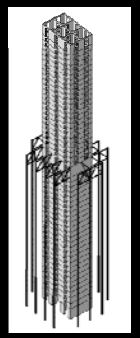
Possibility of Expansion Without Adding Additional Feeders

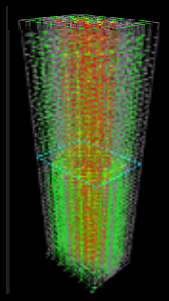
The New York Times



Lateral Force Resisting System

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





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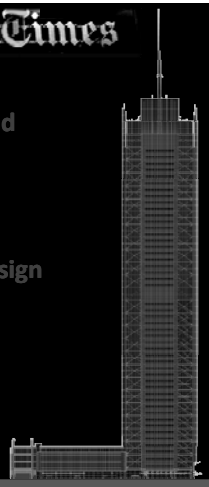


Lateral Force Resisting System

Initial Design Parameters

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

Assumed Serviceability Governed Design

SRSS – Period of Vibration

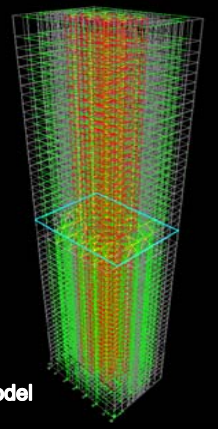
- 10% of 10.8s (Existing Design)

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



ETABS Analytical Model

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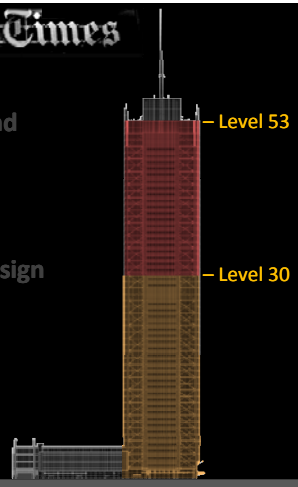
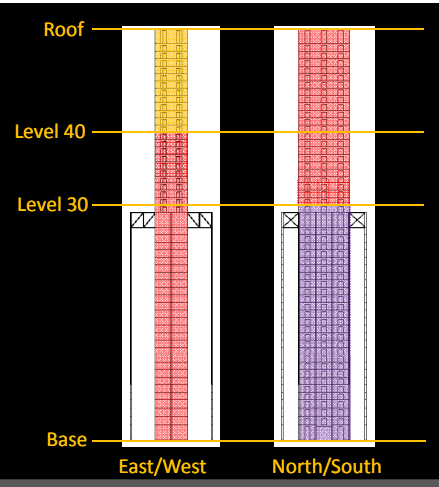


Lateral Force Resisting System

Concrete Compressive Strength
- – 8 ksi
- – 10 ksi

Shear Wall Thickness
- – 20”
- – 24”
- – 30”

Coupling Beams
- o 36” Depth
- o Width Dependent upon Support



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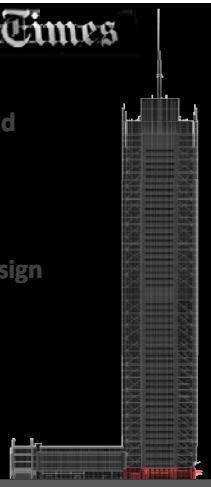
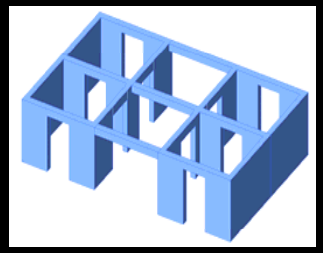


Lateral Force Resisting System

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



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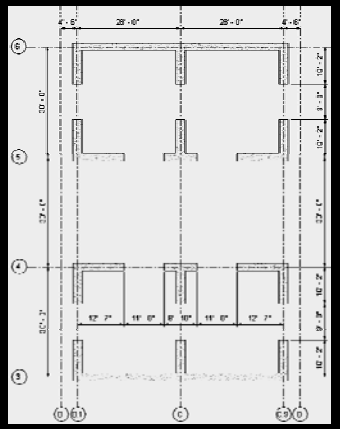

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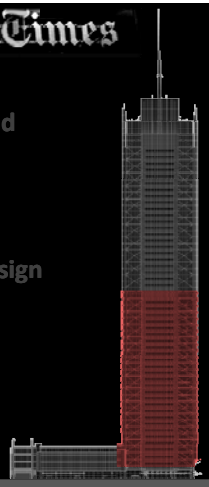
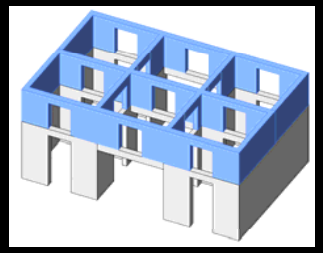


Lateral Force Resisting System

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



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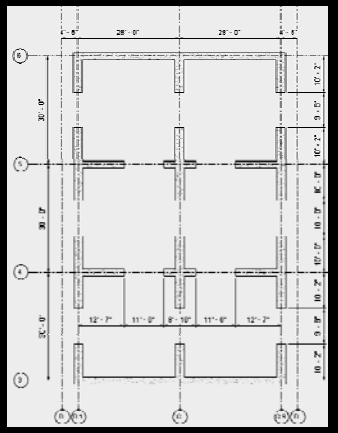

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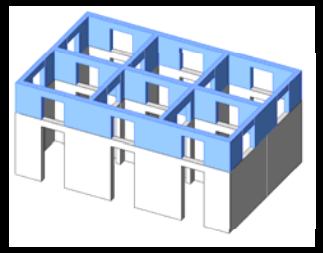
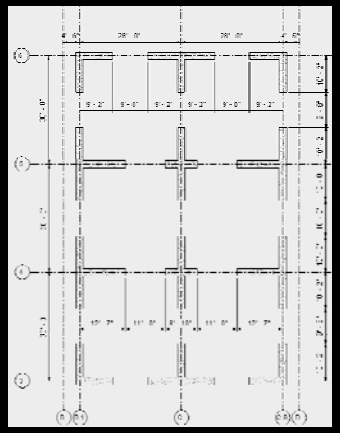
Lateral Force Resisting System

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



N W E S



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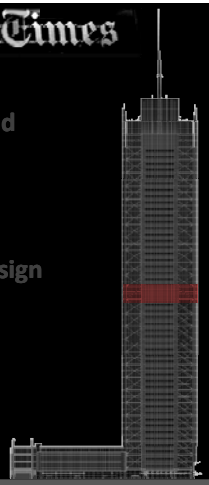
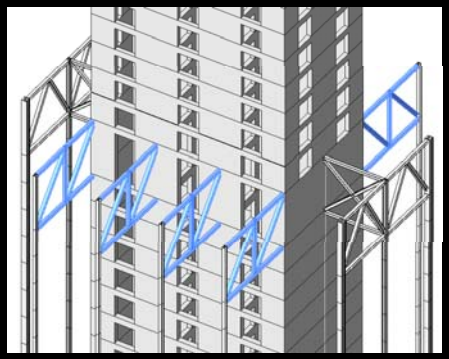
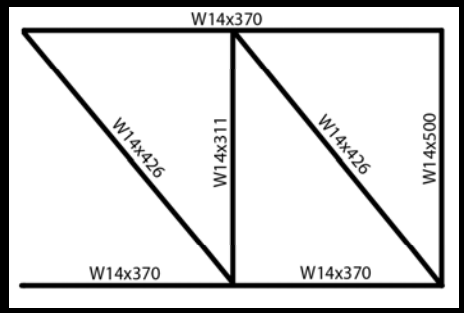


Lateral Force Resisting System

Outrigger Design: 28th Mechanical Floor





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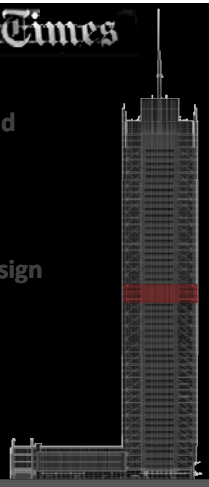
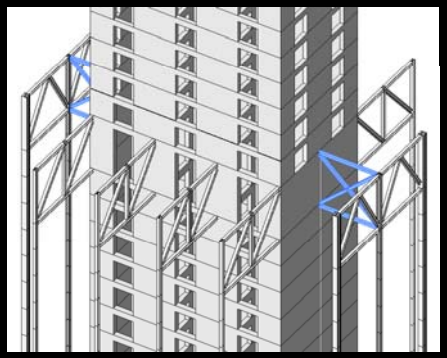
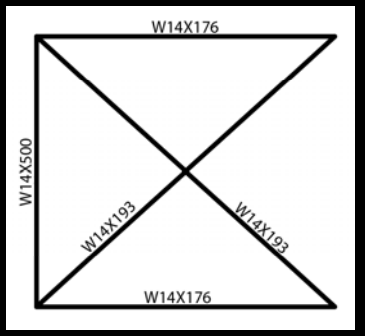


Lateral Force Resisting System

Outrigger Design: 28th Mechanical Floor





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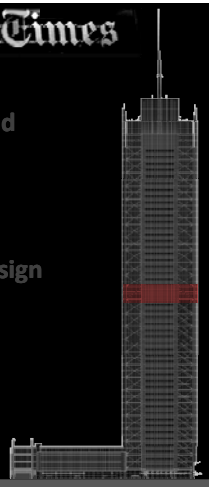
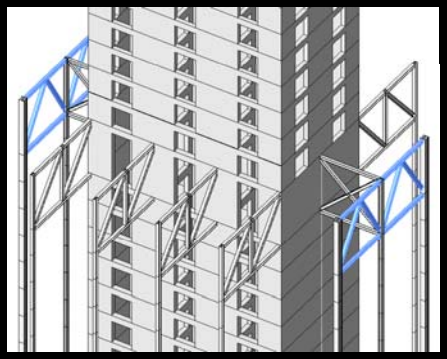
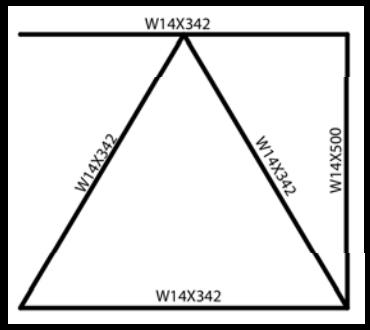


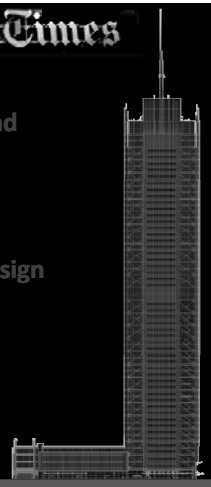
Lateral Force Resisting System

Outrigger Design: 28th Mechanical Floor





The New York Times



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 – $0.015h_{sx}$ ✓

Lateral Displacement Due to 0.7 Wind			
Direction	Displ. (in)	H/450 (in)	Compliance?
N/S	10.9	19.88	ok
E/W	7.1	19.88	ok

Story Drift Check								
			Seismic			Wind		
Direction	Level	h_{sx} (ft)	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

The New York Times

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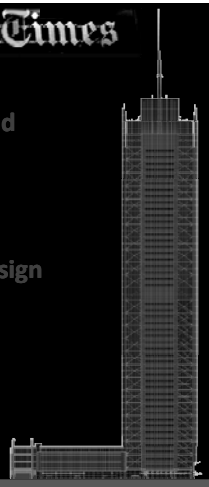
CoGen Redesign

BIM/IPD
Metrics of Success



Cost and Schedule Changes

Cost of concrete core vs. existing steel core

General conditions changes
- o Superstructure schedule
- o GC cost changes
- o 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

The New York Times

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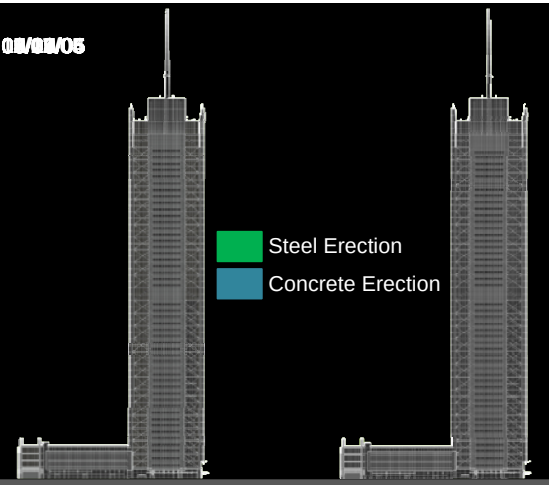

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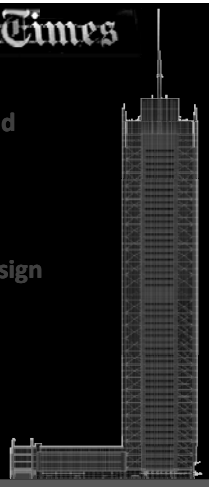

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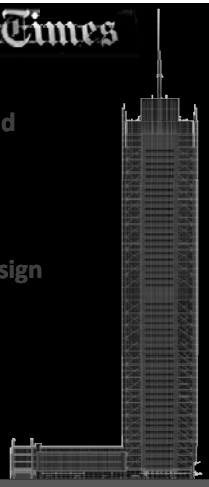

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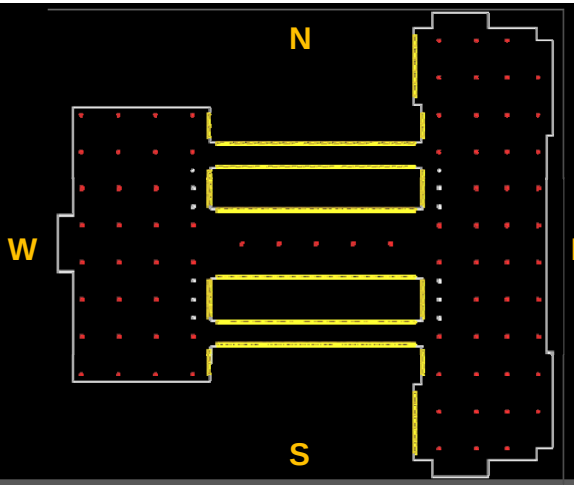
Lobby Lighting Redesign

9" Recessed Downlight

8" Recessed Directional Downlight

4' Recessed Cove



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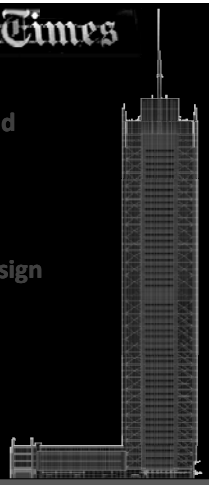
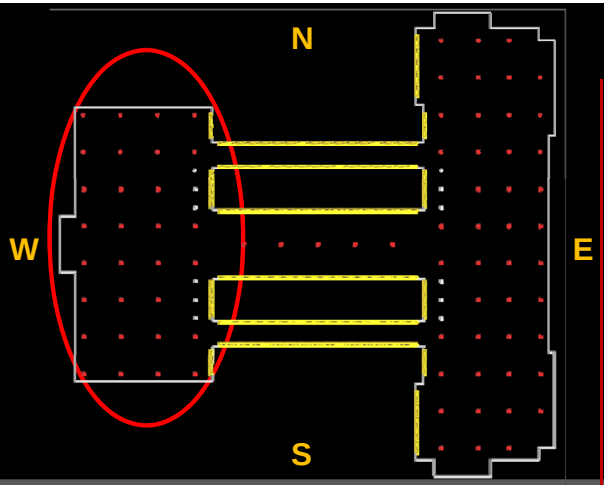


Lobby Lighting Redesign



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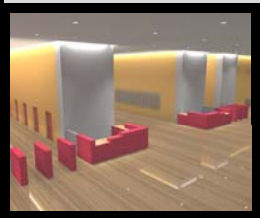

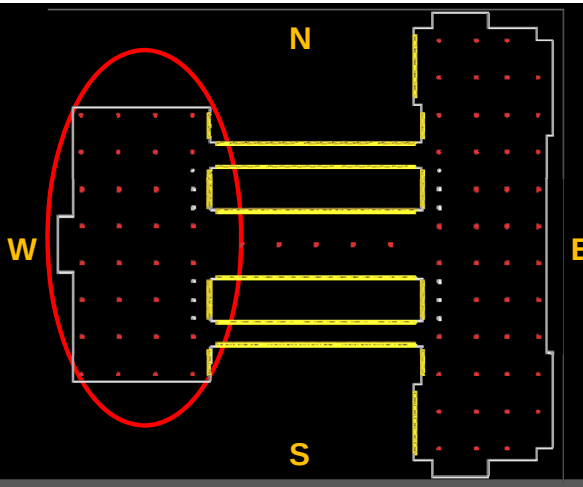

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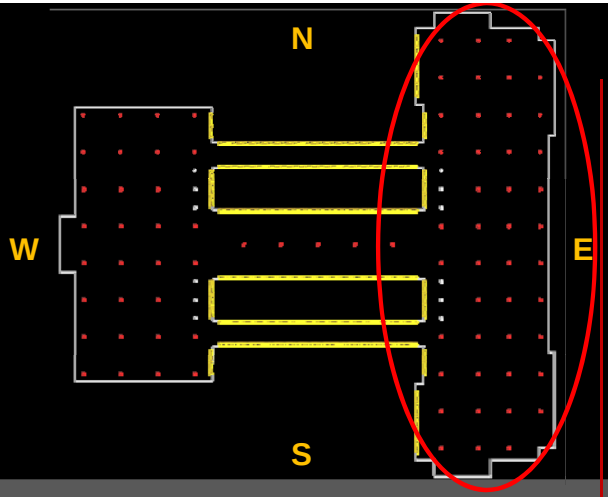

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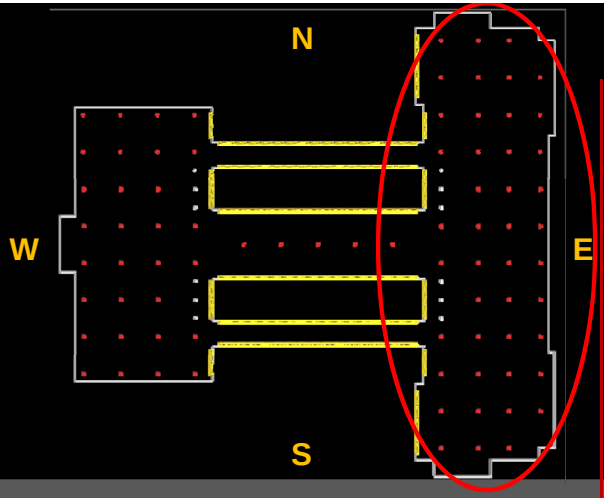
Lobby Lighting Redesign



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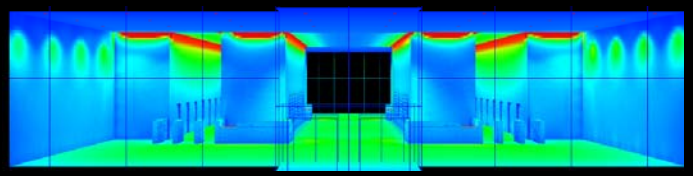
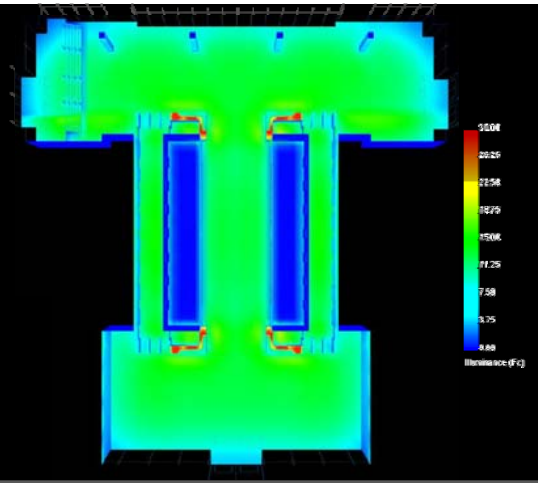




The New York Times

Existing System / Goals

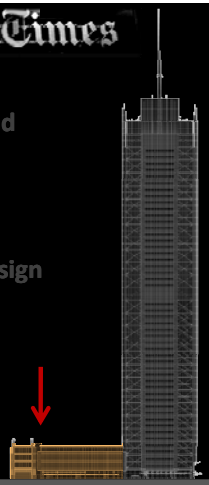
Existing System:

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

Redesign Goals:

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

The New York Times



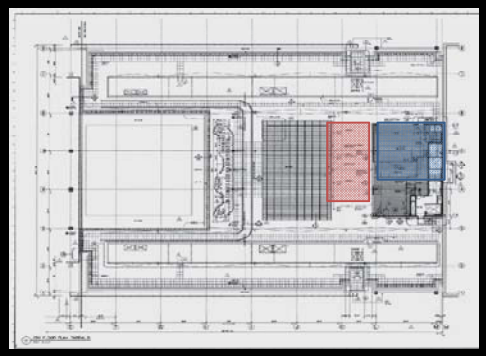
Redesign Considerations

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	Consolodated 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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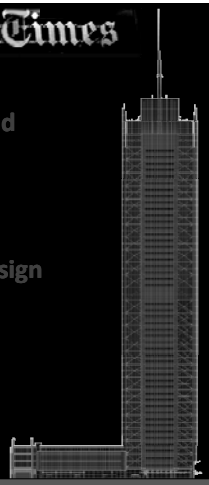
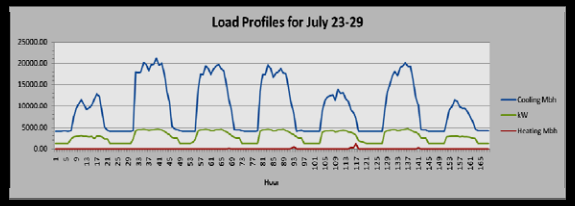
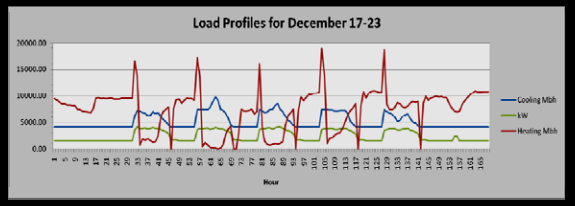


Redesign Consideration

Redesign Considerations:

- Building thermal and electrical loads





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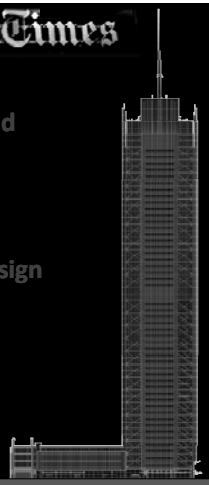


Redesign Alternatives

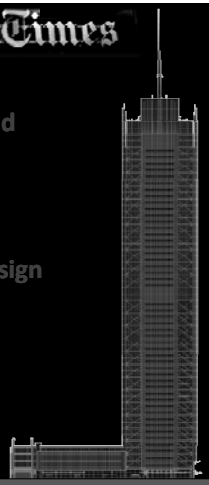
Prime Movers

CHP System	Existing	Alternative 1	Alternative 2	Alternative 3
Prime Movers				
Reciprocating 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	65,720	60,340

Gas Turbines

IC Engines

The New York Times



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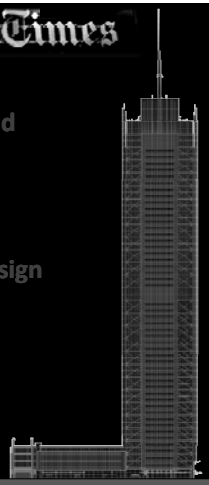
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Total Floor Area (ft^2)	1,600	4,800	2,970	2,735
Total Weight (lbs)	35,340	106,020	65,720	60,340

Existing System: 1,400 kW

IC Engines

The New York Times



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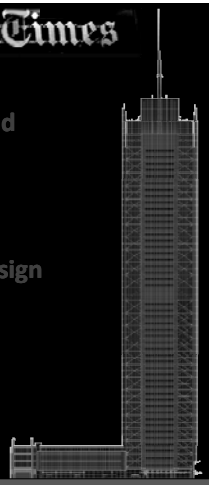
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Total Floor Area (ft^2)	1,600	4,800	2,970	2,735
Total Weight (lbs)	35,310	106,020	65,720	50,310

Alternative 1: 4,200 kW

IC Engines

The New York Times



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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

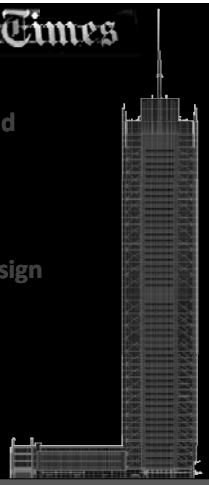
Alternative 2: 2,700 kW

IC Engines

+

1,300 kW IC Engine

The New York Times



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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)	35,910	106,020	65,720	50,340

Alternative 3: 2,700 kW

+

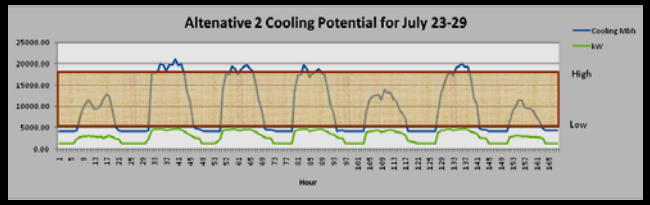
IC Engines

1,300 kW Gas Turbine

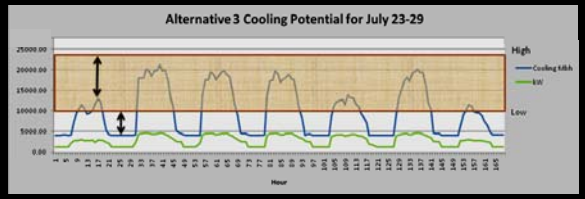
The New York Times

Redesign Alternatives

IC Engine: Cooling Load Potential



Gas Turbine: Excess Thermal



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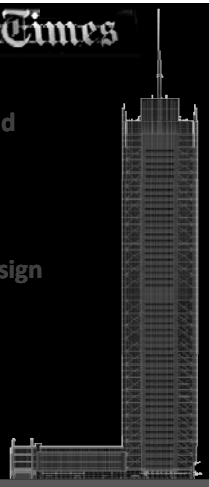
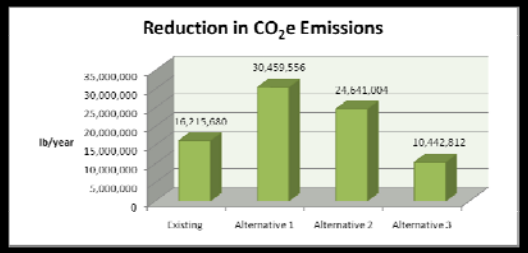


Redesign Alternatives

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 11,358,554
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_2e/year)	16,215,680	30,459,556	24,641,004	10,442,812



The New York Times

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	$0.005 $0.015
Maintenance Costs ($/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

The New York Times

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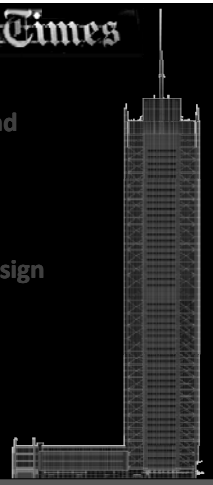

Redesign Alternatives

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	$0.005 $0.015
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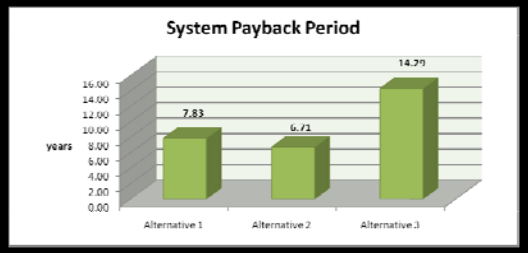

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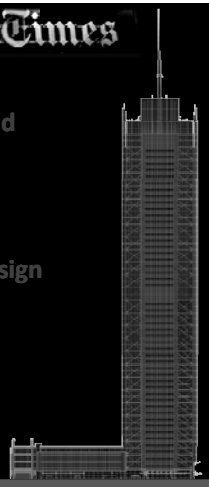


Redesign Alternatives

Summary

Overall Comparison	Existing	Alternative 1	Alternative 2	Alternative 3
Energy Cost	✖	☺		
Source Energy Emissions	✖	☺		
Payback Period			☺	✖
System Footprint	☺	✖		

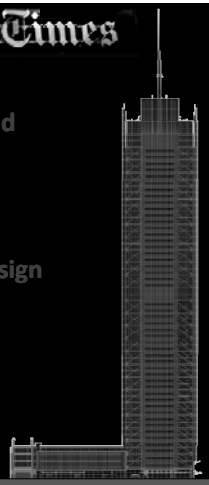
Alternative 2: 2,700 kW

IC Engines

+

1,300 kW IC Engine

The New York Times

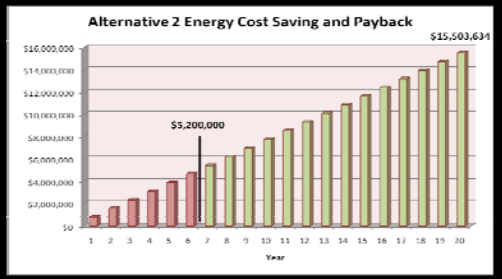


Redesign Alternatives

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



The New York Times

Integrated Project Delivery Process

The New York Times

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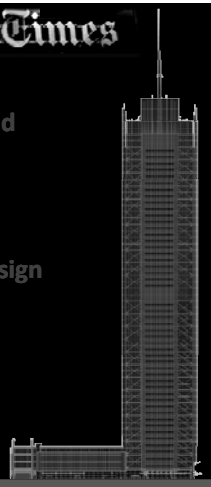

BIM Goals

Building Information Modeling Process:

BIM Goals

Group Goals:
- o Enhance communication and information flow
- o Visualize project changes

BIM Use Analysis

Workflows

The New York Times

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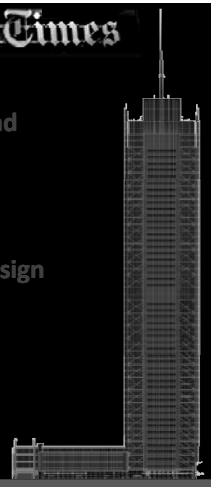

BIM Use Analysis

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

BIM Workflows

Building Information Modeling Process:

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Group Goals:
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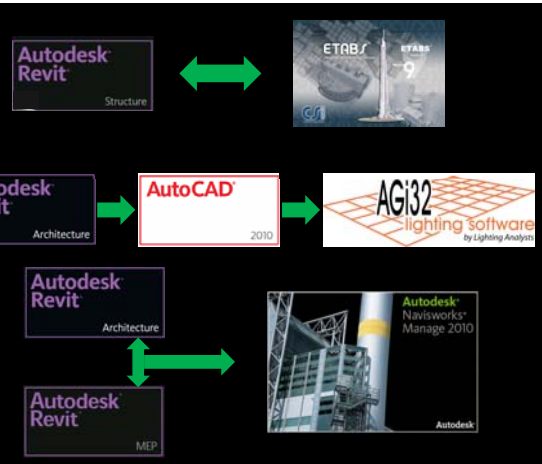
Workflows



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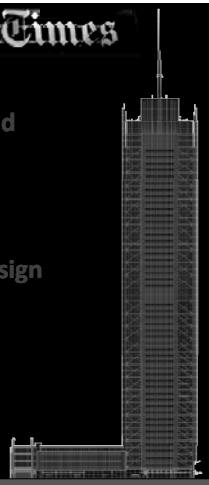

Metrics of Success

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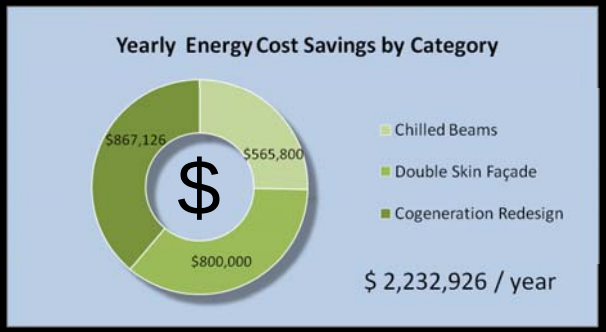
Increased Profitability
- Operating Costs
- Leasable Space

Increased Marketability
- Sustainability
- Iconic Image



The New York Times

Metrics of Success

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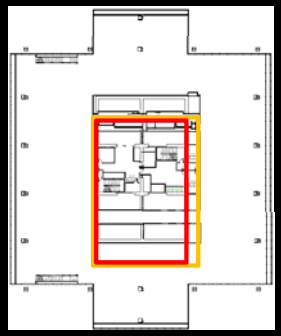
Additional Square Footage	26,864 SF
Additional Rent	$ 1,601,840



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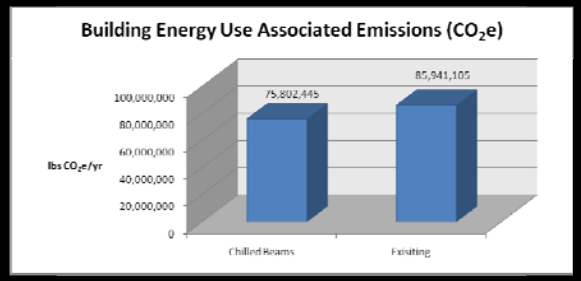

35% Energy CO_2e Reduction

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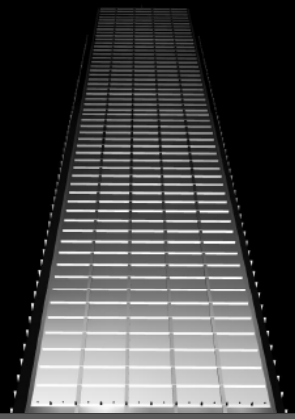

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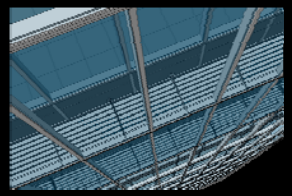

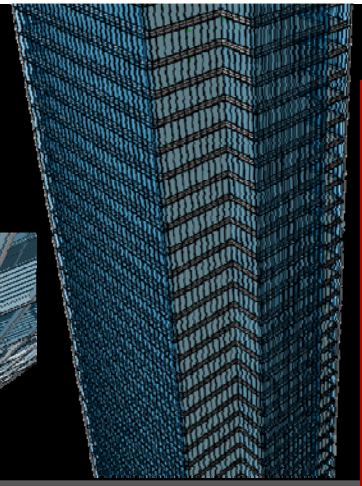

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Façade	
Upfront Cost	$ 18.7 million
Annual Energy Savings	$ 800,000
Payback Period	**23.4 years**

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**

The New York Times

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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**

The New York Times

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Lessons Learned

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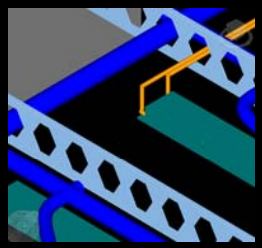

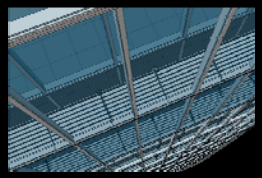

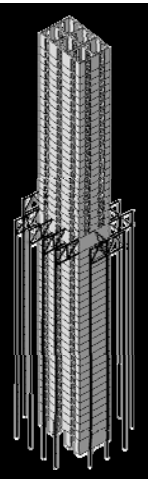

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Questions/Comments