1000 CONNECTICUT AVENUE, NW OFFICE BUILDING
WASHINGTON D.C.

PRESENTATION OUTLINE OVERVIEW

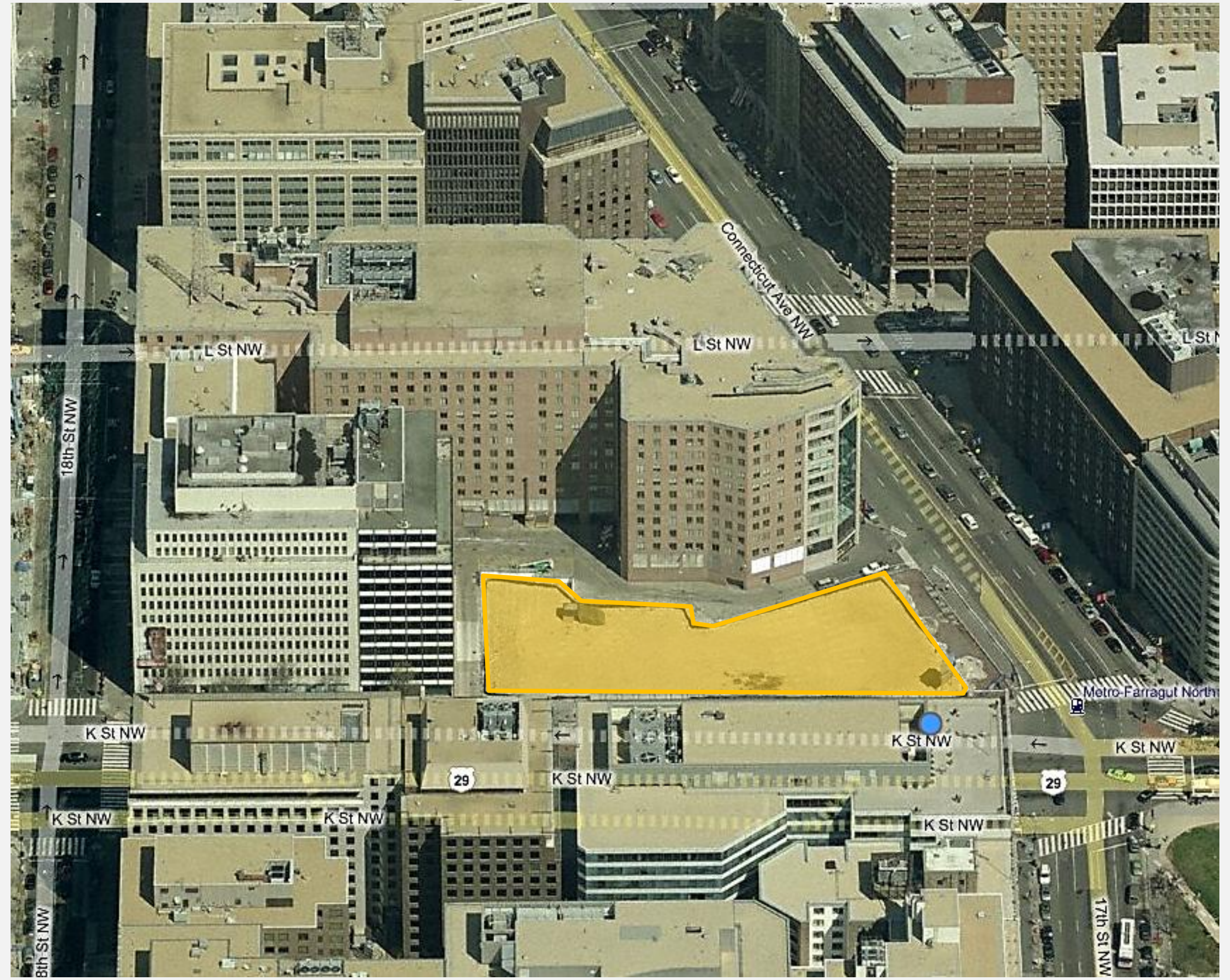
1. BUILDING INTRODUCTION
2. Existing Structural System
3. Proposal Overview
4. Gravity System Re-Design
5. Lateral System Re-Design
6. Construction Management Breadth
7. Summary
8. Acknowledgements
9. Questions/ Comments

1000 CONNECTICUT AVENUE

BUILDING INTRODUCTION

- Commercial office building with fitness center, retail, and parking garages
- Located at 1701 K Street, NW at Connecticut Ave, in Washington, DC
- 555,000 SF (370, 000 SF above grade and 185,000 SF below grade)
- Height: 130 ft. above grade
- 12 stories above and 4 stories below grade (underground parking)
- Construction Dates: September 2009- February 2012
- Construction Cost: $60 million
- LEED Gold

SITE MAP



PROJECT TEAM

- Owner Representative: MJ Tyler and Associates
- Architect-of-Record: WDG Architecture
- Design Architect: Pei Cobb Freed and Partners
- MEP: Girard Engineering
- Structural: SK&A Structural Engineers
- Civil Engineer: VIKA, Inc.
- General Contractor: Clark Construction Group

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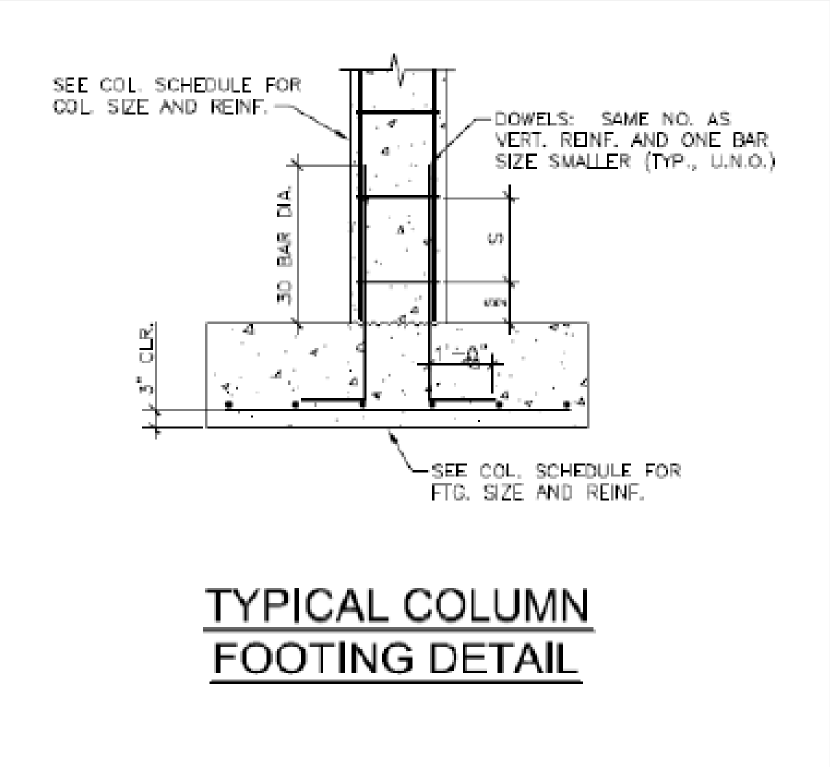
ARCHITECTURAL FEATURES

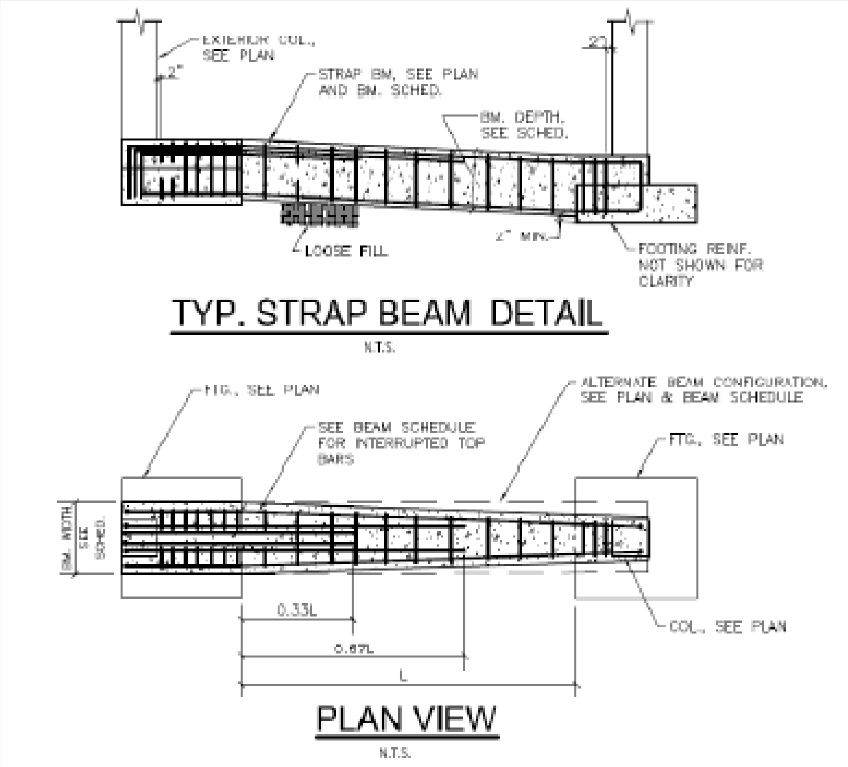
- Curtain wall glass façade
  - Blends both traditional and modern materials to compliment surrounding institutions
  - Consists of glass, stainless steel, and stone panels
- Two-story intricate lobby space
  - Carrera marble
  - Chelmsford flooring
  - Aluminum spline panels integrated with glass fiber reinforced gypsum ceiling tiles
  - European white oak wood screens
- Integrated green roof and roof-top terrace

RENDERINGS

EXISTING STUCTURAL SYSTEM

- Foundation
  - Spread footings
    - Typical sizes include 4'x4', 5'x5', and 4'x8'
  - Strap beams
  - 5" thick, 5000 psi SOG
  - The foundation walls consists of CMUs





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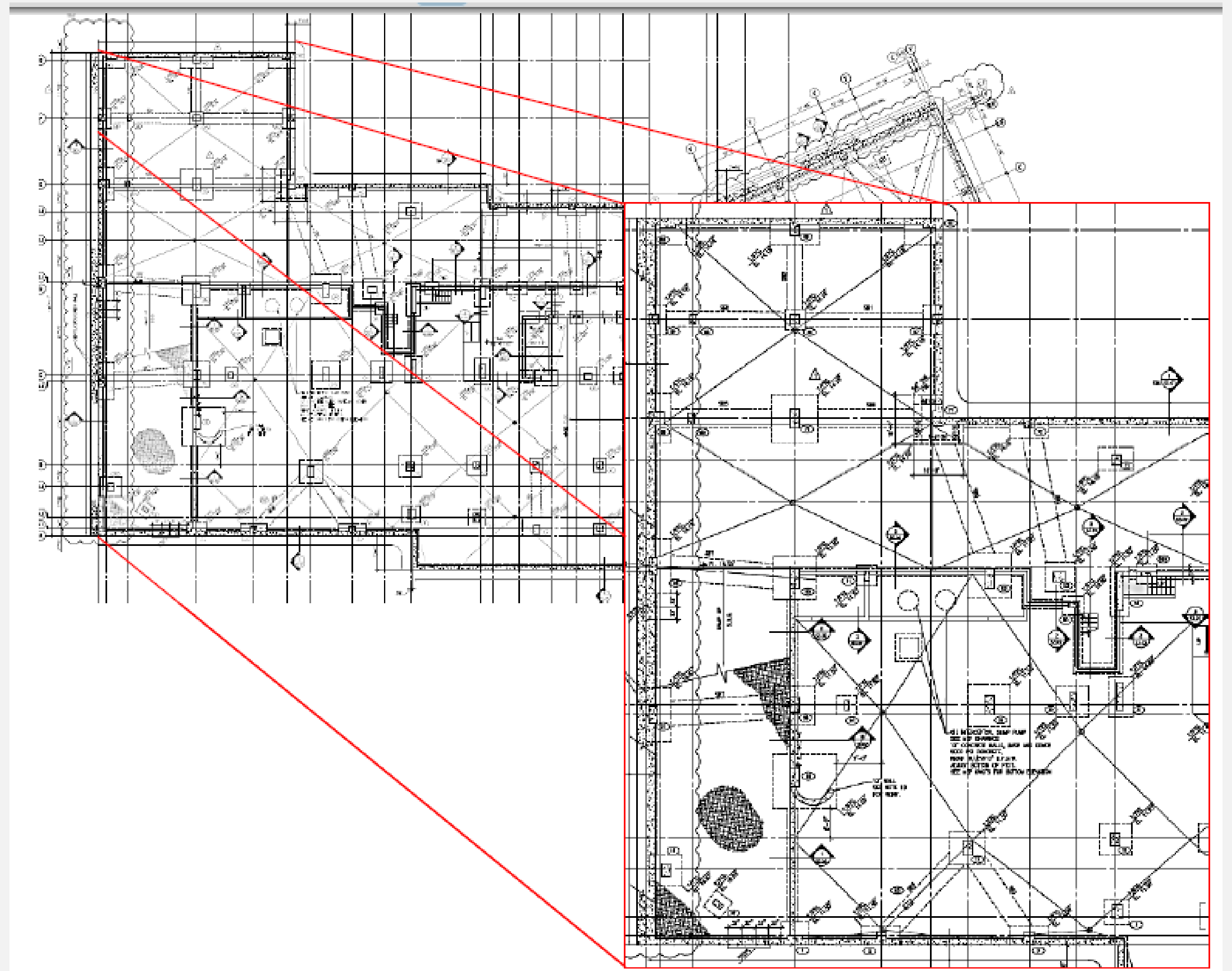
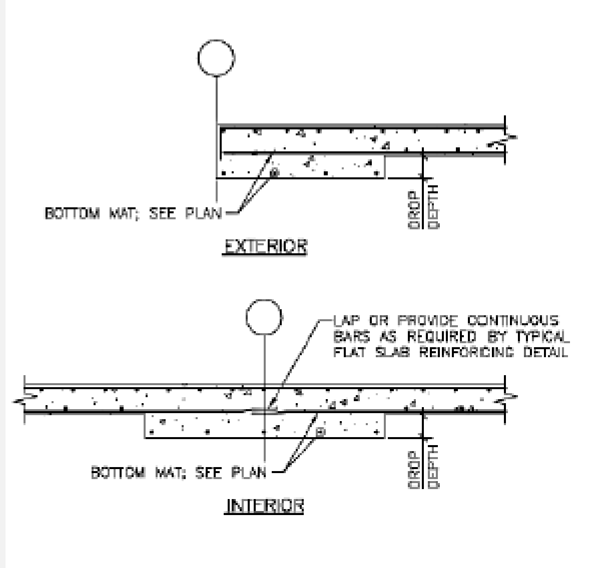


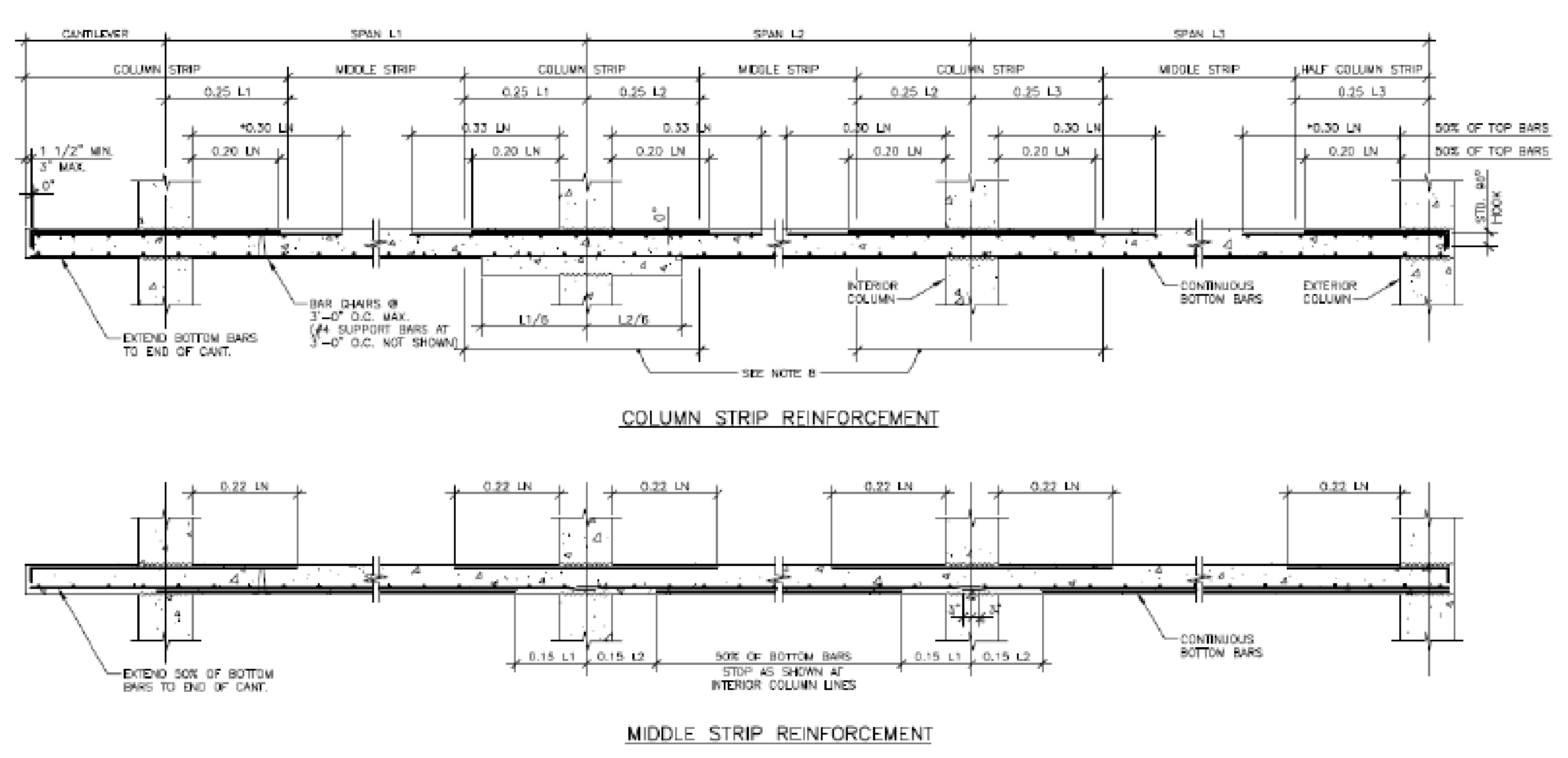
1000 Connecticut Avenue

EXISTING STUCTURAL SYSTEM

- Gravity Floor System
  - Comprised of 8" thick two-way flat slab with 8" thick drop panels
  - Has a specified strength of f'c=5000 psi



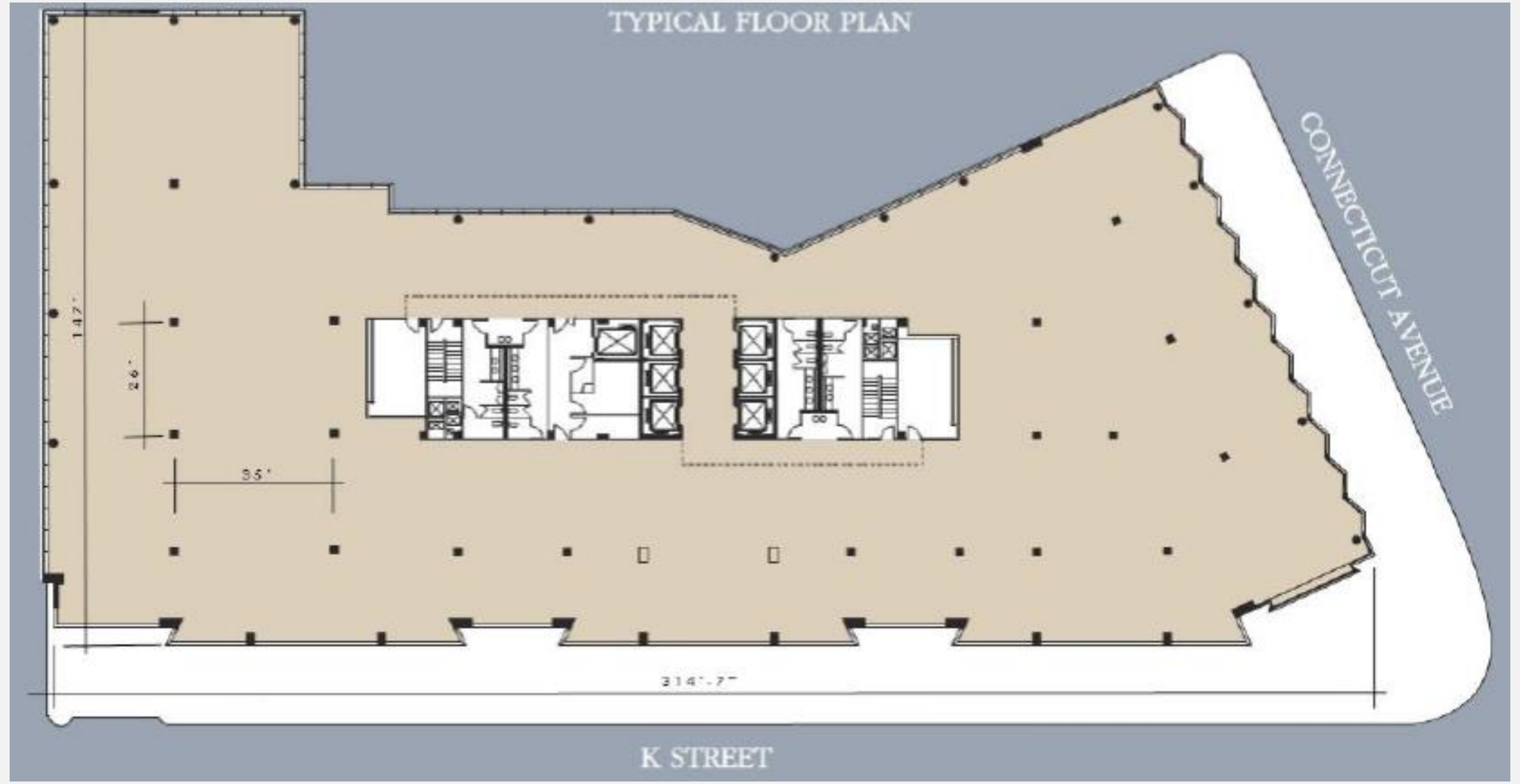
TYPICAL CONTINUOUS DROP REINFORCING DETAILS



1000 CONNECTICUT AVENUE

EXISTING STUCTURAL SYSTEM

- Framing System
  - Composed of reinforced concrete columns with 6" thick column capitals
    - Typical column sizes are 24"x24", 16"x48", 24"x30"
  - 30'x30' average column-to-column spacing
  - Specified column strength of f'c= 8000 psi for levels B4-B1, f'c= 6000 psi for levels 4-7, f'c=5000 psi levels 8 though mech. PH
  - Columns frame at the concrete floor



EXISTING STUCTURAL SYSTEM

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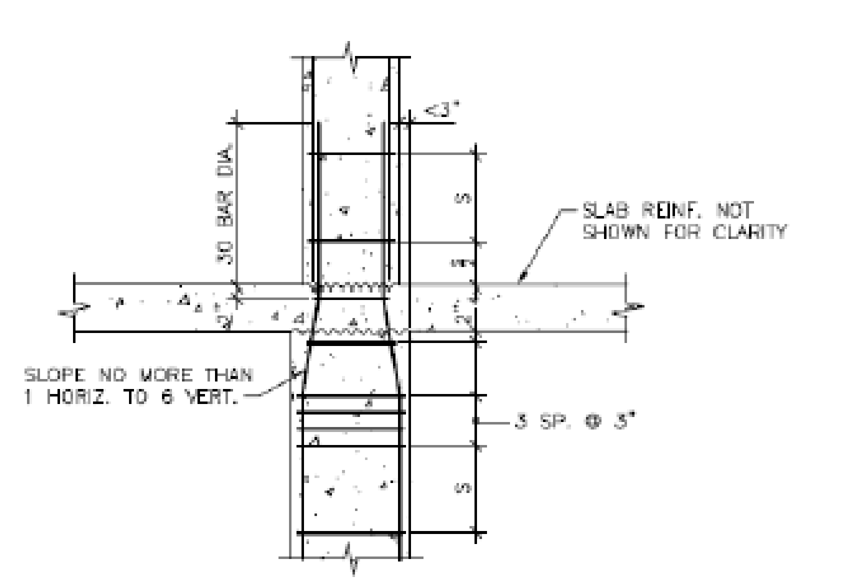
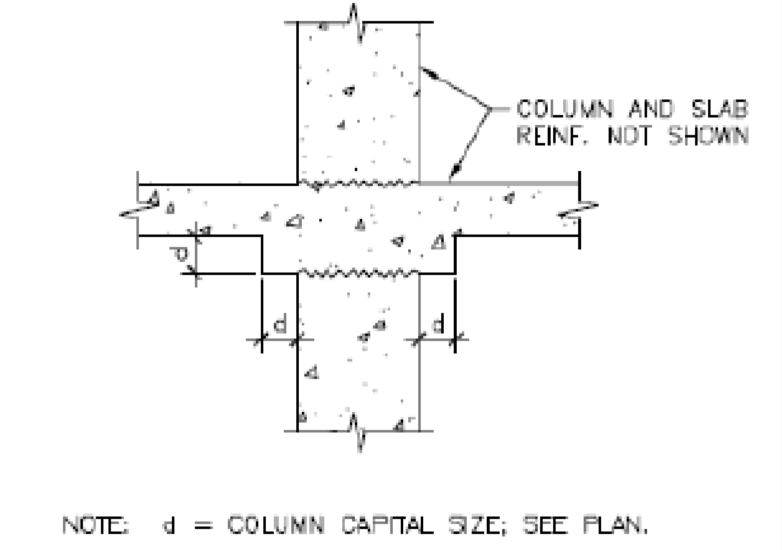
  - Columns frame at the concrete floor
- Lateral System
  - Reinforced concrete moment frame
  - The two-way flat slab and concrete columns forms the moment frame



TYPICAL DETAIL OF COLUMN FRAMED AT FLOOR



TYPICAL COLUMN CAPITAL DETAIL

PROPOSAL OVERVIEW

- Interest in steel design
- Steel structural system will increase floor structural depth
- Maintain minimum floor-to-ceiling height of 8'-6"
- To use new steel structural system, number of stories must reduce to stay within Washington D.C.'s restricted height limit of 130 ft and to maintain 8'-6" floor-to-ceiling height
- Using existing non-uniform column layout with new steel system will result in large number of skewed members
- New steel system is more flexible

PROPOSAL OVERVIEW

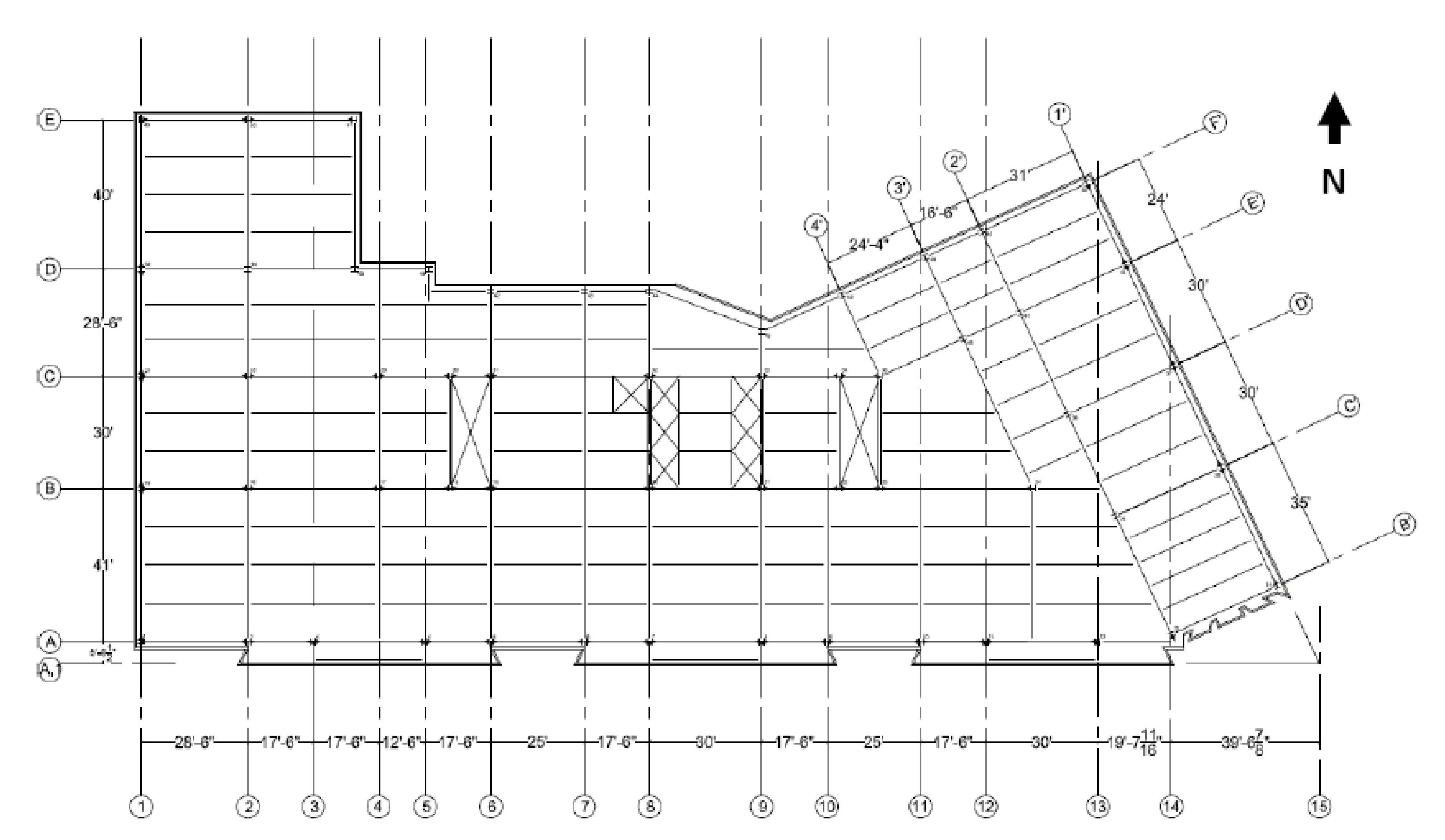
- Building relocated to Arlington, VA
  - New location does not have a height limitation
- Create new structural system layout with wider bays
- Create uniform column layout to reduce number of required skewed members
- Increase floor-to-floor height to create higher floor-to-ceiling heights
- Use composite beam/girder system with composite deck for gravity floor system
- Use braced frames and moment frames for the lateral system

GOALS

- Increase the bay sizes to open the floor plan layout
- Increase floor-to-floor height to increase the openness of the space
- Reduce the construction schedule
- Reduce the structural system cost
- Increase the annual revenue by increasing the rental value of the space and increasing the amount of rentable space

GRAVITY SYSTEM RE-DESIGN

- Composite beams/girders used for gravity system
- Designed manually using AISC 14th edition
- LRFD
  - 1.2D+1.6L+0.5Lr controlled design
- To increase the rental value of the building , wider bays and higher floor-to-ceiling heights were created
- Certain existing column lines that were in the existing structural layout were removed to increase the bay sizes
- columns were re-located to create a uniform framing layout to reduce the number of required skewed connections
- 3VLI20 composite deck was chosen for the floor system



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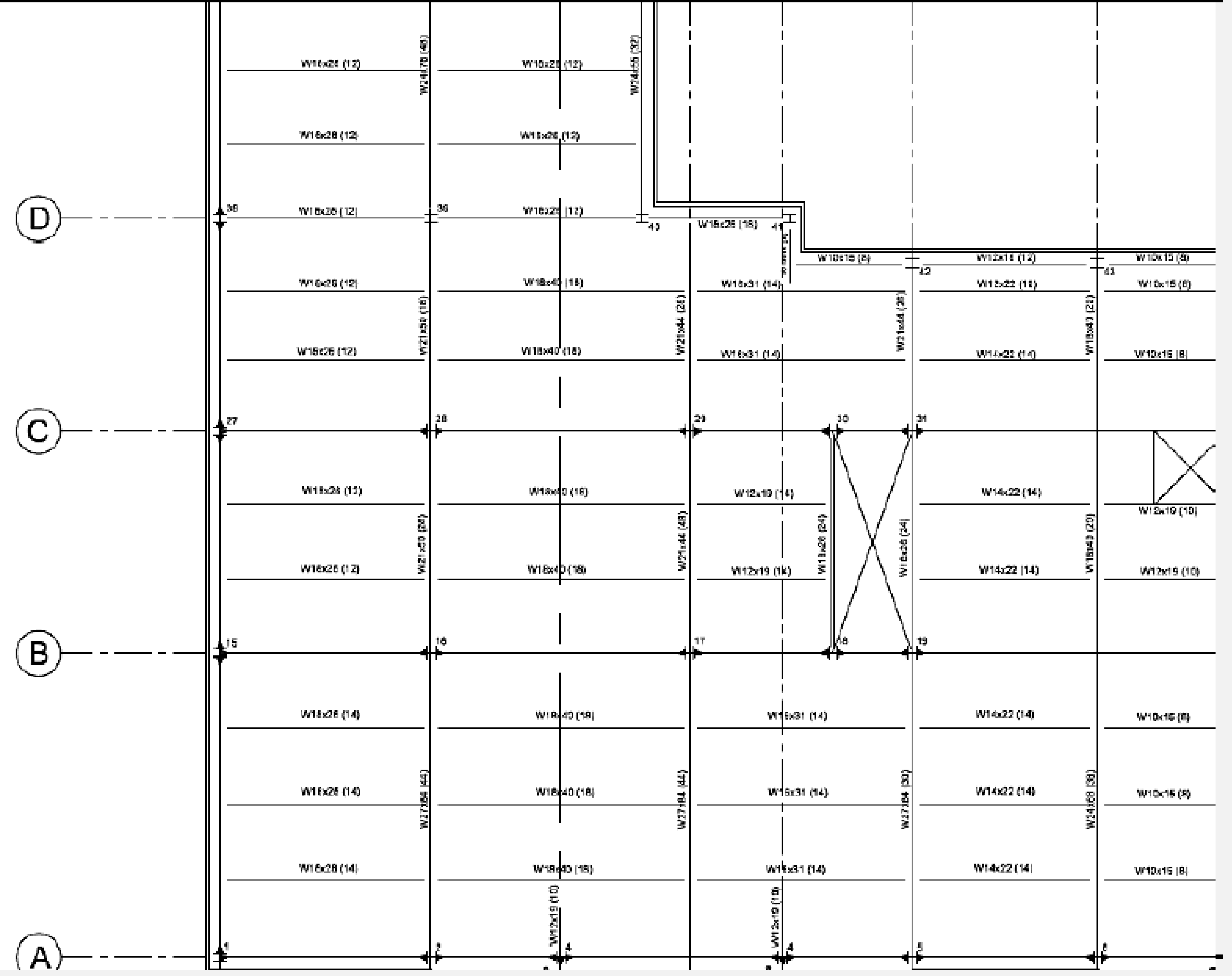

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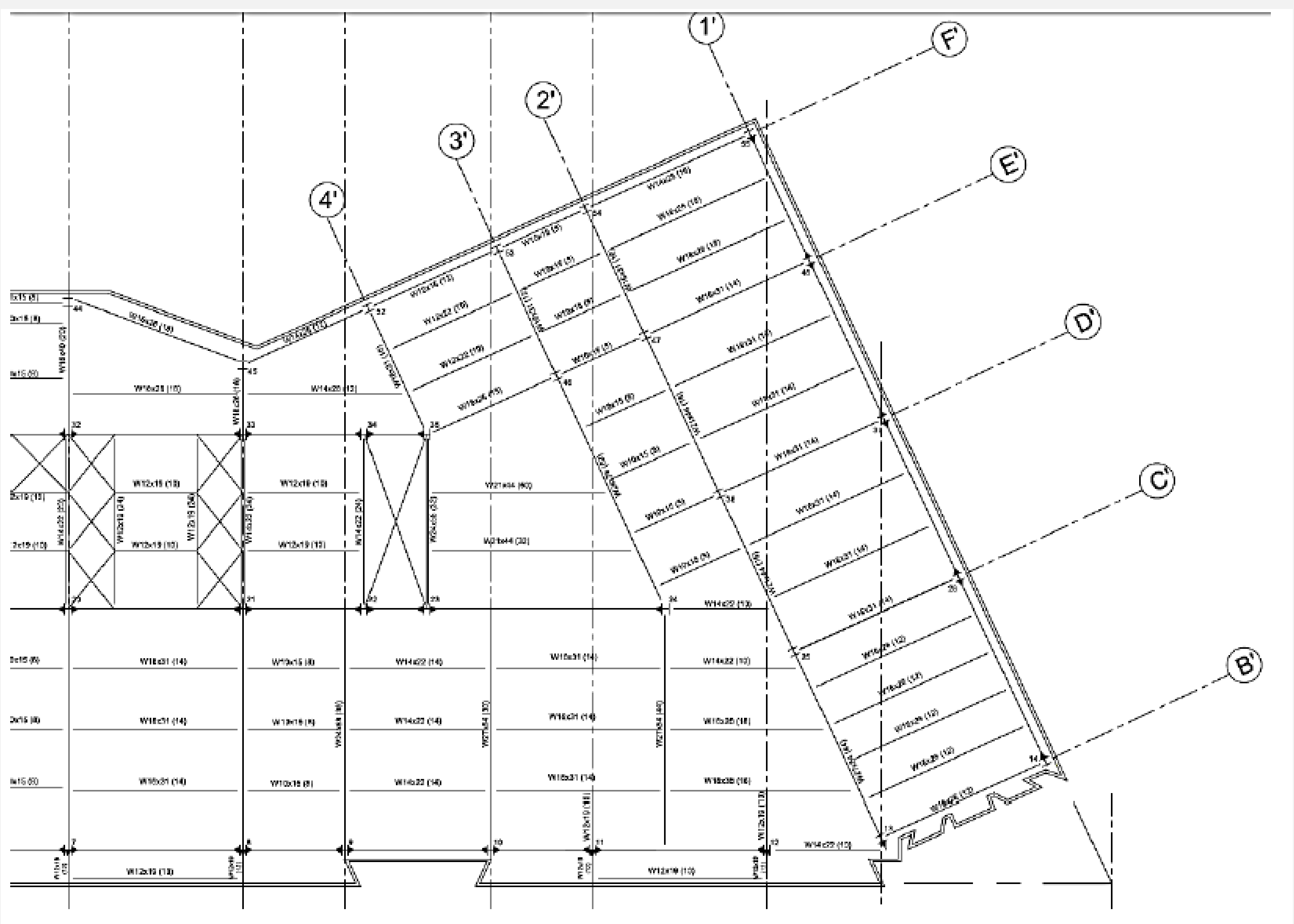

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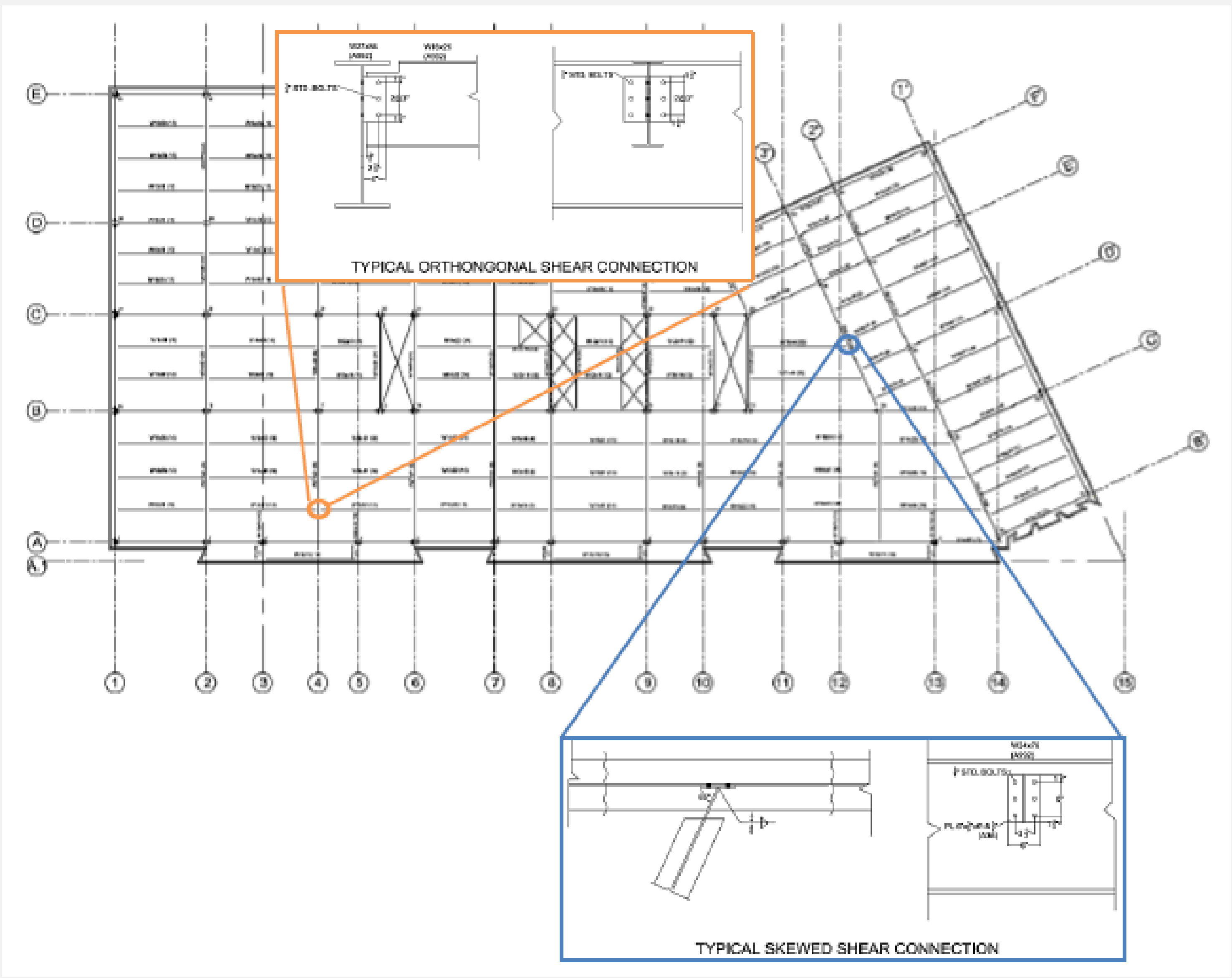
GRAVITY SYSTEM RE-DESIGN

- To maintain high floor-to-ceiling heights while taking into account the increase in structural depth due to the gravity members, floor-to floor height increased from 10'-7" to 15'-0"
- Columns designed as two-tiers
- Gravity columns designed manually using AISC 14th edition

GRAVITY COLUMN SCHEDULE															
COLUMN MARK	13	25	36	39	40	41	42	43	44	45	46	47	52	53	54
COLUMN SIZE	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED	AS NOTED
PENTHOUSE ROOF ELEV. MACH. ROOM MAIN ROOF															
12TH FLOOR 11TH FLOOR	W14x43	W14x61	W14x48	W14x53	W14x43	W14x43	W14x43	W14x43	W14x48	W14x43	W14x43	W14x43	W14x43	W14x43	W14x43
10 FLOOR 9TH FLOOR	W14x61	W14x74	W14x68	W14x82	W14x61	W14x43	W14x43	W14x43	W14x68	W14x43	W14x61	W14x61	W14x43	W14x43	W14x43
8TH FLOOR 7TH FLOOR	W14x61	W14x90	W14x90	W14x99	W14x90	W14x43	W14x43	W14x43	W14x90	W14x48	W14x68	W14x82	W14x53	W14x48	W14x53
6TH FLOOR 5TH FLOOR	W14x82	W14x109	W14x99	W14x132	W14x99	W14x43	W14x43	W14x61	W14x109	W14x61	W14x90	W14x90	W14x61	W14x61	W14x61
4TH FLOOR 3RD FLOOR	W14x90	W14x132	W14x120	W14x159	W14x120	W14x53	W14x53	W14x61	W14x132	W14x61	W14x90	W14x109	W14x68	W14x61	W14x68
2ND FLOOR 1ST FLOOR	W14x99	W14x159	W14x145	W14x193	W14x145	W14x61	W14x61	W14x68	W14x145	W14x74	W14x109	W14x132	W14x82	W14x68	W14x82

GRAVITY SYSTEM RE-DESIGN

- Typical orthogonal and skewed shear connections were designed manually using AISC 14th edition and material learned in Steel Connection Design Course (AE 534)



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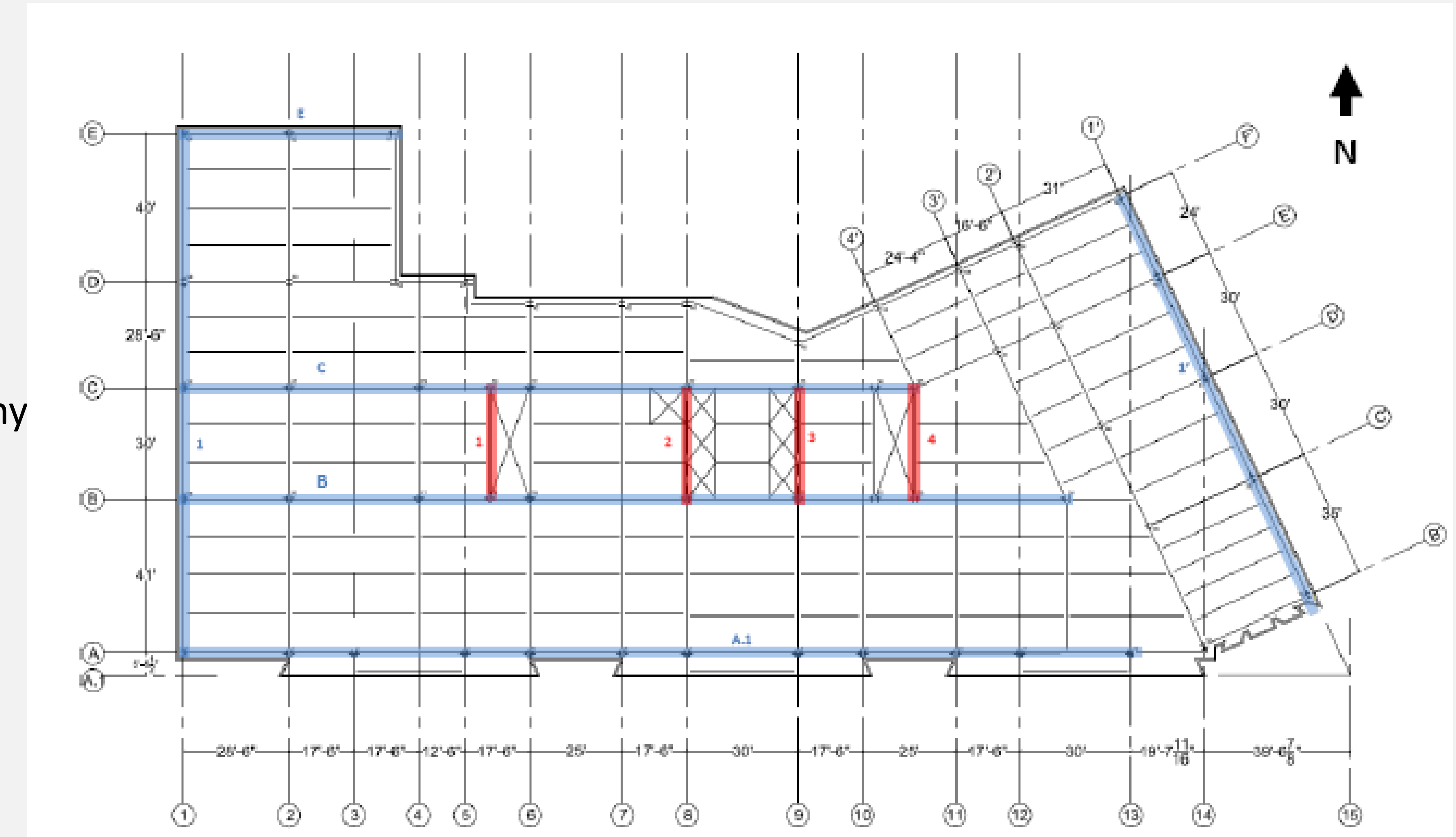
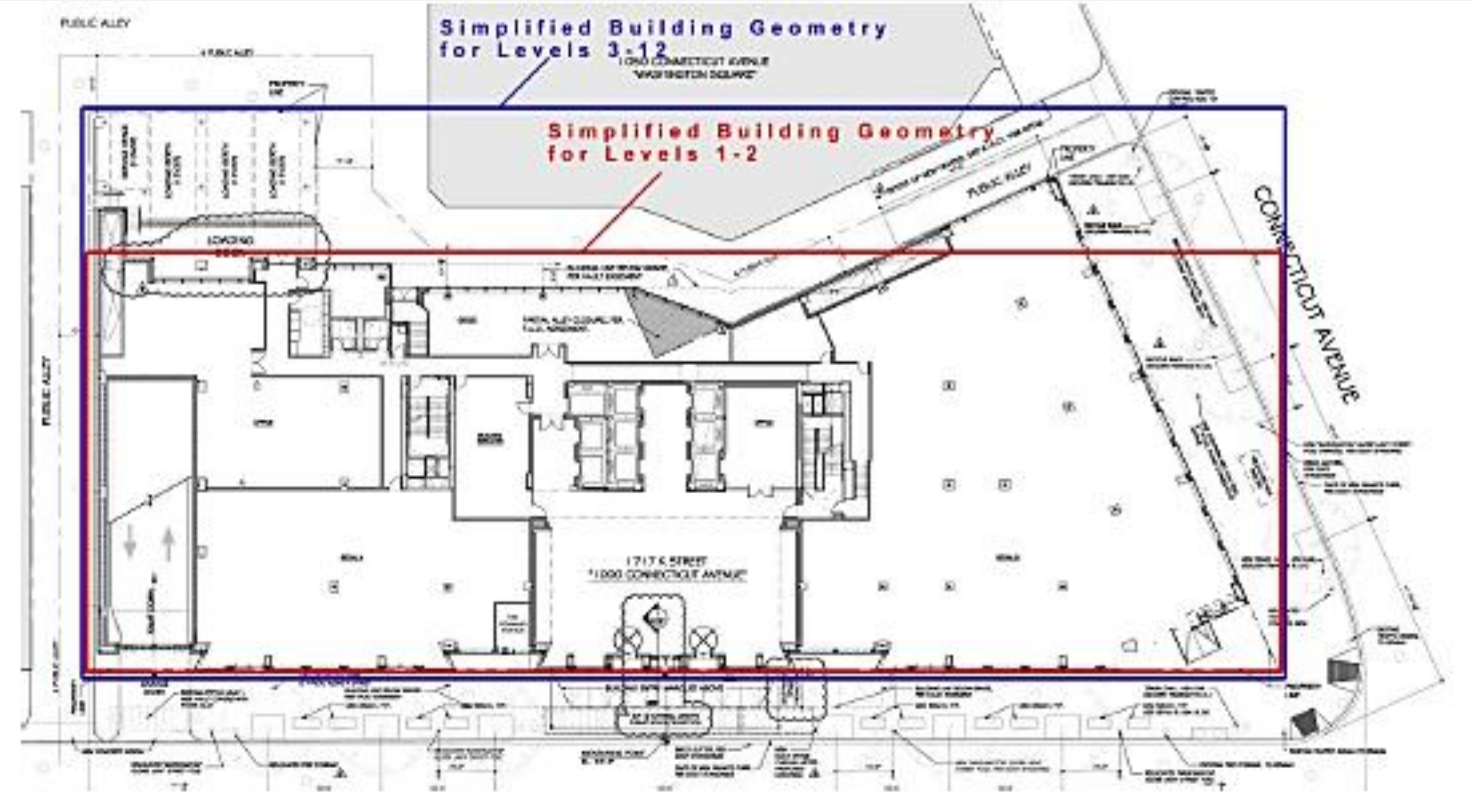
LATERAL SYSTEM RE-DESIGN

- 5 moment frames were chosen to resist the lateral loads in the E-W direction
- 2 moment frame and 4 brace frames chosen to resist lateral loads in N-S direction
- Moment frames were used to maintain an open floor plan without any obstructions.
- To keep the floor layout open, the brace frames were located around the elevator shafts and stairwell cores



LATERAL SYSTEM RE-DESIGN

- Wind loads were determined using the Main Wind Force Resisting System (MWFRS) procedure (method 2) in conformance to Chapters 26 and 27 outlined in ASCE 7-10
- Due to the building's complex geometry, a rectangular building shape was assumed to simplify the wind load analysis



General Wind Load Design Criteria		
Design Wind Speed, V	115 mph	ASCE 7-10, Fig. 26.5-1A
Directionality Factor, K_d - MWFRS	0.85	ASCE 7-10, Tbl. 26.6-1
Directionality Factor, K_d - Mechanical PH	0.9	ASCE 7-10, Tbl. 26.6-1
Exposure Category	B	ASCE 7-10, Sect. 26.7.3
Topographic Factor, K_{zt}	1.0	ASCE 7-10, Sect. 26.8.2
Internal Pressure Coeficient, GC_{pi}	0.18	ASCE 7-10, Tbl. 26.11-1

Gust Factor-MWFRS			
N-S Wind		E-W Wind	
Levels 1-2	Levels 3-12	Levels 1-2	Levels 3-12
0.895	0.894	0.994	0.972
Gust Factor-Mechnical Penthouse			
N-S Wind		E-W Wind	
0.85		0.85	

LATERAL SYSTEM RE-DESIGN

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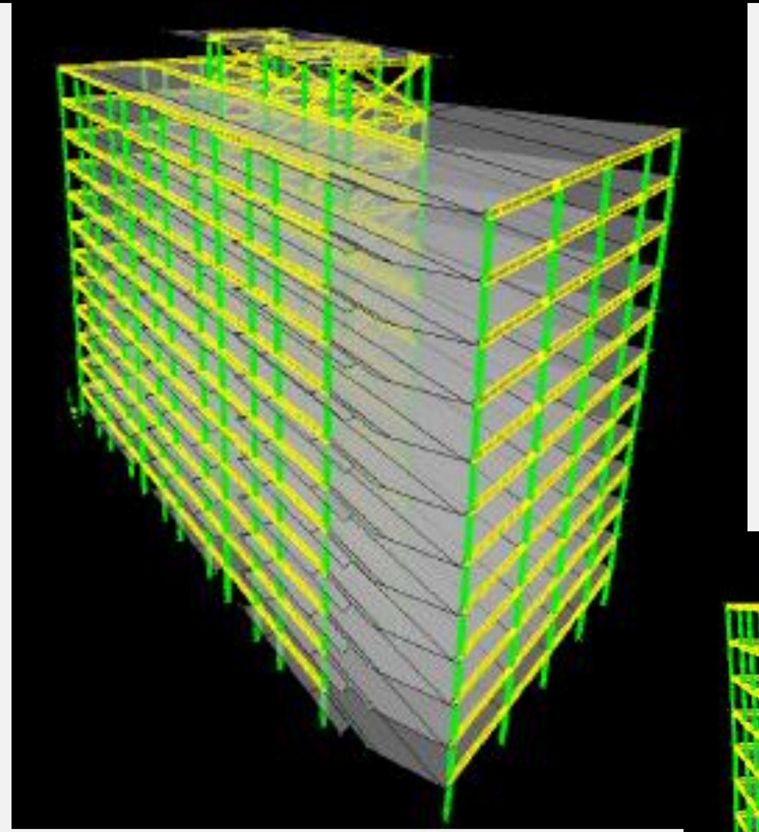
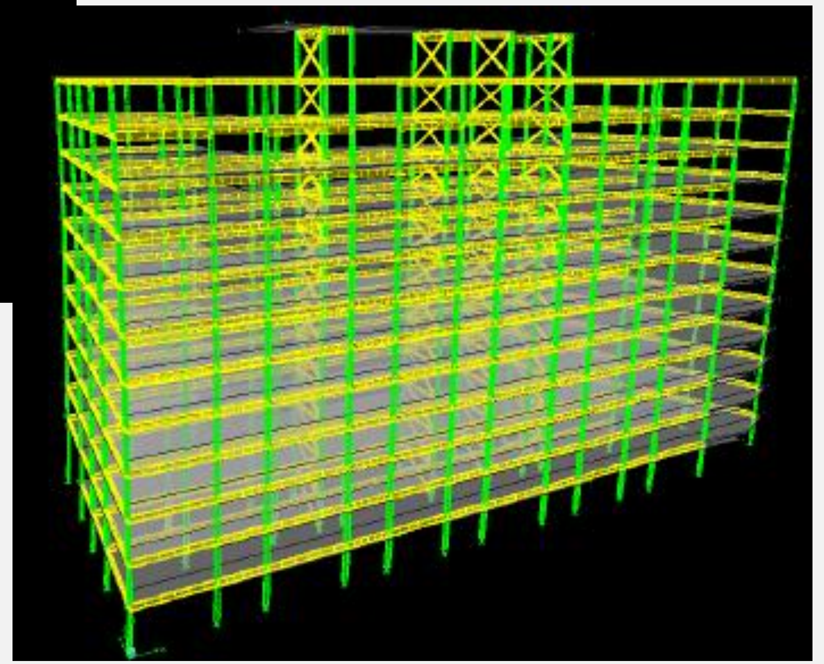
- Due to the building's complex geometry, a rectangular building shape was assumed to simplify the wind load analysis
- Seismic loads were determined using the Equivalent Lateral Force Procedure outlined in Chapters 11 and 12 in ASCE 7-10

Summary of Lateral Load Results			
Direction	Load	Base Shear, V	Overturning Moment, M_z
		(kips)	(k-ft)
E-W	Wind (case 1)	850	88,086
	Seismic	518	71,659
N-S	Wind (case 1)	2119	218,031
	Seismic	939	123,773

LATERAL SYSTEM RE-DESIGN

- The lateral- force resisting beams that connect the columns were designed as non-composite.
- The member sizes were estimated by manually designing the beams, girders, and columns for gravity loads only using AISC 14th edition
- Lateral system with estimated member sizes was modeled in ETABS using concepts learned in Computer Modeling (AE 597A)
- ETABS model used to determine controlling wind load case and controlling load combination for strength design





LATERAL SYSTEM RE-DESIGN

- To determine the controlling wind load case and controlling load combination, shear forces acting in each frame on story 6 were used
- The wind load case that resulted in the highest shear forces in the frames was concluded to control the design
    - Wind load case 1 was found to control

Wind Load Case 1- Story 6			
Frame	X-Direction	Y-Direction	
	Shear Force (kips)	Shear Force (kips)	
MF-A.1	205.8	-	
MF-B	152.7	-	
MF-C	162.3	-	
MF-E	48.7	-	
MF-1	-	38.6	
MF-1'	35.8	63.6	
BF-1	-	327.1	
BF-2	-	260.4	
BF-3	-	289.2	
BF-4	-	369.1	
Average Shear=	121.1	224.7	kips

Wind Load Case 2- level 6			
Frame	X-Direction	Y-Direction	
	Shear Force (kips)	Shear Force (kips)	
MF-A.1	172.8	-	
MF-B	117.4	-	
MF-C	111.6	-	
MF-E	29.8	-	
MF-1	-	25.0	
MF-1'	14.8	106.3	
BF-1	-	59.6	
BF-2	-	172.8	
BF-3	-	267.3	
BF-4	-	427.6	
Average Shear=	89.3	176.4	kips

Wind Load Case 3- level 6		
Frame	Shear Force (kips)	
MF-A.1	167.5	
MF-B	125.0	
MF-C	117.5	
MF-E	36.5	
MF-1	46.3	
MF-1'	15.3	
BF-1	312.8	
BF-2	205.2	
BF-3	206.0	
BF-4	226.6	
Average Shear=	145.9	kips

Wind Load Case 4- level 6		
Frame	Shear Force (kips)	
MF-A.1	184.6	
MF-B	107.5	
MF-C	40.1	
MF-E	4.3	
MF-1	17.8	
MF-1'	68.8	
BF-1	65.5	
BF-2	132.0	
BF-3	204.0	
BF-4	317.6	
Average Shear=	190.4	kips

LATERAL SYSTEM RE-DESIGN

- To determine the controlling wind load case and controlling load combination, shear forces acting in each frame on story 6 were used
- The load combination that resulted in the highest shear forces in the frames was concluded to control the strength of the design
  - Load combination 1.2D+1.0L+1.0W was found to control strength of design

Seismic- North-South - story 6	
Load Combination- 1.2 D+L+1.0E	
Frame	Shear Force (kips)
MF-A.1	-
MF-B	-
MF-C	-
MF-E	-
MF-1	22.0
MF-1'	40.5
BF-1	195.6
BF-2	157.9
BF-3	177.5
BF-4	227.1
Average Shear=	136.8 kips

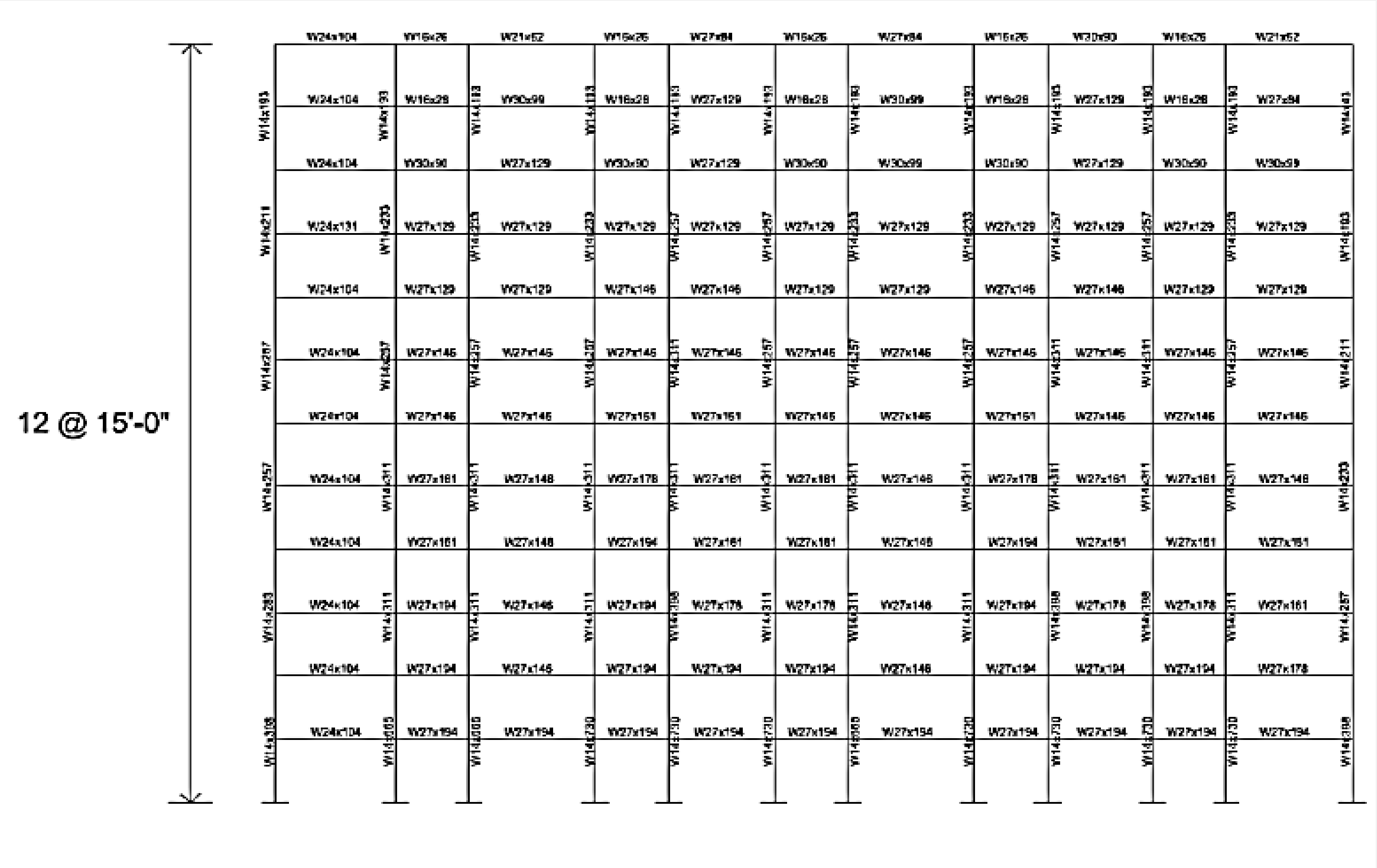
Wind Load Case 1- North-South - story 6	
Load Combination- 1.2 D+L+1.0W	
Frame	Shear Force (kips)
MF-A.1	-
MF-B	-
MF-C	-
MF-E	-
MF-1	38.6
MF-1'	63.4
BF-1	327.1
BF-2	260.4
BF-3	289.2
BF-4	369.1
Average Shear=	224.6 kips

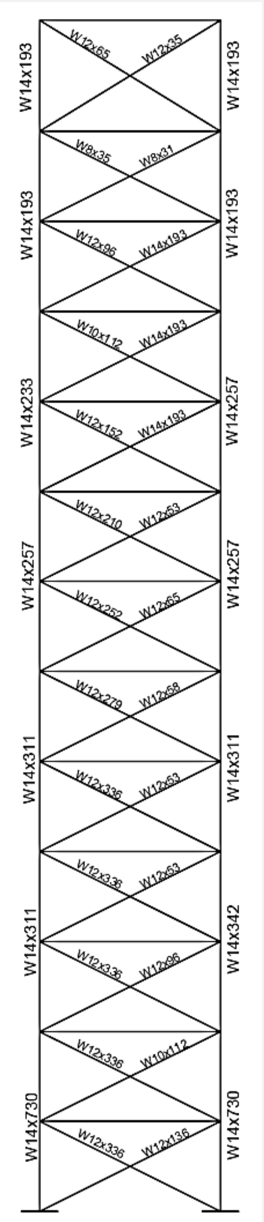
Seismic- East-West - Story 6	
Load Combination- 1.2 D+L+1.0E	
Frame	Shear Force (kips)
MF-A.1	184.3
MF-B	132.7
MF-C	135.9
MF-E	39.3
MF-1	-
MF-1'	26.2
BF-1	-
BF-2	-
BF-3	-
BF-4	-
Average Shear=	86.4 kips

Wind Load Case 1- East-West - story 6	
Load Combination- 1.2 D+L+1.0W	
Frame	Shear Force (kips)
MF-A.1	205.8
MF-B	152.7
MF-C	162.3
MF-E	48.7
MF-1	-
MF-1'	35.8
BF-1	-
BF-2	-
BF-3	-
BF-4	-
Average Shear=	100.9 kips

LATERAL SYSTEM RE-DESIGN

- The steel frame design check in ETABS was used to design the lateral system





LATERAL SYSTEM RE-DESIGN

- The steel frame design check in ETABS was used to design the lateral
- Inter-story drift limited to
  - H/400 for un-factored wind load case 1 and
  - 0.02H for un-factored seismic loads

Story Displacement/ Drift Due to Unfactored Wind Loads (Wind Load Case 1)						
Story	Height Above Grade (ft)	Actual Displacement X (in)	Actual Displacement Y (in)	H/400 (in)	Inter-Story Drift X (in)	Inter-Story Drift Y (in)
Main Roof	180	2.0567	1.8145	0.45	0.0705	0.2160
11	165	1.9862	1.5985	0.45	0.0967	0.1921
10	150	1.8895	1.4064	0.45	0.1154	0.1936
9	135	1.7741	1.2128	0.45	0.1412	0.1890
8	120	1.6329	1.0238	0.45	0.1588	0.1922
7	105	1.4741	0.8316	0.45	0.1784	0.1831
6	90	1.2957	0.6485	0.45	0.1866	0.1657
5	75	1.1091	0.4828	0.45	0.2018	0.1456
4	60	0.9073	0.3372	0.45	0.2062	0.1243
3	45	0.7011	0.2129	0.45	0.2098	0.0921
2	30	0.4913	0.1208	0.45	0.1852	0.0622
1	15	0.3061	0.0586	0.45	0.3061	0.0586

Total Rigid Diaphragm Displacement Due to Unfactored Wind Loads (case 1)			
Displacement X (in)	Displacement Y (in)	Total Height (ft)	H/400 (in)
2.11	2.26	180	5.4

Story Displacement/ Drift Due to Unfactored Seismic Loads						
Story	Height Above Grade (ft)	Actual Displacement X (in)	Actual Displacement Y (in)	0.02H (in)	Inter-Story Drift X (in)	Inter-Story Drift Y (in)
Main Roof	180	2.0308	1.192	3.6	0.0969	0.144
11	165	1.9339	1.048	3.6	0.1323	0.1263
10	150	1.8016	0.9217	3.6	0.1482	0.13
9	135	1.6534	0.7917	3.6	0.1709	0.1275
8	120	1.4825	0.6642	3.6	0.1809	0.1304
7	105	1.3016	0.5338	3.6	0.20	0.1237
6	90	1.1	0.4101	3.6	0.18	0.1104
5	75	0.9225	0.2997	3.6	0.191	0.0955
4	60	0.732	0.2042	3.6	0.1828	0.0796
3	45	0.5492	0.1246	3.6	0.1741	0.0568
2	30	0.3751	0.0678	3.6	0.1442	0.0358
1	15	0.2309	0.032	3.6	0.2309	0.032

Total Rigid Diaphragm Displacement Due to Unfactored Seismic Loads			
Displacement X (in)	Displacement Y (in)	Total Height (ft)	0.02H (in)
2.07	1.62	180	43.2

LATERAL SYSTEM RE-DESIGN

- The steel frame design check in ETABS was used to design the lateral
- Inter-story drift limited to
  - H/400 for un-factored wind load case 1 and
  - 0.02H for un-factored seismic loads

Story Displacement/ Drift Due to Unfactored Wind Loads (Wind Load Case 1)						
Story	Height Above Grade (ft)	Actual Displacement X (in)	Actual Displacement Y (in)	H/400 (in)	Inter-Story Drift X (in)	Inter-Story Drift Y (in)
Main Roof	180	2.0567	1.8145	0.45	0.0705	0.2160
11	165	1.9862	1.5985	0.45	0.0967	0.1921
10	150	1.8895	1.4064	0.45	0.1154	0.1936
9	135	1.7741	1.2128	0.45	0.1412	0.1890
8	120	1.6329	1.0238	0.45	0.1588	0.1922
7	105	1.4741	0.8316	0.45	0.1784	0.1831
6	90	1.2957	0.6485	0.45	0.1866	0.1657
5	75	1.1091	0.4828	0.45	0.2018	0.1456
4	60	0.9073	0.3372	0.45	0.2062	0.1243
3	45	0.7011	0.2129	0.45	0.2098	0.0921
2	30	0.4913	0.1208	0.45	0.1852	0.0622
1	15	0.3061	0.0586	0.45	0.3061	0.0586

Story Displacement/ Drift Due to Unfactored Seismic Loads						
Story	Height Above Grade (ft)	Actual Displacement X (in)	Actual Displacement Y (in)	0.02H (in)	Inter-Story Drift X (in)	Inter-Story Drift Y (in)
Main Roof	180	2.0308	1.192	3.6	0.0969	0.144
11	165	1.9339	1.048	3.6	0.1323	0.1263
10	150	1.8016	0.9217	3.6	0.1482	0.13
9	135	1.6534	0.7917	3.6	0.1709	0.1275
8	120	1.4825	0.6642	3.6	0.1809	0.1304
7	105	1.3016	0.5338	3.6	0.20	0.1237
6	90	1.1	0.4101	3.6	0.18	0.1104
5	75	0.9225	0.2997	3.6	0.191	0.0955
4	60	0.732	0.2042	3.6	0.1828	0.0796
3	45	0.5492	0.1246	3.6	0.1741	0.0568
2	30	0.3751	0.0678	3.6	0.1442	0.0358
1	15	0.2309	0.032	3.6	0.2309	0.032

nd Loads (Wind Load Case 1)

H/400 (in)	Inter-Story Drift X (in)	Inter-Story Drift Y (in)
0.45	0.0705	0.2160
0.45	0.0967	0.1921
0.45	0.1154	0.1936
0.45	0.1412	0.1890
0.45	0.1588	0.1922
0.45	0.1784	0.1831
0.45	0.1866	0.1657
0.45	0.2018	0.1456
0.45	0.2062	0.1243
0.45	0.2098	0.0921
0.45	0.1852	0.0622
0.45	0.3061	0.0586

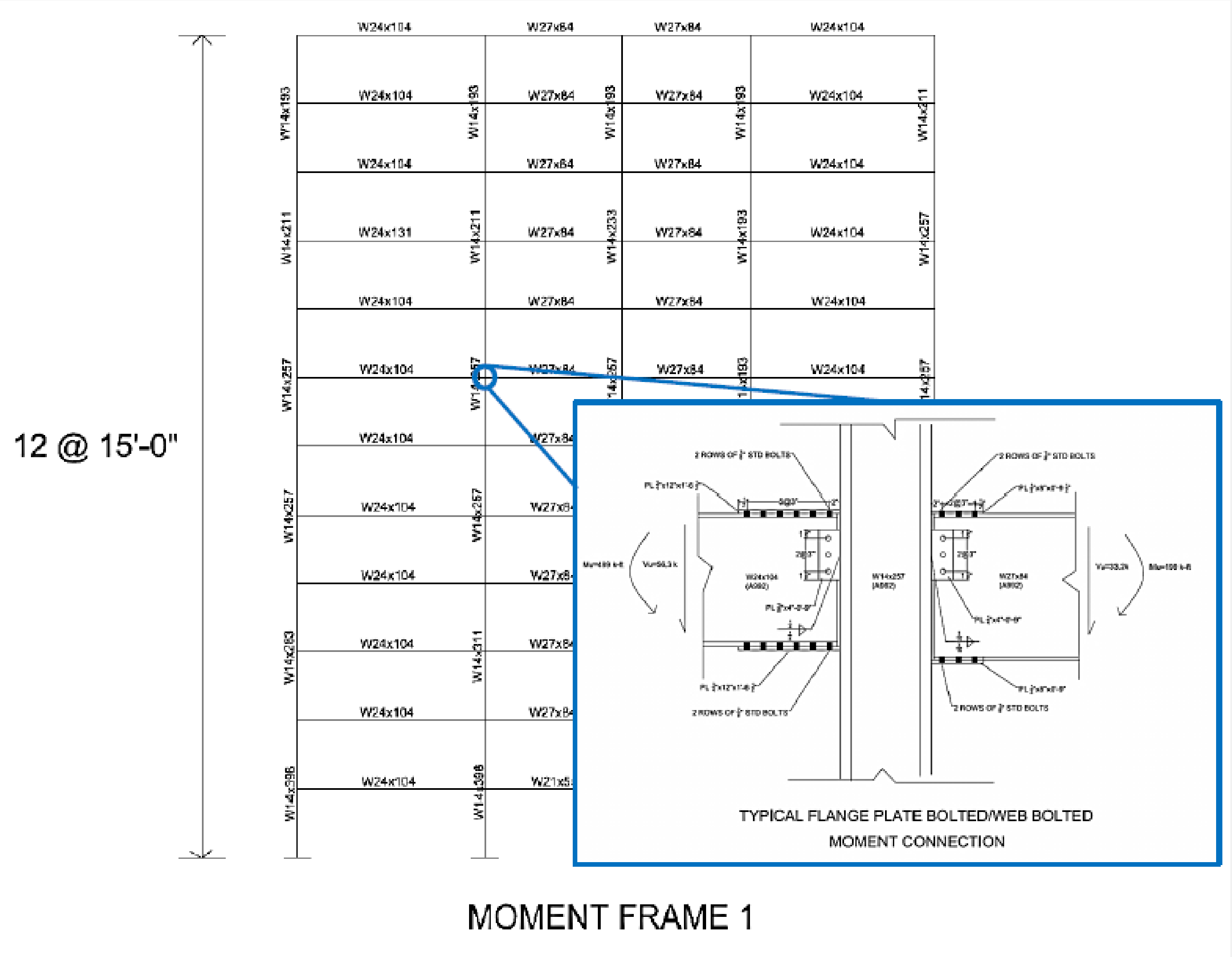
tored Seismic Loads

0.02H (in)	Inter-Story Drift X (in)	Inter-Story Drift Y (in)
3.6	0.0969	0.144
3.6	0.1323	0.1263
3.6	0.1482	0.13
3.6	0.1709	0.1275
3.6	0.1809	0.1304
3.6	0.20	0.1237
3.6	0.18	0.1104
3.6	0.191	0.0955
3.6	0.1828	0.0796
3.6	0.1741	0.0568
3.6	0.1442	0.0358
3.6	0.2309	0.032

1000 Connecticut Avenue

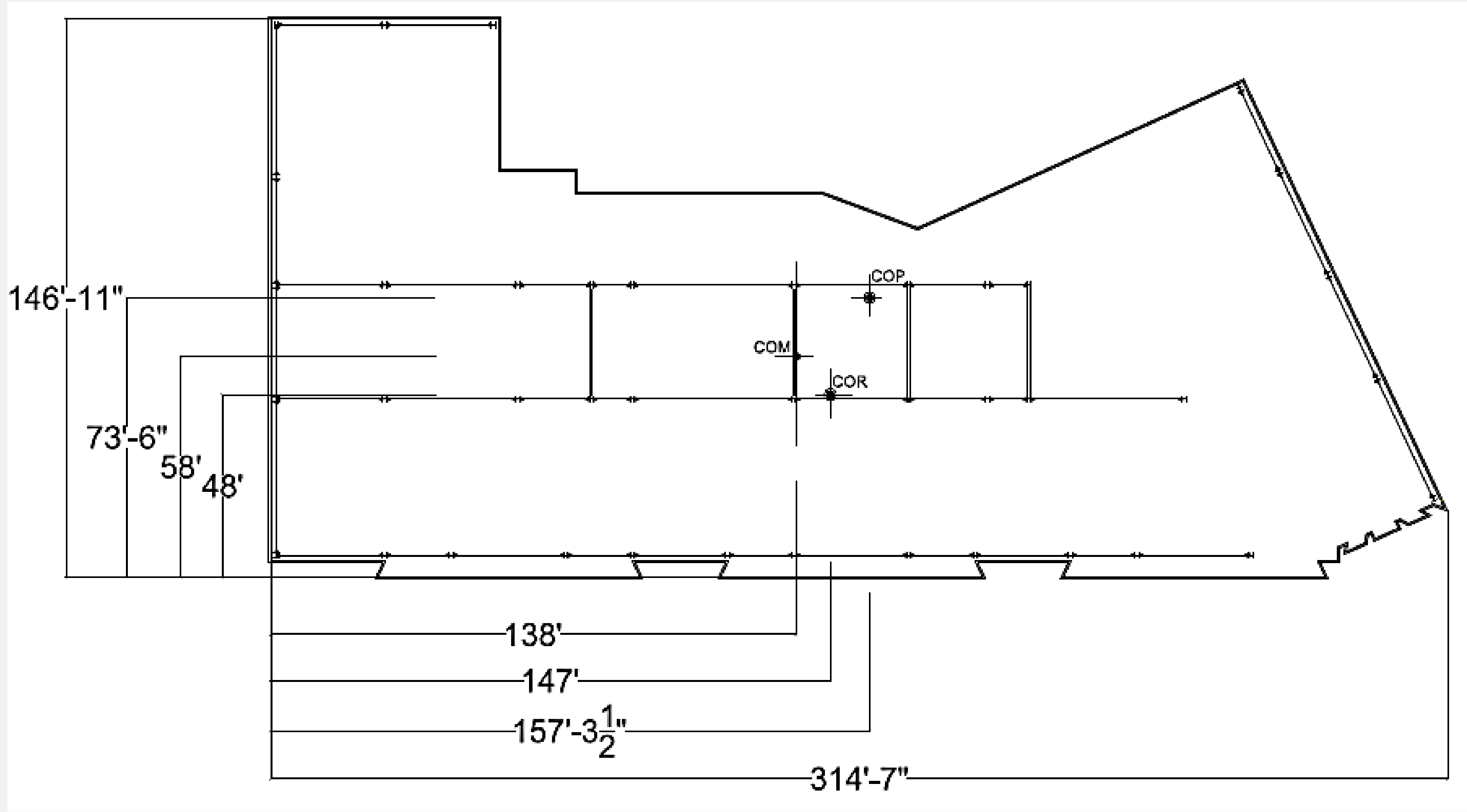
LATERAL SYSTEM RE-DESIGN

- The steel frame design check in ETABS was used to design the lateral
- Inter-story drift
  - Limited to L/400 for un-factored wind loads
  - Limited to 0.02H for un-factored seismic loads
- Typical moment connection designed in accordance to AISC 14th edition and material learned in Steel Connections Design (AE 534)



LATERAL SYSTEM RE-DESIGN

- The Lateral system was checked for
  - Building torsion due to eccentric wind



LATERAL SYSTEM RE-DESIGN

- The Lateral system was checked for
  - Building torsion due to eccentric wind
  - Relative stiffness
    - Moment frame B will resist the largest portion of the lateral load in the E-W direction
    - Brace frame 3 will resist the largest portion of the lateral load in the N-S direction

Relative Stiffness of LFRS in E-W Direction				
Frame	Displacement (12th story) X dir (in)	shear force (12th story) X dir (Kips)	Stiffness, K X dir (kip/in)	Relative Stiffness (%) X dir
MF-A.1	7.570	293.40	38.76	90.05
MF-B	7.790	335.30	43.04	100.00
MF-C	7.950	294.90	37.09	86.19
MF-E	8.320	73.30	8.81	20.47
MF-1'	7.640	47.80	6.26	14.54

Relative Stiffness of LFRS in N-S Direction				
Frame	Displacement (12th story) Y dir (in)	shear force (12th story) Y dir (Kips)	Stiffness, K Y dir (kip/in)	Relative Stiffness (%) Y dir
MF-1'	3.720	101.30	27.23	51.80
BF-1	4.400	231.30	52.57	100.00
BF-2	4.198	166.60	39.69	75.49
BF-3	4.081	178.60	43.76	83.25
BF-4	3.964	179.20	45.21	85.99

LATERAL SYSTEM RE-DESIGN

- The lateral system was checked for overturning and stability
  - Controlling load combination for checking overturning is 0.9D +1.0W
  - Resisting Moment ≥ Overturning moment in both N-S and E-W directions, therefore the structure is adequate to resist the overturning moment

Overturning Moment					
		N-S Wind		E-W Wind	
Floor	Height (ft)	Lateral Force (kips)	Moment (k-ft)	Lateral Force (kips)	Moment (k-ft)
PH Roof	198.5	152.81	30332.8	47.75	9478.4
Main Roof	180	92.39	16630.2	39.48	7106.4
12	165	184.77	30487.1	78.87	13013.6
11	150	182.83	27424.5	77.89	11683.5
10	135	179.02	24167.7	75.91	10247.9
9	120	174.57	20948.4	73.69	8842.8
8	105	172.14	18074.7	72.46	7608.3
7	90	168.25	15142.5	70.49	6344.1
6	75	162.9	12217.5	67.77	5082.8
5	60	157.55	9453.0	65.06	3903.6
4	45	151.72	6827.4	62.1	2794.5
3	30	144.43	4332.9	57.82	1734.6
2	15	132.84	1992.6	42.78	641.7
Overturning Moment=		∑=	**218031**		**88482**

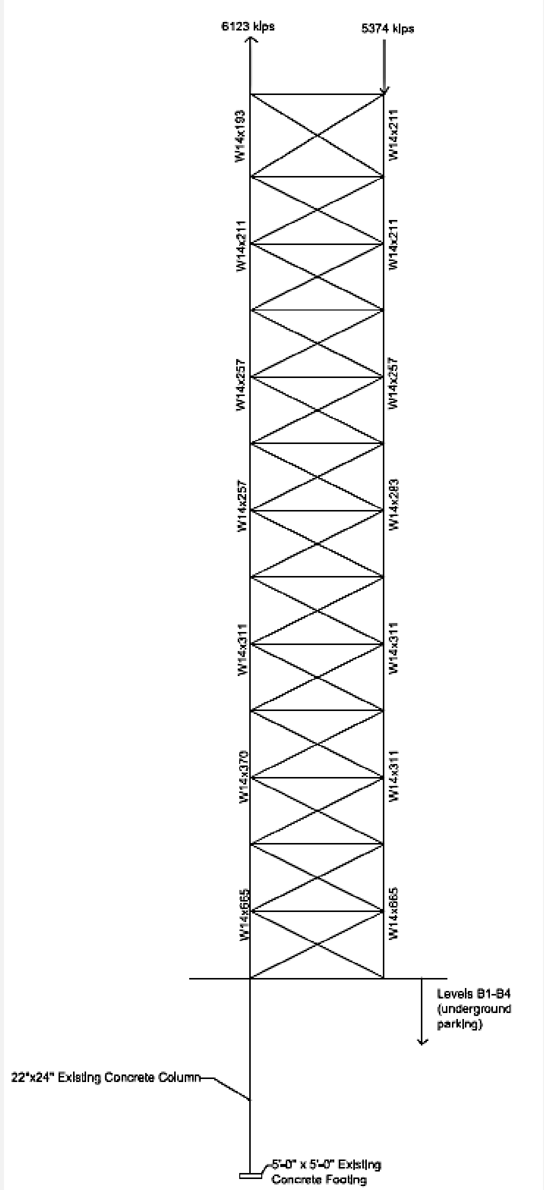
Resisting Moment				
Bulding Weight kips)	N-S Wind		E-W Wind	
	Length- Y direction (ft)	Moment (k-ft)	Length- X direction (ft)	Moment (k-ft)
38099	147	2520272	314.6	5393724
0.9* DL (kips)				
34289				

Summary of Moments		
Direction	Overturning Moment (k-ft)	Resisting Moment (k-ft)
N-S	218031	2520272
E-W	88482	5393724

1000 CONNECTICUT AVENUE

LATERAL SYSTEM RE-DESIGN

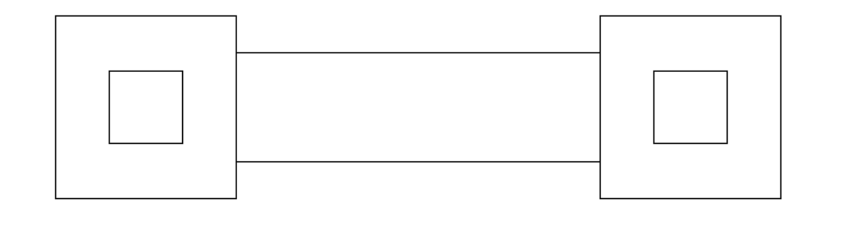
- Foundation design beyond scope of re-design, but foundation checked for uplift forces
  - The brace frames will subject the foundation to uplift
  - 0.9D+1.0W load combination controlled uplift force
  - Uplift force ≥ 0.9DL, therefore foundation will be subjected to uplift



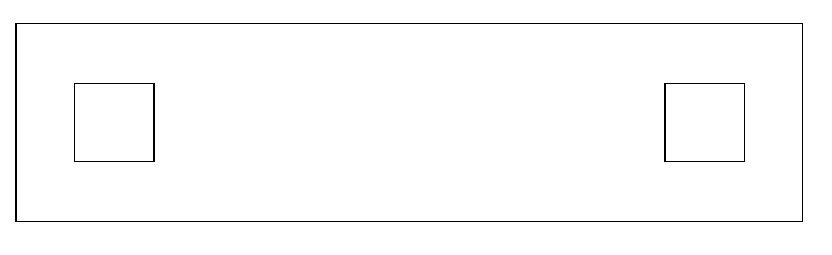
Total Load Acting on Footing supporting Column-21		
Tributary Area		
per floor or roof=	1027	ft^2
Influence Area=	3022	ft^2
Floor Dead Load= (slab+SDL+bm/gird. self-wt)	90	psf
Roof Dead Load= (slab+SDL+bm/gird. Self-wt)	90	psf
PH roof DL	32.0	kips
Parking Level DL (slab+SDL)	110	psf
steel column self-wt	65.7	kips
concrete column self wt	24.6	kips
Load Above Footing	Roof +	
	16	Floors
P_D	1610.0	kips
Total DL	1732.3	kips
0.9DL	1559.0	kips
Total Uplift Force due to controlling N-S Lateral Load	6123	kips

LATERAL SYSTEM RE-DESIGN

- Foundation design beyond scope of re-design, but foundation checked for uplift forces
  - The brace frames will subject the foundation to uplift
  - 0.9D+1.0W load combination controlled uplift force
  - Uplift force ≥ 0.9DL, therefore foundation will be subjected to uplift
  - 3 alternative foundation options for controlling uplift
    - Grade beam
    - Combined footing
    - Mat foundation



Grade beam



Combined footing

CONSTRUCTION MANAGEMENT BREADTH

- New System Cost
  - $5,994,630 increase in system cost
- Construction schedule
  - Erection of superstructure with new steel system will be completed 18 days earlier than the existing superstructure

Structural Steel System Super Structure Cost Summary	
	Total Cost
Gravity Beams	$1,109,598
Gravity Girders	$907,770
Moment Frame Beam/ Girder Members	$2,229,921
Gravity Columns	$287,164
Moment Frame Columns	$2,350,577
Braces	$764,853
Column Base Plates Connections	$4,952
Colum Splice Connections	$138,207
Orthogonal Shear Coonnections	$255,409
Skewed Shear Connections	$8,101
Moment Frame Connections	$235,523
Brace Frame Connections	$147,783
Steel Floor Deck	$985,470
Shear Studs	$52,869
Sprayed Cementious Fireproofing	$580,587
Elevated Slabs	$1,760,434
Total Steel Structure Bare Cost	**$11,819,218**
SYSTEM	**COST**
B-4 SOG	$400,000
Building Foundations (footings & strap beams)	$725,000
Lower level (B-4 to 1st flr) foundation walls	$1,200,000.00
Columns and elevated decks (B-4 to 1st flr)	$3,140,000.00
Misc. subcontractor costs (submittals, gen. conditions, tower crane, etc.)	$250,000.00
Total Bare Superstructure Cost	$17,534,218.05
O & P	10% O&P
Location Adjustment	92/100
Grand Total	$17,744,628.67

Existing Concrete Super Structure Cost Summary	
B-4 SOG	$400,000
Building Foundations (footings & strap beams)	$725,000
Lower level (B-4 to 1st flr) foundation walls	$1,200,000.00
Columns and elevated decks (B-4 to 1st flr)	$3,140,000.00
Misc. subcontractor costs (submittals, gen. conditions, tower crane, etc.)	$250,000.00
Columns from 1st floor & elevated decks up through penthouse roof	$6,035,000.00
Grand Total	**$11,750,000.00**

1000 CONNECTICUT AVENUE

CONSTRUCTION MANAGEMENT BREADTH

- New System Cost
  - $5,994,630 increase in system cost
- Construction schedule
  - Erection of superstructure with new steel system will be completed 18 days earlier than the existing superstructure
- Site Logistics
  - Site logistics study was conducted to determine how concrete and steel will have to be managed differently on the same site.
  - The existing project used Ox Blue, a web camera , to track the on-site progress of the project

October 2009

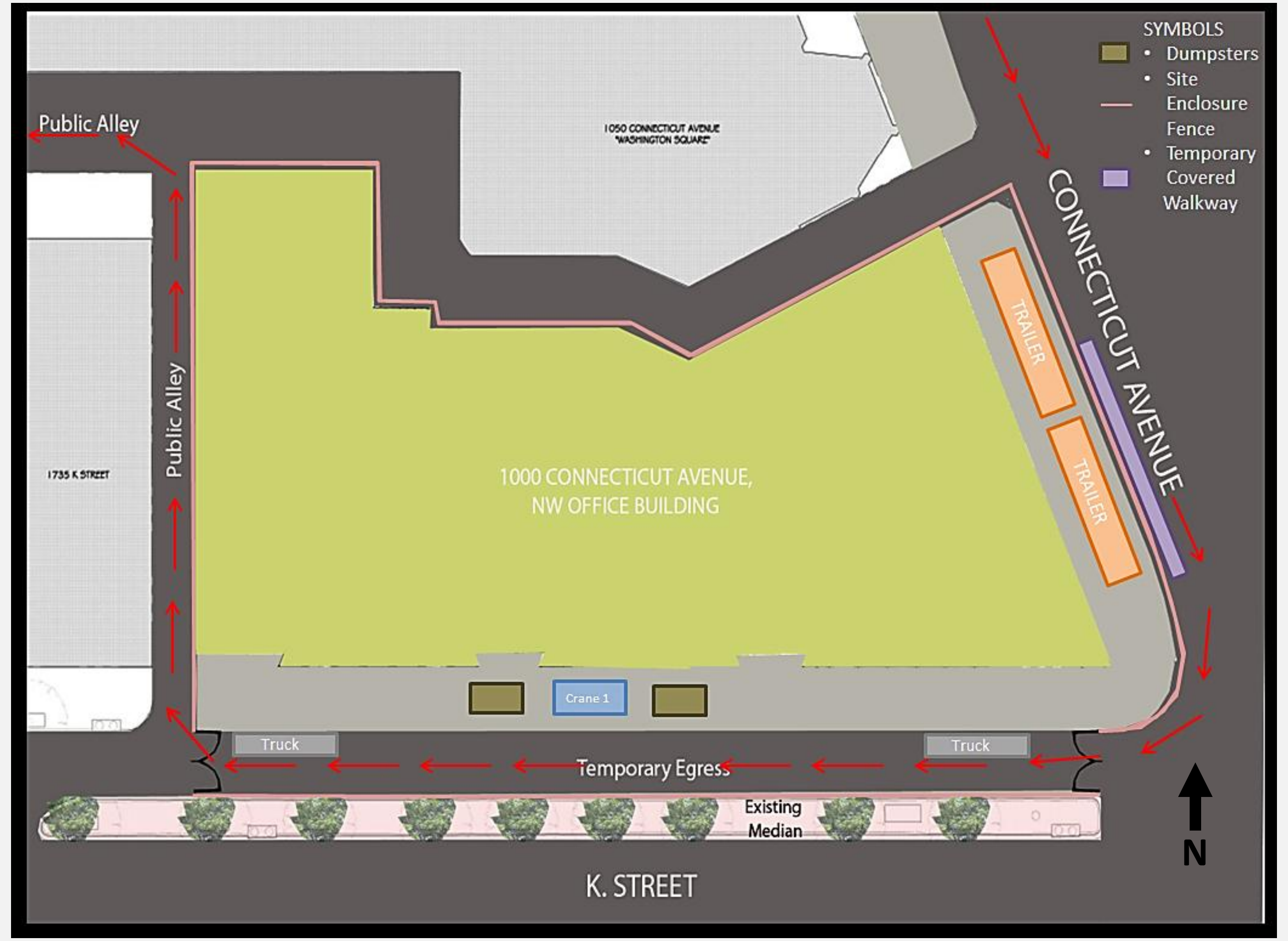
December 2009

April 2010

March 2011

CONSTRUCTION MANAGEMENT BREADTH

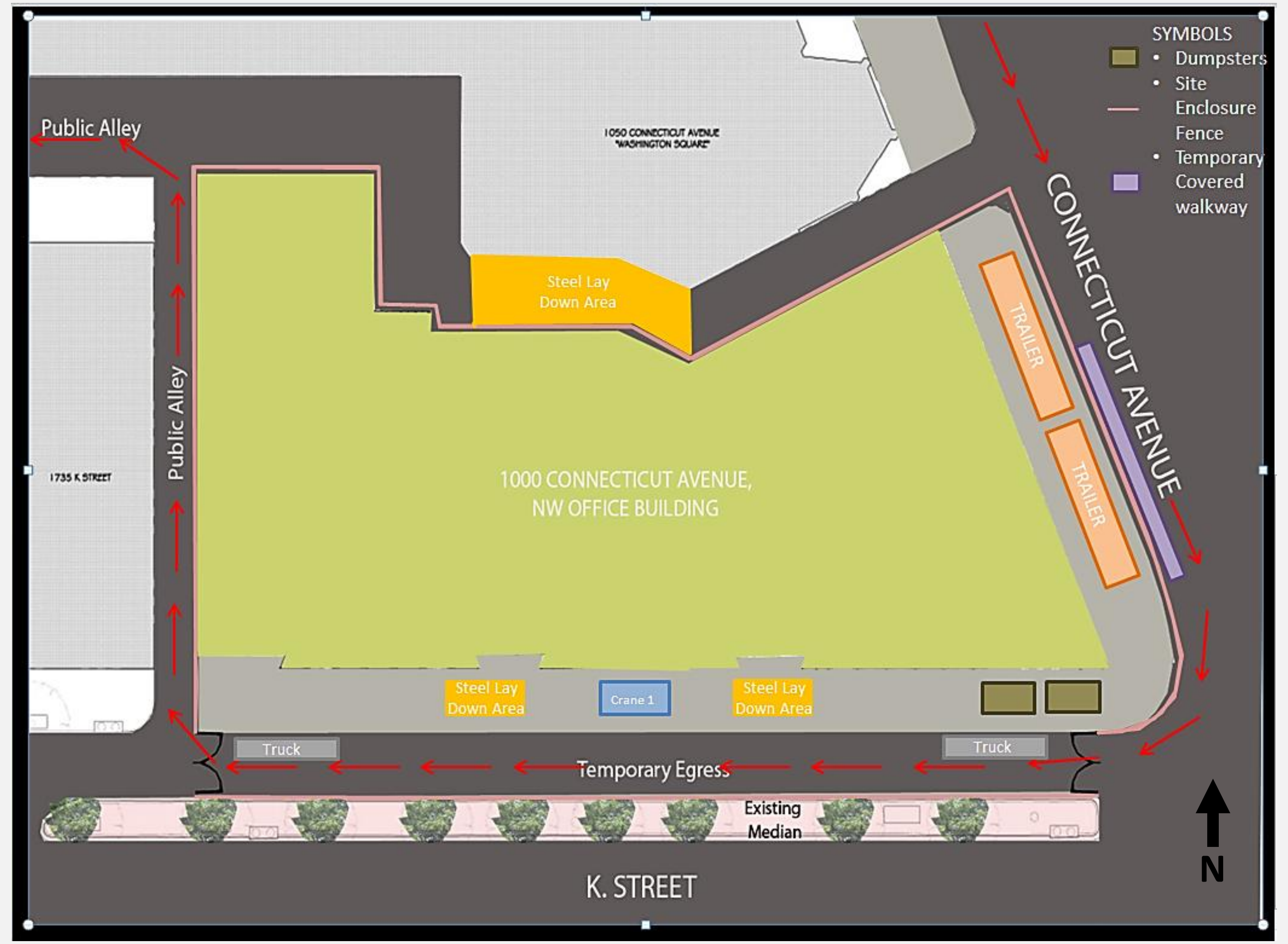
- New System Cost
  - $5,994,630 increase in system cost
- Construction schedule
  - Erection of superstructure with new steel system will be completed 18 days earlier than the existing superstructure
- Site Logistics
  - Site logistics study was conducted to determine how the existing site will have to be managed differently for steel vs. concrete
  - The existing project used Ox Blue, a web camera used to track the on-site progress of the project
    - Conn. Ave and public alley ways used for egress
    - Trailers located along Conn. Ave, which provides good viewing location for project managers and engineers
    - Crane and bucket used to pour and place concrete



Existing concrete system's site logistics

CONSTRUCTION MANAGEMENT BREADTH

- New System Cost
  - $5,994,630 increase in system cost
- Construction schedule
  - Erection of superstructure with new steel system will be completed 18 days earlier than the existing superstructure
- Site Logistics
  - Site logistics study was conducted to determine how the existing site will have to be managed differently for steel vs. concrete
  - The existing project used Ox Blue, a web camera used to track the on-site progress of the project
    - Conn. Ave and public alley ways used for egress
    - Trailers located along Conn. Ave, which provides good viewing location for project managers and engineers
    - Crane and bucket used to pour and place concrete
  - New System
    - Site logistics will be similar to that of the existing system
    - Lay down areas adjacent to crane and on the North facing side of the building



proposed site logistics plan for steel construction

CONSTRUCTION MANAGEMENT BREADTH

- LEED Certification Check
  - Building will remain LEED Gold certified with new steel system
- Revenue
  - Current asking price: $55.00 per sq. ft.
  - Additional amenities of higher floor-to-ceiling heights and wider bays will increase the asking cost to an additional $10 to 20 per sq. ft.
  - New system will increase building annual revenue an additional $3,705,450

Annual Revenue				
Ammenities	Existing Structural System Layout		NewStructural System Layout	
Avg. column spacing	30'-0"		35'-0"	
Floor-to-ceiling Ht	8'-6"		10'-6"	
# of columns above grade	89		55	
Total rentable office area	370545	sf. ft.	370545	sf. ft
Total rentable retail area	15246	sf. ft.	15246	sf. ft.
cost per sq. ft.	$55.00		$65.00	
Annual Revenue	**$20,379,975.00**		**$24,085,425.00**	
Additional Annual Revenue Obtained from New Structural System Layout	**$3,705,450.00**			

SUMMARY

GOALS

- Increase the bay sizes to open the floor plan layout
- Increase floor-to-floor height to increase the openness of the space
- Reduce the construction schedule
- Reduce the structural system cost
- Increase the annual revenue by increasing the rental value of the space and increasing the amount of rentable space

RESULTS

- Increased average bay size from 30' to 35'
- Increase floor-to-floor height from 10'-7" to 15'-0"
- Increased floor-to-ceiling height from 8-6" to 10'-6"
- Reduced the construction schedule by 18 days
- Structural system cost increased $6,000,000
- Increased rental value of space, therefore resulting in an increased annual revenue of $3,705,450

After the design and analysis, I can conclude that the proposed steel system is a viable alternative system to use in Arlington, VA since the new system has many additional benefits compared to the existing structural system.

ACKNOWLEDGEMENTS

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- SK&A Structural Engineers
- MJ Tyler and Associates
- WDG Architecture
- Girard Engineering

- All AE Faculty and Staff
  - Dr. Linda Hanagan

- Family and friends for their support

QUESTIONS??