

JAKE POLLACK
STRUCTURAL OPTION
AE 897G – SENIOR THESIS



NEW YORK POLICE ACADEMY
COLLEGE POINT, NEW YORK

PRESENTATION OUTLINE

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PROBLEM SOLUTION

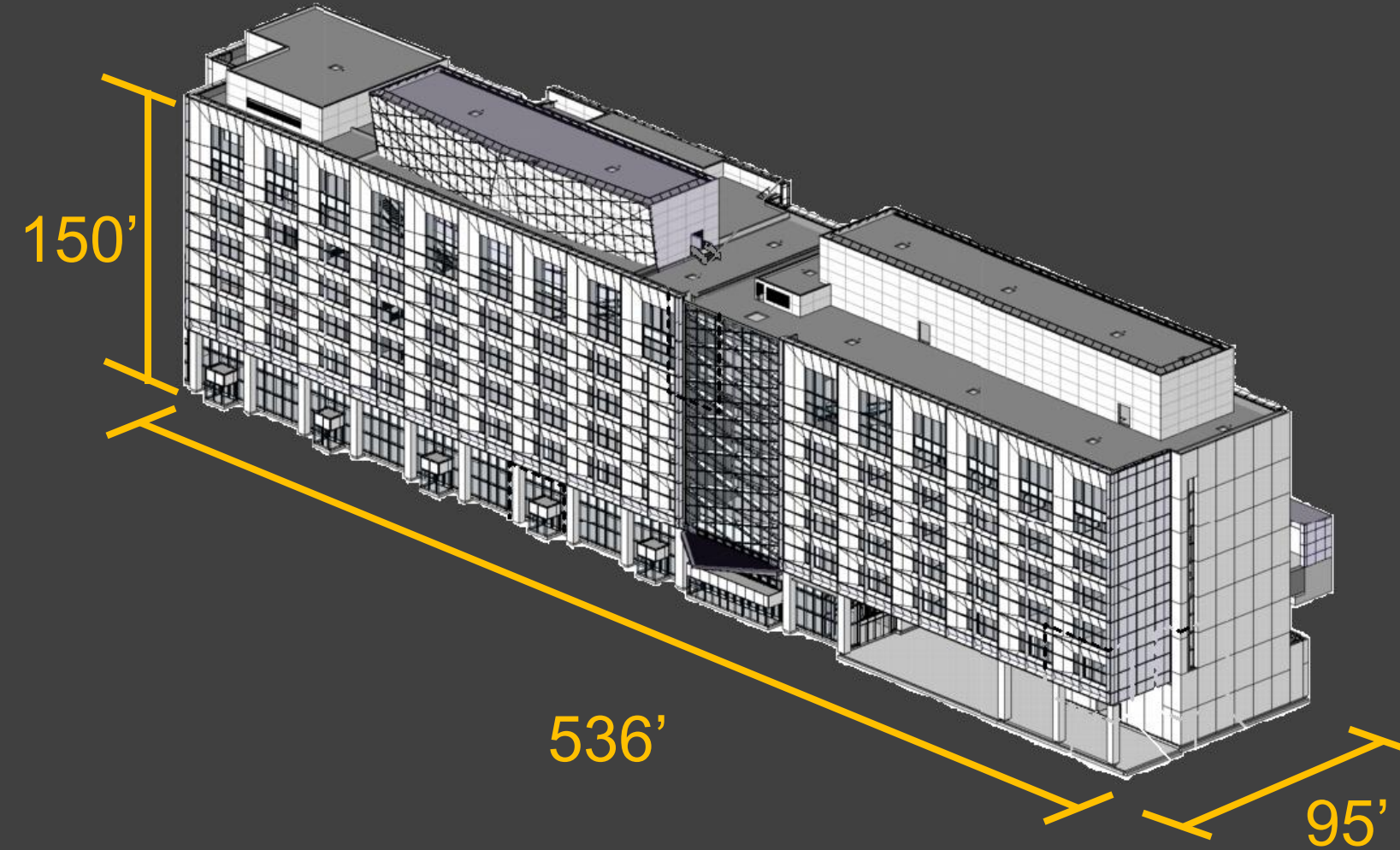
THESIS REDESIGN

ARCHITECTURAL IMPACT

COST AND SCHEDULE IMPACT

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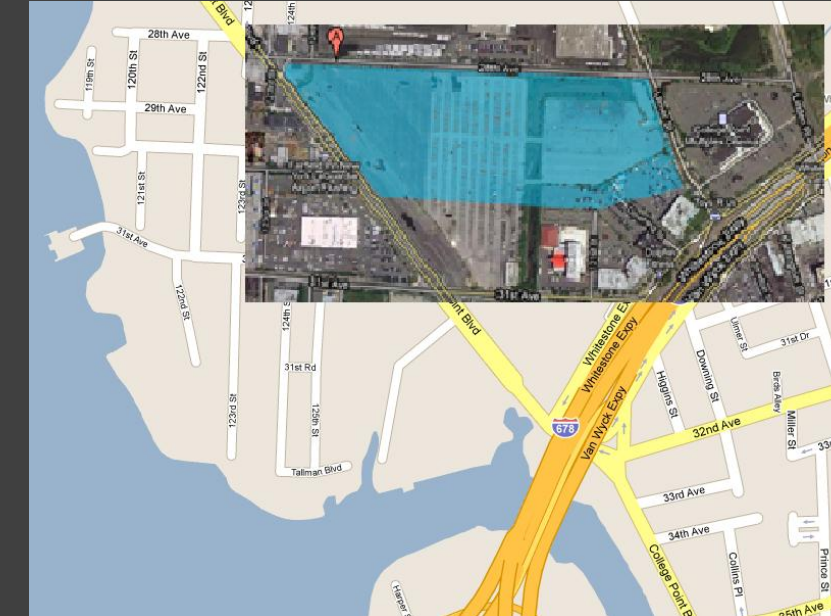
NEW YORK POLICE ACADEMY COLLEGE POINT, NEW YORK

PURPOSE AND FEATURES

FUNCTION: ACADEMY

SCALE: 1,000,000 SF
\$656 MILLION

CONSTRUCTION: DESIGN-BID-BUILD
OCTOBER 2010 – DECEMBER 2013



MAPS.GOOGLE.COM

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PROJECT TEAM

OWNER: NEW YORK DEPARTMENT OF
CONSTRUCTION AND DESIGN

CONSTRUCTION: TURNER CONSTRUCTION

ARCHITECT: PERKINS + WILL

STRUCTURAL ENGINEER: ROBERT SILMAN ASSOCIATES

MEPF ENGINEER: WSP FLACK + KURTZ

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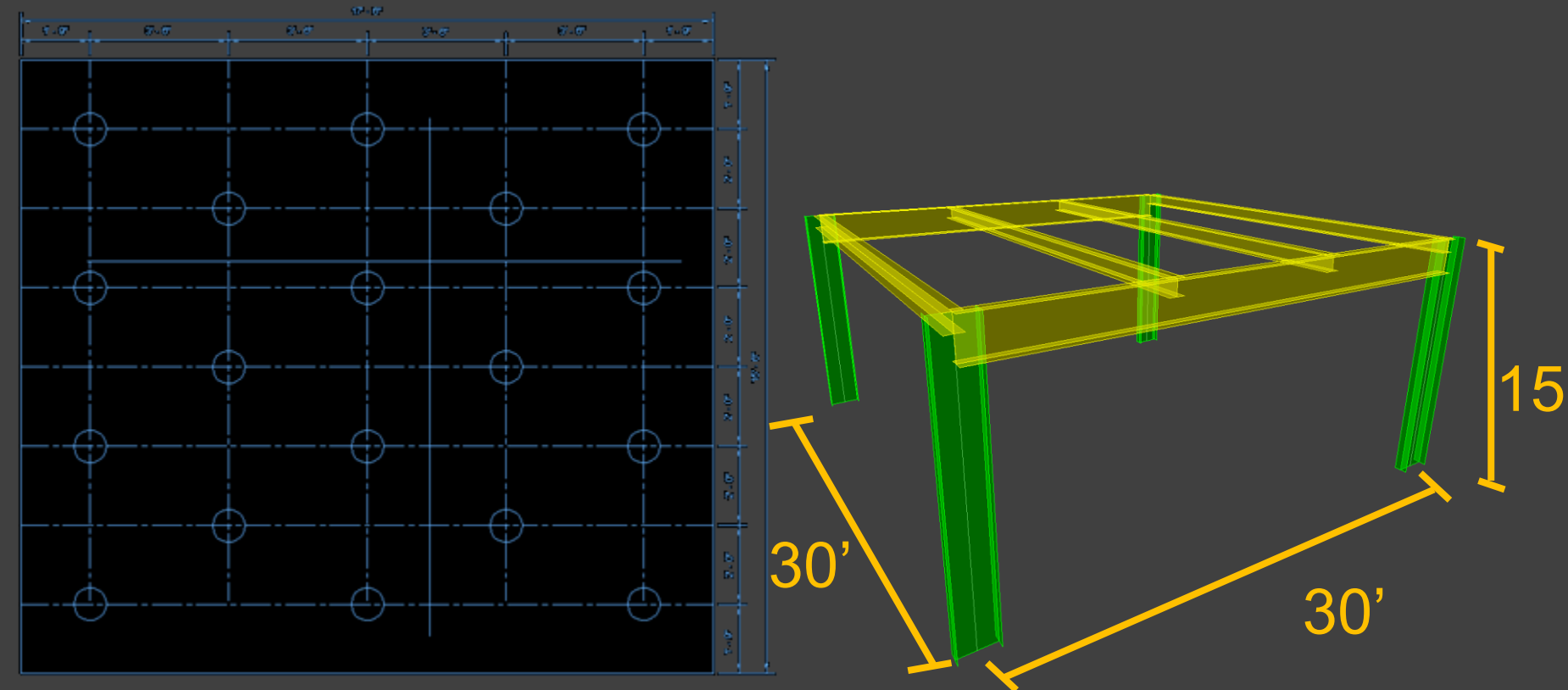
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THE EXISTING SYSTEM

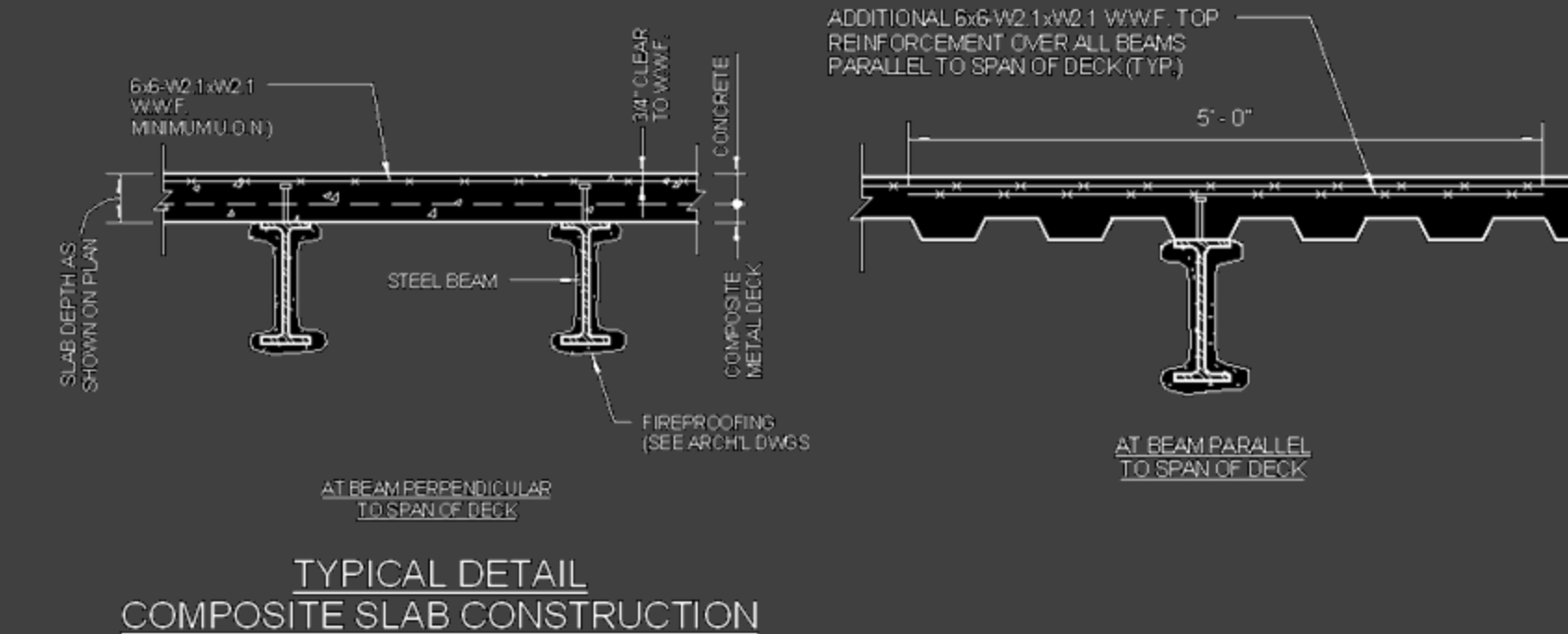
EXISTING FOUNDATION

EXISTING FRAMING SYSTEM



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EXISTING FLOOR SYSTEM



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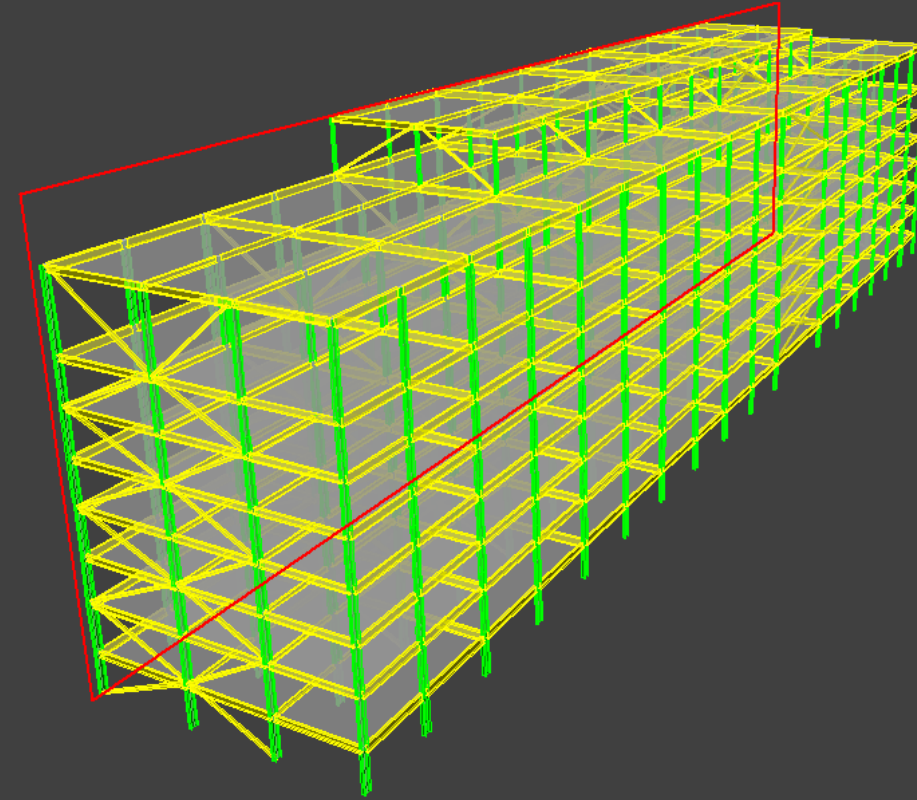
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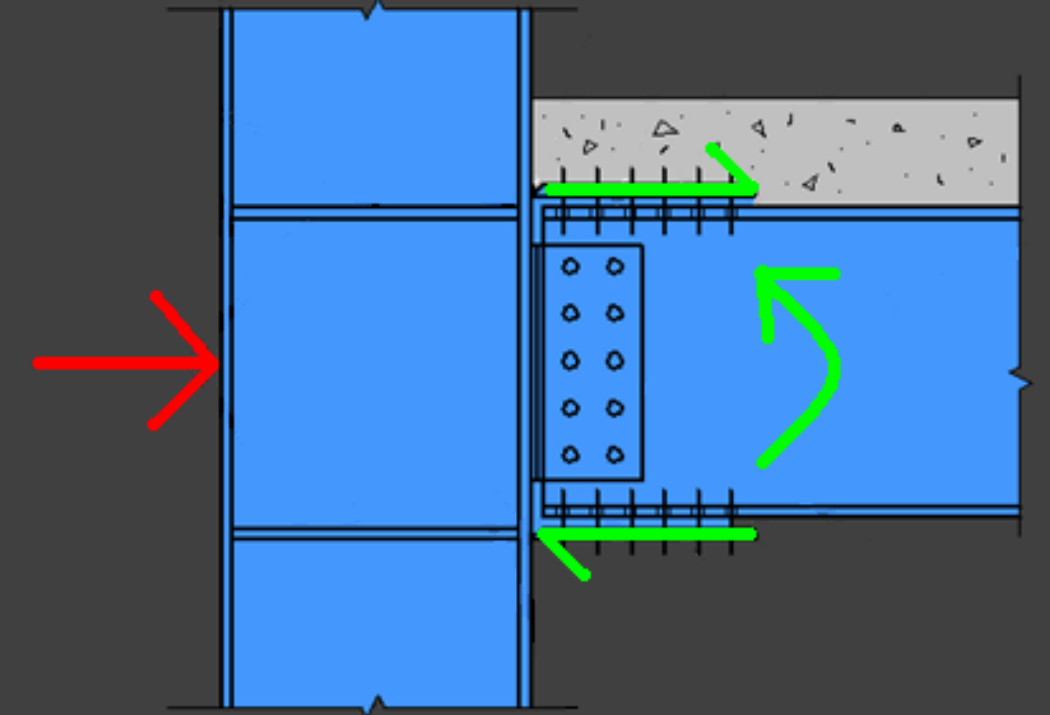
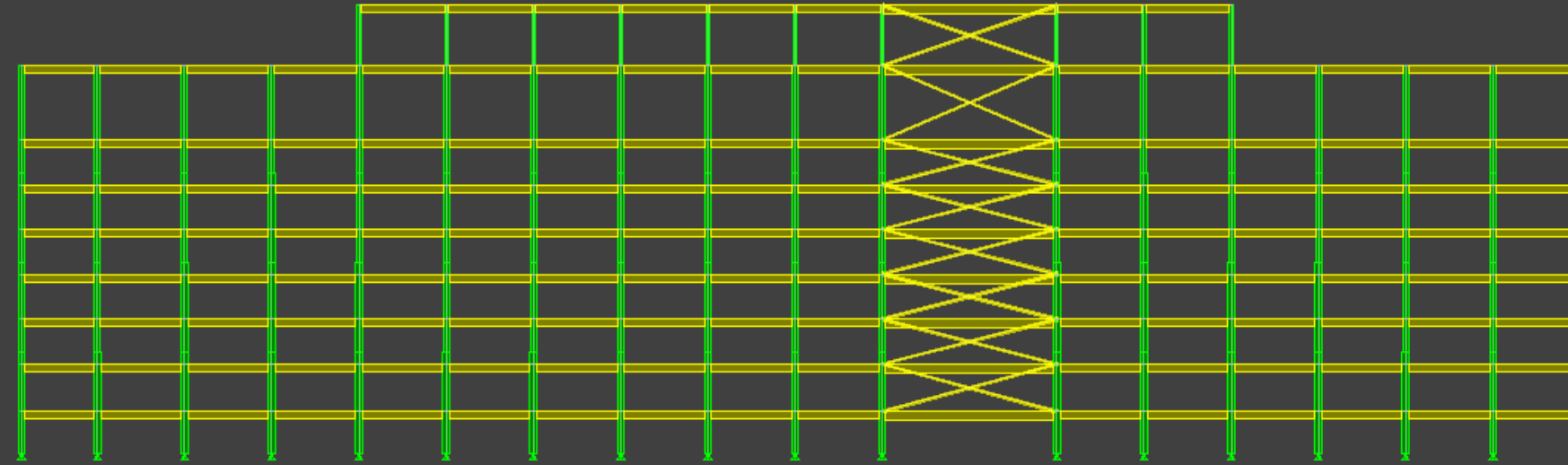
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X-FRAME



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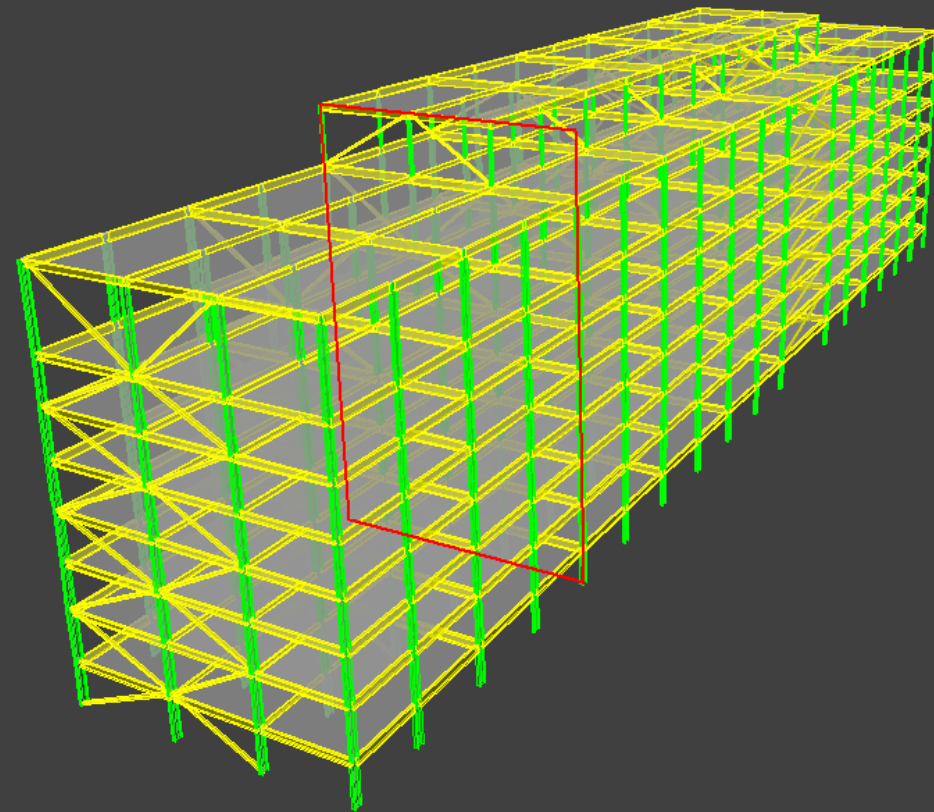
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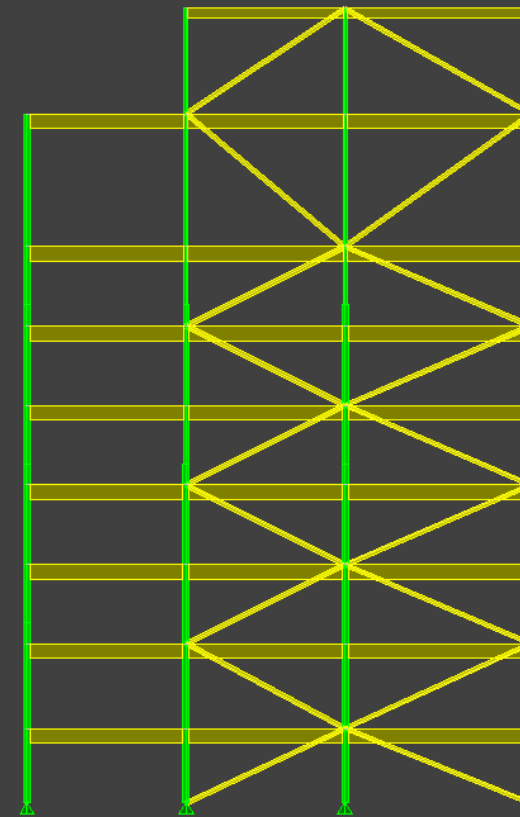
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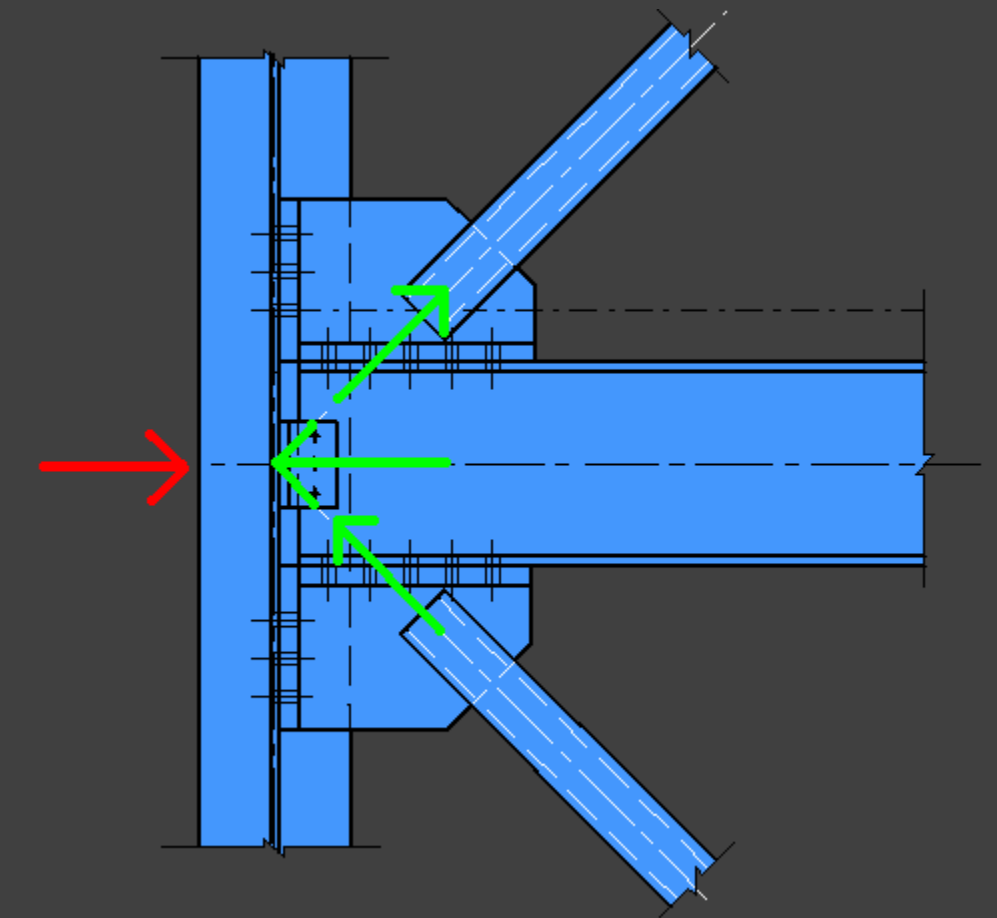


THE EXISTING SYSTEM

Y-FRAME



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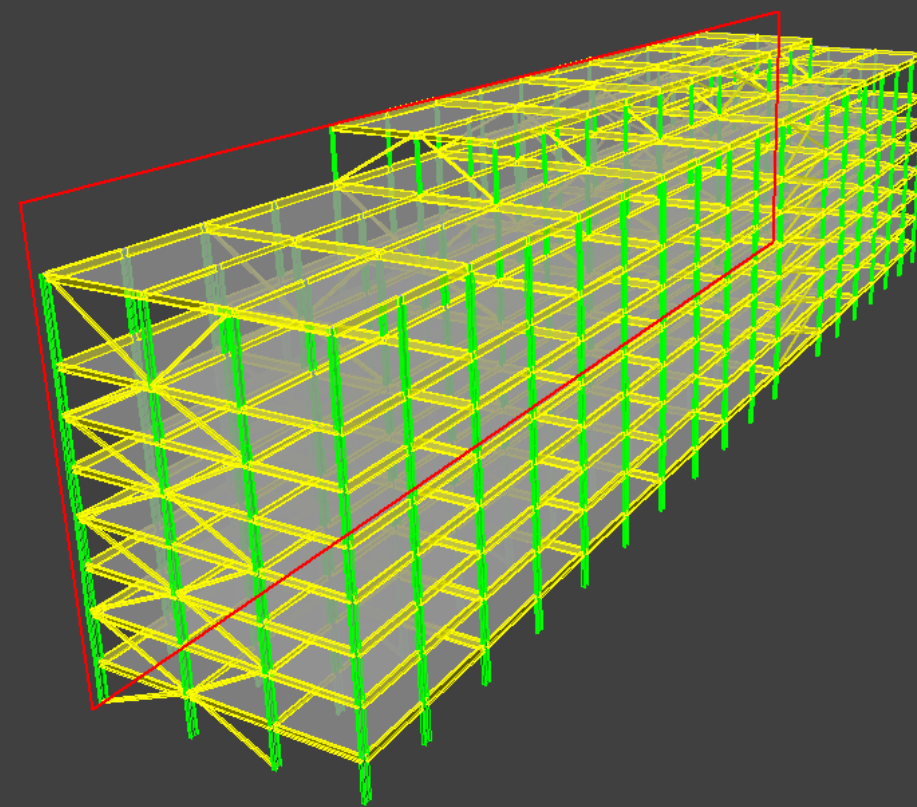
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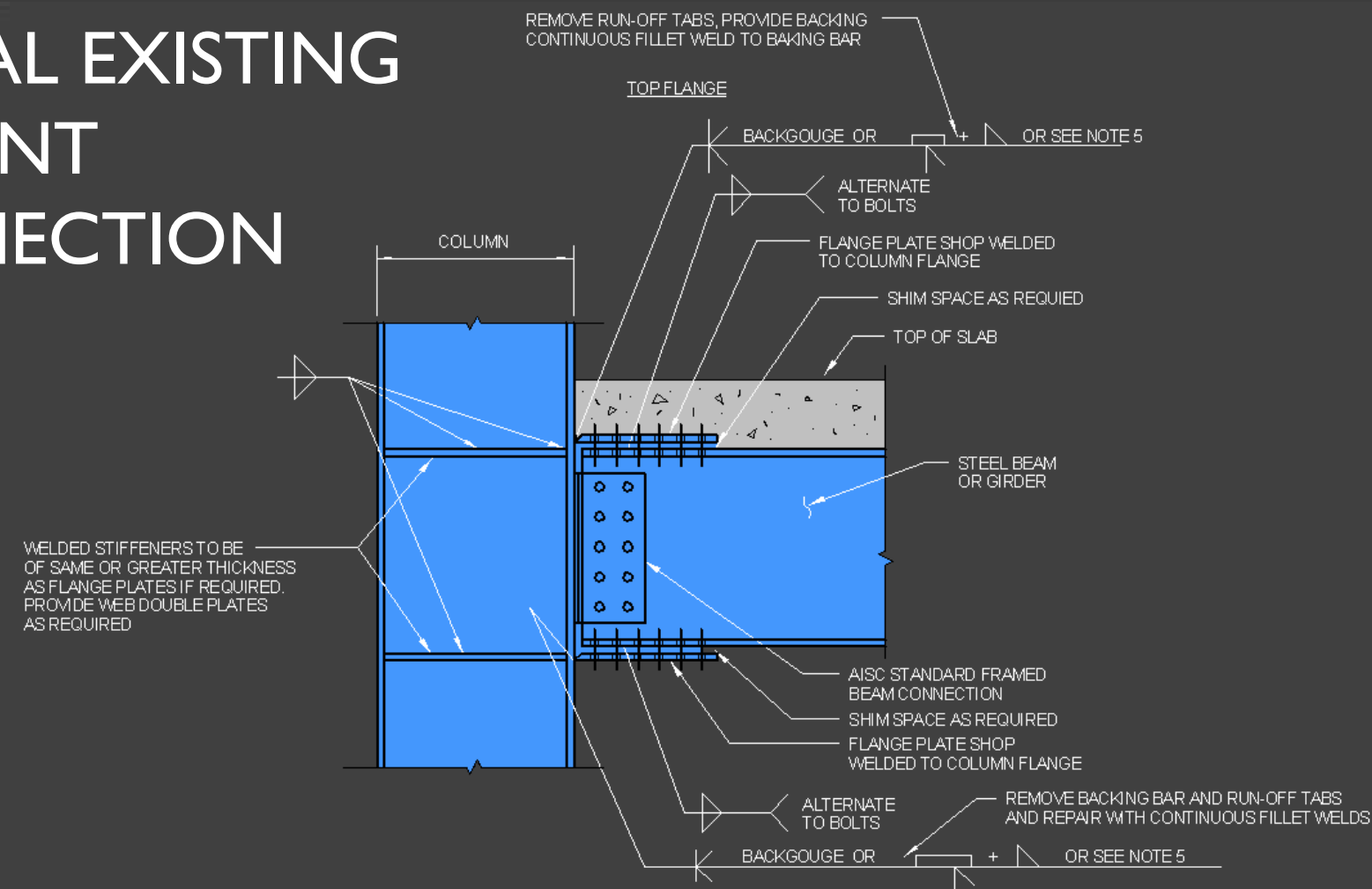
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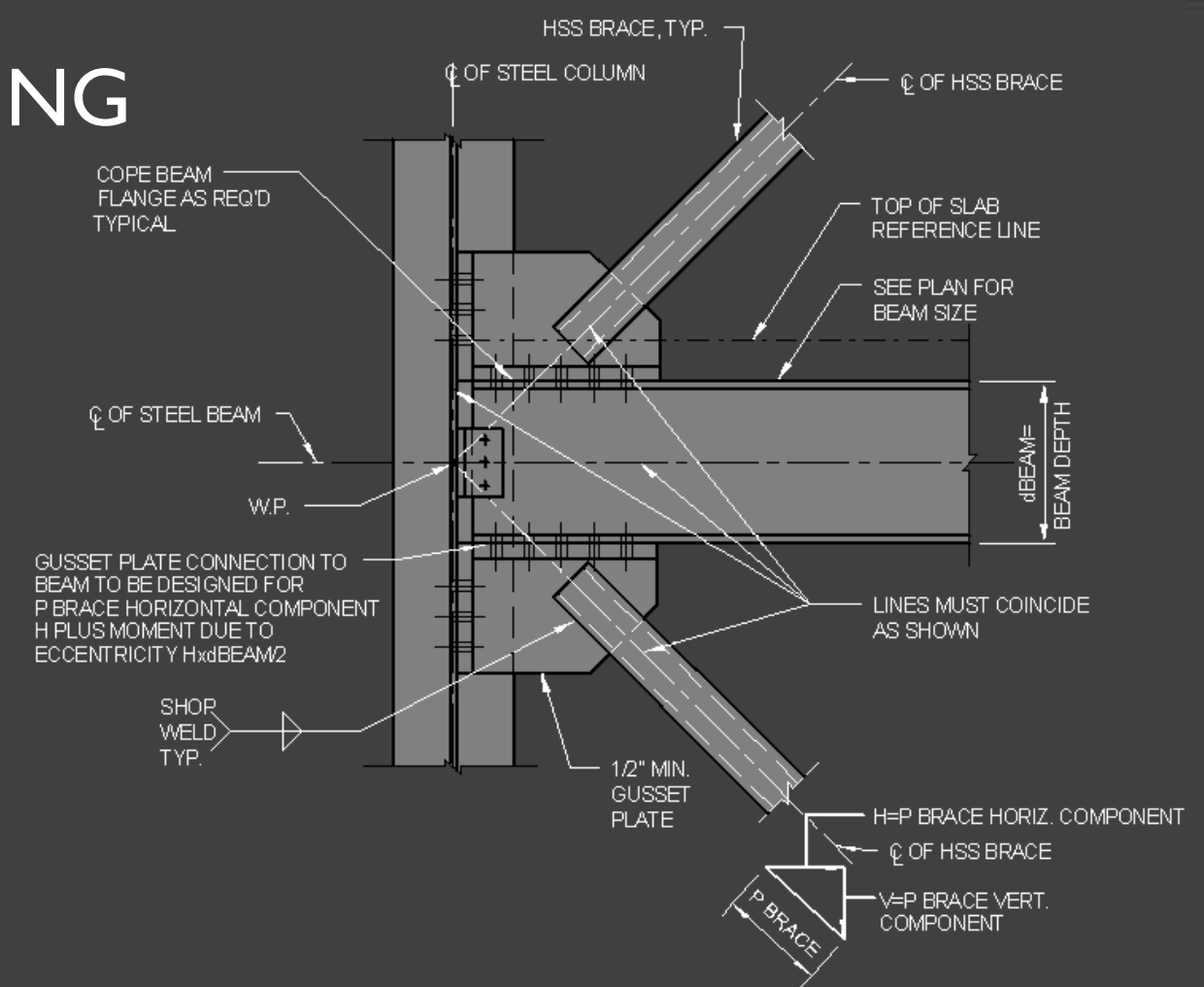
THE PROBLEM

TYPICAL EXISTING MOMENT CONNECTION



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TYPICAL EXISTING HSS CBF CONNECTION



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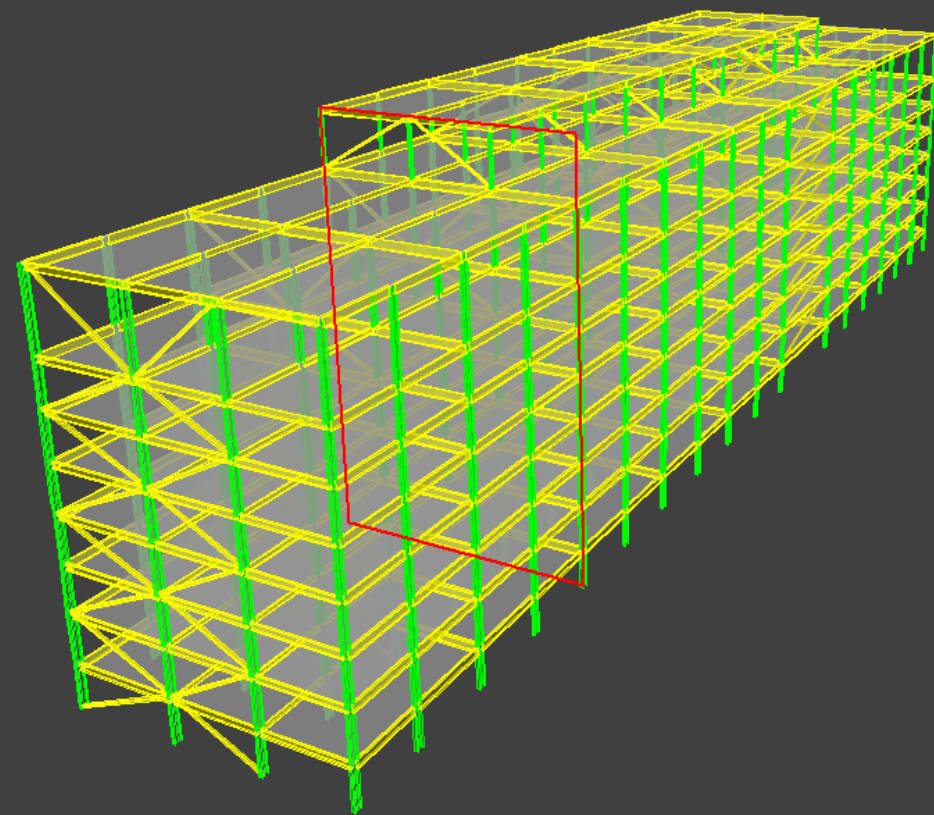
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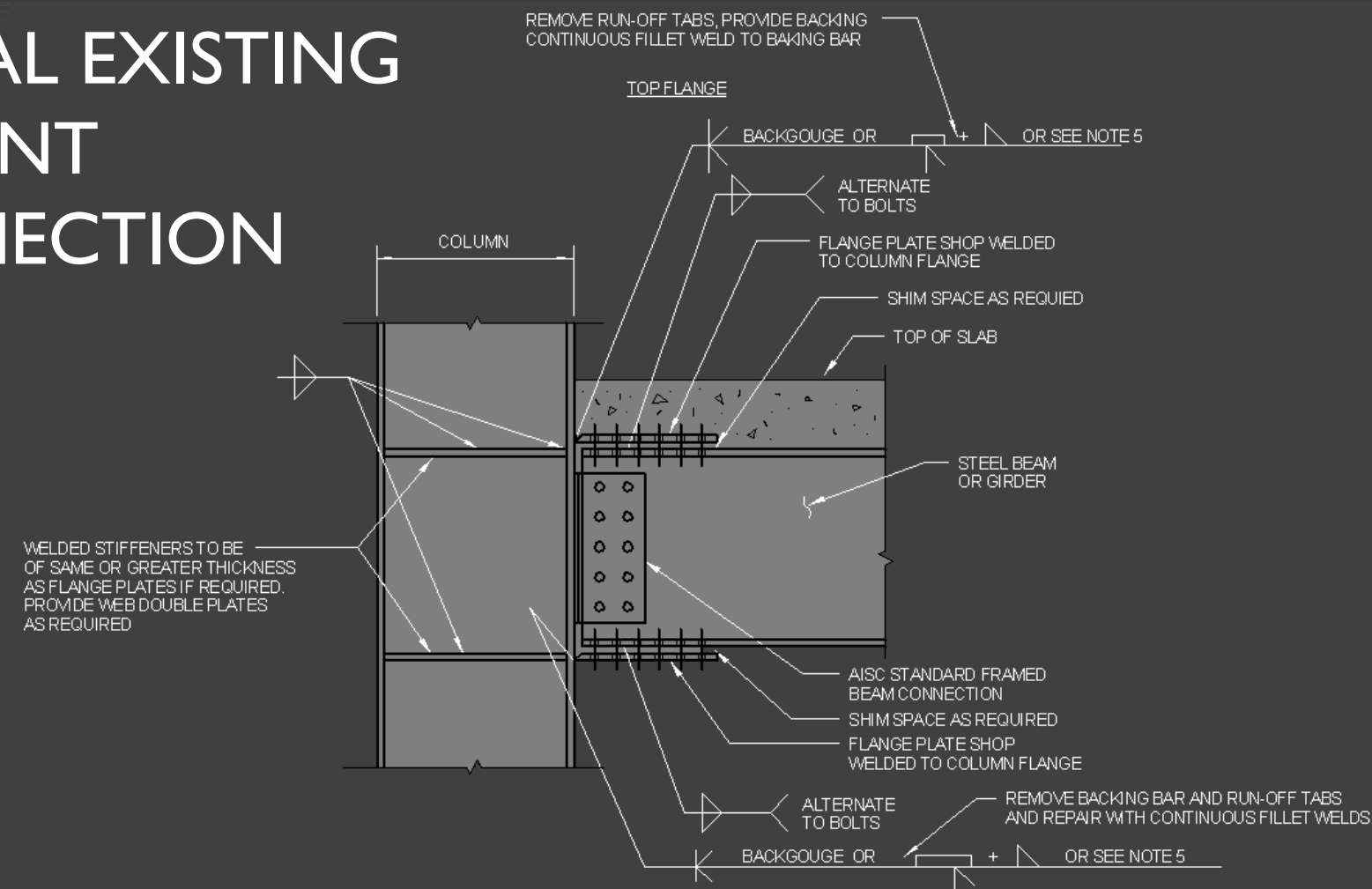
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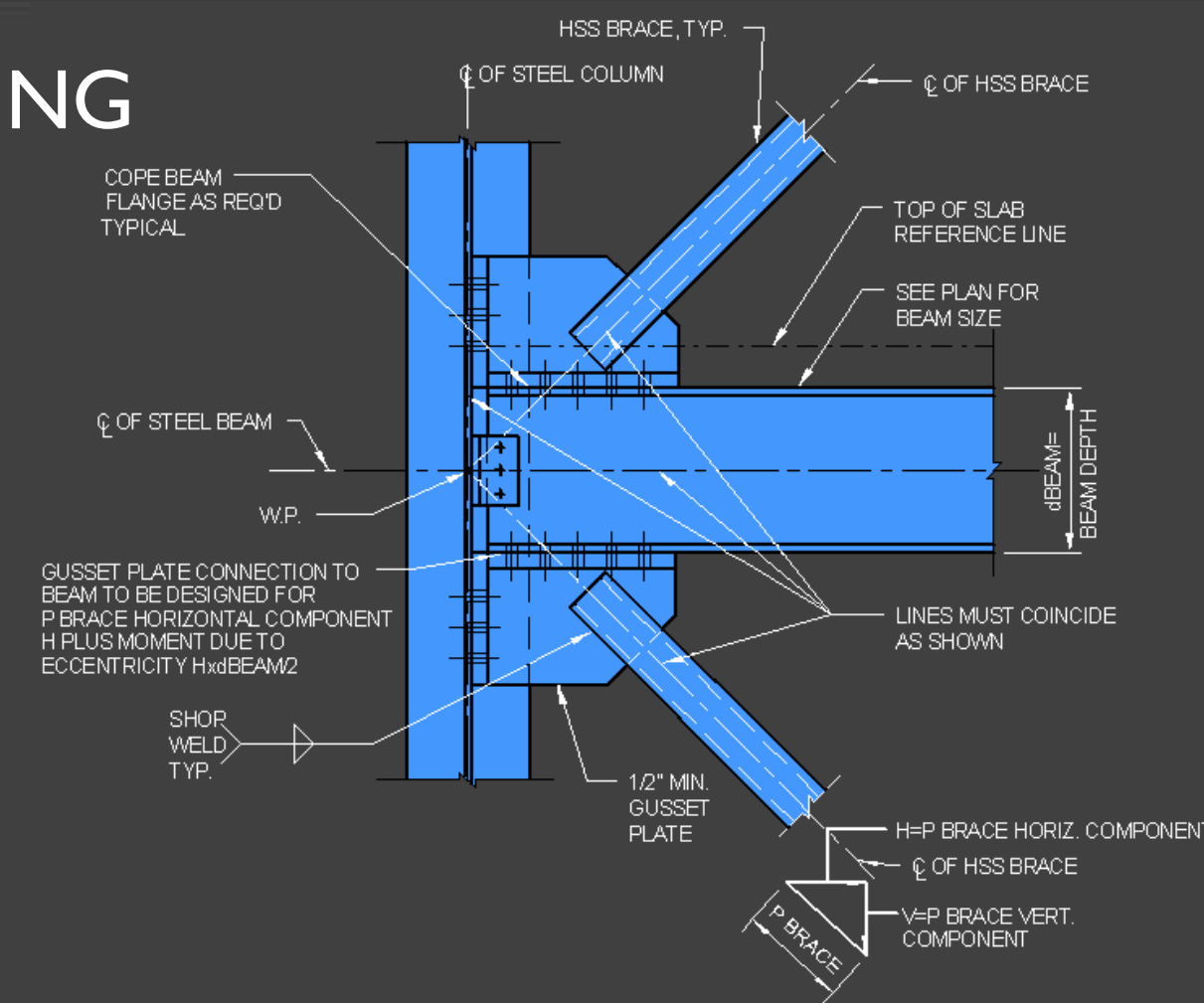


THE PROBLEM

TYPICAL EXISTING MOMENT CONNECTION



TYPICAL EXISTING HSS CBF CONNECTION



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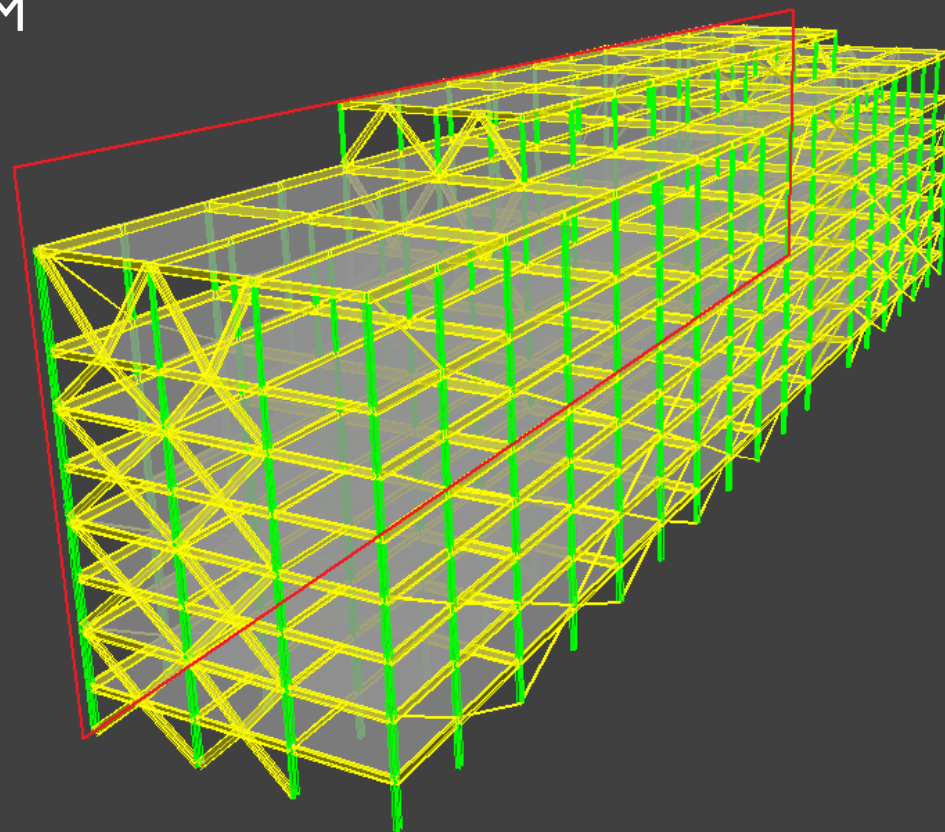
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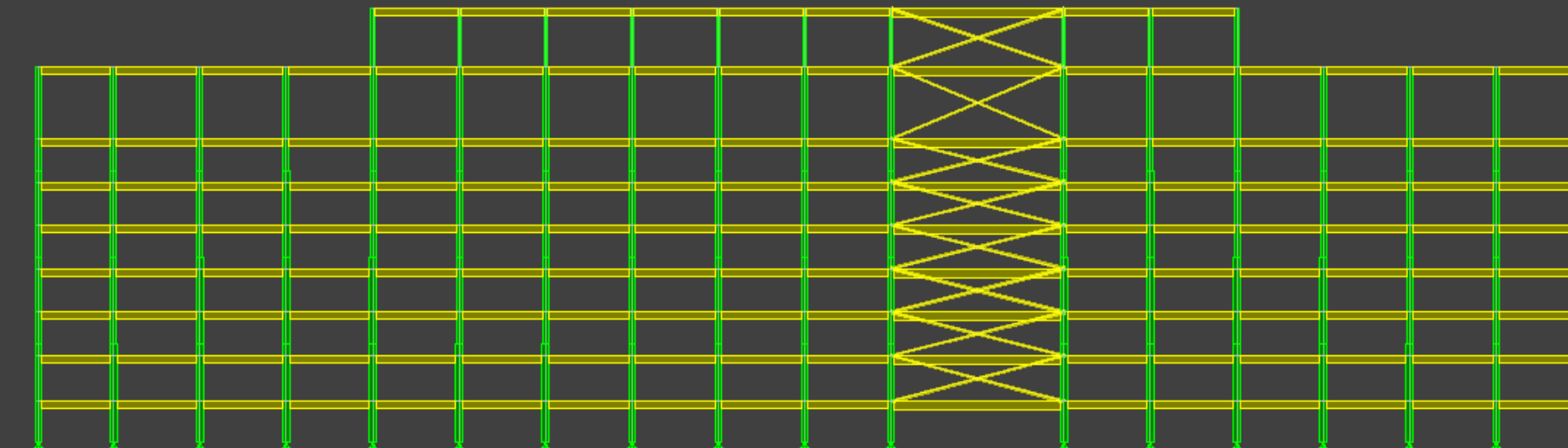
THE SOLUTION

LATERAL SYSTEM POSSIBILITIES

COMBINATION #	X-FRAME	Y-FRAME
1	MOMENT FRAMES	CONCENTRICALLY BRACED FRAMES
2	MOMENT FRAMES	ECCENTRICALLY BRACED FRAMES
3	MOMENT FRAMES	MOMENT FRAMES
4	CONCENTRICALLY BRACED FRAMES	CONCENTRICALLY BRACED FRAMES
5	CONCENTRICALLY BRACED FRAMES	ECCENTRICALLY BRACED FRAMES
6	CONCENTRICALLY BRACED FRAMES	MOMENT FRAMES
7	ECCENTRICALLY BRACED FRAMES	CONCENTRICALLY BRACED FRAMES
8	ECCENTRICALLY BRACED FRAMES	ECCENTRICALLY BRACED FRAMES
9	ECCENTRICALLY BRACED FRAMES	MOMENT FRAMES

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X-FRAME



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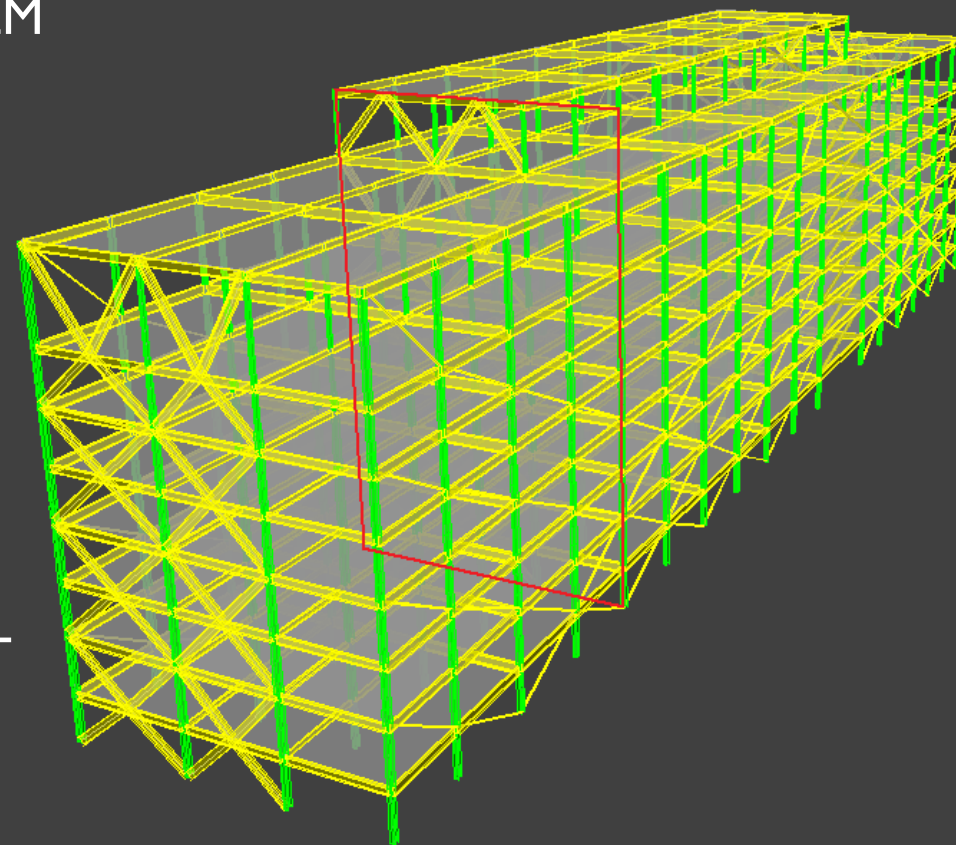
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ARCHITECTURAL IMPACT

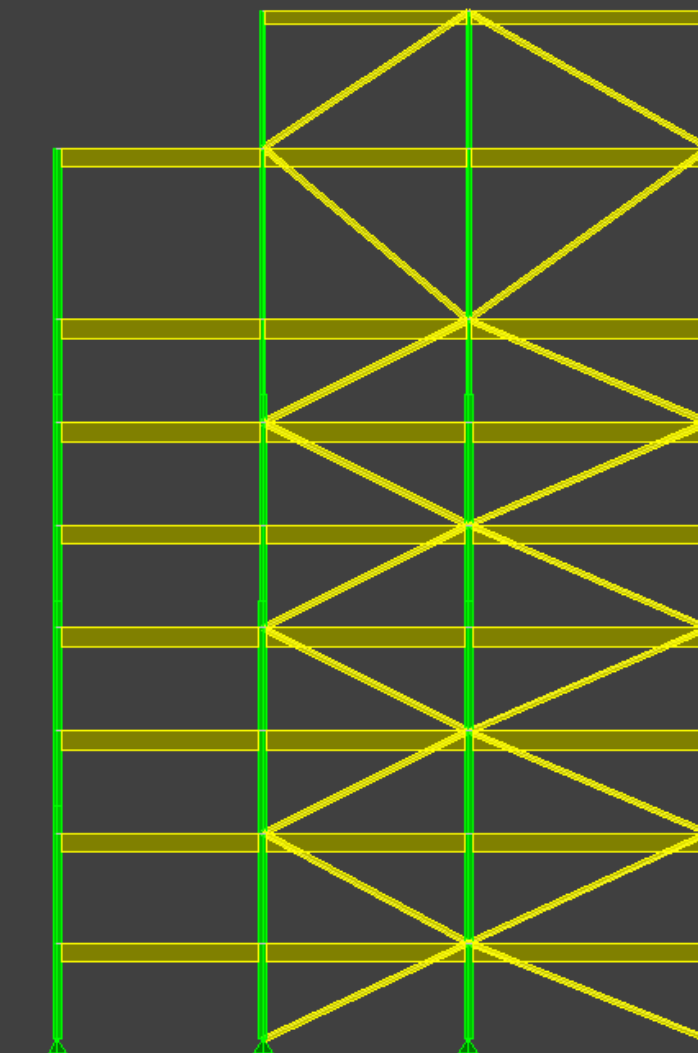
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LATERAL SYSTEM POSSIBILITIES		
COMBINATION #	X-FRAME	Y-FRAME
1	MOMENT FRAMES	CONCENTRICALLY BRACED FRAMES
2	MOMENT FRAMES	ECCENTRICALLY BRACED FRAMES
3	MOMENT FRAMES	MOMENT FRAMES
4	CONCENTRICALLY BRACED FRAMES	CONCENTRICALLY BRACED FRAMES
5	CONCENTRICALLY BRACED FRAMES	ECCENTRICALLY BRACED FRAMES
6	CONCENTRICALLY BRACED FRAMES	MOMENT FRAMES
7	ECCENTRICALLY BRACED FRAMES	CONCENTRICALLY BRACED FRAMES
8	ECCENTRICALLY BRACED FRAMES	ECCENTRICALLY BRACED FRAMES
9	ECCENTRICALLY BRACED FRAMES	MOMENT FRAMES

Y-FRAME



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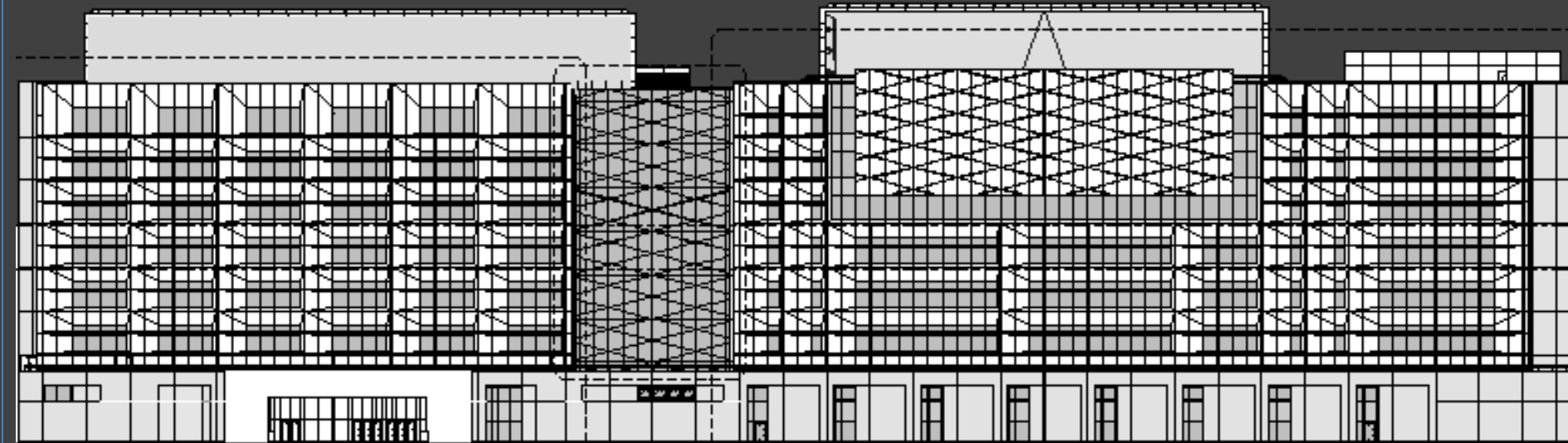
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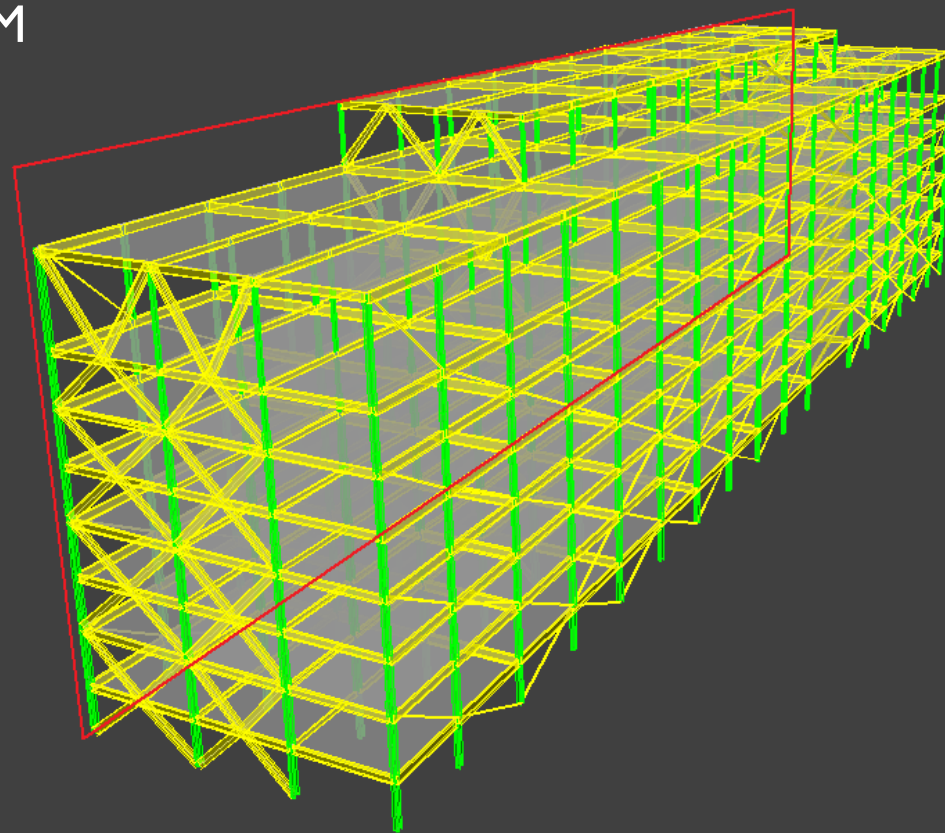
ARCHITECTURE



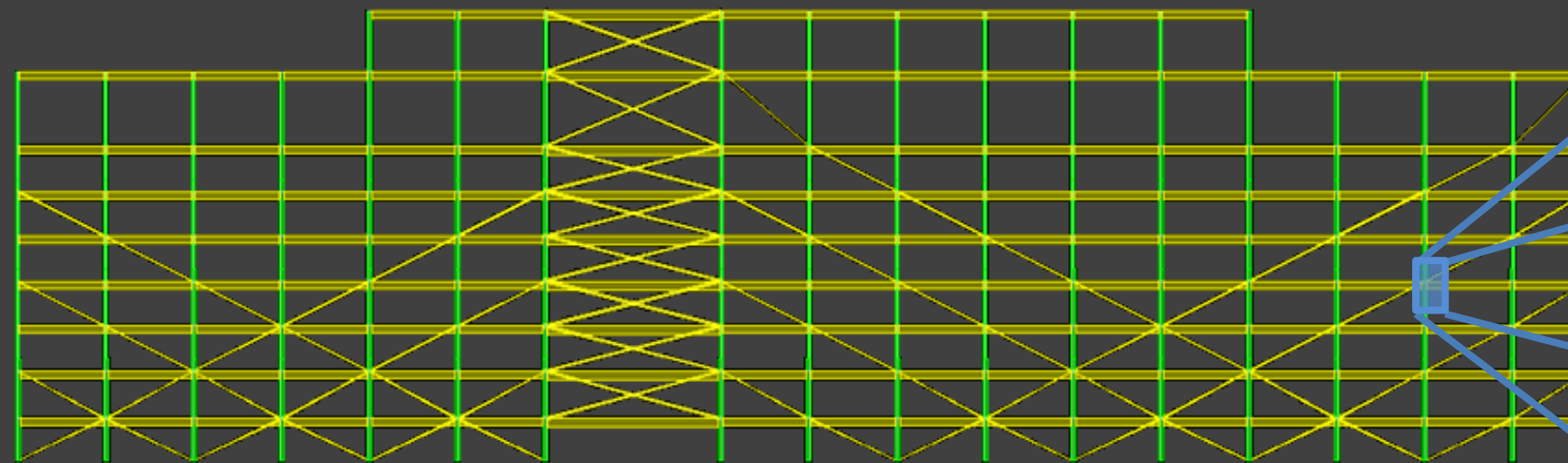
CONSTRUCTABILITY

- MATERIAL COST (SHAPES)
- FABRICATION SCHEDULING AND COST
- LABOR SCHEDULING AND COST

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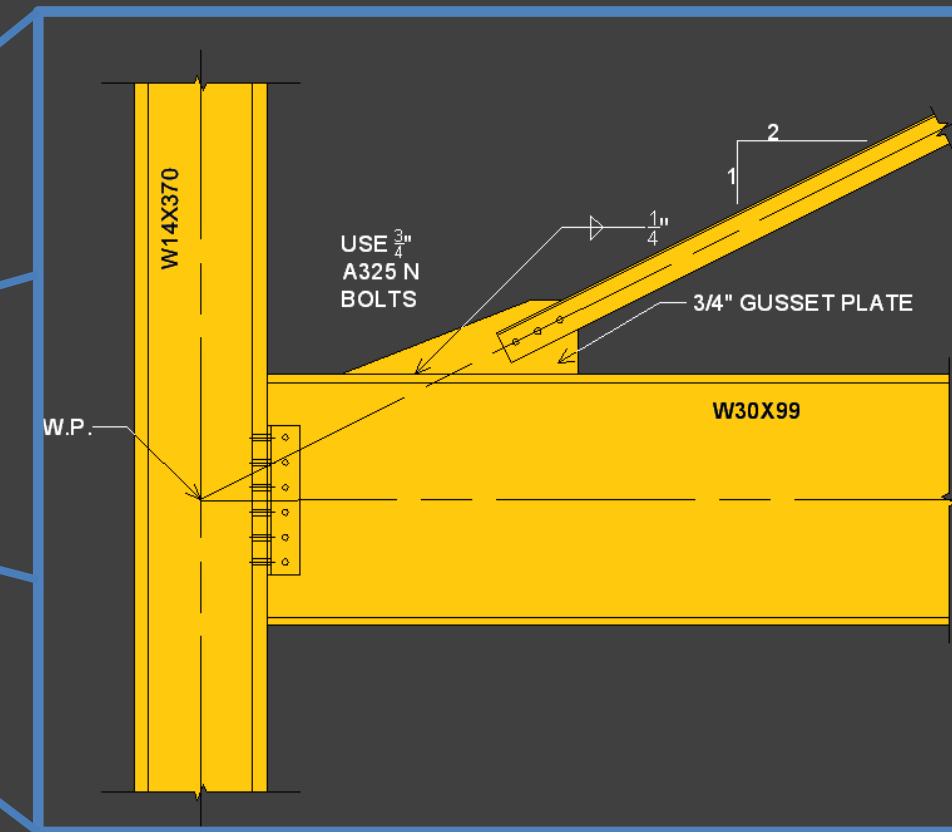


THESIS X-FRAME



THESIS X-FRAME DETAIL

CONCENTRICALLY BRACED CONNECTIONS



- INCLUDES:
- BEAM: W30X99
 - COLUMN: W14X370
 - BRACE: 2L4X4X1/2"
 - GUSSET: 3/4"

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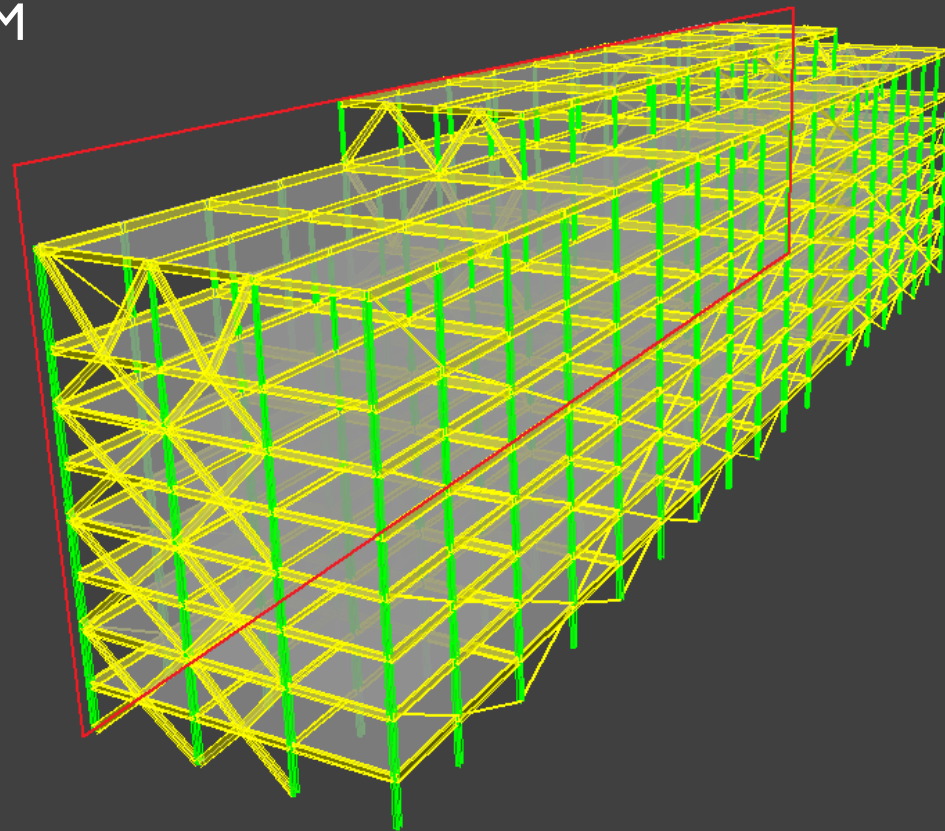
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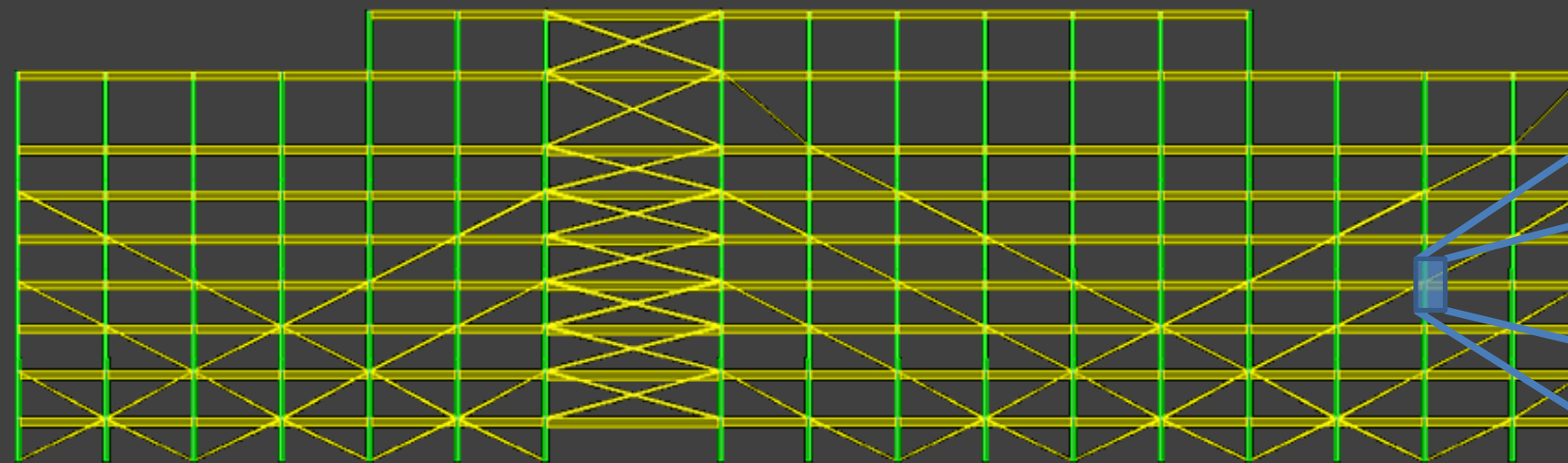
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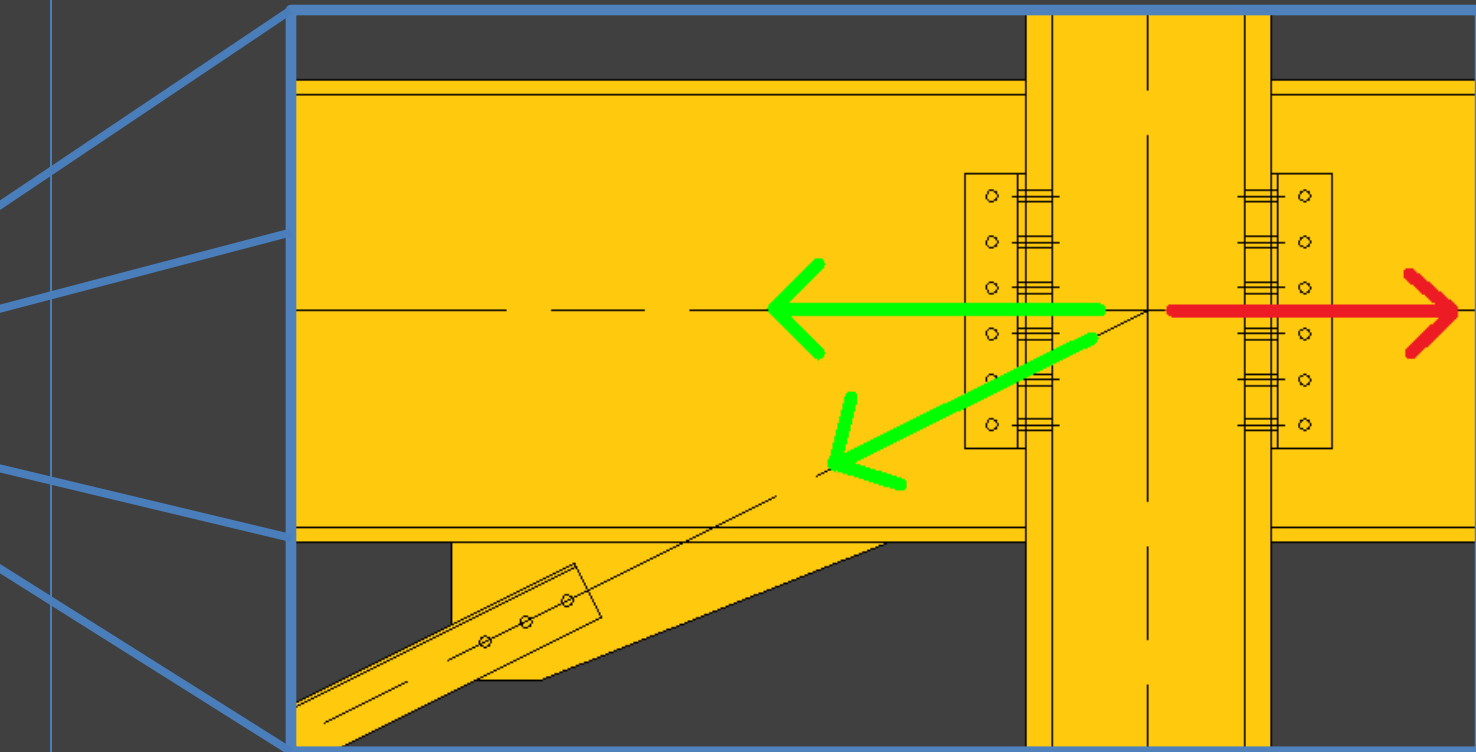
THE THESIS REDESIGN

THESIS X-FRAME



NEW YORK POLICE ACADEMY COLLEGE POINT, NEW YORK

THESIS X-FRAME LOAD PATH CONCENTRICALLY BRACED CONNECTIONS



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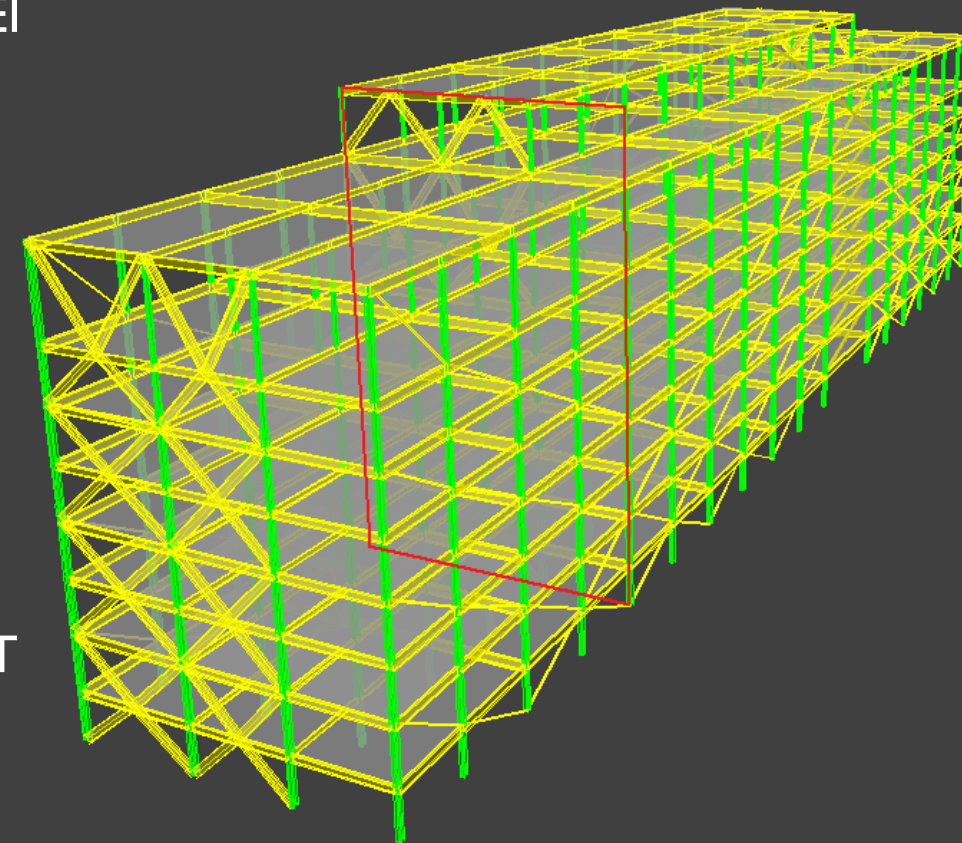
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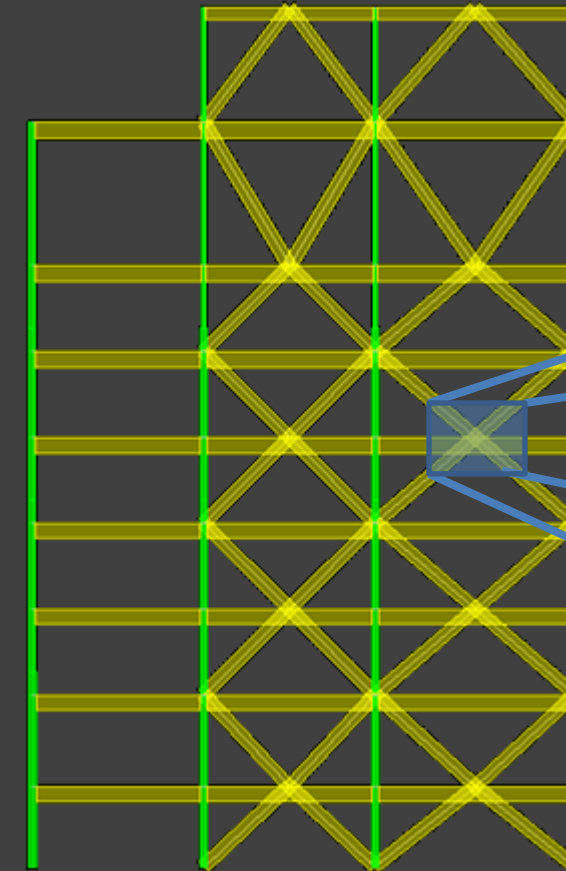
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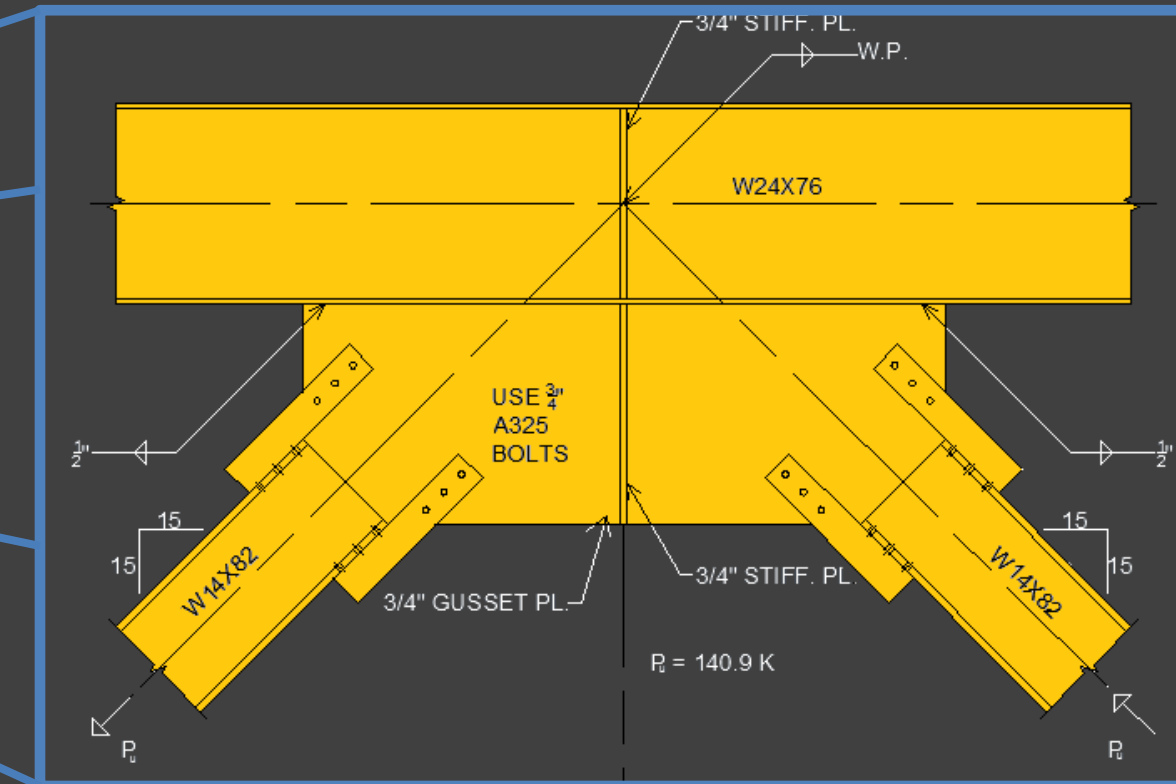
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THESIS Y-FRAME



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THESIS Y-FRAME DETAIL CHEVRON BRACED CONNECTIONS

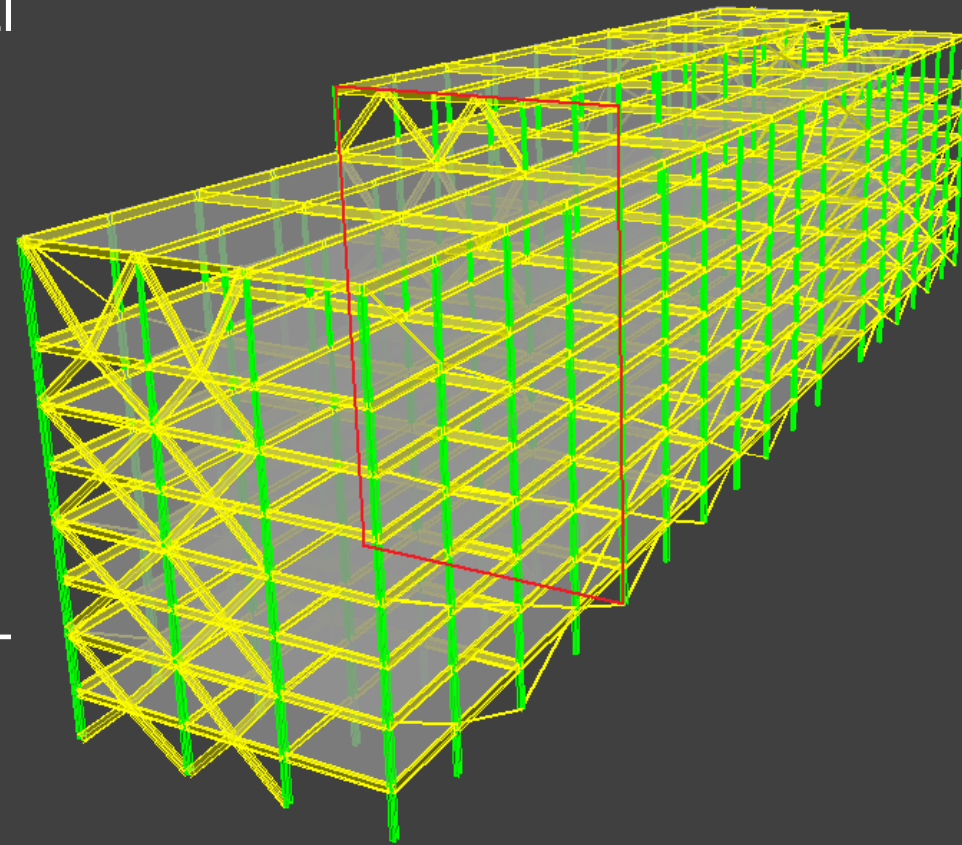


INCLUDES:

- BEAM: W24X76
- STIFFENERS: 3/4"
- BRACE: W14X82"
- GUSSET: 3/4"

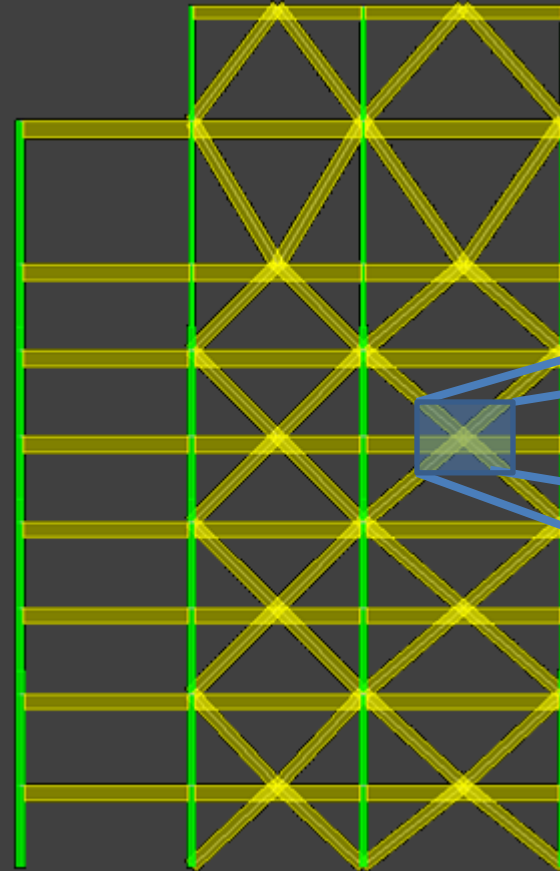
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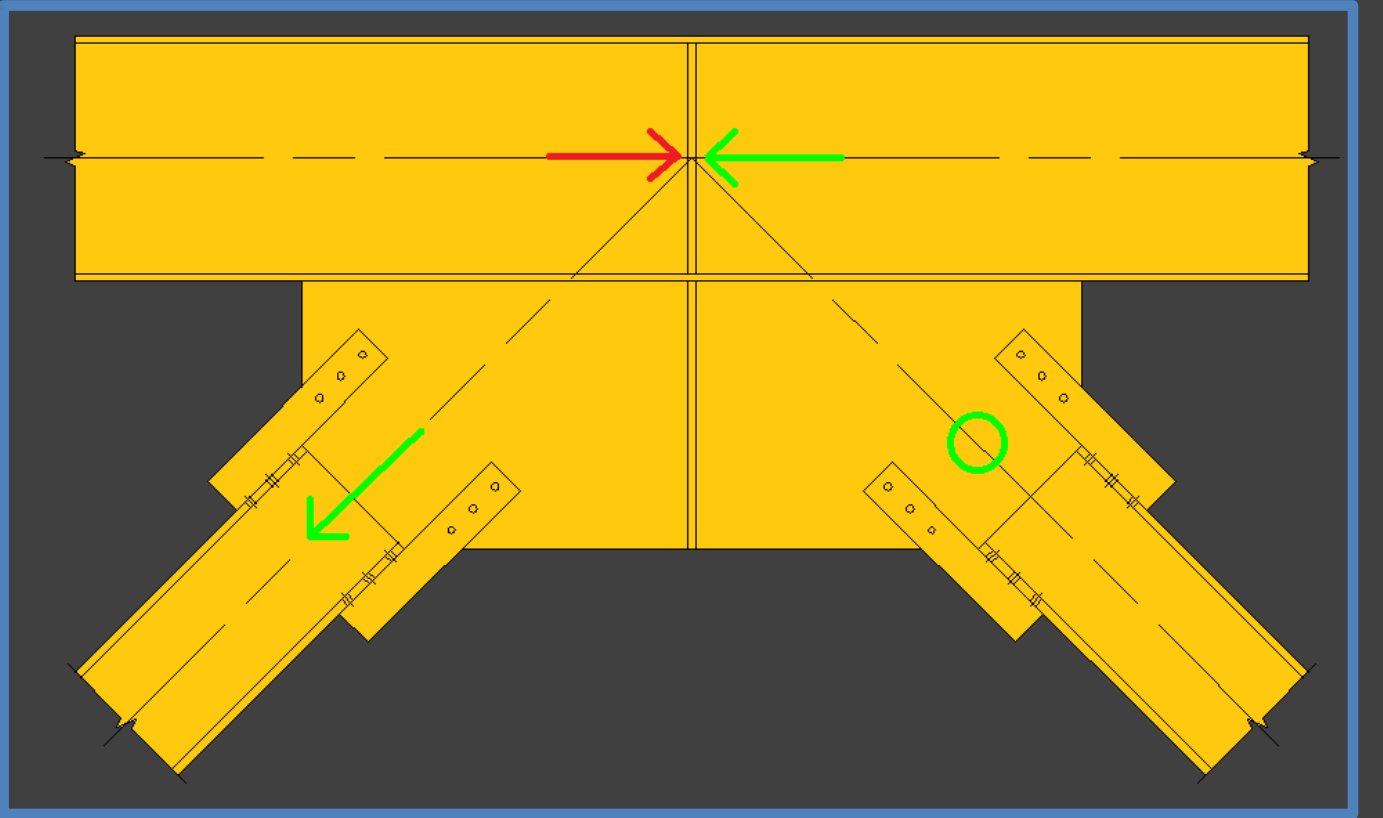
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THESIS Y-FRAME DETAIL CHEVRON BRACED LOAD PATH



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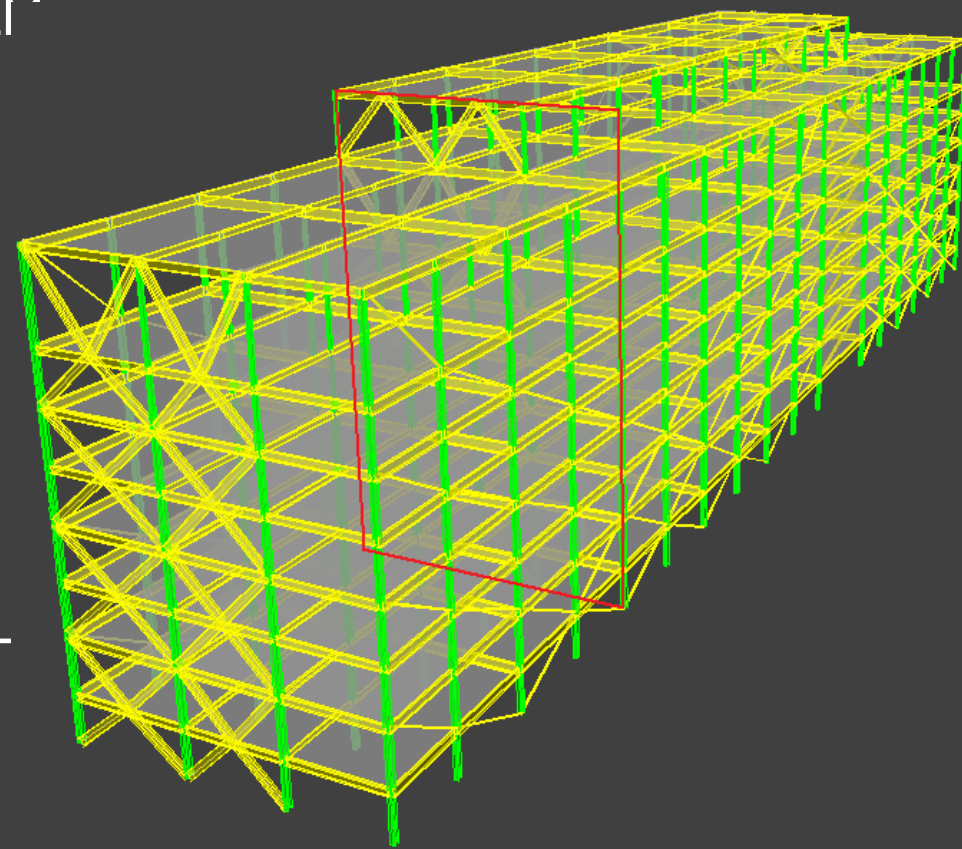
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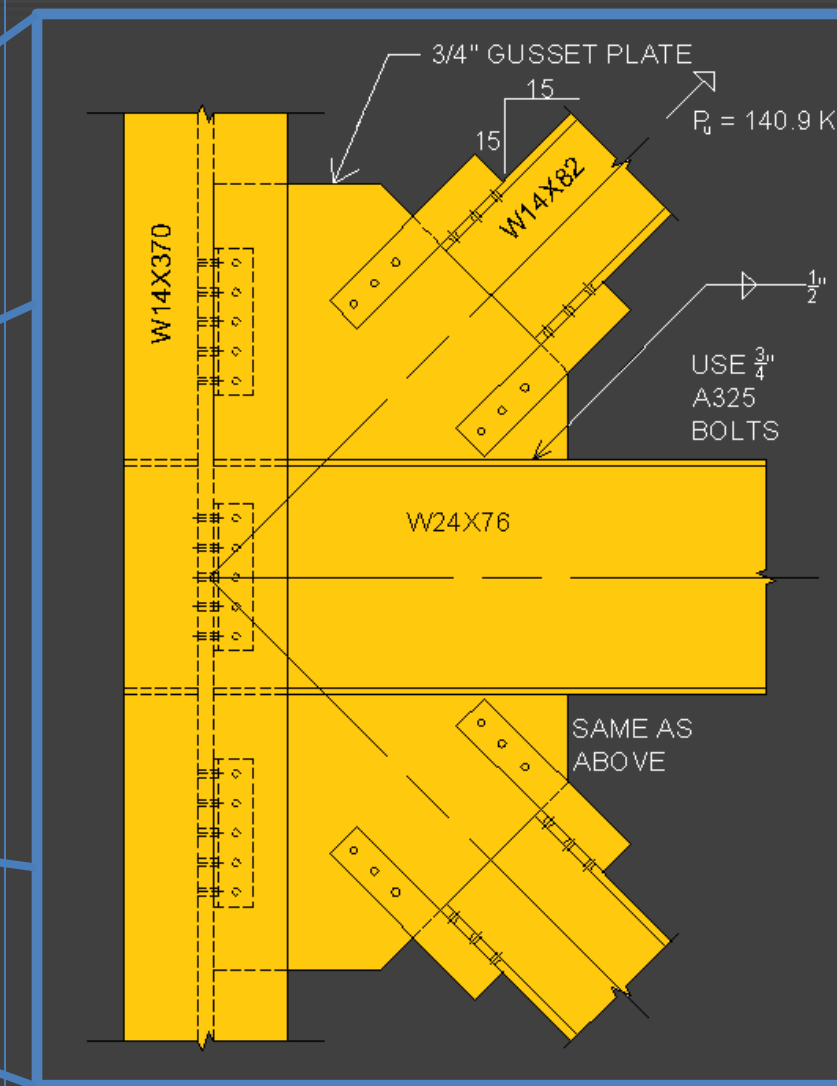
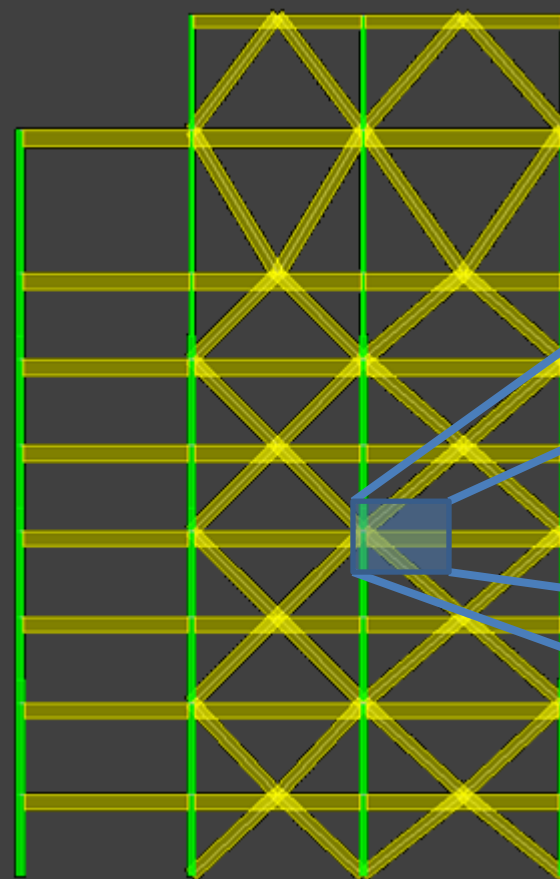
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THE THESIS REDESIGN

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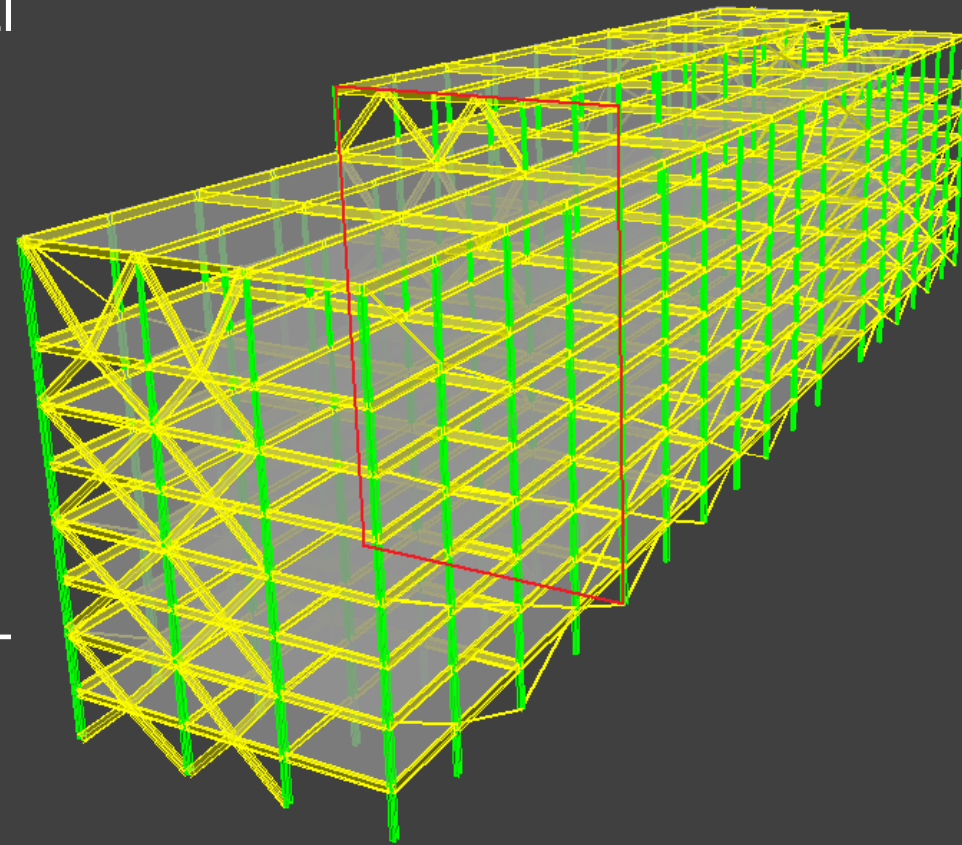
THESIS Y-FRAME DETAIL DIAGONAL BRACED CONNECTIONS

INCLUDES:

- BEAM: W24X76
- COLUMN: W14X370
- BRACE: W14X82"
- GUSSET: 3/4"

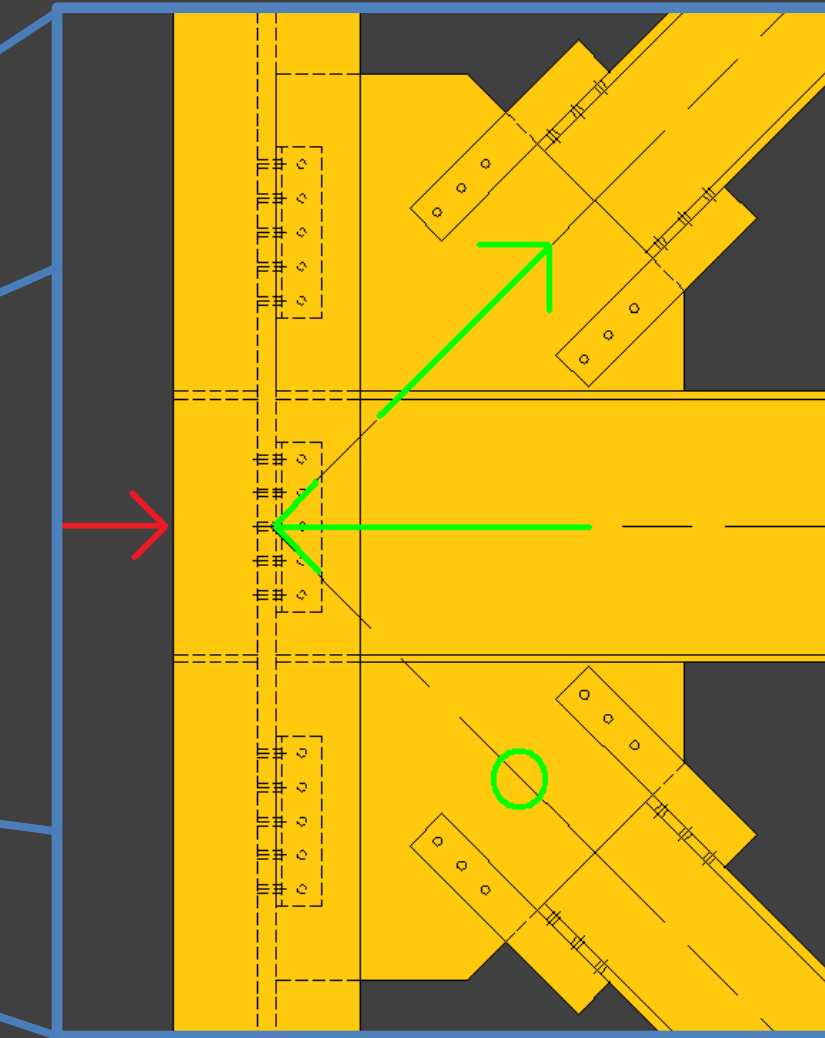
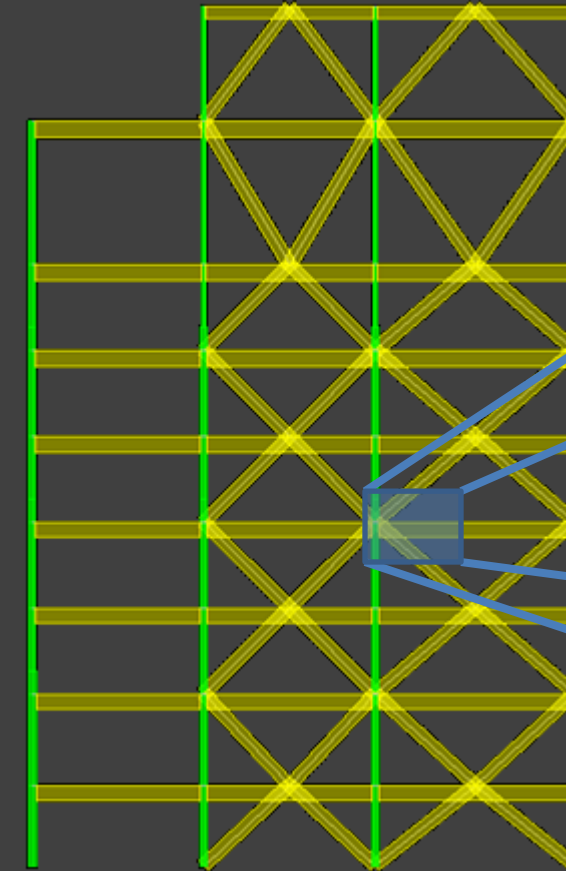
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THESIS Y-FRAME DETAIL

DIAGONAL BRACED
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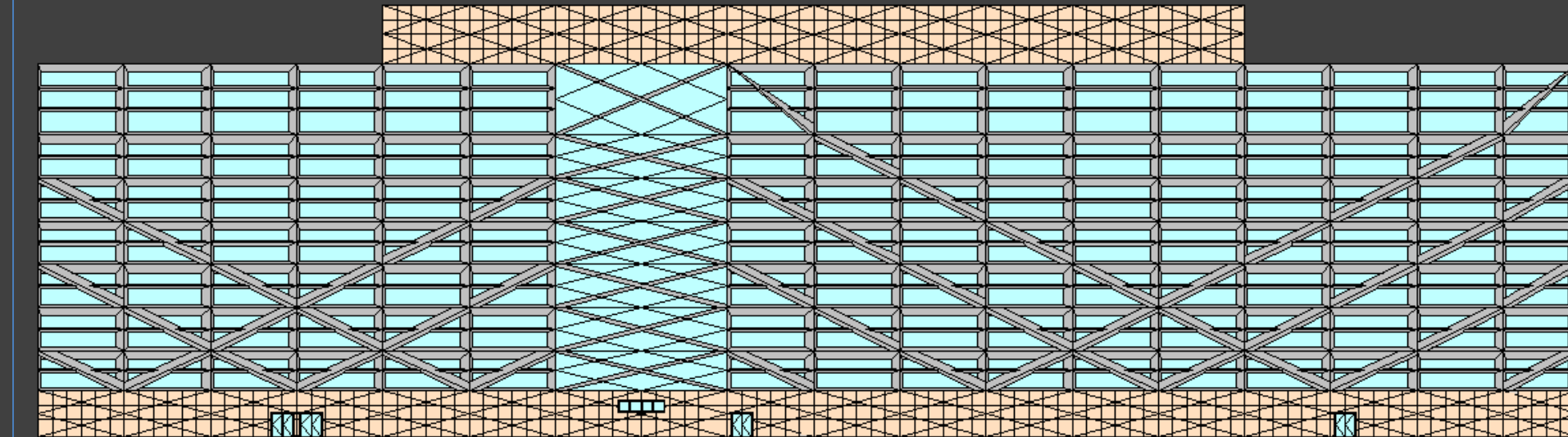
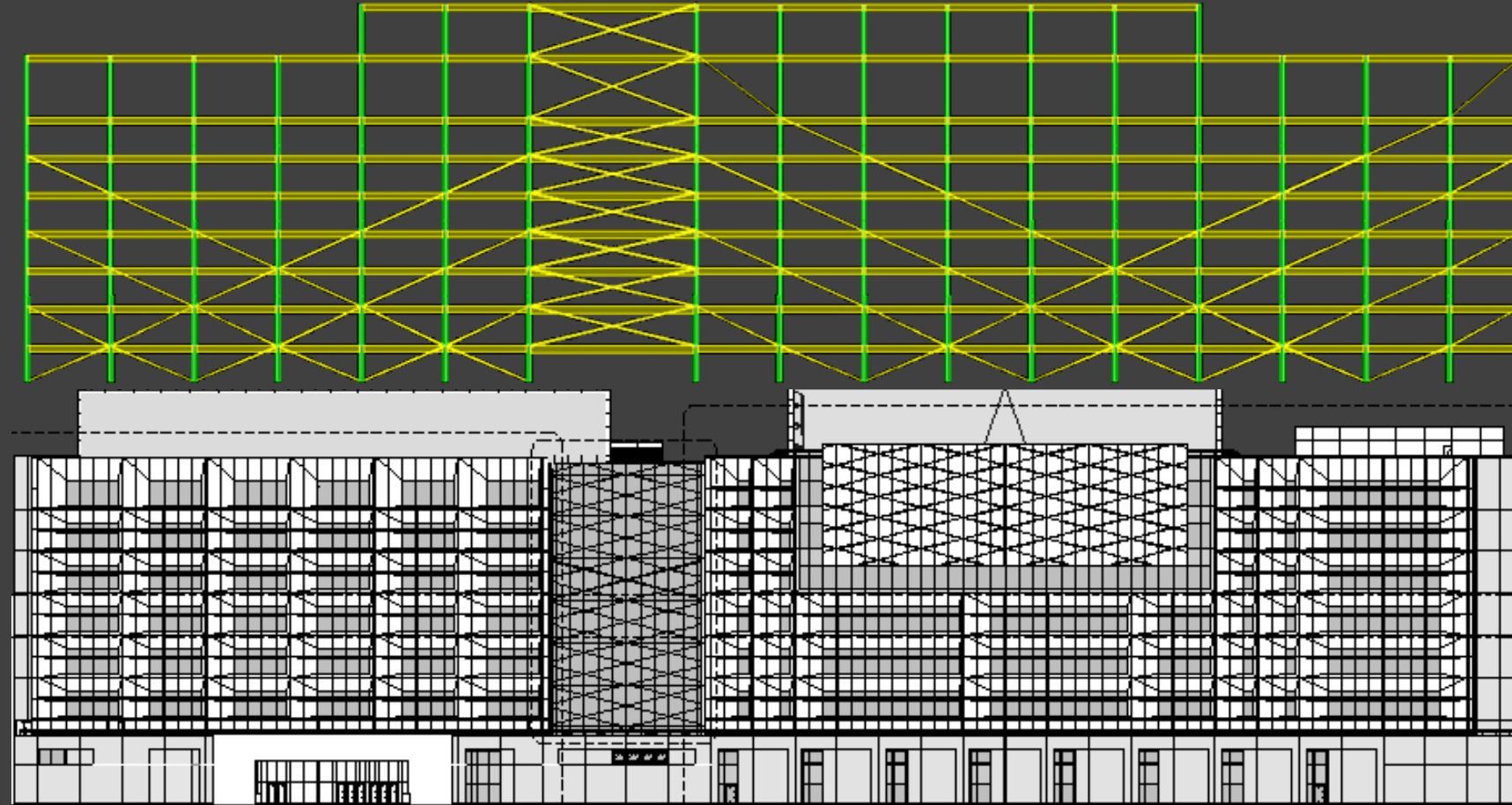
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DESIGN INTEGRATION



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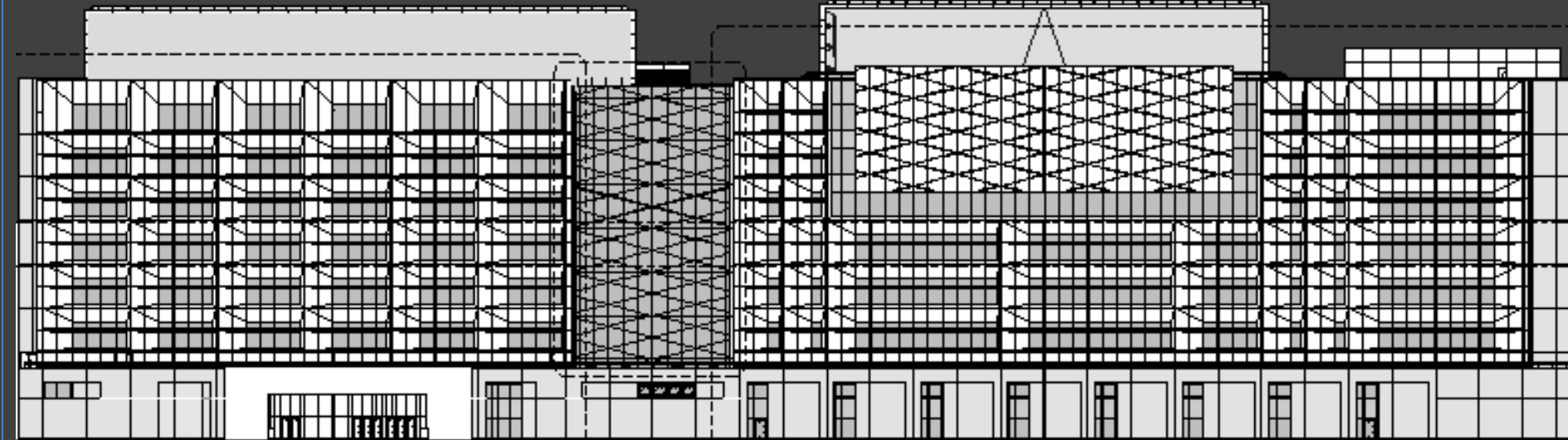
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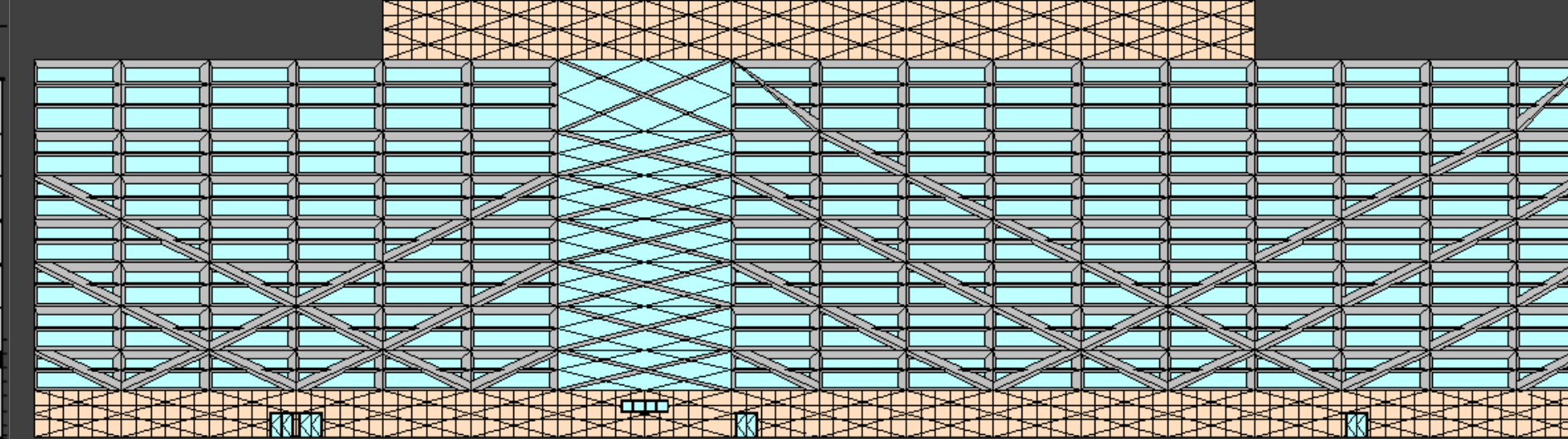
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ORIGINAL NORTH ELEVATION



THESIS NORTH ELEVATION



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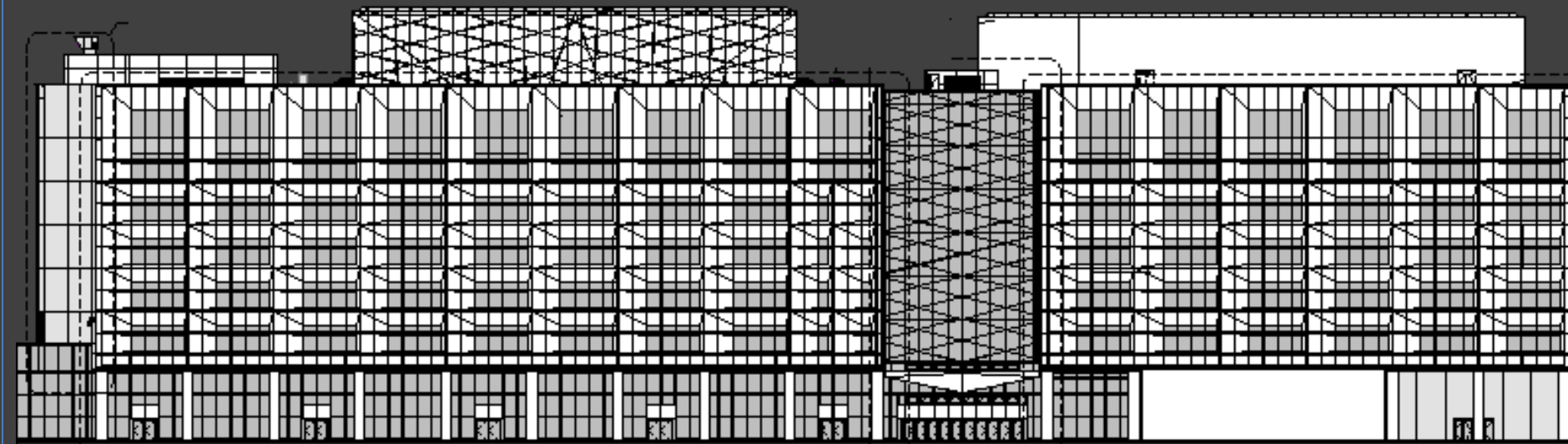
THESIS REDESIGN

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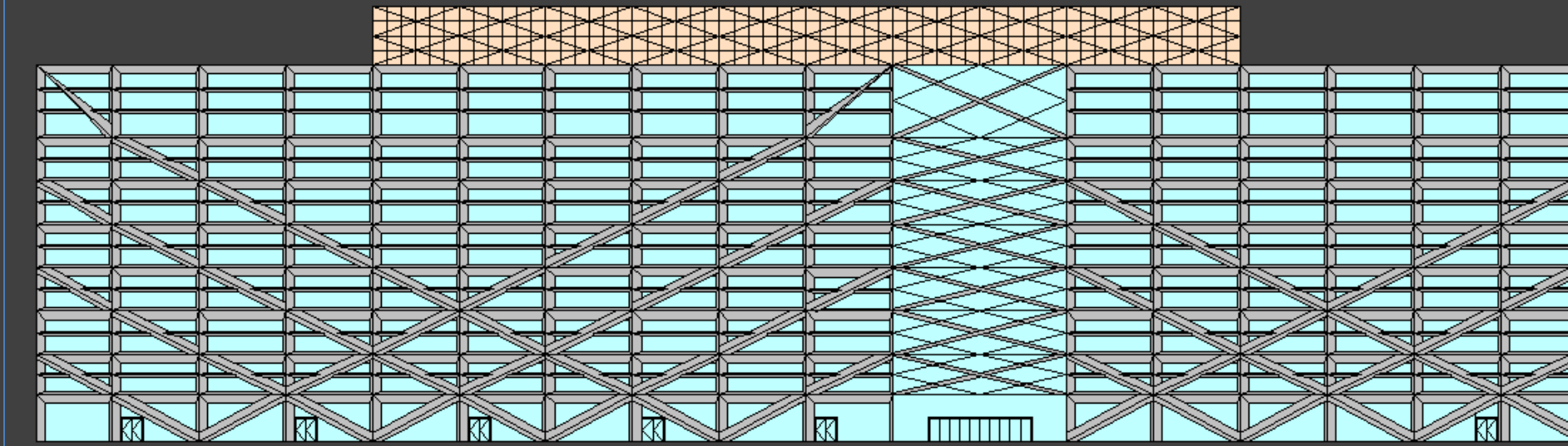
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ORIGINAL SOUTH ELEVATION



THESIS SOUTH ELEVATION



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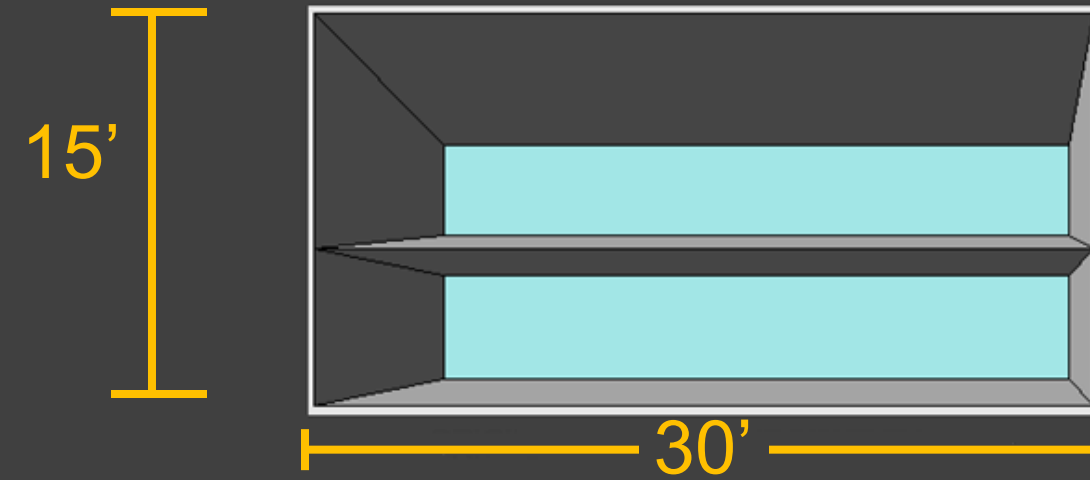
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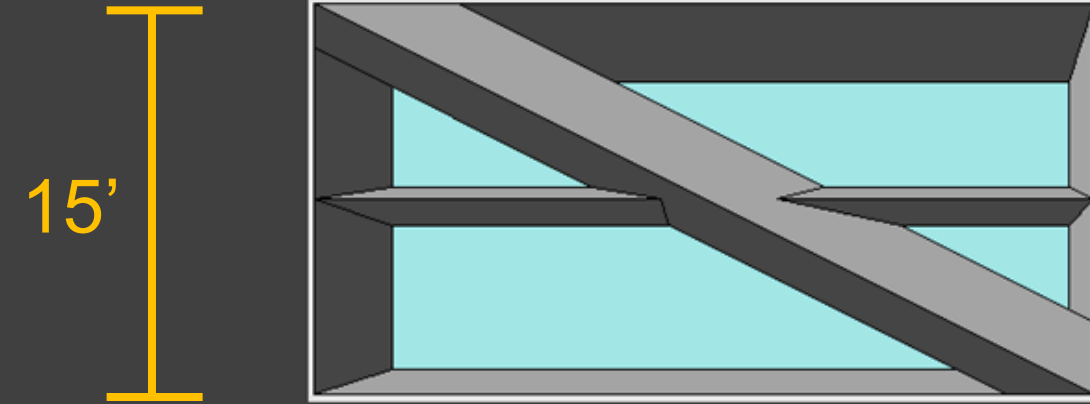
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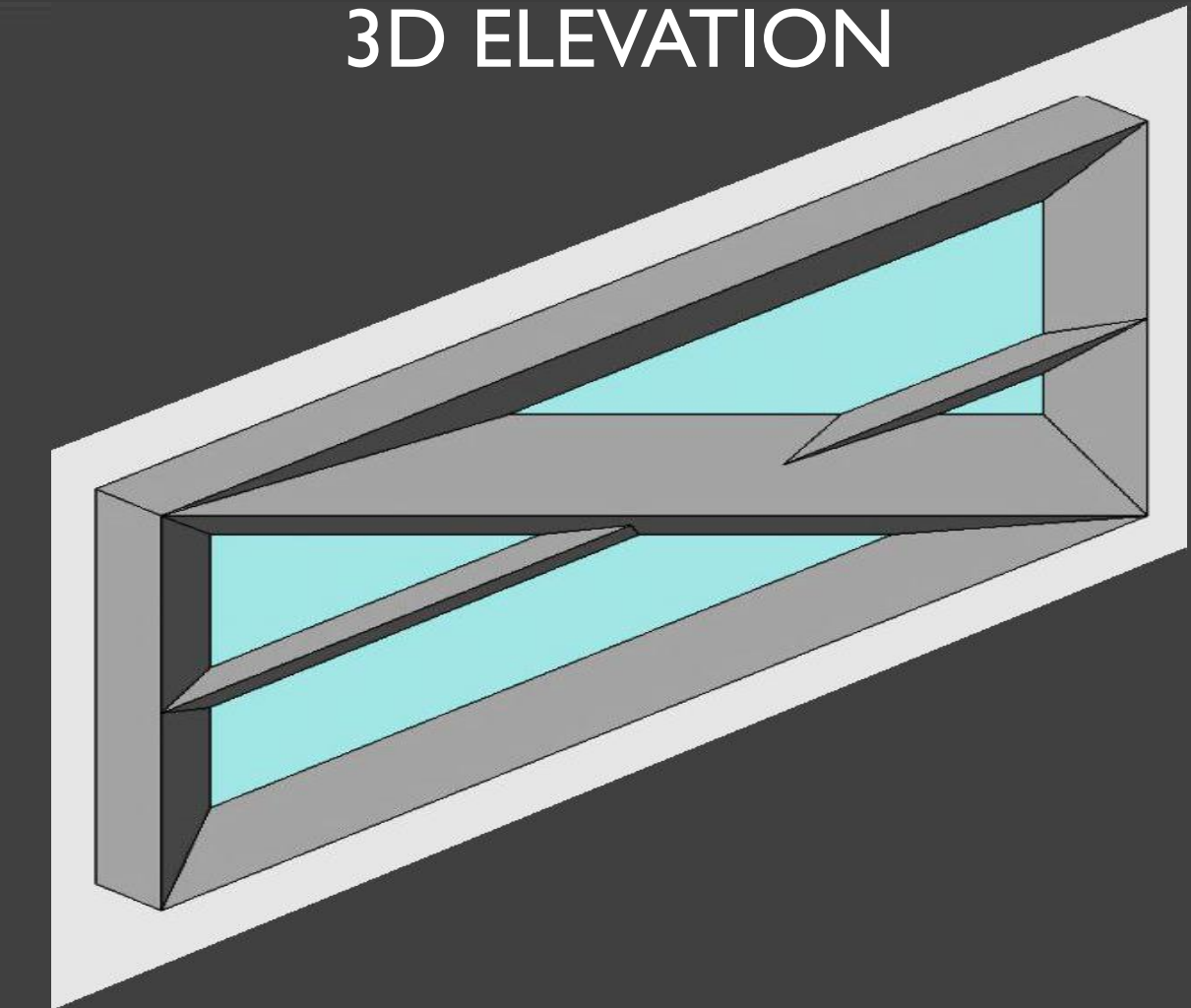
ORIGINAL DESIGN WINDOW ELEVATION



THESIS DESIGN WINDOW ELEVATION



3D ELEVATION



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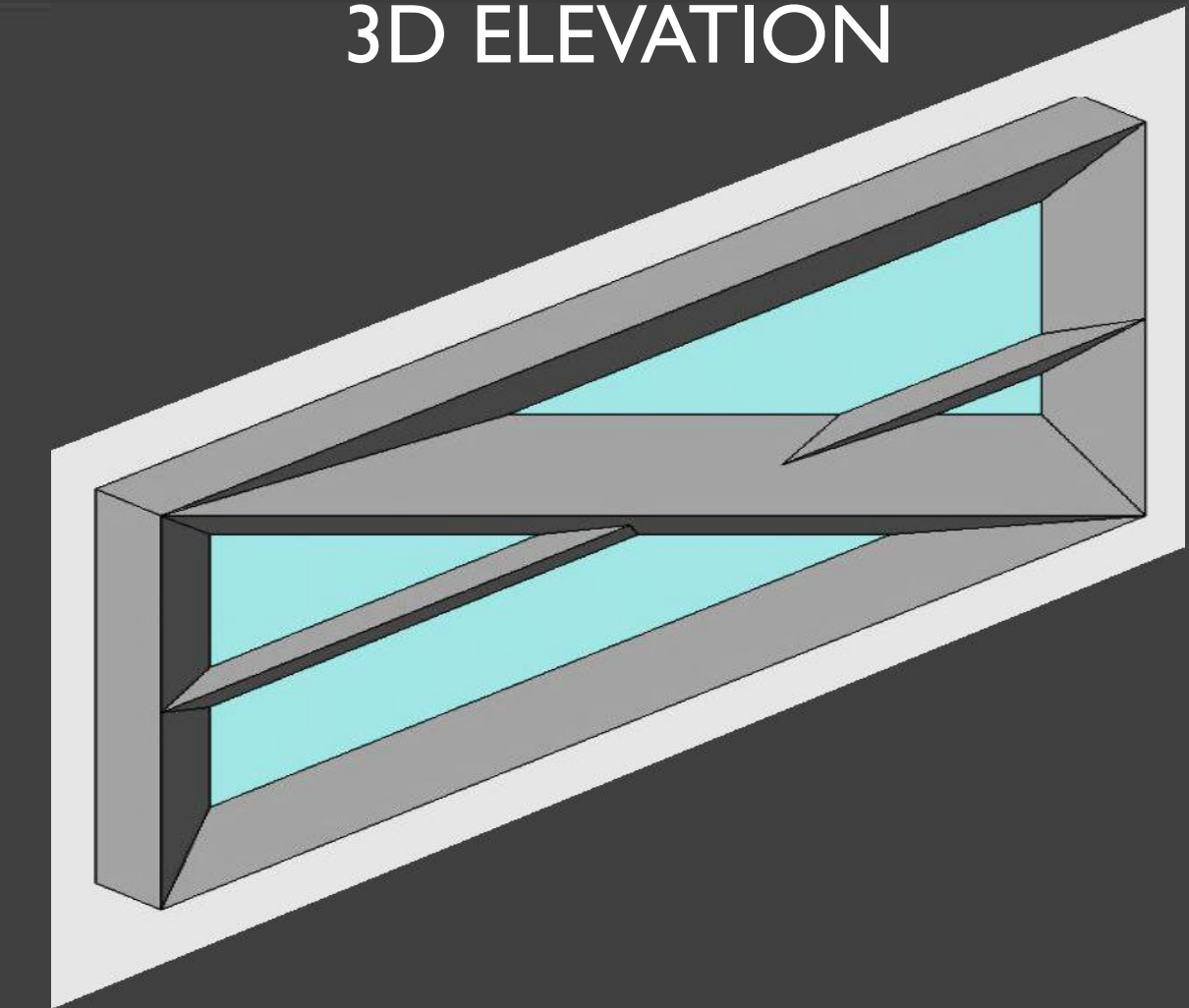
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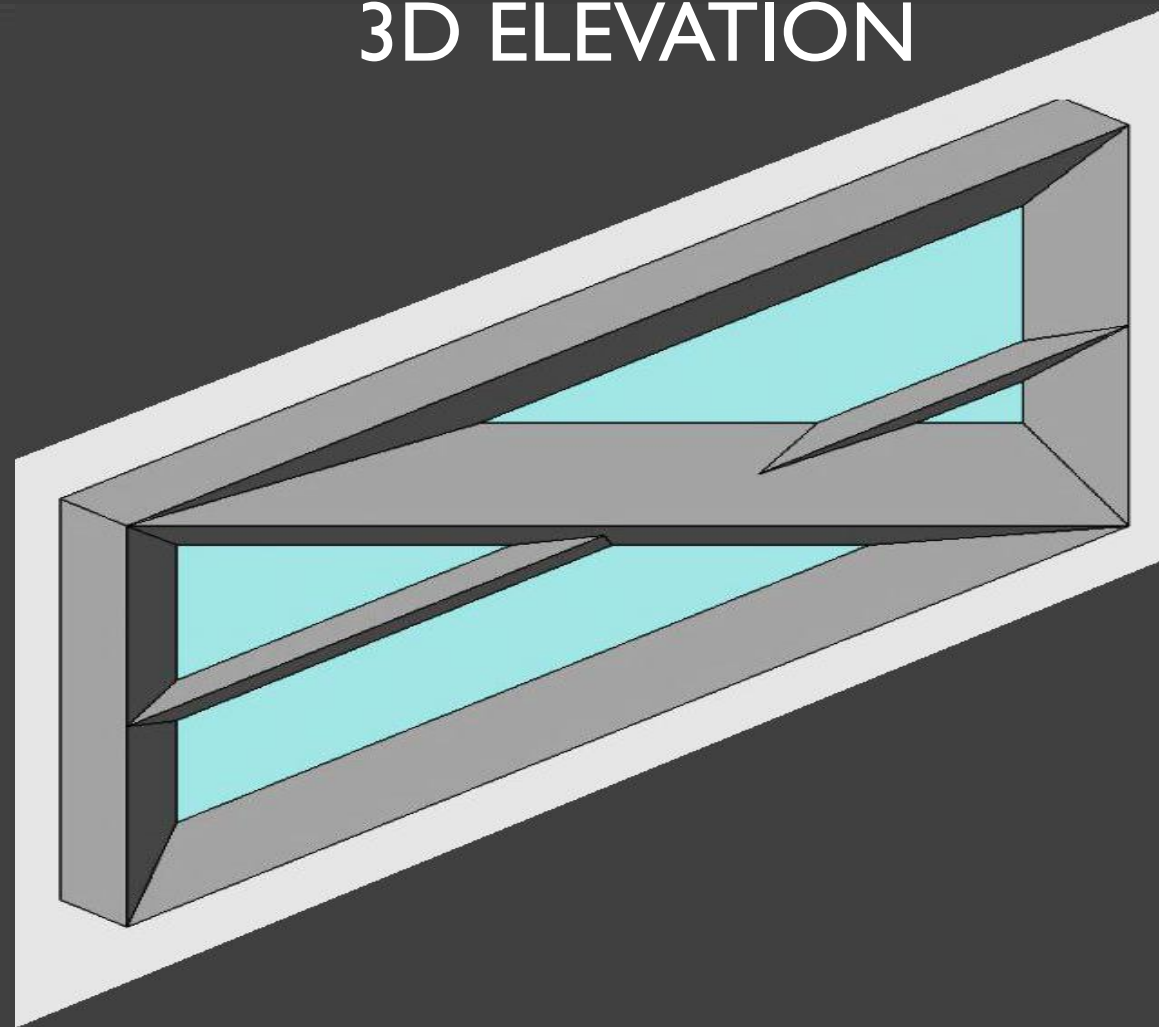
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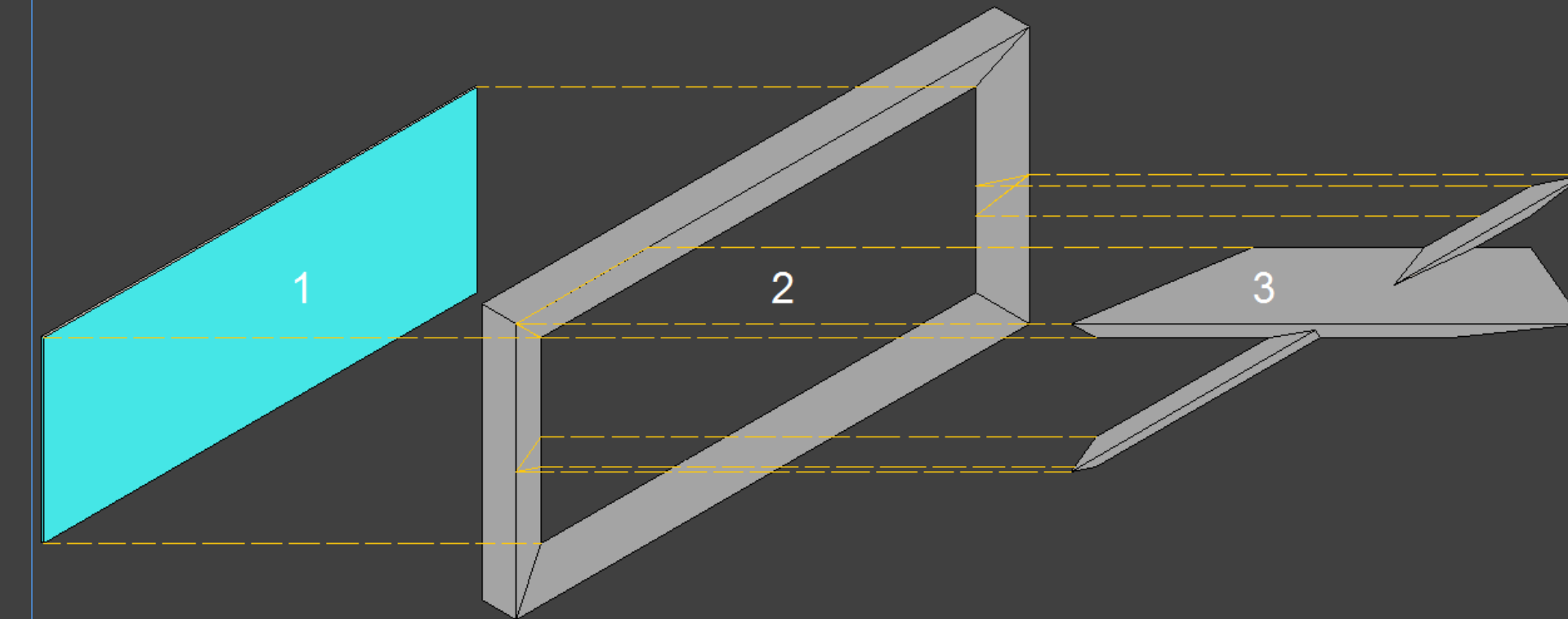
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3D ELEVATION



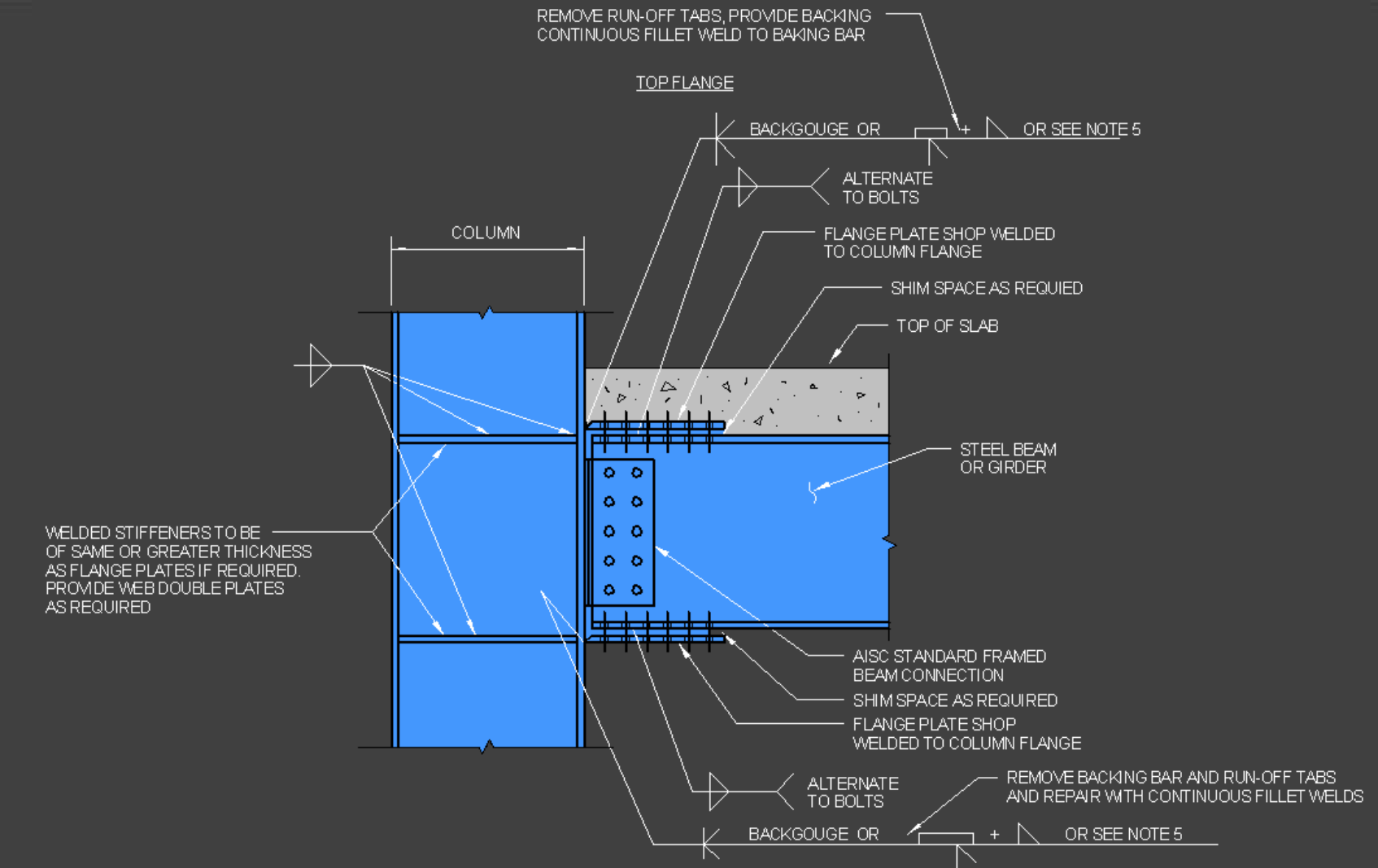
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FABRICATION, LABOR AND MATERIAL NEEDS

CONNECTION	TYPICAL MOMENT	TYPICAL HSS CONCENTRICALLY BRACED	TYPICAL DOUBLE ANGLE ECCENTRICALLY BRACED	TYPICAL W-SHAPE CHEVRON / DIAGONALLY BRACED
FABRICATION NEEDS	CUT: <ul style="list-style-type: none"> • PLATE • ANGLE PUT HOLES IN: <ul style="list-style-type: none"> • BEAM • ANGLE • PLATE 	FABRICATE: <ul style="list-style-type: none"> • CONNECTION CLIPS • GUSSET PLATES NOTCH AND WELD HSS BRACES	CUT: <ul style="list-style-type: none"> • PLATE • ANGLE PUT HOLES IN: <ul style="list-style-type: none"> • ANGLE • PLATE WELD	CUT: <ul style="list-style-type: none"> • GUSSET PLATE • ANGLE PUT HOLES IN: <ul style="list-style-type: none"> • BEAM • ANGLE • PLATE WELD
LABOR NEEDS	INSTALL BOLTS WELD ANGLE TO COLUMN	BOLT UP CONNECTIONS	BOLT UP CONNECTIONS	BOLT UP CONNECTIONS
MATERIAL NEEDS	<ul style="list-style-type: none"> • BOLTS • PLATE • CONNECTION CLIP 	<ul style="list-style-type: none"> • BOLTS • PLATE • ANGLES 	<ul style="list-style-type: none"> • GUSSET PLATE • BOLTS 	<ul style="list-style-type: none"> • BOLTS • GUSSET PLATES • ANGLES

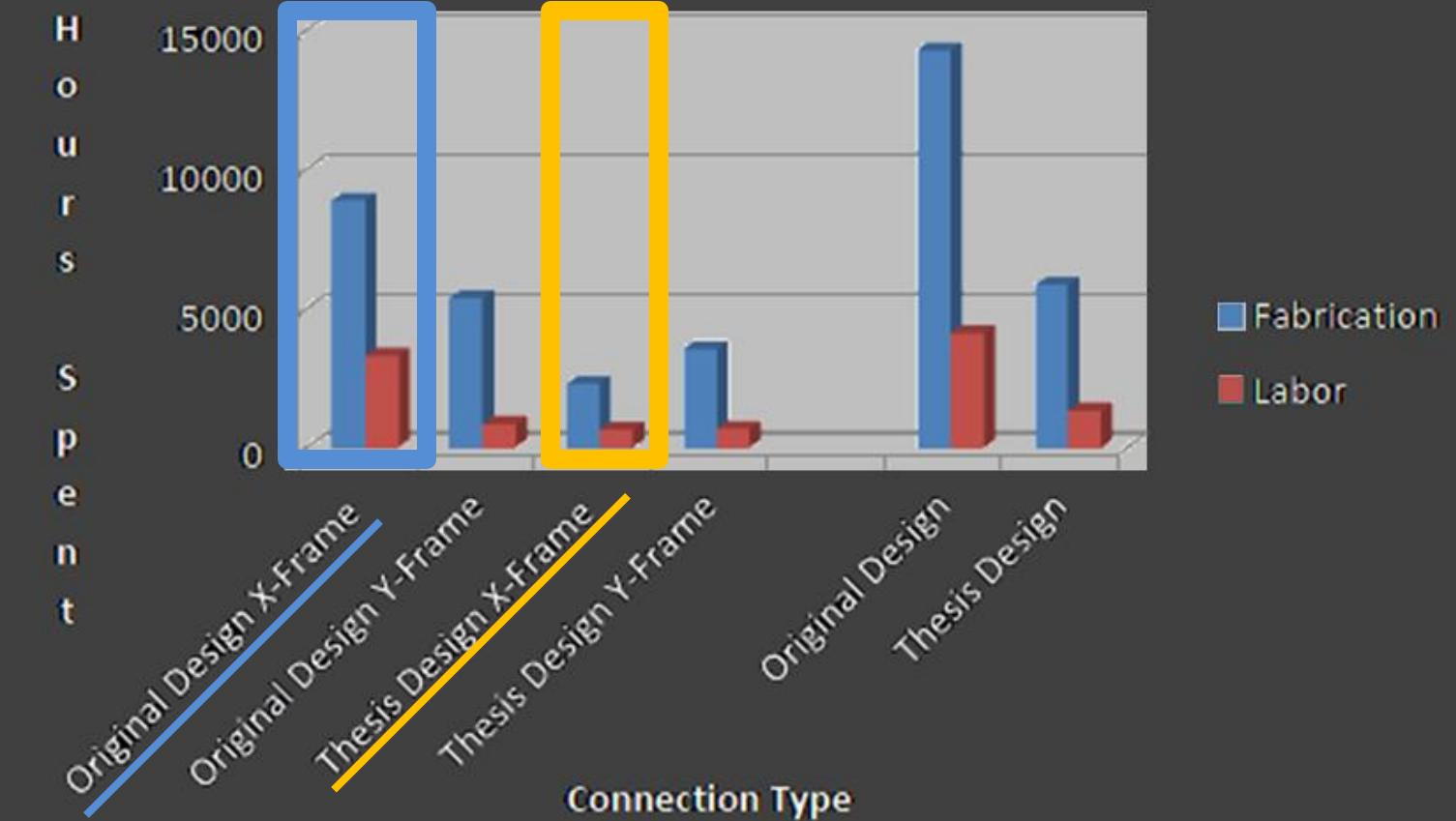


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FABRICATION AND LABOR MAN-HOURS

CONNECTION	TYPICAL MOMENT	TYPICAL HSS CONCENTRICALLY BRACED	TYPICAL DOUBLE ANGLE ECCENTRICALLY BRACED	TYPICAL W-SHAPE CHEVRON BRACED
FABRICATION COST	19 HOURS @ \$69.14	32 HOURS @ \$69.14	26 HOURS @ \$69.14	18 HOURS @ \$69.14
LABOR COST	7 HOURS @ \$69.57	5 HOURS @ \$69.57	5 HOURS @ \$69.57	5 HOURS @ \$69.57
NUMBER OF CONNECTIONS	468	168	128	136
TOTAL FABRICATION HOURS	8,892	5,376	2,304	3,536
TOTAL LABOR HOURS	3,276	840	640	680
TOTAL HOURS	12,168	6,216	2,944	4,216

Amount of Time Spent (Hours)



PRESENTATION OUTLINE

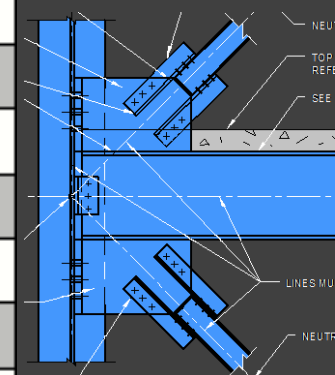
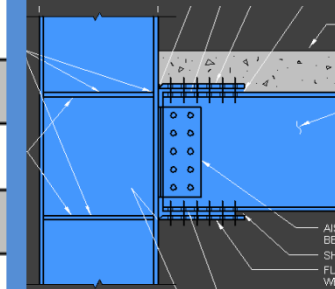
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COST STUDY

ORIGINAL COST

ORIGINAL DESIGN X-FRAME MOMENT CONNECTION CALCULATION				
	COST	MULTIPLIER	HOURS	SUBTOTAL
MATERIAL	\$223.00	1.165	N/A	\$259.80
LABOR	\$48.55	1.433	2	\$487.01
FABRICATION	\$55.00	1.257	19	\$1,313.57
SUBTOTAL				\$2,060.37
CONNECTIONS (#)	468		TOTAL	\$964,250.84

ORIGINAL DESIGN Y-FRAME HSS CONNECTION CALCULATION				
	COST	MULTIPLIER	HOURS	SUBTOTAL
MATERIAL	\$1,083.00	1.165	N/A	\$1,261.70
LABOR	\$48.55	1.433	5	\$347.86
FABRICATION	\$55.00	1.257	32	\$2,212.32
SUBTOTAL				\$3,821.88
CONNECTIONS (#)	168		TOTAL	\$642,075.13
TOTAL ORIGINAL SYSTEM COST				\$1,606,325.97



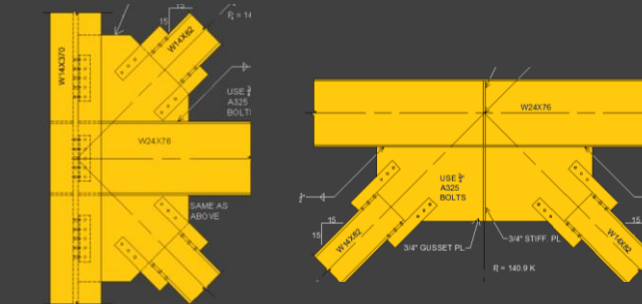
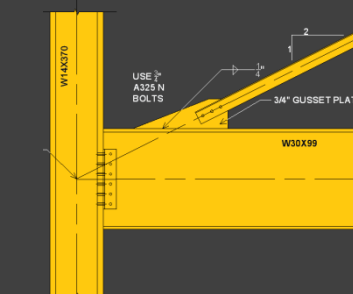
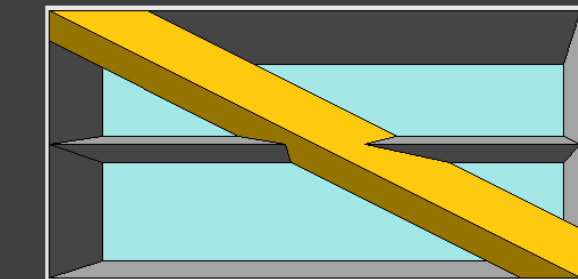
NEW YORK POLICE ACADEMY COLLEGE POINT, NEW YORK

THESIS COST

ADDITIONAL ALUMINUM PANELING				
	COST	MULTIPLIER	HOURS	SUBTOTAL
MATERIAL	\$791.19	1.165	N/A	\$921.74
LABOR	\$48.55	1.433	N/A	\$0.00
FABRICATION	\$55.00	1.257	2	\$138.27
SUBTOTAL				\$1,060.01
CONNECTIONS (#)	128		TOTAL	\$135,680.81

THESIS DESIGN X-FRAME MOMENT CONNECTION CALCULATION				
	COST	MULTIPLIER	HOURS	SUBTOTAL
MATERIAL	\$542.00	1.165	N/A	\$631.43
LABOR	\$48.55	1.433	5	\$347.86
FABRICATION	\$55.00	1.257	18	\$1,244.43
SUBTOTAL				2,223.72
CONNECTIONS (#)	128		TOTAL	\$284,636.26

THESIS DESIGN Y-FRAME W-SHAPE CONNECTIONS CALCULATION				
	COST	MULTIPLIER	HOURS	SUBTOTAL
MATERIAL	\$672.00	1.165	N/A	\$782.88
LABOR	\$48.55	1.433	5	\$347.86
FABRICATION	\$55.00	1.257	26	\$1,797.51
SUBTOTAL				\$2,928.25
CONNECTIONS (#)	136		TOTAL	\$398,242.10
TOTAL THESIS SYSTEM COST				\$818,559.17



PRESENTATION OUTLINE

COST STUDY

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ORIGINAL COST

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SUBTOTAL				\$2,060.37
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ORIGINAL DESIGN Y-FRAME HSS CONNECTION CALCULATION				
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LABOR	\$48.55	1.433	5	\$347.86
FABRICATION	\$55.00	1.257	32	\$2,212.32
SUBTOTAL				\$3,821.88
CONNECTIONS (#)	168		TOTAL	\$642,075.13
TOTAL ORIGINAL SYSTEM COST				\$1,606,325.97

\$1,606,325.97

THESIS COST

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LABOR	\$48.55	1.433	N/A	\$0.00
FABRICATION	\$55.00	1.257	2	\$138.27
SUBTOTAL				\$1,060.01
CONNECTIONS (#)	128		TOTAL	\$135,680.81
THESIS DESIGN X-FRAME ECCENTRIC CONNECTION CALCULATION				
	COST	MULTIPLIER	HOURS	SUBTOTAL
MATERIAL	\$542.00	1.165	N/A	\$631.43
LABOR	\$48.55	1.433	5	\$347.86
FABRICATION	\$55.00	1.257	18	\$1,244.43
SUBTOTAL				2,223.72
CONNECTIONS (#)	128		TOTAL	\$284,636.26
THESIS DESIGN Y-FRAME W-SHAPE CONNECTIONS CALCULATION				
	COST	MULTIPLIER	HOURS	SUBTOTAL
MATERIAL	\$672.00	1.165	N/A	\$782.88
LABOR	\$48.55	1.433	5	\$347.86
FABRICATION	\$55.00	1.257	26	\$1,197.51
SUBTOTAL				\$2,928.25
CONNECTIONS (#)	136		TOTAL	\$208,242.10
TOTAL THESIS SYSTEM COST				\$818,559.17

\$818,559.17

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COST AND SCHEDULE

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ORIGINAL DESIGN

TOTAL SYSTEM COST: \$1,606,325.97

LABOR: 4,116 MAN HOURS

THESIS REDESIGN

TOTAL SYSTEM COST: \$827,408.92

LABOR: 1,320 MAN HOURS

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THESIS

PERCENTAGE OF TIME SAVED: **68%**

TOTAL TIME SAVED: **2,796 HOURS**



REDESIGN

PERCENTAGE OF COST SAVINGS: **48%**

TOTAL COST SAVINGS: **\$778,917.05**



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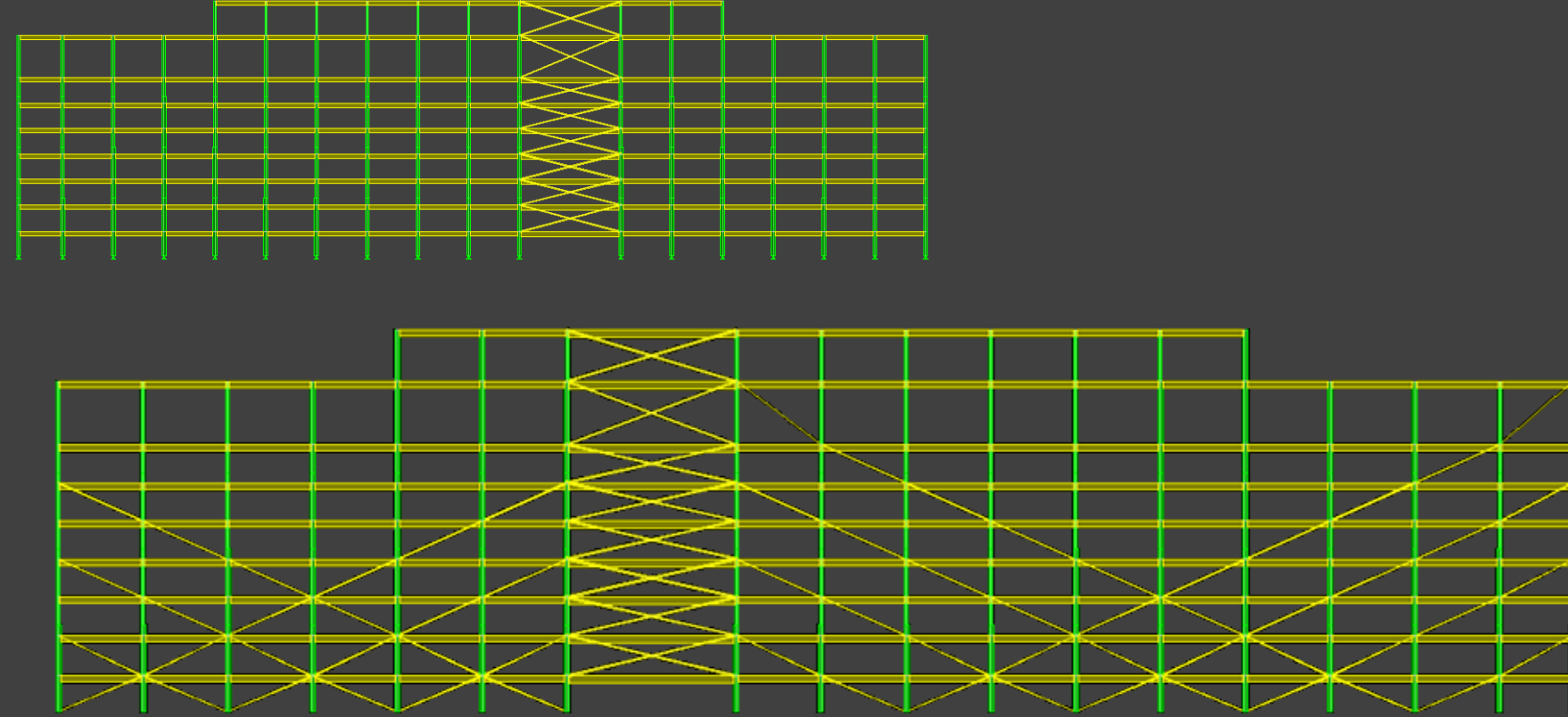
ARCHITECTURAL IMPACT

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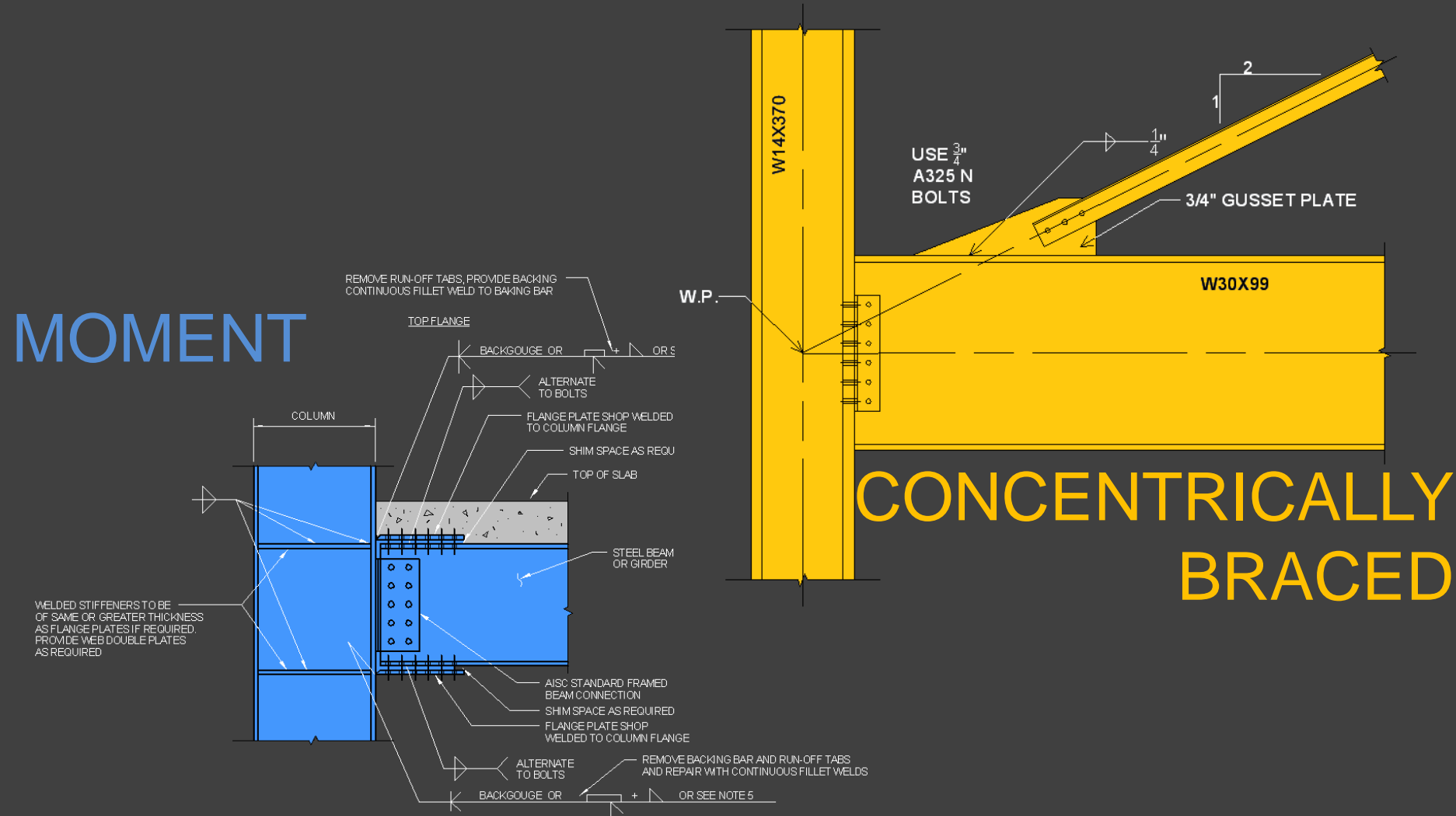
CONCLUSION

CONCLUSION

X-FRAME



MOMENT

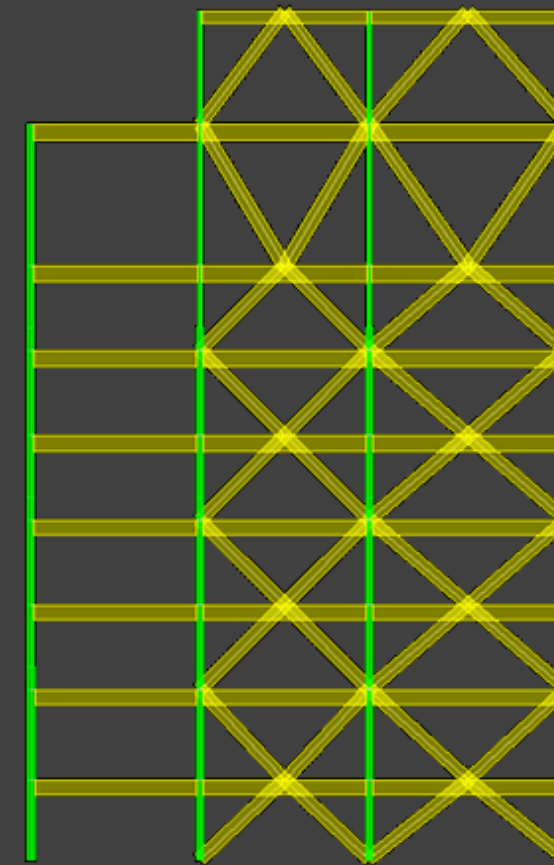
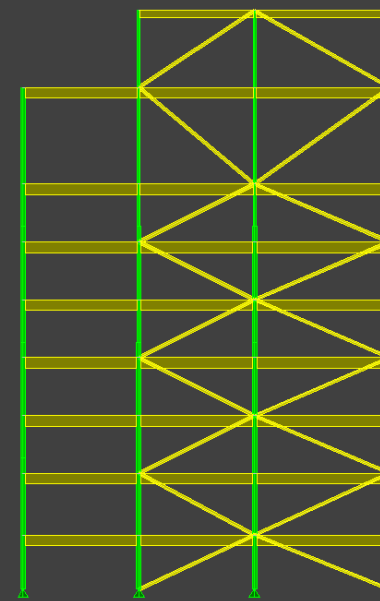


PRESENTATION OUTLINE

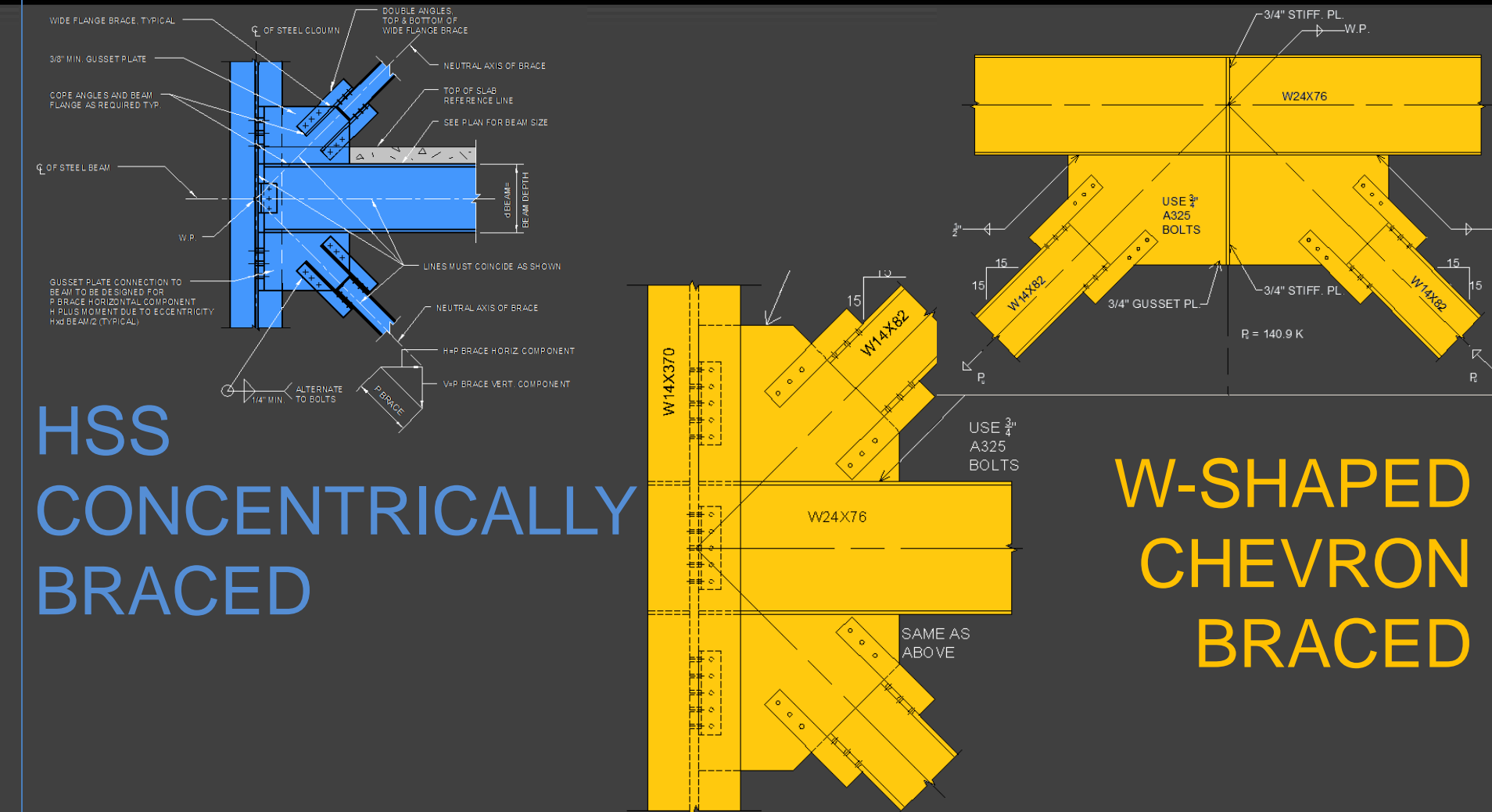
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Y-FRAME



HSS CONCENTRICALLY BRACED



W-SHAPED CHEVRON BRACED

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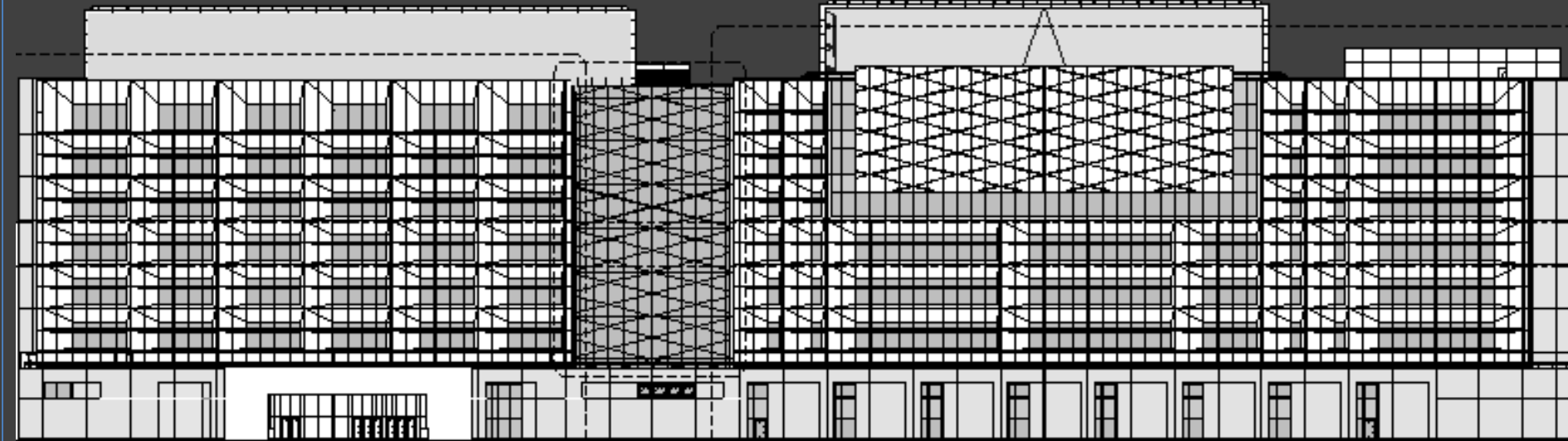
THESIS REDESIGN

ARCHITECTURAL IMPACT

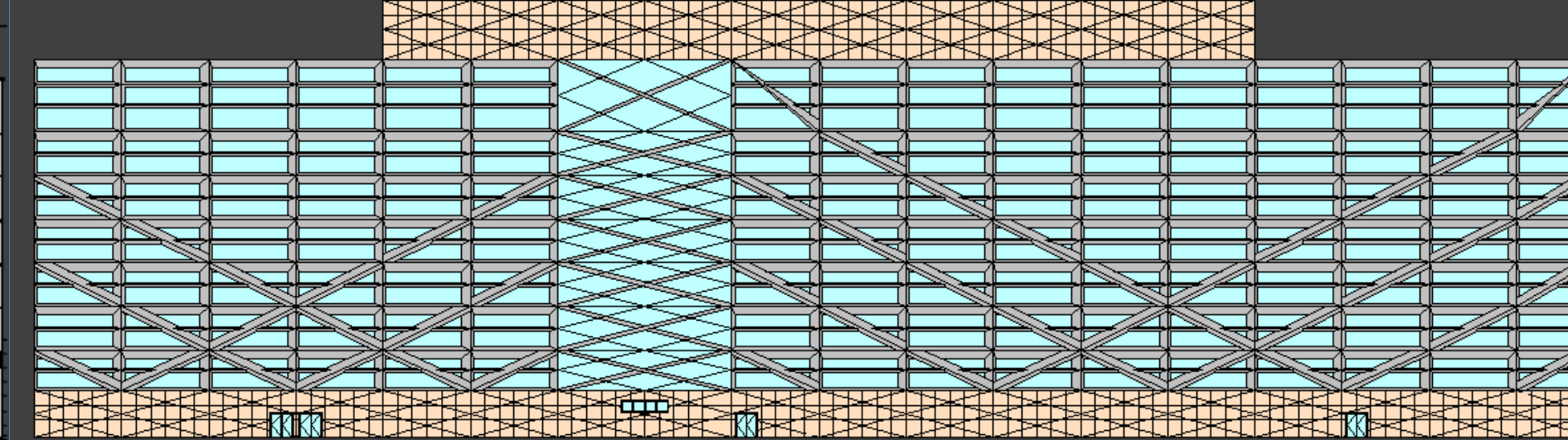
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ORIGINAL NORTH ELEVATION



THESIS NORTH ELEVATION



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THESIS

TIME PERCENTAGE SAVINGS: **68%**

TIME TOTAL SAVINGS: **2,796 HOURS**



REDESIGN

COST PERCENTAGE SAVINGS: **48%**

TOTAL COST SAVINGS: **\$778,917.05**



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QUESTIONS

SPECIAL THANKS TO:

Turner

