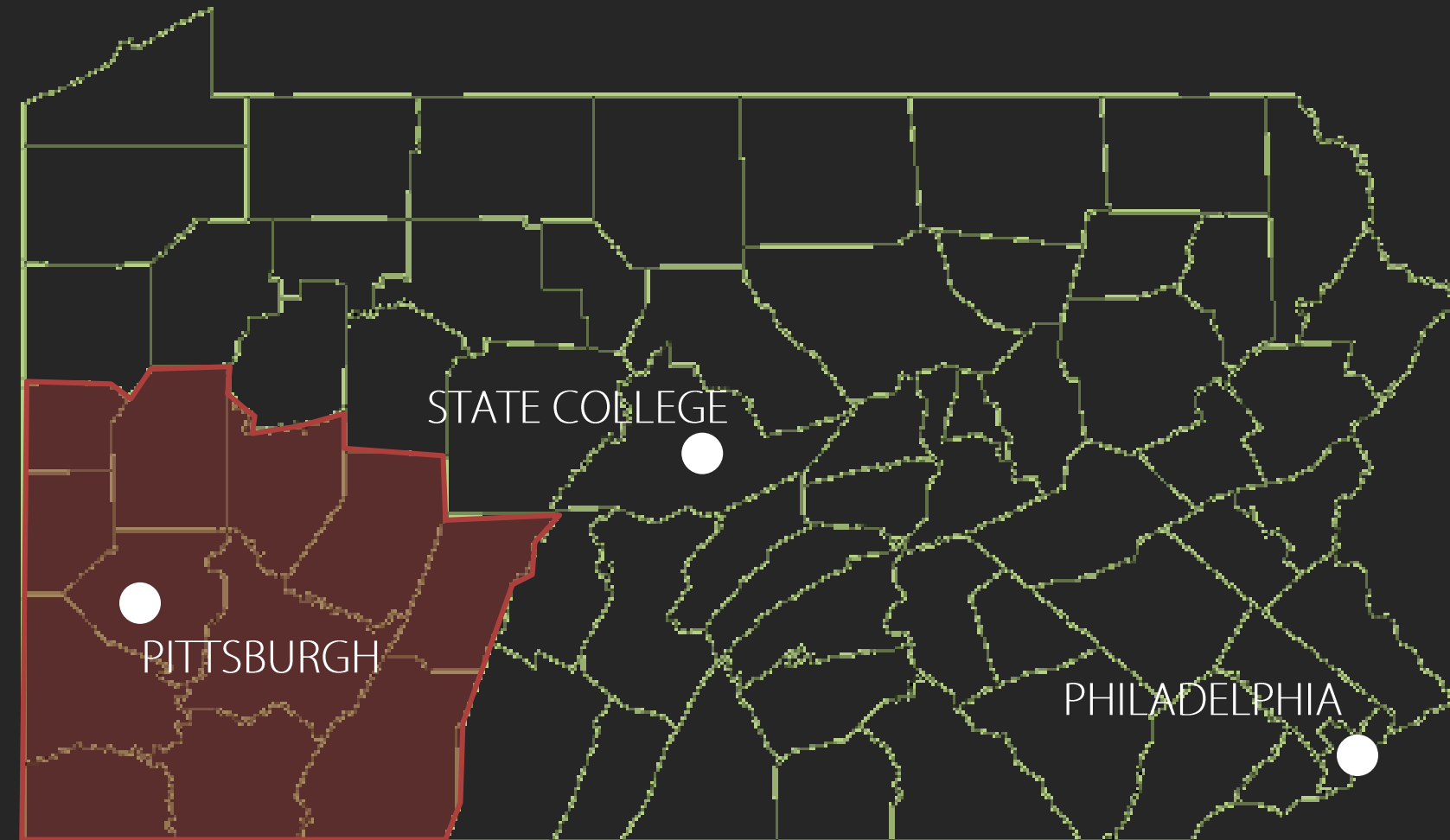


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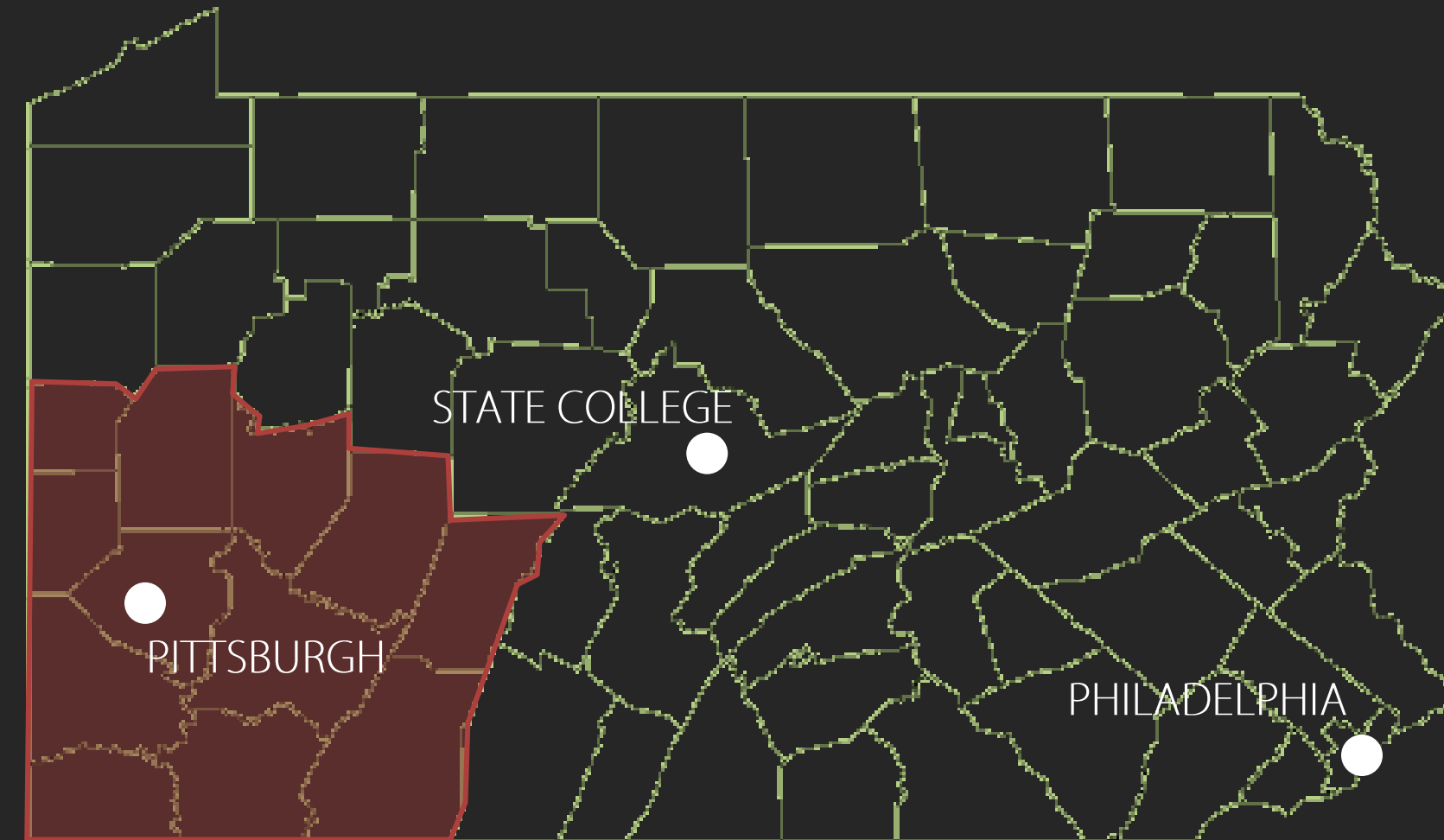


AE SENIOR THESIS
APRIL 14th, 2014

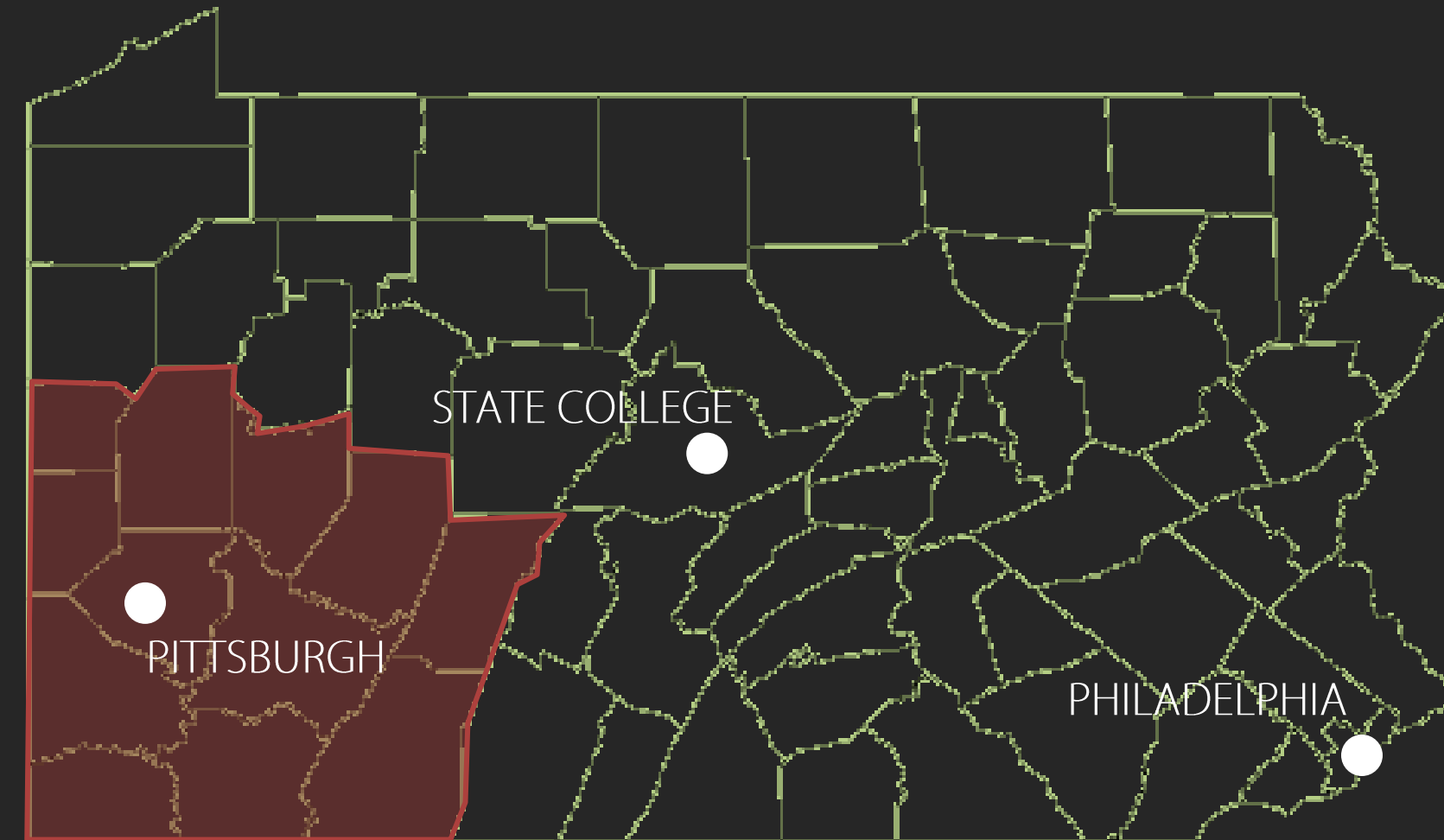
CHRIS DUARTE – STRUCTURAL
Dr. THOMAS BOOTHBY



- SOUTHWEST PENNSYLVANIA
- URBAN ENVIRONMENT
- ADJACENT PARKING GARAGE



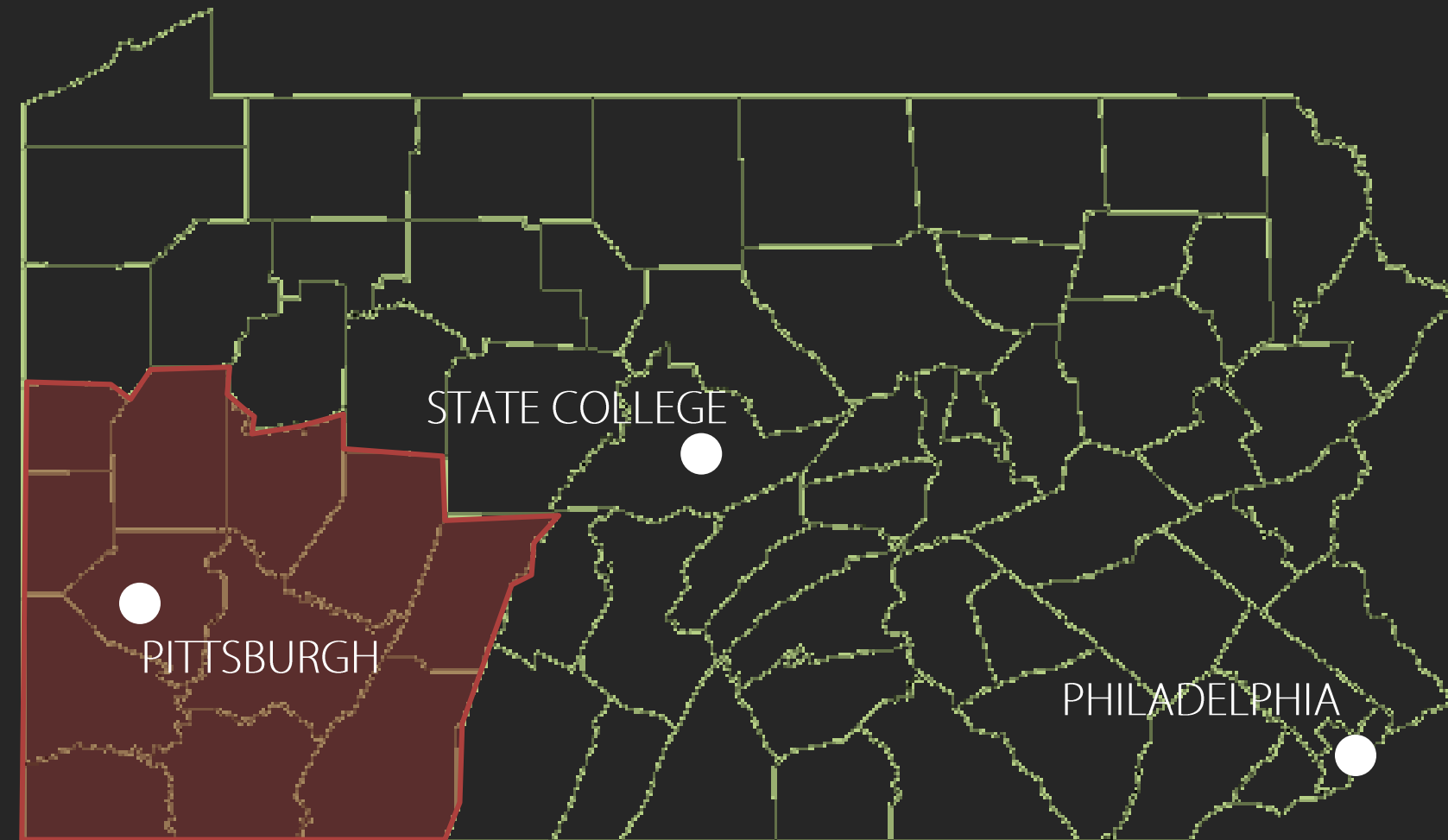
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- URBAN ENVIRONMENT
- ADJACENT PARKING GARAGE



PROPERTY DEVELOPER

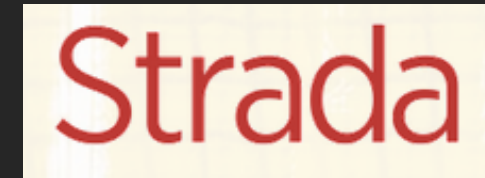


- SOUTHWEST PENNSYLVANIA
- URBAN ENVIRONMENT
- ADJACENT PARKING GARAGE

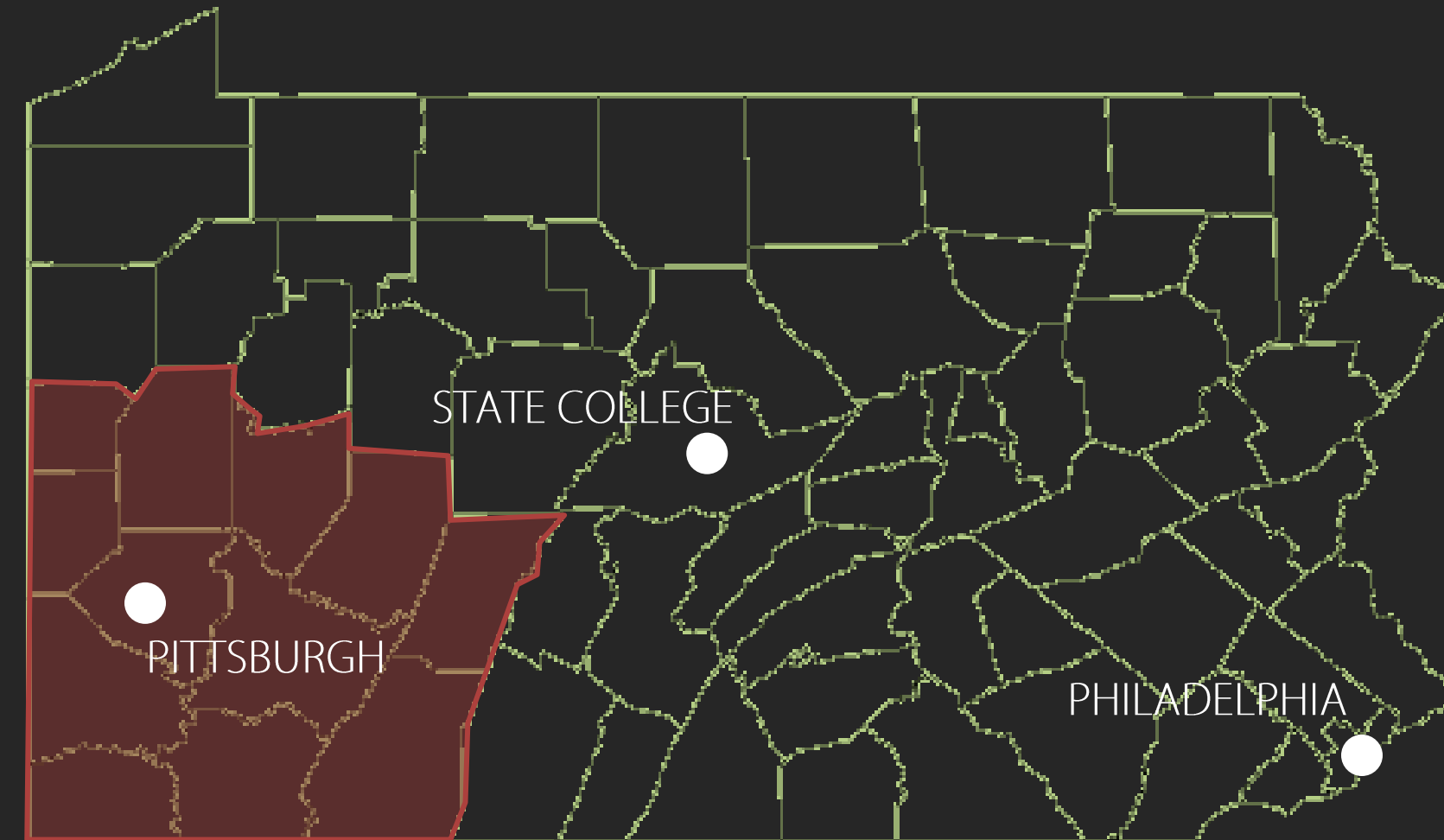


PROPERTY DEVELOPER

ARCHITECT



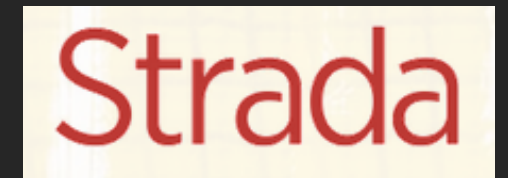
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- URBAN ENVIRONMENT
- ADJACENT PARKING GARAGE



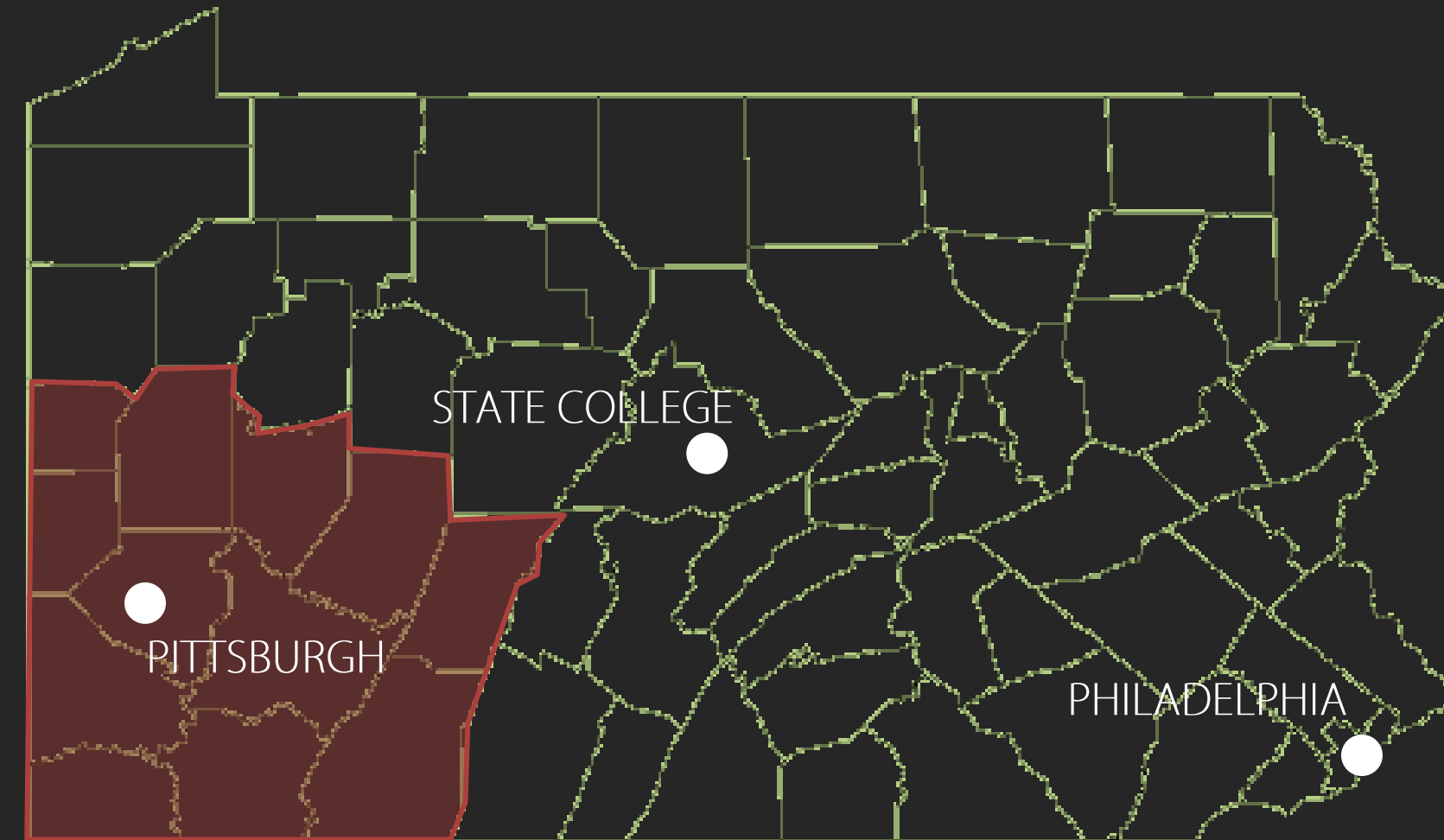
PROPERTY DEVELOPER

ARCHITECT

STRUCTURAL ENGINEER



- SOUTHWEST PENNSYLVANIA
- URBAN ENVIRONMENT
- ADJACENT PARKING GARAGE

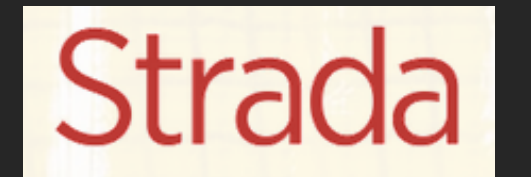


PROPERTY DEVELOPER

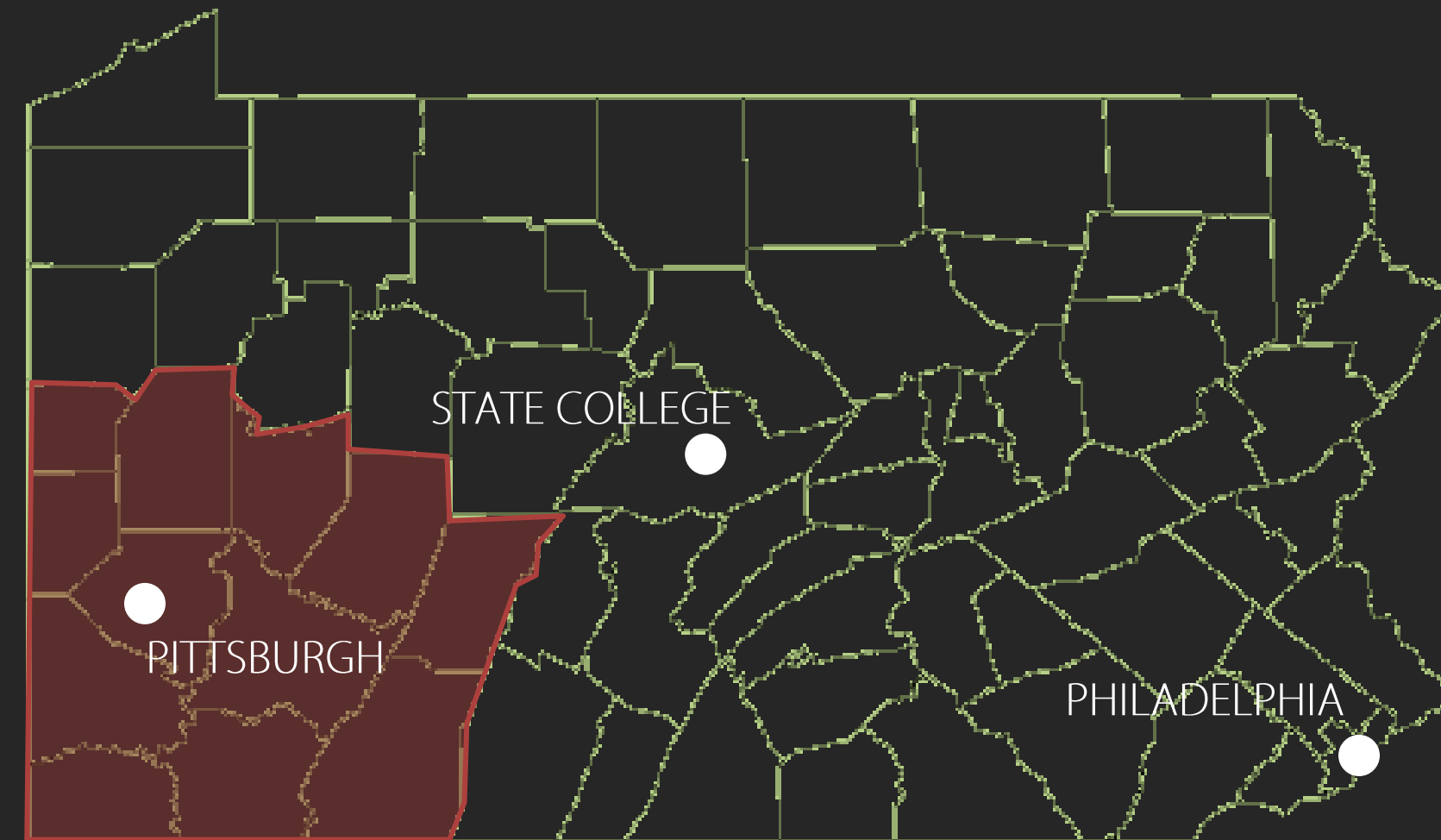
ARCHITECT

STRUCTURAL ENGINEER

CIVIL ENGINEER



- SOUTHWEST PENNSYLVANIA
- URBAN ENVIRONMENT
- ADJACENT PARKING GARAGE



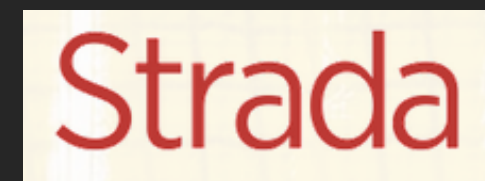
PROPERTY DEVELOPER

ARCHITECT

STRUCTURAL ENGINEER

CIVIL ENGINEER

MEP ENGINEER



- OCCUPANCY – OFFICE
- LEVELS - 6
- SIZE – 144,000 S.F.
- COST - \$18.5 MILLION
- COMPLETED – DECEMBER 2006



- OCCUPANCY – OFFICE
- LEVELS - 6
- SIZE – 144,000 S.F.
- COST - \$18.5 MILLION
- COMPLETED – DECEMBER 2006



LIMESTONE BASE

- OCCUPANCY – OFFICE
- LEVELS - 6
- SIZE – 144,000 S.F.
- COST - \$18.5 MILLION
- COMPLETED – DECEMBER 2006



GLAZING & CURTAIN WALL

LIMESTONE BASE

- OCCUPANCY – OFFICE
- LEVELS - 6
- SIZE – 144,000 S.F.
- COST - \$18.5 MILLION
- COMPLETED – DECEMBER 2006



BRICK VENEER

GLAZING & CURTAIN WALL

LIMESTONE BASE

- OCCUPANCY – OFFICE
- LEVELS - 6
- SIZE – 144,000 S.F.
- COST - \$18.5 MILLION
- COMPLETED – DECEMBER 2006



METAL PANELING

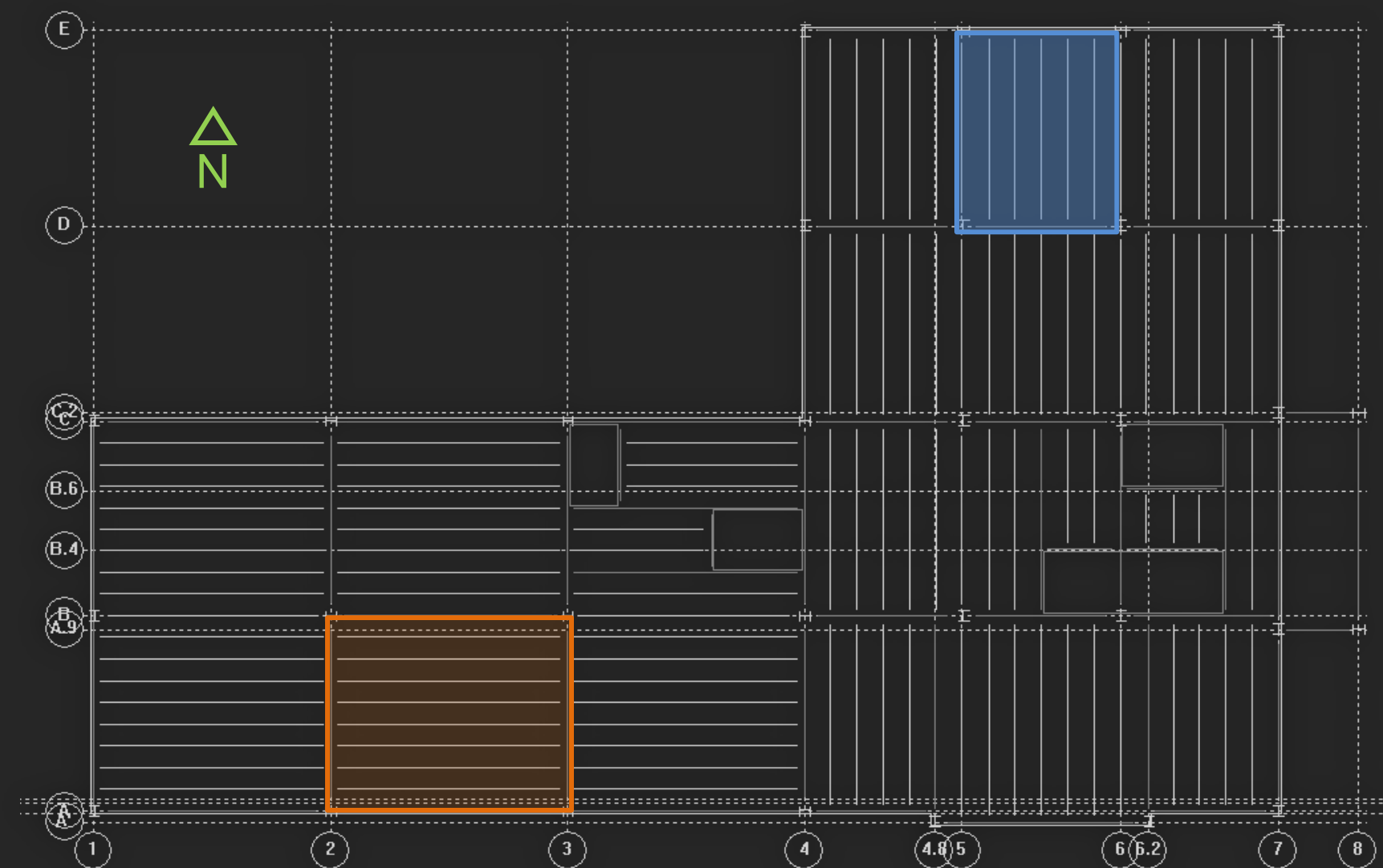
BRICK VENEER

GLAZING & CURTAIN WALL

LIMESTONE BASE

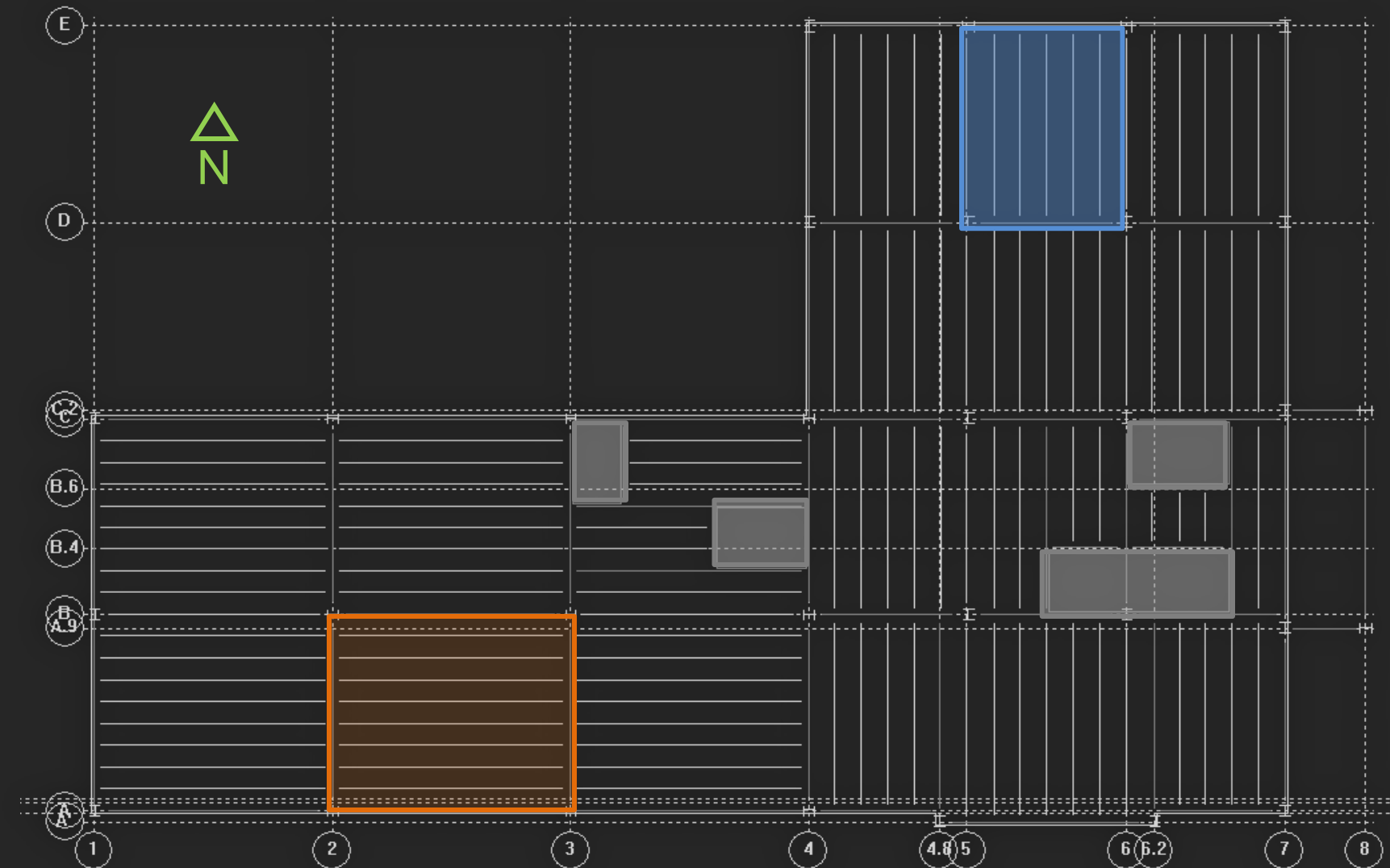
TYPICAL BAYS CONSIDERED

■ - 35' x 42' 28' x 35' - ■



TYPICAL BAYS CONSIDERED

■ - 35' x 42' 28' x 35' - ■

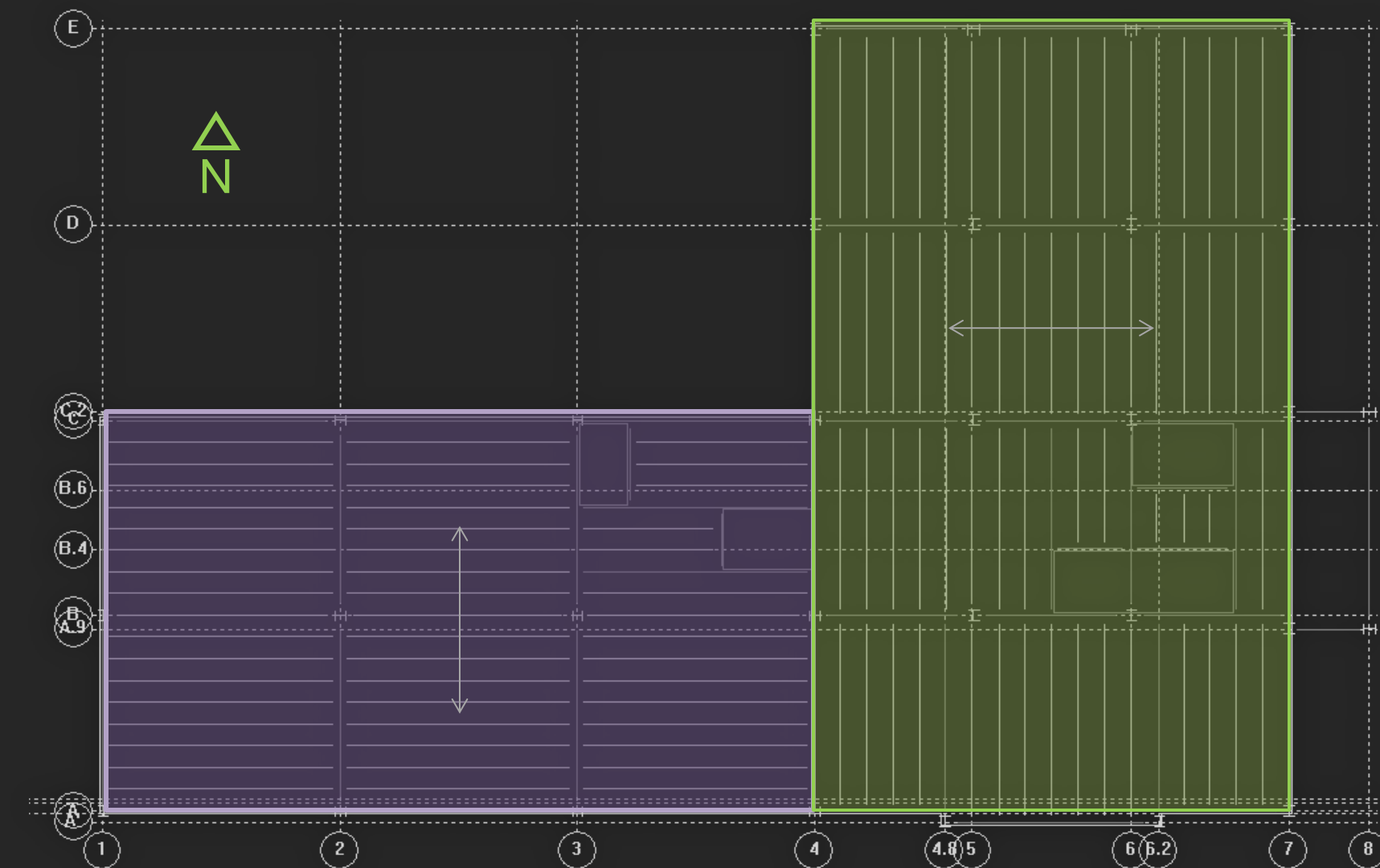
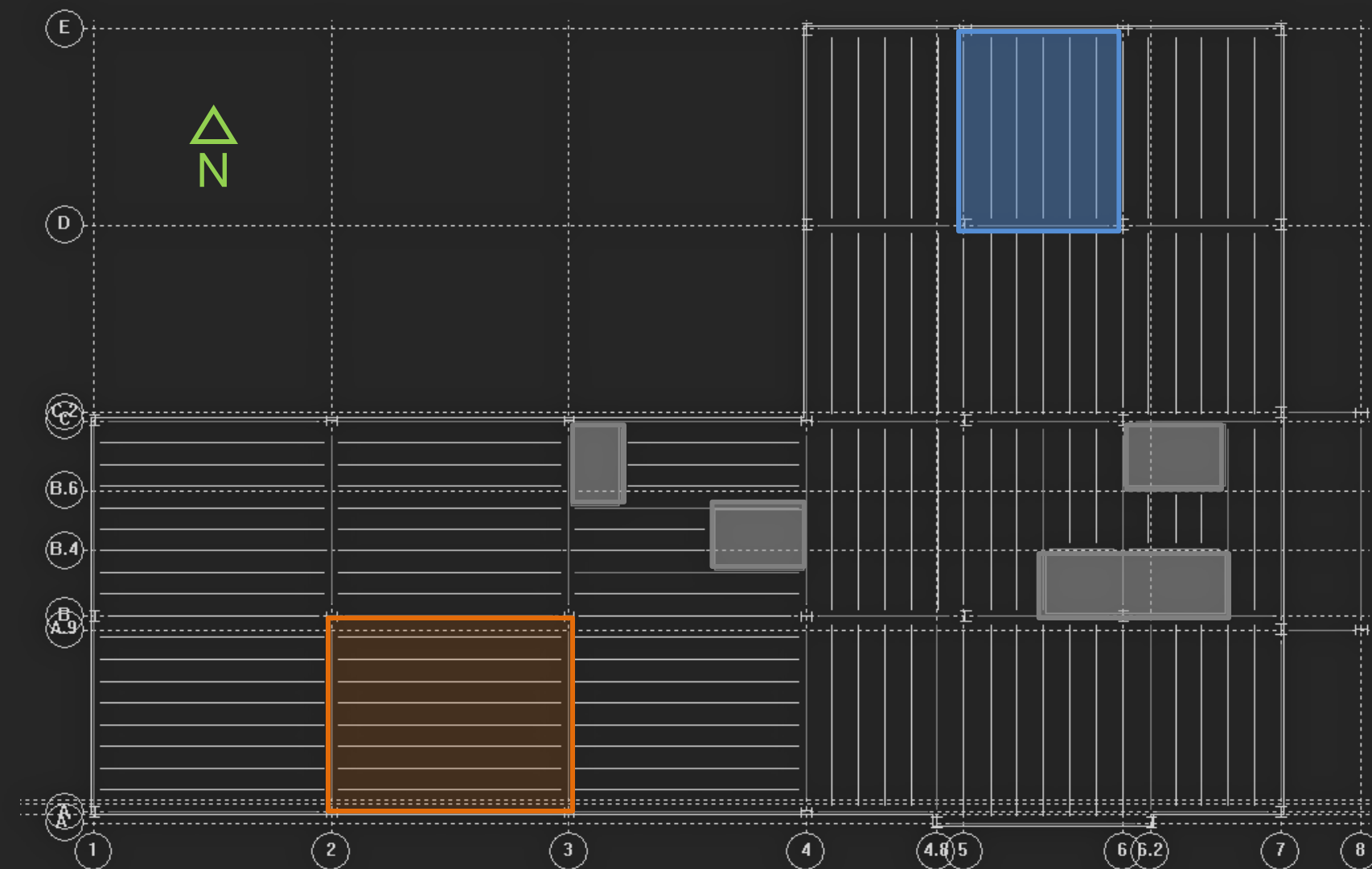


TYPICAL BAYS CONSIDERED

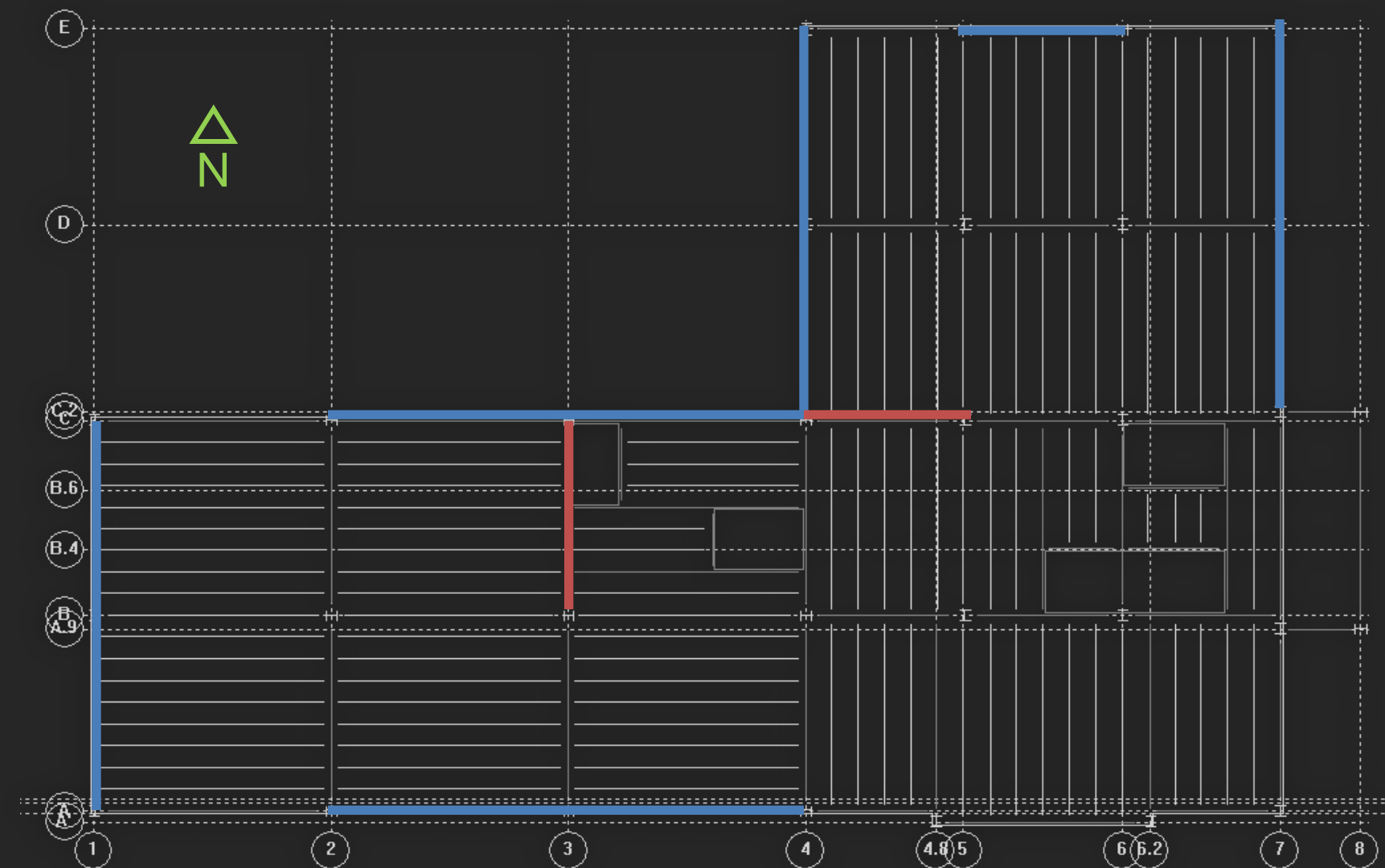
■ - 35' x 42' 28' x 35' - ■

DECKING REGIONS

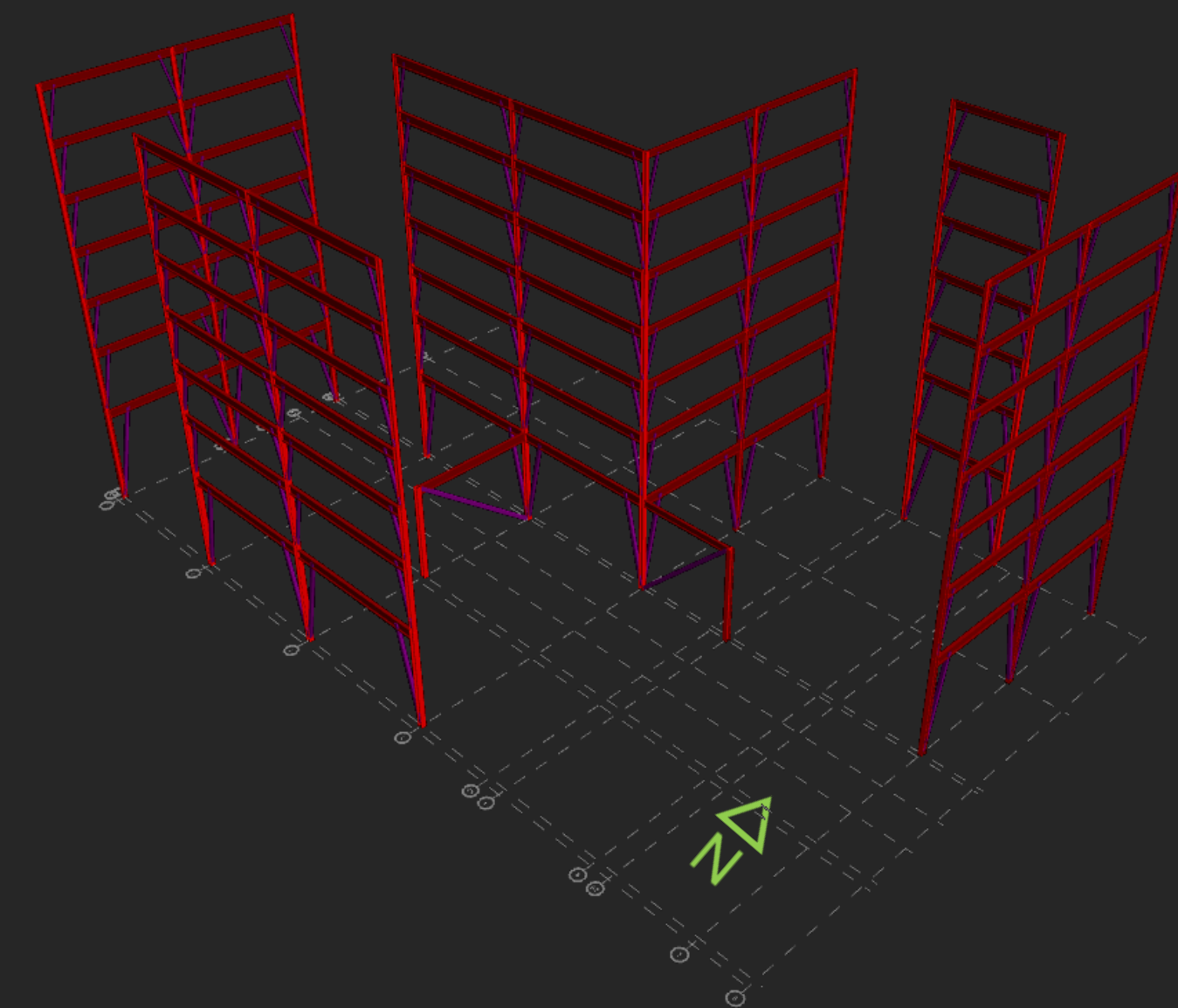
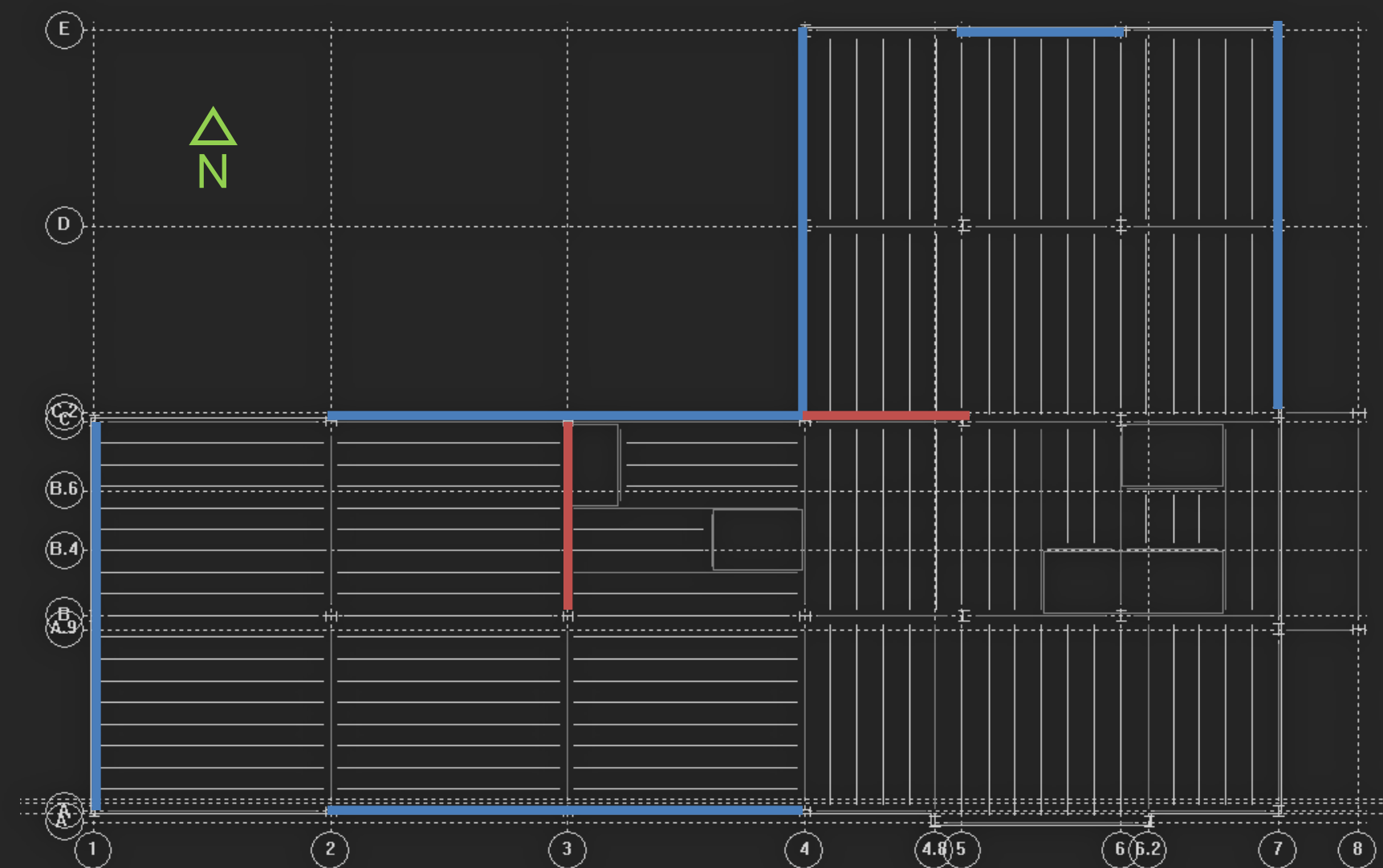
■ - N-S E-W- ■



EXISTING ECCENTRIC FRAMES

 - FULL HEIGHT FRAMES - GROUND LEVEL FRAMES

EXISTING ECCENTRIC FRAMES

 - FULL HEIGHT FRAMES - GROUND LEVEL FRAMES

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OPEN-WEB STEEL JOIST
FLOOR SYSTEM



PROPOSAL

OPEN-WEB STEEL JOIST
FLOOR SYSTEM



HVAC INTEGRATION



PROPOSAL

OPEN-WEB STEEL JOIST
FLOOR SYSTEM



HVAC INTEGRATION



PROPOSAL



CONCENTRIC LATERAL
FRAMING

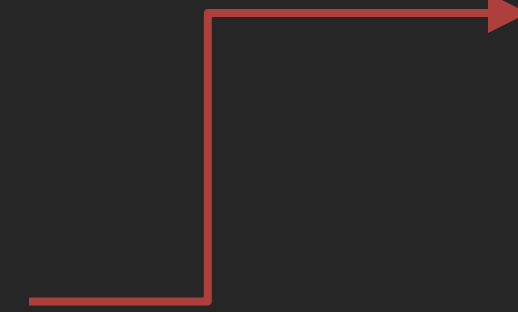
OPEN-WEB STEEL JOIST
FLOOR SYSTEM



HVAC INTEGRATION



PROPOSAL



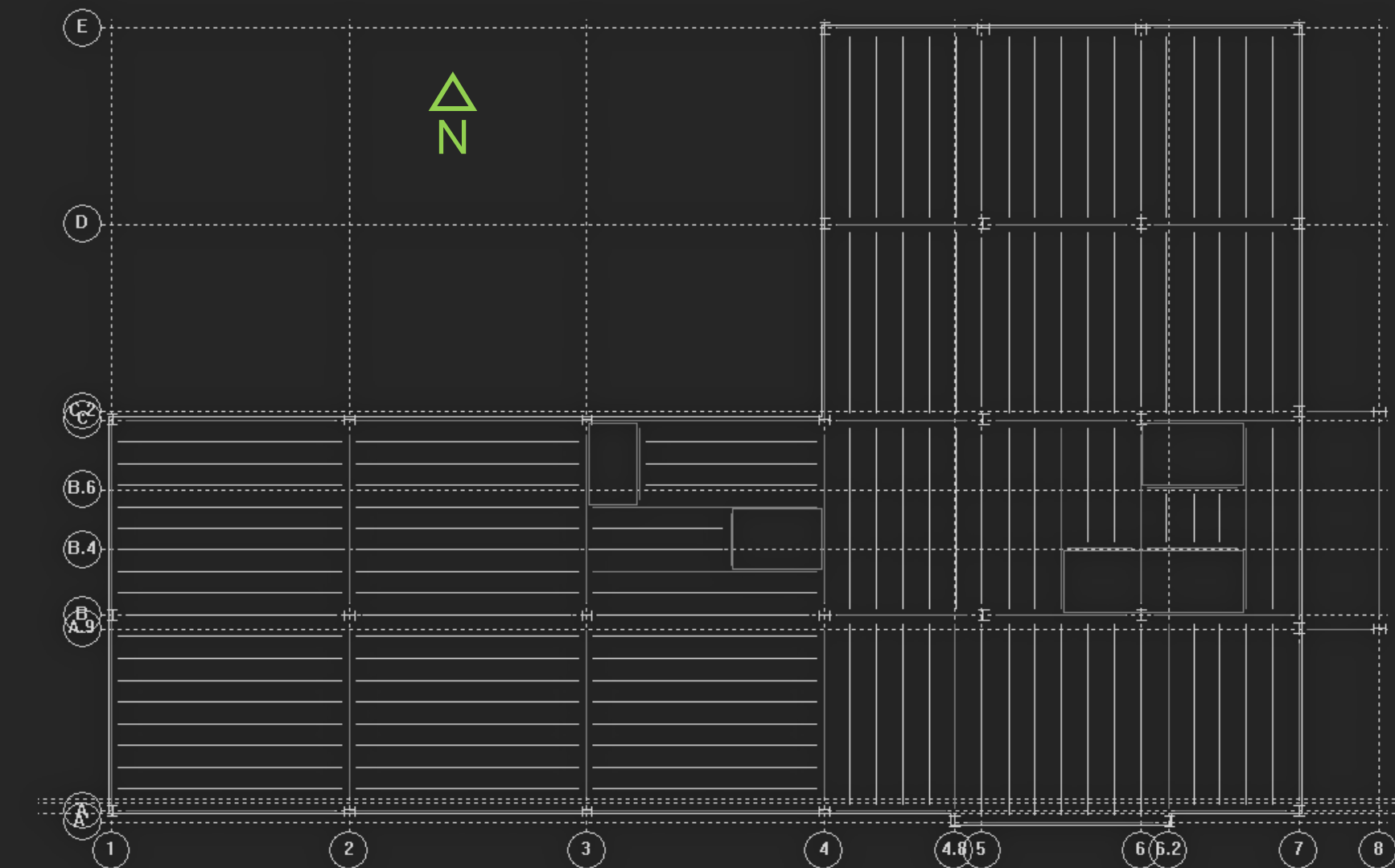
CONCENTRIC LATERAL
FRAMING



ARCHITECTURAL IMPACT

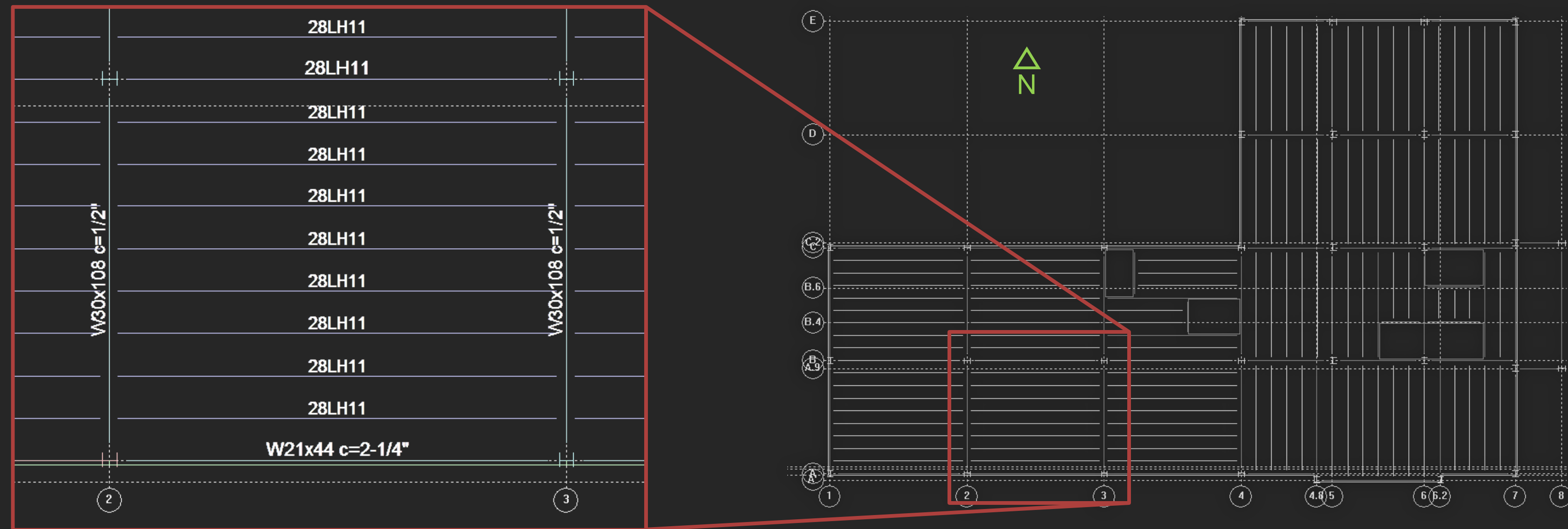
OPEN-WEB STEEL JOIST FLOOR SYSTEM

- NON-COMPOSITE SYSTEM
- 2" DECK WITH 4.5" SLAB
- 28" DEPTH RESTRICTION
- 42' SPAN
- 80psf DEAD LOAD
- 100psf LIVE LOAD



OPEN-WEB STEEL JOIST FLOOR SYSTEM

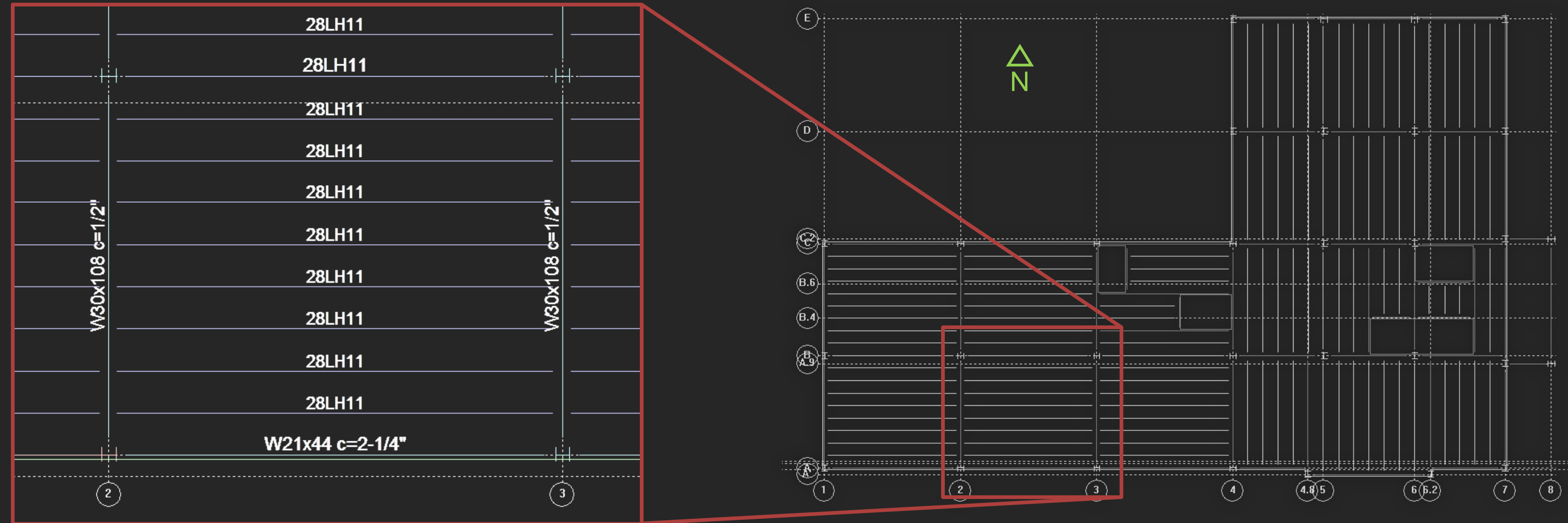
- NON-COMPOSITE SYSTEM
- 2" DECK WITH 4.5" SLAB
- 28" DEPTH RESTRICTION
- 42' SPAN
- 80psf DEAD LOAD
- 100psf LIVE LOAD

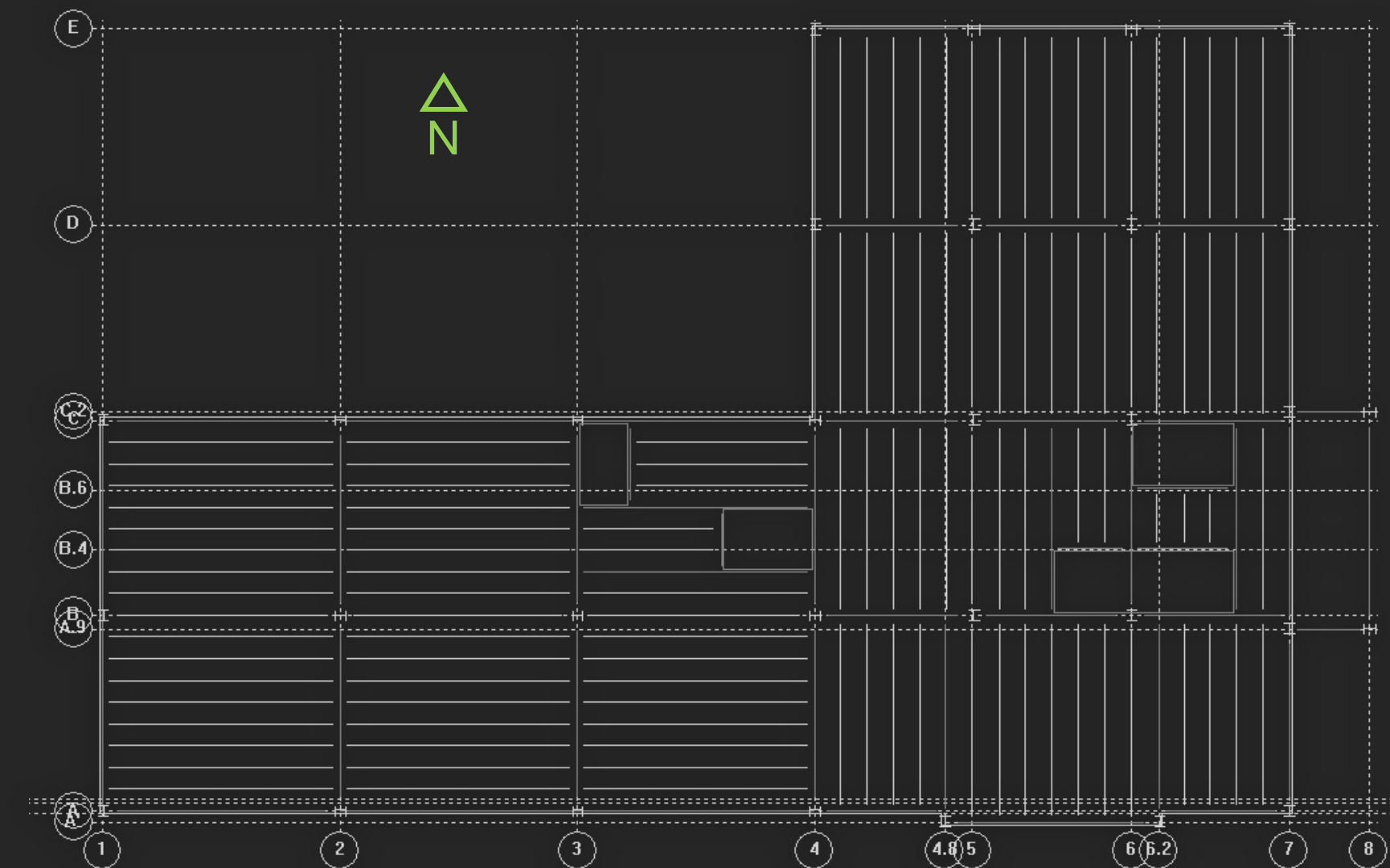


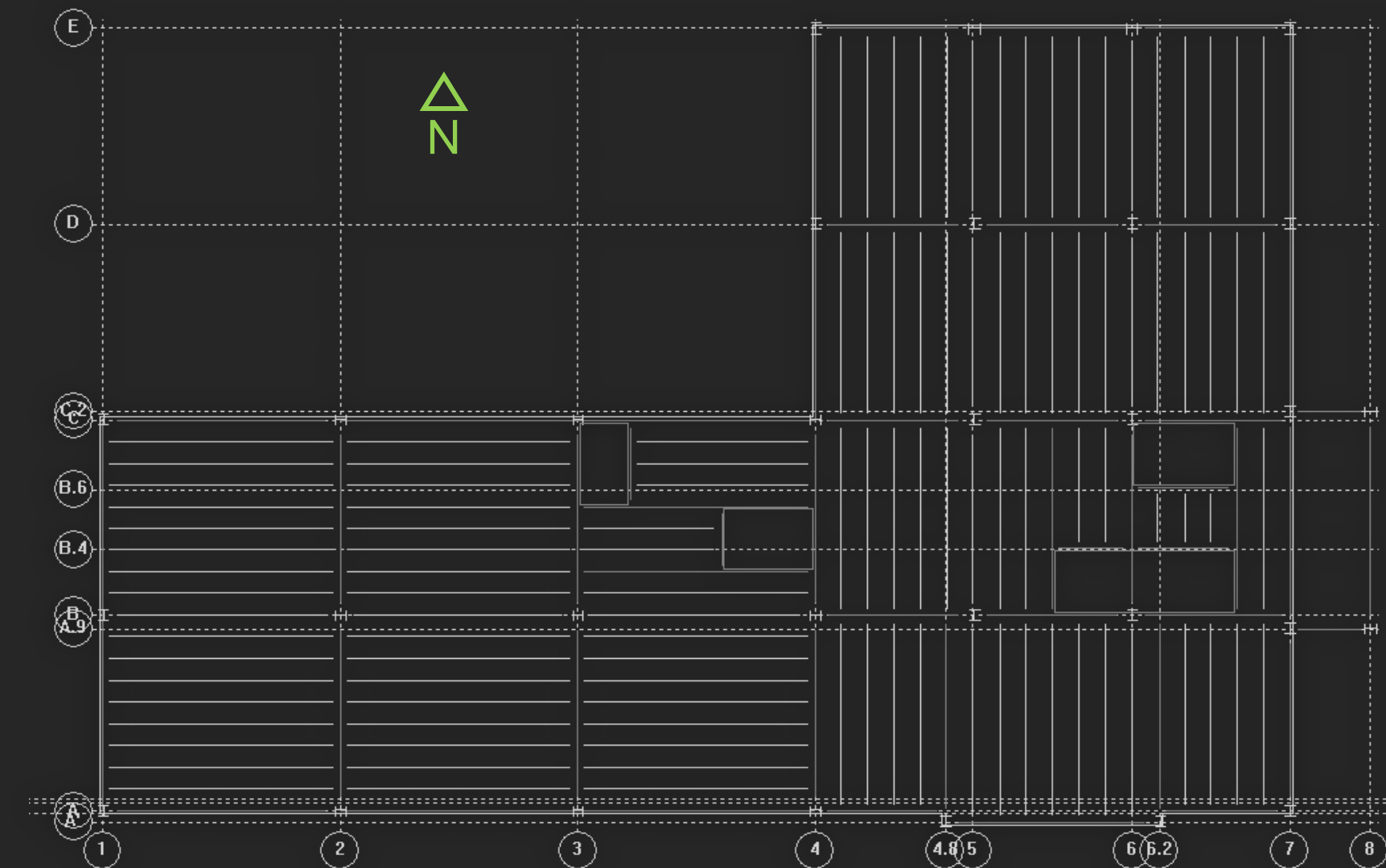
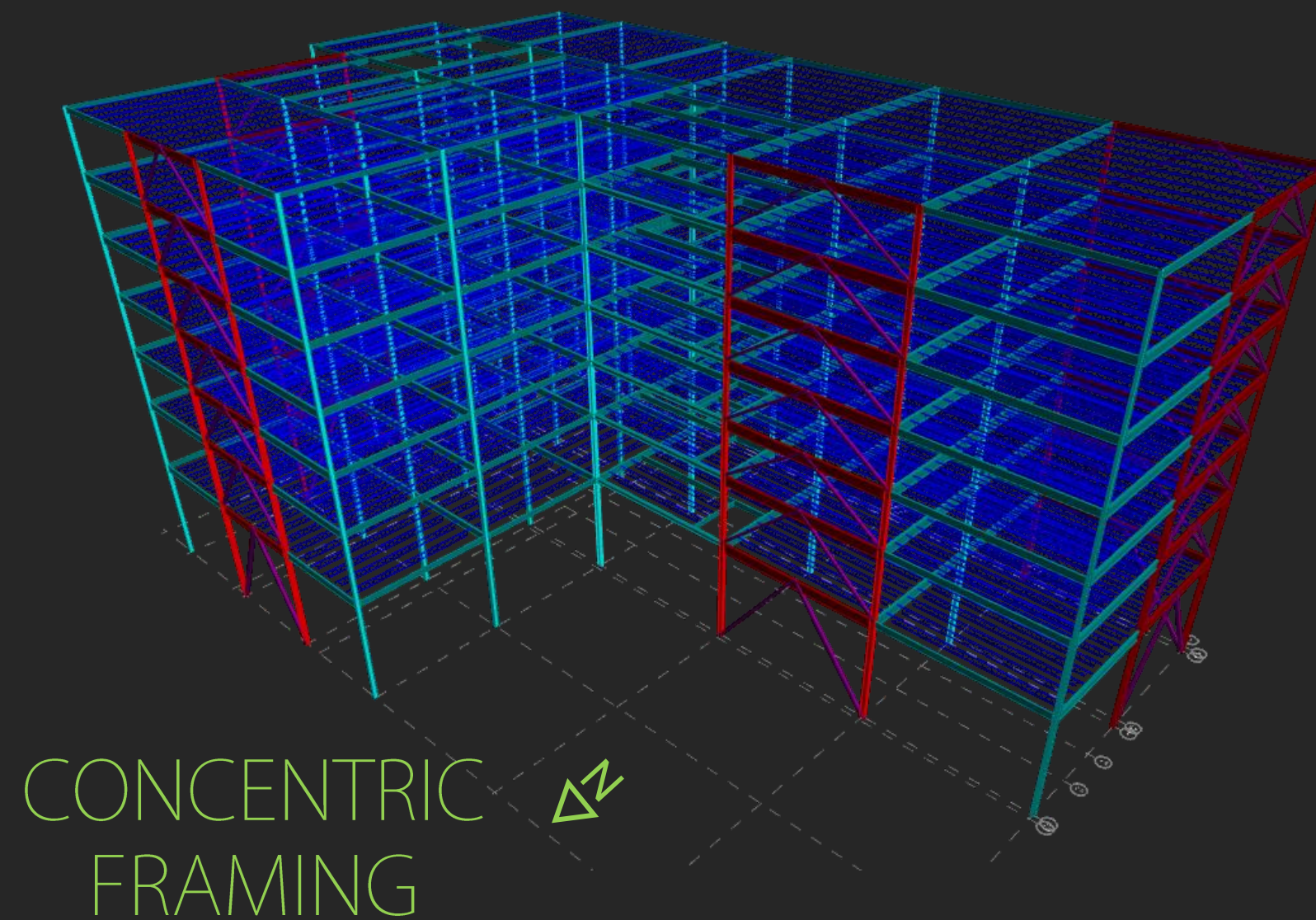
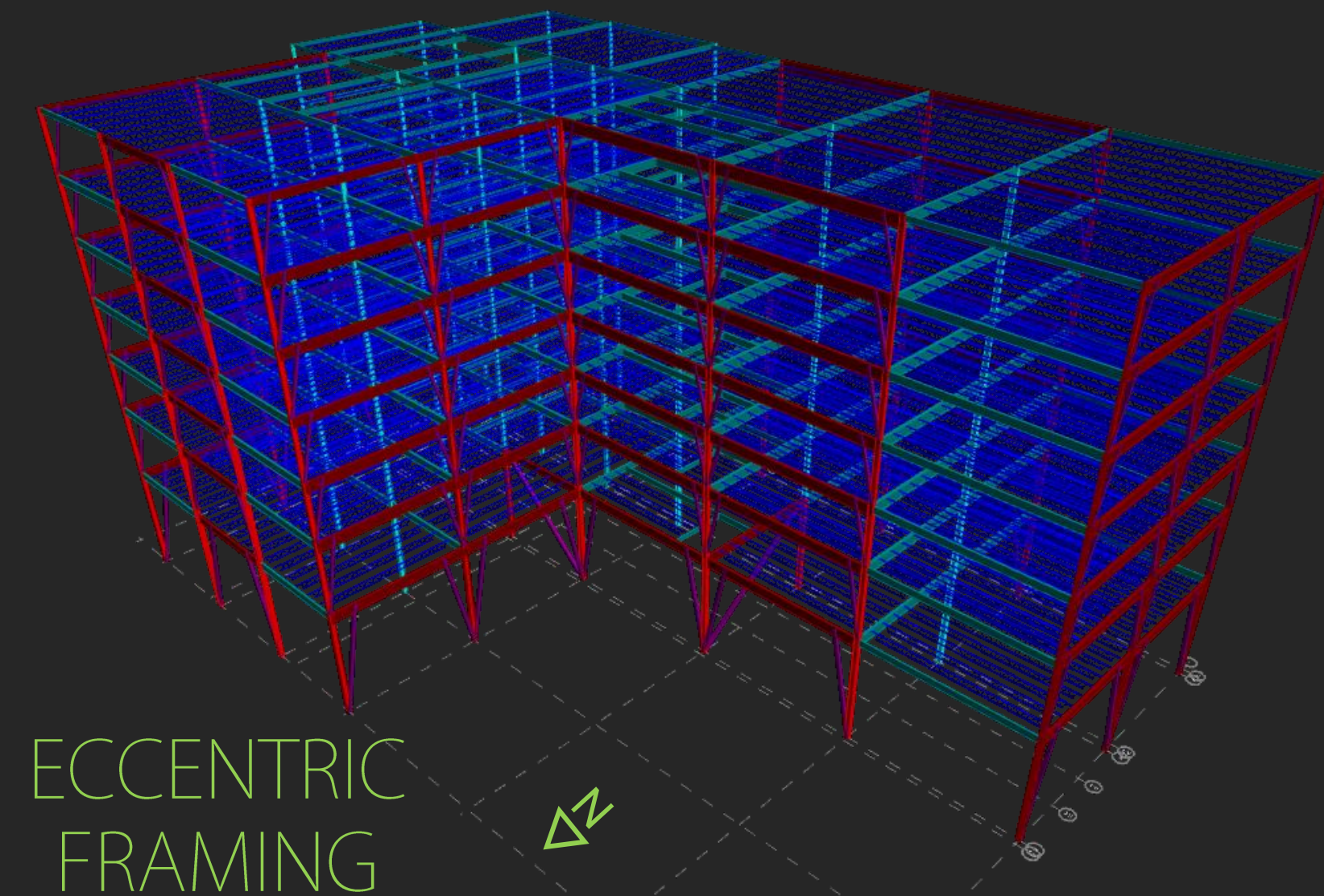
VIBRATION CONCERNS

- 2" DECK WITH 4.5" SLAB
- 28LH11 JOISTS w/ 42' SPAN
- W30x108 GIRDER w/ 35' SPAN
- 80psf DEAD LOAD
- 100psf LIVE LOAD

$$\frac{a_o}{g} = \frac{65e^{(-0.35)(0.005)}}{0.003 (603348)} = 0.0035 < 0.005$$

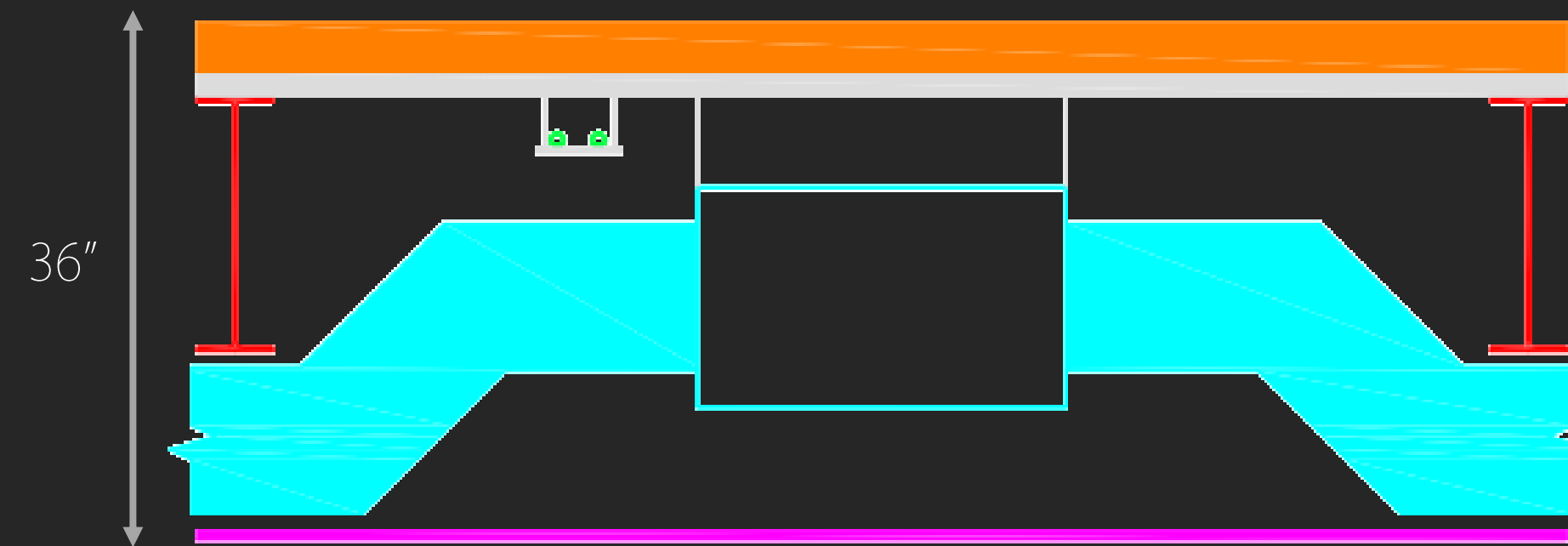






HVAC INTEGRATION

- 18" X 30" SUPPLY DUCT
- 8" AUXILIARY DUCTS



- CONCRETE SLAB



- ACOUSTIC TILE CEILING



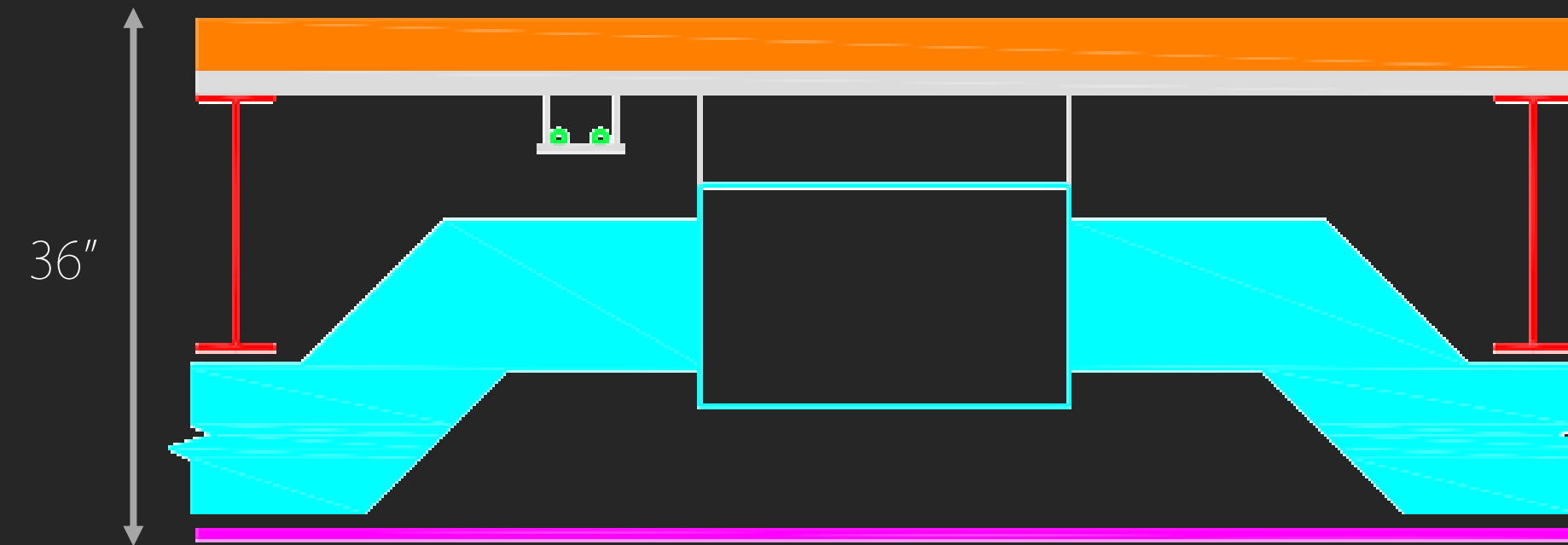
- HVAC DUCTS



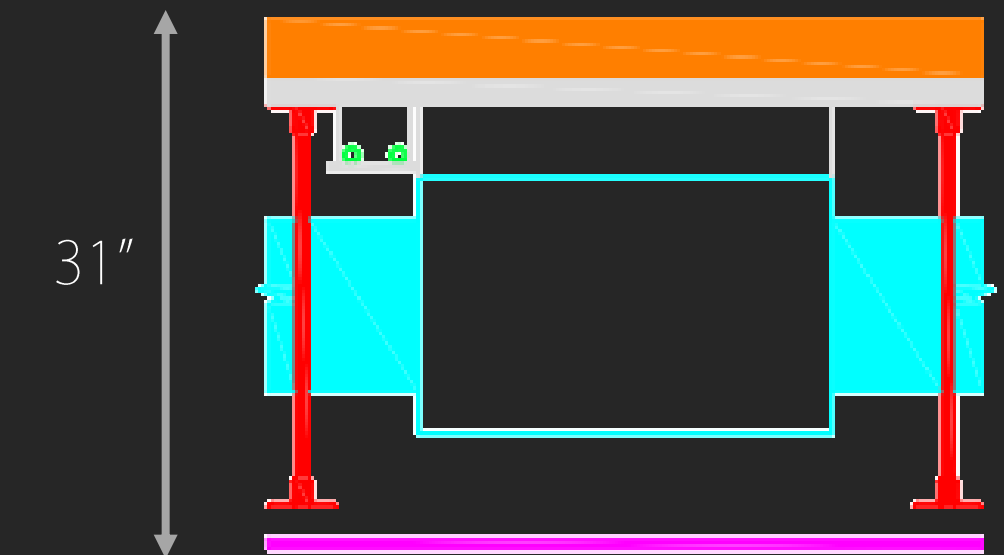
- FLOOR STRUCTURE

HVAC INTEGRATION

- 18" X 30" SUPPLY DUCT
- 8" AUXILIARY DUCTS



- - CONCRETE SLAB
- - ACOUSTIC TILE CEILING



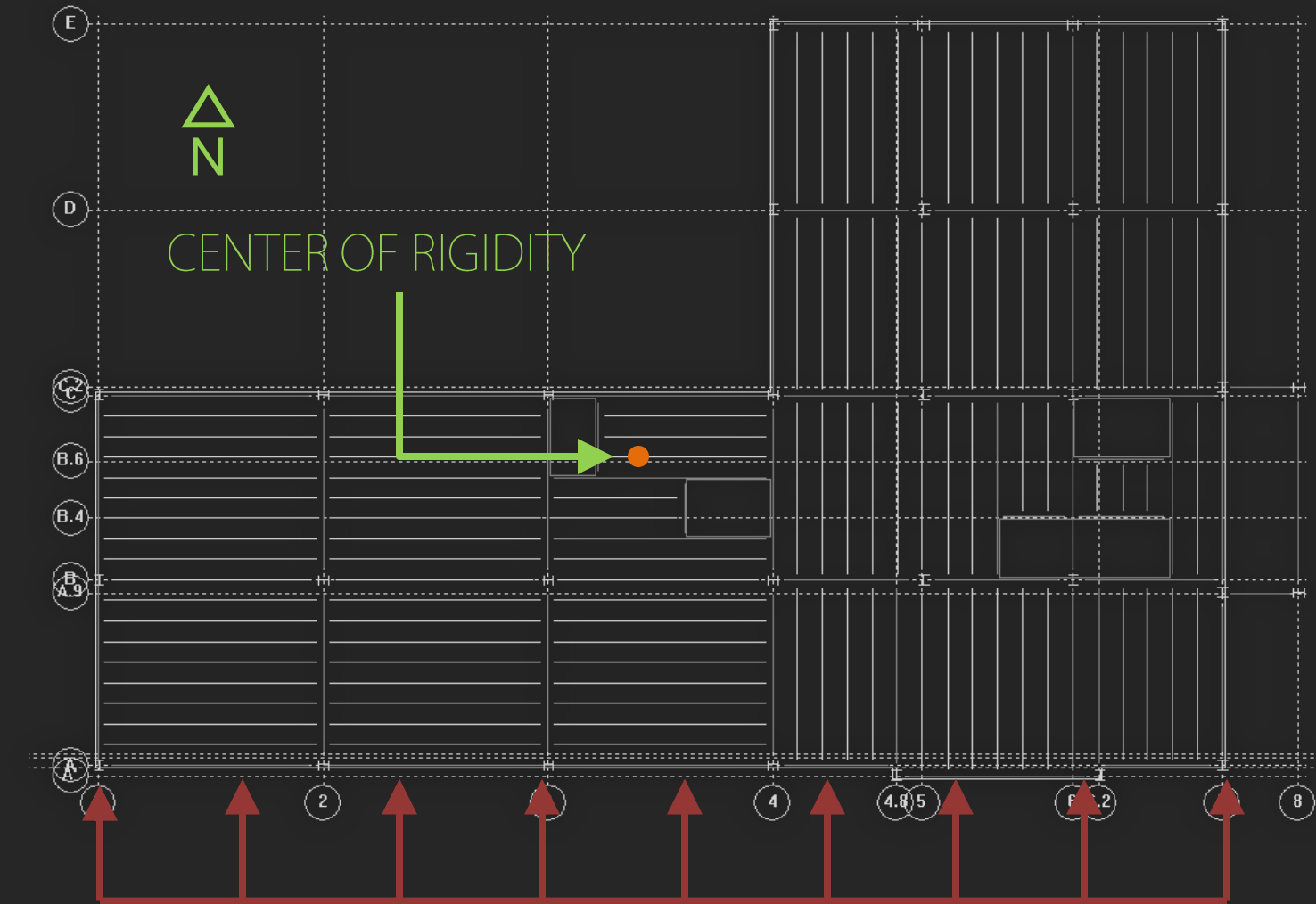
- - HVAC DUCTS
- - FLOOR STRUCTURE

FRAME COMPARISON

- MAXIMUM WIND SPEED
90mph
- CONTROLLING LOAD CASE
WIND N-S
- TOTAL BASE SHEAR
- 496 kips

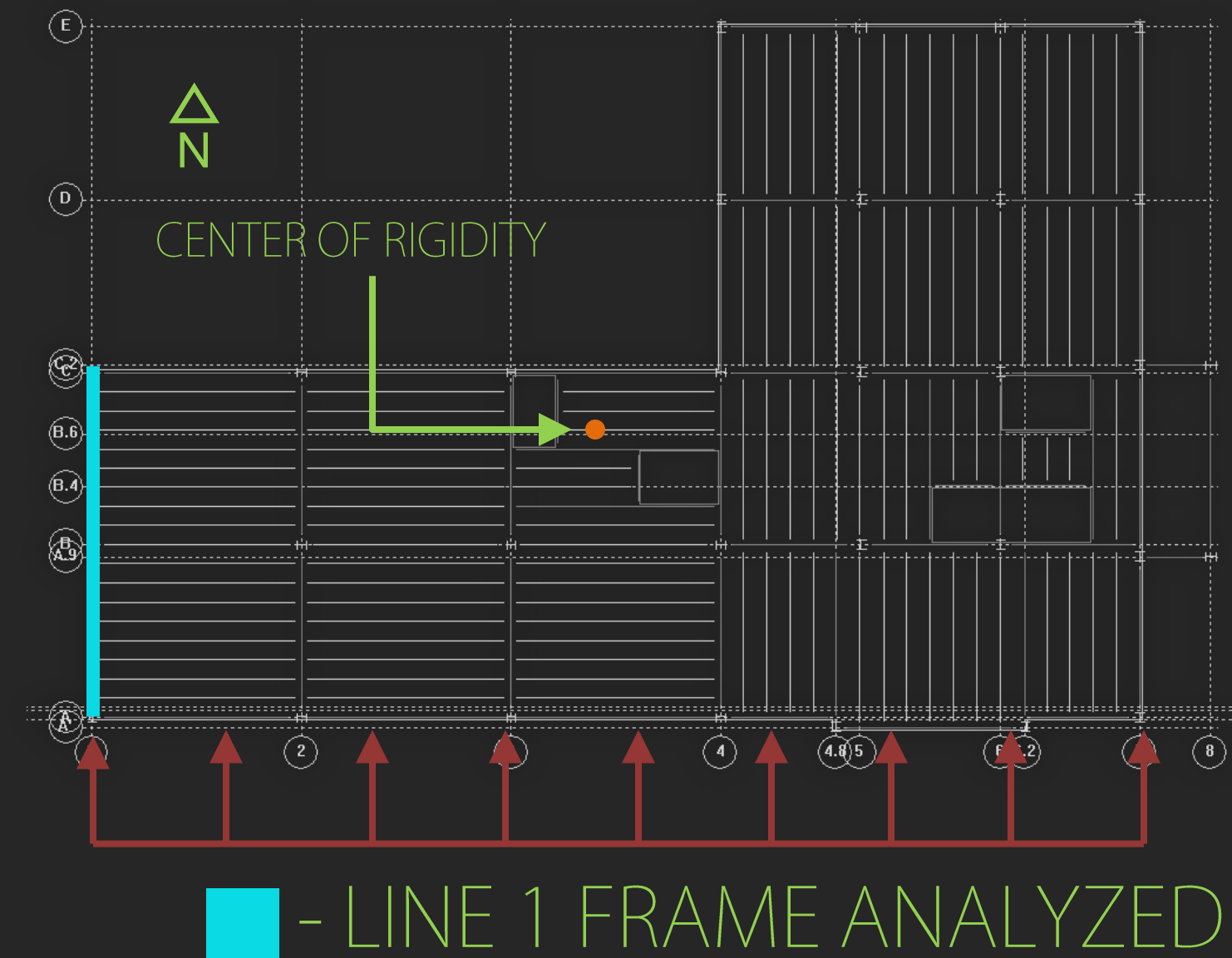
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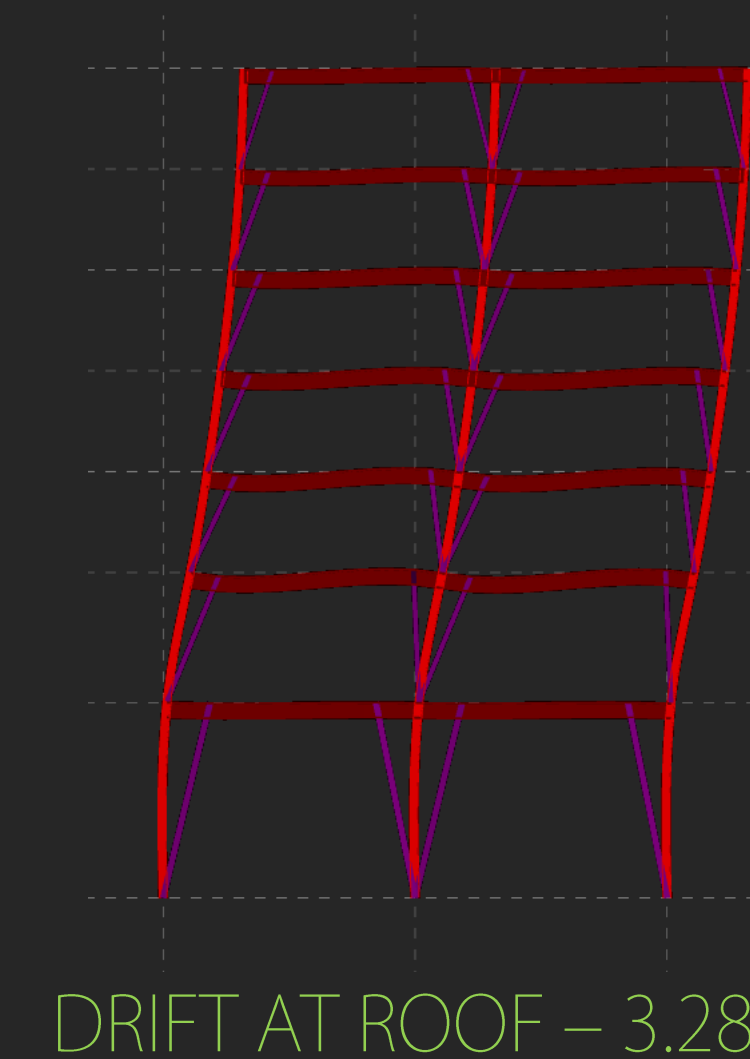
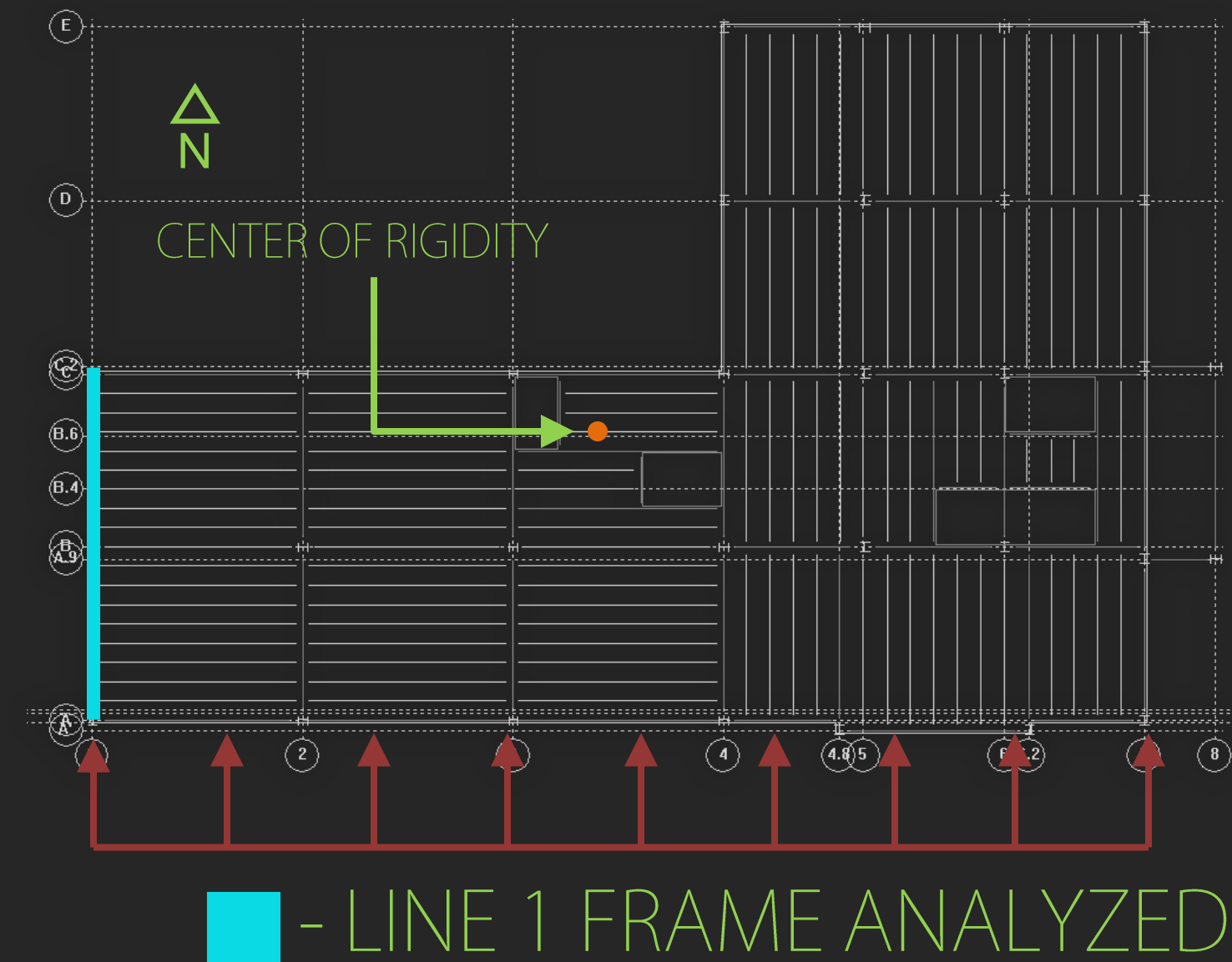
FRAME COMPARISON

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FRAME COMPARISON

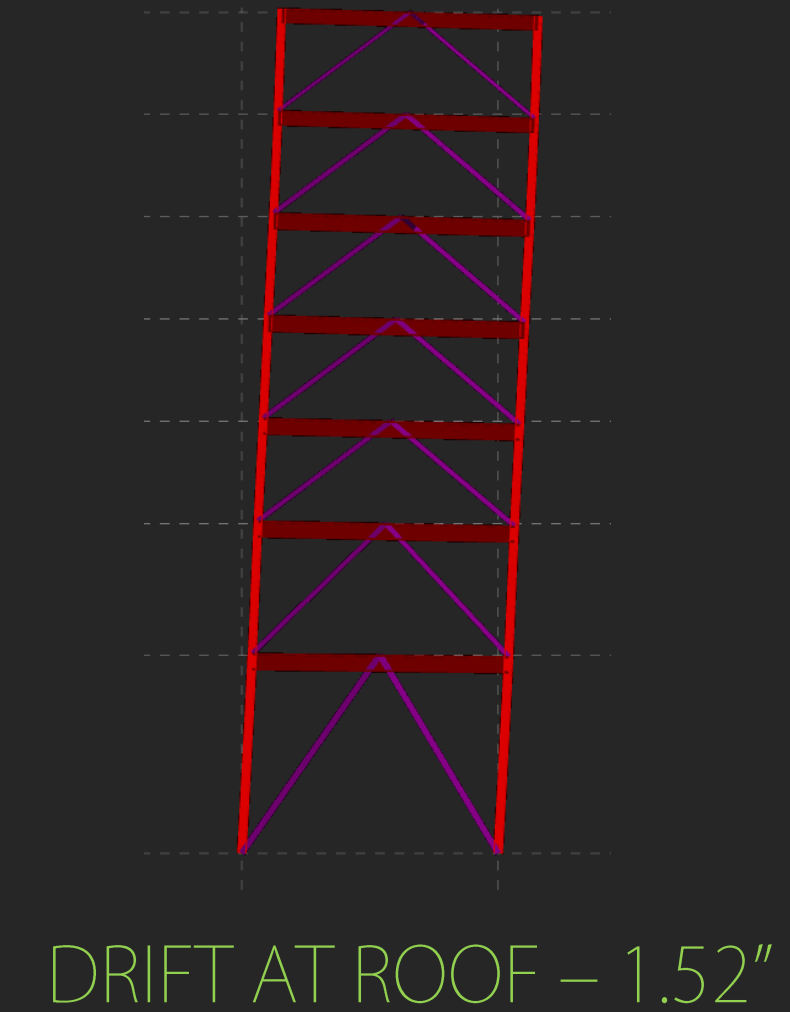
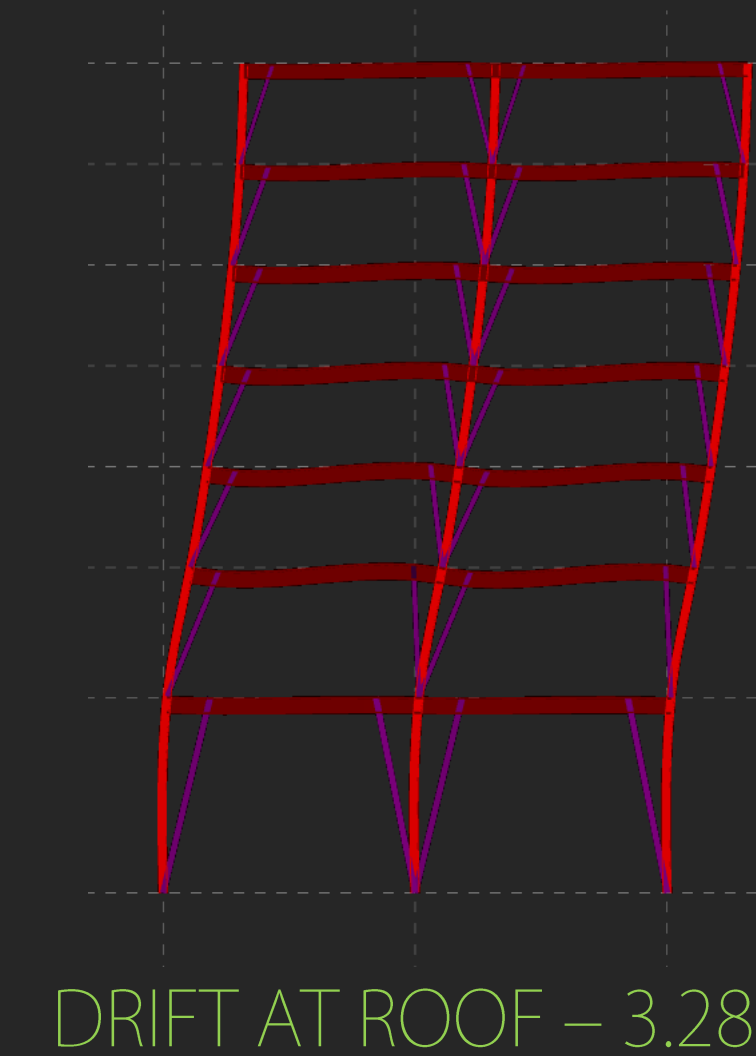
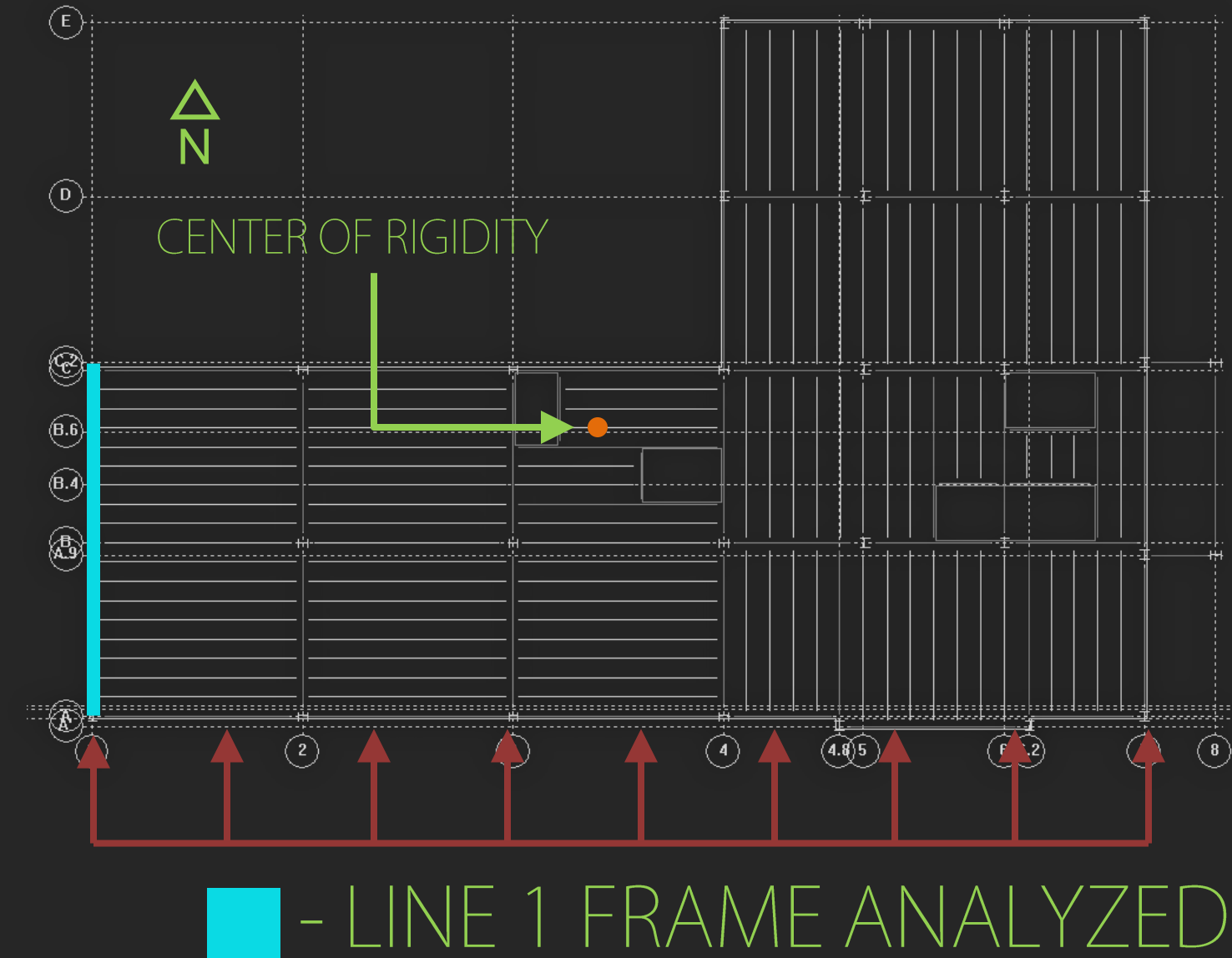
- MAXIMUM WIND SPEED
90mph
- CONTROLLING LOAD CASE
WIND N-S
- TOTAL BASE SHEAR
496 kips



DISPLACEMENTS AMPLIFIED BY A FACTOR OF 50

FRAME COMPARISON

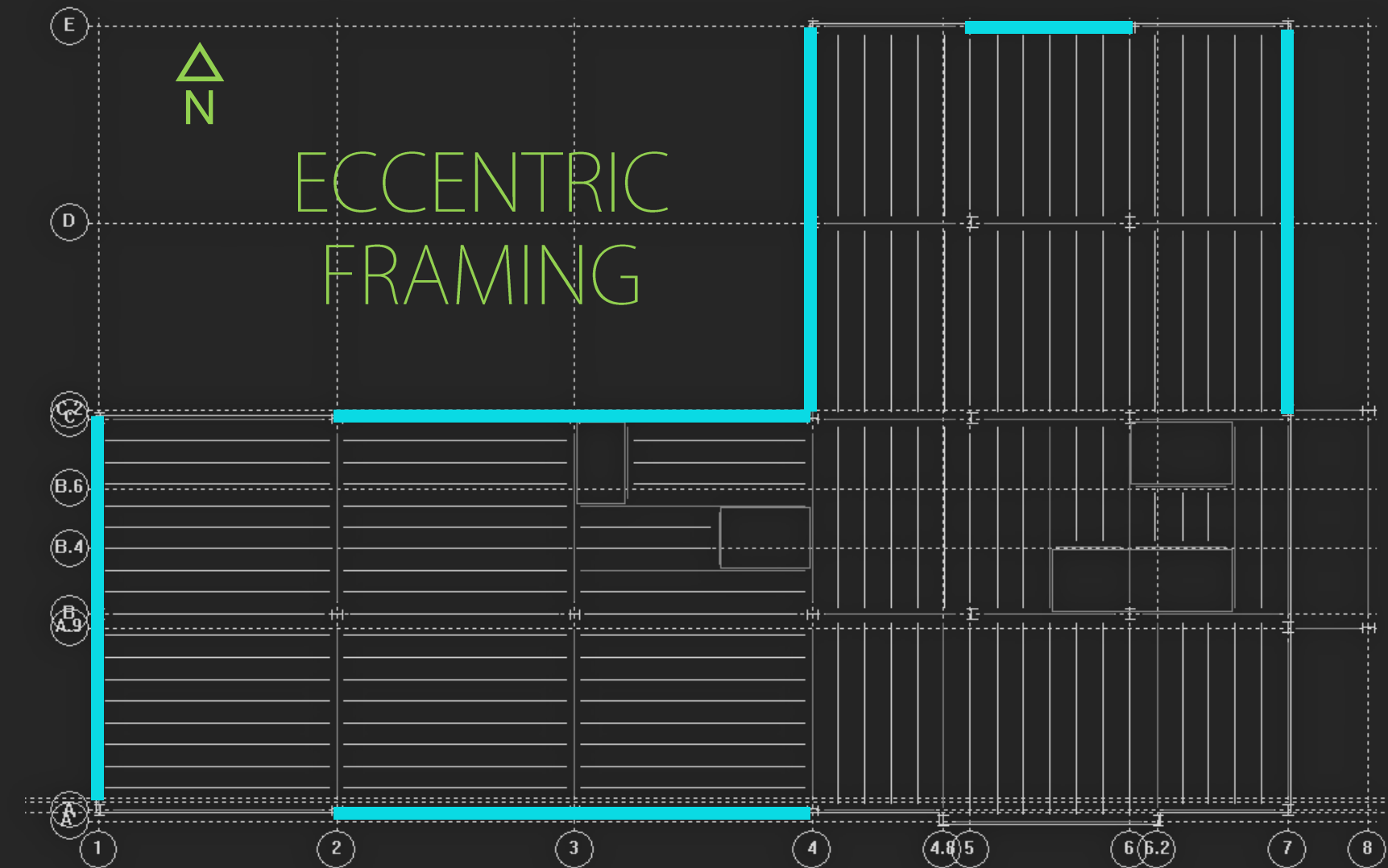
- MAXIMUM WIND SPEED
90mph
- CONTROLLING LOAD CASE
WIND N-S
- TOTAL BASE SHEAR
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DISPLACEMENTS AMPLIFIED BY A FACTOR OF 50

ARCHITECTURAL IMPACT

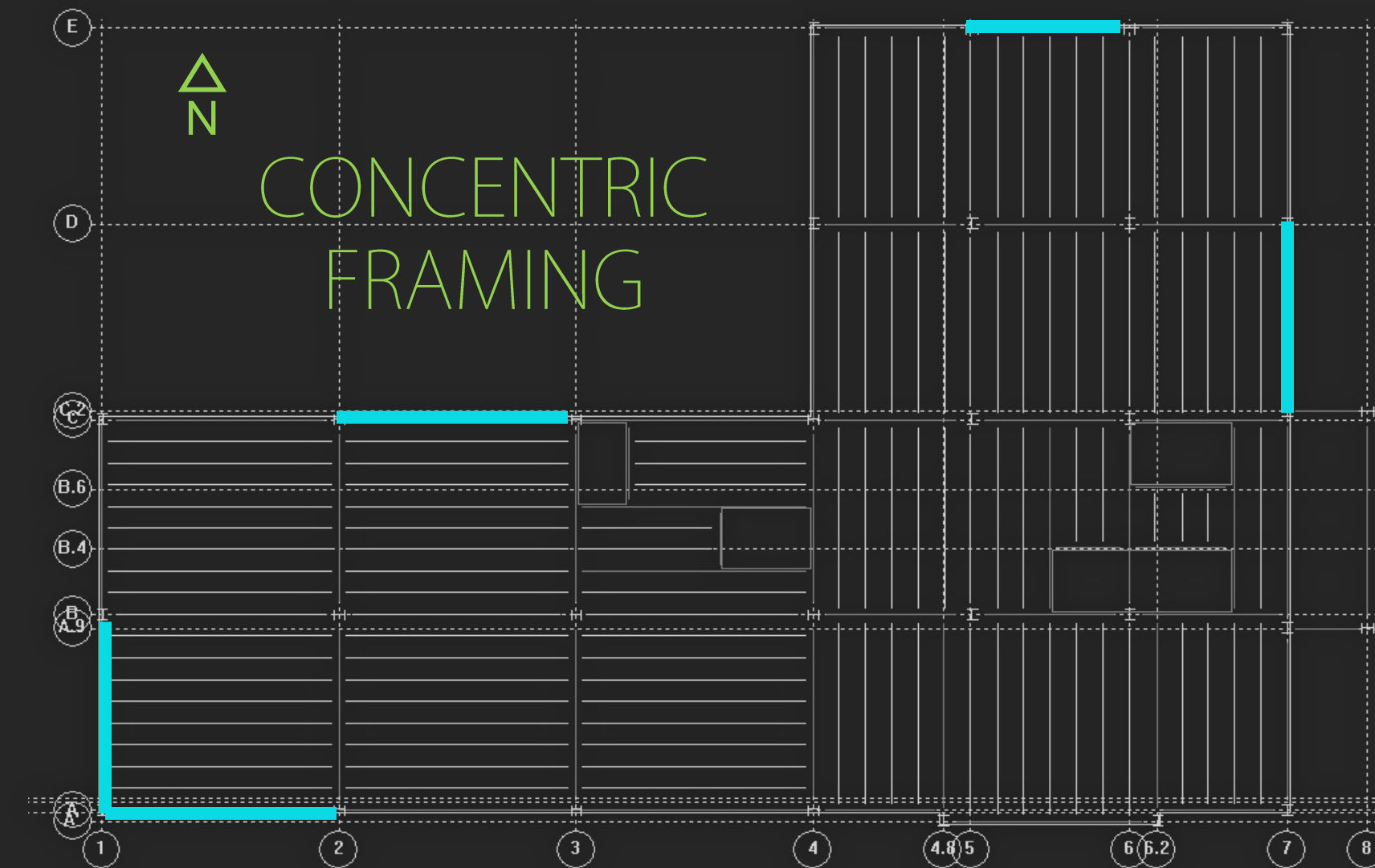
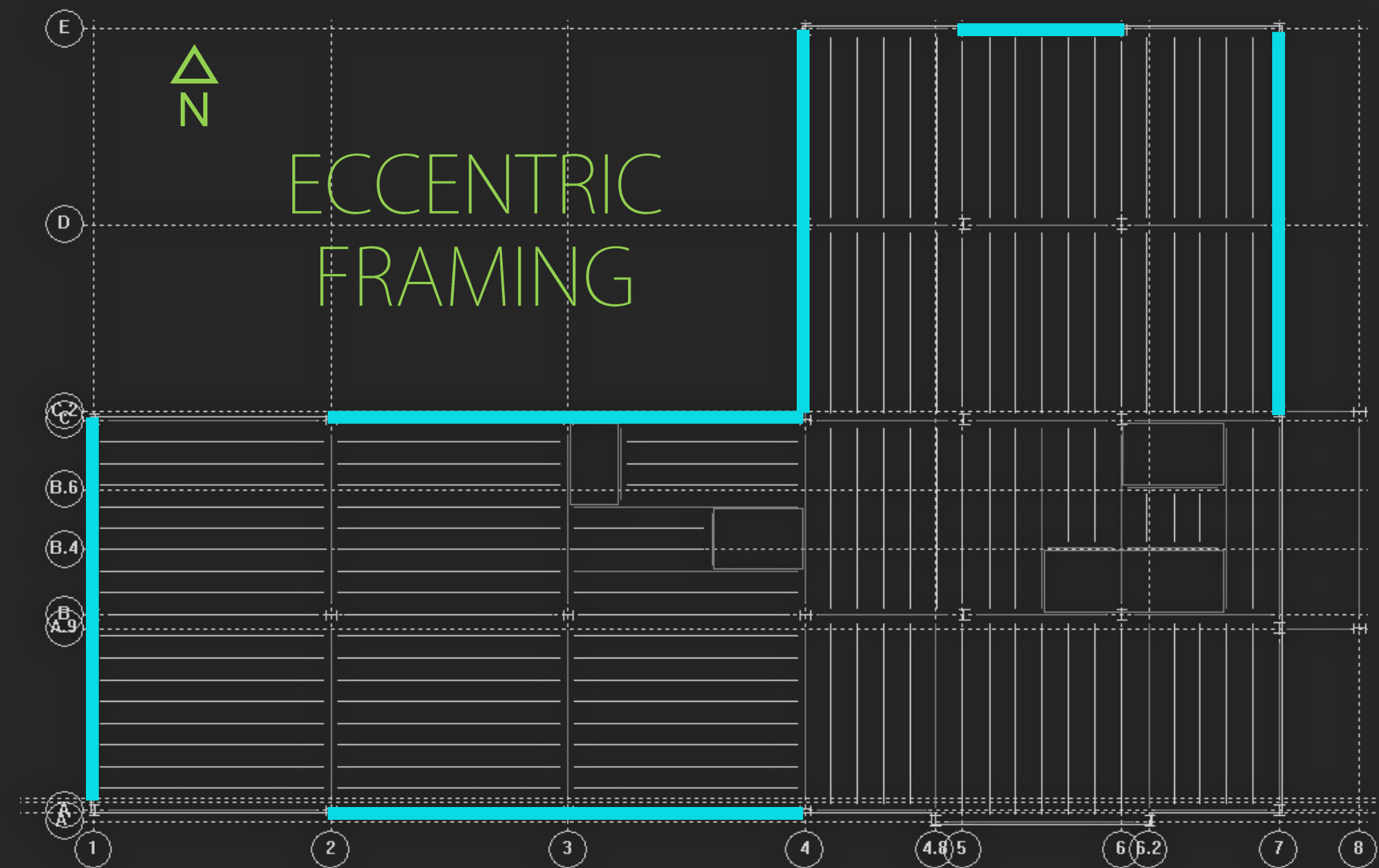
ECCENTRIC BAYS - 11



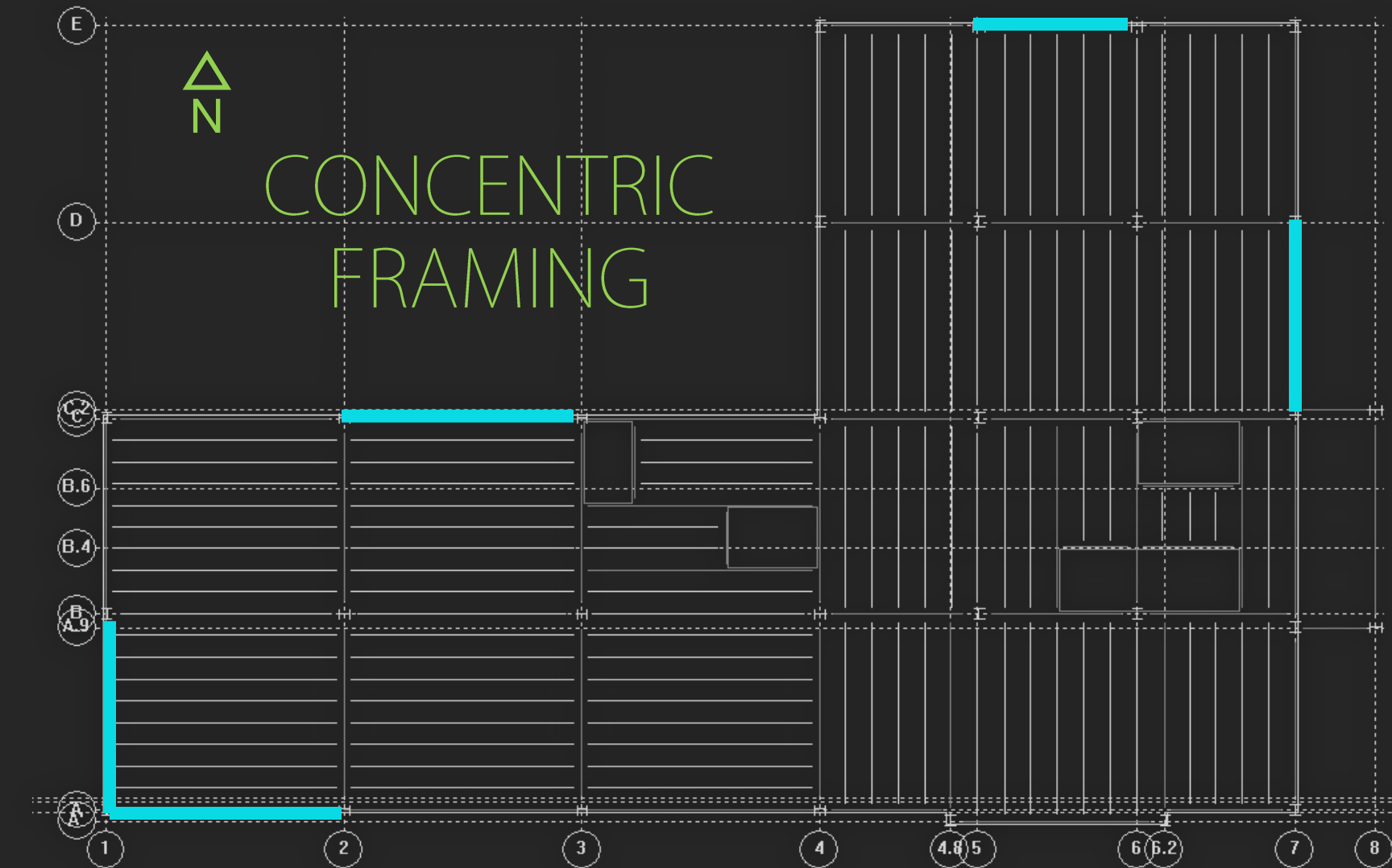
ARCHITECTURAL IMPACT

ECCENTRIC BAYS - 11

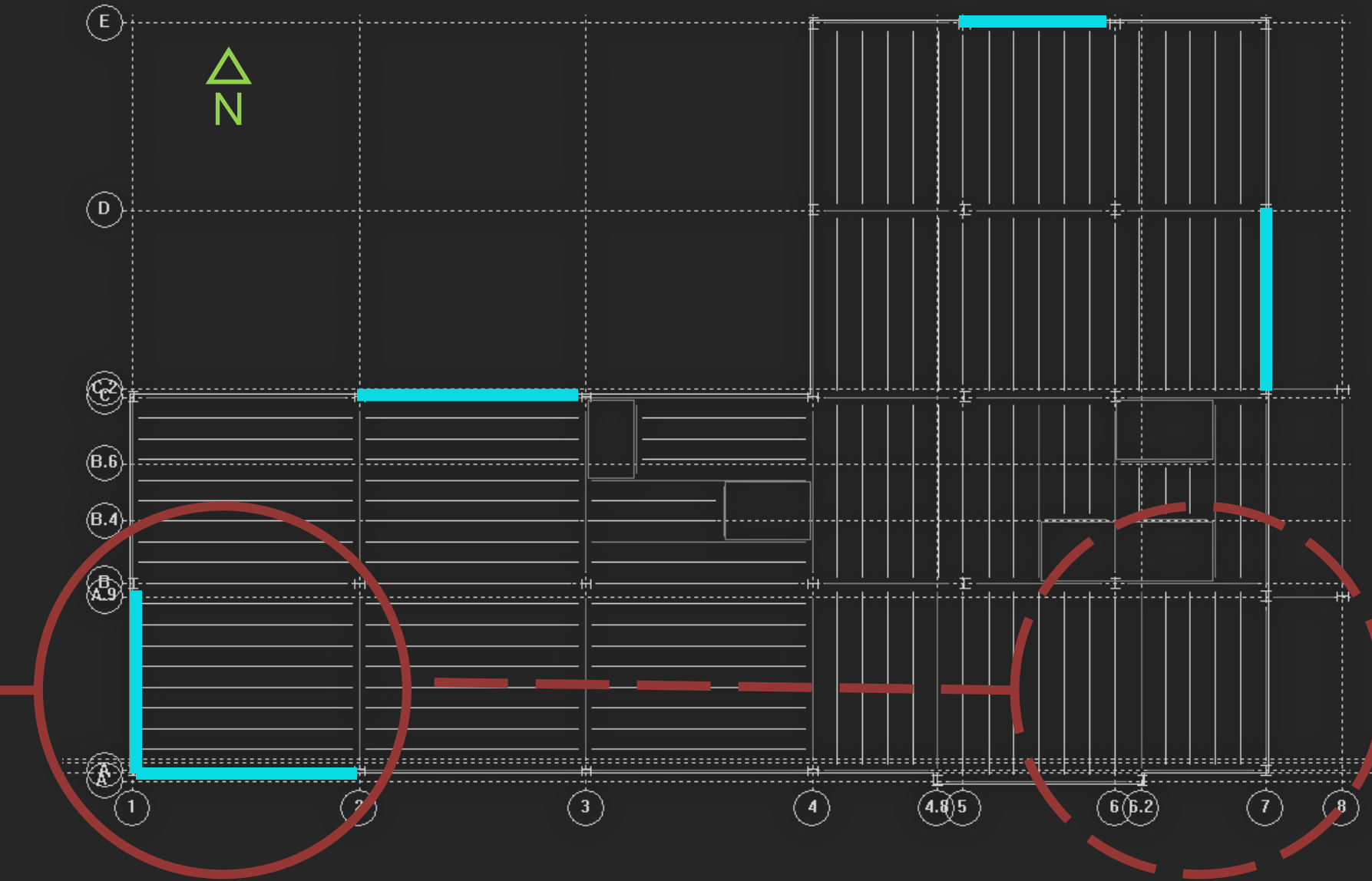
CONCENTRIC BAYS - 5



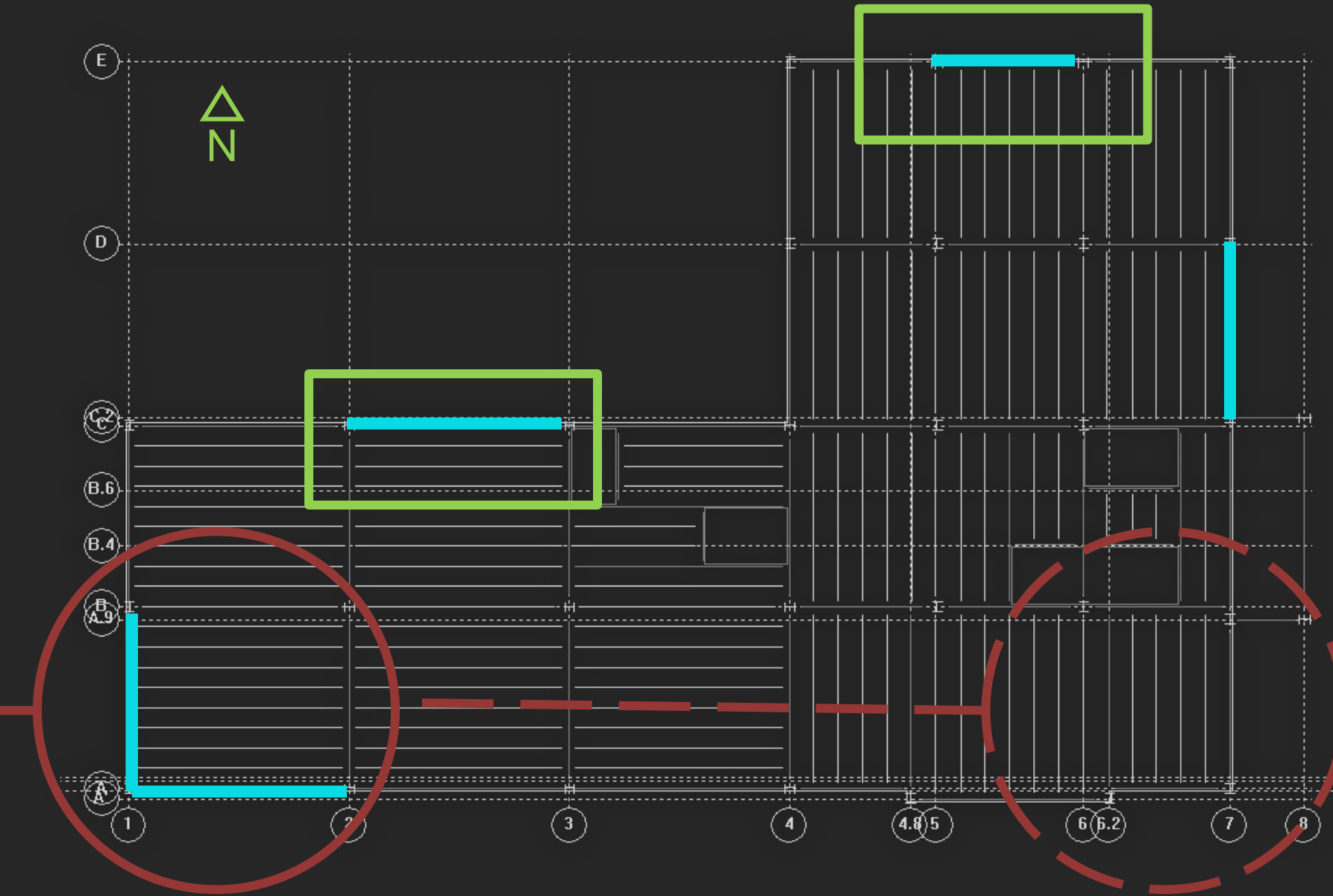
ARCHITECTURAL IMPACT



ARCHITECTURAL IMPACT



ARCHITECTURAL IMPACT



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STRUCTURAL REVIEW

OPEN-WEB STEEL JOIST FLOOR SYSTEM

- 28LH11 JOIST
- W30X108 GIRDER $C=1/2''$
- SATISFIES VIBRATION CONCERNS

STRUCTURAL REVIEW

OPEN-WEB STEEL JOIST FLOOR SYSTEM

- 28LH11 JOIST
- W30X108 GIRDER $C=1/2''$
- SATISFIES VIBRATION CONCERNS

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- CEILING RAISE POTENTIAL OF 5''

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STRUCTURAL REVIEW

CONCENTRIC FRAMING

- ELIMINATION OF 6 FRAMING BAYS
- 24 BRACING MEMBERS & 42 WELDED CONNECTIONS

STRUCTURAL REVIEW

CONCENTRIC FRAMING

- ELIMINATION OF 6 FRAMING BAYS
- 24 BRACING MEMBERS & 42 WELDED CONNECTIONS

ARCHITECTURAL IMPACT

- CURTAIN WALLS USED IN FRAMING BAYS

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BREADTH STUDIES

BREADTH STUDIES

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- BUILDING MODELED TO VISUALIZE SHADOWS
- JANUARY & JUNE
- 9AM – 12PM – 4PM

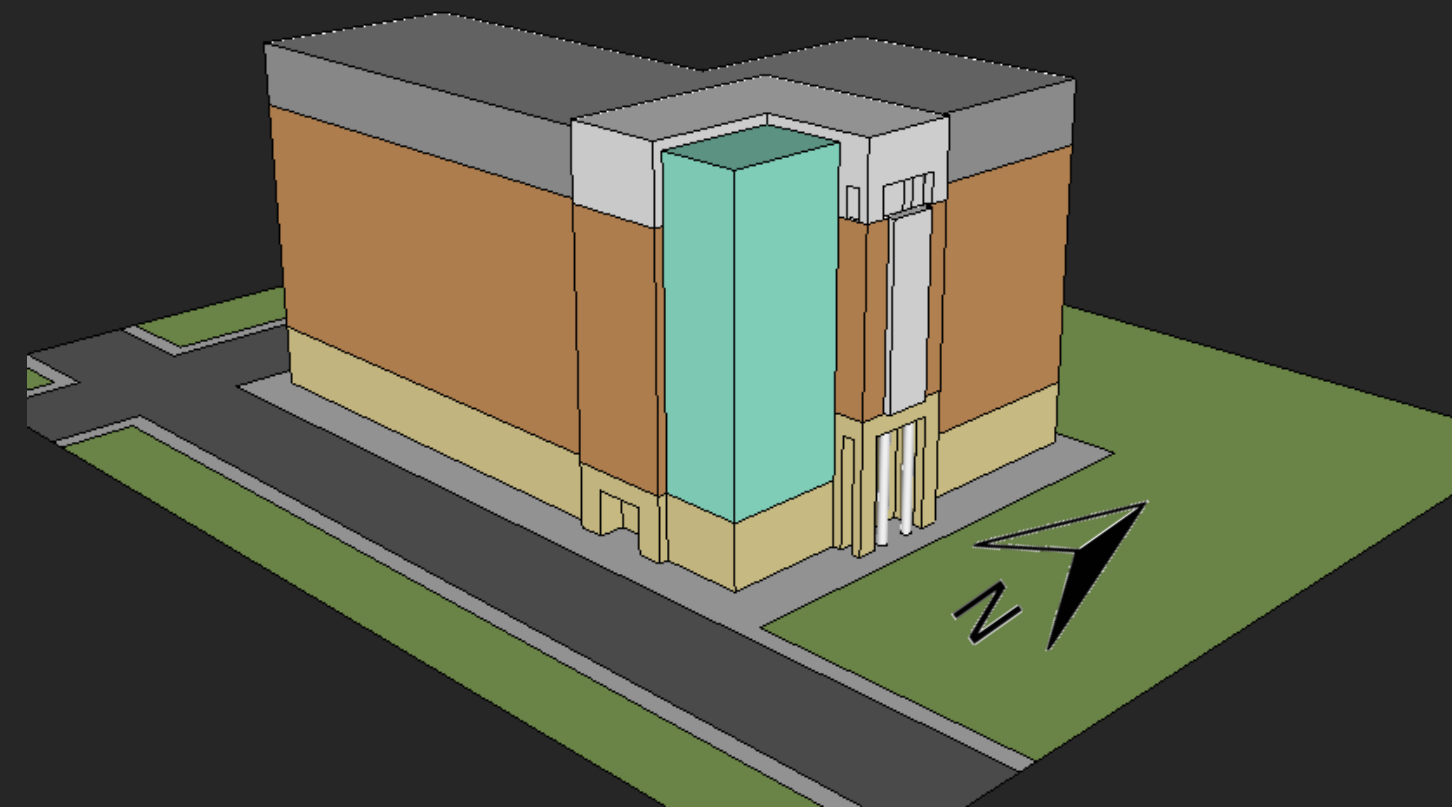
BREADTH STUDIES

DAYLIGHTING

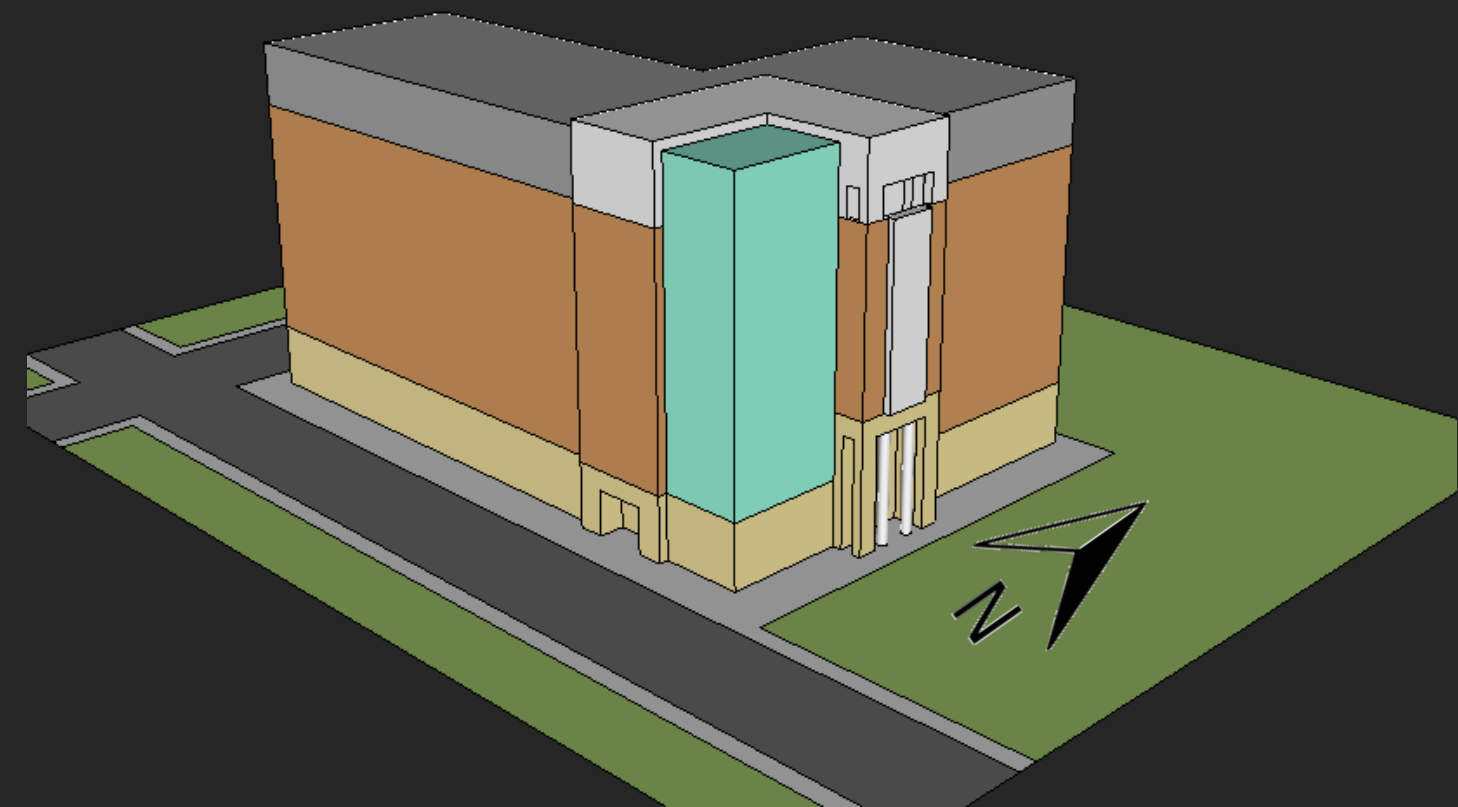
- BUILDING MODELED TO VISUALIZE SHADOWS
- JANUARY & JUNE
- 9AM – 12PM – 4PM

GREEN ROOF

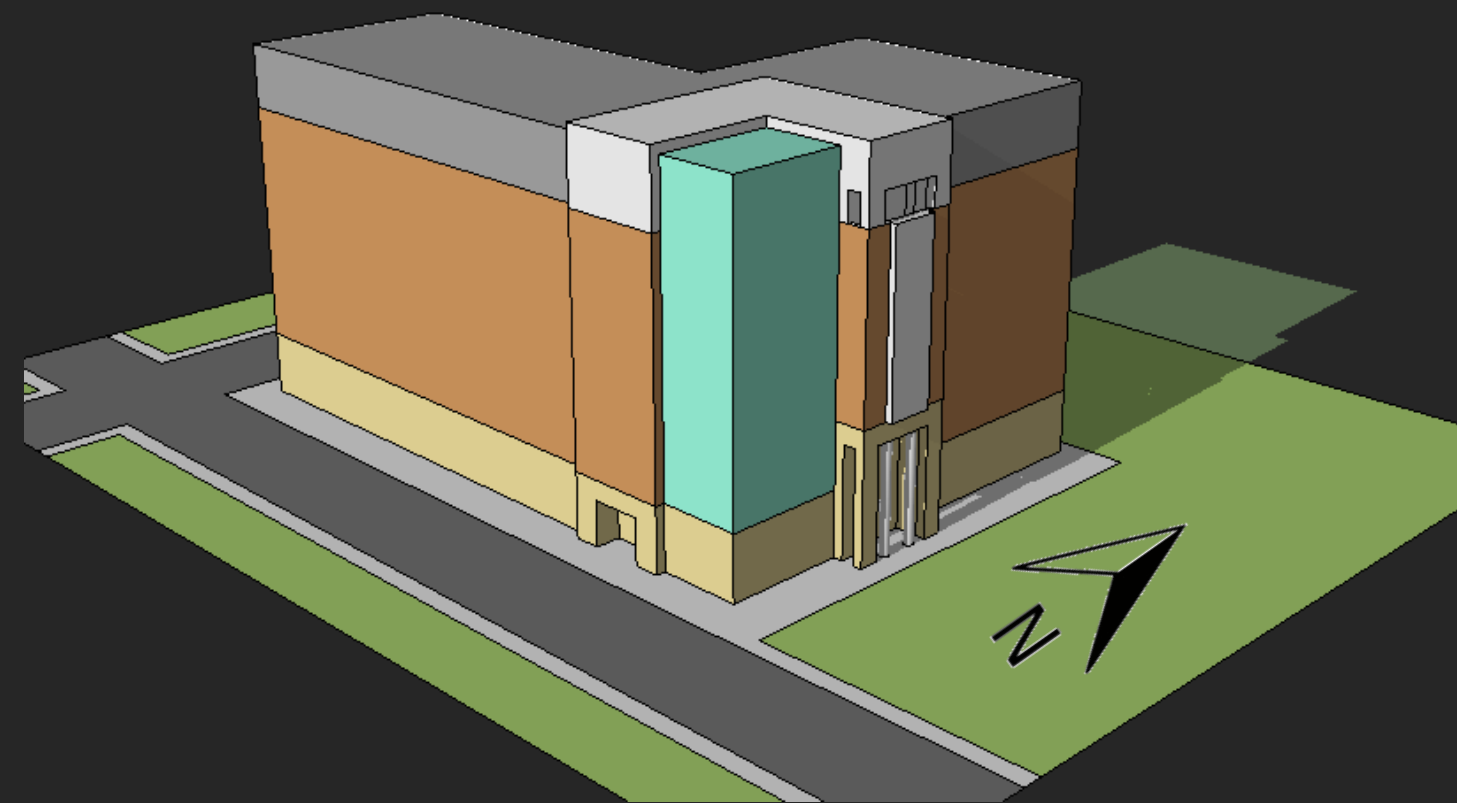
- MOST APPROPRIATE SYSTEM RESEARCHED
- LOADING IMPLICATIONS
- FALL PROTECTION



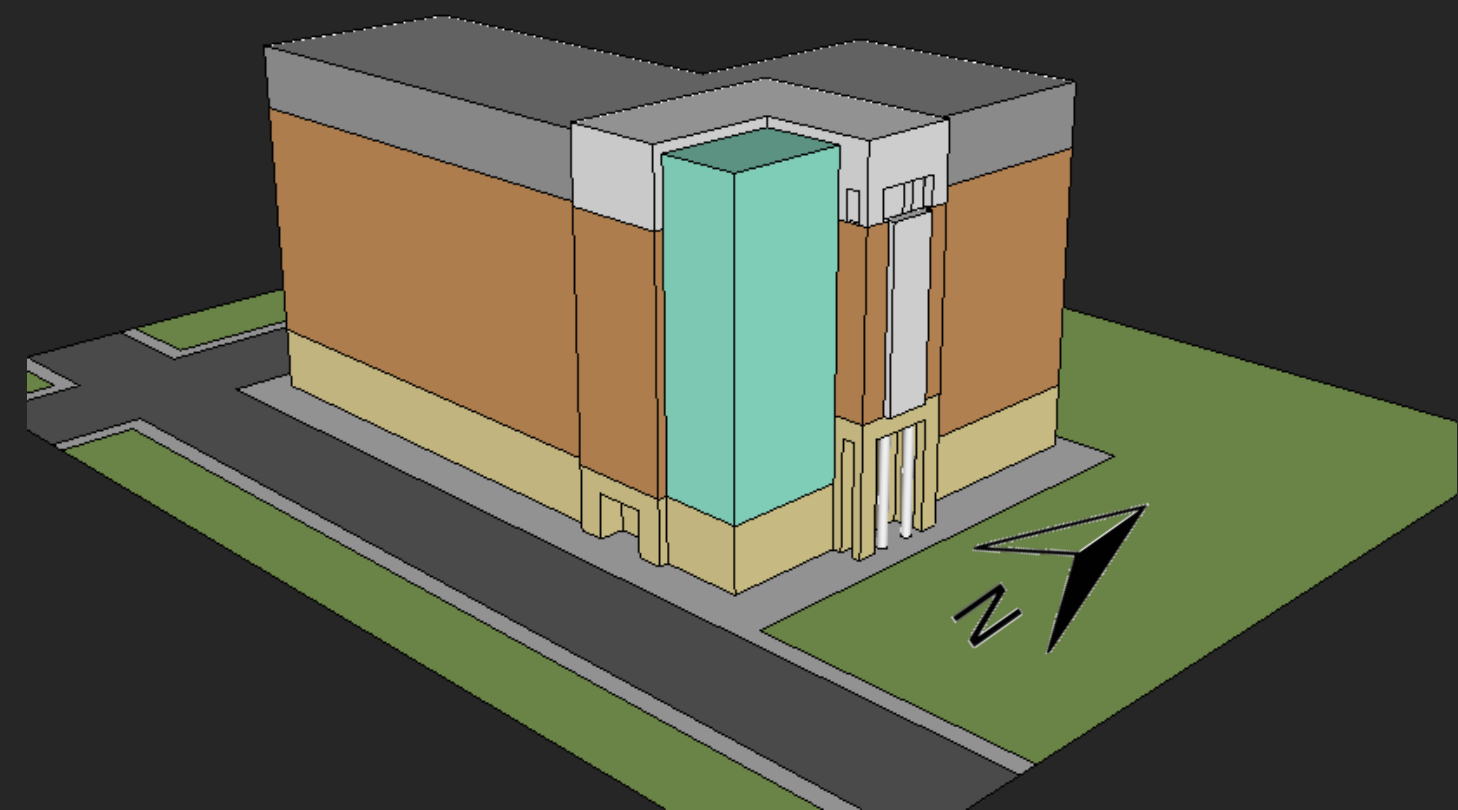
JANUARY – 9AM



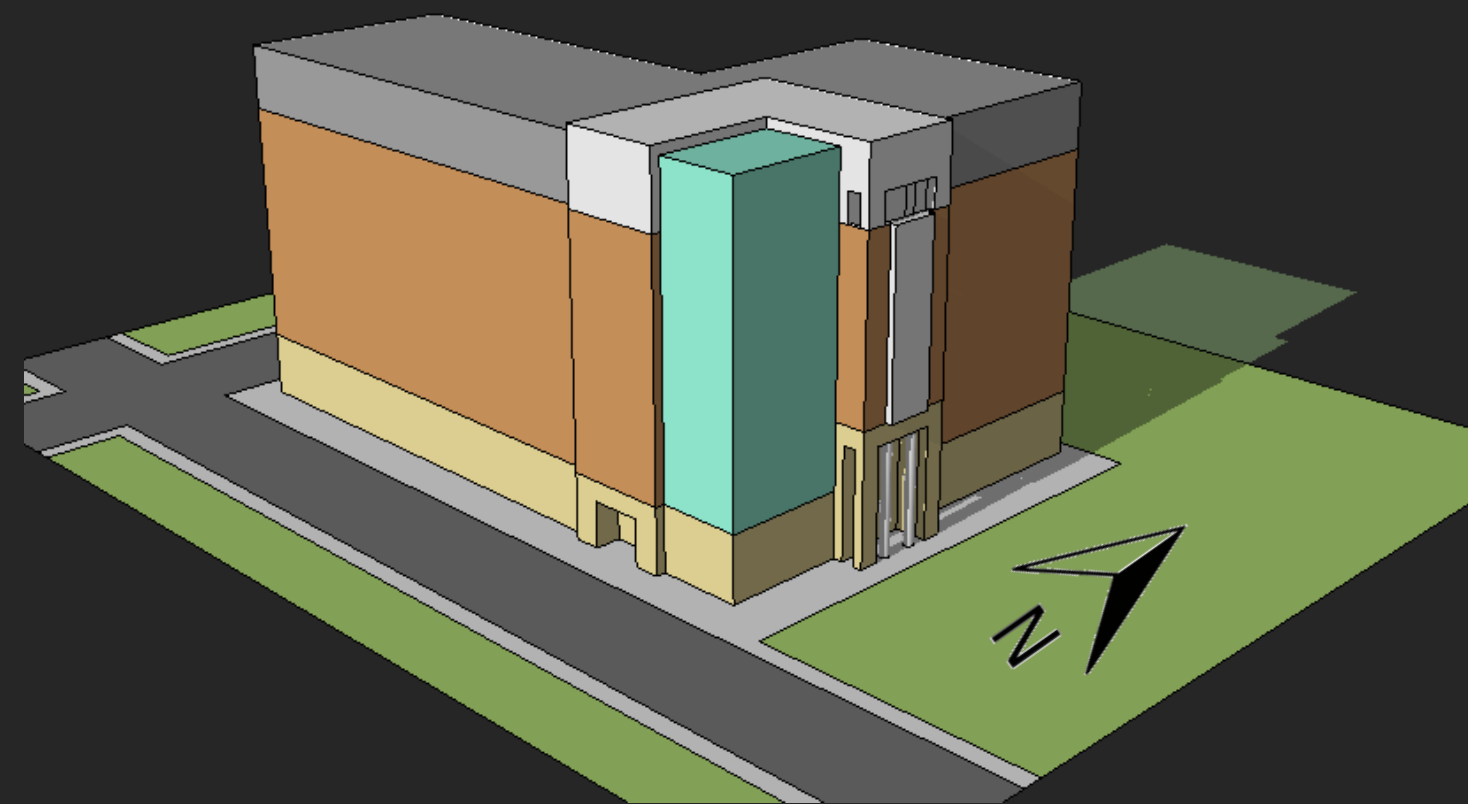
JANUARY – 9AM



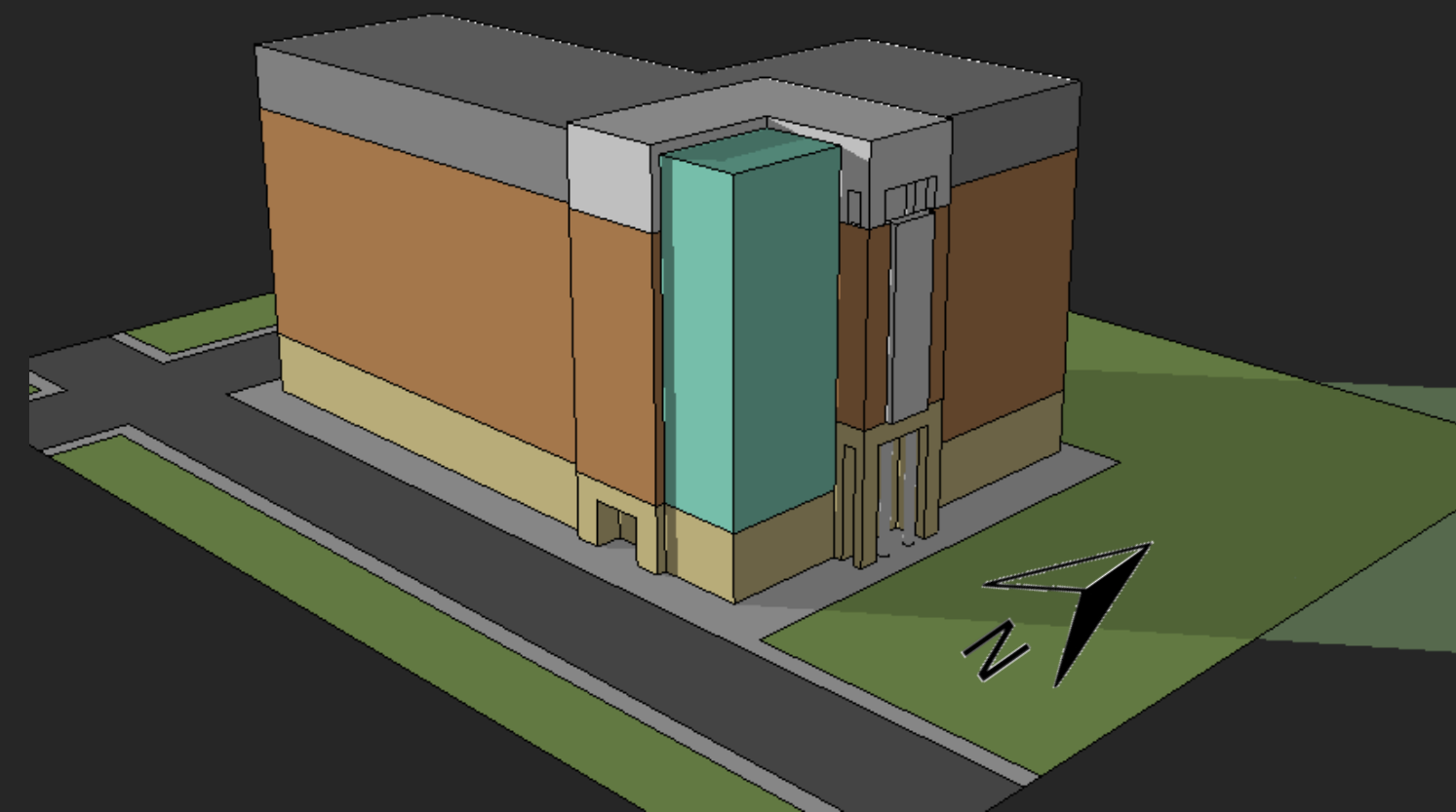
JANUARY – 12PM



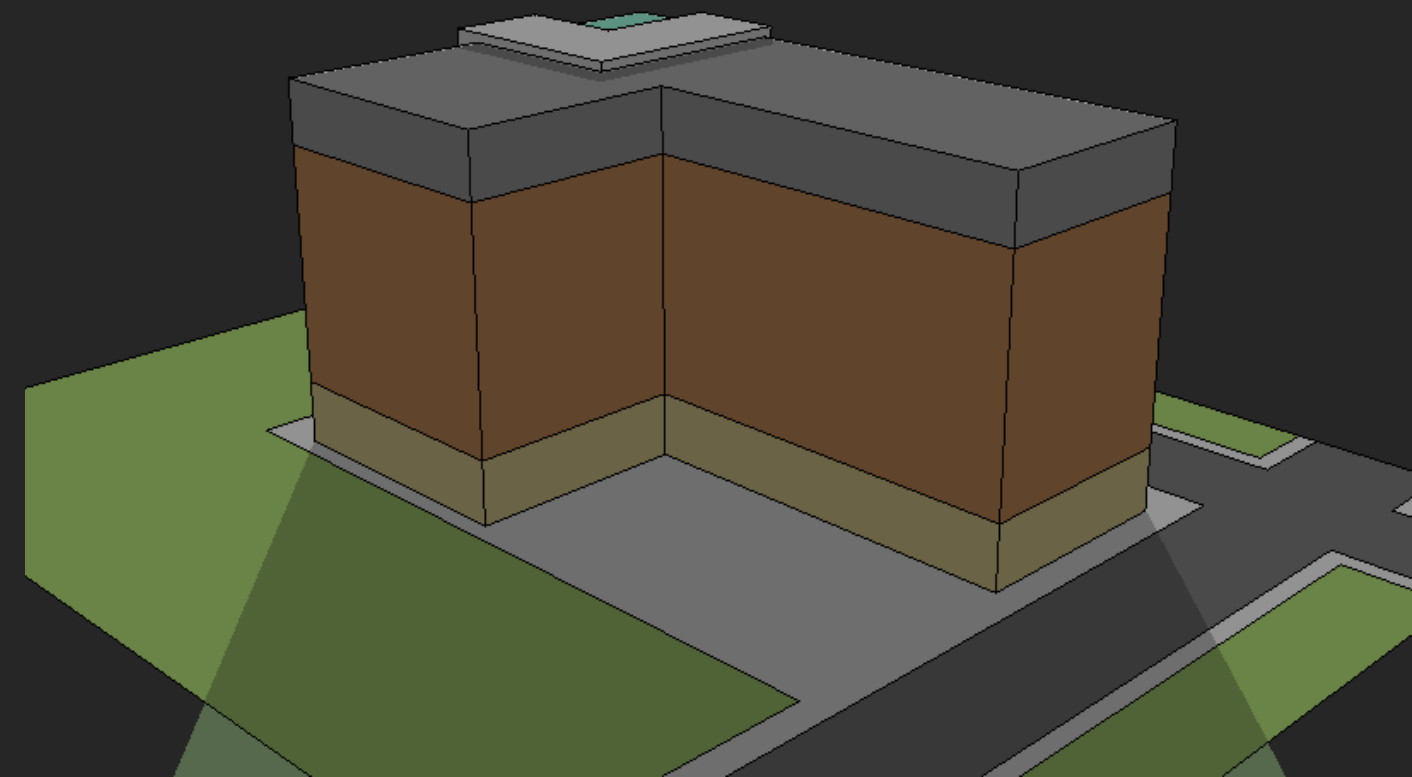
JANUARY – 9AM



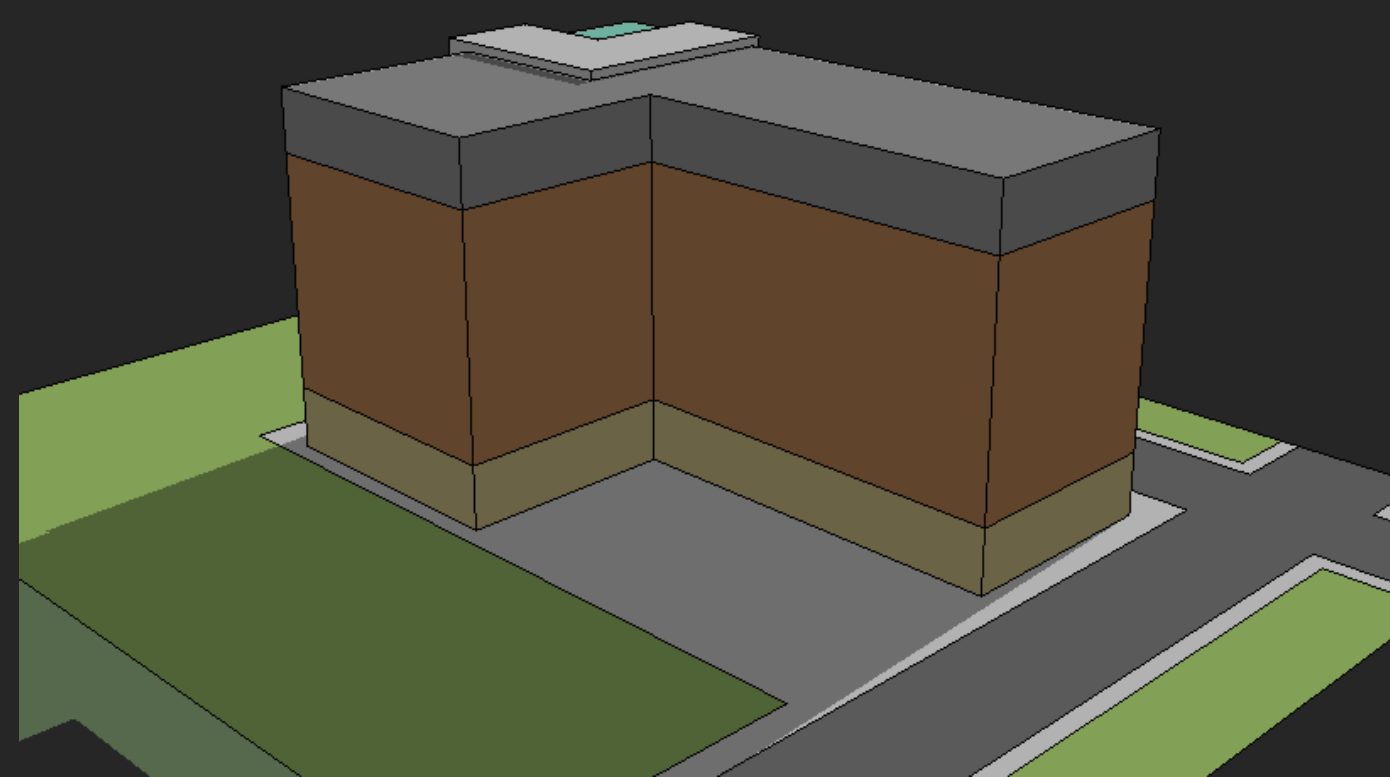
JANUARY – 12PM



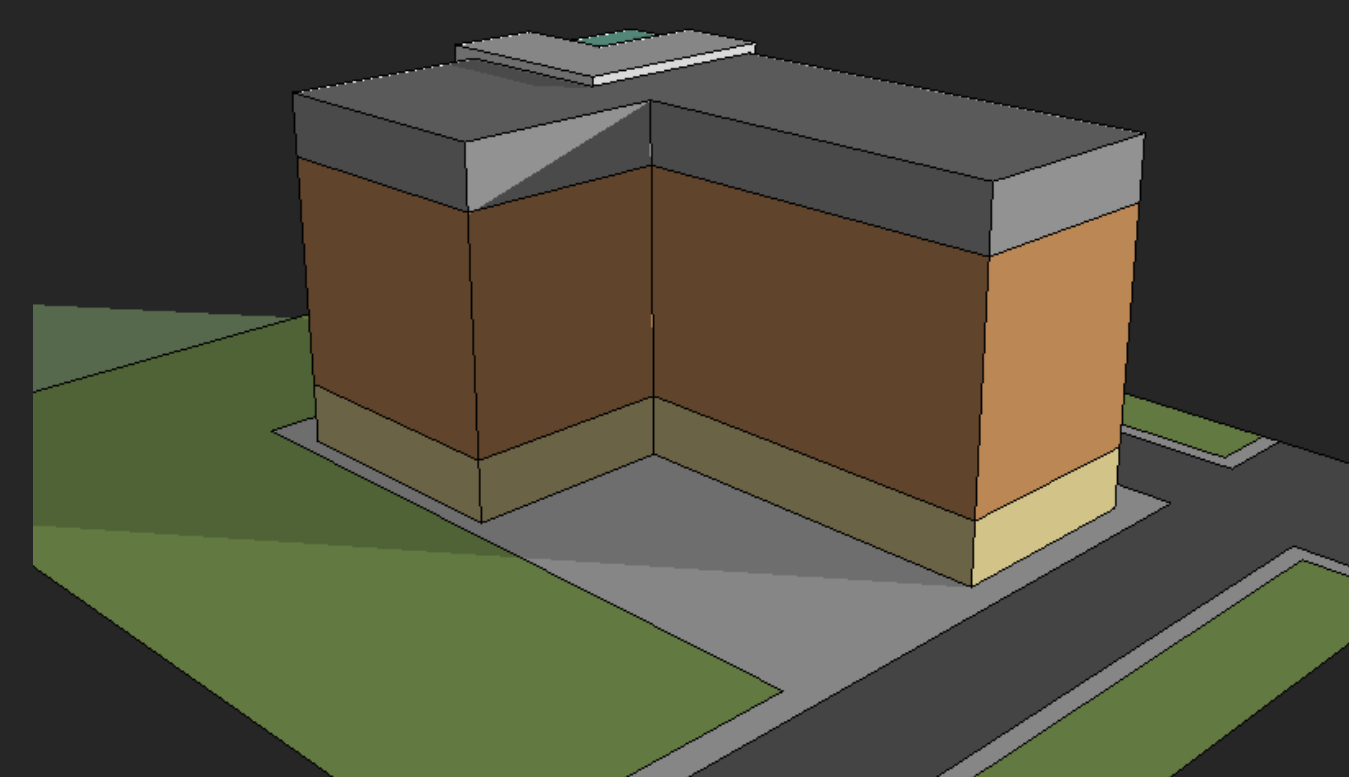
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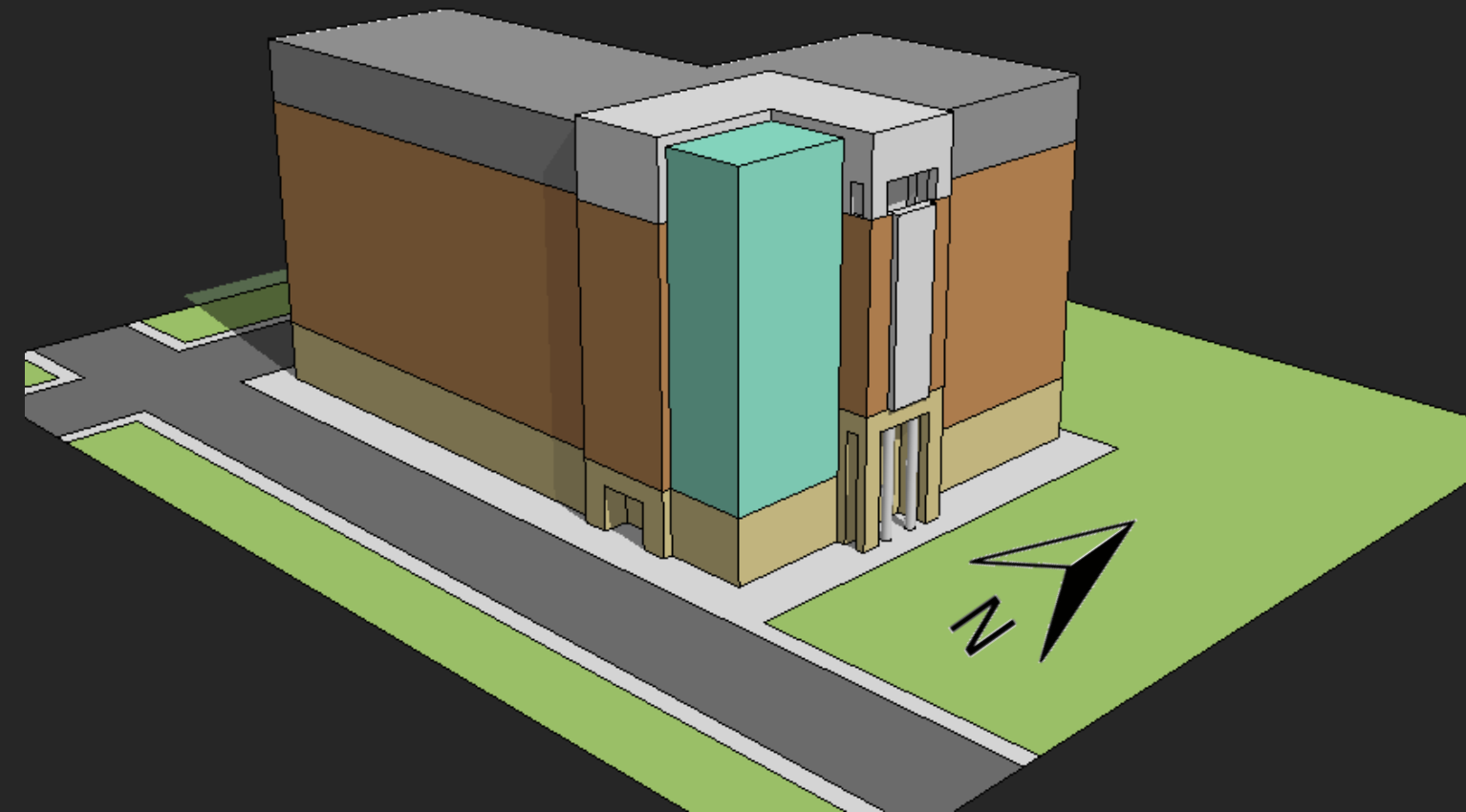
JANUARY – 9AM



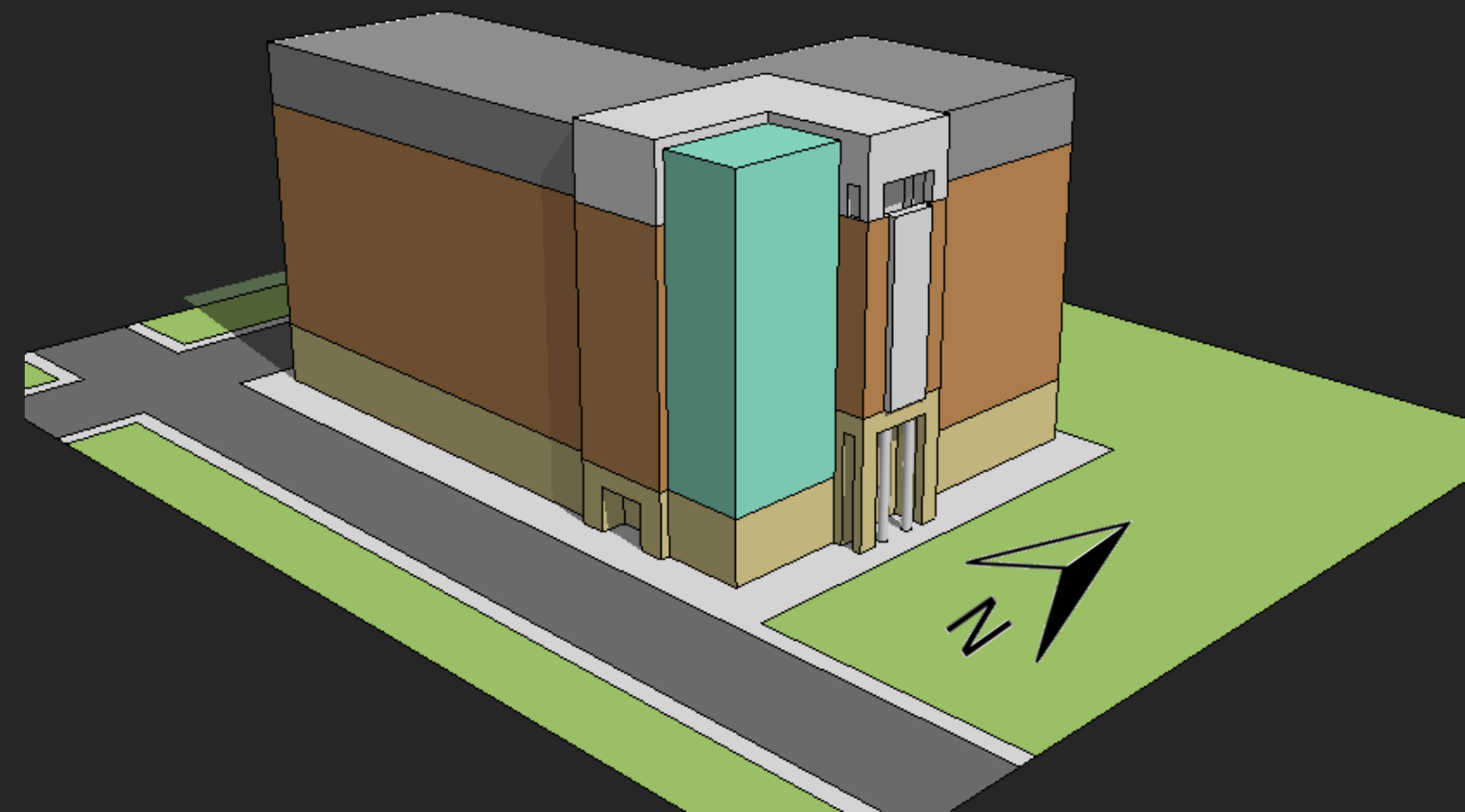
JANUARY – 12PM



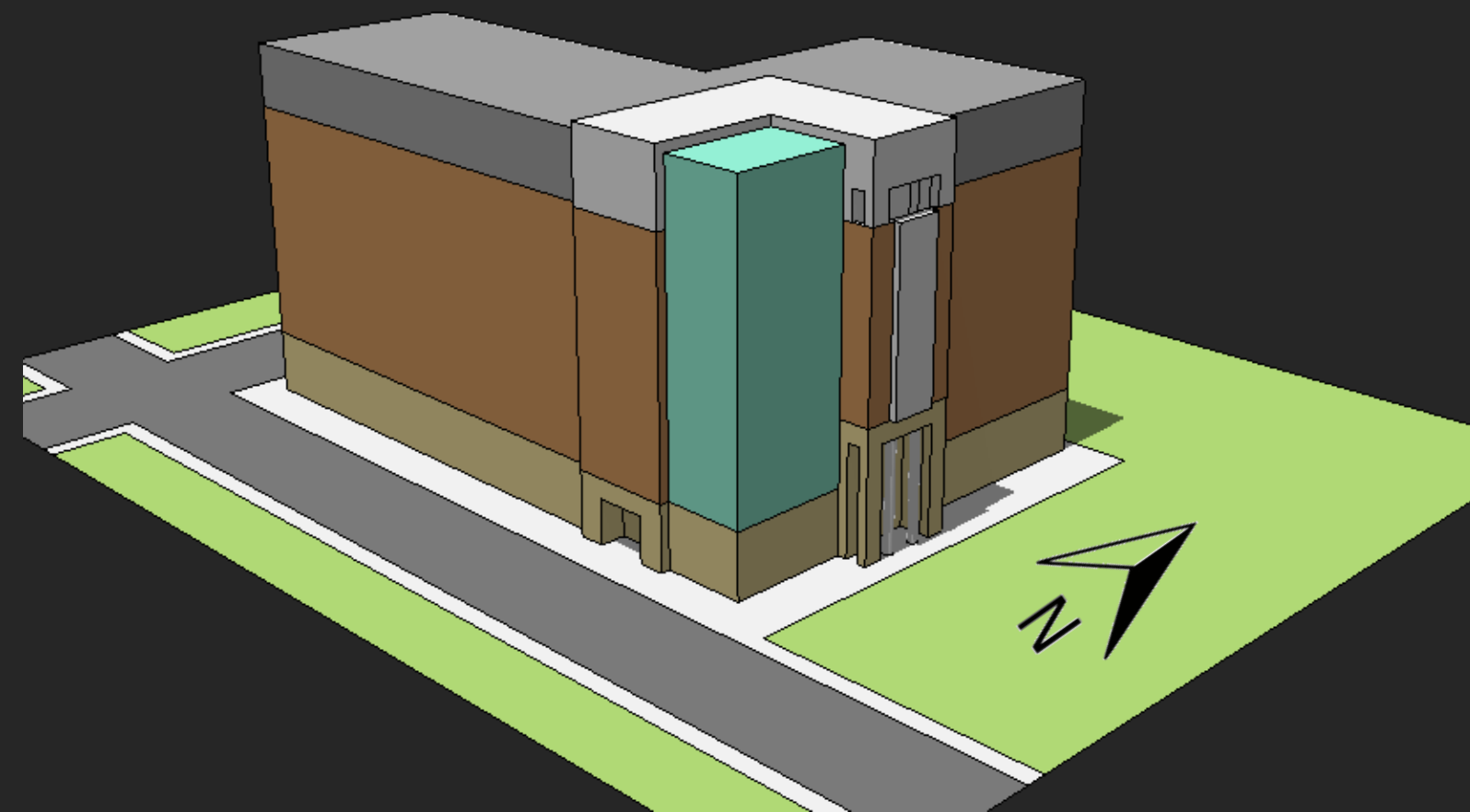
JANUARY – 4PM



JUNE- 9AM



JUNE- 9AM



JUNE - 12PM

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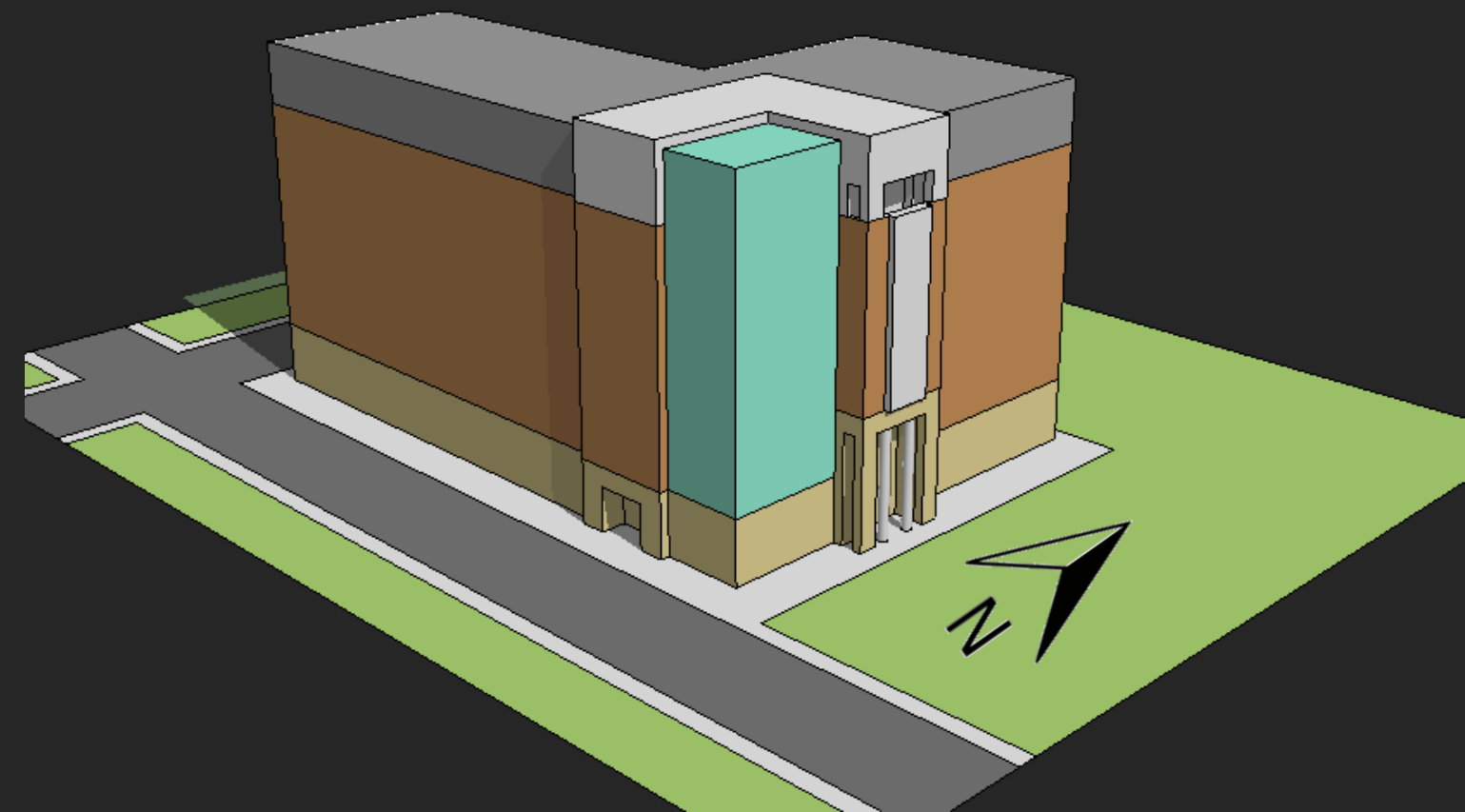
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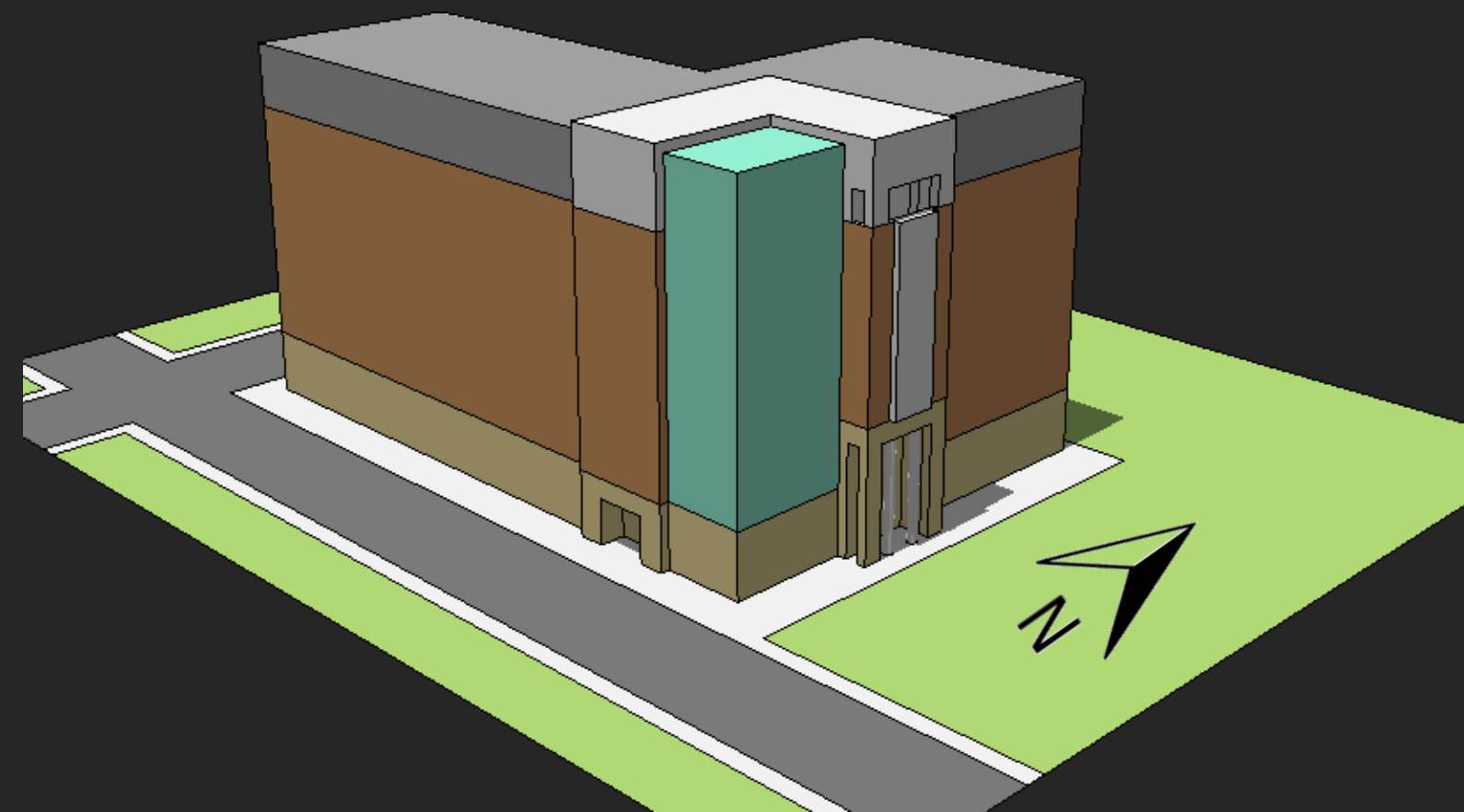
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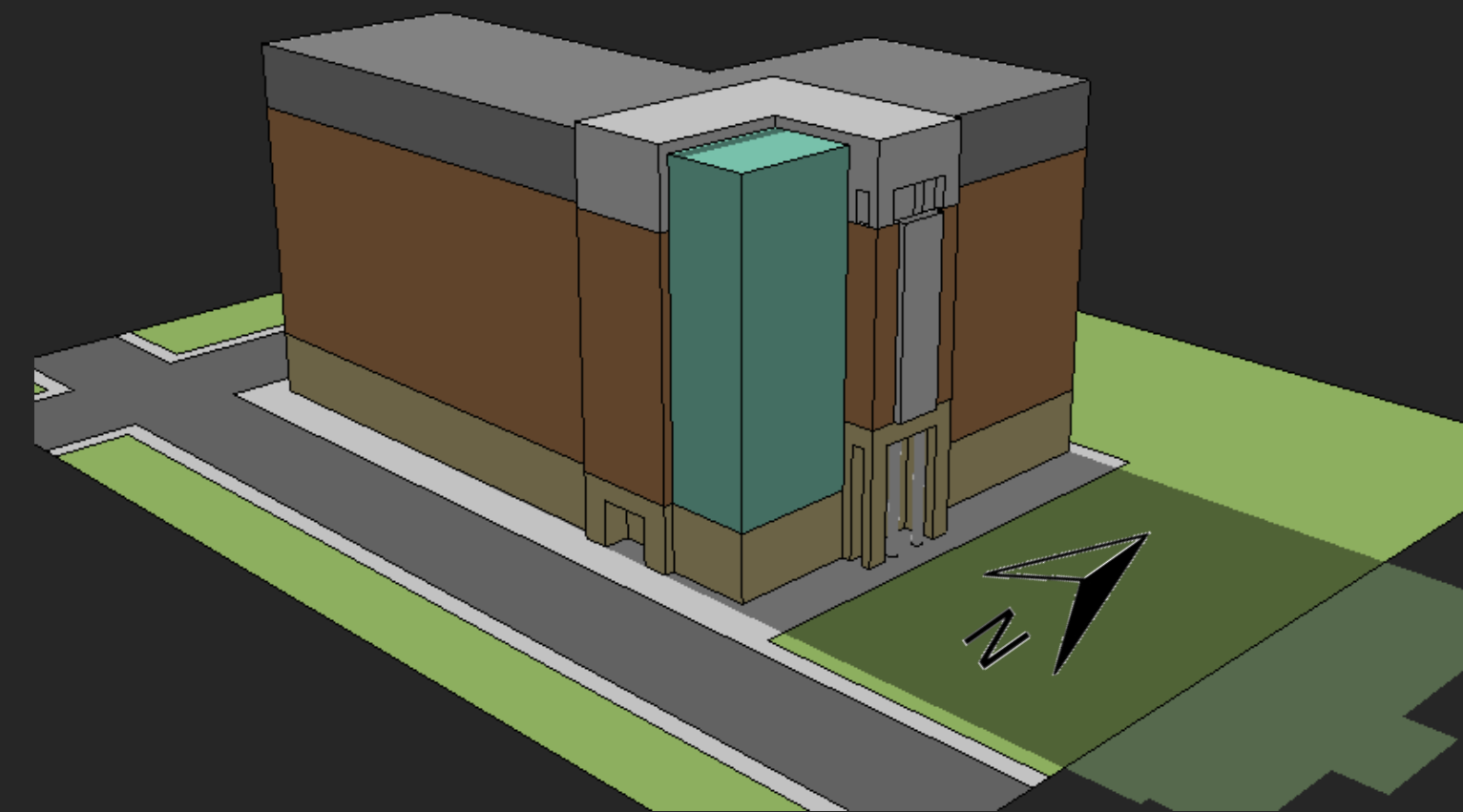
CONCLUSION



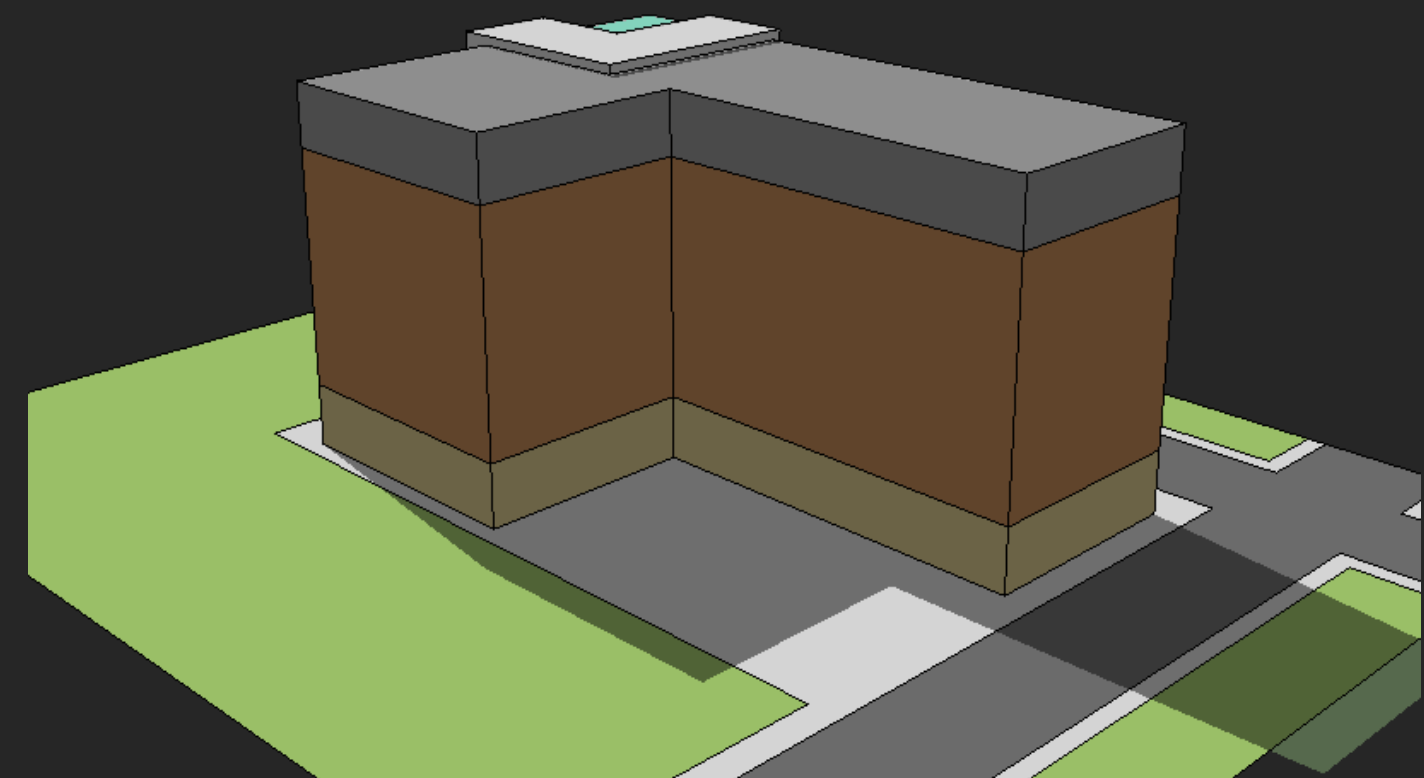
JUNE - 9AM



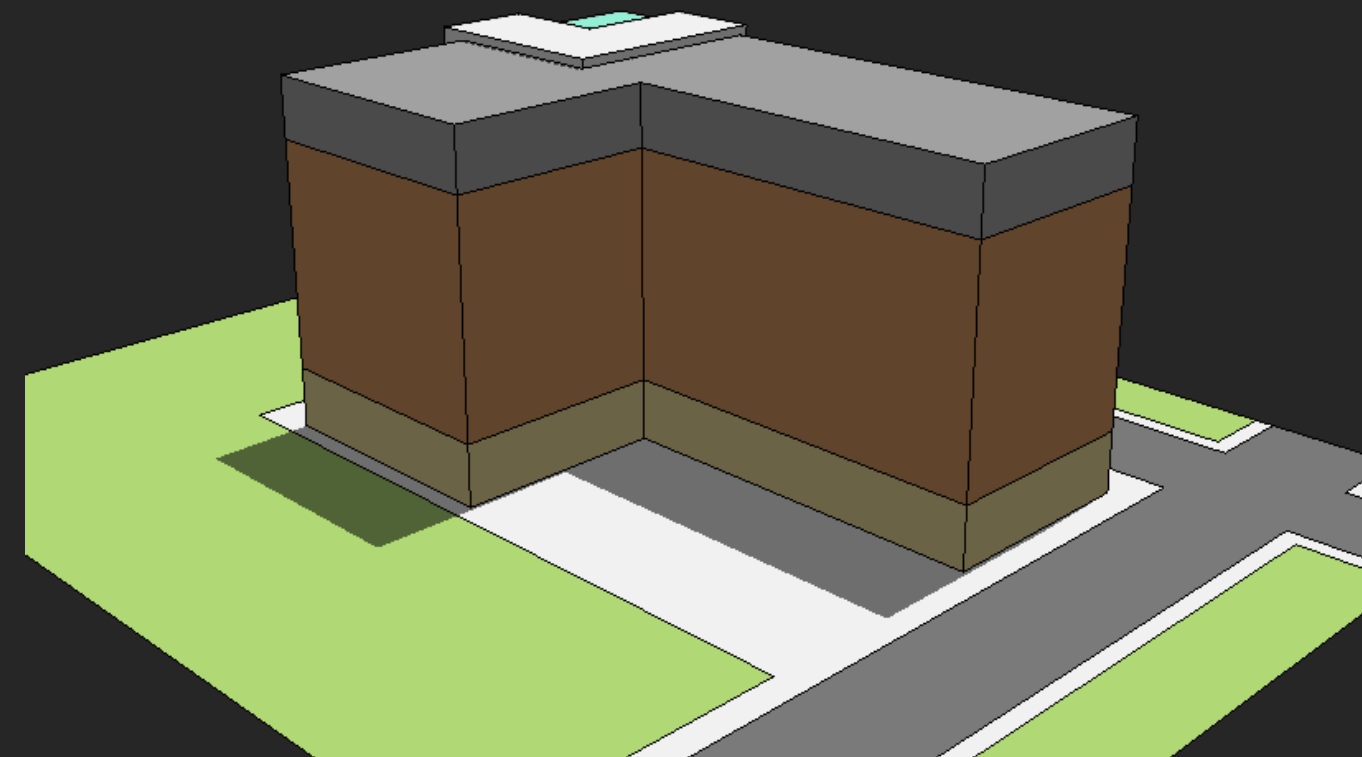
JUNE - 12PM



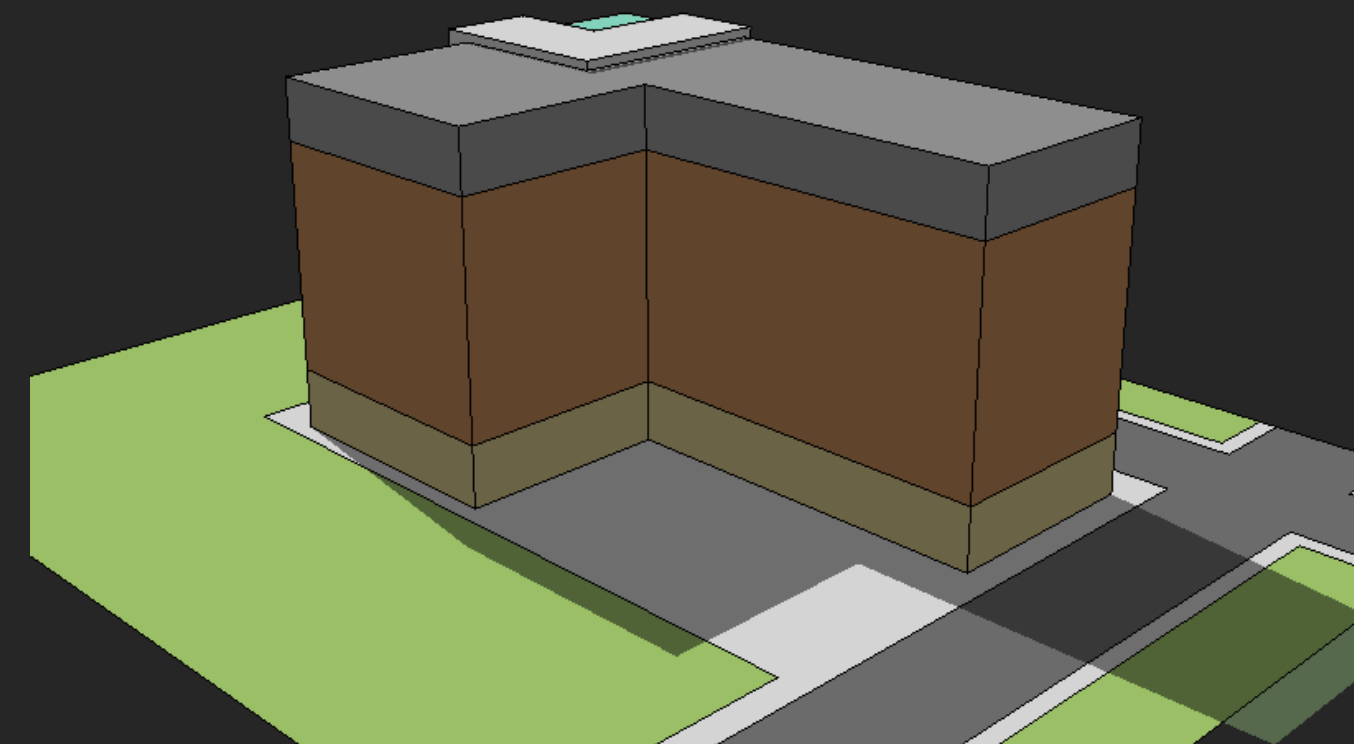
JUNE - 4PM



JUNE – 9AM



JUNE – 12PM



JUNE – 4PM

JANUARY

DAYLIGHTING
CONCLUSIONS

- LOW SOUTHERN LIGHT BEST MITIGATED WITH OPERABLE INTERIOR SHADES
- MORNING AND EVENING SUNLIGHT PARTIALLY SHADED USING VERTICAL FINS



http://www.angarch.com/products/brise-soleil_01_archive.html

JUNE

DAYLIGHTING CONCLUSIONS

- HIGH ANGLE AFTERNOON LIGHT BEST MITIGATED WITH HORIZONTAL CANTILEVER SHADES
- MORNING AND EVENING SUNLIGHT BEST MITIGATED WITH INTERIOR OPERABLE SHADES



http://levolux.blogspot.com/2012_02



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- MILLCRAFT INV.
- A.E. DEPT. FACULTY
- FAMILY, FRIENDS,
CLASSMATES



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QUESTIONS?