Adaptive Reuse: WeStreet Ice Center

Tulsa Twin Ice

Tulsa, Oklahoma

Hunter Senior, PE - Martin/Martin
Architectural Eng. B.S. in 2017
Civil Eng. M.S. in 2019

U.S. REGISTRATIONS

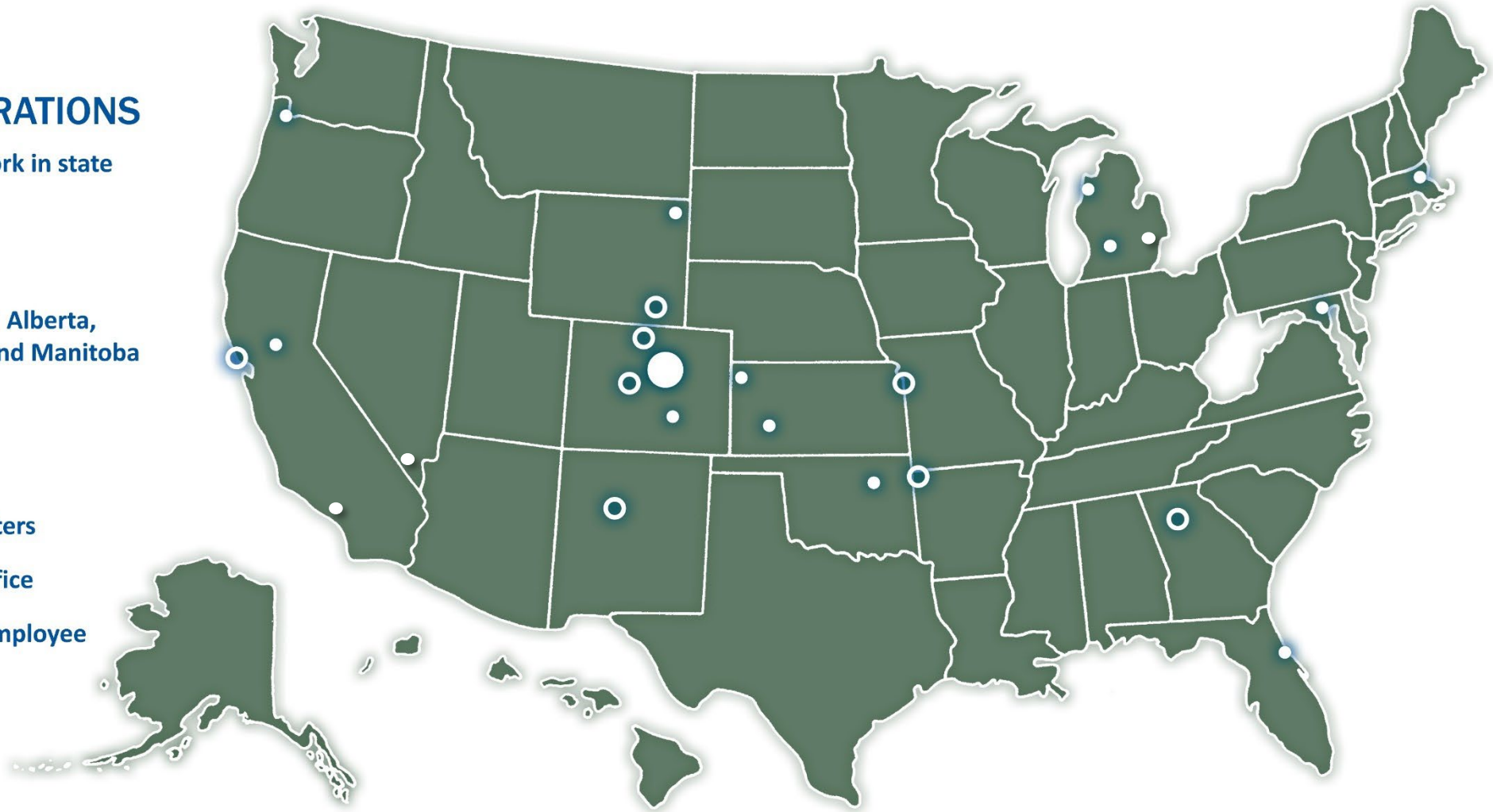
Licensed to work in state

CANADA

Licensed to work in Alberta,
British Columbia, and Manitoba

LOCATIONS

- Headquarters
- Branch Office
- Remote Employee



Tulsa Oilers

macy's

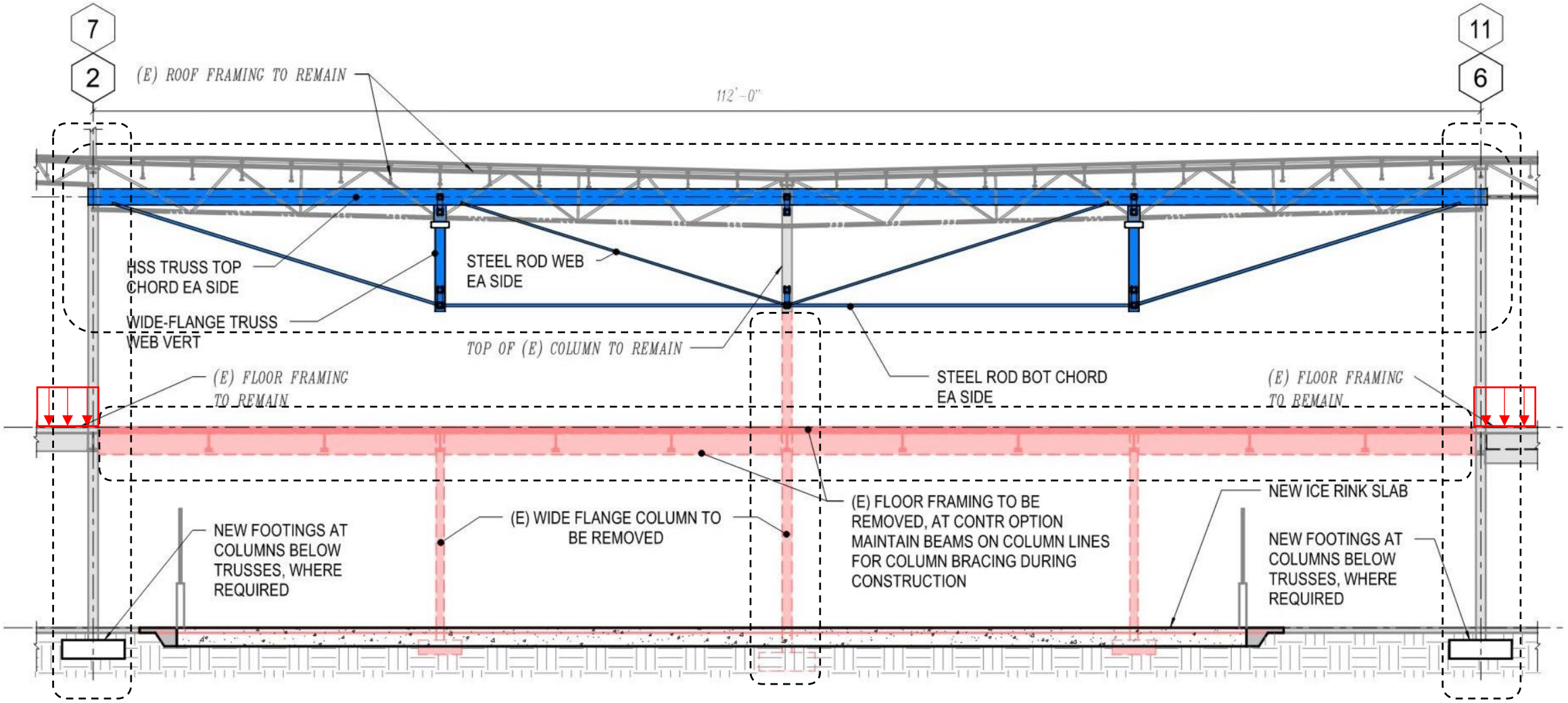
OILERS TULSA

Tulsa Promenade Mall

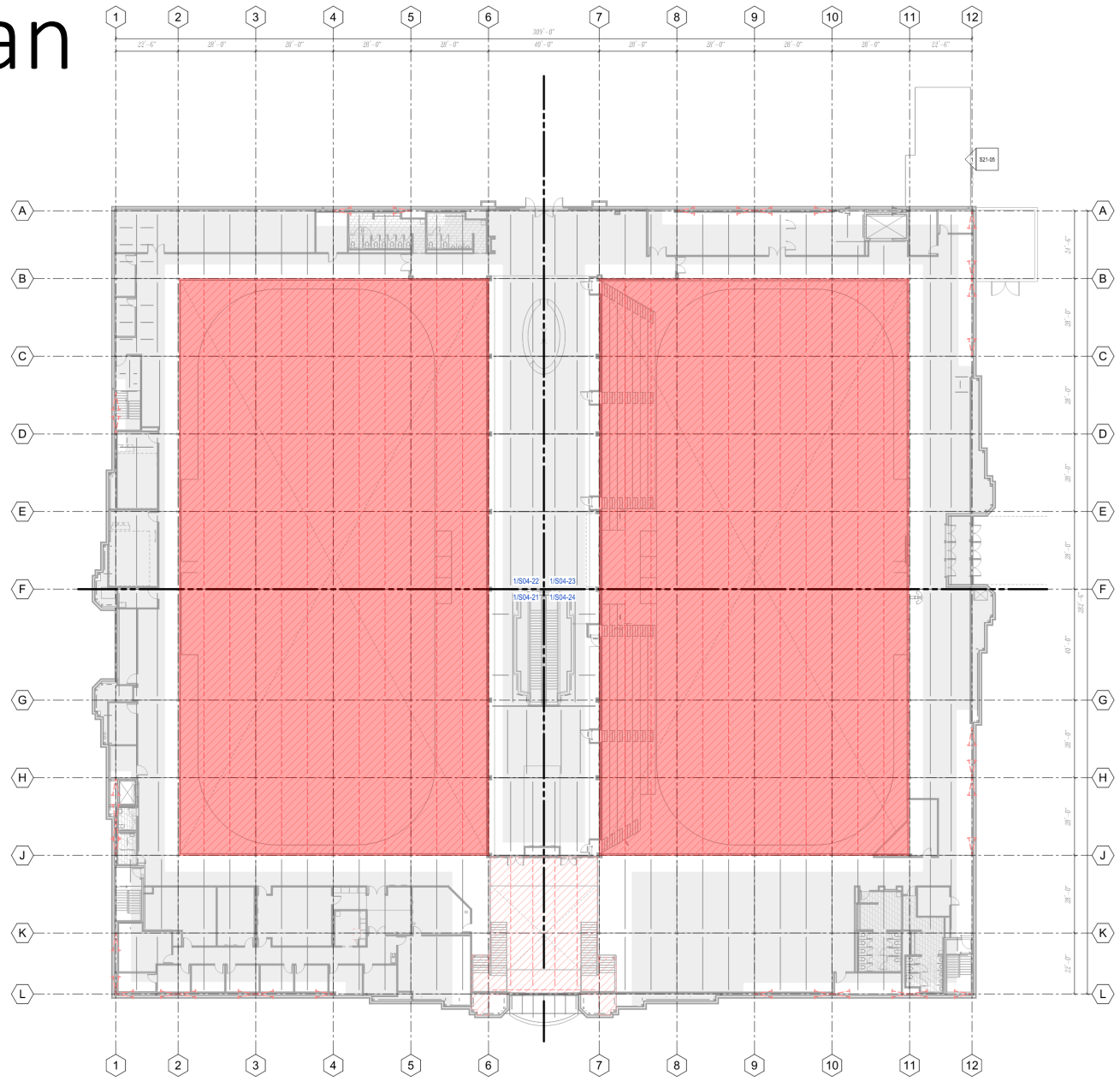
- At time of project start, 90% of leases were vacant or permanently closed
- Mall shutdown indefinitely in 2023

Macy's Anchor Store

Typical Building Cross Section



Demo Plan


1
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A
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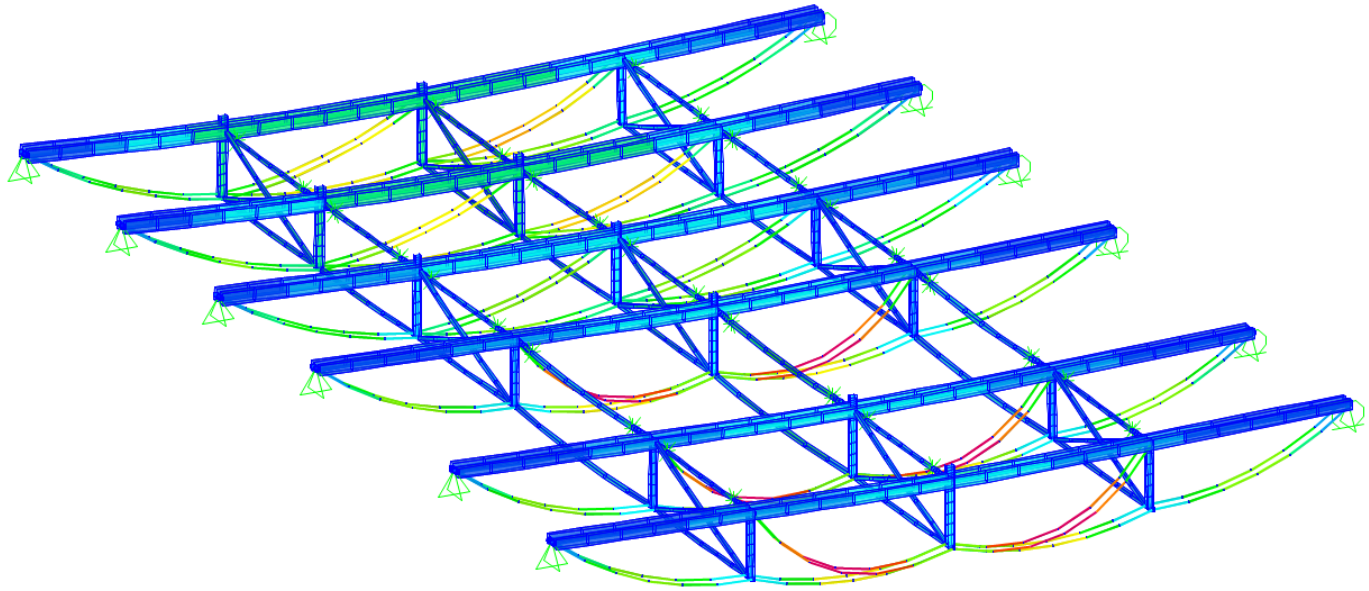
J
K
L
S21-05
1/S04-22
1/S04-23
1/S04-21
1/S04-24

Truss Deflection

- Changing from 2 span joist girder to single span truss
- Maintain roof slopes
- Understanding *actual* dead load
- Connection weights

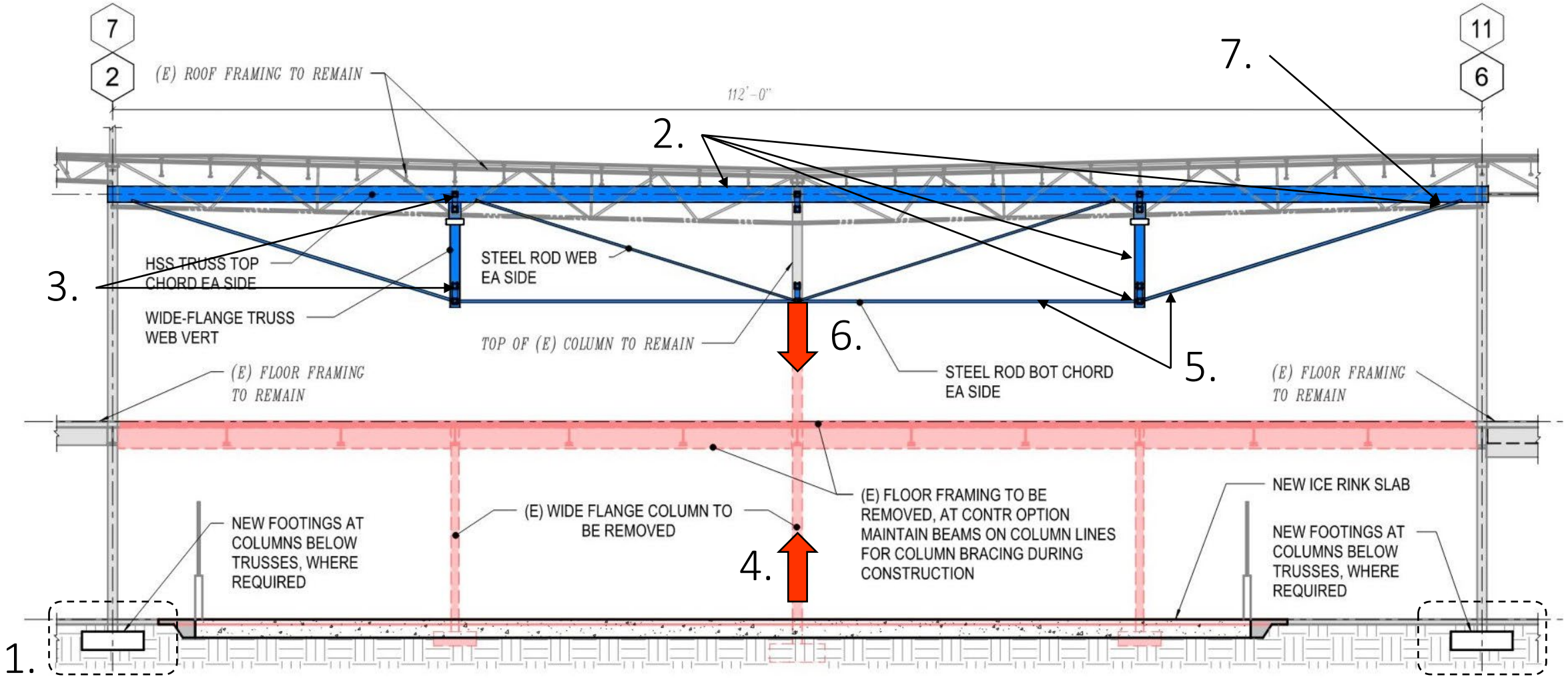


Demolition / Column Removal

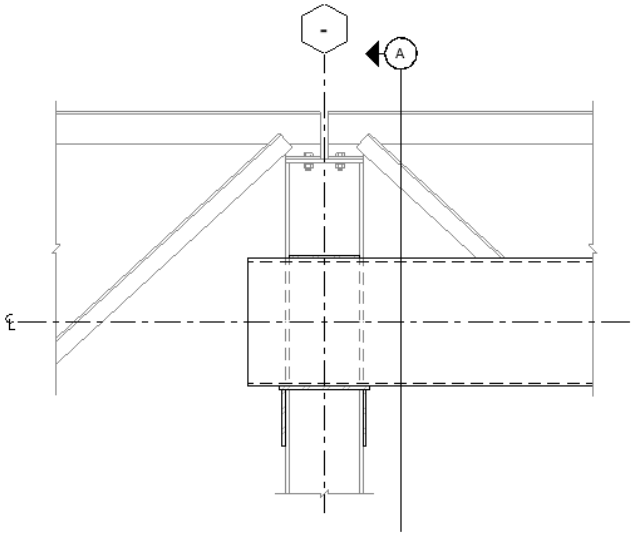
- Bottom chord rod connections could be tightened if truss sagged

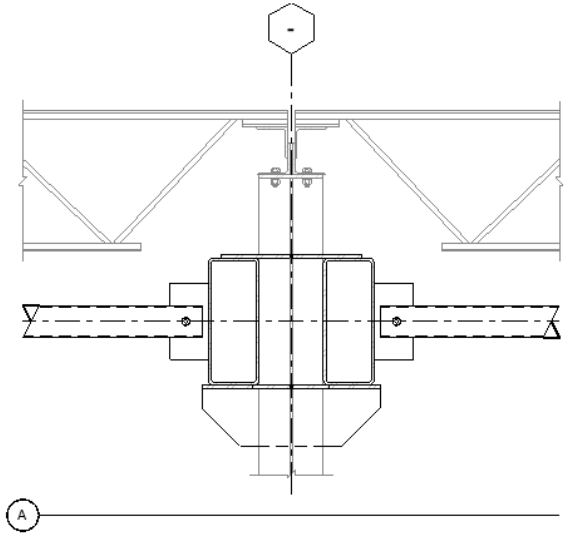
COLUMN JACK LOAD AND DISPLACEMENT TABLE			
MARK	JACK EXPECTED LOAD (KIP) ASD	JACK DESIGN LOAD (KIP) ASD	TARGET JACK HEIGHT FOR TRUSS ERECTION
1	53	70	N/A
2	77	100	N/A
3	60	75	2 3/4"
4	115	145	N/A
5	65	85	3"
6	58	75	N/A
7	150	185	N/A
8	41	55	3 1/2"
9	65	85	2"
10	236	295	N/A
11	99	125	2 1/2"
12	51	65	N/A

Construction Sequencing

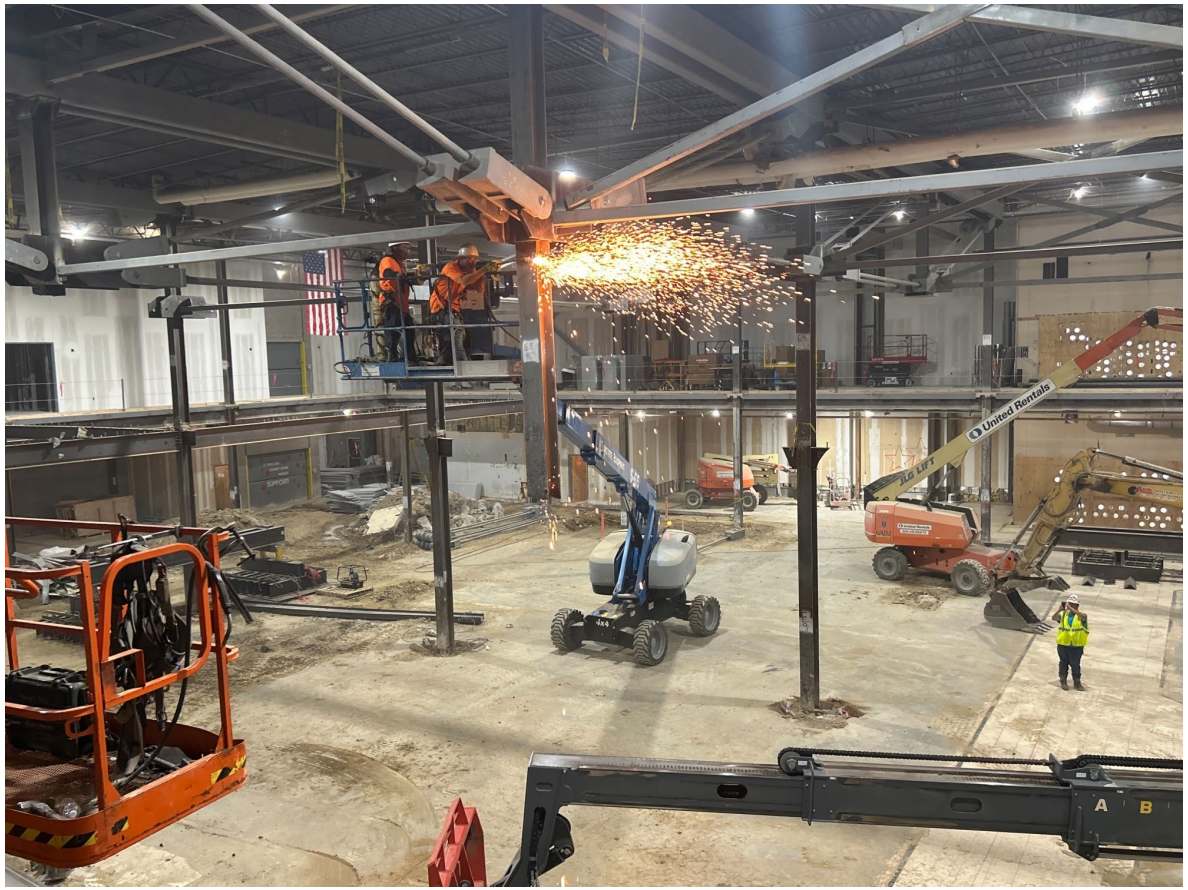


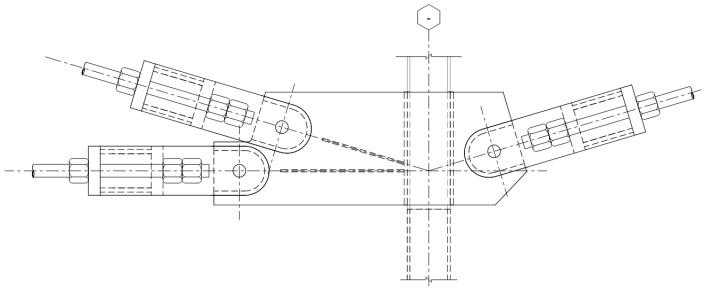
Truss Design





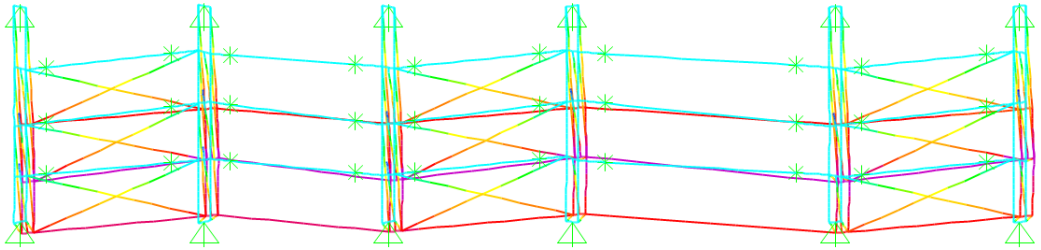
Truss Design - Connections

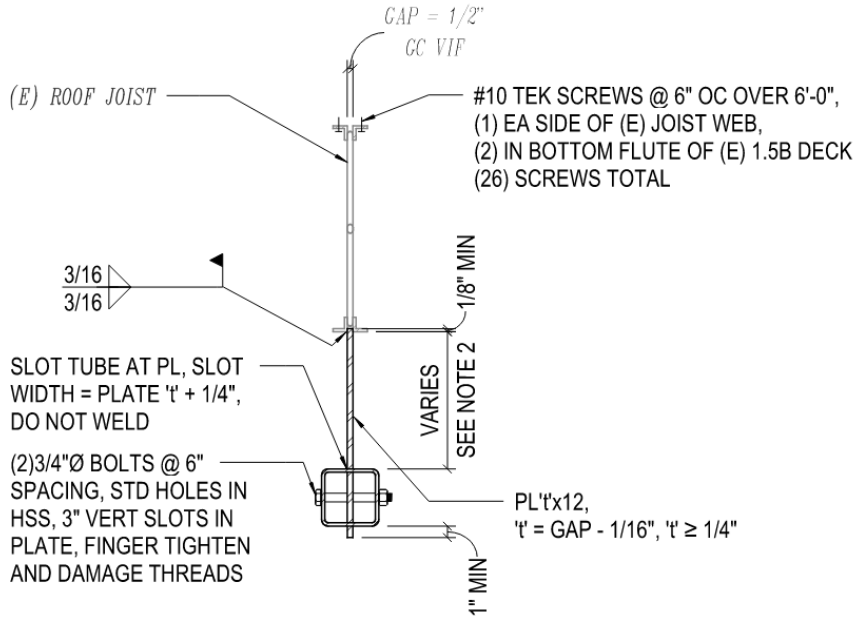




Truss Design

- Bridging designed for stability, strength and stiffness requirements per AISC 360 – Appendix A
- 3-Bays of X-bracing/bridging
- A load-path from the bridging elements to the roof deck diaphragm and lateral system was detailed

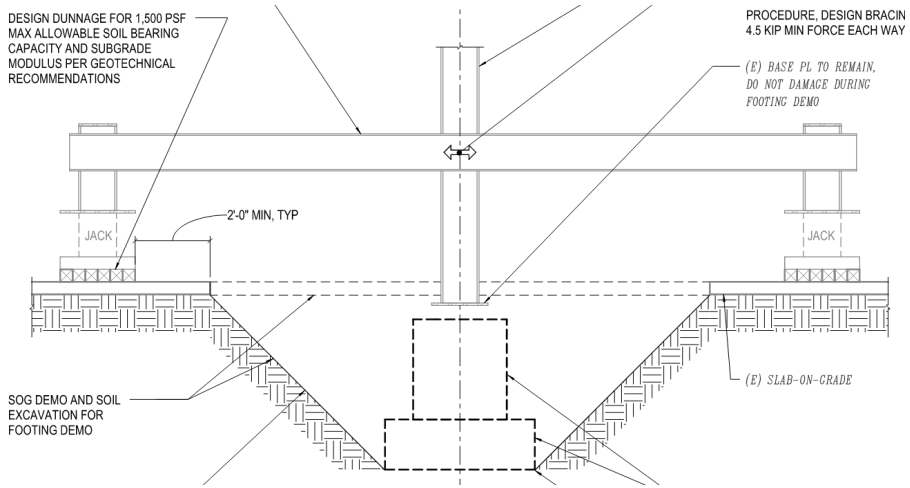




CONN TO (E) JOISTS

Foundation Reinforcing

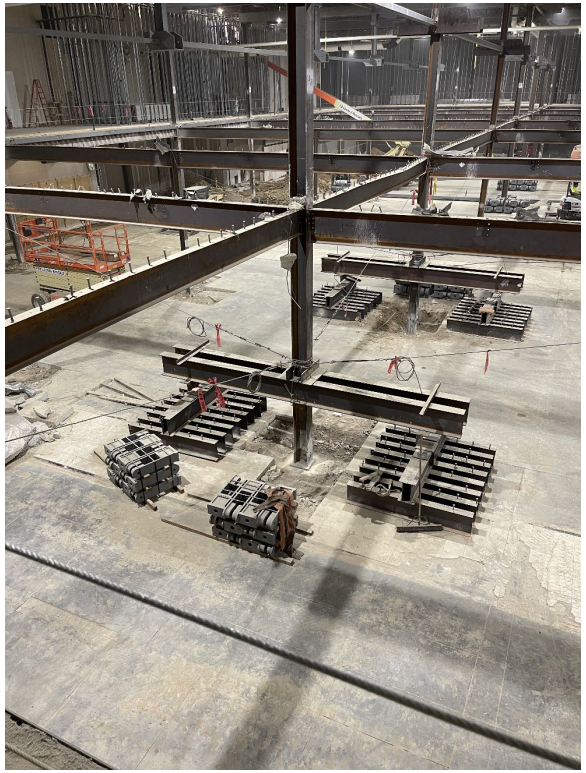
- Removing and replacing was done via jacking
- Carry frame spanned across footing to dunnages bearing on SOG



Foundation Reinforcing

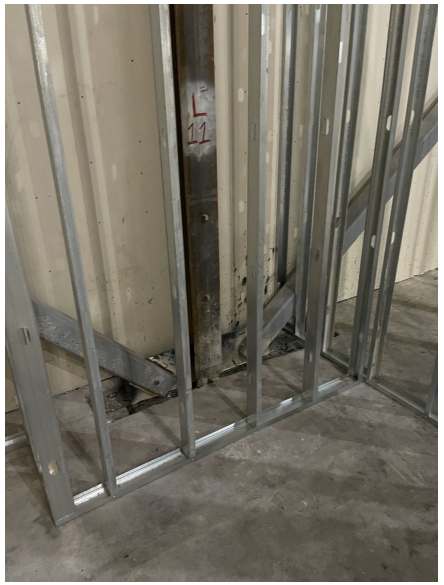
Demolition / Column Removal

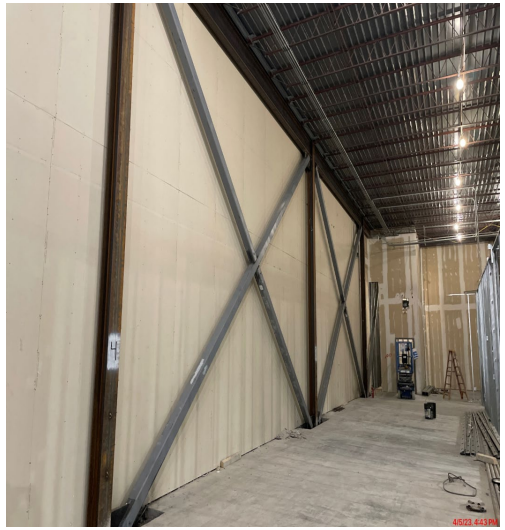
- Fully removed 36 WF columns
- Removed / modified 41% of all existing columns
- (E) framing remained for column bracing until truss install



Lateral Retrofitting

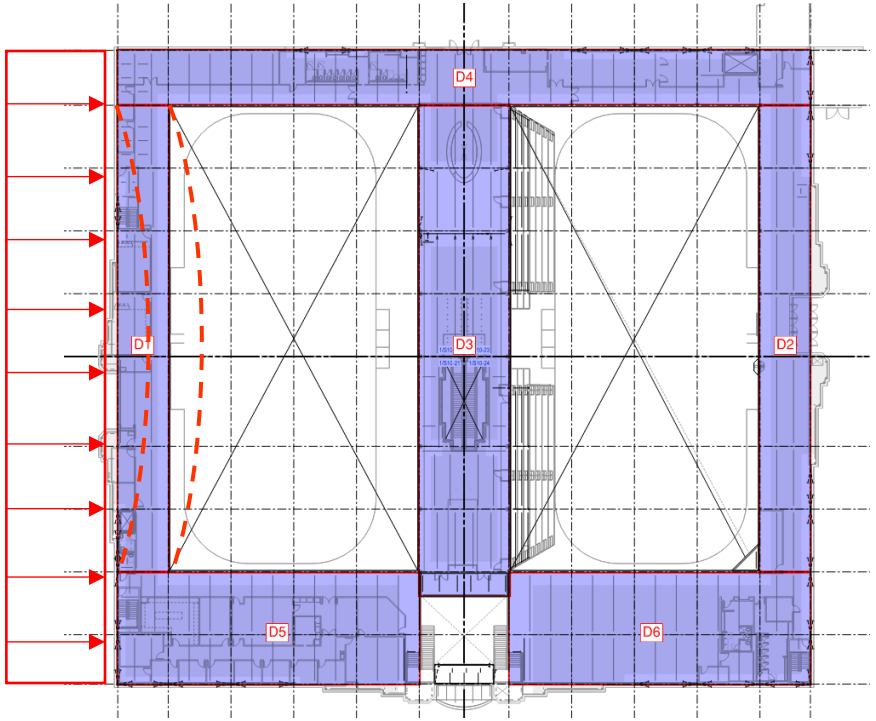
- Increased Risk Category
- Removed several bays of braced frames / could not easily access existing frames
- Some (E) braces were not installed correctly
- Retrofitted from 2” pipes to HSS6x6x3/8 braces

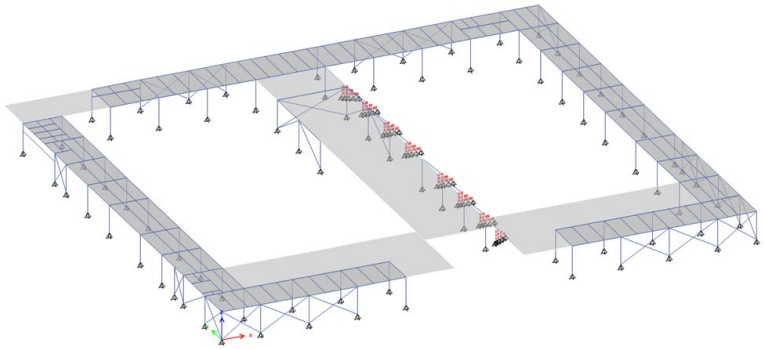




Lateral Retrofitting - Diaphragm

- Cut two massive holes in Level 2
- Split into 6-sub diaphragms
- Transformed into semi-rigid diaphragms due to aspect-ratio
- Add drag connections and turn regular members into chord members



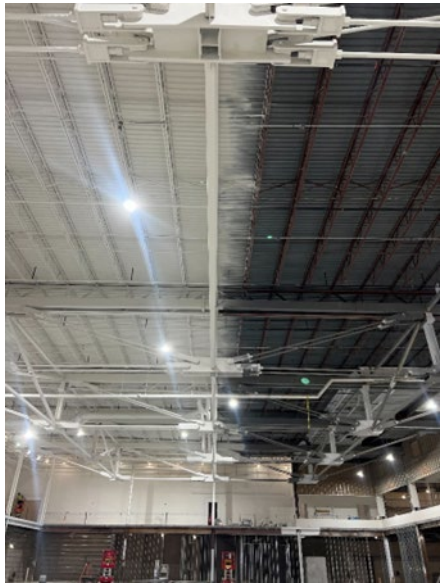


Stadia

- Slab-on-metal-deck stadia with WF Rakers
- Could not do traditional precast due to accessibility

Unique Considerations

- Zamboni pit and trench drains
- Skate friendly finishes
- Massive buried pipes for refrigerant



Adaptive Reuse Advantages

- Saved on schedule
- Greatly reduced material cost
- 76% reduction of embodied carbon

Embodied Carbon Intensity kgCO2e/Sq. Ft.

New Ground-Up	Actual Construction
29.02	6.86

Total Area = 95,000 ft^2

Category	Concrete	Steel	Architectural	Total (kgCO2e)	GWP Reduction %
New Ground-Up	604,600	1,456,700	695,300	2,756,600	-
Actual Construction	105,000	546,400	-	651,400	**76.37**

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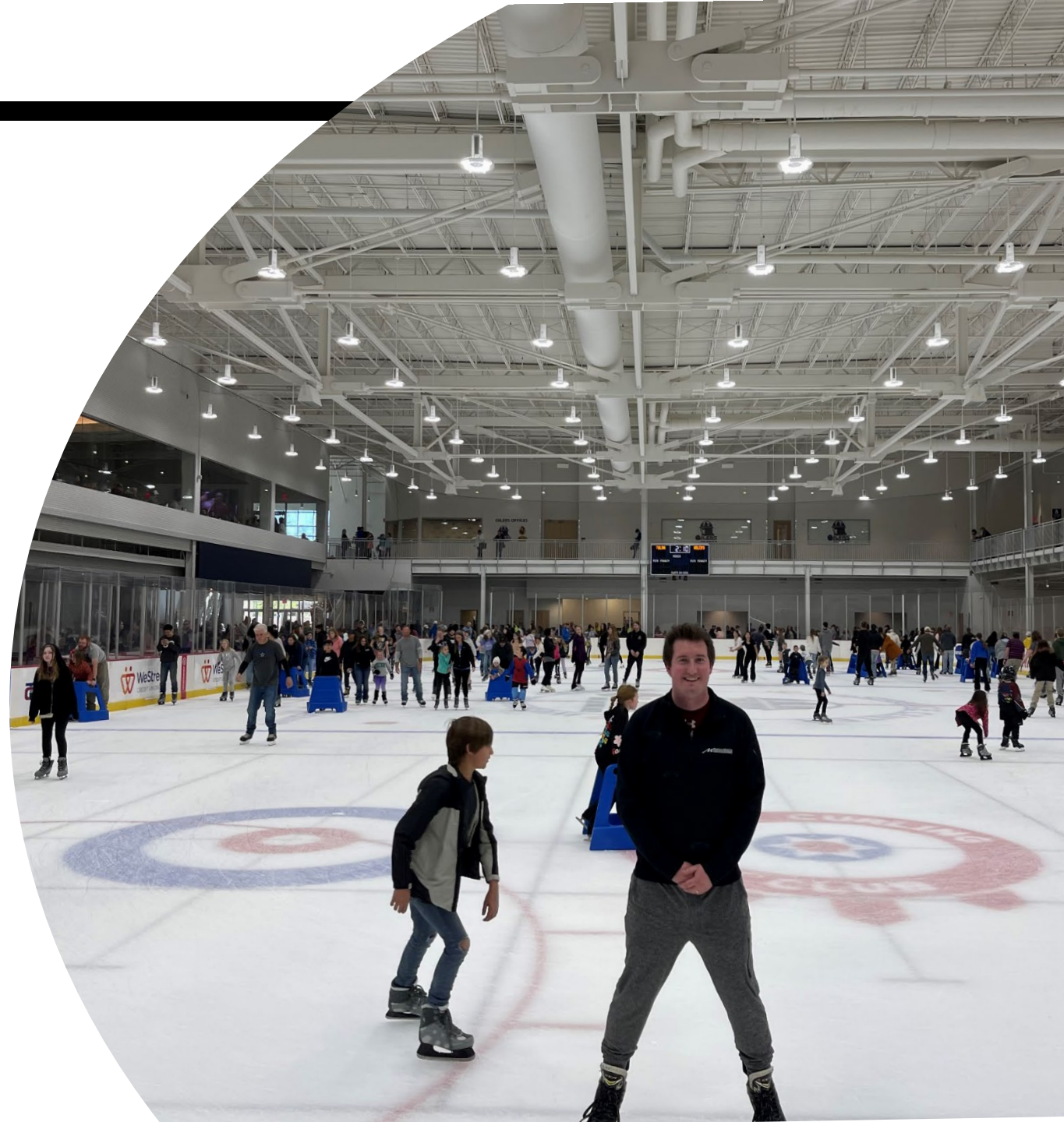
CONSULTING ENGINEERS

Thank You



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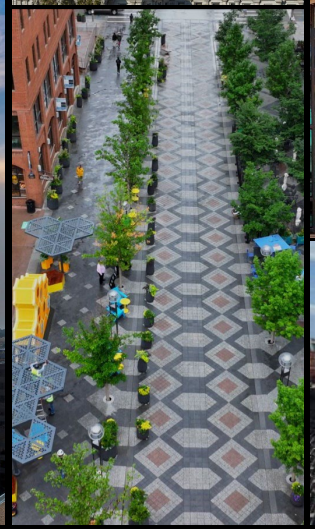

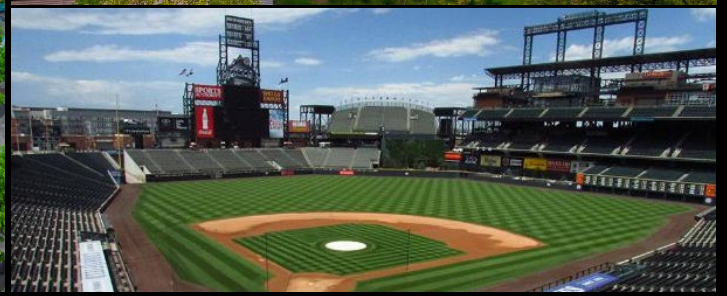

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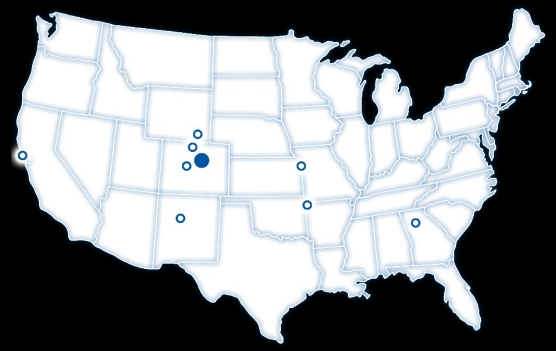

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