University of Kansas

David Booth Memorial Stadium

The Gateway District - Phase 1

HNTB Architecture
Structure's Group

March 5, 2026

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71th Annual Structural Engineer Conference

Today's Topics

- History of Memorial Stadium
- Project Overview
- Project Schedule
- Project Challenges
- Lessons Learned
- Q&A

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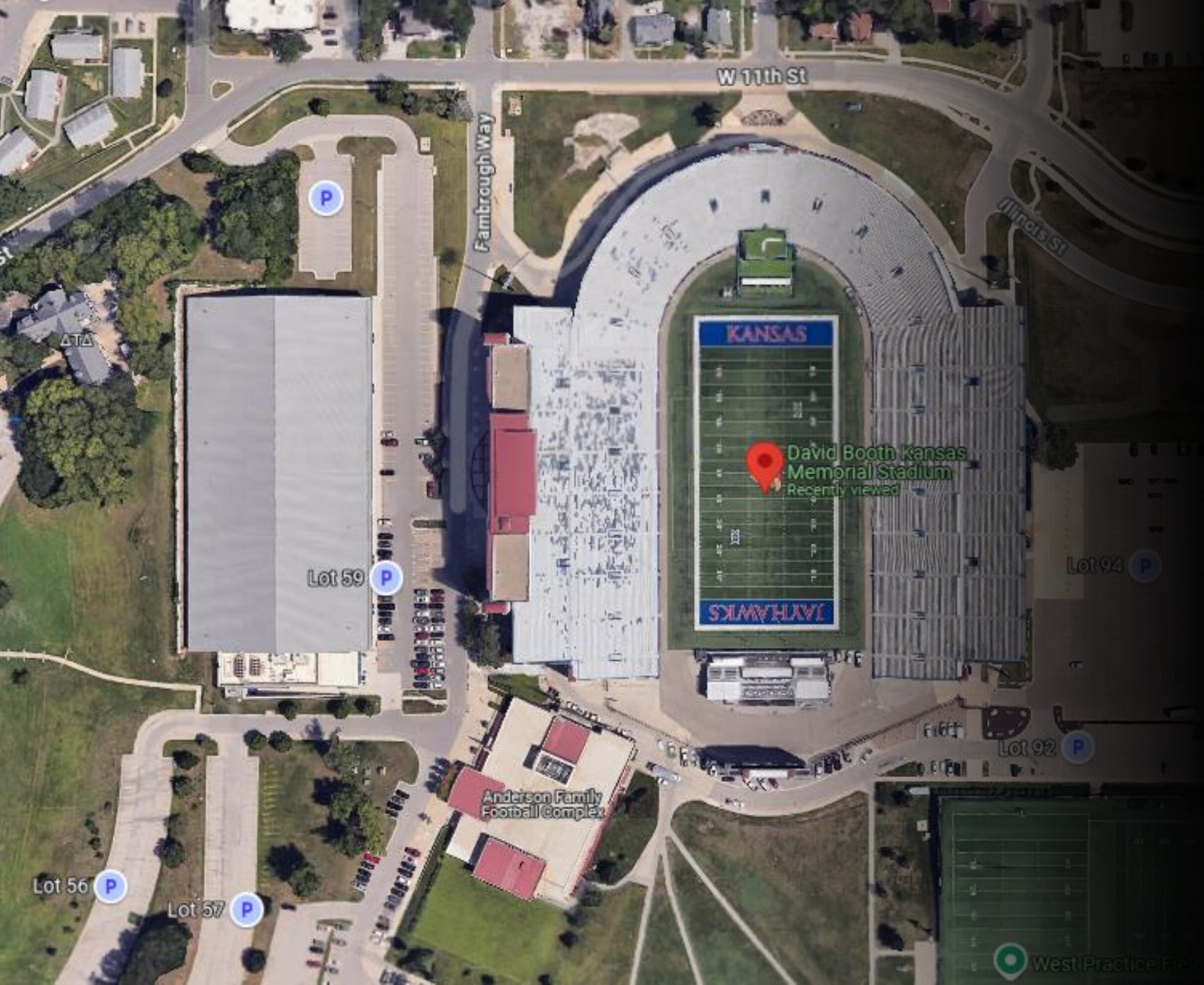

History of Memorial Stadium

- Built in 1921 - $460k
- WWI Memorial
- Upper bowl added in the 60's
- Press Box & Suites in the 90's
- AFFC built in 2009
- Indoor Practice Facility - 2019

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History of Memorial Stadium

- 1923 ACI 19th Annual Convention
- 632 by 464 ft and 47ft high
- Resembles Harward Stadium & the Coliseum at Rome
- 30,000 seat capacity
- Reinforce concrete used
- Steel too costly
- Unit Construction Co. of St. Louis

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Project Overview

Phase 1

- AFFC Renovation and Expansion
- New West Sideline
- New North Endzone & Conference Center
- New Scoreboard

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District – Phase 2

Project Overview

Phase 2

- East Sideline
- South endzone

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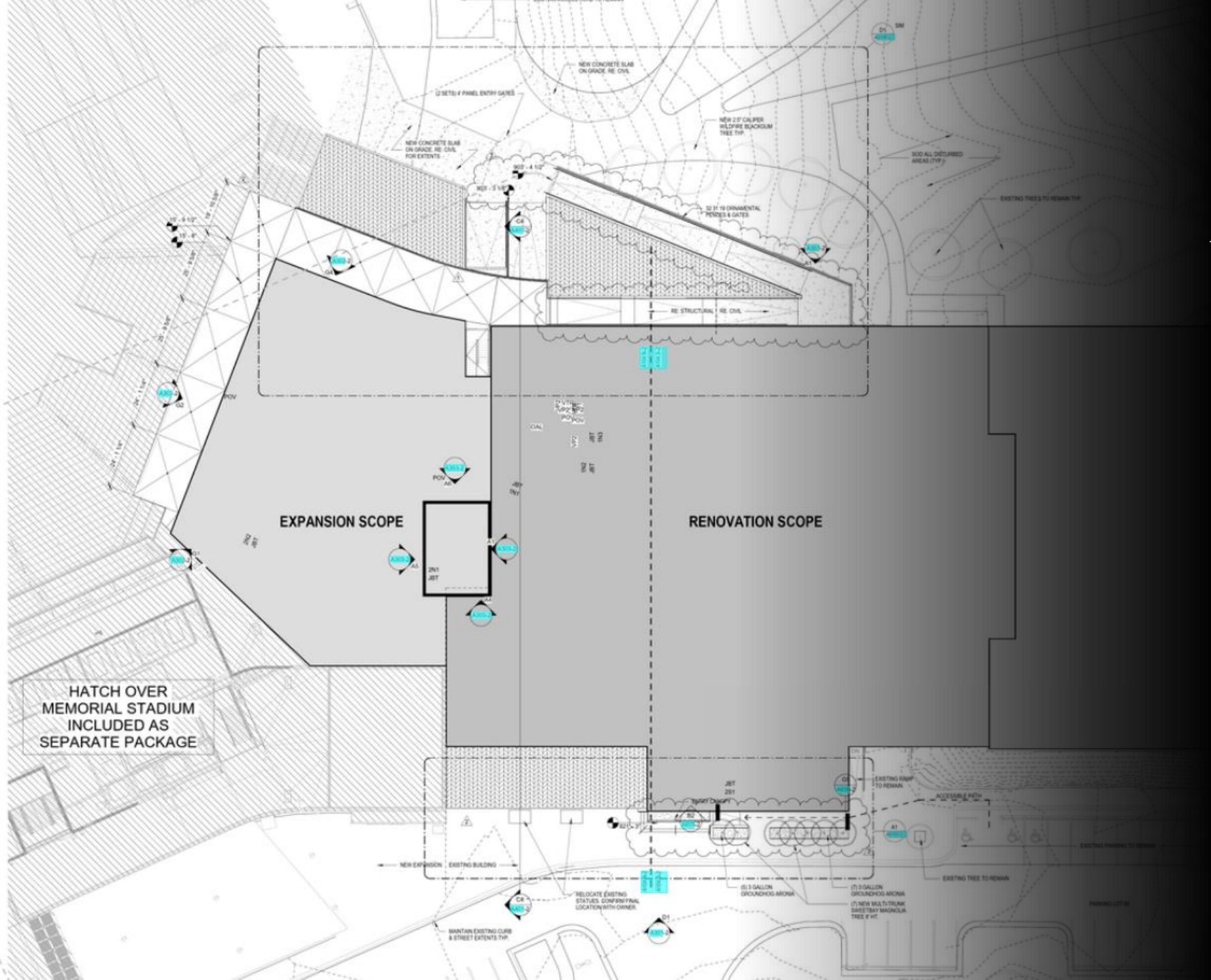
Project Overview

Anderson Family Football Complex (AFFC)



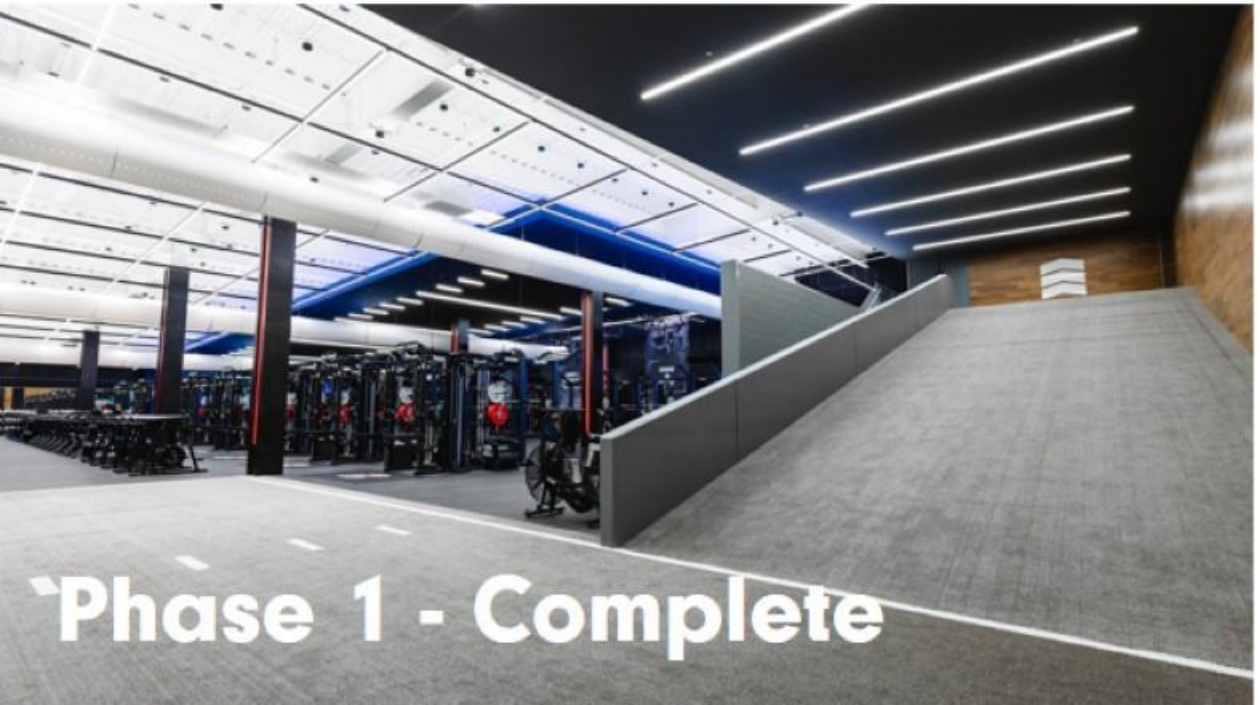
Project Overview

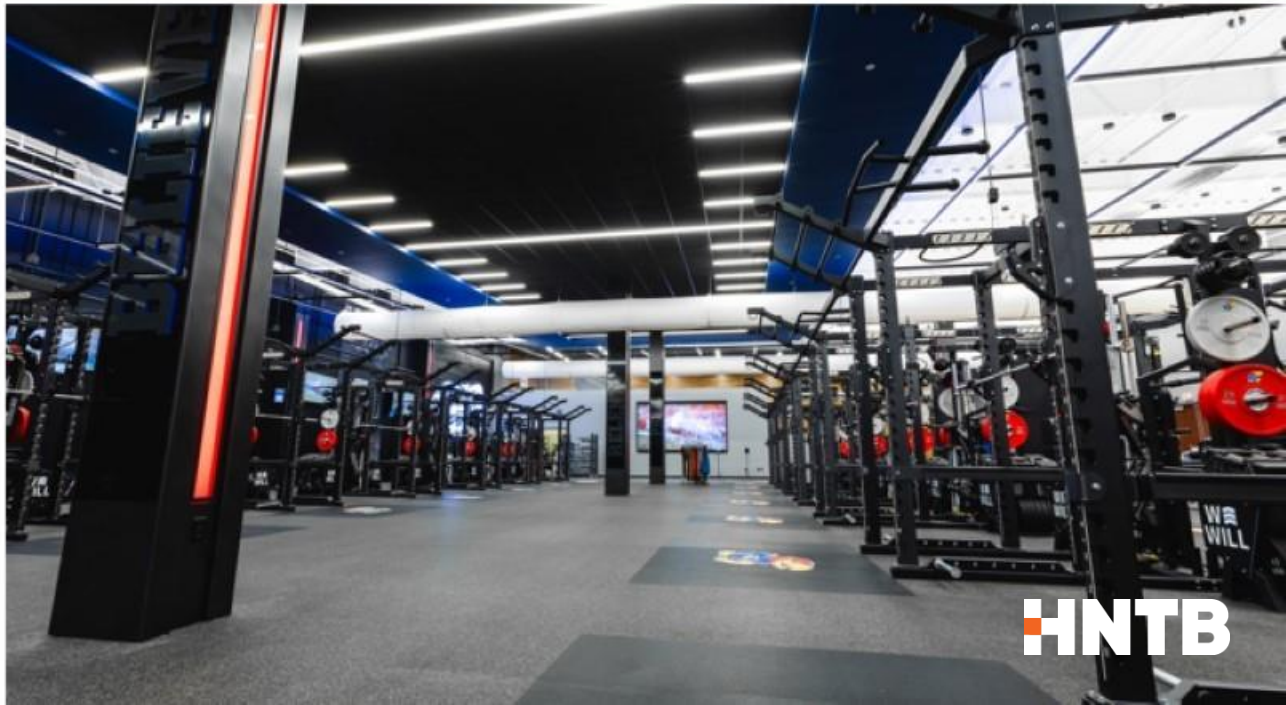
AFFC

- Tie AFFC into the stadium
- New Meeting Rooms
- New Coach’s Office
- Added Lower Bowl Seating
- New Multi-purpose Rooms
- Refresh interior spaces


ROCK CHALK
ANDERSON FAMILY FOOTBALL COMPLEX
ELEVATORS
KANSAS JAYHAWKS
TEAM MEETING ROOM
RECRUITING LOUNGE


KANSAS


Phase 1 - Complete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KU
50
40
30
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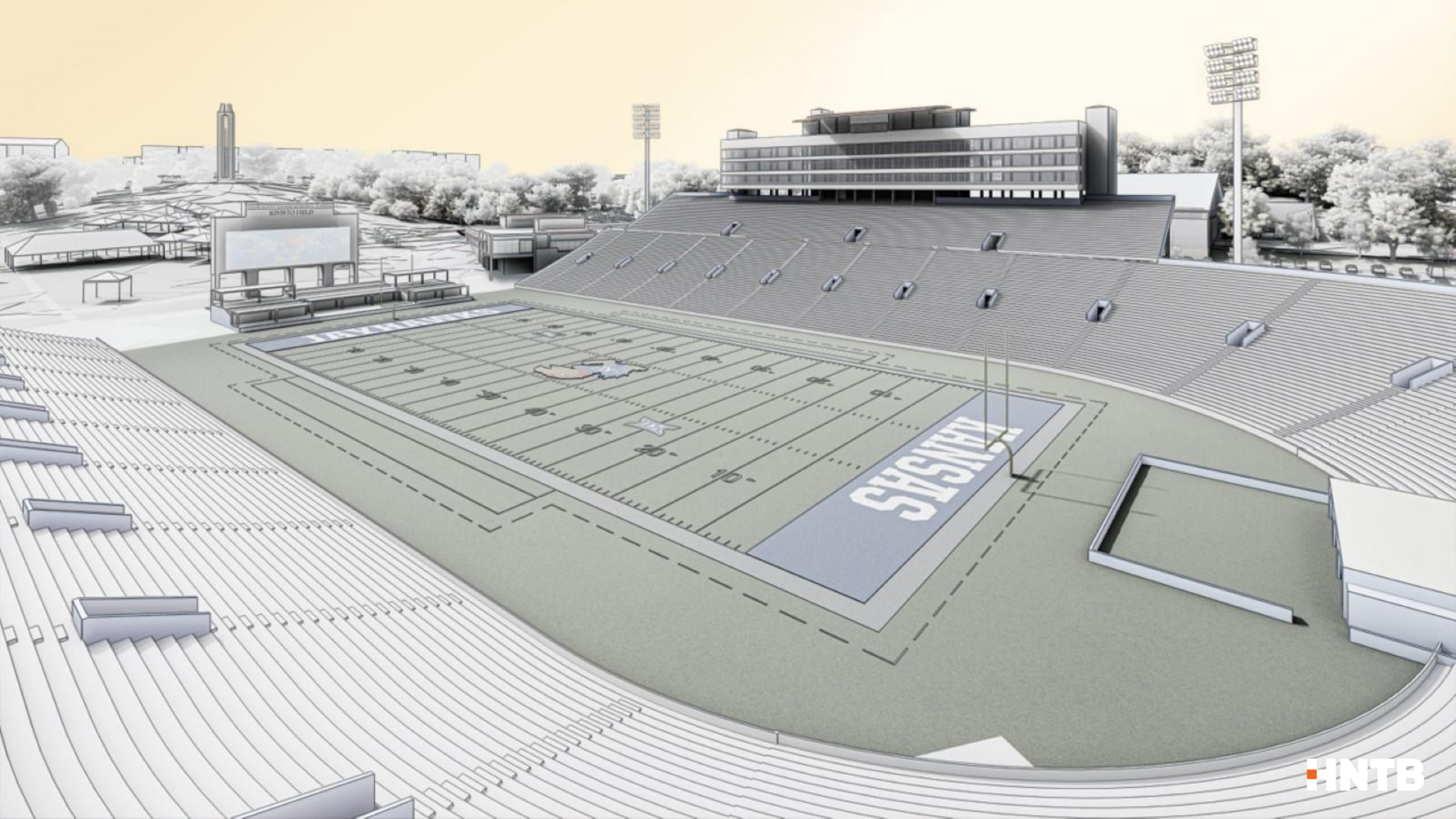
KANSAS


Phase 2


KANSAS FOOTBALL
WE WILL
HNTB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ROCK
CHALK
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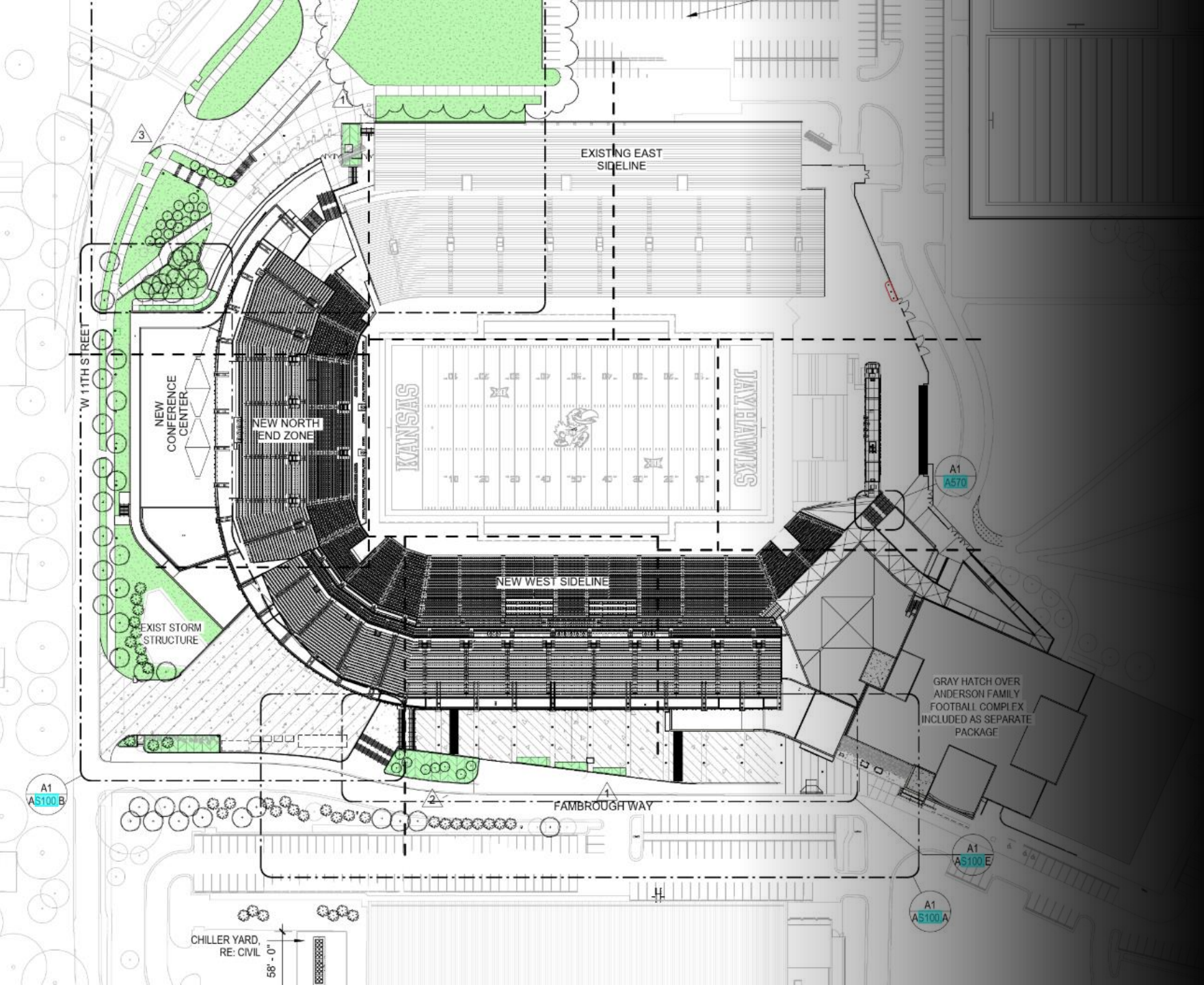
Project Overview

Stadium



Project Overview

Phase 1

- Brings Fans Closer To The Field
- New Clubs
- New Suites & Press
- VIP Entrance
- Enhance Arrival Experience
- Year-round events
- New Conference Center

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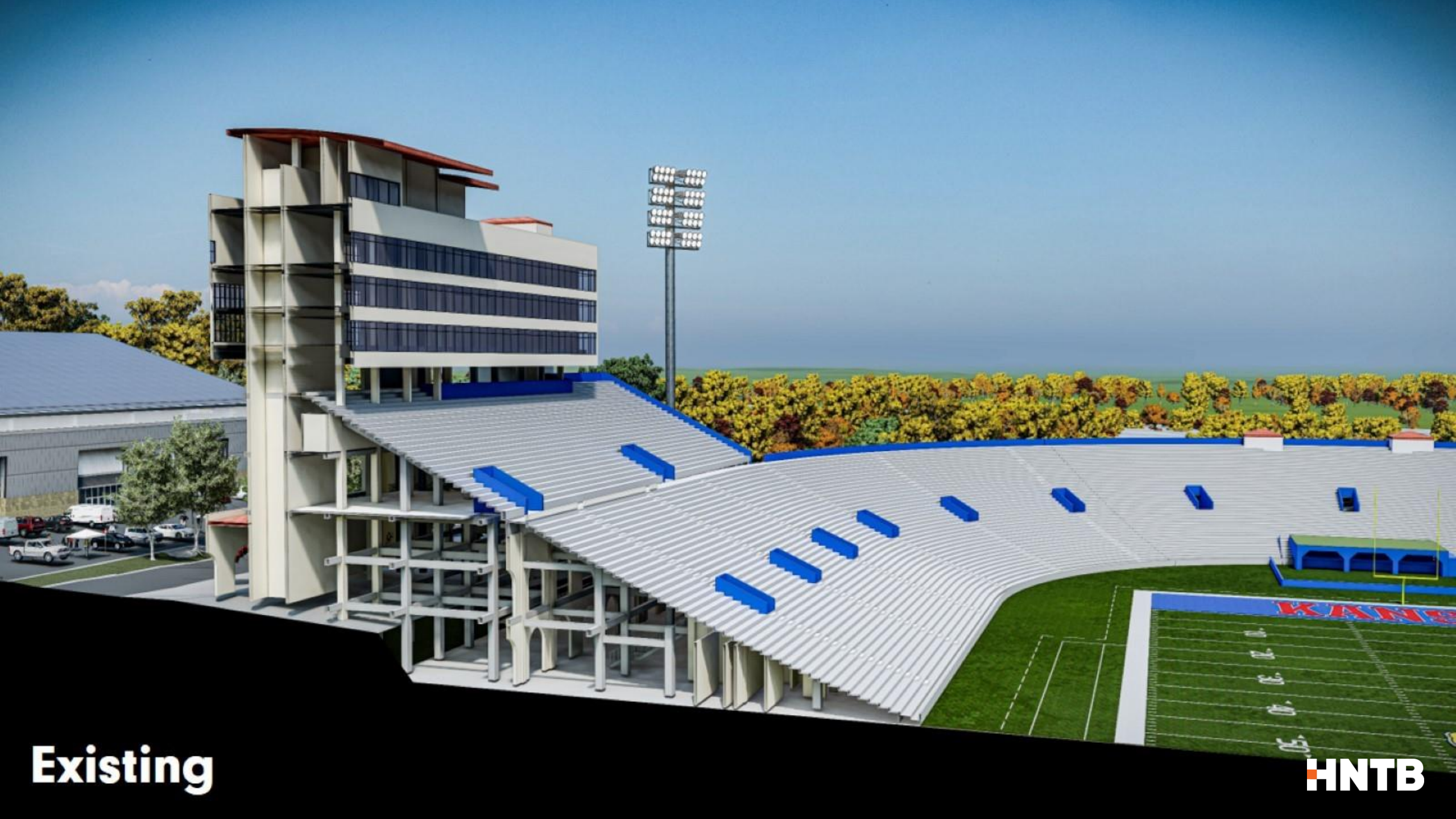

Existing

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New – Closer to the Action / More Diverse

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In-Game Experience

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North Endzone - Existing

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North Conference Center + Field Club

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COMPLETED

~~In Progress~~ - VIP Lobby

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COMPLETED

~~In Progress~~ - Limestone Club

HNTB

COMPLETED

~~In Progress~~ – Suite Level Arrival

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COMPLETED
In Progress – Traditional Suites
HNTB

COMPLETED

~~In Progress~~ – Founders Lounge

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Project Overview

Structure

- ✓ 2018 IBC / ASCE 7-16
- ✓ Drilled Shaft Foundations
- ✓ Structural Steel Frame
- ✓ Precast Bowl Seating
- ✓ A913 Grade 65 for Cols > 100plf
- ✓ Lateral System
  - ✓ SCBF
  - ✓ Sway Frames
  - ✓ Precast Shear Walls

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Project Overview

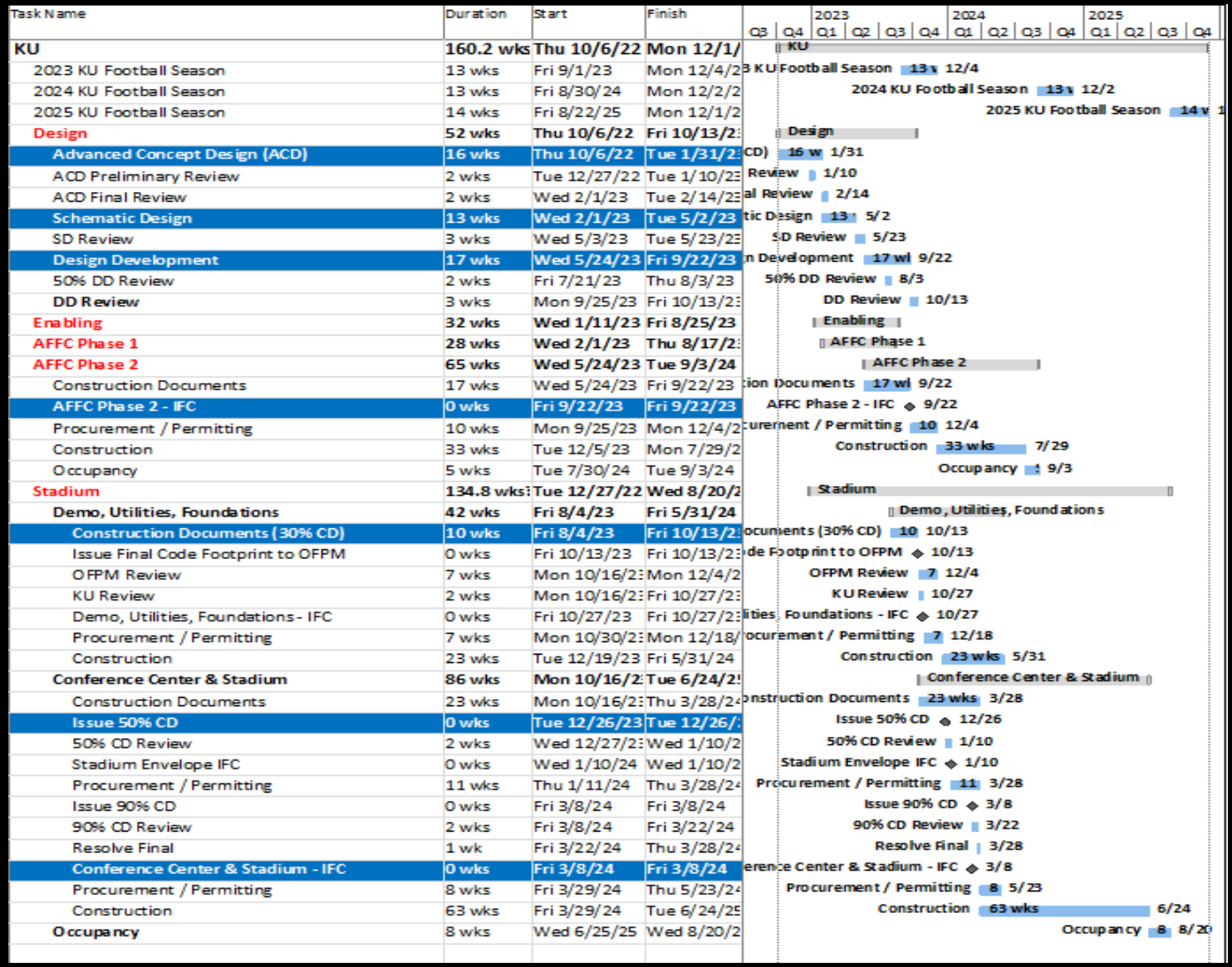
Key Stats

- $340M Construction Cost
- 40,000 seats
- 4300 Total Tons of Steel
- 12 months from IFC to Final Steel
- 23 months from IFC to Opening

Project Schedule

Project Schedule

- NTP in Oct ‘22
- Concept Design – Jan ’23
- Schematic Design – May ’23
- Stadium DD & AFFC IFC – Sept ’23
- Stadium C&S IFC – Jan ‘24
- Stadium IFC – Mar ‘24
- Opening – Aug ‘25



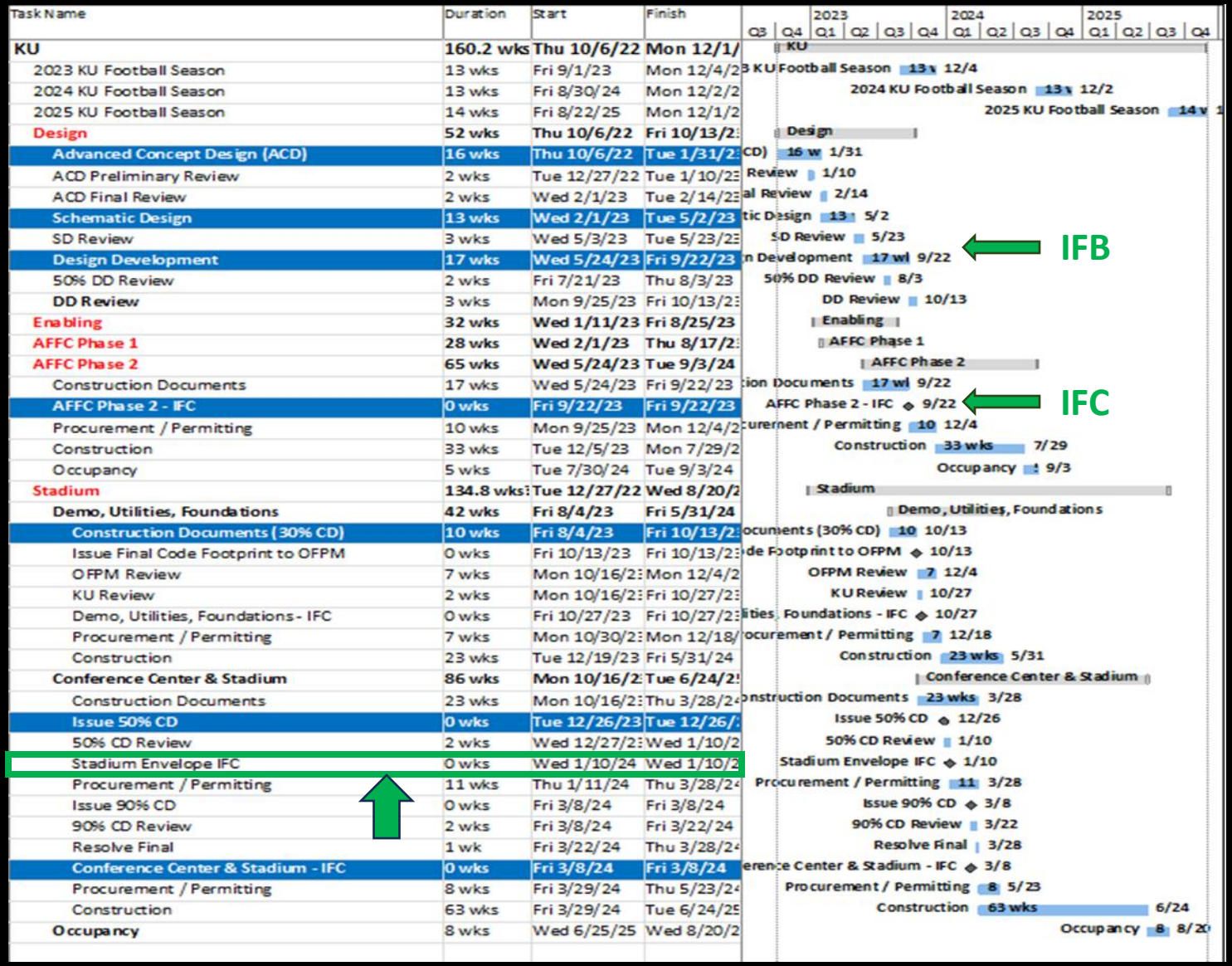
Task Name	Duration	Start	Finish
KU	160.2 wks	Thu 10/6/22	Mon 12/1/
2023 KU Football Season	13 wks	Fri 9/1/23	Mon 12/4/23
2024 KU Football Season	13 wks	Fri 8/30/24	Mon 12/2/2
2025 KU Football Season	14 wks	Fri 8/22/25	Mon 12/1/2
Design	52 wks	Thu 10/6/22	Fri 10/13/2
Advanced Concept Design (ACD)	16 wks	Thu 10/6/22	Tue 1/31/2
ACD Preliminary Review	2 wks	Tue 12/27/22	Tue 1/10/23
ACD Final Review	2 wks	Wed 2/1/23	Tue 2/14/23
Schematic Design	13 wks	Wed 2/1/23	Tue 5/2/23
SD Review	3 wks	Wed 5/3/23	Tue 5/23/23
Design Development	17 wks	Wed 5/24/23	Fri 9/22/23
50% DD Review	2 wks	Fri 7/21/23	Thu 8/3/23
DD Review	3 wks	Mon 9/25/23	Fri 10/13/23
Enabling	32 wks	Wed 1/11/23	Fri 8/25/23
AFFC Phase 1	28 wks	Wed 2/1/23	Thu 8/17/2
AFFC Phase 2	65 wks	Wed 5/24/23	Tue 9/3/24
Construction Documents	17 wks	Wed 5/24/23	Fri 9/22/23
AFFC Phase 2 - IFC	0 wks	Fri 9/22/23	Fri 9/22/23
Procurement / Permitting	10 wks	Mon 9/25/23	Mon 12/4/2
Construction	33 wks	Tue 12/5/23	Mon 7/29/2
Occupancy	5 wks	Tue 7/30/24	Tue 9/3/24
Stadium	134.8 wks	Tue 12/27/22	Wed 8/20/2
Demo, Utilities, Foundations	42 wks	Fri 8/4/23	Fri 5/31/24
Construction Documents (30% CD)	10 wks	Fri 8/4/23	Fri 10/13/2
Issue Final Code Footprint to OFPM	0 wks	Fri 10/13/23	Fri 10/13/23
OFPM Review	7 wks	Mon 10/16/23	Mon 12/4/2
KU Review	2 wks	Mon 10/16/23	Fri 10/27/23
Demo, Utilities, Foundations - IFC	0 wks	Fri 10/27/23	Fri 10/27/23
Procurement / Permitting	7 wks	Mon 10/30/23	Mon 12/18/
Construction	23 wks	Tue 12/19/23	Fri 5/31/24
Conference Center & Stadium	86 wks	Mon 10/16/2	Tue 6/24/25
Construction Documents	23 wks	Mon 10/16/23	Thu 3/28/24
Issue 50% CD	0 wks	Tue 12/26/23	Tue 12/26/
50% CD Review	2 wks	Wed 12/27/23	Wed 1/10/2
Stadium Envelope IFC	0 wks	Wed 1/10/24	Wed 1/10/2
Procurement / Permitting	11 wks	Thu 1/11/24	Thu 3/28/24
Issue 90% CD	0 wks	Fri 3/8/24	Fri 3/8/24
90% CD Review	2 wks	Fri 3/8/24	Fri 3/22/24
Resolve Final	1 wk	Fri 3/22/24	Thu 3/28/24
Conference Center & Stadium - IFC	0 wks	Fri 3/8/24	Fri 3/8/24
Procurement / Permitting	8 wks	Fri 3/29/24	Thu 5/23/24
Construction	63 wks	Fri 3/29/24	Tue 6/24/25
Occupancy	8 wks	Wed 6/25/25	Wed 8/20/2

Then a CMAR was hired….

- Turner hired in the end April ‘23
- Completely changed the design schedule
- We need to bid steel now!!

New Project Schedule

- Structural Steel IFB – July ‘23
- West Stadium IFC (PH1) – Sep ‘23
- West Stadium IFC (PH2) – Nov ‘23
- North Stadium IFC – Dec ‘23
- Envelope (C & S) IFC – Jan ’24
- Stadium IFC – Mar ‘24



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Project Schedule

- Summary of Quantities
- Primary Steel Only
- Based on a Schematic Design and issued following VE studies
- Excluded Many items
- Estimated 3992 tons
- Went from 5 FTEs to 10 FTEs

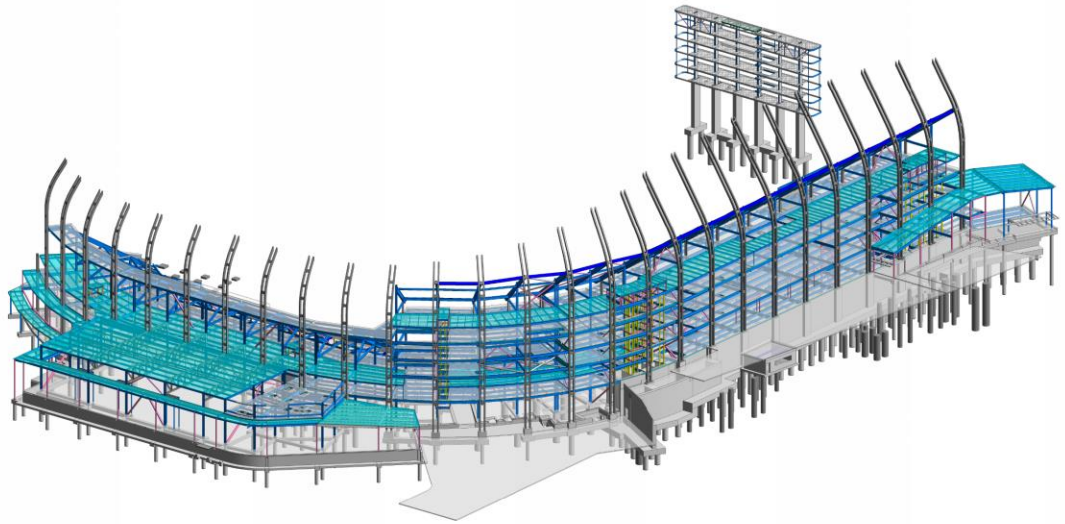
SUMMARY

BUILDING	STRUCTURAL COMPONENT	TONNAGE (TONS)	REMARKS
STADIUM	MAIN CONCOURSE	317	REF: SHEET S851
STADIUM	LOWER BOWL SEATING	256	REF: SHEET S851
STADIUM	WEST EXTERIOR PLAZA	81	REF: SHEET S851
STADIUM	NORTH ROOF	45	REF: SHEET S851
STADIUM	MECH YARD	23	REF: SHEET S851
STADIUM	MAIN CONCOURSE ROOF	22	REF: SHEET S852
STADIUM	NORTH CONFERENCE CENTER ROOF	200	REF: SHEET S852
STADIUM	CLUB CONCOURSE	130	REF: SHEET S853
STADIUM	PRECAST CLUB SEATING	100	REF: SHEET S853
STADIUM	PREMIUM FLOOR	154	REF: SHEET S854
STADIUM	SOUTH WEST ENTRANCE ROOF	23	REF: SHEET S854
STADIUM	PREMIUM PRECAST SEATING	15	REF: SHEET S854
STADIUM	WEST CONCOURSE	200	REF: SHEET S855
STADIUM	NORTH UPPER CONCOURSE	38	REF: SHEET S855
STADIUM	WEST UPPER CONCOURSE SEATING	23	REF: SHEET S855
STADIUM	NORTH UPPER BOWL SEATING	188	REF: SHEET S855
STADIUM	ANCILLARY ROOFS OVER CONCOURSE	36	REF: SHEET S856
STADIUM	WEST UPPER BOWL SEATING	265	REF: SHEET S857
STADIUM	STRUCTURAL COLUMNS	120	STANDARD WIDE FLANGE, HSS AND PIPE
STADIUM	STRUCTURAL FRAME BRACES	60	HSS REC
STADIUM	PERIMETER PLATE COLUMNS	480	DOUBLE HSS20x12x1/2 AT 28 LOC, TOTAL LEN=3,872'
STADIUM	PERIMETER CLADDING SUPPORT	284	ASSUMED 8 PSF OVER 71,000 SF
STADIUM	SCOREBOARD	267	
STADIUM	**SUBTOTAL:**	**3327**	SUMMATION OF ALL STRUCTURAL COMPONENTS
STADIUM	20% DESIGN DEVELOPMENT...	665	
STADIUM	**TOTAL:**	**3992**	

STEEL QUANTITY NOTES:

1. A 20% TONNAGE ALLOWANCE/CONTINGENCY, IN ADDITION TO LISTED VALUES, FOR FURTHER DEVELOPMENT FROM SCHEMATIC DESIGN HAS BEEN INCLUDED.
2. ROOF AND FLOOR STEEL DECK NOT INCLUDED
3. QUANTITIES IN THE TABLE ARE FOR THE PRIMARY STRUCTURAL FRAME ONLY AND NO ALLOWANCE IN THE TONNAGE TABLE HAS BEEN MADE FOR THE FOLLOWING:
   a. STEEL WASTE DURING THE FABRICATION PROCESS, SUCH AS EXCESS PLATE AND STOCK LENGTH CUT OFFS
   b. MISCELLANEOUS STEEL REQUIRED FOR THE SUPPORT AND SERVICING OF MEP EQUIPMENT
   c. STEEL STAIRS, INTERMEDIATE LANDINGS AND LADDERS
   d. HANDRAILS AND OTHER MISCELLANEOUS METALS
   e. TEMPORARY SHORING / BRACING AND OTHER ERECTION AIDS
   f. SIGNAGE SUPPORTS, ETC.
   g. MECHANICAL EQUIPMENT SUPPORTS, PIPING SUPPORTS, ETC
   h. COLD FORMED METAL FRAMING
   i. OTHER MISCELLANEOUS METALS AND STRUCTURAL STEEL NOT ASSOCIATED WITH THE PRIMARY SUPPORT OF THE BUILDING STRUCTURE
   j. EMBEDDED ITEMS
   k. COMPOSITE BEAM STUDS. ASSUME 12" CENTER TO CENTER SPACING FOR ESTIMATING PURPOSES - UTILIZE 3/4" DIA STUDS
   l. VERTICAL TRANSPORTATION STEEL
   m. HSS AND PLATES ASSOCIATED WITH PRECAST STADIA BEARING SEATS PER PRECAST STADIA TYPICAL DETAILS
   n. SLAB AND ROOF EDGE BENT PLATES
4. REFER TO SHEETS S851 THRU S857 FOR DETAILED BREAKDOWN OF TONNAGES PER ZONE
5. COLUMN WEIGHTS AND CORRESPONDING TONNAGES HAVE BEEN INCORPORATED INTO THE FRAMING CATEGORIES AT EACH LEVEL, EXCEPT FOR THE PERIMETER STADIUM COLUMNS.

STRUCTURAL STEEL TONNAGE AND NOTES	A1
1" = 1'-0"	



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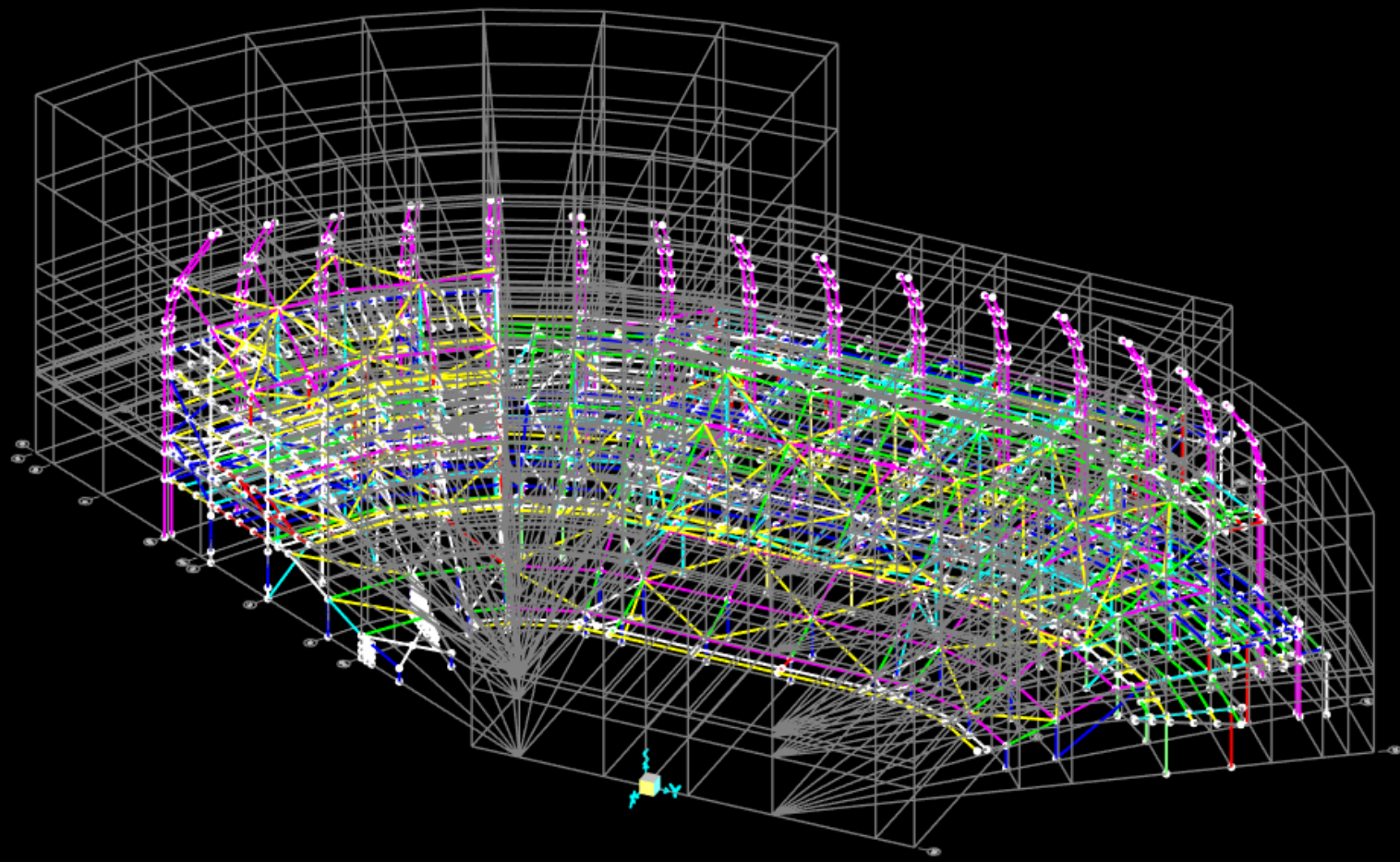
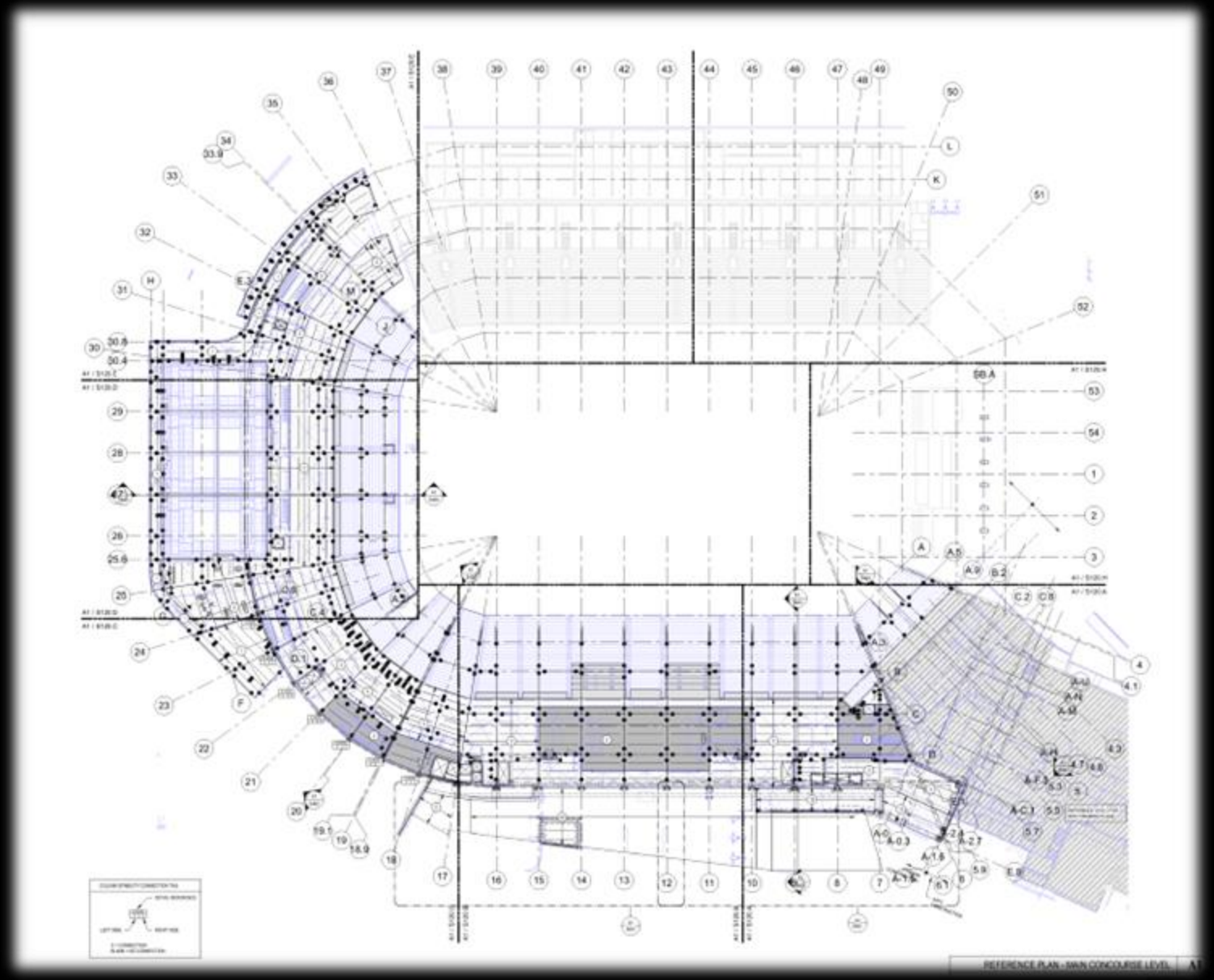
Project Challenges





Project Challenges

- Schedule
  - Design Assist
  - Changes
- Design
  - Braced Frame Locations
  - Lateral Load Paths
  - Lighting Columns
  - MEP Coordination

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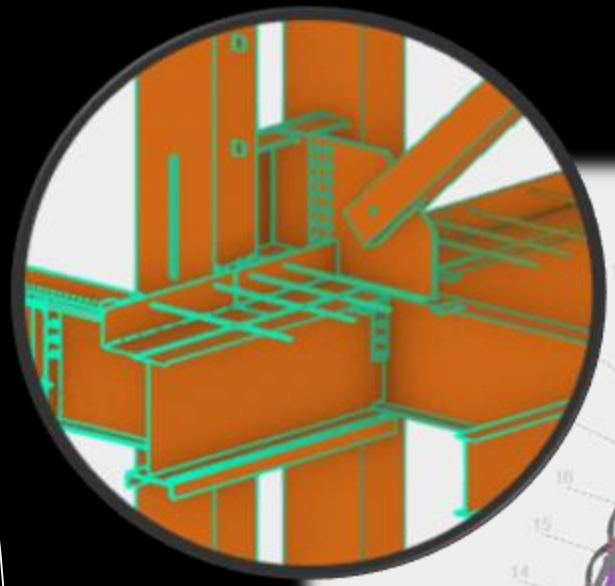
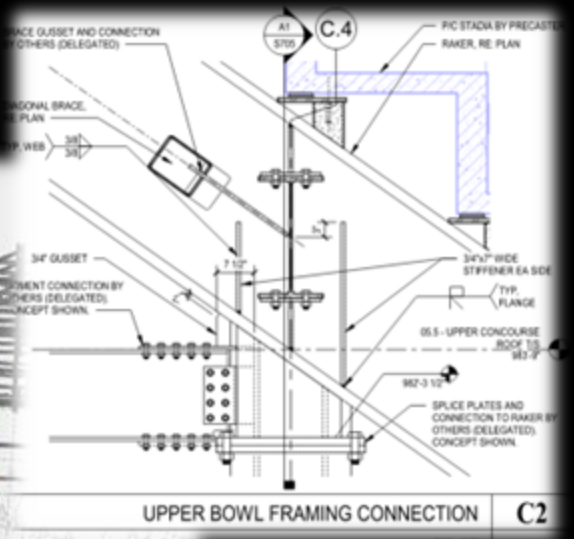
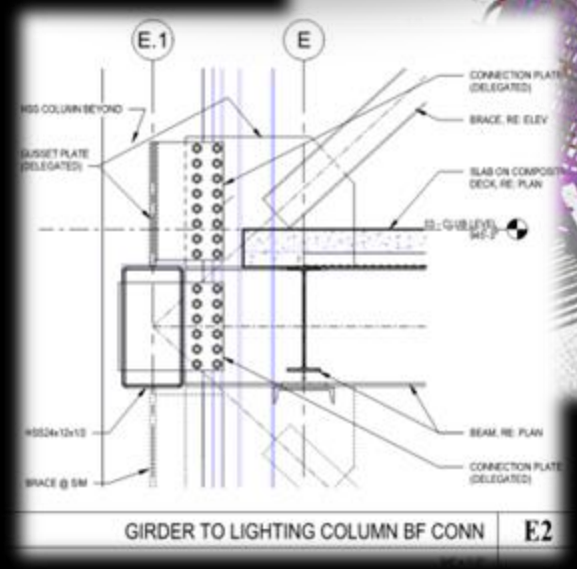
Project Challenges

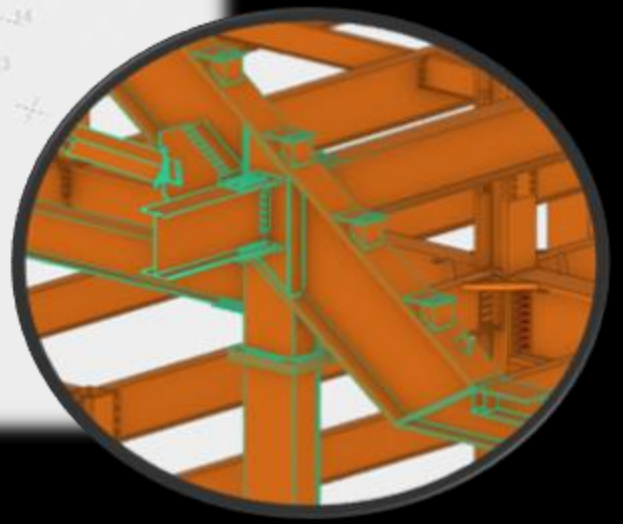
Schedule – Design Assist

- Thornton Thomasetti
  - TEKLA Model
  - Delegated Design
    - Connections
    - Stairs
  - Construction Support
- Worked together to incorporate changes on the fly





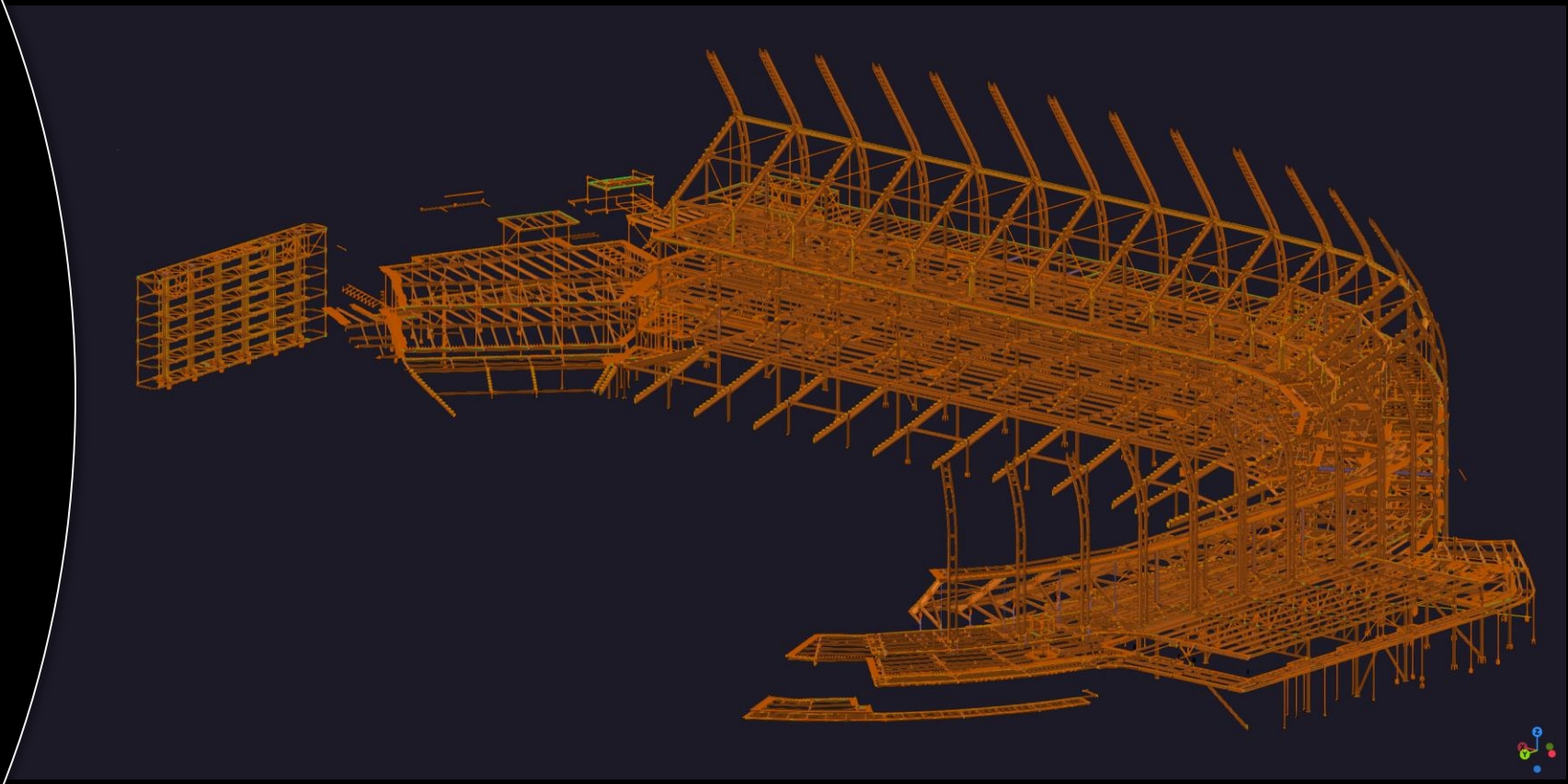




Project Challenges

Schedule – Design Assist

- TEKLA Model
  - Shop drawing review
  - Fabrication during review
- Engineer/Fabricator/DA Direction Coordination for Connection Optimization



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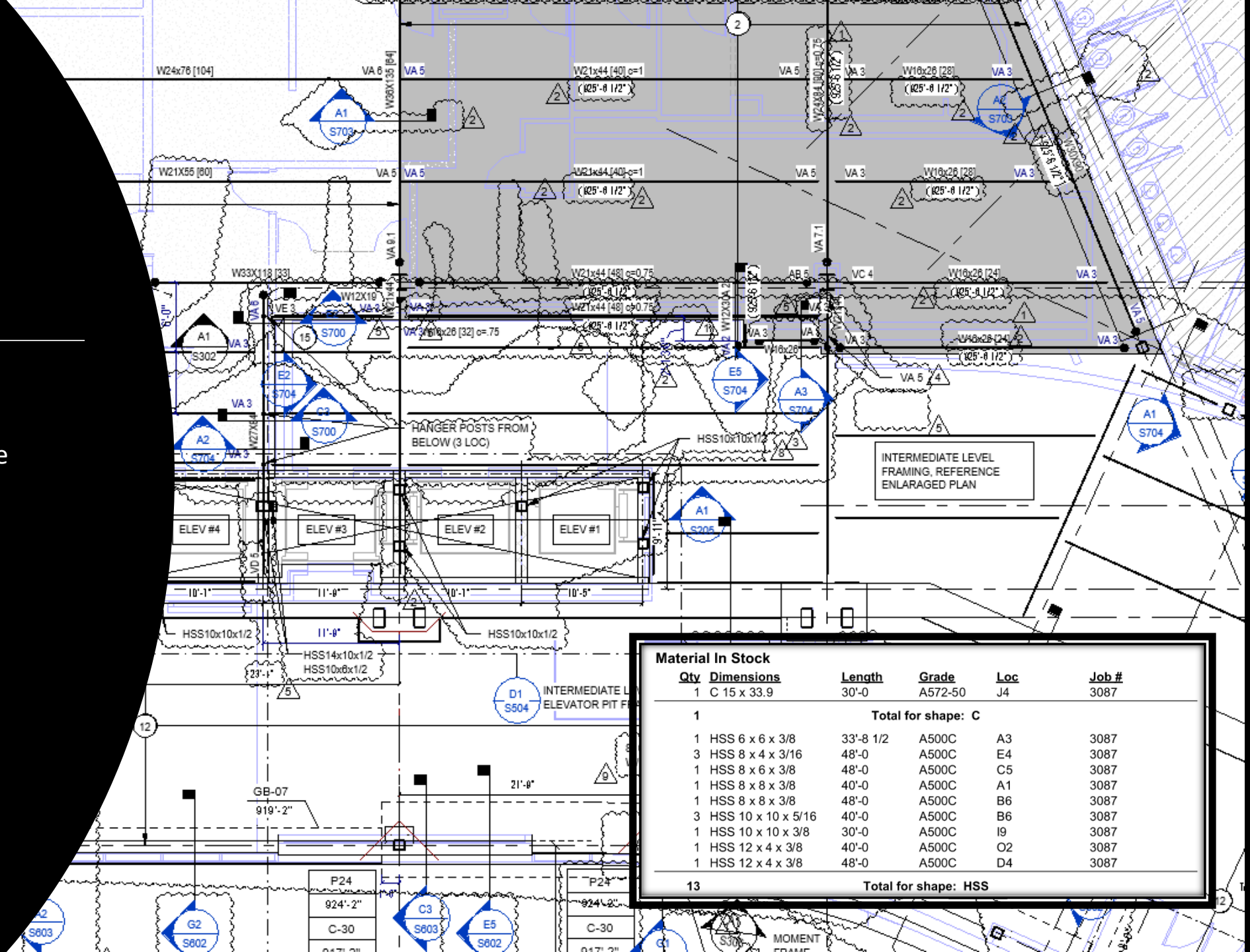
Project Challenges

Schedule - Changes

- Limiting Design Changes
- Treat like Existing Structure
- Change Orders
- Reuse of purchased Steel



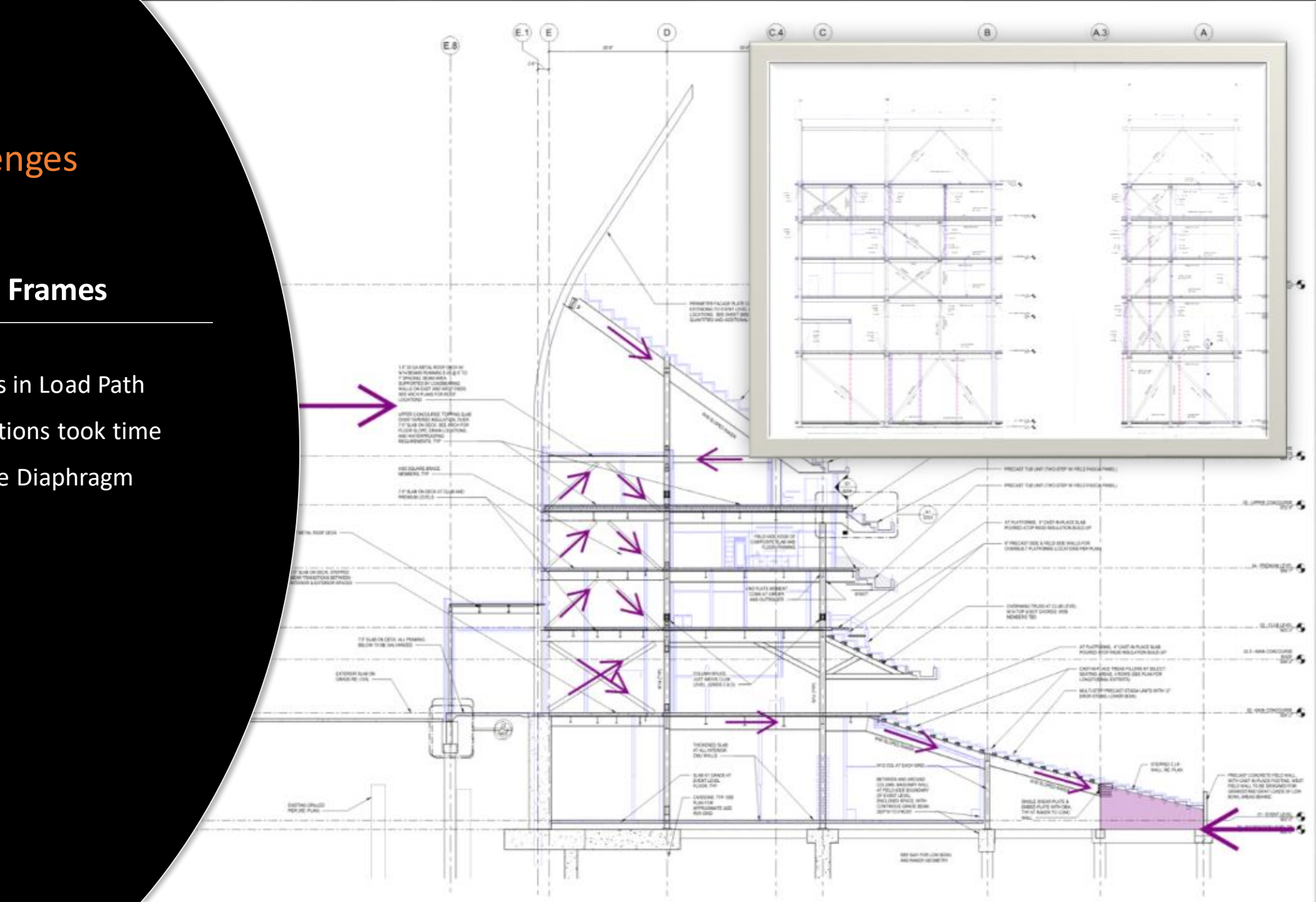
Material In Stock

Qty	Dimensions	Length	Grade	Loc	Job #
1	C 15 x 33.9	30'-0	A572-50	J4	3087
1		Total for shape: C			
1	HSS 6 x 6 x 3/8	33'-8 1/2	A500C	A3	3087
3	HSS 8 x 4 x 3/16	48'-0	A500C	E4	3087
1	HSS 8 x 6 x 3/8	48'-0	A500C	C5	3087
1	HSS 8 x 8 x 3/8	40'-0	A500C	A1	3087
1	HSS 8 x 8 x 3/8	48'-0	A500C	B6	3087
3	HSS 10 x 10 x 5/16	40'-0	A500C	B6	3087
1	HSS 10 x 10 x 3/8	30'-0	A500C	I9	3087
1	HSS 12 x 4 x 3/8	40'-0	A500C	O2	3087
1	HSS 12 x 4 x 3/8	48'-0	A500C	D4	3087
13		Total for shape: HSS			

Project Challenges

Design – Braced Frames

- Discontinuities in Load Path
- Finalizing locations took time
- North Endzone Diaphragm



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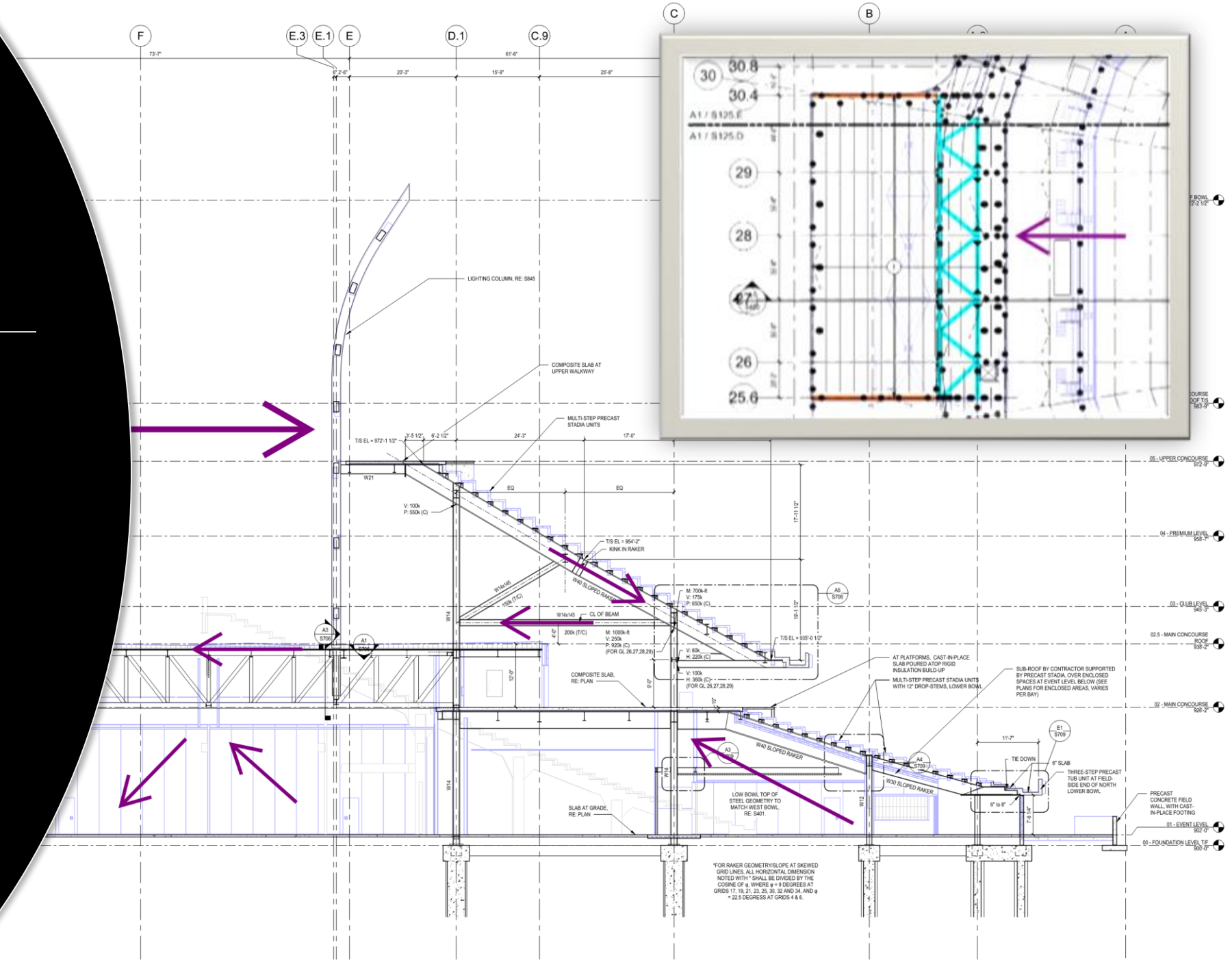
Project Challenges

Design – Lateral Load Paths

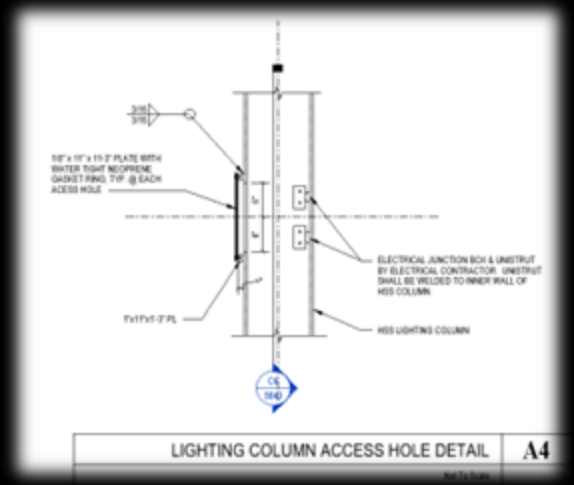
- North Endzone Diaphragm

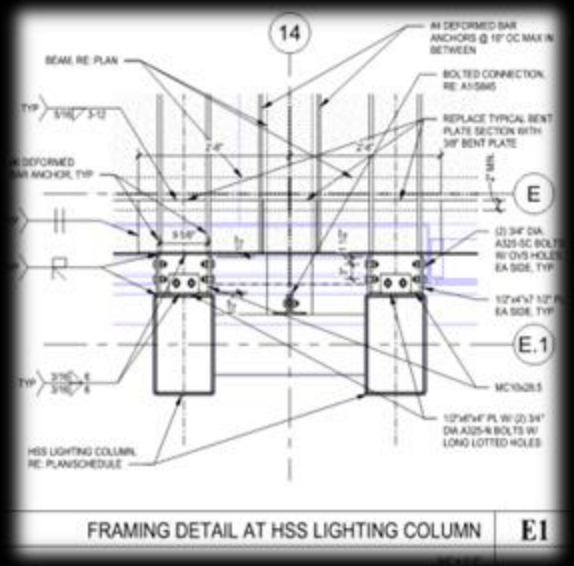


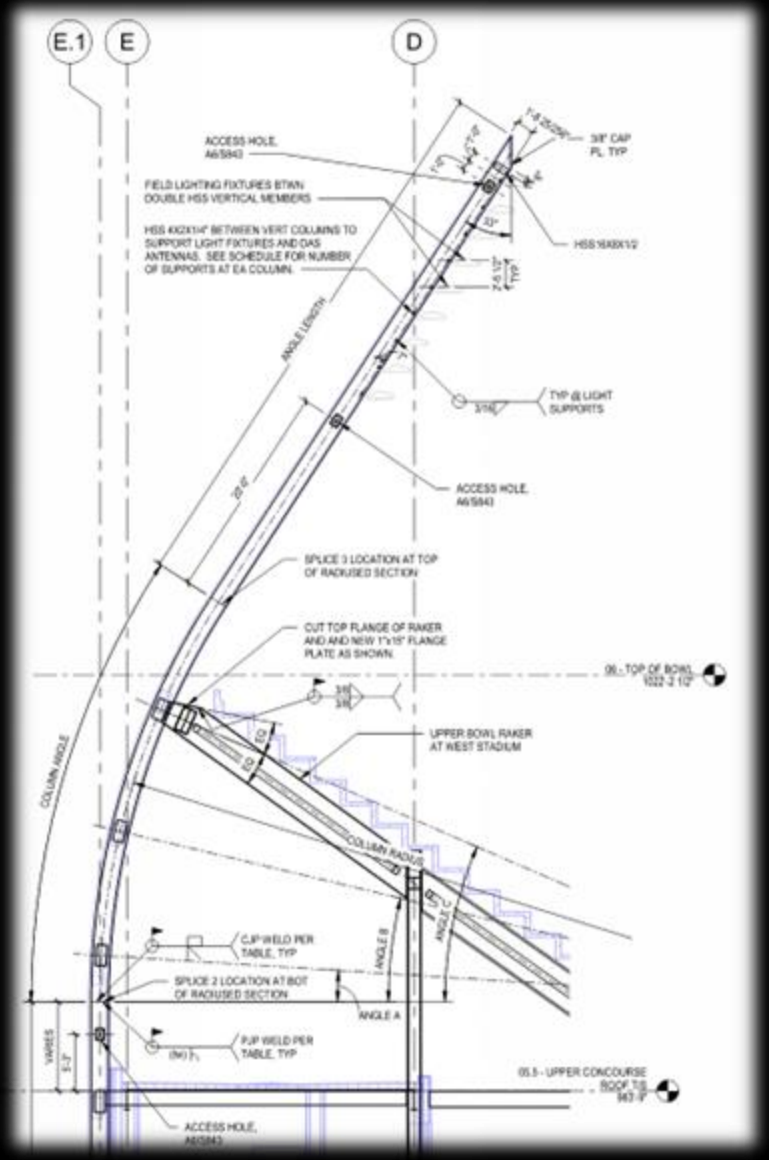
Project Challenges

Design – Lighting Columns

- 2 - HSS20x12x1/2 Cols
- Outboard of building
- Internal conduit
- Braced Frames
- Column lateral Bracing
- CJP/PJP welding on site



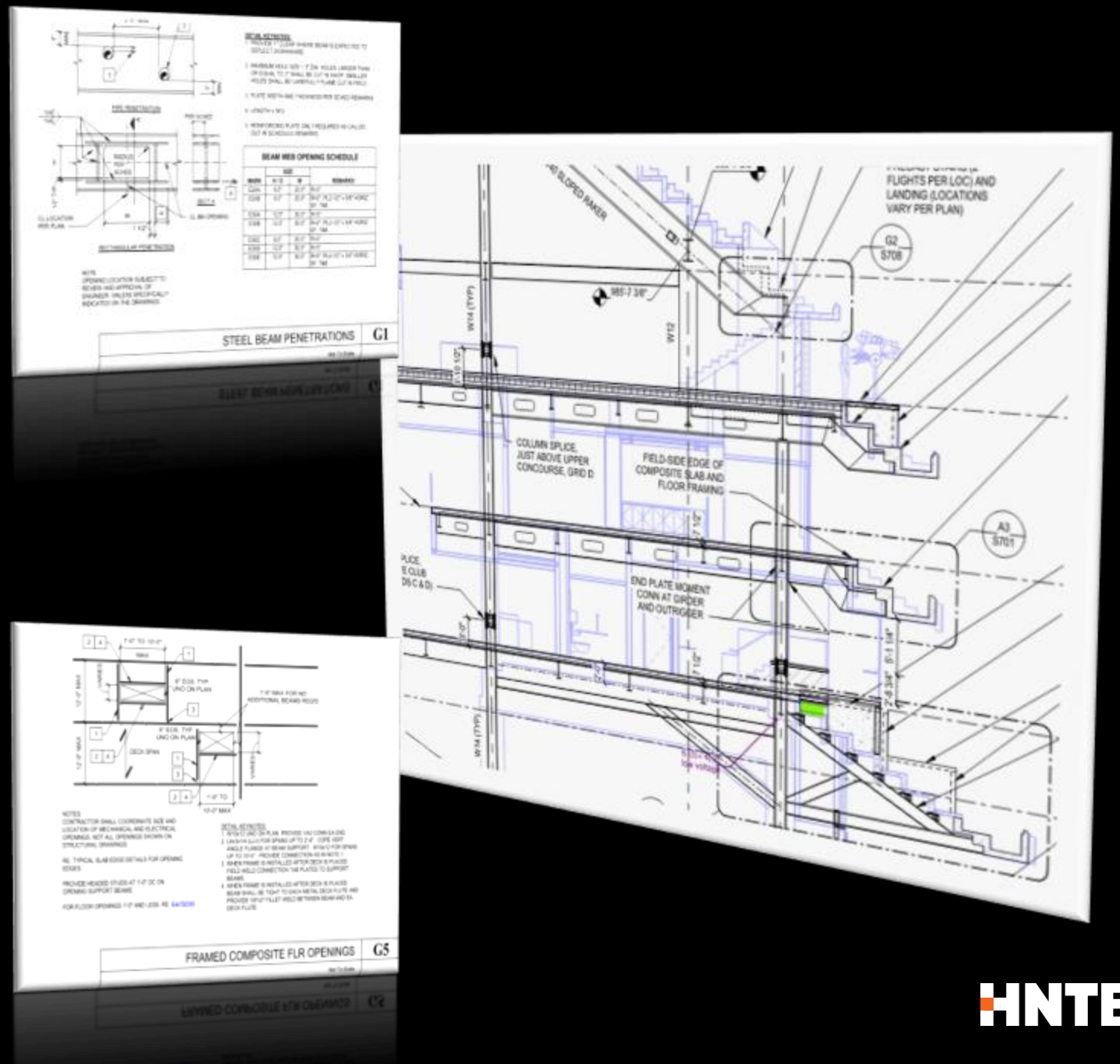




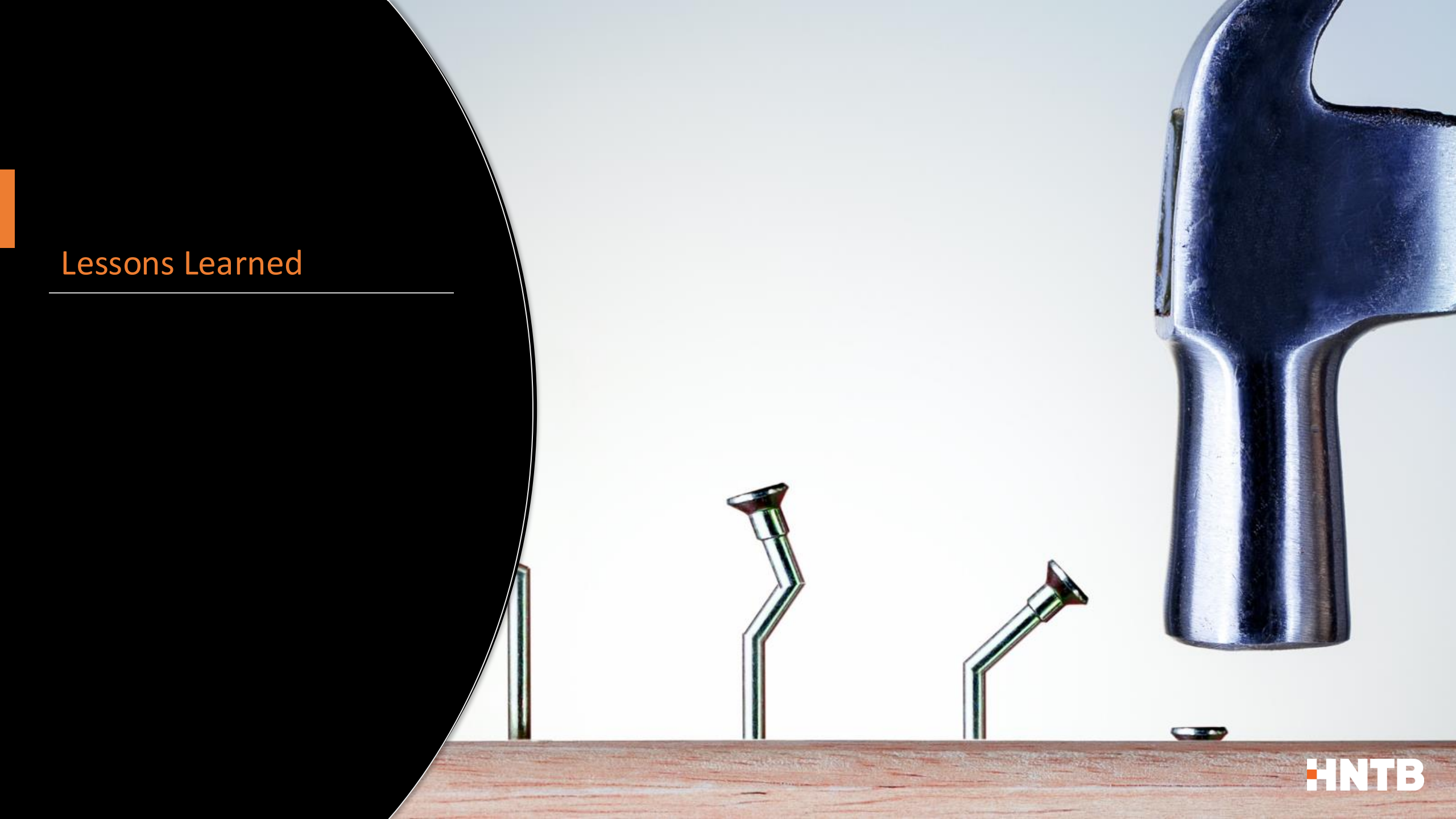
Project Challenges

Design – MEP Coordination

- Limited floor to floor heights
- Adding framed openings
- RTUs
- Heavy equipment



Lessons Learned



Lessons Learned

- Schedule
  - Changes in Approach
  - Better Communication
- Design
  - Lateral System
  - Overall Approach
  - Lighting Columns

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Changes in Approach

- Estimating Quantities
  - Didn’t account for increase in number of pieces
  - Didn’t account for shear studs and/or bolts
  - Underestimated the tonnage due to changes
  - Underestimated cost due to complexity
    - Steel already purchased
    - Connections started fabrication
  - 20% Contingency withheld didn’t cover overages

Lessons Learned

Lessons Learned

Better Communication

- Expectations to Owner about Change orders
  - Issuing steel packages 6 mos early
- Having all disciplines invested in early packages
- Understanding the additional effort required
- Being involved in VE discussion
  - Changes impacting structure
  - Net reductions weren’t what they thought.

Lateral Systems

- Concrete shear walls at elevator cores
    - Reduced the amount of coordination with elevator manufacturer
    - Reduced the amount of coordination locating braced frames
    - Can accommodate different elevator manufacturer easier.

Lessons Learned

Overall Approach

- Being overly conservative or not conservative enough
    - Every ton we save, frees up $$ for arch design
    - Focus on connections – Max bolts for shear conn.
- Reduced time to find efficient solutions
    - Limited time for design evolution
    - Experience crew – limited time to mentor
- Push to get the CM onboard at the start of the project

Lessons Learned

Overall Approach

Lessons Learned

- Being overly conservative or not conservative enough
    - Every ton we save, frees up $$ for arch design
    - Focus on connections – Max bolts for shear conn.
- Reduced time to find efficient solutions
    - Limited time for design evolution
    - Experience crew – limited time to mentor
- Push to get the CM onboard at the start of the project
- DON’T ISSUE BID SETS AT SCHEMATIC DESIGN!!
    - Quote from Architect, “We are never doing this again”
    - My Response, “Well, we’ve shown that we can”

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Lighting Columns

Lessons Learned

- Accounted for 10% of the tonnage (27 Columns!)
- Only one place in the US could roll the columns (curve)
- Present a thermal break challenge being outside the envelope
- Braced Frame connections were complex
- Being outboard of the frame, stability was a challenge
- Was there a better solution?

Level of Effort

- 16000 total SE hours
- 1800 hours of OT
- Three offices (KC, LA & SEA)
- 23 Different Struc. Engineers
- Peak – 13 Engineers
- Estimate 15% additional effort due to project acceleration
- **>> Original Plan was 5 FTE**

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Questions?

Acknowledgements

Construction Manager at Risk: Turner Construction Company; Kansas City, MO
Steel Fabricator and Detailer: Doherty Steel; Paola, KS
Concrete Contractor: George J Shaw Construction; Kansas City, MO
Design Assist Engineer: Thorton Thomasetti Group, Kansas City, MO
MEP&FP Engineers: Henderson Engineering; Lenexa, KS
Structural Engineer: HNTB Architecture; Kansas City, MO
Architect: HNTB Architecture; Kansas City, MO
Associate Architect: Multistudio; Lawrence, KS
Owner: The University of Kansas

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