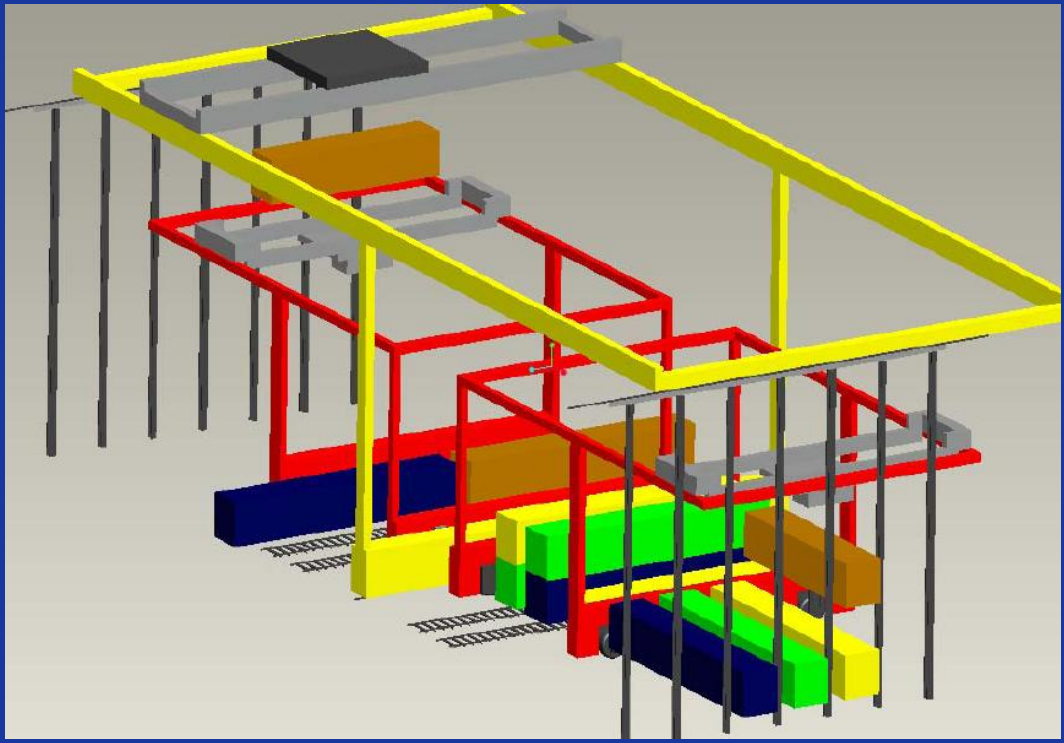
IPRO 307: Intermodal Container Facility Improvements

Sponsored by: MI-JACK PRODUCTS

Presented by: Michael Krueger, Ryan Maas, Andrey Kolesnikov

Problem Statement

- Identify and meet our client’s needs while proving the logistical, engineering and financial feasibility of the proposed technology.



WHY?

- The current industry "norm" is to use trackside storage with gantry cranes or fork lifts when the truck arrives.
- The proposed technology uses a buffer system to lower the intermodal unit onto the truck chassis when it arrives.
- Eliminates the need for an individual operator to go back and forth throughout the yard when a truck arrives.

Goals

- To enhance the productivity of Harvey Intermodal Storage Yard and Trucking Terminal by providing a new crane structure that utilizes buffers.
- Increase the number of average lifts per year from 300,000 to 1,000,000.
- Prove that such a crane is possible, capable of holding that capacity of production, and potentially profitable.
- Cost estimate for the implementation and creation of this system.

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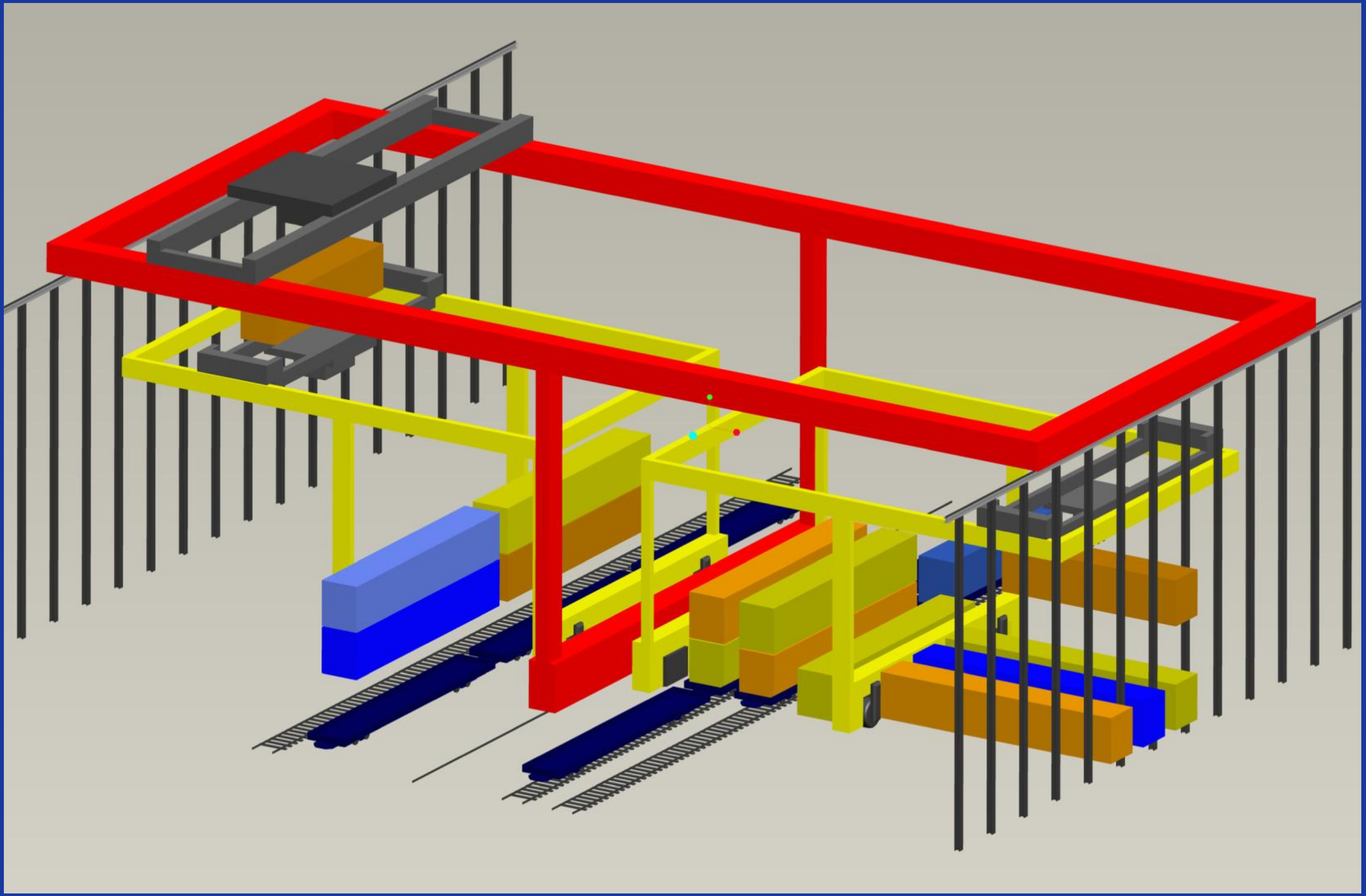

Team Structure

- Each meeting is run by a different Session Leader who was secretary at the prior meeting.
- At the beginning of each meeting, a secretary is appointed for the next meeting.
- The group will be divided into sub-groups with six major areas of focus.

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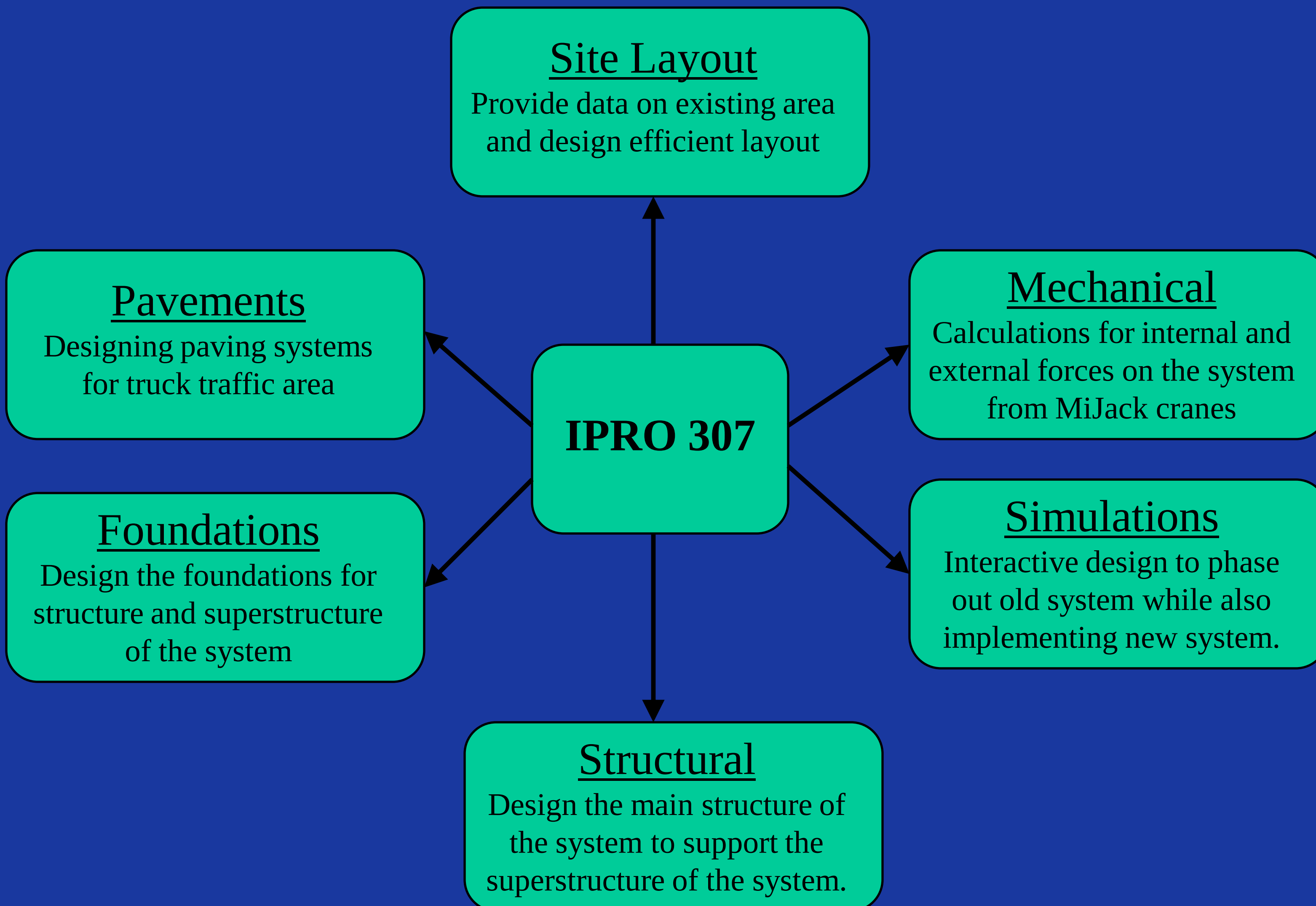
Breakdown

Name	**Tasks**
Gallagher, Ellen	Foundations Subgroup Leader
Gregory, Nicole	Foundations Subgroup Member
Hartwig, Michael	Layout Subgroup Leader
Krueger, Michael	Layout Subgroup Member
Kutryn, Anna	Layout Subgroup Member
Kolesnikov, Andrey	Mechanical Subgroup Leader
Loquidis, Ryan	Mechanical Subgroup Member
Pirkle, Matthew	Mechanical Subgroup Member
Haucke, Stephen	Pavement Subgroup Leader
Hafdi, Kamal	Pavement Subgroup Member
Sun, Yuefeng	Simulation Subgroup Leader/Mechanical Member
Gima, Daniel	Simulation Subgroup Member
McCloat, Declain	Simulation Subgroup Member
Maas, Ryan	Structural Subgroup Leader
Guglielmo, Kyle	Structural Subgroup Member
Olney, Peter	Structural Subgroup Member

Team Structure



Obstacles

- Defining the scope of the project
- Determining whether the 1,000,000 lifts could actually be possible with the space and time restrictions of the crane
- The size and number of the cranes
- Stability of the structure
- Placement of the entire system in the existing yard

Final Progress

- Simulations
  - Defined terms
  - Initial "proof of concept" run to show that there would be enough space to accommodate the increase in production
  - Proved that 4 tracks would be necessary and buffers should be two high
  - Created a loading pattern

1 Civil, 1 Mechanical

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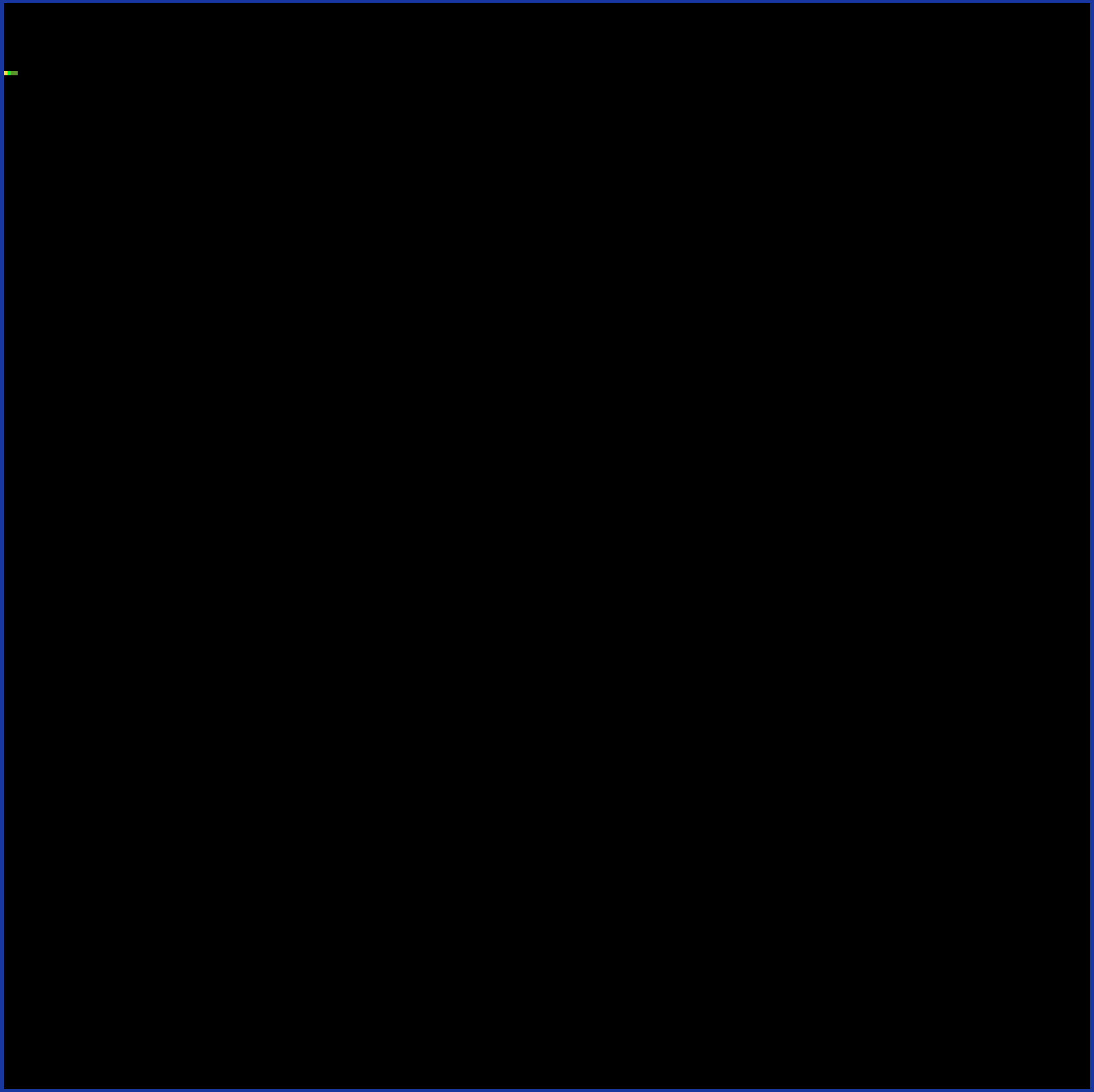

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Day 1: 6 trains arrive 6 trains depart = (+ 960 – 960)
Day 2: 6 trains arrive 6 trains depart plus decay of previous day's delivery (+480 + 960 – 960)
Day 3: 6 trains arrive 6 trains depart plus decay of previous ***days'*** delivery(+192+480+960–960)
Day 4: " "
………

Full example:

D1: (+ 960 – 960) = 0
D2: (+480 +960 –960) = 480
D3: (+192 +480 +960 –960) = 672
D4: (+96 +192 +480 +960 -960) = 768
D5: (+0 +96 +192 +480 +960 -960) = 768
D6: (+0 +0 +96 +192 +480 +960 –960) = 768
D7: (+0 +0 +0 +96 +192 +480 +960 -960) = 768
D8: (+0 +0 +0 +0 +96 +192 +480 +960 -960) = 768

In this case we can see that with 6 trains in and out per day, we will occupy 768 of the available spaces.

Therefore, using the pattern discovered above, we must determine how many trains in and out will overload our yard.

Table Driven

IPRO 307 Calculations by Michael Krueger and Ryan Maas

- With 8 trains in and out per day,

Trains IN AND OUT / day	IM's in - out / day	Decay / day		Total Accupied space at all times	Lifts /	
8	1280	0.5	640	640	Day	2560
		0.3	384	256	Year	798720
		0.1	128	128		
		0.1	128	0		
				1024		

- *Too many*

- With 7 trains in and out per day,

Trains IN AND OUT / day	IM's in - out / day	Decay / day		Total Accupied space at all times	Lifts /	
7	1120	0.5	560	560	Day	2240
		0.3	336	224	Year	698880
		0.1	112	112		
		0.1	112	0		
				896		

- *This is the maximum number of trains our system can handle without overflowing the available spaces. This is under 1 Million lifts!*

Therefore, we know that availability of spaces DOES control!!

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Final Progress

- Mechanical
  - Full renderings
  - Dynamic loads
  - Crane interference clearance

1 Engineering Management, 1 Aerospace, 1 Mechanical

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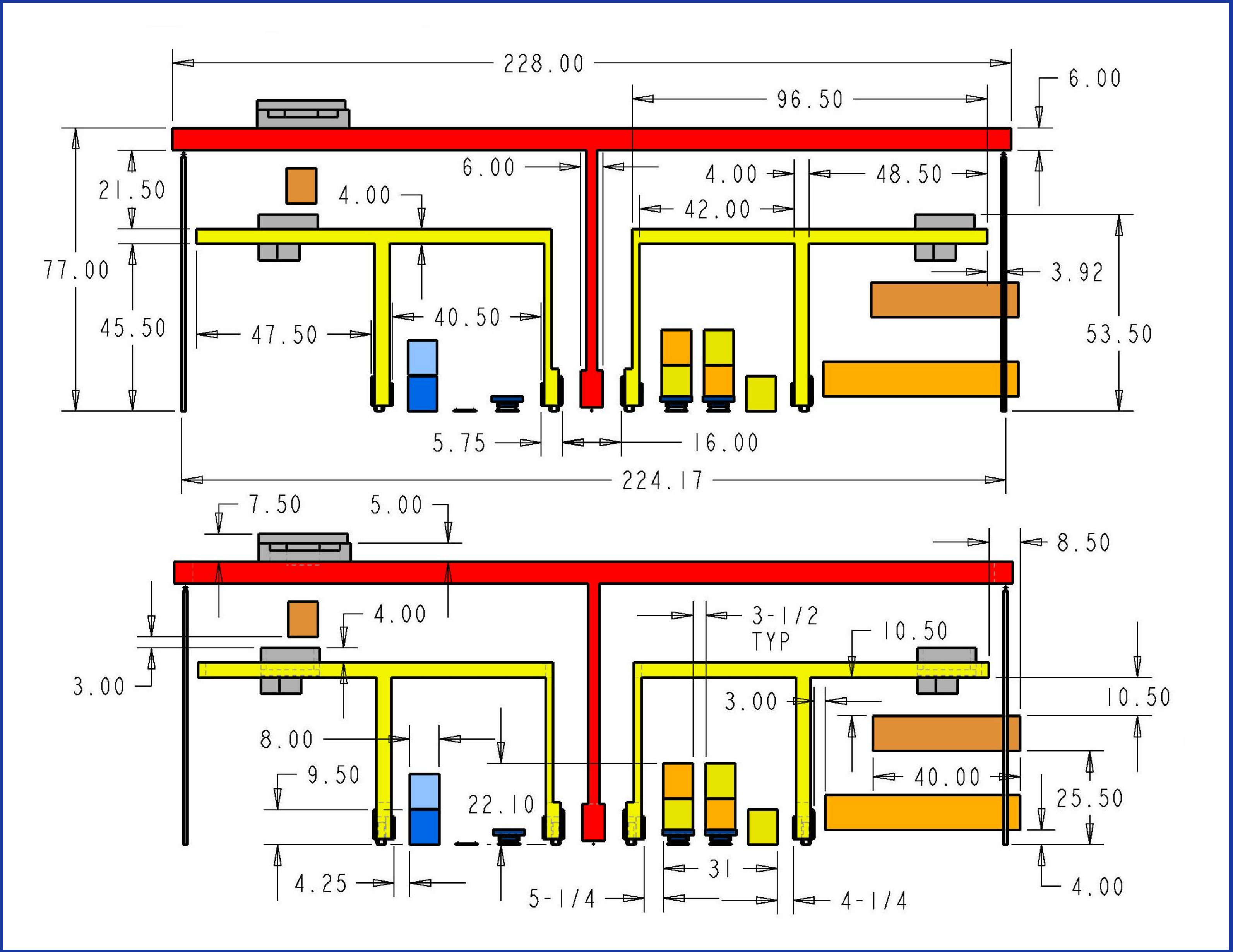
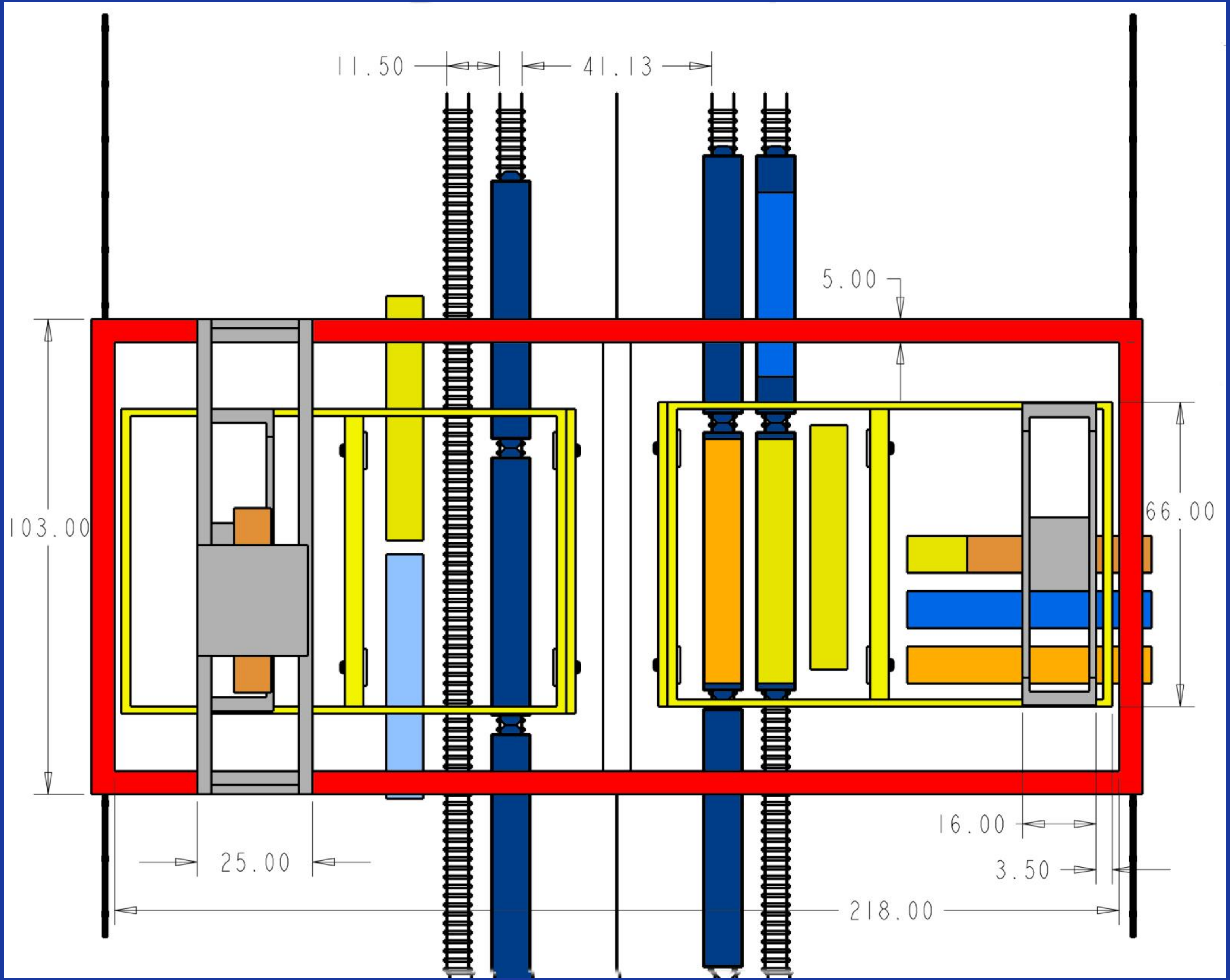
- Next Steps
- Questions?




11.50
41.13
5.00
103.00
66.00
16.00
3.50
25.00
218.00

Final Progress

- Structural
  - Superstructure and Substructure designed to accommodate loads of the crane and containers
  - Frame designed to carry the crane up and down the span of the tracks

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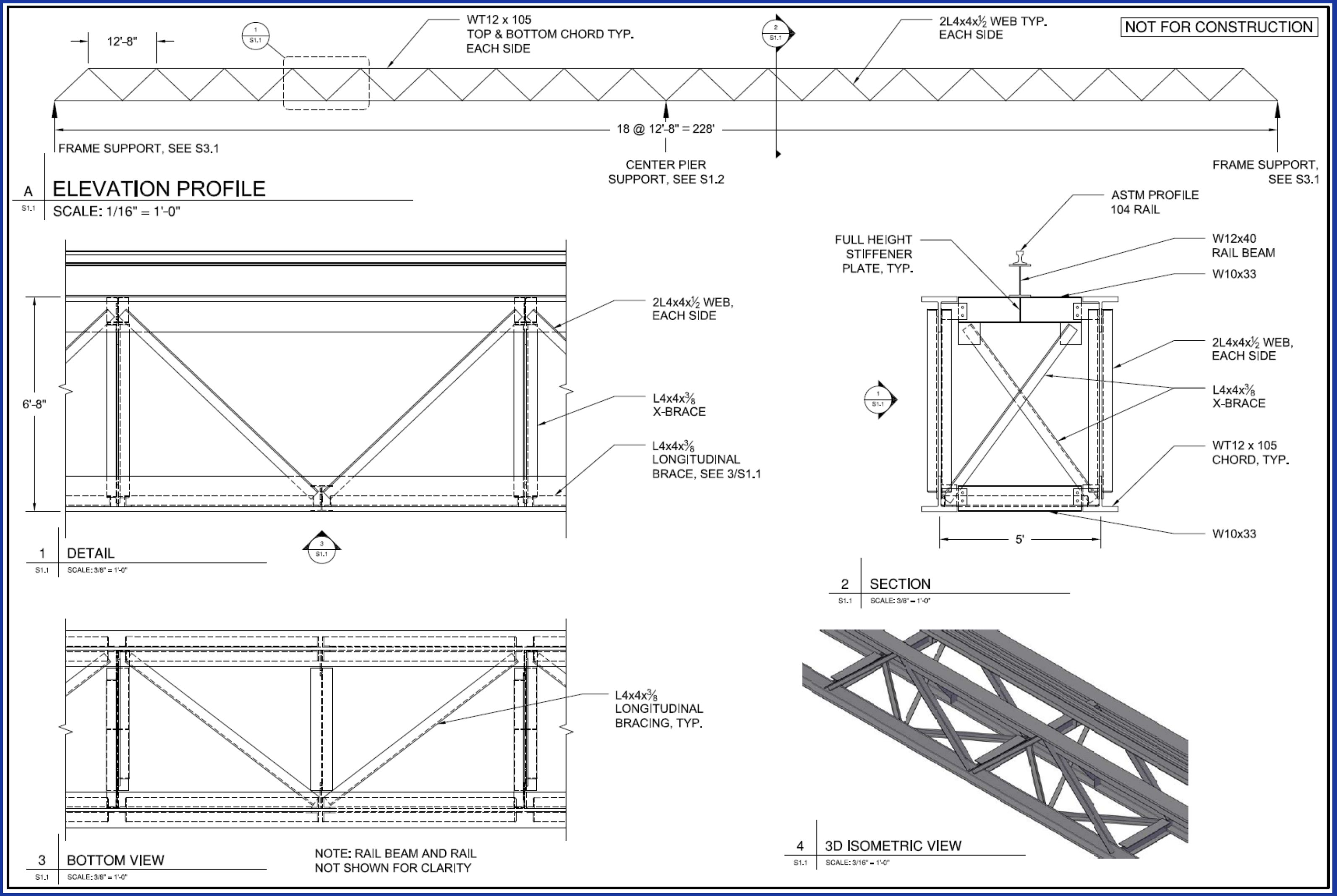

NOT FOR CONSTRUCTION
12'-8"
WT12 x 105
TOP & BOTTOM CHORD TYP.
EACH SIDE
2L4x4x½ WEB TYP.
EACH SIDE
18 @ 12'-8" = 228'
FRAME SUPPORT, SEE S3.1
CENTER PIER
SUPPORT, SEE S1.2
FRAME SUPPORT,
SEE S3.1
A
S1.1
ELEVATION PROFILE
SCALE: 1/16" = 1'-0"
ASTM PROFILE
104 RAIL
FULL HEIGHT
STIFFENER
PLATE, TYP.
W12x40
RAIL BEAM
W10x33
6'-8"
2L4x4x½ WEB,
EACH SIDE
L4x4x⅜
X-BRACE
L4x4x⅜
LONGITUDINAL
BRACE, SEE 3/S1.1
2L4x4x½ WEB,
EACH SIDE
L4x4x⅜
X-BRACE
WT12 x 105
CHORD, TYP.
W10x33
5'
1
S1.1
DETAIL
2
S1.1
SECTION
L4x4x⅜
LONGITUDINAL
BRACING, TYP.
3
S1.1
BOTTOM VIEW
NOTE: RAIL BEAM AND RAIL
NOT SHOWN FOR CLARITY
4
S1.1
3D ISOMETRIC VIEW

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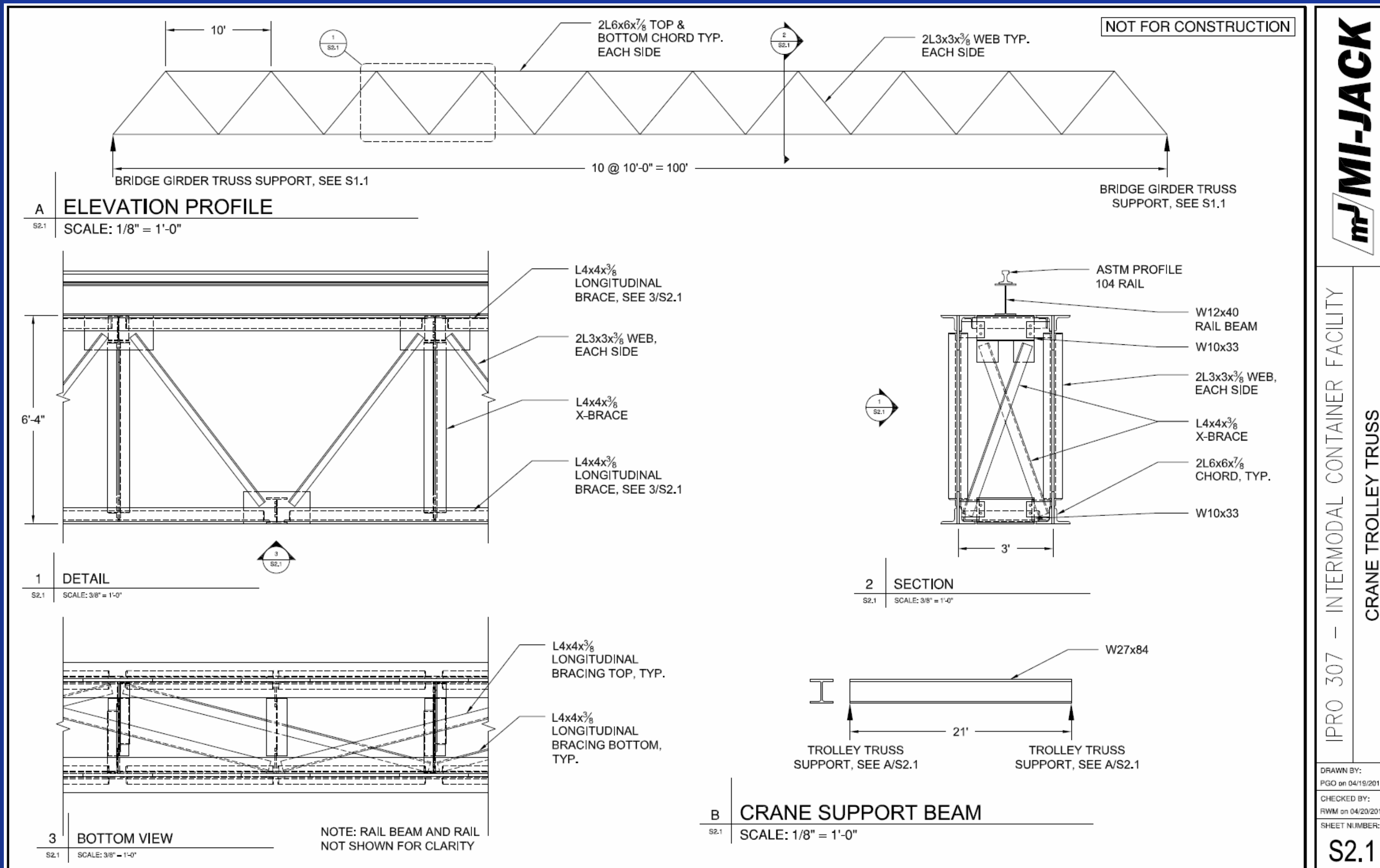

Final Progress

- Site Layout
  - Full overlay of aerial photography
  - Analyzed gradations and water retentions
  - Created two options for the cranes positioning.
  - Proposed best option based on the owners needs and cost effectiveness
  - Creating preliminary staging plans and finalized design

3 Civil, 2 with Construction Management

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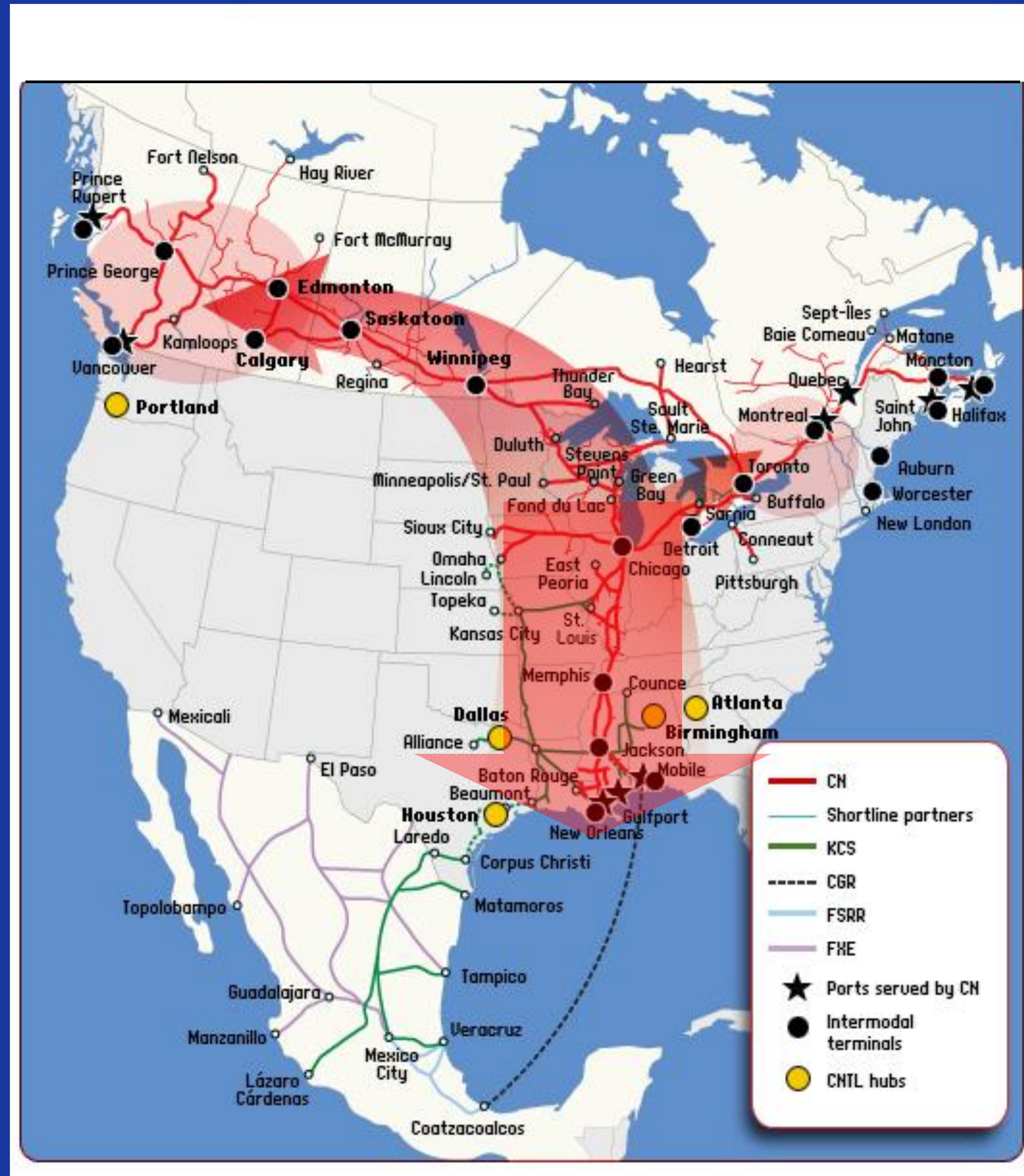

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Option A

Pros:

- Minimal Building Relocation
- Do not have to shut down/relocate maintenance area
- Could potentially reroute intermodal terminal to middle of yard for better space utilization

Cons:

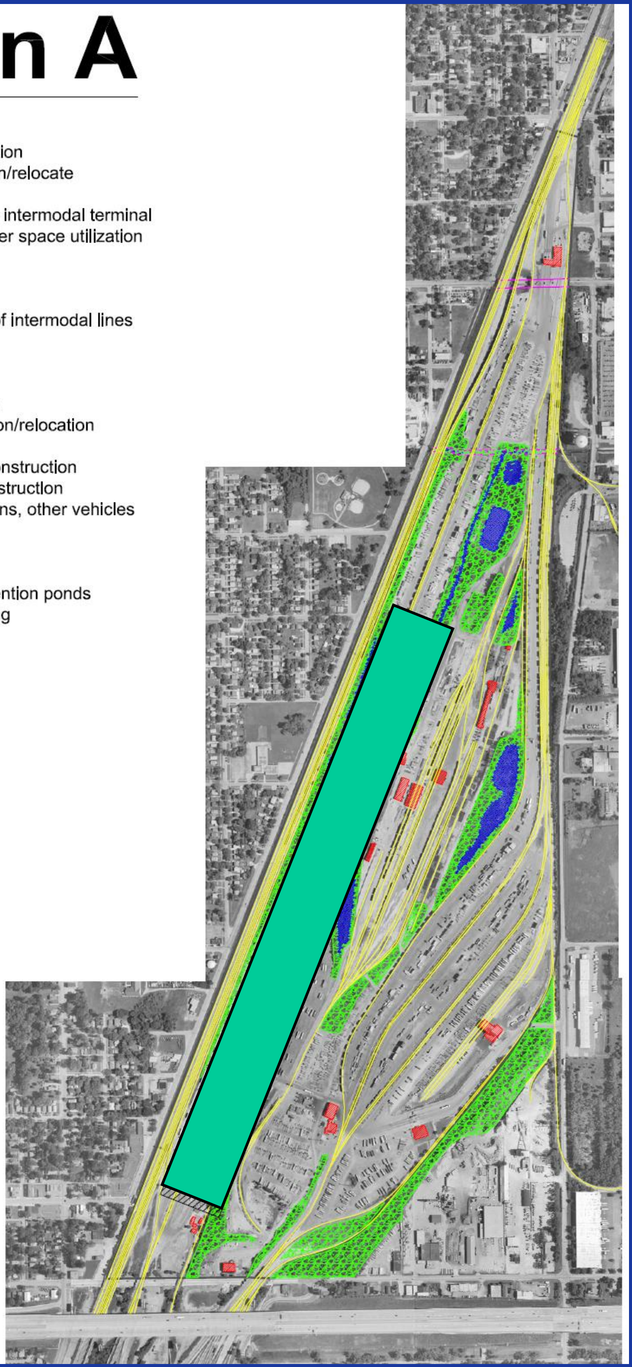
- Retention pond
- Have to shut down half of intermodal lines during construction

Deciding Factors

- Cost of moving retention
- Cost of building demolition/relocation
- Cost of land clearing
- Yard operation during construction
- Yard operation after construction
- Traffic flow of trucks, trains, other vehicles

Staging

- Relocation of buildings
- Relocation and fill of retention ponds
- Land clearing and grading
- Lay foundations
- Lay rails
- Build crane structure
- Place cranes 1,2,3



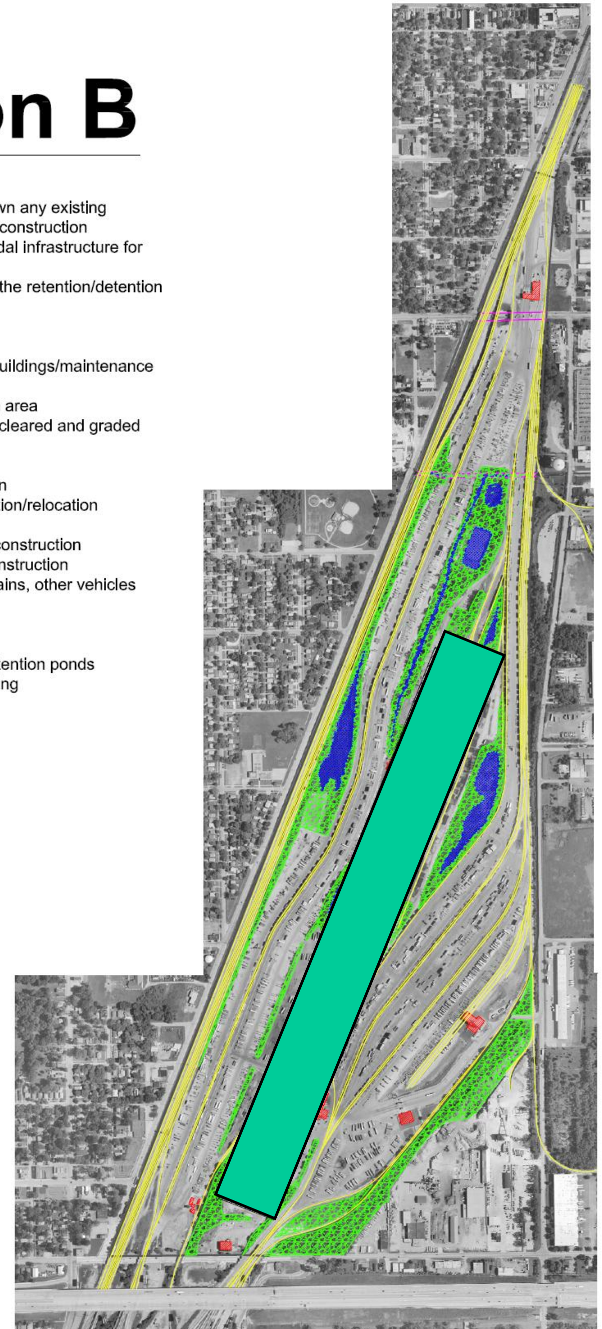
Option B

Pros:
- Do not have to shut down any existing intermodal lines during construction
- Retain existing intermodal infrastructure for overload capacity
- Do not disrupt much of the retention/detention areas

Cons:
- Must relocate several buildings/maintenance facilities
- Must relocate all rails in area
- Several areas must be cleared and graded

Deciding Factors
- Cost of moving retention
- Cost of building demolition/relocation
- Cost of land clearing
- Yard operation during construction
- Yard operation after construction
- Traffic flow of trucks, trains, other vehicles

Staging
- Relocation of buildings
- Relocation and fill of retention ponds
- Land clearing and grading
- Lay foundations
- Lay rails
- Build crane structure
- Place cranes 1,2,3



- Final layout still allows for the existing yard to remain operational throughout most of construction and can be used for overflow if crane requires emergency maintenance.

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Final Progress

- Pavements
  - Typical Pavement cross sections calculated for the entire system
  - Runoff and retention data collected

2 Civils

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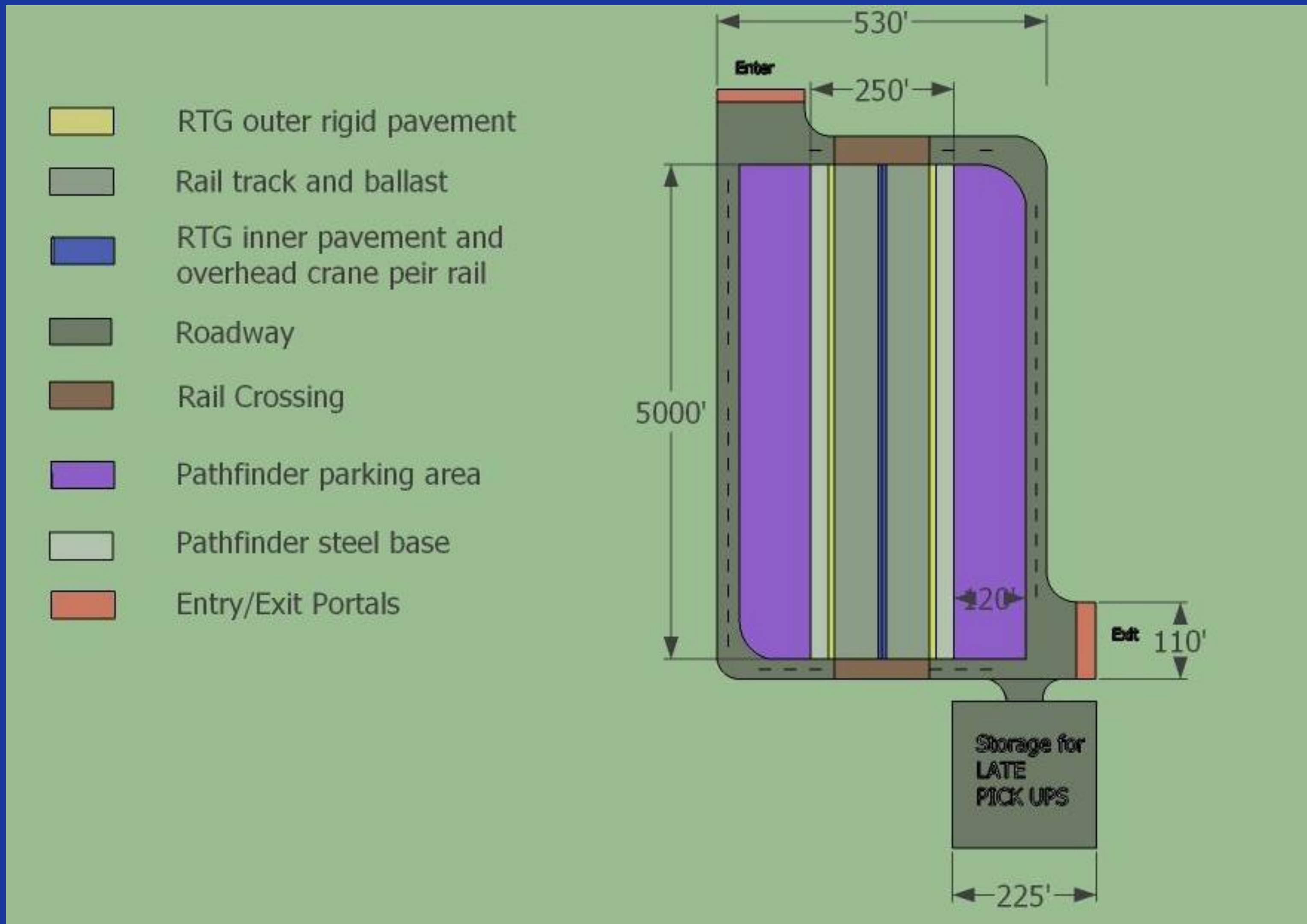
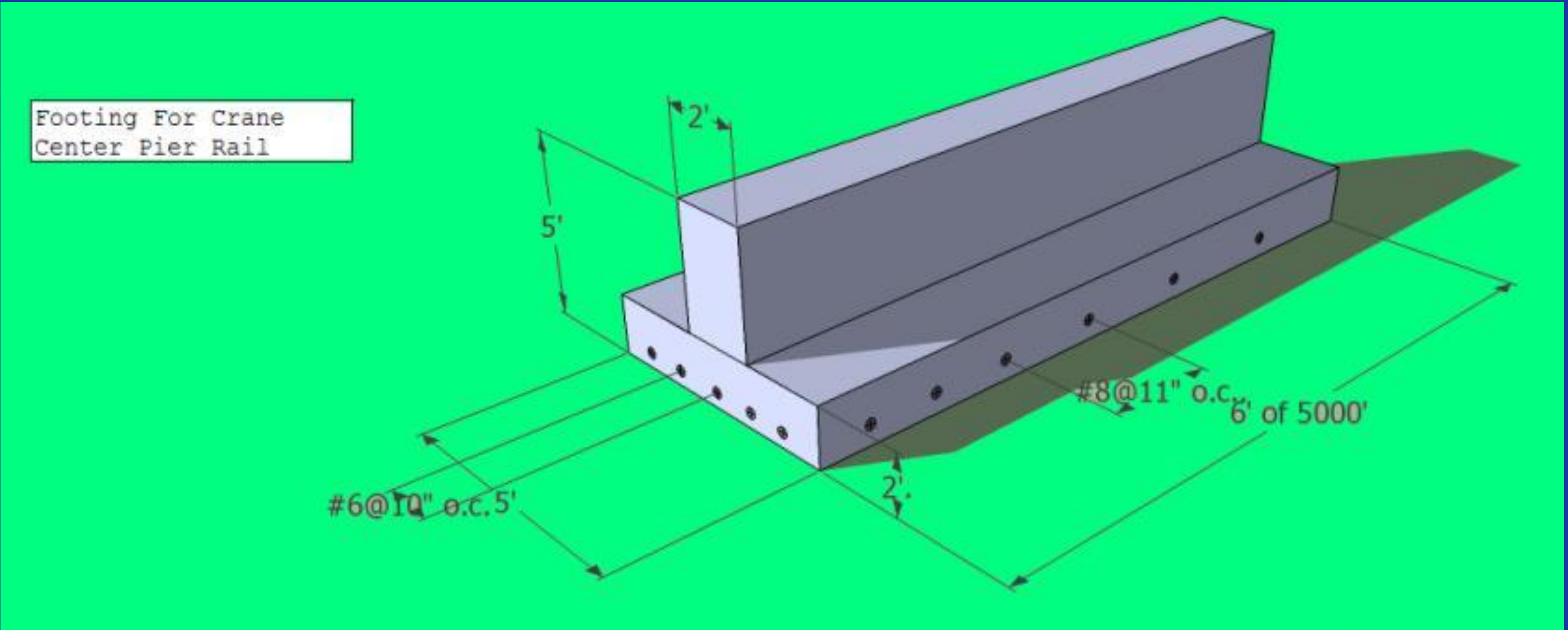
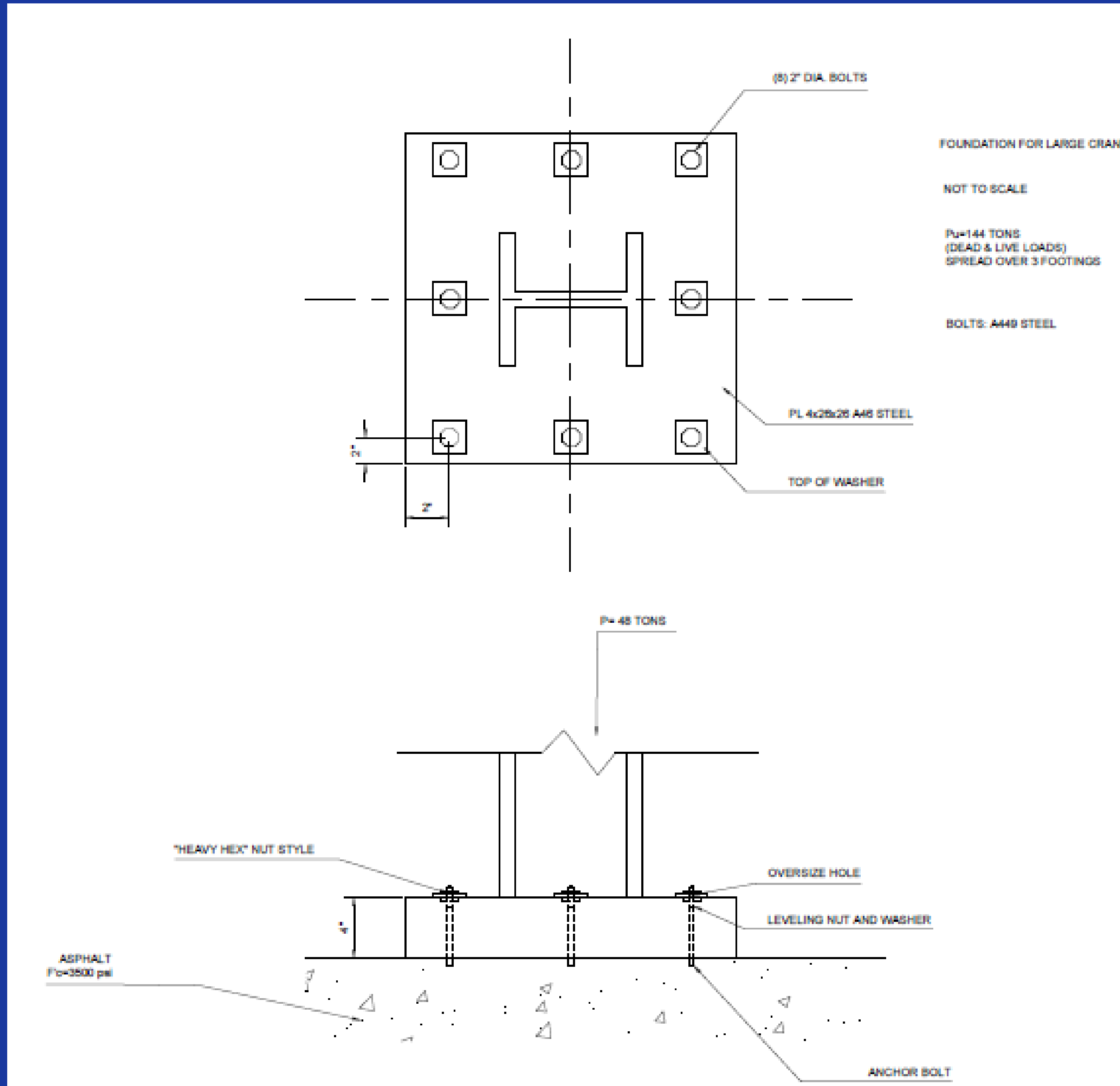


Final Progress

- Foundations
  - Forces calculated
  - Geographical data collected
  - Footings and Load bearing plates were designed.



Drawn By: Steve Haucke Drawing number:P5 Date: 4/10/2010 Drawing Not To Scale	IPRO 307 Intermodal Container Facility Improvements for Chicago Region (Focus on Harvey & Dalton)	Drawn By: Checked By:


(8) 2" DIA. BOLTS
FOUNDATION FOR LARGE CRANE
NOT TO SCALE
Pu=144 TONS
(DEAD & LIVE LOADS)
SPREAD OVER 3 FOOTINGS
BOLTS: A449 STEEL
PL 4x26x26 A46 STEEL
TOP OF WASHER
2"
2"
P= 48 TONS
"HEAVY HEX" NUT STYLE
OVERSIZE HOLE
LEVELING NUT AND WASHER
ASPHALT
F'c=3500 psi
ANCHOR BOLT

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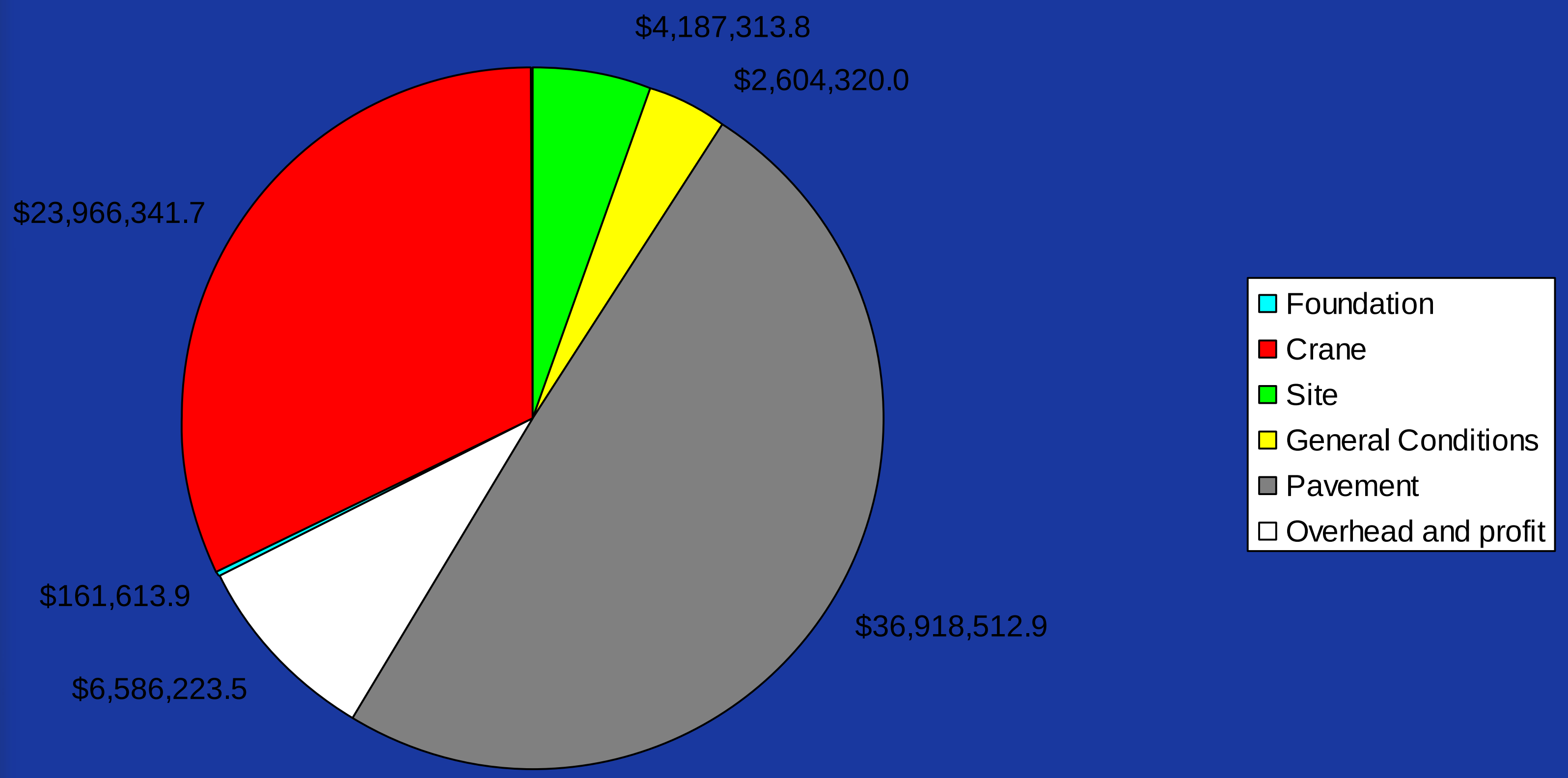
COST



TOTAL: $74,424,326

Next Steps

- Verifying cost analysis
- Verifying crane design capacity and detailing
- Integration of the system to the yard
- Cost Benefit Analysis

Questions?

Thank you!