



Pegula Ice Arena



Building Information

Location: Pennsylvania State University | University Park
 Function: Division 1 Hockey | Community Rink
 Size: 227,500 SF
 Three Stories
 Height = 65 ft. above grade
 LEED: Gold Potential



Construction Information

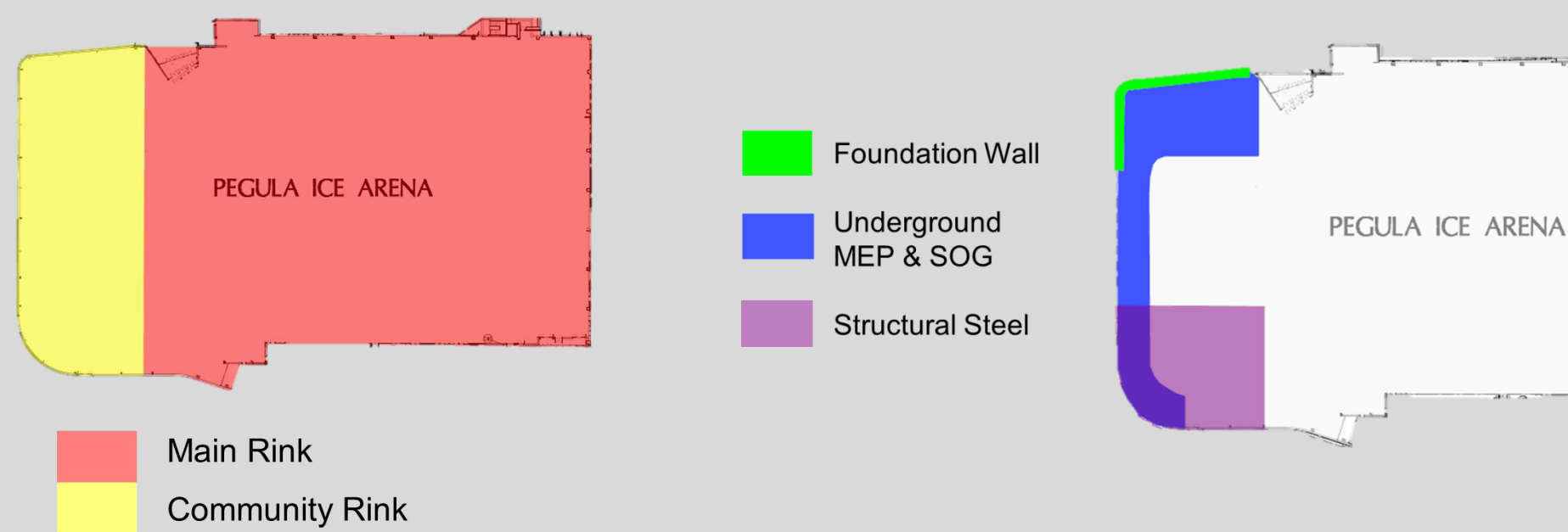
Schedule: First Puck Drop – PSU vs. Army | October 11, 2013
 Start | February, 2012
 End | September, 2013
 Delivery Method: CM at Risk
 Cost: Project | \$102 M
 Construction | \$89 M
 Contract: Guaranteed Maximum Price
 Structure: Moment & Braced Frame
 Precast Stadia
 Mechanical: 12 Air Handling Units



Project Team Members

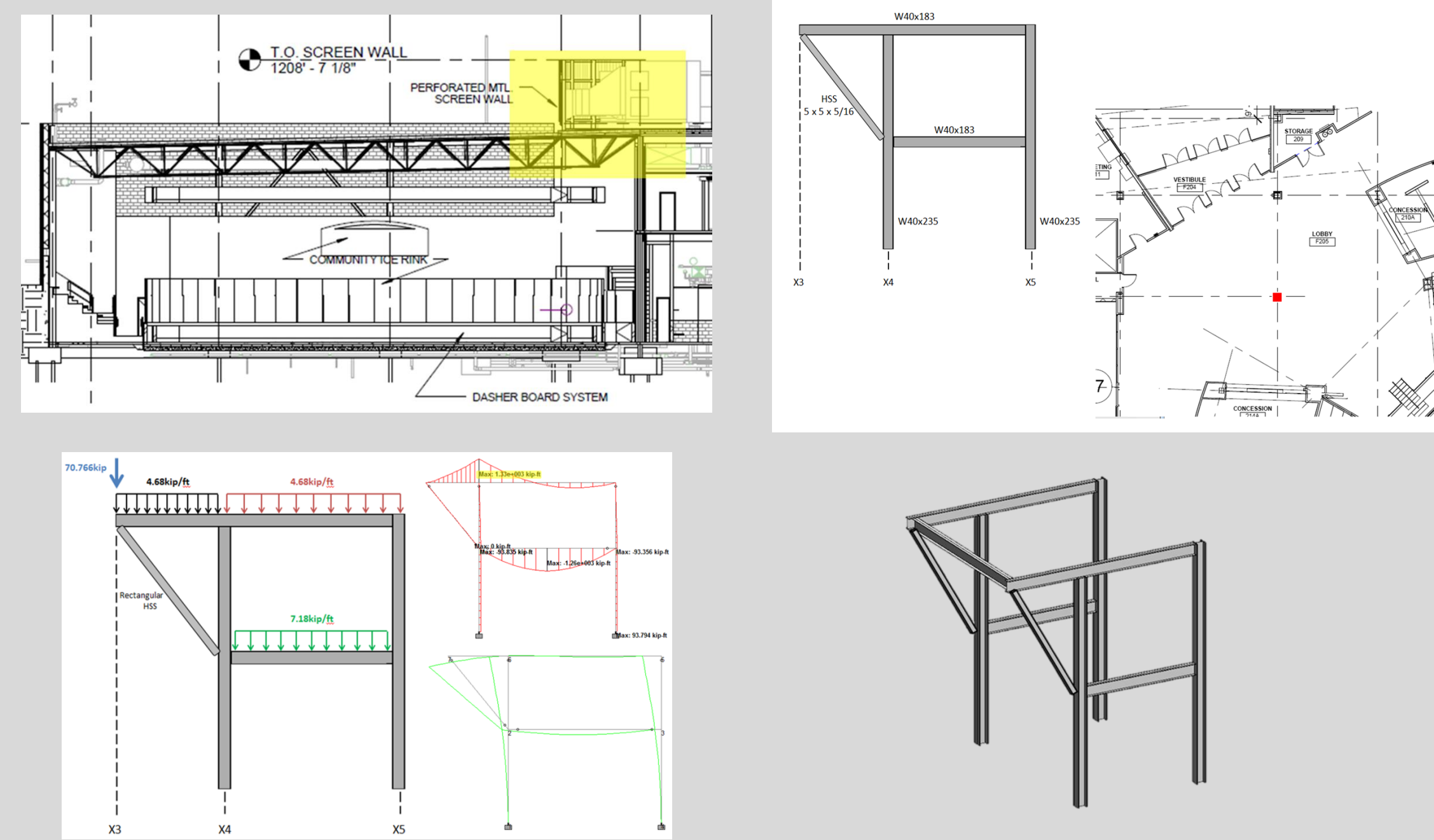


Analysis 1 Community Rink Sequence off Critical Path



Finish Work Driven Activities (FRP SW #9 Ends)		
	Original Schedule	New Schedule
Start Date	5/18/2012	5/18/2012
Finish Date	11/6/2012	10/15/2012
Actual Days	174	151
Working Days	123	107

Total Days Gained: 22
Working Days Gained: 16



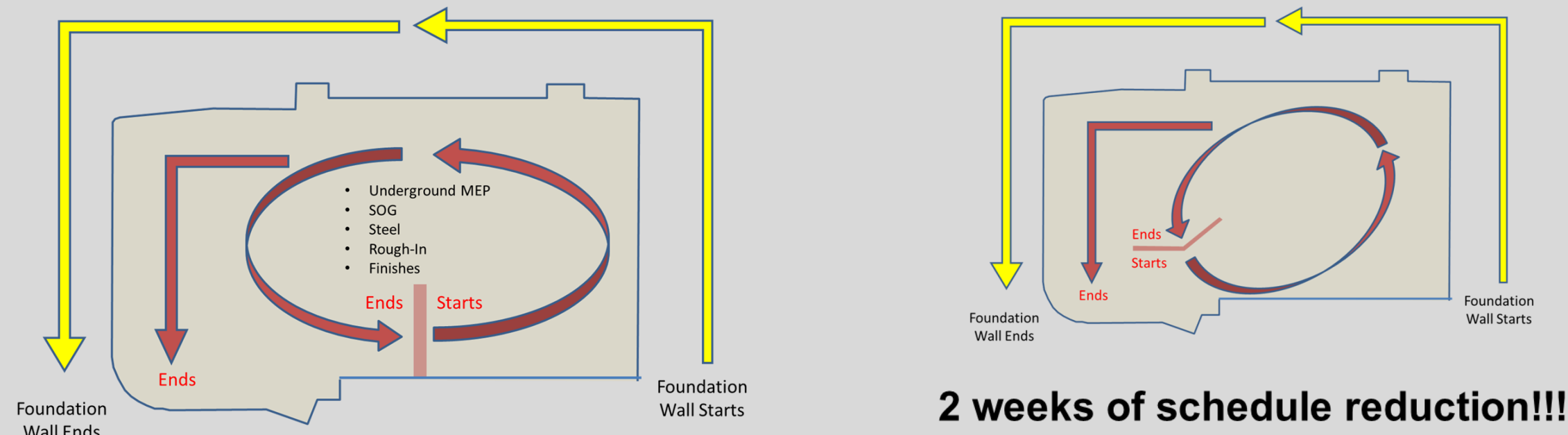
Advantages

- Finishes can begin more quickly ahead of the current schedule which will result in the project finishing three weeks ahead of schedule.
- Allows more float on community rink activities. Specifically mechanical room has much more time to get underground work finished.
- Decrease in general conditions
 - o Employee Costs: \$91,500
 - o Miscellaneous Costs: \$8,175
 - o Total Costs: \$99,675

Disadvantages

- Significant increase in size of steel columns and girders.
- Additional cost in steel. (\$361,748)
- Potential foundation upgrades.
- Minimal crane time saving.
- Significant aesthetic disruption at student entrance.

Analysis 2 Building Sequence



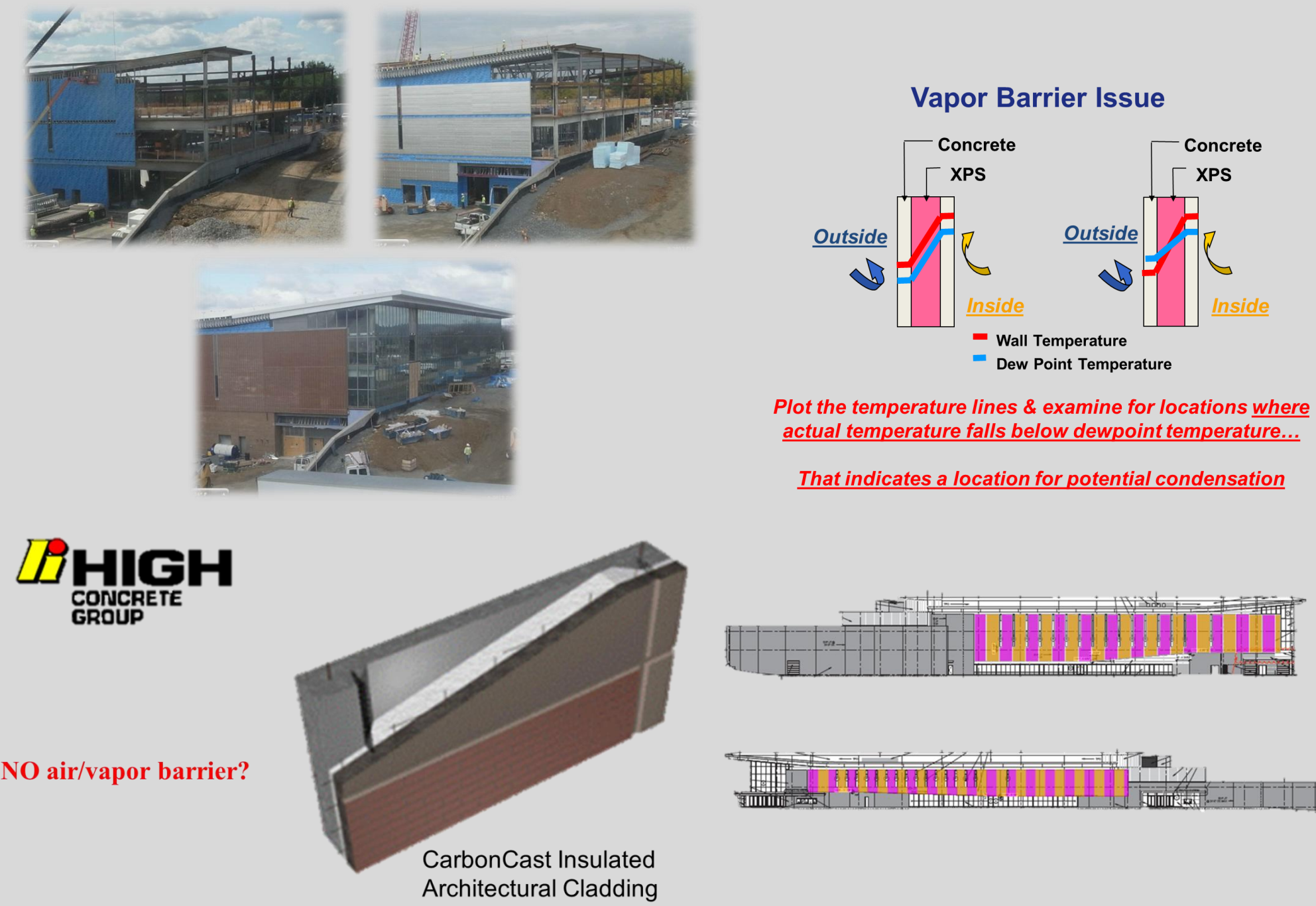
Advantages

- Rough-In and Finishes can begin more quickly (2 weeks of schedule reduction)
- Roof enclosure has less chance to be "snowed out"
- Potential alternative crane logistics
- Potential for no SOG comeback pours

Disadvantages

- Most difficult sequence of steel / precast would be installed blind
- Potential for increased crane time and additional cost

Analysis 3 Building Enclosure



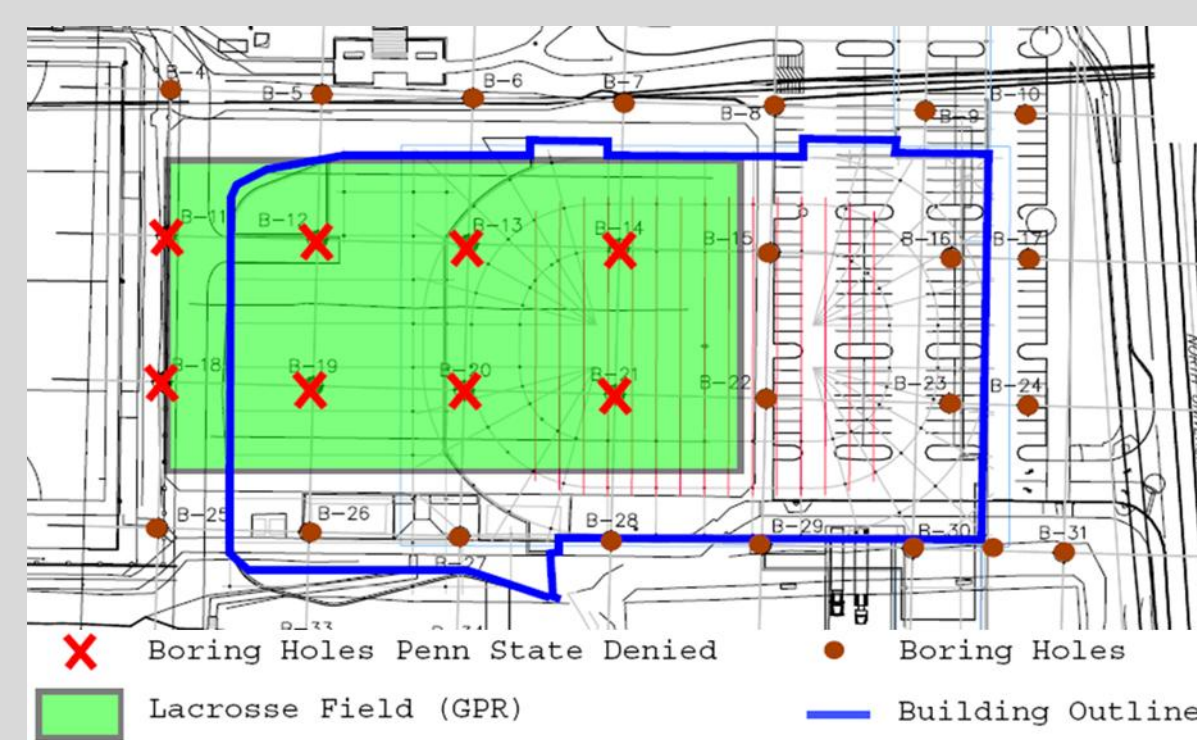
Advantages

- Rough-In and Finishes can begin more quickly (2 weeks of schedule reduction)
- Roof enclosure has less chance to be "snowed out"
- Potential alternative crane logistics
- Potential for no SOG comeback pours

Cost

- Original System**
- Panels (Studs, Sheathing, Vapor Barrier, Insulation) = \$495,000
 - Scaffold Temporary Heating = \$30,000
 - Brick = \$9.00 sf x 12,973 sf = \$116,757
 - Total = \$641,757 | \$49.47 sf
- New System**
- 6" Precast Concrete = \$44.84 sf x 12,973 sf = \$581,709
 - Insulation Panel (3") = \$1.60 sf x 12,973 sf = \$20,757
 - Thin Brick façade, modular, red= \$8.75 sf x 12,973 = \$113,514
 - Cost increase of crane = \$50,000
 - Adjustment Factor (admixtures, large panels/shipping, additional structural support to accommodate additional weight) = 1.1
 - Total = \$842,578 | \$64.95 sf

Analysis 4 Geotechnical Investigation



Boring						
Geotechnical Estimate (Boring)						
System	Amount	Unit	Material	Equipment	Total	Cost
Borings, initial field stake out & determination of elevations	1	Day	705	78.5	783.5	\$1,150
Preparing, showing, boring details	1	Day	310	310	620	\$890
Report and recommendations from P.E.	1	Day	720	720	1,440	\$800
Mobilization and demobilization	1	Day	299	246	545	\$550
Borings in earth, with samples, 8-1/2" diameter	567	L.F.	22	13.05	17.7	\$4,75
					65.5	\$17,700
						Total: \$40,736

- Advantages**
- Accurate, Proven, Consistent
 - Reliable in identifying soil type
 - Reliable in identifying ground water

- Disadvantage**
- Expensive
 - Identifies material and water through destruction (turf example)

Ground Penetrating Radar



\$1,000 - \$2,000

- Advantages**
- Fast and instant
 - Inexpensive
 - Environmentally friendly
 - Noninvasive
 - Can detect utility lines
 - Can be used inside (reinforcement in slabs)

- Disadvantage**
- NOT efficient and accurate
 - Does not work well through clay
 - Does NOT reach great depths
 - Does NOT detect a water table



Boring vs. GPR

Boring	Soil	GPR
✓	Ground Water	✓
✓	Cost	✓
✓	Depth	✓
	Invasiveness	✓
	Environment	✓



Shane Marshall Senior Thesis Construction Management