Technical Report II.

Emily Roarty

Executive Summary

The Foundry at 41st is a six story luxury apartment complex located in the Pittsburgh neighborhood of Lawrenceville, PA. The area of the city in in high demand for its shops and restaurants. The total project cost is $27 million with a budget of $35 million. Bay 4 is a historical steel frame that remains from a foundry that used to exist on site. Typical to this area of Pittsburgh, the structure chosen was a podium style structure with the first floor post tensioned concrete and the remaining five stories are wooden.

For this report, a metal stud structure was explored to replace the wooden structure. The benefits of metal structure are its fireproofing, long term stability, and resistance to water. The main drawback is its overall cost.

The site logistics is a challenge because the Bay 4 must be protected, so that makes the whole Western part of the site unavailable for laydown. The Eastern part of the site is available for parking, trailers, and laydown. The use of lifts to detail and install the metal panels on each exterior face of the building will be tight use of space.

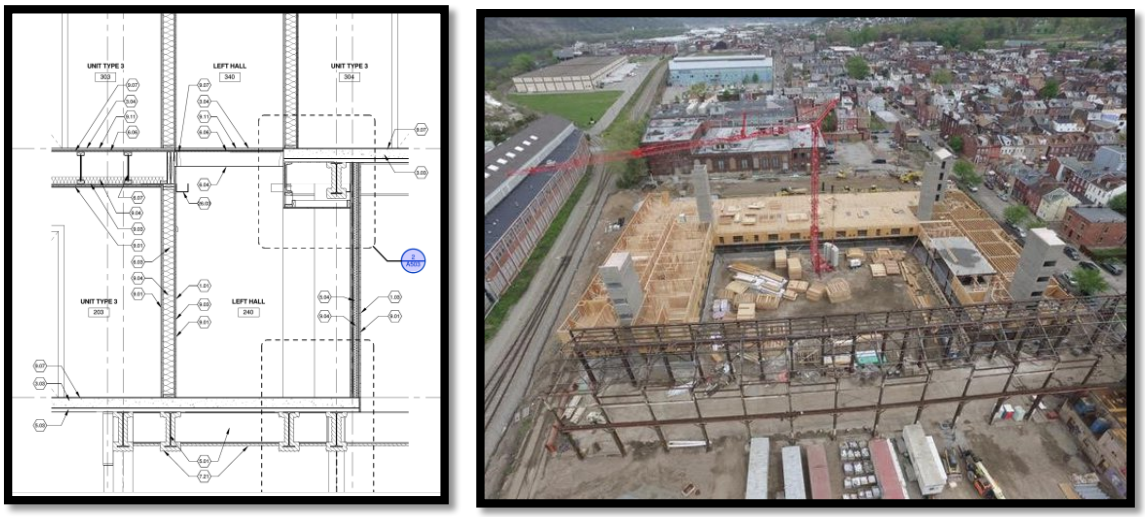
With discussion with the superintendent, we discussed various structural systems to provide an economical product to the owner. The superintendent confirmed that the choice of the podium structure is the most economical to the overall building. In terms of priorities of the owner, the podium style structure is the most economical and schedule conscious as well as the wooden frame.

The report details both the Production Plan and Critical Analysis of the structural system on the Foundry at 41st. Finally, a superintendent interview discusses how to meet the constructability and logistical challenges of the site.

Production Plan

The chosen engineered system for Technical Report II is the structural system, which is a wooden frame system currently. This report is a comparison between the existing system and a metal stud system. The building structural system is critical to the overall building, so the means, methods, schedule, cost, and the logistics have been detailed below.

Means & Methods



Second and Third Floor wall section showing the wooden framing typical to the building.

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The second through the sixth floors were analyzed during this technical report. The first floor is concrete for the parking garage and was omitted from this analysis. As seen above in the wall section the building has wooden framing this is typical for the second through eighth floors. It was natural to explore metal framing as a structural system to replace the wooden framing. The relative quickness and cost of the wooden frame is the reason why this structural system was chosen.

Construction will be completed floor by floor. For each floor it will take 20 working days. The wooden frame was constructed on site frame by frame. In addition, space restrictions of the Lawrenceville neighborhood have caused a challenge to the crane placement on site. The crane is placed in the courtyard where the future pool is located. In terms of chose of a crane, the chose does well to protect against disrupting historic Bay 4. The stair towers can be built without disruption to the rest of the floors. The site is really tight, and the only area for laydown is in the courtyard and East of the site. In Appendix A, there is a detailed linear foot take off of the wooden framed system.

Production Schedule

A detailed production schedule using Primavera can be found in Appendix B. Construction begins in October 15, 2015 and ends on May 15, 2017. The schedule is broken down by floor to show each of the

Detailed Cost Estimate

An estimate using Timberline is found in Appendix C. The cost estimate is broken down floor by floor. The cost of the wooden frame is cheaper due to overall material costs. See the table below for a breakdown of the overall costs.

Structure	**Costs**
Wooden Frame	$ 208,888
Metal Studs	$ 230,680

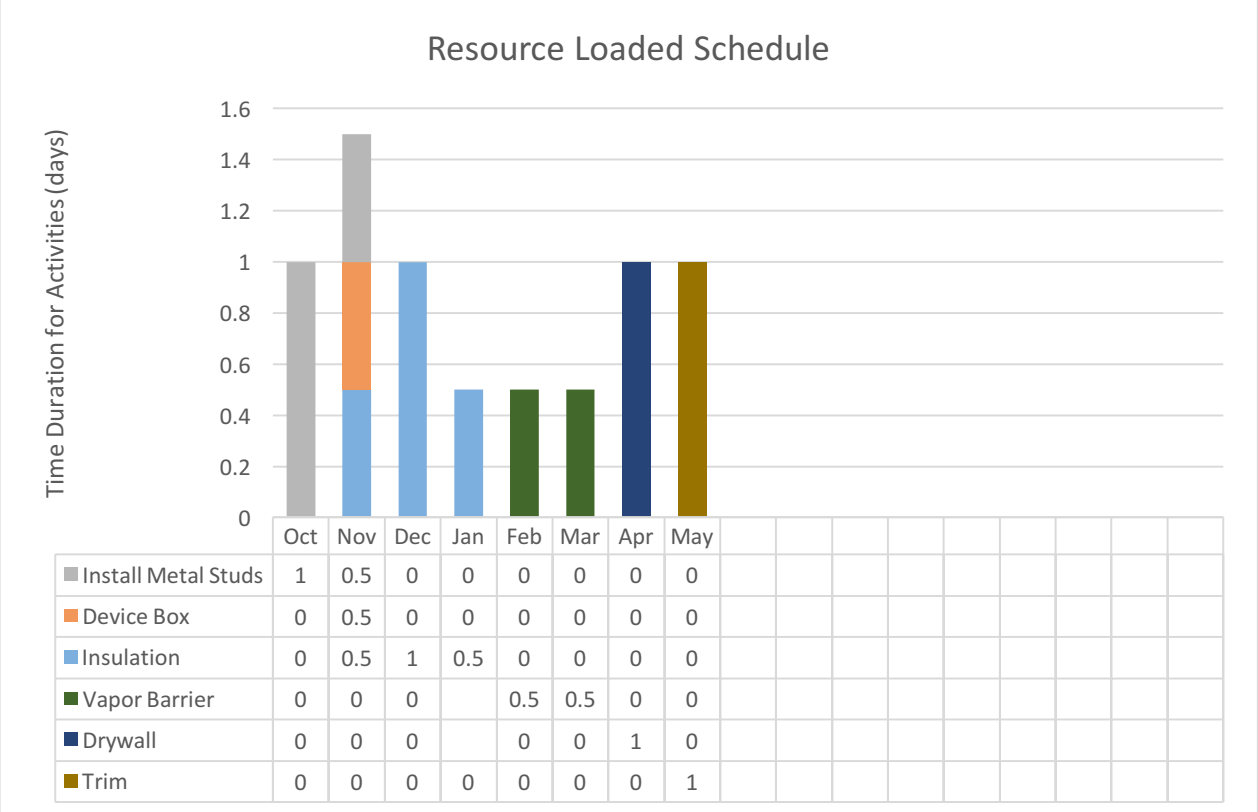
Site Plan and Logistics

The site logistics in 2D are found in Appendix D. The plans show the phases of construction vehicles, materials, crane, trailer, and dumpsters.

Production Analysis

Production

The tasks include install metal studs, device boxes, insulation, vapor barrier, drywall, and trim. In terms of production, the concrete structure reaches a maximum in crew size early on in the project in order to finish the complex first floor. The faster choice is the concrete structure. The graph to the right shows the labor on site throughout the months of the construction schedule. The metal stud structure is much more expensive than the wooden podium style structure, which will be analyzed in the next section.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Install Metal Studs	1	0.5	0	0	0	0	0	0
Device Box	0	0.5	0	0	0	0	0	0
Insulation	0	0.5	1	0.5	0	0	0	0
Vapor Barrier	0	0	0		0.5	0.5	0	0
Drywall	0	0	0		0	0	1	0
Trim	0	0	0	0	0	0	0	1

Cost Analysis

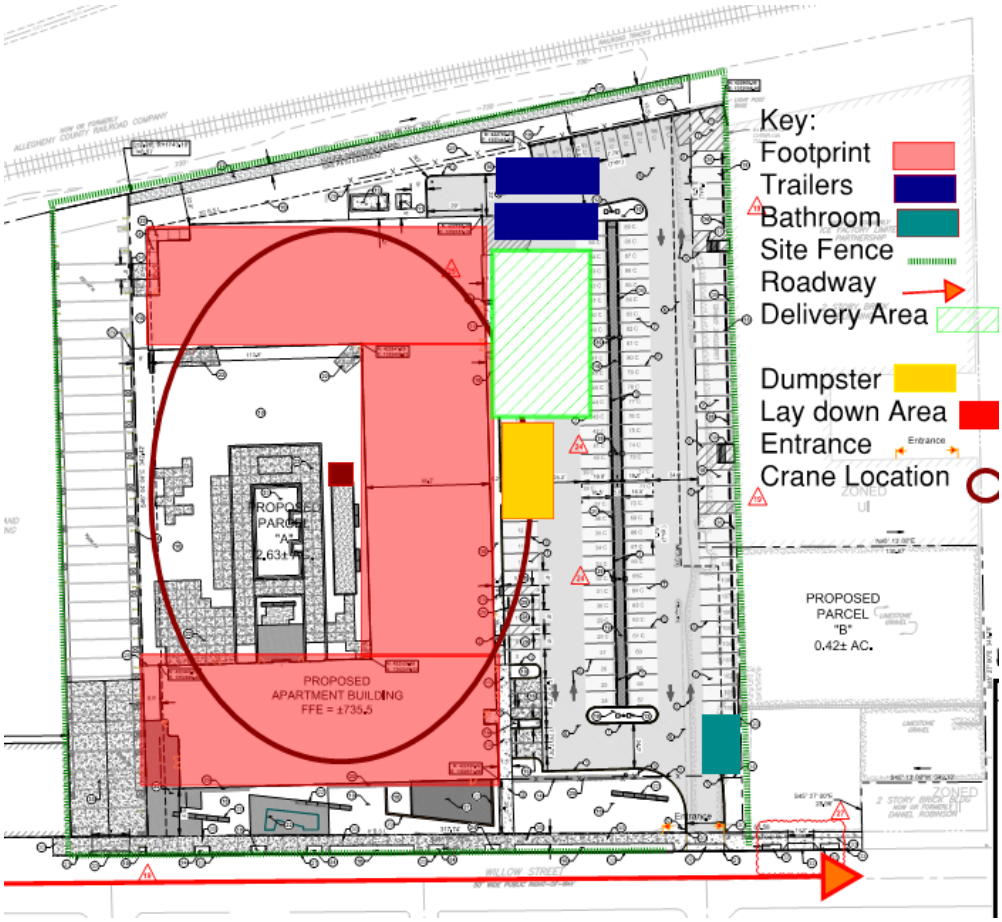
Analysis	Cost
Wooden Frame	$208,888
Metal Frame	$230,681

As expected the metal framing costs more to implement on the project than the wooden frame. Although the cost of the estimates is similar, they are not accurate. The cost of labor for the metal frame should be more than the wooden frame.

Logistical Analysis

In order to implement the metal frame one must consider the difference in weight change for the crane. Being in city of Pittsburgh, the site logistics are a challenge to the project. Another challenge is in protection of the steel frame of Bay 4. I broke the structure down into three areas with A being the one closest to the railroad and C being the closest to Willow Street. The project team chose to use one large tower crane for all three areas. I would choose this method of construction in order to reduce time assembling and dissembling the crane. Parking for workers can be held on site as well as the trailers. Absolutely no laydown can be done in Parcel C or near Bay 4.

As mentioned previously the biggest challenge in site logistics is the crane and protection of Bay4. Being an important priority of the owner and historical to the area, Bay 4 must be protected throughout construction; therefore, all laydown and the boom of the crane must avoid this area of the site overall.



Total linear ft of framing
= 16,296 ft.

2ND FLOOR:

P_{ext} = 114' + 167'-10" + 13'-11" + 29'-2" + 27'-3" + 182'-3" + 263'-8" + 30'-9" + 28'-9" + 27' + 44'-8" + 33'-9" + 57'-9" + 64'-1" + 16'-3" + 28'-8" + 28'-8"

P_{ext} = 1150' - 96" = 1158'

P_{int}: 33'-3" + 33'-3" + 41'-7" + 109'5" + 44'5" + 232'7" + 120' + 33'3" + 33'3" + 94'-3" + 169'9" = 944' 6"

P_{units} = 40 (30'-9") = 1200' 360" = 1230'

Wood frame = 3,332' 6"
2nd.

3RD, 4TH, 5TH FLOORS:

P_{ext}: 114' + 168'6" + 114' + 29'-2" + 81'-5" + 32'1" + 154'2" + 263'-3" + 25'-9" + 3'-10" + 28'-9" + 27' + 140'5" + 42'-10" = 1560'-02" = 1555'

P_{INT} = 33'-3" + 33'-3" + 100'-4" + 121'2" + 232'-5" + 116'1" + 93'7" + 26'6" + 26'6" + 170'3" + 100'4" ≈ 1053' 6"

P_{UNIT} = (29'5")(38) = 1117' 6"

3726' x3

WOOD Frame 3rd-5th = 11,175'

6TH FLOOR

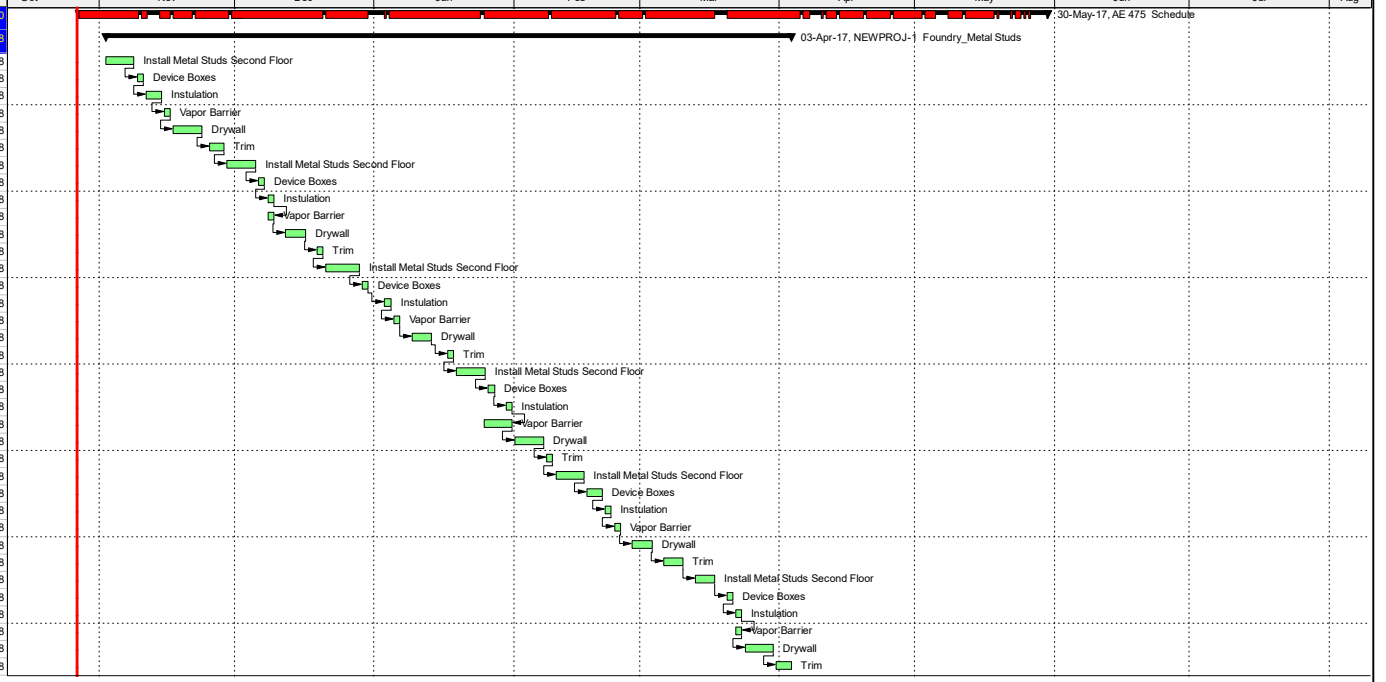
P_{ext} = 69'7" + 37'-3" + 168' + 114'-10" + 29'-3" + 28'-3" + 185'-10" + 263'2" = 896'

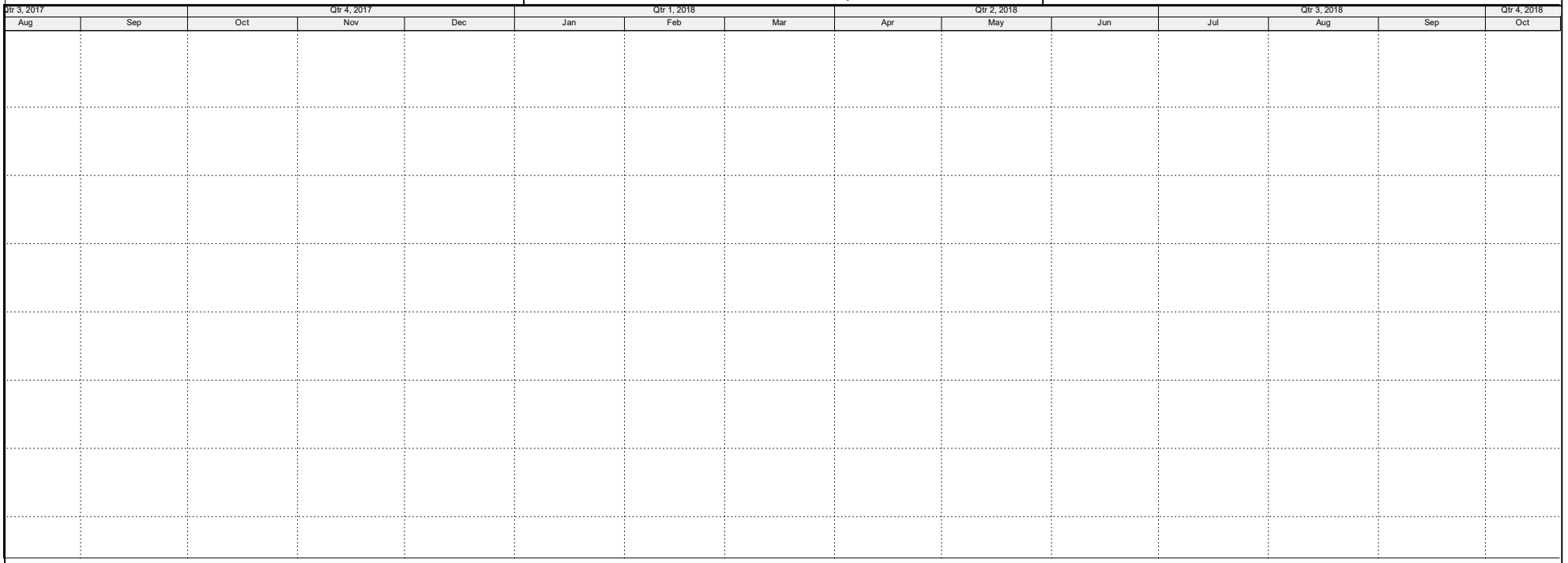
P_{int} = 170'3" + 231'11" + 10'9" + 30'9" + 99'4" + 115'5" + 35'4" + 33'3" = 727'

P_{units} = (29'5")(30) = 165.5'

WOOD FRAME = 1,788.5
6TH

Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	Start	Finish	Total Float
AE 475 Schedule		148	148	0%	27-Oct-16	30-May-17	0
NEWPROJ-1 Foundry_		105	105	0%	02-Nov-16	03-Apr-17	28
A10	Install Metal Studs Second I	5	5	0%	02-Nov-16	08-Nov-16	28
A10	Device Boxes	2	2	0%	09-Nov-16	10-Nov-16	28
A10	Instulation	2	2	0%	11-Nov-16	14-Nov-16	28
A10	Vapor Barrier	2	2	0%	15-Nov-16	16-Nov-16	28
A10	Drywall	5	5	0%	17-Nov-16	23-Nov-16	28
A10	Trim	2	2	0%	25-Nov-16	28-Nov-16	28
A10	Install Metal Studs Second I	5	5	0%	29-Nov-16	05-Dec-16	28
A10	Device Boxes	2	2	0%	06-Dec-16	07-Dec-16	28
A10	Instulation	2	2	0%	08-Dec-16	09-Dec-16	28
A10	Vapor Barrier	2	2	0%	08-Dec-16	09-Dec-16	28
A11	Drywall	5	5	0%	12-Dec-16	16-Dec-16	28
A11	Trim	2	2	0%	19-Dec-16	20-Dec-16	28
A11	Install Metal Studs Second I	5	5	0%	21-Dec-16	28-Dec-16	28
A11	Device Boxes	2	2	0%	29-Dec-16	30-Dec-16	28
A11	Instulation	2	2	0%	03-Jan-17	04-Jan-17	28
A11	Vapor Barrier	2	2	0%	05-Jan-17	06-Jan-17	28
A11	Drywall	5	5	0%	09-Jan-17	13-Jan-17	28
A11	Trim	2	2	0%	17-Jan-17	18-Jan-17	28
A11	Install Metal Studs Second I	5	5	0%	19-Jan-17	25-Jan-17	28
A11	Device Boxes	2	2	0%	26-Jan-17	27-Jan-17	28
A12	Instulation	2	2	0%	30-Jan-17	31-Jan-17	28
A12	Vapor Barrier	5	5	0%	25-Jan-17	31-Jan-17	28
A12	Drywall	5	5	0%	01-Feb-17	07-Feb-17	28
A12	Trim	2	2	0%	08-Feb-17	09-Feb-17	28
A12	Install Metal Studs Second I	5	5	0%	10-Feb-17	16-Feb-17	28
A12	Device Boxes	2	2	0%	17-Feb-17	20-Feb-17	28
A12	Instulation	2	2	0%	21-Feb-17	22-Feb-17	28
A12	Vapor Barrier	2	2	0%	23-Feb-17	24-Feb-17	28
A12	Drywall	5	5	0%	27-Feb-17	03-Mar-17	28
A12	Trim	5	5	0%	06-Mar-17	10-Mar-17	28
A13	Install Metal Studs Second I	5	5	0%	13-Mar-17	17-Mar-17	28
A13	Device Boxes	2	2	0%	20-Mar-17	21-Mar-17	28
A13	Instulation	2	2	0%	22-Mar-17	23-Mar-17	28
A13	Vapor Barrier	2	2	0%	22-Mar-17	23-Mar-17	28
A13	Drywall	5	5	0%	24-Mar-17	30-Mar-17	28
A13	Trim	2	2	0%	31-Mar-17	03-Apr-17	28





Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining W...

TASK filter: All Activities

Project name	Foundry3
Labor rate table	Non-Prev
Report format	Sorted by 'Group phase/Phase' 'Detail' summary

Item		Description	Takeoff Qty		Labor Unit Cost	Labor Amount	Material Unit Cost	Material Amount	Subcontract Amount
6000.000		***LUMBER & FRAMING***							
6010.000		**Lumber & Framing Budgets**							
	101	Lumber	29,093.00	sf	-	-	-	-	203,651
		Lumber & Framing Budgets							**203,651**
6020.000		**Framing Labor**							
	40	Framing Walls Labor	29,093.00	sf	0.18 /sf	5,237	-	-	-
		Framing Labor				**5,237**			
		LUMBER & FRAMING				***5,237***		***0***	***203,651***

Subcontract	Equipment	Other	Total
Name	Amount	Amount	Amount
	-	-	203,651
			203,651
	-	-	5,237
			5,237
	0	***0***	***208,888***

Estimate Totals

Description	Amount	Cuts/Adds	Net Amount	Totals	Hours	Rate	Cost Basis	Cost per Unit
Labor	5,237		5,237					
Material								
Subcontract	203,651		203,651					
Equipment								
Other								
	208,888			**208,888**				
Total				***208,888***				

Percent of Total
2.51%
97.49%
100.00 ####

Project name	Foundry 2
Labor rate table	Non-Prev
Report format	Sorted by 'Group phase/Phase' 'Detail' summary

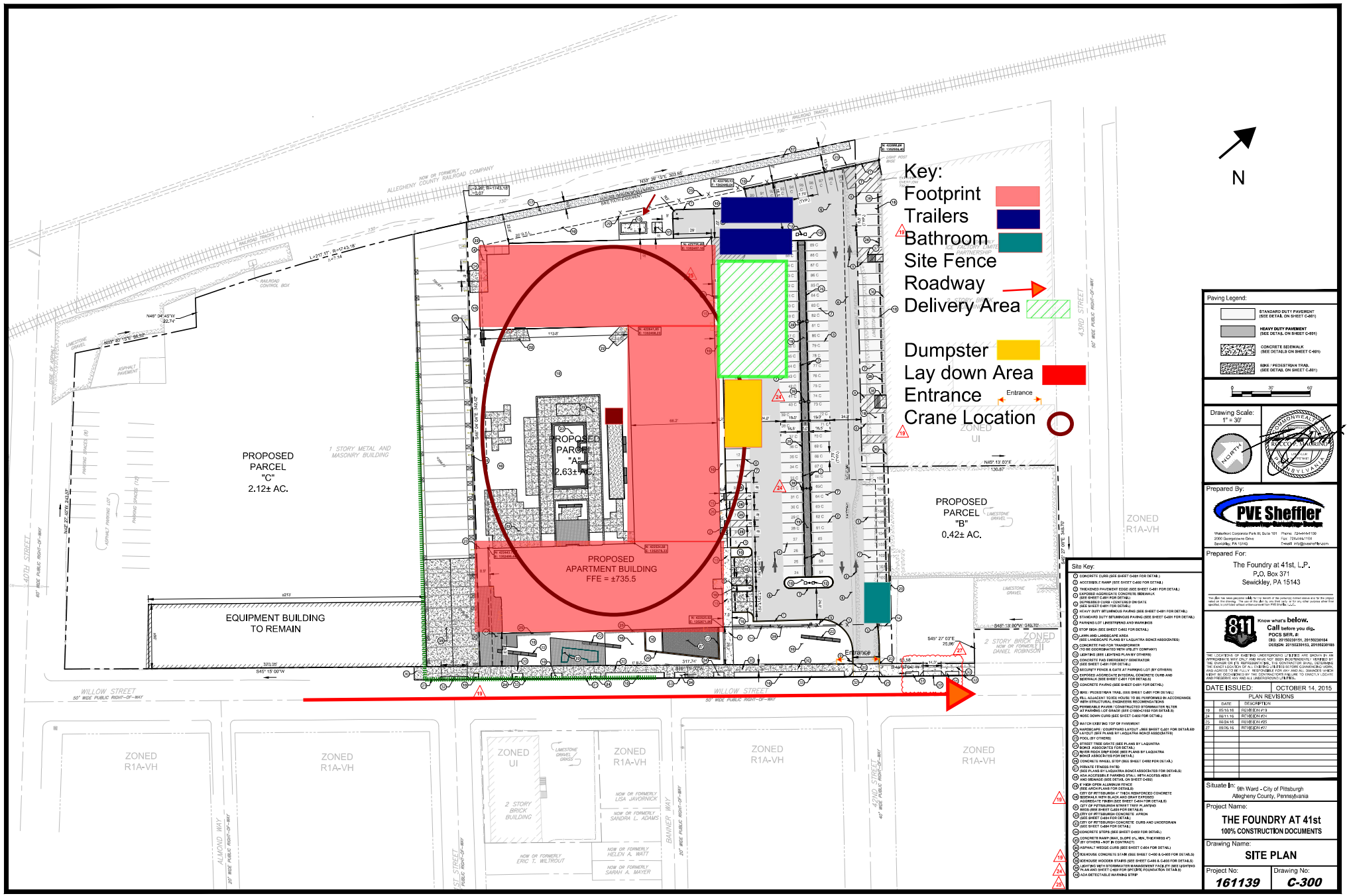
Item		Description	Takeoff Qty		Labor Unit Cost	Labor Amount	Material Unit Cost	Material Amount	Subcontract Amount
6000.000		***LUMBER & FRAMING***							
6010.000		**Lumber & Framing Budgets**							
	1	Framing Labor	29,093.00	sf	-	-	-	-	160,012
		Lumber & Framing Budgets							**160,012**
6071.100		**Studs #1**							
	16	2x4x16 #1 Stud	12,237.00	ea	-	-	4.032 /ea	49,340	-
	16	2x4x16 #1 Stud	1,958.00	ea	-	-	4.032 /ea	7,895	-
		Studs #1						**57,234**	
6071.300		**Stud Grade Studs**							
	16	2x4x16 S/G Stud	3,332.00	ft	-	-	4.032 /ft	13,435	-
		Stud Grade Studs						**13,435**	
		LUMBER & FRAMING				***0***		***70,669***	***160,012***

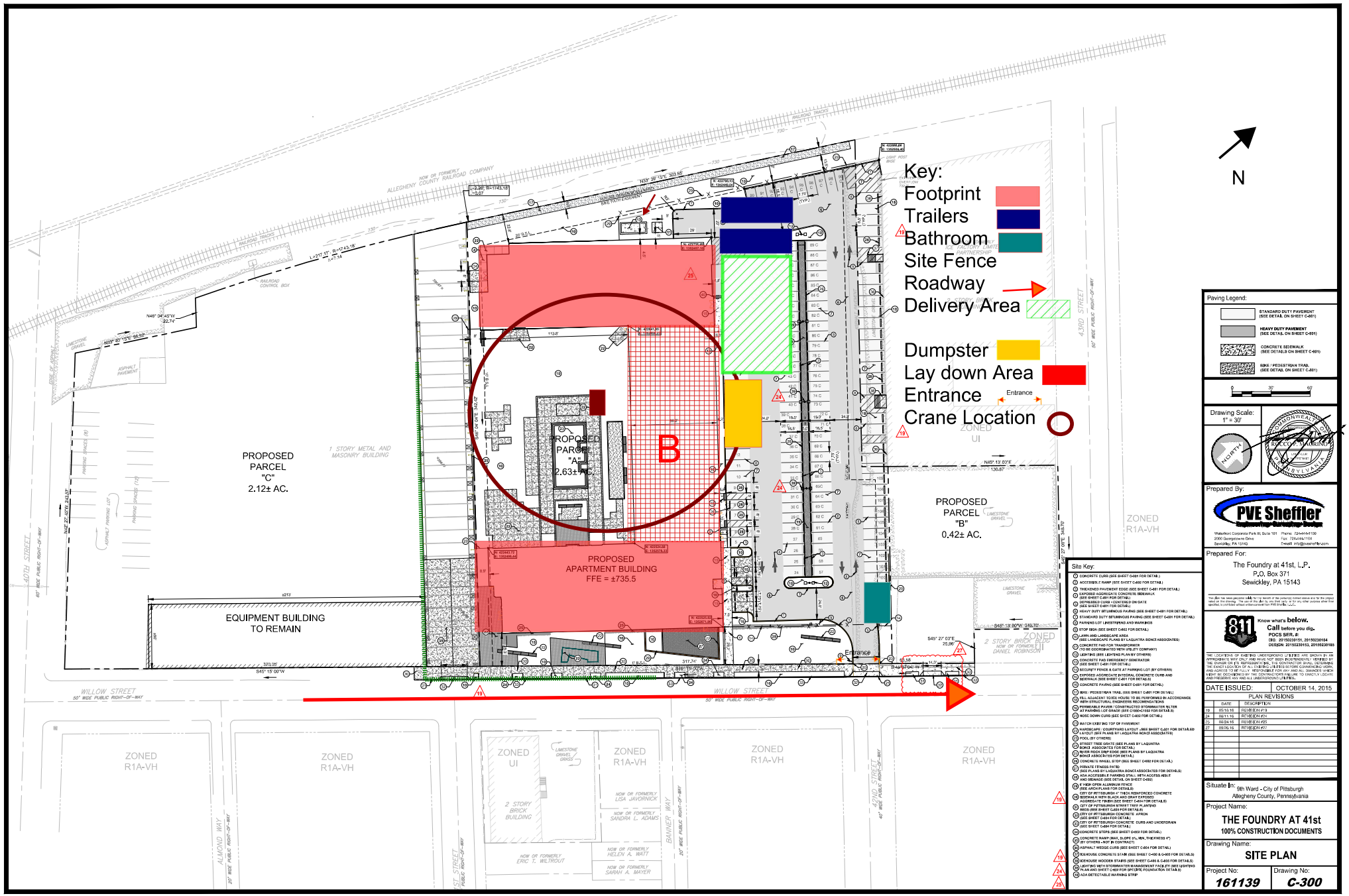
Subcontract Name	Equipment Amount	Other Amount	Total Amount
	-	-	160,012
			160,012
	-	-	49,340
	-	-	7,895
			57,234
	-	-	13,435
			13,435
	0	***0***	***230,680***

Estimate Totals

Description	Amount	Cuts/Adds	Net Amount	Totals	Hours	Rate	Cost Basis	Cost per Unit
Labor								
Material	70,669		70,669					
Subcontract	160,012		160,012					
Equipment								
Other								
	230,681			**230,681**				
Total				***230,681***				

Percent of Total
30.63%
69.36%
100.00 **####**


Key:
Footprint
Trailers
Bathroom
Site Fence
Roadway
Delivery Area
Dumpster
Lay down Area
Entrance
Crane Location
N
PROPOSED PARCEL "C" 2.12± AC.
PROPOSED PARCEL "A" 2.63±
PROPOSED APARTMENT BUILDING FFE = ±735.5
PROPOSED PARCEL "B" 0.42± AC.
EQUIPMENT BUILDING TO REMAIN
1 STORY METAL AND MASONRY BUILDING
2 STORY BRICK BLDG NOW OR FORMERLY DANIEL ROBINSON
WILLOW STREET
50' WIDE PUBLIC RIGHT-OF-WAY
40TH STREET
43RD STREET
ALMOND WAY
BANNER WAY
ZONED R1A-VH
ZONED UI
Entrance
Paving Legend:
STANDARD DUTY PAVEMENT (SEE DETAIL ON SHEET C-601)
HEAVY DUTY PAVEMENT (SEE DETAIL ON SHEET C-601)
CONCRETE SIDEWALK (SEE DETAILS ON SHEET C-601)
BIKE / PEDESTRIAN TRAIL (SEE DETAIL ON SHEET C-601)
Drawing Scale: 1" = 30'
Site Key:
Prepared By:
PVE Sheffler
Prepared For:
The Foundry at 41st, L.P.
P.O. Box 371
Sewickley, PA 15143
Know what's below. Call before you dig.
PA One Call Serial Numbers: 20152230105, 20159330184
DESIGN: 20152230153, 20159230185
DATE ISSUED: OCTOBER 14, 2015
PLAN REVISIONS
DATE DESCRIPTION
19 05/16/16 REVISION #19
24 09/11/16 REVISION #24
25 09/26/16 REVISION #25
27 09/26/16 REVISION #27
Situate In: 9th Ward - City of Pittsburgh
Allegheny County, Pennsylvania
Project Name:
THE FOUNDRY AT 41st
100% CONSTRUCTION DOCUMENTS
Drawing Name:
SITE PLAN
Project No: 161139
Drawing No: C-300



Paving Legend:

- STANDARD DUTY PAVEMENT (SEE DETAIL ON SHEET C-601)
- HEAVY DUTY PAVEMENT (SEE DETAIL ON SHEET C-601)
- CONCRETE SIDEWALK (SEE DETAILS ON SHEET C-601)
- BIKE / PEDESTRIAN TRAIL (SEE DETAIL ON SHEET C-601)

0 30' 60'

Drawing Scale: 1" = 30'

Site Key:

1. CONCRETE CURB (SEE SHEET C-601 FOR DETAIL)
2. ACCESSIBLE RAMP (SEE SHEET C-602 FOR DETAIL)
3. THICKENED PAVEMENT EDGE (SEE SHEET C-601 FOR DETAIL)
4. EXPOSED AGGREGATE CONCRETE BENCHWALK (SEE SHEET C-601 FOR DETAIL)
5. DEPRESSED CURB - CENTERED ON GATE (SEE SHEET C-601 FOR DETAIL)
6. HEAVY DUTY BITUMINOUS PAVING (SEE SHEET C-601 FOR DETAIL)
7. STANDARD DUTY BITUMINOUS PAVING (SEE SHEET C-601 FOR DETAIL)
8. PARKING LOT LINESTRIPING AND MARKINGS
9. STOP SIGN (SEE SHEET C-602 FOR DETAIL)
10. LAWN AND LANDSCAPE AREA (SEE LANDSCAPE PLANS BY LAQUATRA BONCI ASSOCIATES)
11. CONCRETE PAD FOR TRANSFORMER (TO BE COORDINATED WITH UTILITY COMPANY)
12. LIGHTING (SEE LIGHTING PLAN BY OTHERS)
13. CONCRETE PAD EMERGENCY GENERATOR (SEE SHEET C-601 FOR DETAIL)
14. CONCRETE PAVING (SEE SHEET C-601 FOR DETAIL)
15. SECURITY FENCE & GATE AT PARKING LOT (BY OTHERS)
16. EXPOSED AGGREGATE INTEGRAL CONCRETE CURB AND SIDEWALK (SEE SHEET C-601 FOR DETAILS)
17. BIKE / PEDESTRIAN TRAIL (SEE SHEET C-601 FOR DETAIL)
18. FILL ADJACENT TO ECO HOUSE TO BE PERFORMED IN ACCORDANCE WITH STRUCTURAL ENGINEERS RECOMMENDATIONS
19. PERMEABLE PAVER / CONSTRUCTED STORMWATER FILTER AT PARKING LOT GRADE (SEE C1560-C1562 FOR DETAILS)
20. MOSS DOWN CURB (SEE SHEET C-602 FOR DETAIL)
21. MATCH EXIST BIG TOP OF PAVEMENT
22. HARDSCAPE - COURTYARD LAYOUT - SEE SHEET C-201 FOR DETAILED LAYOUT (SEE PLANS BY LAQUATRA BONCI ASSOCIATES)
23. POOL (BY OTHERS)
24. STREET TREE GRATE (SEE PLANS BY LAQUATRA BONCI ASSOCIATES FOR DETAIL)
25. RIVER ROCK DRY EDGE (SEE PLANS BY LAQUATRA BONCI ASSOCIATES FOR DETAIL)
26. CONCRETE WHEEL STOP (SEE SHEET C-602 FOR DETAIL)
27. PRIVATE FITNESS PATIO (SEE PLANS BY LAQUATRA BONCI ASSOCIATES FOR DETAILS)
28. ADA ACCESSIBLE PARKING STALL WITH ACCESS AISLE AND SIGNAGE (SEE DETAIL ON SHEET C-602)
29. ASPHALT MILL AND OVERLAY (SEE ARCH'S PLANS FOR DETAILS)
30. CITY OF PITTSBURGH 7" THICK REINFORCED CONCRETE SIDEWALK WITH BLACK AND GRAY EXPOSED AGGREGATE FINISH (SEE SHEET C-604 FOR DETAILS)
31. CITY OF PITTSBURGH STREET TREE PLANTING PITS (SEE SHEET C-605 FOR DETAILS)
32. CITY OF PITTSBURGH CONCRETE APRON (SEE SHEET C-604 FOR DETAIL)
33. CITY OF PITTSBURGH CONCRETE CURB AND UNDERDRAIN (SEE SHEET C-604 FOR DETAIL)
34. CONCRETE STEPS (SEE SHEET C-605 FOR DETAIL)
35. CONCRETE RAMP (MAX. SLOPE 9%, MIN. THICKNESS 4") (BY OTHERS - NOT IN CONTRACT)
36. ASPHALT WEDGE CURB (SEE SHEET C-604 FOR DETAIL)
37. ECOHOUSE CONCRETE STAIR (SEE SHEET C-600 & C-605 FOR DETAILS)
38. ECOHOUSE WOODEN STAIRS (SEE SHEET C-605 & C-606 FOR DETAILS)
39. LIGHTING WITH STORMWATER MANAGEMENT FACILITY (SEE LIGHTING PLAN AND SHEET C-600 FOR SPECIFIC FOUNDATION DETAILS)
40. ADA DETECTABLE WARNING STRIP

Prepared By:

PVE Sheffler
Professional Surveying Services
Waterfront Corporate Park III, Suite 101
2000 Georgetowne Drive
Sewickley, PA 15143
Phone: 724-444-1100
Fax: 724-444-1108
E-mail: info@pvesheffler.com

Prepared For:

The Foundry at 41st, L.P.
P.O. Box 371
Sewickley, PA 15143

811 Know what's below. Call before you dig.
PGCS SER. #:
DES: 20150230155, 20159330164
DESIGN: 20150230153, 20150230165

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

DATE ISSUED: OCTOBER 14, 2015

PLAN REVISIONS

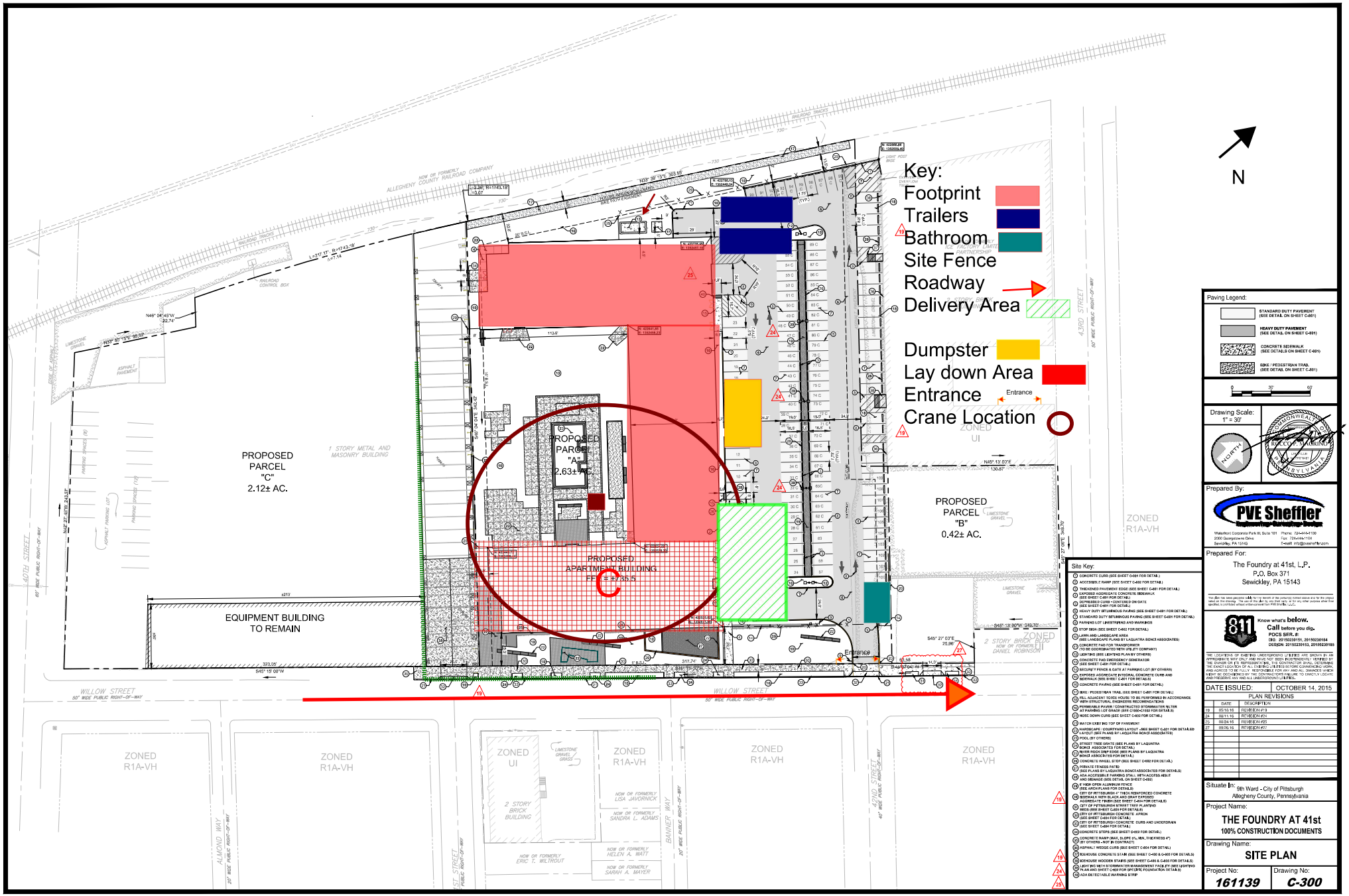
	DATE	DESCRIPTION
19	05/16/16	REVISION #19
24	08/11/16	REVISION #24
25	09/26/16	REVISION #25
27	09/26/16	REVISION #27

Situate In: 9th Ward - City of Pittsburgh
Allegheny County, Pennsylvania

Project Name:
THE FOUNDRY AT 41st
100% CONSTRUCTION DOCUMENTS

Drawing Name:
SITE PLAN

Project No: 161139
Drawing No: C-300


Key:
Footprint
Trailers
Bathroom
Site Fence
Roadway
Delivery Area
Dumpster
Lay down Area
Entrance
Crane Location
N
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PROPOSED PARCEL "A" 2.63±
PROPOSED PARCEL "B" 0.42± AC.
PROPOSED APARTMENT BUILDING FF = ±735.5
EQUIPMENT BUILDING TO REMAIN
1 STORY METAL AND MASONRY BUILDING
2 STORY BRICK BUILDING
ZONED R1A-VH
ZONED UI
WILLOW STREET
50' WIDE PUBLIC RIGHT-OF-WAY
40TH STREET
43RD STREET
ALMOND WAY
BANNER WAY
Entrance
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100% CONSTRUCTION DOCUMENTS
Drawing Name:
SITE PLAN
Project No: 161139
Drawing No: C-300

Superintendent Interview
Bruce, PJ Dick

1) What are the biggest risks on the project to date?

   The biggest risk on the project is definitely the utilities and working with the City of Pittsburgh. The construction management team was at the mercy of the utility companies and did not have a lot of control over that process. Utilities include permanent power, water, and electrical systems to the building. There was no real way to start earlier or have manpower shifts for this problem.

2) What are potential opportunities for value engineering?
   Some possibilities for Value Engineering include making the skin all one color (making the overall process quicker), and buying lower grade finishes like cabinets. Some of the Value Engineering items that were pursued were changing the roof system and changing the windows from normal to storefront. For the roofing system, rhino bond was used to mechanically weld the roofing membrane down.

3) Discuss constructability issues of the structural system analysis?
   In changing the system to a metal framed system, one would face weight limit issues, use of more scaffolding, and improve overall fire protection. BIM might need to be used if it is a metal framed building. The current building did not use BIM because a lot of the mechanical and heating systems are exposed. It would obviously be more expensive to build.

4) How does this impact construction methods?
   It would impact having the steel and material order in time. Sometimes the project was at the mercy of waiting around for material shipments.

5) What resources, cost, and techniques would be required for the Value Engineered solutions?
   Increased coordination with Montgomery truss who did the prefabricated wall panels. PJ Dick would have to ensure that they do metal prefabricated wall panels. Once again this would increase overall cost of the project. Also having them shipped to site would have logistical and transportation constraints.