Tech III.

Exploring project challenges

Emily Roarty

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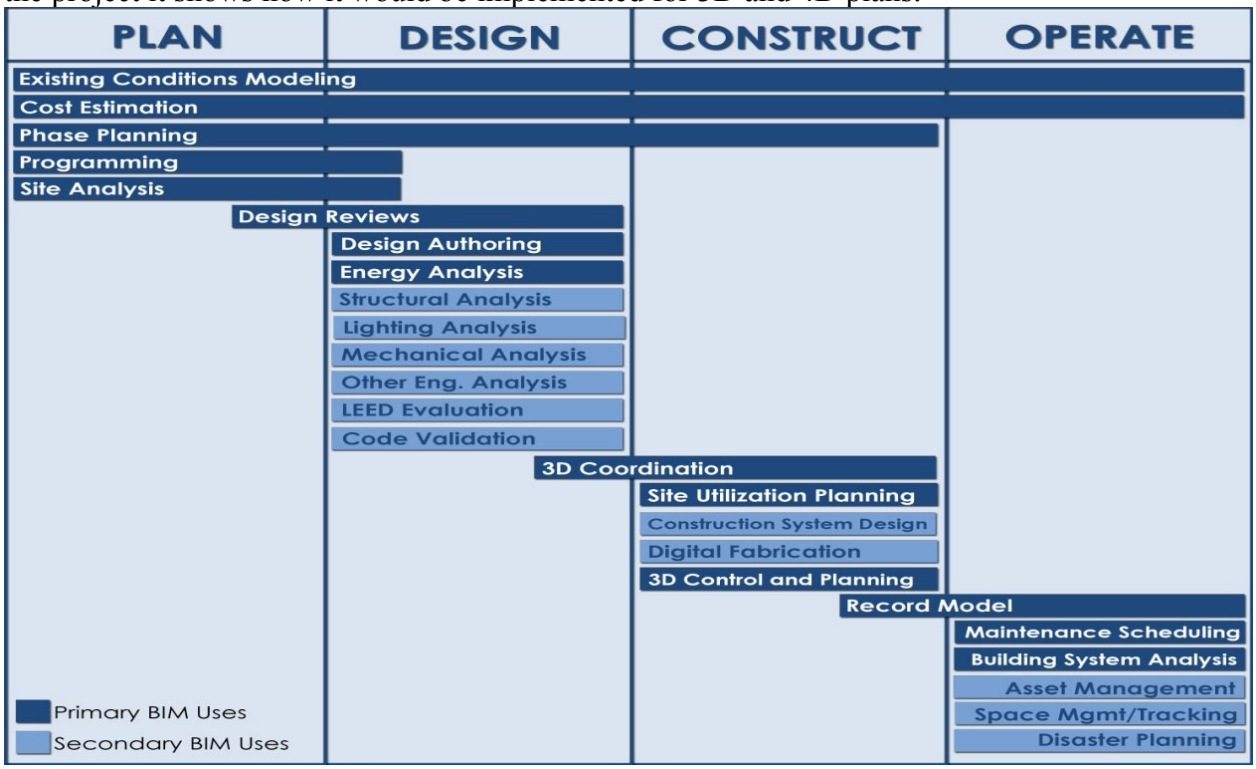
Building Information Modeling Use Evaluation

Existing BIM Use

When talking with Bryan the Project Manager on the Foundry at 41st, he mentioned that no BIM was used during the construction of the building nor do the plan to in the future on this project. A lot of the work in exposed in the apartment units, so there was not a huge need for clash detection. Bryan mentioned that Building Information Modeling would be more advantageous for a hospital or medical facility with a lot of concealed mechanical spaces.

Level 1 Process Map

The Level 1 process map and BIM goal analysis is in Appendix A. If BIM where to be used on the project it shows how it would be implemented for 3D and 4D plans.



BIM Implementation and Uses

Figure 1 depicts the potential BIM uses on a project and the phases they would be involved in. For the Foundry at 41st, BIM would be useful for Site Utilization Planning, Mechanical Analysis, and 3D Coordination. During the design phase, mechanical analysis of the chase walls between the kitchens that are back to back. As well as the bathrooms that are back to back. In addition, site utilization could be mapped out using Building Information Modeling because of the tight site in Lawrenceville. Finally, the construction phase 3D coordination can be used to design mockups for the four different types of units, and potential buyers could virtually view the rooms and high end finishes.

For the modeling of the kitchen and bathrooms, they could be highly detailed models that are prefabricated and shipped on site. The contractor and prefabricator would have to work ahead of time to design, construction, ship, and install the units.

Critical Industry Issues: PACE

Breakout Session 1: Future Technology Opportunities

The discussion began with automation of submittal process or review process. Even got into shipping the process off site, and have a third party do the review. The discussion got into a little bit into Augmented and Virtual Reality, but we got back on track. We talked about the potential for robotics to prefabricate off site. Most of us agreed that we are not at this point yet, but the industry is heading this way. Robotics have the potential to be safer and save on labor costs. In addition, we talked about how to get into this area put of college. One industry member thought that we should include more computer programming classes and just start learning any computer language. Being able to write software could allow for more integration of programs and allow for simpler user interfaces. Drones were mentioned for their continued use to map the site. The fly over of campus was mentioned for its ability to use both BIM and GIS.

Panel Discussion: Industry Workforce Challenges

The ratio of 1:2:7 1 graduate student: 3 college grads: 7 technical degrees was very interesting. The industry needs to expand the appeal of technical education. A map showing the dire need for technical degrees and workers showed red all over the United States map. A cliff of workers was mentioned that in a few years with the aging workforce, the technical educated workers will drop off. High school outreach was mentioned as the solution to this problem. As well reaching out and appealing to the families of high school students who are considering this path.

Breakout Session 2: Modularization

Dr. Leicht opened up the floor to industry members who have done modular. We discussed why one would not and would do modular. A company would choose not to do modular because of transportation, off site facility costs, startup costs, and installation on site (how does it get put into place? Wheels, duct jack, etc.) A company would choose to do modular if there are a lot of repeatable units, safety, better quality control, and reduced labor costs. Industry members seemed to be interested in modularization, but only some had done it. Most of the industry members had done some form of prefabrication. The discussion was based on if a company should pursue modularization from a return on investment stand point.

Feedback from Pace Roundtable

Leaha from Davis Construction discussed potential research ideas with me. After explaining my sites challenges, Leaha recommended that a pursue prefabricated wall panels, which I learned later in my Project Manager interview is what the team did pursue. There were prefabricated wooden trusses from Montgomery Truss that were transported to site. Leaha recommended that I use Building Information Modeling for Kitchen and Bathroom areas and create prefabricated units. As well Leaha recommended that I do not pursue any type of modularization, but focus on

prefabrication. We discussed the industry workforce challenges, and talked about how impactful reaching out to high schools in the area could help students decide their career path.

Project Management Interview

The transcript of the Interview is in the Appendix. The interview was conducted with Bryan Pascarella from PJ Dick who is the Project Manager at the Foundry at 41st. He has worked on Bakery Living and other local projects in Pittsburgh.

Project Management Services

Construction services were the main focus for the owner, and the project was relatively routine from an engineering perspective for Atlantic Engineering Services. They has designed similar podium style apartment buildings in the area. There was little preconstruction on this project because it is a new construction project. A lot of the goals of the project management team were to communicate clearly with the owner, keep a clean project, and work with the city of Pittsburgh on the utilities to get permanent power and water.

Value Engineering Services

Some of the things that were value engineered include the roofing membrane and the windows were changed from regular to storefront glass. The roofing membrane used rhino roofing which is a membrane that was mechanically fastened which was safer. As well with the glass, the project team value engineered the typical window to a storefront glass.

As well as what the team did, the Project Manager discussed some Value Engineered topics that were not considered on the project. Bryan wanted to improve the communication with the owner so there could be more frequent owner meetings as well as a jobsite webcam. Bryan said that using a prefabricated chase for the kitchen and bathroom was a potential solution.

LEED

The Foundry at 41st was not a LEED certified project. After doing the analysis, the project would be a Gold certified building, which is a 60 to 79. The project as an easy access to public transportation and there is a bike path planned on the North of the site. In terms of the actual units the highend finishes where shipped in from far away, this would have a significant impact on the LEED rating. In order to be a sustainable structure, the contractor could have considered more local vendors for the finishes and prefabricated panels. Tenants would be more willing to live in a building that is sustainable and green.

79	14	15	**TOTALS**	**Possible Points: 110**

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

Appendix

SECTION D: PROJECT GOALS / BIM USES

Describe how the BIM Model and Facility Data are leveraged to maximize project value (e.g. design alternatives, life-cycle analysis, scheduling, estimating, material selection, pre-fabrication opportunities, site placement, etc.) Reference www.engr.psu.edu/bim/download for BIM Goal & Use Analysis Worksheet.

1. MAJOR BIM GOALS / OBJECTIVES:

State Major BIM Goals and Objectives

PRIORITY (HIGH/ MED/ LOW)	GOAL DESCRIPTION	POTENTIAL BIM USES
High	Mechanical Analysis	
Med	Site Utilization	
High	3D Coordination	

2. BIM USE ANALYSIS WORKSHEET: ATTACHMENT 1

Reference www.engr.psu.edu/bim/download for BIM Goal & Use Analysis Worksheet. Attach BIM Use analysis Worksheet as Attachment 1.

3. BIM USES:

Highlight and place an X next to the additional BIM Uses to be developed by the use of the BIM model as selected by the project team using the BIM Goal & Use Analysis Worksheet. See BIM Project Execution Planning Guide at www.engr.psu.edu/BIM/BIM_Uses for Use descriptions. Include additional BIM Uses as applicable in empty cells.

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING		DESIGN AUTHORING	+	SITE UTILIZATION PLANNING		BUILDING MAINTENANCE SCHEDULING
	SITE ANALYSIS		DESIGN REVIEWS		CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
		+	3D COORDINATION	+	3D COORDINATION		ASSET MANAGEMENT
			STRUCTURAL ANALYSIS		DIGITAL FABRICATION		SPACE MANAGEMENT / TRACKING
			LIGHTING ANALYSIS		3D CONTROL AND PLANNING		DISASTER PLANNING
			ENERGY ANALYSIS		RECORD MODELING		RECORD MODELING
		+	MECHANICAL ANALYSIS				
			OTHER ENG. ANALYSIS				
			SUSTAINABLITY (LEED) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

BIM USE ANALYSIS
Version 2.0

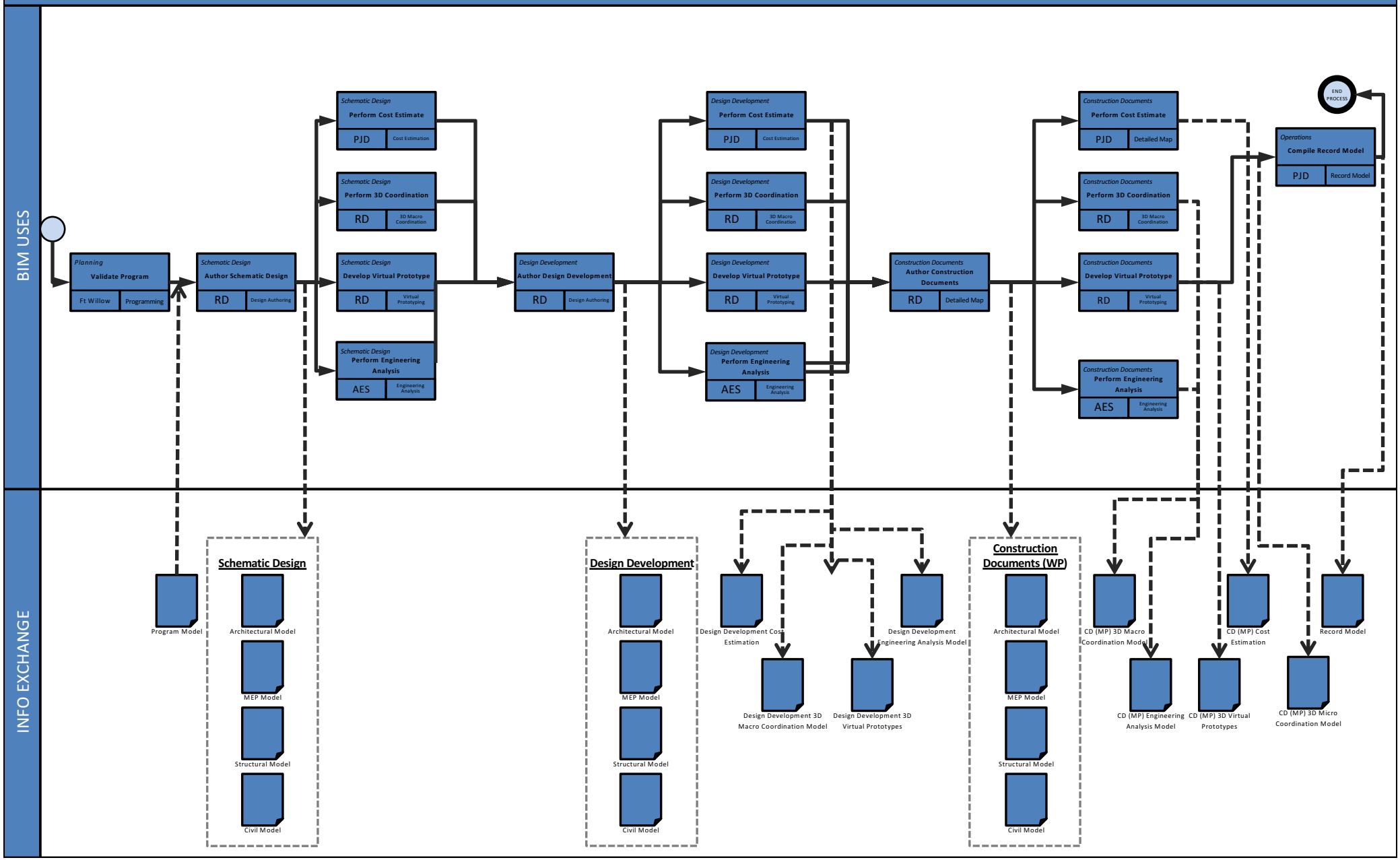
BIM Use*	Value to Project	Responsible Party	Value to Resp Party	Capability Rating			Additional Resources / Competencies Required to Implement	Notes
	High / Med / Low		High / Med / Low	Scale 1-3 (1 = Low)				
				Resources	Competency	Experience		
Mechanical Analysis	High	Engineers	high	2	2	2		
		Allan and Shariff	high	3	2	3		
		PJ Dick	high	2	2	3		
Building Systems Analysis	High	Engineers	high	2	2	2		
		Allan And Shariff	high	3	3	3		
		PJ Dick	high	2	3	3		
Record Modeling	Low	PJ Dick	high	2	2	3		
Cost Estimation	Medium	PJ Dick	high	3	3	3		
4D Modeling	Low	PJ Dick	high	1	1	1		
Site Utilization Planning	High	PJ Dick	high	2	2	2		
Design Reviews	Low	PJ Dick	high	2	2	2		
		Allan and Shariff	high	1	1	1		
		Ft Willow	low	1	1	1		
3D Coordination (Design)	High	PJ Dick	High	2	3	3		
		Alan and Shariff	high	2	3	3		
Existing Conditions Modeling	Low	PJ Dick	high	2	2	2		
		Ft. Willow	low	1	1	1		
Design Authoring	Low	PJ Dick	high	2	1	2		
		Ft Willow	low	2	2	2		
Programming	Low	PJ Dick	High	3	3	3		
		Ft. Willow	low	3	3	3		

LEVEL 1: BIM EXECUTION PLANNING PROCESS

Project Title

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team

http://www.engr/psu.edu/ae/cic/bimex



PACE Roundtable

STUDENT FORM

Student Name Emily Roarty

Session 1: Topic: Future Technologies

Research Ideas:

Research Ideas:

1) Creating an integrated Estimating and Modling Tool for the project.

2) Creating a simpler user interface for construction management program, so team members don't have to keep reentering same data into software.

Session 2: Topic: Workforce Challenges

Research Ideas:

Research Ideas:

1) Have High School programs that are a meet and greet with project team.

2) Research local technical schools and see how they can appeal more to high school students in compairson to colleges

Session 3: Topic: Modular Construction

Research Ideas:

Research Ideas:

1) Prefabricated Wall Panels that are just shipped on to site.

2) Prefabricated MEP walls between bathroom and kitchens in the units.

STUDENT FORM

Industry Member: Leaha, DAVIS Construction

Key Feedback:

Which research topic is most relevant to industry? What is the scope of the topic?

The workforce challenges are the most imporant to industry if there is a cliff. How can we recruit more skilled workers to the industry? How can local schools and technical appreticship programs be involved?

Suggested Resources:

What industry contacts are needed? Is the information available?

A lot of research on local schools and programs in the area. More research based and less numerical based research topic overall.

LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Nam
Date:

Y	?	N					Y	?	N
			Credit	Integrative Process	1				
28	**2**	**0**	**Location and Transportation**		**16**		**5**	**6**	**0**
14			Credit	LEED for Neighborhood Development Location	16		Y		
1			Credit	Sensitive Land Protection	1		Y		
	2		Credit	High Priority Site	2		3		
5			Credit	Surrounding Density and Diverse Uses	5			2	
5			Credit	Access to Quality Transit	5			2	
1			Credit	Bicycle Facilities	1			2	
1			Credit	Reduced Parking Footprint	1		2		
1			Credit	Green Vehicles	1				
4	**0**	**6**	**Sustainable Sites**		**10**		**7**	**6**	**1**
Y			Prereq	Construction Activity Pollution Prevention	Required		Y		
1			Credit	Site Assessment	1		Y		
		2	Credit	Site Development - Protect or Restore Habitat	2			2	
		1	Credit	Open Space	1		2		
		3	Credit	Rainwater Management	3		1		
2			Credit	Heat Island Reduction	2			2	
1			Credit	Light Pollution Reduction	1			1	
							2		
							2		
									1
								1	
9	**0**	**2**	**Water Efficiency**		**11**		**3**	**0**	**0**
Y			Prereq	Outdoor Water Use Reduction	Required		2		
Y			Prereq	Indoor Water Use Reduction	Required		1		
Y			Prereq	Building-Level Water Metering	Required				
2			Credit	Outdoor Water Use Reduction	2				
6			Credit	Indoor Water Use Reduction	6				
		2	Credit	Cooling Tower Water Use	2				
1			Credit	Water Metering	1				
23	**0**	**6**	**Energy and Atmosphere**		**33**		**0**	**0**	**0**
Y			Prereq	Fundamental Commissioning and Verification	Required				
Y			Prereq	Minimum Energy Performance	Required				
Y			Prereq	Building-Level Energy Metering	Required				
Y			Prereq	Fundamental Refrigerant Management	Required				
		6	Credit	Enhanced Commissioning	6				
14			Credit	Optimize Energy Performance	18				
1			Credit	Advanced Energy Metering	1				
2			Credit	Demand Response	2				
3			Credit	Renewable Energy Production	3				
1			Credit	Enhanced Refrigerant Management	1				
2			Credit	Green Power and Carbon Offsets	2				

79	**14**	**15**

ıe:

Materials and Resources		13
Prereq	Storage and Collection of Recyclables	Required
Prereq	Construction and Demolition Waste Management Planning	Required
Credit	Building Life-Cycle Impact Reduction	5
Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
Credit	Building Product Disclosure and Optimization - Material Ingredients	2
Credit	Construction and Demolition Waste Management	2

Indoor Environmental Quality		16
Prereq	Minimum Indoor Air Quality Performance	Required
Prereq	Environmental Tobacco Smoke Control	Required
Credit	Enhanced Indoor Air Quality Strategies	2
Credit	Low-Emitting Materials	3
Credit	Construction Indoor Air Quality Management Plan	1
Credit	Indoor Air Quality Assessment	2
Credit	Thermal Comfort	1
Credit	Interior Lighting	2
Credit	Daylight	3
Credit	Quality Views	1
Credit	Acoustic Performance	1

Innovation		6
Credit	Innovation	5
Credit	LEED Accredited Professional	1

Regional Priority		4
Credit	Regional Priority: Specific Credit	1
Credit	Regional Priority: Specific Credit	1
Credit	Regional Priority: Specific Credit	1
Credit	Regional Priority: Specific Credit	1

TOTALS	Possible Points:	110

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

Project Manager Interview
Bryan Pascarella, Project Manager PJ Dick

1) What are the biggest challenges or constraints on the project?
   Enclosures and having the building dry, steel delivered, and material ordering was the biggest challenges on the project in addition to utilities. Getting the steel and enclosing the project was driving the project from the beginning.

2) Are there particular services to improve the clients experience? How would you implement them to the project?
   Have more weekly updates with the owner, rather than monthly updates to improve communication with the owner. A webcam could be used on the project so that the owner could view the project progress. As well as a drone could be used to document the progress of the construction. The owner started to use a drone at the beginning but then it faded out.

3) How do you think you could Value Engineer the project and make it improve?
   Using prefabbed panels for the chase walls for plumbing in between bathrooms could save on time. One of the solutions that was implemented was that each room has their own control over the mechanical system like a hotel. This improves the tenants overall experience.

4) What are the overall goals of the owner on the Foundry project?
   Schedule and renting out the rooms is driving the owner. As well as having the mockup rooms done on time. By far having a clean project has been an important goal of the owner. In comparison to other apartment jobs like Bakery Square the developer pushed to have a clean project.

5) How has this project used past projects to build a better end product?
   The Foundry has learned a lot from other projects in the local area like Bakery Square. Atlantic Engineering Services have done similar apartment buildings in the past, so the engineering was relatively standard on the structural side of the project.