

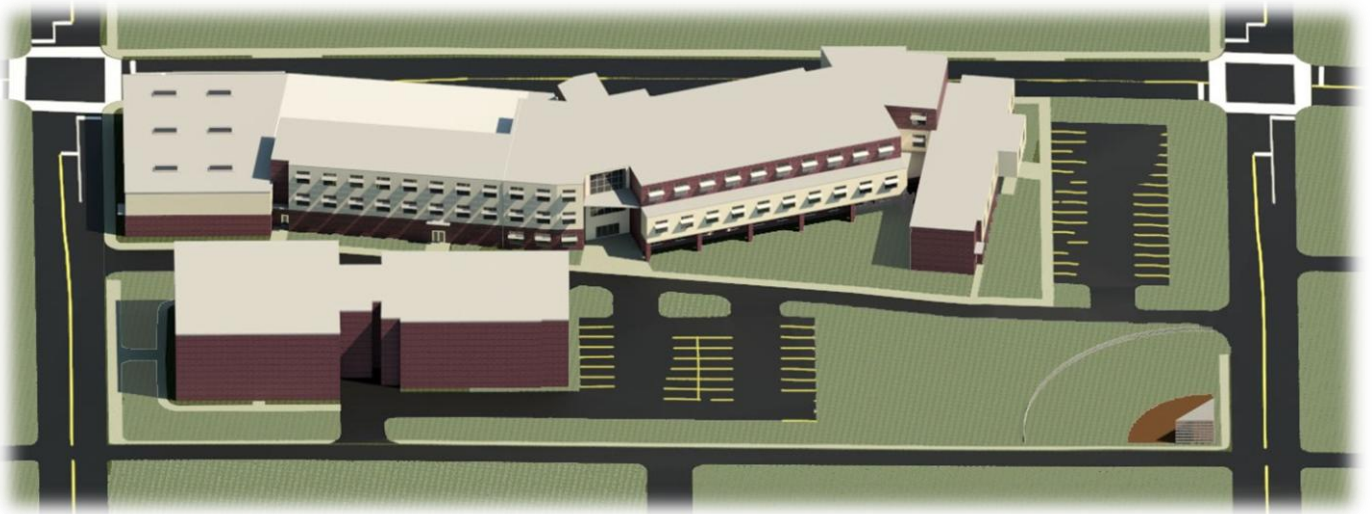
22 February 2013

2013 ASCE Charles Pankow Foundation
Annual Architectural Engineering Student Competition



HEWLETT-
PACKARD

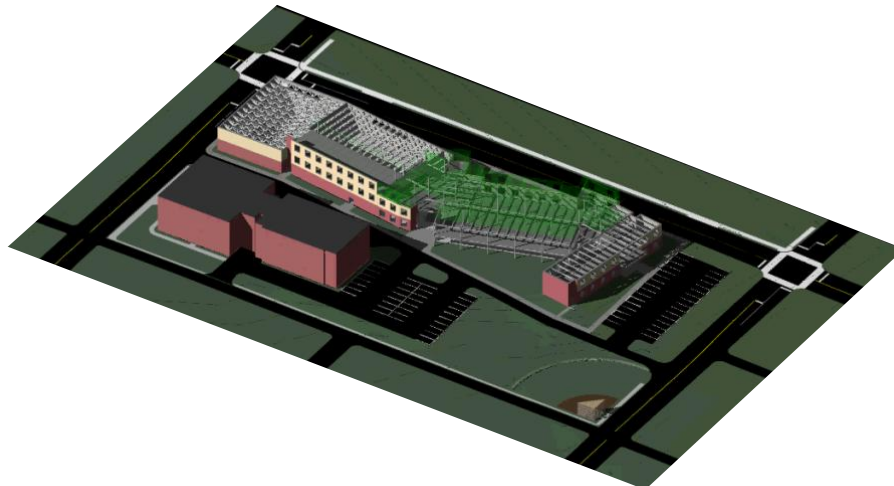
CONSTRUCTION MANAGEMENT



Team Registration Number: 02-2013

Table of Contents

▼	Executive Summary	1
▼	1. Introduction	2
	1.1 BIM Execution Plan	2
	1.2 Owners Core Values	3
	1.3 Nexus Goals	3
	1.4 Construction Management Tactics	4
▼	2. Safety and Security	5
	2.1 Building Security	5
	2.2 Occupant Safety	5
	2.3 Construction Worker Safety	5
▼	3. Delivery Method	6
	3.1 Delivery Method Selection	6
	3.2 Delivery Method Rationale	6
▼	4. Project Planning	7
	4.1 Site Planning	7
	4.2 Site Plans Rationale	8
▼	5. Cost Estimate	9
	5.1 Reading School District	9
	5.2 Cost Estimate Summary	10
	5.3 Cost Estimate Rationale - Value Engineering and Life-Cycle	11
	5.4 LEED	12
	5.5 Pool Cost Analysis	12
▼	6. Construction Schedule	13
	6.1 Schedule and Sequencing	13
	6.2 Schedule Rationale	14
▼	7. Conclusion	15
▼	Supporting Documentation	16
▼	Drawings	36



Executive Summary

Through the integration of the structural, mechanical, and lighting/electrical engineering disciplines along with innovative construction management techniques, Nexus plans to deliver the new Reading Elementary School with a seamless and fluid approach that results in the most functional and cost-effective school building for the district. The construction managers were tasked with ensuring an integrated building design that addressed the delivery method, project planning, budget, and schedule. This integration began by developing a BIM Execution Plan, which helped define team dynamics. For further explanation, see **Page 2**.

The most essential goal of both the Reading School District and Nexus is the **safety** and wellbeing of all occupants. Nexus approached safety from the inception of the project – from design to construction, but most importantly end use when the building is occupied by students. For further explanation, see **Page 5**.

The construction **delivery method** proposed for this project meets Pennsylvania state regulations, which states that the construction manager must act as an agent while not holding subcontracts. Per the design-bid-build delivery method for public projects, the lowest bidders will be chosen – providing Reading School District with the lowest cost school. Hiring local contractors will help augment the local economy. For further explanation, see **Page 6**.

The **project planning** section of this report is largely composed of site logistics planning during and after construction. The site logistics plans developed for construction show how the various trades will flow on site to maintain the construction schedule and alleviate conflicts. The new campus plan shows how the school was repositioned to the center of the northern half of the site to accommodate space for a potential pool. For further explanation, see **Page 7**.

For most construction projects, the **budget** is the first item defined during the feasibility study and programming phases. Based on PlanCon funding limits for elementary schools, the state funding would total \$5,297,230¹ (see page 27 of Supporting Documentation). This state allocation is significant due to Reading's low socio-economic status. Nexus proposes a \$200 cost per square foot and total project cost of \$17.5 million. This economical upfront cost was achieved through quality-based value engineering to enable more funds to be allocated towards learning resources. For further explanation, see **Page 9**, and pages 23-28 of Supporting Documentation.

Nexus plans for the new school to be built on a 15 month **schedule**. A shorter schedule helps reduce construction labor costs while also having a smaller impact on the environment. This project must start immediately following the end of the school year, continue throughout the following year, and finally end before the subsequent academic year starts. This will allow time for the school staff and faculty to set up classroom and auxiliary spaces. For more details on the total project schedule, see **Page 13**, and pages 29-32 of Supporting Documentation.

1. Introduction

1.1 BIM Execution Plan

The inception of this project involved understanding the given data and information regarding the new elementary school in Reading, Pennsylvania. As the team coordinators, the construction managers developed a BIM Execution Plan to help all four disciplines integrate their designs. This execution plan specifically defines the roles to be fulfilled by the construction managers, along with the structural, mechanical, and lighting/electrical engineers (see page 16 of Supporting Documentation). In addition, it defines the information exchanges between the four disciplines, and what information is needed by each member and for each discipline to allow Nexus' design to progress (see pages 17-19 of Supporting Documentation). See pages 43 of Drawings for more BIM Execution Plan details.

Outlining objectives and goals was necessary to facilitate each discipline's independence and ability to produce their respective system designs. By defining these goals, each of Nexus' disciplines had a mutual understanding of the expectations of the team's final product. These goals guided Nexus' decisions and ultimately helped to prevent unnecessary work. Increasing the team's efficiency and effectiveness was critical throughout this project in order for each discipline to meet the several interim submissions scheduled by Nexus. Thus, the construction managers' time spent planning in the early phases of this competition's project facilitate more productive team communication and progress meetings. As a result, the integration of Nexus' building systems reduces redundancy and enhances the architecture of the school building (see Figure 1).

Nexus' Mission Statement:

To develop a design that merges education with the community in a facility that is safe and cost effective while functioning as a learning tool.




Figure 1: Final Building Rendering

Construction Management Tactics	Nexus' Project Goals	Owner Core Values
Efficiency →	Integration →	Safety & Security
Lifecycle →	Lean Practices →	Lifecycle and Maintenance
Cost Advantage →	Learning Tool →	Cost Effectiveness


Figure 2: Arrows indicate a linear flow of support in order to achieve the owner objectives

1.2 Owner Core Values


Nexus defined several owner core values for the construction of Reading School District's new elementary school. Nexus was able to meet these objectives through team-defined project goals and individual discipline goals. The objectives can be categorized into three groups.

safety & security 

Safety and security are a main concern of Reading School District, the parents in the community, and the students of the district. By increasing the security on the elementary school campus, students will feel more comfortable and willing to come to school. As a result of Nexus' design, student attendance rates are expected to rise. This is due to the sense of 'unseen' safety that will enhance the feeling of safety in the new building.

lifecycle & maintenance 


Reading School District desires a building that can last for 100 years. The district also desires the building to be adaptable, flexible, and able to accommodate new emerging technologies, learning styles, and teaching techniques. The flexibility of the spaces designed into the building help increase its **lifecycle**, while the systems selected reduce the need for routine **maintenance**.

cost effective 


Reading School District wants a building that is **cost effective** in both the short and long term. The city of Reading is economically disadvantaged and therefore will not have the necessary funds to support the construction of a new elementary school on their own. By reducing the building's initial cost and maintaining a low operations and maintenance cost, Reading will be able to afford a new school both now and in the future.

1.3 Nexus Goals


Nexus' project goals help achieve the owner objectives and are supported by the individual discipline goals. Nexus' project goals can also be categorized into three main groups.

integration 

Integration is the all-encompassing goal of meeting the owner's objectives. Integration involves not only team work and collaboration, but also the integration of the building systems and components. As the main theme of the architecture of the building was pre-established, Nexus focused on integrating the structural, mechanical, and lightning/electrical aspects of the building through predefined discipline goals and information exchanges.

reduce, recover, reuse 

This holistic building integration was produced through lean practices which include **reduce, reuse, and recover**. Specific lean focuses of construction management include producing less construction waste, maintaining a shorter construction schedule, and utilizing sustainable materials.

learning tool 

Nexus desired to create a building that could be used as a **learning tool** for the end users. The building has exposed ceilings, which highlights its structural, mechanical, and lighting/electrical elements, along with an exterior façade, both of which can be used as teaching tools. All of these items were coordinated through extensive planning and team performance requirements.

The six icons representative of the owner core values and Nexus goals above will be utilized next to section subtitles throughout this report to express achievement of the core values or goals.

1.4 Construction Management Tactics

To achieve the project goals and maintain the owner core values, the construction management team also defined three goals for the construction management discipline. The decisions made in the narrative and rationale sections below reflect these goals and in turn the team and owner goals (see Figure 3).

Construction Management Tactics
Efficiency
Lifecycle
Cost Advantage

Figure 3: Construction management goals that support project goals

First, **efficiency** is best evidenced through the construction process explained in this report. However, owner application efficiency teaches the owner to use the building and its systems as they were designed. This will allow the owner to reap the full potential of the integrated building systems. The

total project schedule explains the importance of planning in the early stages of the project's conception, in order to help reduce actual construction time on site, disturbances to the neighborhood, and the existing school on site.

Second, **lifecycle** is accomplished through maintainability, and material and building system selection. Through value engineering, with both quality and cost considerations, Nexus chose building systems that were simple to operate and maintain by the Reading School District maintenance staff. LEED requirements were also taken into consideration when making building system design decisions.

Third, **cost advantage** comes from value engineering principles implemented through building material and system selection, construction labor costs, schedule sequencing, and lifecycle analyses. Cost advantage assists in finding the comfortable medium between first costs and lifecycle costs.

2. Safety and Security

2.1 Building Security



Safety is of upmost importance to Nexus. Nexus has taken the approach that safety is not solely a field responsibility, but rather an obligation to be borne by all parties involved. Both safety and security were addressed from the design phase through operations and maintenance.

Nexus' School Security and Occupant Safety Checklist		
Level of Integration	Significant	Acceptable
Secure Main Entrance	✓	
Safe Main Entrance	✓	
Parking Lot Balusters		✓
Public Address System	✓	
Security Alarms	✓	
Intrusion Detection System	✓	
Lockdown Security Doors	✓	
Manual Window Shades		✓
Video Surveillance	✓	
First Floor Bullet-Resistant Glass	✓	

Figure 4: Indoor and Outdoor Security Analysis

Reading's violent crime rate was 133.52% higher than the national average in 2010². This, along with recent events, had a major impact on the approach that Nexus took towards designing for safety. The original main entrance of the school was located on the North side of the building next to a highly-trafficked road. Nexus moved the main entrance to the South side of the building, so it faces the interior of the school campus. Balusters were added to prevent unwanted cross traffic through the center of the educational campus (see page 41 of Drawings). To further ensure student and faculty safety, all windows on the first floor have been designed as bullet-resistant glass (see Figure 4).

2.2 Occupant Safety



Safety was implemented into the building by providing one secure main entrance that requires visitors to pass through the reception area prior to entering the lobby. Nexus provides a sense of unseen security through the use of hidden cameras monitoring the main entrance. Some of the other security features that were designed include a public address system with speakers in each classroom (not only for daily announcements, but also security purposes), security alarms triggered by an intrusion detection system at all exterior doors, automatic lockdown security doors in the corridors that double as fire doors, and manual shades to cover the classroom door window and sidelight. See page 41 of Drawings for a lockdown plan.

2.3 Construction Worker Safety



Safe site working conditions will be achieved largely through contractor work practices. According to the contract, all parties on site must meet or exceed OSHA regulations. Nexus recommends that additional safety precautions be considered – such as daily toolbox talks (see page 20 of Supporting Documentation), submission of subcontractor company safety procedures, and a mandatory five foot tie-off rule. A construction fence will be installed to protect the students, teachers, and staff members of the current elementary school, as well as pedestrians on the sidewalks and vehicular passengers. In addition, the site fence will double as a security fence for the site during construction. Lastly, the building footprint will remain lit at night to prevent vandalism and theft.

3. Delivery Method

3.1 Delivery Method Selection



With both state and local funding, the innovative learning facility will be constructed under a Construction Manager Agent with a multi-prime contractor delivery method (see Figure 5). This is a form of the standard design-bid-build delivery method. Based on Pennsylvania state regulations for public school projects that receive state and local funding, there must be a minimum of four prime contractors who will each have a lump sum contract. The construction management agent will act as the school district's advocate throughout the preconstruction and construction processes. However, the construction manager will not be responsible (hold) for any of the subcontracts on the project. Thus, the school district will incur the associated risks. This is not Nexus' preferred method; however, it is the state-mandated construction method.

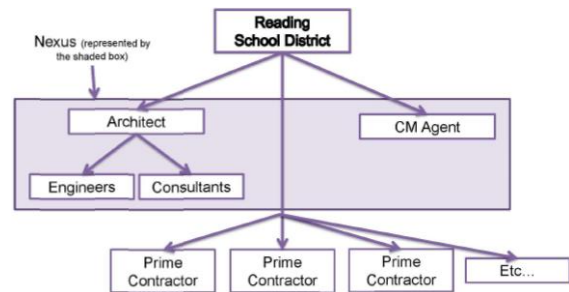


Figure 5: Delivery Method

3.2 Delivery Method Rationale



The construction manager will be responsible for overseeing all of the preconstruction and construction efforts. The preconstruction efforts encompass preliminary cost estimates, schedule projections, and risk and constructability analyses. Additionally, the construction manager may define project execution guidelines and work flow interchanges. The work flow interchanges will be managed through an internet-based project management document system. These documents include construction drawings, shop drawings, change order requests, change orders, requests for information, cost accounting reports, architectural supplementary information, and additional information. Furthermore, the construction manager will obtain the necessary construction permits from local jurisdictions, commence a site investigation, verify the geotechnical report discoveries, and coordinate utility tie-in points. In addition, the construction manager will develop a sustainability work plan with explicit strategies that will reinforce Reading School District's emphasis on addressing energy conservation and environmentalism in the new school.

Once the project parameters are established the construction manager analyzes the design and engineering aspects of the building and determines the construction schedule. Thereafter, the construction manager will develop a fair-value cost estimate for the entire project. They will then write and develop cost estimates for each scope of work. Once a bid schedule for the entire project is defined, the construction manager will send out bid invitations to prequalified subcontractors, with an emphasis on local contractors. Once bids are received in March 2014, the construction manager will conduct scope reviews of the subcontractors' bids and select the lowest bidder for each scope (based on Pennsylvania state regulations for public school projects that receive federal, state, and local funding). The school district, as the owner of the subcontracts, will award and hold the subcontracts throughout the entirety of the project.

Long Lead Items	
Items	Months
Steel Mill Order	4
Insulated Concrete Form Order	2
AHU's	4
Pumps & Boilers	2
Switchgear	3

Figure 6: Lead Items Identified by Nexus

It is important to note that while writing scopes of work, the construction manager, with the architect and engineers, must identify long lead items (see Figure 6). It is necessary for the respective subcontractors to order the long lead items from their vendors so that they are delivered to the site and installed on time. The requirement to order the long lead items on time is normal on most projects,

but even more so on this project since 89,000 square feet need to be constructed in 15 months. The next step involves submittals. The construction manager will require the subcontractors to have all submittals approved before construction starts in June 2014. Having the submittals approved will help ensure all lead times are met and construction begins on the scheduled mobilization date (June 9, 2014).

4. Project Planning

4.1 Site Planning

The site logistics plans were created with Nexus' team goals of integration and sustainability along with the school district's objectives of safety, accessibility, flexibility, and cost benefit in mind. To begin, the site logistics plans encompass the entire project site, surrounding roads, and the existing elementary school on site (see Figure 7). First, it is imperative to note that Nexus repositioned the proposed elementary school to the center of the northern portion of the site (see Figure 8). This repositioning was done to accommodate for the pool on the west end. As seen in the final campus plan for the finished building, the parking area in the northeast corner was reduced in size due to the building moving east. This displaced parking was moved to a new central lot, increasing the size of the existing lot. However, the baseball field proportions were not affected, thus maintaining the existing playground area. The bus lane will remain one way, with traffic progressing from west to east as already established. For an existing utilities plan, see page 22 of Supporting Documentation.

Prior to creating a learning environment, safety had to be established. In order to maintain the feeling of security, Nexus repositioned the entrance in order to shelter the students (see Figure 8). This inward turn allows students to congregate on the inside of the campus, away from the main roads and the dangers of the community.

Even though Nexus believes it is not in the district's best interest to build a swimming pool at this point in time, the pool has been designed and incorporated into the project as best as possible. The pool sits on the west end of the site and shares a wall and a stairwell with the gymnasium. The building was shifted towards the east end of the site in order to accommodate the pool. The pool's mechanical, structural and lighting/electrical systems are all independent

of the rest of the school building to allow for a potential second phase. The projected cost of the pool is \$2.68 million, which increases the cost per square foot of the school from \$200/SF to \$231/SF (see page 26 of Supporting Documentation). If Reading chooses not to build the pool, the building will stay shifted to the east to provide a small safety buffer between 13th Street and the building. This will also allow for the future necessary space to potentially build a pool.

4.2 Site Plans Rationale



Nexus chose to leave the existing elementary school in place to be reutilized as the Reading School District sees fit. Choosing to keep the elementary school was driven by a few factors. Retaining the building created a significant savings in both cost and schedule. The reuse of a building is also a sustainable principle and helps keep unnecessary waste out of landfills. With the current economic status of Reading, Nexus did not think it was logical to eliminate an already existing resource.

The proposed bus lane will be the guide for the main access road during construction. It is important to note that this access road will only have an entrance from the west end during excavation work to help with dump truck flow continuity. Due to the removal of the contaminated soil, no soil will be stockpiled on site. It is also important to note that the north gate will only be utilized as an entrance while the east gate will only be utilized as an exit (see Figure 9). By having two gates, Nexus is allowing for the possibility of a union and non-union gate, along with the possibility of having a third gate (the west gate) for site access in the case of a labor strike.

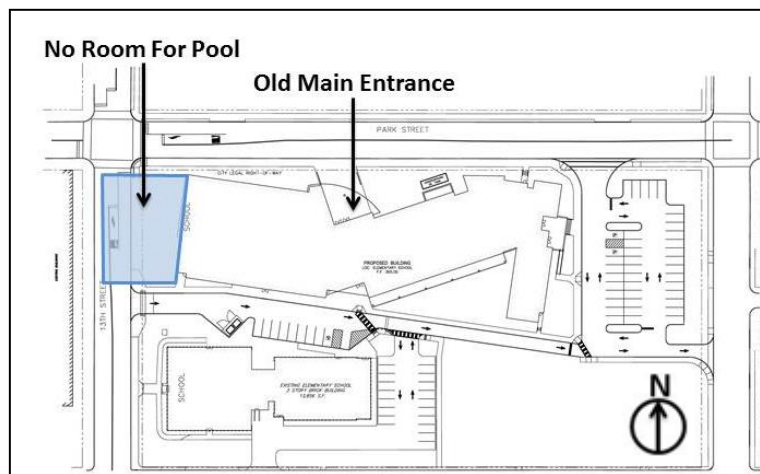


Figure 7: Original Site Plan Provided by the AEI Competition

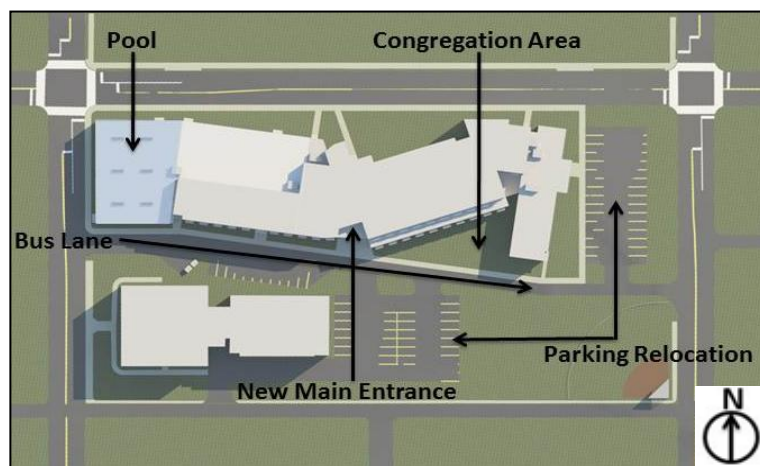


Figure 8: Nexus' Revised Campus Plan (building moved east, parking reallocated, and pool addition)

General site logistics items to note are the site trailers (most likely utilized by the construction manager and four prime contractors) with space available for parking. The placement of the trailers between the two main gates is to oversee deliveries and other vehicles arriving on site. Various storage containers and laydown areas can be staged in the south-eastern region of the



Figure 9: Excavation Site Plan

site. The concrete pump will be staged between the south access road and building at all times in order to leave the road open for concrete trucks. In addition, this road will be used for the crawler crane and steel delivery trucks (see page 42 of Drawings). In the case of a bottleneck, due to the safety concerns of the crane and its delivery trucks, the steel contractor will have priority of the access road over the concrete contractor (who has more mobile equipment and trucks).

The site will contain a comingled dumpster for offsite recycling. This will help cut down on contractor material waste and promote material reuse, garnering LEED points as well. Due to the relatively short 15 month construction schedule, the school district will be able to gain quicker access to their recreational field and auxiliary spaces. This will help reduce the impact on local traffic patterns and inconveniences to the neighborhood.

5. Cost Estimate

5.1 Reading School District



Reading School District is one of the least affluent school districts in Pennsylvania. The state average for dollars allocated to each student is \$14,535, whereas Reading only allocates \$12,989 per student. The vast majority (84%) of Reading’s educational revenue comes from state and federal funding. Only 12% of the district’s educational revenue is funded locally³. Reading’s economic situation had a major impact on the projected cost budget for the project and ultimately Nexus’ design.

Grade 5 - Non-proficient Students		
	PA State Average	Reading SD
Math	23%	38%
Reading	32%	53%

Figure 10: Student Proficiency Statistics

Reading School District’s students consistently underperform in comparison to their Pennsylvania counterparts² (see Figure 10). This may be due to the insufficient resources of Reading’s student in comparison to students in other districts. The environment in which they learn may also have an impact on how they perform. Thus, Nexus

strove to design a cost effective building that encourages students to attend class and creates a flexible environment to accommodate each student’s individual learning style.

5.2 Cost Estimate Summary



Nexus’ cost estimate at the design development level breaks the building into eight broad categories (see Figure 11 and page 24 of Supporting Documentation). One of the things to note about this estimate is that there are no funds allocated to Special Construction & Demolition. Nexus does not include the pool in this estimate; however, there is a breakout of additional pool costs (see Section 5.5). It should also be noted that more than 70% of the money is allotted to the Shell and Services categories. This was made possible thanks to a significant effort by Nexus to minimize unnecessary Interiors costs (see section 5.3).

Nexus then broke down the project costs into 17 scopes of work (see page 28 of Supporting Documentation). These scopes of work are not meant to be bid to individual subcontractors, but rather provide a means by which to ensure that all facets of the project are covered.

Cost Estimate			
	Total Cost	\$ / SF	% of Cost
A. Substructure	\$ 713,750	\$ 8.02	4%
B. Shell	\$ 6,516,250	\$ 73.22	37%
C. Interiors	\$ 1,970,000	\$ 22.13	11%
D. Services	\$ 6,475,000	\$ 72.75	37%
E. Equipment & Furnishings	\$ 300,000	\$ 3.37	2%
F. Special Construction & Demolition	\$ -	\$ -	0%
G. Building Sitework	\$ 475,000	\$ 5.34	3%
Z. General Conditions	\$ 997,650	\$ 11.21	6%
*Uniformat Categories (A-G, Z)	\$ 17,447,650	\$196.04	89,000 SF

Figure 11: Summary Cost Estimate

In order to help fund the project, Nexus delved into the multiple resources available to public school districts in Pennsylvania. The largest contribution by the state comes from PlanCon funds. The estimated \$5,296,915 from PlanCon will help alleviate the financial burden of the new school on the local residents (see page 27 of Supporting Documentation).

Figure 12 displays the construction cost and schedule along with student data for two elementary schools built in the last few years. Despite having the highest total cost (by \$1,335,545), Nexus’ design has the shortest construction schedule (by one month), lowest cost per square foot (by \$55.41), and lowest cost per student (by \$18, 867). The other two schools have a fewer number of students (by 475) yet more square feet allocated per student (by 48 square feet). Therefore, Nexus believes it has provided Reading School District with one of the most economical designs for new elementary schools in recent years.

School Cost Comparison							
	Total Cost	Construction Schedule	Total SF	\$ / SF	# of Students	\$ / Student	SF / Student
Mount Nittany Elementary School	\$15,700,000	16 months	60,000	\$261.67	400	\$ 39,250	150
Ferguson Township Elementary School	\$16,500,000	16 months	64,500	\$255.81	400	\$ 41,250	161
Nexus’ Proposed New RSD Elementary School	\$17,835,545	15 months	89,000	\$200.40	875	\$ 20,383	102

Figure 12: This data documents Nexus’ efforts to reduce cost and schedule for RSD’s new elementary school

5.3 Cost Rationale - Value Engineering and Lifecycle



The objectives and goals that were laid out at the onset of the project drove the value engineering process. It was essential to Nexus that quality not be sacrificed in order to reduce costs. Nexus strove to eliminate unnecessary interior finishes to reduce the upfront cost, while increasing lifecycle savings.

Nexus first value engineered vinyl composition tile in the hallways. The cost of using VCT in the hallways was \$90,510 which was significantly more expensive than using an epoxy concrete finish which cost \$10,710

Value Engineered Finishes			
	SF	\$/SF	Total
Concrete with Epoxy Finish	21,000	\$ 0.51	\$ 10,710
VCT	21,000	\$ (4.31)	\$ (90,510)
Acoustic Ceiling Tile	55,600	\$ (3.51)	\$ (195,156)
Total Savings			\$ (296,376)

Figure 13: Cost Savings

(see Figure 13). Nexus understands that when concrete cures that it tends to develop hairline cracks that would be covered by the VCT, but Nexus feels that the cost saving here outweigh the minor aesthetic benefits. There are also maintenance savings that go along with not using VCT. Using finished concrete eliminates the need to replace VCT tiles that break or crack which is cost effective and saves time.

Instead of using a drop ceiling, Nexus proposed the use an acoustical decking to help reduce noise issues. This would aide in the use of the building as a learning tool by exposing the structural, mechanical, and lighting systems (see Figure 14). Eliminating the ceiling grid also makes adding future telecom or electrical cables more feasible, which plays into the owner objective of flexibility. This idea was then expanded into the corridors and auxiliary spaces as well, when it was discovered that



Figure 14: Teacher Perspective of a Typical Classroom

it was not acoustically necessary. There was a savings of \$195,156 by not using acoustic ceiling tile in these spaces. Similar to the VCT, eliminating acoustical ceiling tiles has substantial maintenance savings such as the cost of replacement tiles and the labor associated with changing the tiles.

Using exposed ductwork, as opposed to a bulkhead, saved money which was allocated to upgrading the gypsum wall board in the corridors and classrooms to impact resistant wall board. Impact resistant wall board will increase the durability of the classrooms and reduce

future maintenance costs. The floor of the classrooms needed to be carpeted in order to be acoustically acceptable, so carpet tile will be used. Carpet tile was chosen over carpet so that when they are damaged they can be easily replaced as opposed to re-carpeting the entire room. The louvers on the windows are all optimally designed so that they do not need to be operable. This saves on training employees to use a more complex system and also saves on maintaining the system.

These are the measures that Nexus took to reduce both the upfront and lifecycle costs of the building without reducing the quality of the end product. The school district may wish to treat these capital savings as funding mechanisms for technological learning resources for the students. The \$296,376 saved could be used on classroom amenities such as computers, tablet computers, SMART Boards, or simply more paper and pencils. Conversely, the savings could be allocated towards exterior improvements to the site, such as a playground or learning garden.

5.4 LEED

The owner has specified that at a minimum, LEED Certified must be achieved. One of Nexus’ team goals was to reduce, reuse, and recover which aligned with LEED on many counts. Exemplary indoor air quality and low energy use were both achieved through a dedicated outdoor air system that recovers energy through an ethylene glycol run around system. Reuse was accomplished by keeping the existing elementary school to be repurposed by the school district. This helps keep materials out of landfills and maintains a valuable existing resource. Although Reading asked Nexus to explore the option of a green roof, it proved to be too large of a strain on the budget, as well greatly increasing structural loads and maintenance costs.

LEED certification was achieved by integrating sustainability features into the building on a value basis as opposed to “point chasing”. Upon further investigation into PlanCon, it was discovered that the state provides additional funding for a LEED Silver certification. Through minimal additional effort and cost Nexus was able to attain LEED Silver, and in turn an additional \$542,850 in state funding (see page 27 of Supporting Documentation). Nexus used the LEED checklist as a confirmation that the owner’s goals of an energy efficient and environmentally conscious building were achieved (see page 33 of Supporting Documentation).

5.5 Pool Cost Analysis

One of the major concerns that Nexus has is the addition of a pool. The first concern is that the pool is a considerable strain on the project budget (see Figure 15). The maintenance required for a pool also greatly increases life-cycle costs. Additionally, a pool imposes a safety threat (drowning) to the occupants of the school. Nexus has provided the pool as a potential later phase to help accommodate Reading School District’s budget. The school district may want to inquire about accessing Albright University’s aquatic facilities prior to taking on the initial and maintenance costs associated with a pool.

Pool Phase 1	
SF	8,925
\$/SF	\$ 225.50
Total Cost	\$ 2,012,588
Pool Phase 2	
SF	8,925
\$/SF	\$ 300.69
Total Cost	\$ 2,683,654
Variance	
	\$ 671,067

Figure 15: Pool Cost Comparisons

6. Construction Schedule

6.1 Schedule and Sequencing

The two largest preconstruction endeavors involve scheduling and cost estimations. For this project, Nexus determined that the construction schedule will start in early June, immediately after school adjourns for the summer. Construction must then be completed by the end of the following August, approximately 15 months later. Thus, preliminary schedule estimates show that the design phase of the project will need to begin in September 2012.

As stated above, with the scopes of work defined, a bid schedule will then be developed. This schedule will be utilized to hold the subcontractors to the dates that they bid. The sequencing of the schedule was done in conjunction with the development of a 4-dimensional model in Navisworks. To develop this model, a 3-dimensional model was imported from Revit. The Revit model incorporated architectural, structural, mechanical, plumbing, and lighting/electrical aspects. The Navisworks model was utilized for scheduling, sequencing, constructability analysis, and clash-detection (see page 45 of Drawings). Thus, the Navisworks model was the best tool to show systems integration and team collaboration.

The last day of the 2013-2014 Reading School District academic year is Friday, June 6, 2014. On Monday, June 9, 2014, the construction manager will be given a Notice to Proceed. This first major construction milestone means that the site is ready to be mobilized (see Figure 16).

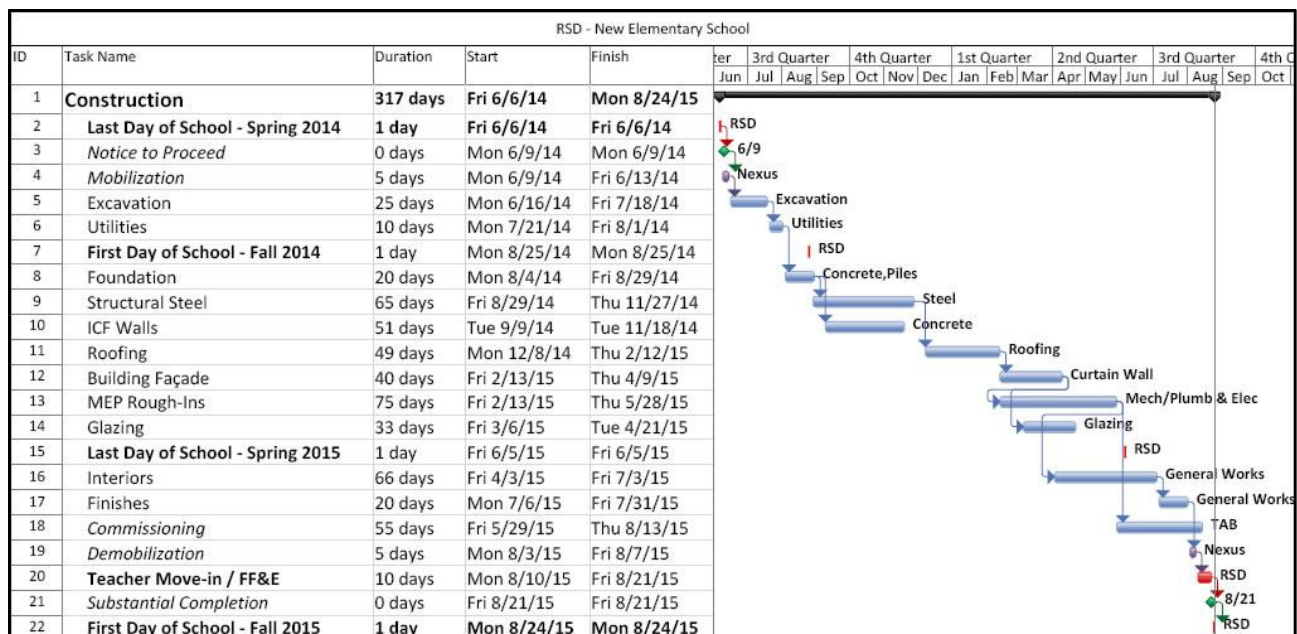


Figure 16: Construction Milestone Schedule

6.2 Schedule Rationale



The construction schedule reinforces Nexus' project goal of reducing construction time on site. Reducing this duration will have a smaller impact on the environment and will most likely reduce construction costs since labor is the most expensive part of construction. Both of these factors meet the school district's objectives of cost benefit, sustainability, and functionality.

Immediately after the Notice to Proceed, excavation will begin and last for approximately five weeks. No other contractor will be permitted on site due to the presence of contaminated soils. Thereafter, prior to the foundation work commencing, the utilities contractor will perform their necessary work on site. The sequencing of the foundation work will proceed as it did during excavation, from the west to east side of the site. After the steel-driven piles are installed, the concrete strip footers and pile caps will follow. Lastly, the pool and basement walls and slabs-on-grade will be cast.

In essence, the concrete work on each floor will lead the steel work (see Figure 17). The steel work will remain one to two building sections behind. On the first floor, the structural steel columns will be erected first. They will be braced to the ground with guyed wires. This will require the use of a crawler crane positioned on the south access road of the site. As the crane moves eastward to erect the basement beams, the concrete pump will be positioned in the pool and gym region of the site to start placing the slabs-on-grade and first lift of insulated concrete form walls. It is important to note that this end of the building is the most concrete intensive. The insulated concrete form walls, although only cast in 14 foot lifts, will be temporarily braced until the steel members supporting them are erected. Then, the first floor beams (second level floor support) will be erected. Likewise, it is also important to note that the classroom area is the most steel-intensive erection area. Consequently, the second and third levels will proceed in a very similar manner.

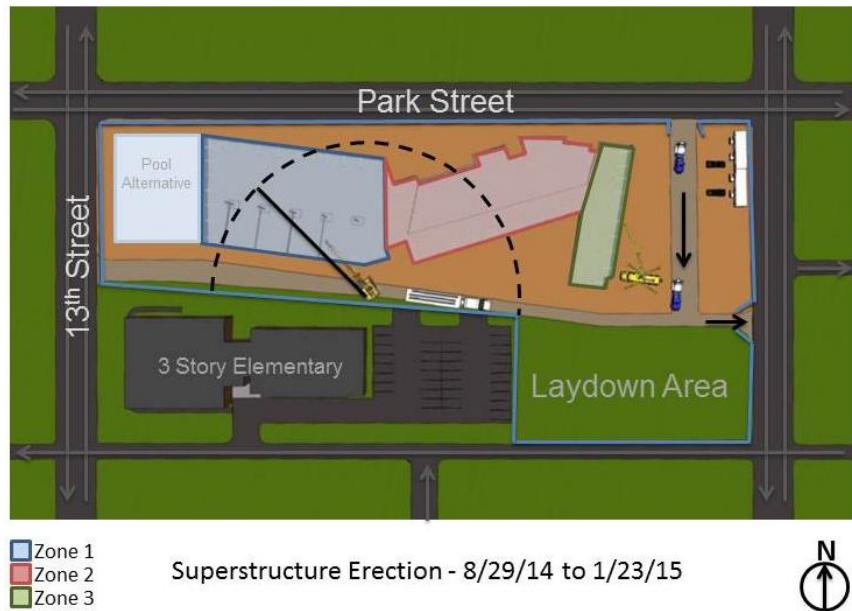


Figure 17: Superstructure Erection Plan

Consequently, the second and third levels will proceed in a very similar manner.

Next on the schedule is the metal decking placement and slab-on-deck placement. Following this, the curtain wall (brick and metal stud backup) will be stick-built and insulated to meet the same thermal requirements as the insulated concrete form walls. Then, the masonry contractor can mobilize and set up scaffolding to start the face-brick installation. In concurrence with this work on the upper floors, the curtain wall contractor will begin the

aluminum panel installations. Once the exterior walls are complete, the glazing contractor will install the window modules. While this is happening, the roofing contractor will make the building water-tight for interior construction to begin.

The main entrance of the building is an aluminum-paneled curtain wall on the first level and a glass curtain wall on the upper two floors. This area will be left open and unconstructed in order for a hoist to be positioned there for material access into the building. Once this is underway, the mechanical, plumbing, electrical, and fire protection work can begin. These various rough-ins will be followed by the metal stud wall framing and gypsum wallboard tasks. Finishing work by the general works contractor will include casework installation, fixtures, and painting. Then, the carpet tile floors can be installed in the classrooms along with the concrete finished flooring in the corridors. Lastly, the testing, adjusting, and balancing contractor can test the building automated systems.

To reach substantial completion, the construction manager and remaining subcontractors on site will demobilize allowing the faculty and staff two weeks to move into the building. Also during these two weeks, any new equipment training for the end-users will be conducted. Finally, school will begin on Monday, August 24, 2015 for the 2015-2016 academic school year.

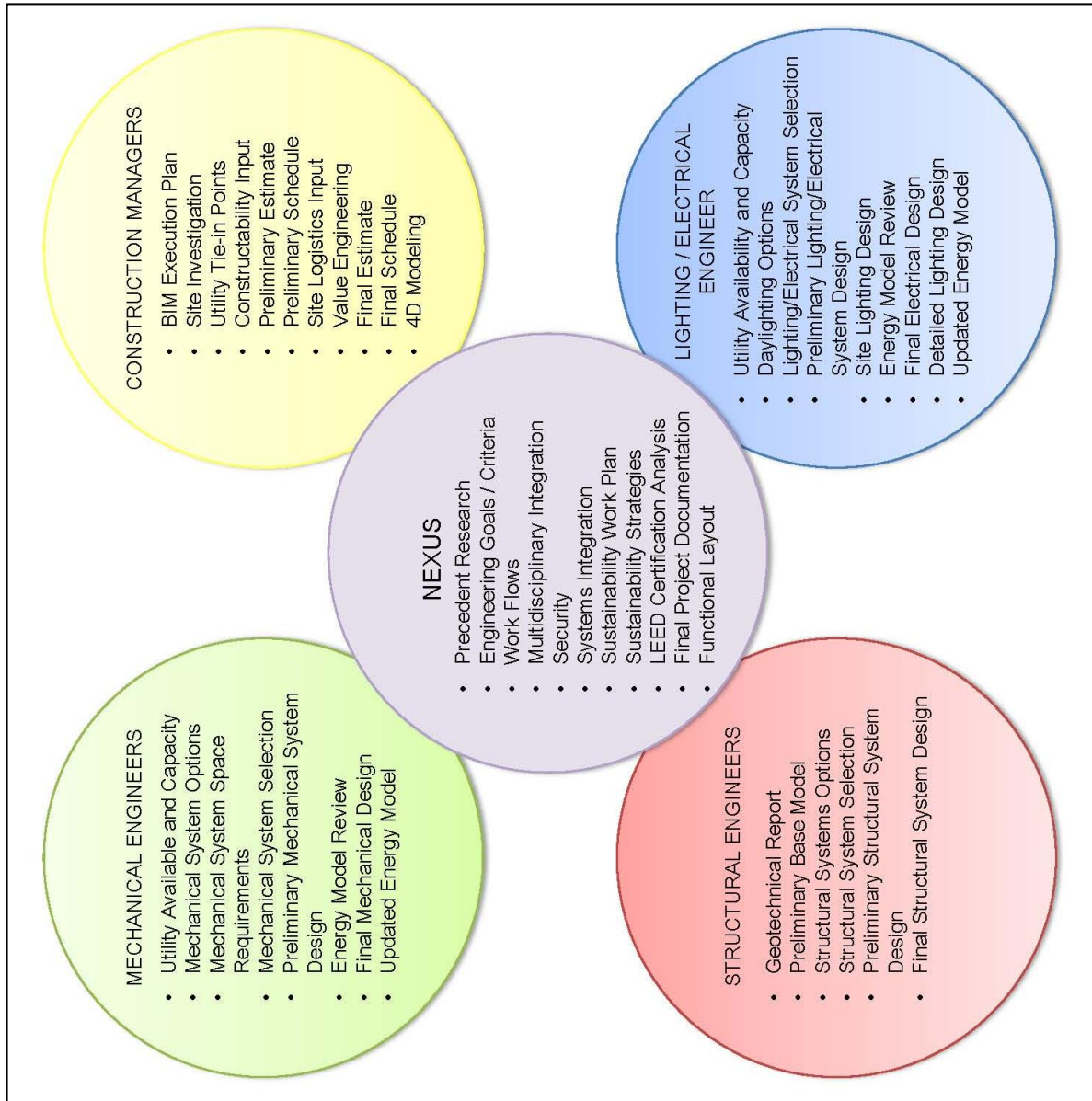
7. Conclusion



The goals set forth by Nexus were created in order to deliver a building that satisfies the needs of the students, teachers, and community members. Nexus' new proposed Reading Elementary School contains a plethora of innovative design solution examples through the integration of each discipline working on the project. Nexus is confident that the proposed elementary school successfully achieves and exceeds the district's objectives. The hidden sense of security far surpass a typical elementary school's safety protocols, ensuring the building cannot be penetrated, and that all occupants are safe from outside dangers. The sustainable features incorporated into the building will lengthen the building's life-cycle and lower the maintenance and operation requirements. Lastly, the integration of the construction, structural, mechanical, and lighting/electrical discipline's systems created a school that acts as a learning tool for the teachers and students, while maintaining a low initial and life-cycle cost.

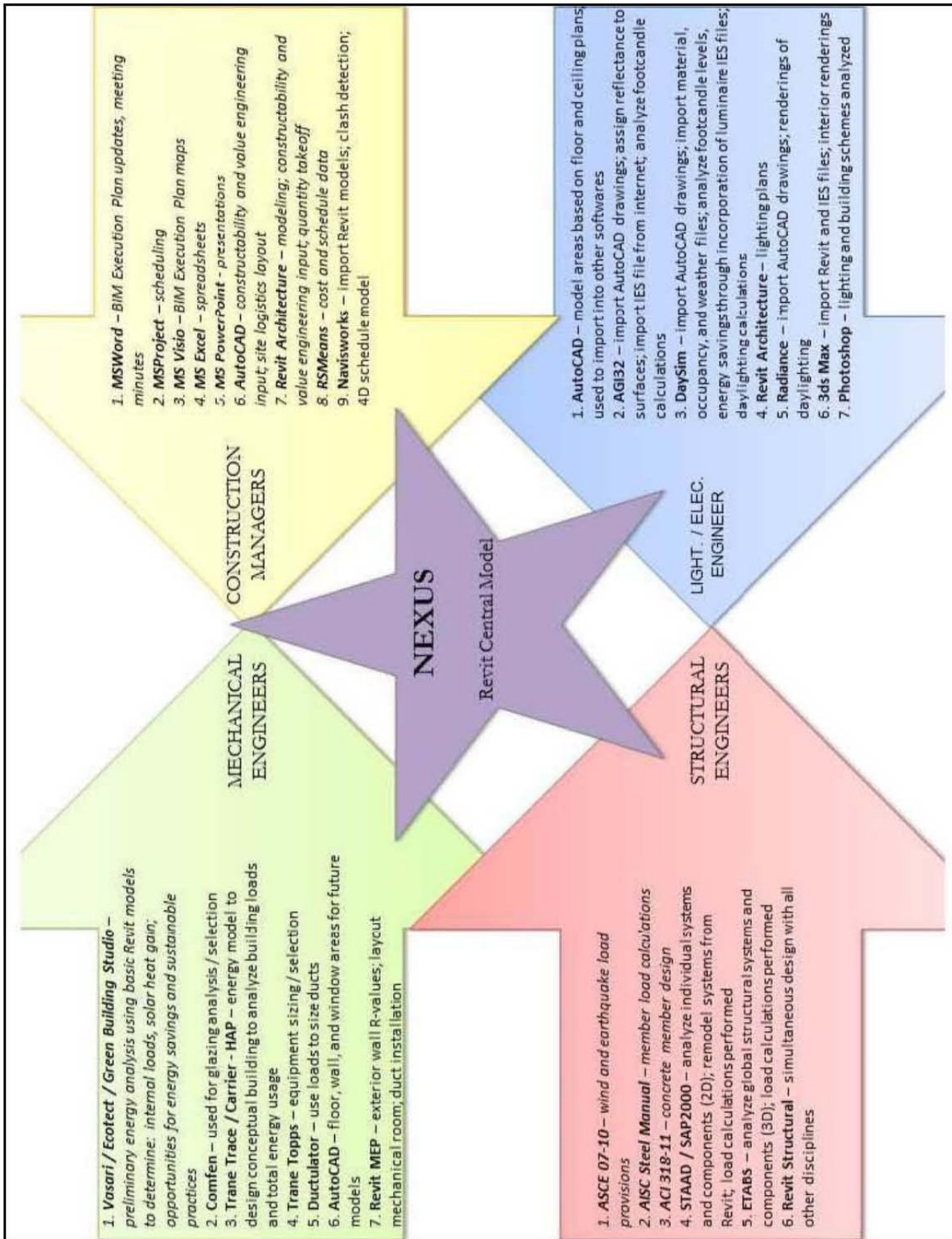
Nexus' construction managers are confident they have met Reading School District's owner objectives through the support of the project and discipline specific goals. By integrating the three other design disciplines, maximizing the security and safety measures, utilizing the required delivery method, engineering efficient construction site plans, sustaining low first and lifecycle costs, and maintaining a short construction schedule arranged around the academic year, Nexus' construction management team will provide the owner with the highest quality elementary school and the most fluid construction services. All of these qualities will result in a school building that can be used as a learning tool for generations to come.

NEXUS DISCIPLINE ROLES AND RESPONSIBILITIES



This figure displays the discipline roles and responsibilities for each of Nexus' four disciplines. Nexus as a whole has roles and responsibilities to fulfill that all team members will contribute towards. Many of these roles are in relation to the BIM Execution Plan BIM Uses and Goals. Read each individual report for more information.

NEXUS SOFTWARE INFORMATION EXCHANGES



This figure displays the software information exchanges amongst Nexus team members. Each team member is to fulfill their roles and responsibilities through the use of these technologies. When one person has completed a task, the information can flow to the next responsible team member. There is a short description next to each software to describe its use for this project.

NEXUS BIM GOAL USE ANALYSIS WORKSHEET

BIM Goal Use Analysis Worksheet				
BIM Use	Project Importance	Disciplines Involved	Discipline Importance	Necessary Data
	High / Med / Low		High / Med / Low	
<i>Design Phase</i>				
Design Review	High	CM SE ME LE	High High High High	Constructability input to design models Structural design models Mechanical design models Lighting / Electrical design models
3D Coordination	High	CM SE ME LE	High High High High	Design models Design models, ETABS and SAP models Design models Design models, ceiling plans
Structural Analysis	High	SE	High	Local codes, ETABS and SAP models
Lighting Analysis	High	LE	High	AGI and Daysim models
Mechanical Analysis	High	ME	High	Energy model and equipment sizing and selection
Energy Analysis	High	ME LE	High High	Preliminary Vasari model and later more accurate energy model AGI - lighting power density information
Sustainability (LEED) Evaluation	High	CM SE ME LE	High High High High	Materials and energy data Material efficiency data Energy model and IAQ information AGI and Daysim analysis
Phase Planning (4D Modeling)	High	CM	High	Design models, project schedule
S.F. / Detailed Cost Estimation	High	CM	High	Materials, building statistics
Existing Conditions	Med	CM SE	Med Med	Site data Ggeotechnical report
Record Modeling	Med	CM SE ME LE	Med Med Med Med	4D coordinated model Structural and ETABS model Model and equipment selection Analyses and models
Site Utilization Planning	High	CM	High	Site layout, equipment, material laydown, project schedule

This figure displays data information exchanges based on BIM Uses. These BIM Uses are rated based on the importance to Nexus on a project whole, the disciplines involved with each BIM Use, and the importance to the individual disciplines. The necessary data refers to the information required to most efficiently utilize the BIM Use.

TOOLBOX TALK MEETING MINUTES TEMPLATE



TOOLBOX TALK MEETING MINUTES

Meeting #:
Location: Project Site
Time: Mondays at 8AM
Topic: Site safety
Subcontractor: General Works
Crew members present:

Initial Date

? _____ _____
? _____ _____
? _____ _____

Guest(s) present: ?

_____ _____

1.1 Old Business
 1.1.1

1.2 New Business
 1.2.1 Site Deliveries
 1.2.2 Site Logistics
 1.2.3 Equipment Use
 1.2.4 Personal Protective Equipment
 1.2.5 Cleanup
 1.2.6 Communication

1.3 Future Business
 1.3.1

Published by,

Name

Signed _____

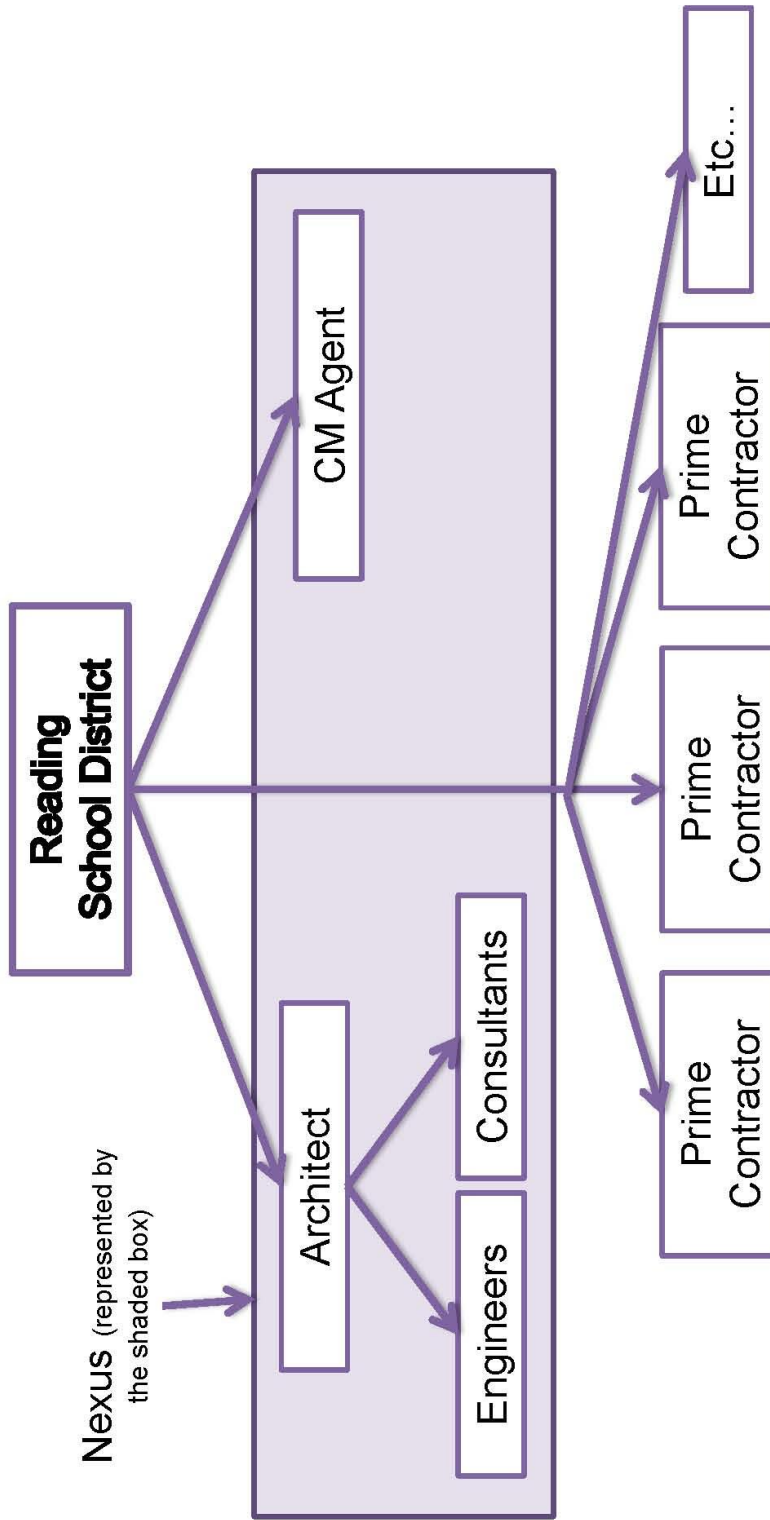
Dated _____

By initialing and dating above, all crew members present, and any guests present, agree to being present at this official Toolbox Talk meeting, and agree to being held responsible for any information discussed. These meeting minutes accurately reflect what occurred during the specified time of the official Toolbox Talk meeting. Any crew members present, or guests present, that do not agree with what is contained within, must respond to the author of these meeting minutes within 48 hours to discuss revisions and a republication of amended meeting minutes.

This template displays a typical toolbox talk meeting minutes template. These will be required of all subcontractors to submit to Nexus each Monday morning. All safety issues must be discussed and documented on this form.

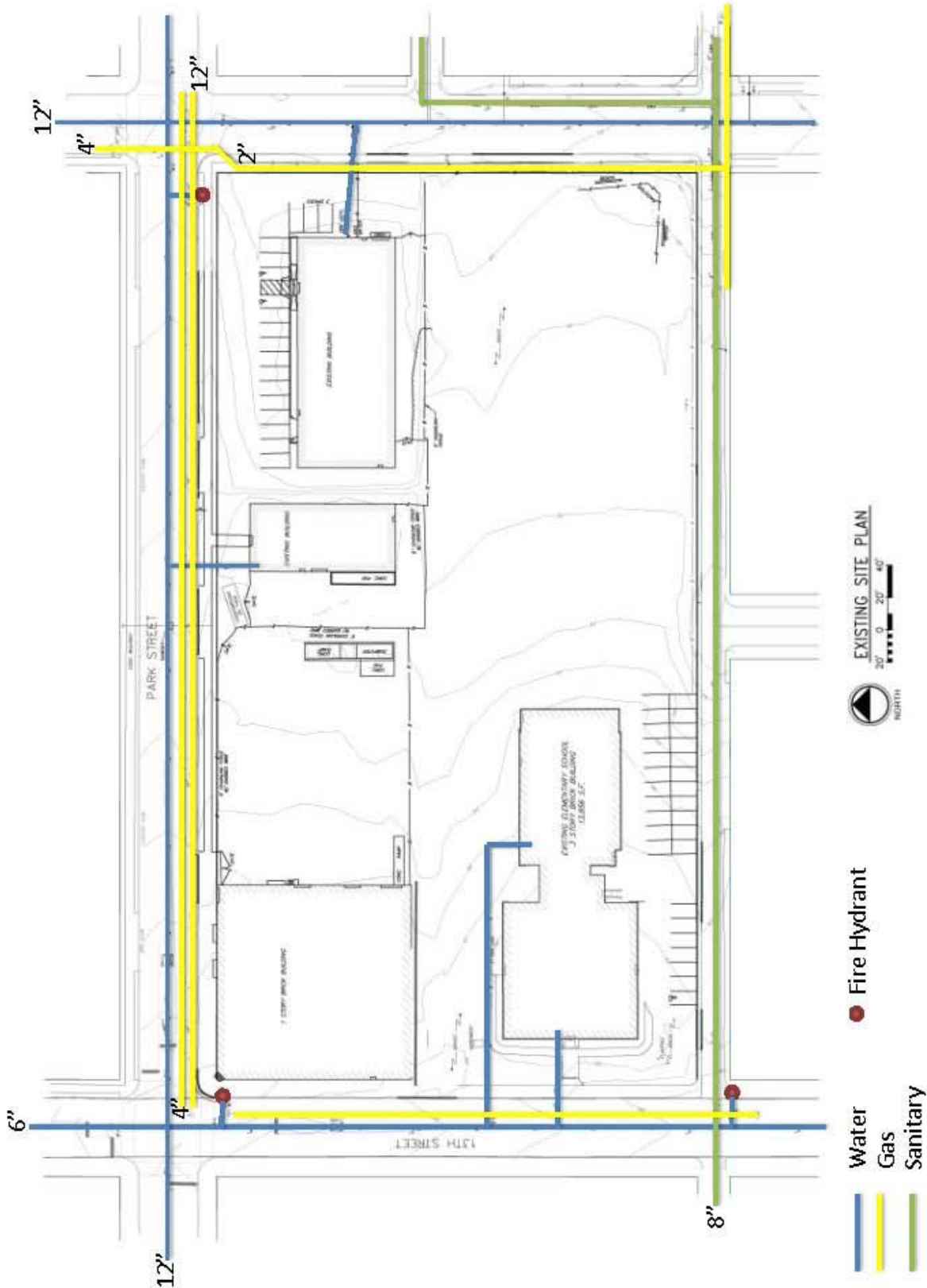
CONSTRUCTION MANAGER AGENT – MULTI-PRIME DESIGN-BID-BUILD

Delivery Method



This figure contains the contractual set-up for the new Reading Elementary School proposed by Nexus. Nexus would normally act as a design-build firm, but with Pennsylvania law, Nexus must act as a CM agent and hire prime contractors. The school must hold all contracts and assume all risk from the architect, CM agent, and subcontractors.

EXISTING UTILITY PLAN



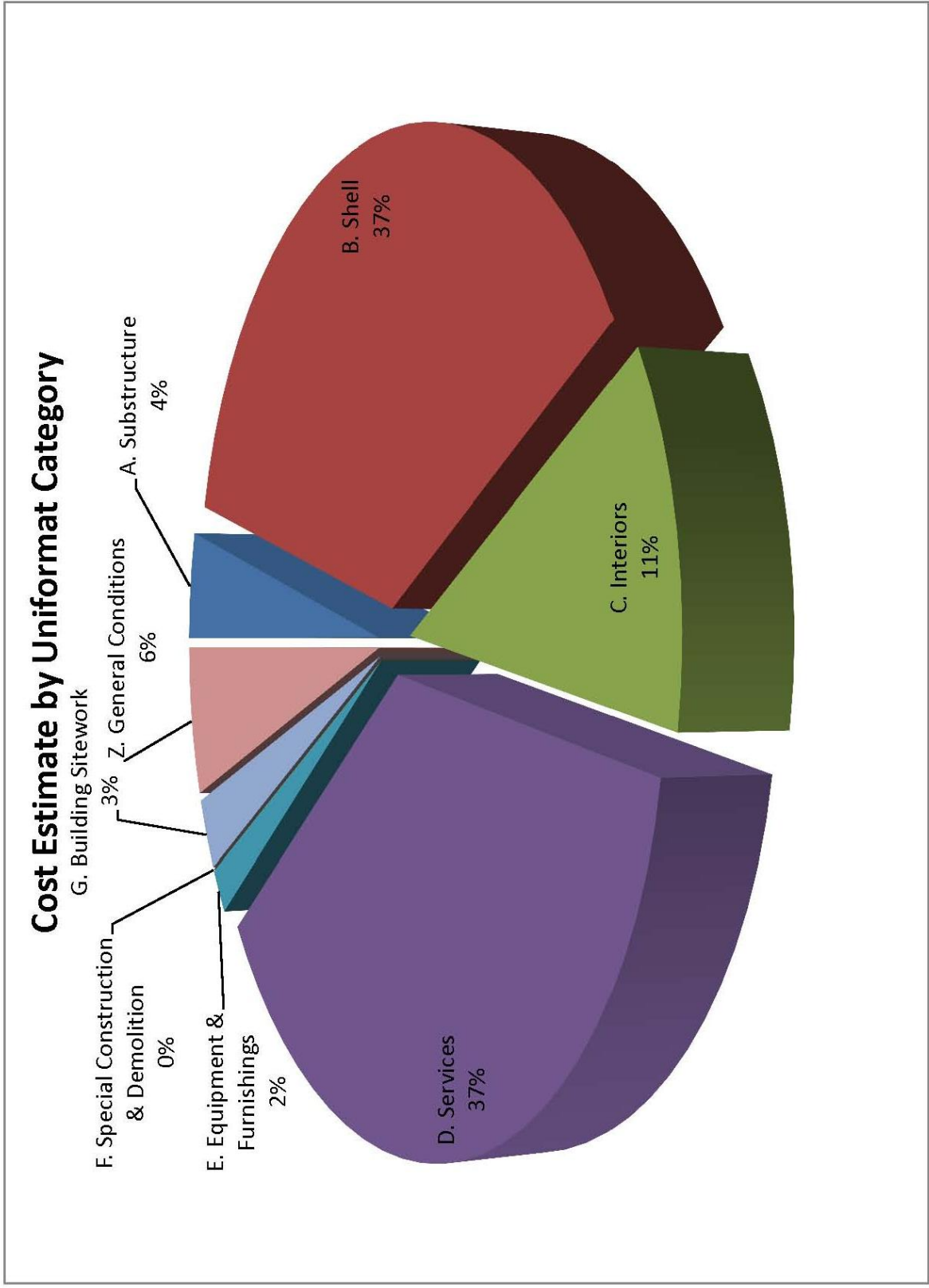
This figure depicts the existing utilities plan. Water, gas, and sanitary lines are shown in various colors. Additionally, fire hydrants are shown with red circles. It is important to note these utilities during surveys and excavation. Any new utilities must tie into the existing utilities.

UNIFORMAT DETAILED COST ESTIMATE

Uniformat Cost Estimate					
A. Substructure	\$ 713,750	A10 Foundations	\$ 459,750	A1010 Standard Foundations	\$ 138,500
				A1020 Special Foundations	\$ 200,000
				A1030 Slab on Grade	\$ 121,250
		A20 Basement Construction	\$ 254,000	A2010 Basement Excavation	\$ 150,000
				A2020 Basement Walls	\$ 104,000
B. Shell	\$ 6,390,250	B10 Superstructure	\$ 1,777,250	B1010 Floor Construction	\$ 1,381,000
				B1020 Roof Construction	\$ 396,250
		B20 Exterior Enclosures	\$ 3,908,000	B2010 Exterior Walls	\$ 3,239,000
				B2020 Exterior Windows	\$ 629,000
				B2030 Exterior Doors	\$ 40,000
		B30 Roofing	\$ 705,000	B3010 Roof Coverings	\$ 700,000
				B3020 Roof Openings	\$ 5,000
C. Interiors	\$ 1,970,000	C10 Interior Construction	\$ 965,000	C1010 Partitions	\$ 830,000
				C1020 Interior Doors	\$ 75,000
				C1030 Fittings	\$ 60,000
		C20 Stairs	\$ 110,000	C2010 Stair Construction	\$ 103,000
				C2020 Stair Finishes	\$ 7,000
		C30 Interior Finishes	\$ 895,000	C3010 Wall Finishes	\$ 180,000
				C3020 Floor Finishes	\$ 500,000
				C3030 Ceiling Finishes	\$ 215,000
D. Services	\$ 6,475,000	D10 Conveying	\$ 175,000	D1010 Elevators & Lifts	\$ 175,000
				D1020 Escalators & Moving Walks	\$ -
				D1090 Other Conveying Systems	\$ -
		D20 Plumbing	\$ 1,400,000	D2010 Plumbing Fixtures	\$ 100,000
				D2020 Domestic Water Distribution	\$ 300,000
				D2030 Sanitary Waste	\$ 240,000
				D2040 Rain Water Drainage	\$ 74,000
				D2090 Other Plumbing Systems	\$ 686,000
		D30 HVAC	\$ 2,800,000	D3010 Energy Supply	\$ -
				D3020 Heat Generating Systems	\$ 140,000
				D3030 Cooling Generating Systems	\$ 280,000
				D3040 Distribution Systems	\$ 520,000
				D3050 Terminal & Package Units	\$ 840,000
				D3060 Controls & Instrumentation	\$ 360,000
				D3070 Systems Testing & Balancing	\$ 200,000
				D3090 Other HVAC Systems & Equipment	\$ 460,000
		D40 Fire Protection	\$ 175,000	D4010 Sprinklers	\$ 105,000
				D4020 Standpipes	\$ 62,000
				D4030 Fire Protection Specialties	\$ 8,000
				D4090 Other Fire Protection Systems	\$ -
		D50 Electrical	\$ 1,925,000	D5010 Electrical Service & Distribution	\$ 551,250
				D5020 Lighting and Branch Wiring	\$ 1,023,750
				D5030 Communications & Security	\$ 350,000
				D5090 Other Electrical Systems	\$ -
E. Equipment & Furnishings	\$ 300,000	E10 Equipment	\$ -	E1010 Commercial Equipment	\$ -
				E1020 Institutional Equipment	\$ -
				E1030 Vehicular Equipment	\$ -
				E1090 Other Equipment	\$ -
		E20 Furnishings	\$ 300,000	E2010 Fixed Furnishings	\$ 200,000
				E2020 Movable Furnishings	\$ 100,000
F. Special Construction & Demolition	\$ -	F10 Special Construction	\$ -	F1010 Special Structures	\$ -
				F1020 Integrated Construction	\$ -
				F1030 Special Construction Systems	\$ -
				F1040 Special Facilities	\$ -
				F1050 Special Controls and Instrumentation	\$ -
		F20 Selective Building Demolition	\$ -	F2010 Building Elements Demolition	\$ -
				F2020 Hazardous Components Abatement	\$ -
G. Building Sitework	\$ 601,000	G10 Site Preparation	\$ 175,000	G1010 Site Clearing	\$ -
				G1020 Site Demolition and Relocations	\$ -
				G1030 Site Earthwork	\$ 125,000
				G1040 Hazardous Waste Remediation	\$ 50,000
		G20 Site Improvements	\$ 301,000	G2010 Roadways	\$ 127,500
				G2020 Parking Lots	\$ 133,500
				G2030 Pedestrian Paving	\$ 15,000
				G2040 Site Development	\$ -
				G2050 Landscaping	\$ 25,000
		G30 Site Mechanical Utilities	\$ 75,000	G3010 Water Supply	\$ 13,000
				G3020 Sanitary Sewer	\$ 15,000
				G3030 Storm Sewer	\$ 16,000
				G3040 Heating Distribution	\$ 12,000
				G3050 Cooling Distribution	\$ 8,000
				G3060 Fuel Distribution	\$ 11,000
				G3090 Other Site Mechanical Utilities	\$ -
		G40 Site Electrical Utilities	\$ 50,000	G4010 Electrical Distribution	\$ 10,000
				G4020 Site Lighting	\$ 25,000
				G4030 Site Communications & Security	\$ 15,000
				G4090 Other Site Electrical Utilities	\$ -
		G90 Other Site Construction	\$ -	G9010 Service and Pedestrian Tunnels	\$ -
				G9090 Other Site Systems & Equipment	\$ -
Z. General Conditions	\$ 997,650	Z10 Design Allowance	\$ -		
		Z20 Overhead & Profit	\$ 997,650	Z2010 Overhead	\$ 685,100
				Z2020 Profit	\$ 312,550
TOTAL	\$ 17,447,650				

This table is a detailed cost estimate based on Uniformat categories. These categories are divided into three levels, as shaded in purple. These levels become more descriptive based on the level of detail. Where there is no cost listed, this aspect is not included in Nexus' new elementary school.

BUILDING GENERAL CONDITIONS COST ESTIMATE



This figure is another representation of the cost estimate breakdown based on Uniformat. Each category is represented as a percentage of the total building cost. General conditions are appropriately allocated at 6%, with the structure consisting of 41%, and the MEP systems as 37%.

BUILDING GENERAL CONDITIONS COST ESTIMATE

General Conditions Cost Estimate				
<i>Personnel</i>				
	Quantity	Unit	Unit Price	Total Cost
Project manager	30	Week	\$ 2,125.00	\$ 63,750
Engineer	30	Week	\$ 1,300.00	\$ 39,000
Superintendent	60	Week	\$ 1,975.00	\$ 118,500
Clerk	30	Week	\$ 420.00	\$ 12,600
				\$ 233,850
<i>Facilities</i>				
	Quantity	Unit	Unit Price	Total Cost
Trailer (32'x8')	15	Month	\$ 185.00	\$ 2,775
Dumpster (40 CY, 1 dump/wk.)	12	Month	\$ 860.00	\$ 10,320
Portable toilet	15	Month	\$ 180.00	\$ 2,700
Storage (40' x 8')	15	Month	\$ 385.00	\$ 5,775
Office expenses	15	Month	\$ 460.00	\$ 6,900
Gravel road (8")	500	SY	\$ 11.73	\$ 5,865
				\$ 34,335
<i>Protection</i>				
	Quantity	Unit	Unit Price	Total Cost
Site fence (6' tall)	4000	LF	\$ 5.16	\$ 20,640
<i>Temporary Utilities</i>				
	Quantity	Unit	Unit Price	Total Cost
Heat (w/ fuel, 12hrs., /wk.)	2700	CSF * wk.	\$ 40.13	\$ 108,351
Lighting	900	CSF	\$ 14.95	\$ 13,455
Power (lighting, 11.8 KWH)	3375	CSF * mn.	\$ 1.65	\$ 5,569
Power (job)	3375	CSF * mn.	\$ 47.00	\$ 158,625
Water	15	Month	\$ 63.00	\$ 945
				\$ 286,945
<i>Insurance, Bonds, Taxes</i>				
	Quantity	Unit	Unit Price	Total Cost
Builder's risk (0.64%)	0.0064	Job		\$ 105,280
				\$ 105,280
<i>Mobilization/Demobilization</i>				
	Quantity	Unit	Unit Price	Total Cost
Mobilization	6	/equipment	\$ 350.00	\$ 2,100
Demobilization	6	/equipment	\$ 325.00	\$ 1,950
				\$ 4,050
<i>Fee</i>				
	Quantity	Unit	Unit Price	Total Cost
1.9%	0.019	Job		\$ 312,550
General Conditions Total				\$ 997,650
Building Direct Cost (materials put in place)				\$ 16,450,000
Gross Total (building direct cost + general conditions)				\$ 17,447,650
<i>Adjustment Factors</i>				
	Quantity	Unit	Unit Price	Total Cost
PA Sales Tax (6%)	0.06	Job		\$ 1,046,859
Available work space (-2%)	-0.02	Job		\$ (348,953)
Good GC/CM management (-2%)	-0.02	Job		\$ (348,953)
Location Factor (0.98)	-0.02	Job		\$ (348,953)
				\$ -
<i>*all information in this table is referenced from RSMeans Building Construction Cost Data 2013</i>				
Building Net Total (building direct cost + general conditions)				\$ 17,447,650

This figure illustrates the general conditions cost estimate calculations for the project. The items included in this cost estimate would be supplied by the construction manager.

POOL GENERAL CONDITIONS COST ESTIMATE – PHASE TWO

Phase 2 Pool Cost Estimate				
<i>Personnel</i>	Quantity	Unit	Unit Price	Total Cost
Project manager	12	Week	\$ 2,125.00	\$ 25,500
Engineer	12	Week	\$ 1,300.00	\$ 15,600
Superintendent	12	Week	\$ 1,975.00	\$ 23,700
				\$ 64,800
<i>Facilities</i>	Quantity	Unit	Unit Price	Total Cost
Trailer (32'x8')	3	Month	\$ 185.00	\$ 555
Dumpster (40 CY, 1 dump/wk.)	3	Month	\$ 860.00	\$ 2,580
Portable toilet	3	Month	\$ 180.00	\$ 540
Office expenses	3	Month	\$ 460.00	\$ 1,380
Gravel road (8")	100	SY	\$ 11.73	\$ 1,173
				\$ 6,228
<i>Protection</i>	Quantity	Unit	Unit Price	Total Cost
Site fence (6' tall)	400	LF	\$ 5.16	\$ 2,064
<i>Temporary Utilities</i>	Quantity	Unit	Unit Price	Total Cost
Lighting	893	CSF	\$ 14.95	\$ 13,350
Power (lighting, 11.8 KWH))	1340	CSF * mn.	\$ 1.65	\$ 2,211
Power (job)	670	CSF * mn.	\$ 47.00	\$ 31,490
Water	3	Month	\$ 63.00	\$ 189
				\$ 47,240
<i>Insurance, Bonds, Taxes</i>	Quantity	Unit	Unit Price	Total Cost
Builder's risk (0.64%)	0.0064	Job		\$ 15,974
				\$ 15,974
<i>Mobilization/Demobilization</i>	Quantity	Unit	Unit Price	Total Cost
Mobilization	6	/equipment	\$ 350.00	\$ 2,100
Demobilization	6	/equipment	\$ 325.00	\$ 1,950
				\$ 4,050
<i>Fee</i>	Quantity	Unit	Unit Price	Total Cost
1.9%	0.019	Job		\$ 47,422
General Conditions Total				\$ 187,778
Building Direct Cost (materials put in place)				\$ 2,495,876
Gross Total (building direct cost + general conditions)				\$ 2,683,654
<i>Adjustment Factors</i>	Quantity	Unit	Unit Price	Total Cost
PA Sales Tax (6%)	0.06	Job		\$ 161,019
Available work space (-2%)	-0.02	Job		\$ (53,673)
Good GC/CM management (-2%)	-0.02	Job		\$ (53,673)
Location Factor (0.98)	-0.02	Job		\$ (53,673)
				\$ -
<i>*all information in this table is referenced from RSMMeans Building Construction Cost Data 2013</i>				
Building Net Total (building direct cost + general conditions)				\$ 2,683,654

This figure demonstrates the general conditions cost for a pool built during a second phase. The increase in cost is due to remobilizing the construction manager and subcontractors.

PLANCON COST CALCULATION

PlanCon Calculation	
Full time equivalent capacity	875 students
Conversion factor	1.3205
Rated Pupil Capacity	1155 students
Elementary legislated per pupil amount	\$4,700
	$\$4,700 \times 1155 =$
Reimbursable Amount	\$5,428,500
Additional Funding for LEED Silver Certification	\$470
	$\$470 \times 1155 =$
Total Additional Funding for LEED Silver Certification	\$542,850
	$\$5,428,500 + \$542,850 =$
Total Reimbursable Project Cost	\$5,971,350
	$\$5,428,500 / \$17,500,000 =$
Reimbursable Percent	34.12%
Minus 0.5% reduction until final project accounting	33.62%
Reading School District - Market Value Aid Ratio	0.9003
	$\$17,500,000 * 0.3362 * 0.9003 =$
State of Pennsylvania Contribution	\$5,296,915.05

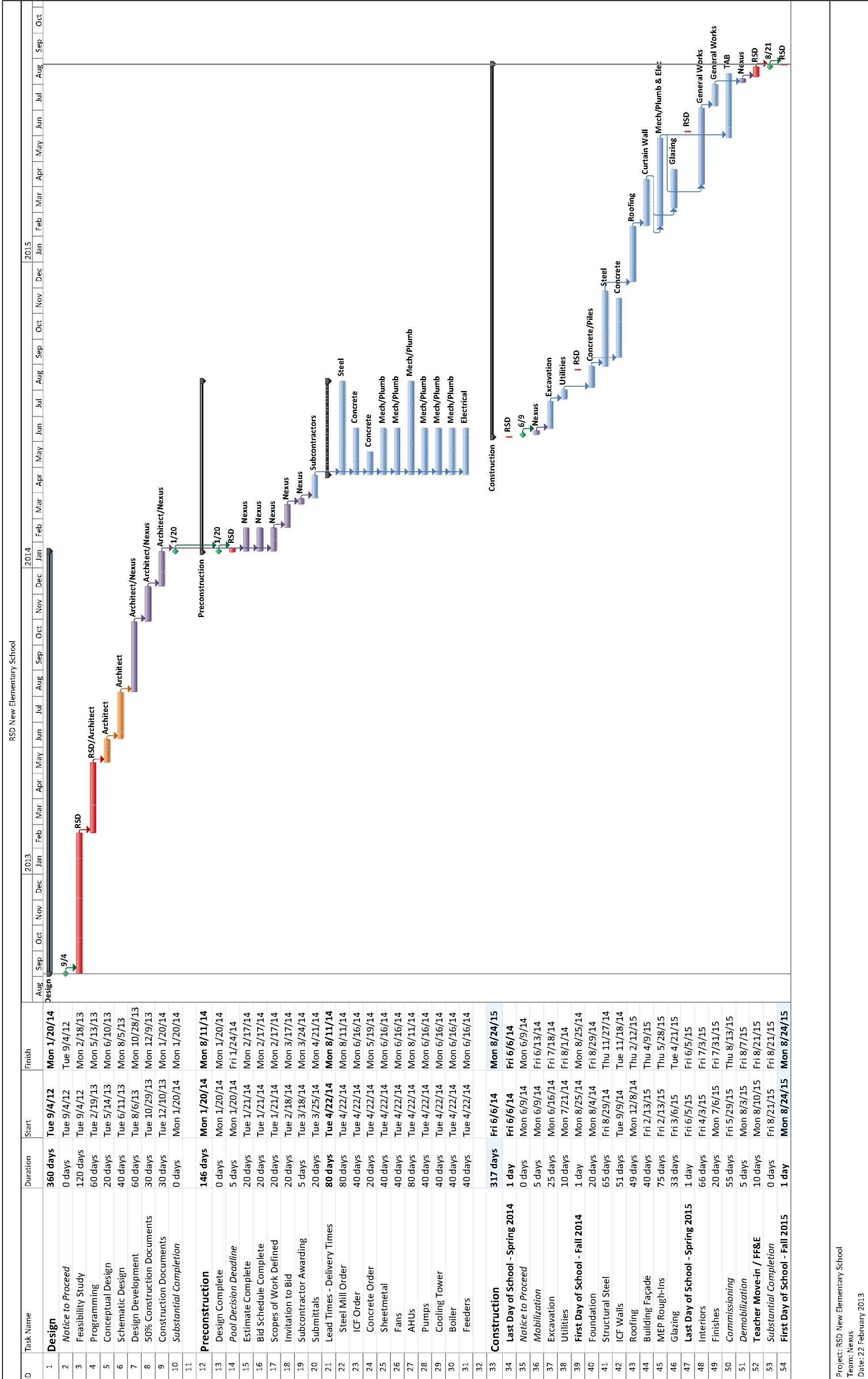
This figure shows calculations of the state funding contributed to the new Reading Elementary school. It is important to note that the number of students was based on a typical class size based on the number of desks shown in a classroom on the first floor plans. Also, based on Nexus' proposed LEED Silver Certification, the school district would be able to obtain an additional \$542,850.

SCOPES OF WORK

- General Works - \$1,800,000
 - metal stud interior partitions; gypsum wallboard; casework; finishes; painting; exterior and interior doors; retractable wall systems in gymnasium and stage
- Concrete - \$2,425,000
 - footers; pile caps / column piers; insulated concrete forms; cast-in-place concrete walls; slab-on-decks; slab-on-grades
- Mechanical and Plumbing - \$4,120,000
 - mechanical equipment and units; sheetmetal; piping; domestic and sanitary piping; diffusers, registers, grilles
- Electrical - \$1,575,000
 - electrical equipment; transformers; switchgear; utility connections; conduit; wiring; fixtures; luminaires
- Data - \$350,000
 - cable trays; data and telecommunication wiring; data and telecommunication devices
- Excavation - \$400,000
 - soil excavation; hauling offsite; disposal of contaminated soil
- Utilities - \$125,000
 - Underground utility runs and connections
- Piles - \$200,000
 - steel-driven piles
- Structural Steel - \$1,275,000
 - structural steel members (HSS columns and lateral bracing); wide-flange girders and beams; joists; trusses; truss braces; metal decking; shear studs
- Roofing - \$700,000
 - built-up white membrane roofing
- Curtain Wall - \$300,000
 - curtain wall elements in classroom spaces; aluminum panel exterior cladding
- Masonry - \$1,400,000
 - concrete masonry unit infill walls; face-brick exterior cladding
- Glazing - \$850,000
 - glazing elements
- Carpet - \$200,000
 - carpet tiles in the classroom spaces
- Flooring - \$300,000
 - finished concrete flooring in corridors and auxiliary spaces; gymnasium hardwood floor; stage floor
- Elevator - \$175,000
 - elevator
- Fire Protection - \$175,000
 - sprinkler piping and heads
- Testing, Adjusting, Balancing - \$80,000
 - mechanical, plumbing, electrical, and fire protection system commissioning

This figure lists the scopes of work as defined by Nexus. This is not meant to be interpreted as a list of subcontractors. However, this list can be used to develop packages for subcontractors to bid towards.

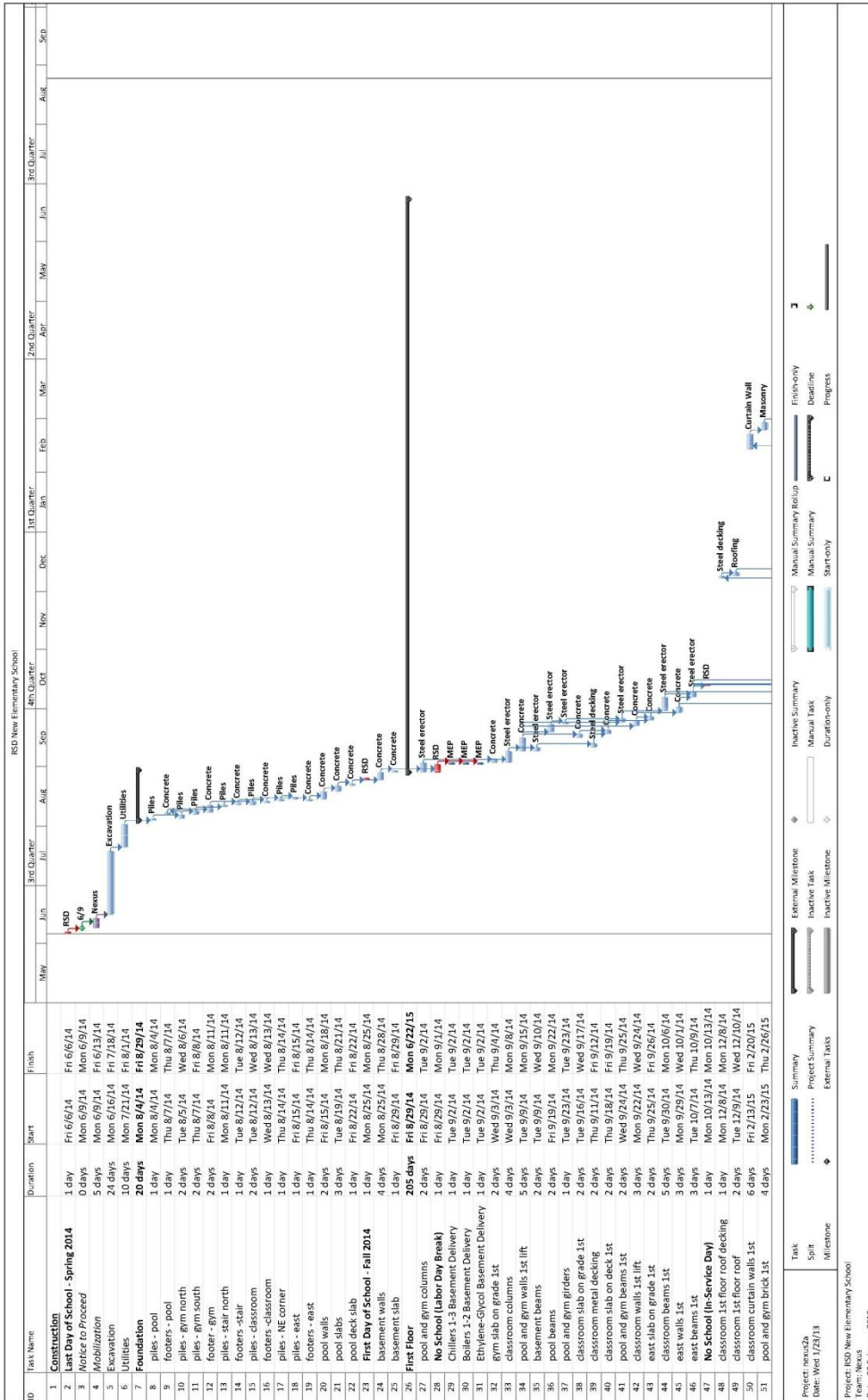
DESIGN, PRECONSTRUCTION, AND CONSTRUCTION MILESTONE SCHEDULE



Project: RSD New Elementary School
 Team: Nexus
 Date: 22 February 2013

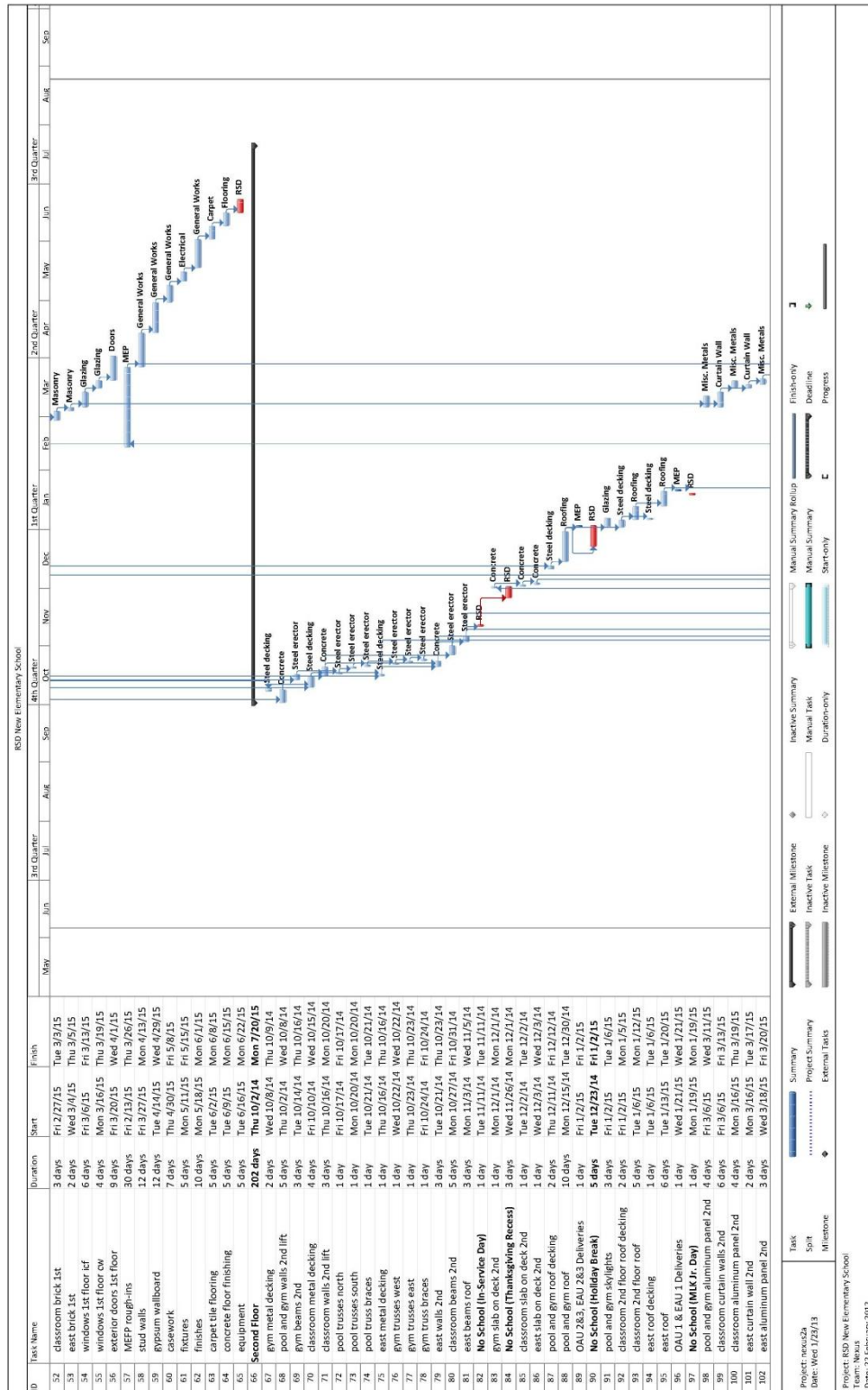
This figure displays a milestone schedule for the project. It is important to note that a design, preconstruction, and construction schedule must be developed to properly plan each phase. The design schedule is largely based on the owner-architect relationship in the planning and design phases. The preconstruction phase involves the owner-architect-constructon manager relationship and eventually the hiring of the subcontractors. Lastly, the construction milestones are listed at the bottom. Nexus has made a point to include all important school dates in their schedule to properly plan for special events both on site and at the existing elementary school.

DETAILED CONSTRUCTION SCHEDULE



This schedule shows the first phases of construction. The excavation is followed by utility work along with concrete and steel foundation work. Next, the first floor structure begins.

DETAILED COONSTRUCTION SCHEDULE CONT.



For clarity, this three page schedule is broken up by floor level. Sequencing the activities this way allows all subcontractors space to work without conflicts.

LEED CHECKLIST

LEED 2009 for Schools New Construction and Major Renovations				Project Name
Project Checklist				Date
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Sustainable Sites	Possible Points: 24	
<input type="checkbox"/> Y ? N	Prereq 1	Construction Activity Pollution Prevention		
<input type="checkbox"/> Y	Prereq 2	Environmental Site Assessment		
<input type="checkbox"/> Y	Credit 1	Site Selection	1	
<input type="checkbox"/> <input type="checkbox"/> N	Credit 2	Development Density and Community Connectivity	4	
<input type="checkbox"/> <input type="checkbox"/> N	Credit 3	Brownfield Redevelopment	4	
<input type="checkbox"/> Y	Credit 4.1	Alternative Transportation—Public Transportation Access	1	
<input type="checkbox"/> Y	Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1	
<input type="checkbox"/> Y	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	2	
<input type="checkbox"/> Y	Credit 4.4	Alternative Transportation—Parking Capacity	2	
<input type="checkbox"/> Y	Credit 5.1	Site Development—Protect or Restore Habitat	1	
<input type="checkbox"/> Y	Credit 5.2	Site Development—Maximize Open Space	1	
<input type="checkbox"/> Y	Credit 6.1	Stormwater Design—Quantity Control	1	
<input type="checkbox"/> <input type="checkbox"/> N	Credit 6.2	Stormwater Design—Quality Control	1	
<input type="checkbox"/> Y	Credit 7.1	Heat Island Effect—Non-roof	1	
<input type="checkbox"/> Y	Credit 7.2	Heat Island Effect—Roof	1	
<input type="checkbox"/> Y	Credit 8	Light Pollution Reduction	1	
<input type="checkbox"/> Y	Credit 9	Site Master Plan	1	
<input type="checkbox"/> Y	Credit 10	Joint Use of Facilities	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Water Efficiency	Possible Points: 11	
<input type="checkbox"/> Y	Prereq 1	Water Use Reduction—20% Reduction		
<input type="checkbox"/> Y	Credit 1	Water Efficient Landscaping	2 to 4	
<input type="checkbox"/> Y	Credit 2	Innovative Wastewater Technologies	2	
<input type="checkbox"/> Y	Credit 3	Water Use Reduction	2 to 4	
<input type="checkbox"/> Y	Credit 3	Process Water Use Reduction	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Energy and Atmosphere	Possible Points: 33	
<input type="checkbox"/> Y	Prereq 1	Fundamental Commissioning of Building Energy Systems		
<input type="checkbox"/> Y	Prereq 2	Minimum Energy Performance		
<input type="checkbox"/> Y	Prereq 3	Fundamental Refrigerant Management		
<input type="checkbox"/> Y	Credit 1	Optimize Energy Performance	1 to 19	
<input type="checkbox"/> <input type="checkbox"/> N	Credit 2	On-Site Renewable Energy	1 to 7	
<input type="checkbox"/> Y	Credit 3	Enhanced Commissioning	2	
<input type="checkbox"/> Y	Credit 4	Enhanced Refrigerant Management	1	
<input type="checkbox"/> Y	Credit 5	Measurement and Verification	2	
<input type="checkbox"/> <input type="checkbox"/> N	Credit 6	Green Power	2	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Materials and Resources	Possible Points: 13	
<input type="checkbox"/> Y	Prereq 1	Storage and Collection of Recyclables		
<input type="checkbox"/> <input type="checkbox"/> N	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 2	
<input type="checkbox"/> <input type="checkbox"/> N	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1	
<input type="checkbox"/> Y	Credit 2	Construction Waste Management	1 to 2	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Materials and Resources, Continued		
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 3	Materials Reuse	1 to 2	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 4	Recycled Content	1 to 2	
<input type="checkbox"/> Y	Credit 5	Regional Materials	1 to 2	
<input type="checkbox"/> Y	Credit 6	Rapidly Renewable Materials	1	
<input type="checkbox"/> Y	Credit 7	Certified Wood	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Indoor Environmental Quality	Possible Points: 19	
<input type="checkbox"/> Y	Prereq 1	Minimum Indoor Air Quality Performance		
<input type="checkbox"/> Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control		
<input type="checkbox"/> Y	Prereq 3	Minimum Acoustical Performance		
<input type="checkbox"/> Y	Credit 1	Outdoor Air Delivery Monitoring	1	
<input type="checkbox"/> Y	Credit 2	Increased Ventilation	1	
<input type="checkbox"/> Y	Credit 3.1	Construction IAQ Management Plan—During Construction	1	
<input type="checkbox"/> Y	Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1	
<input type="checkbox"/> Y	Credit 4	Low-Emitting Materials	1 to 4	
<input type="checkbox"/> Y	Credit 5	Indoor Chemical and Pollutant Source Control	1	
<input type="checkbox"/> <input type="checkbox"/> N	Credit 6.1	Controllability of Systems—Lighting	1	
<input type="checkbox"/> <input type="checkbox"/> N	Credit 6.2	Controllability of Systems—Thermal Comfort	1	
<input type="checkbox"/> Y	Credit 7.1	Thermal Comfort—Design	1	
<input type="checkbox"/> Y	Credit 7.2	Thermal Comfort—Verification	1	
<input type="checkbox"/> Y	Credit 8.1	Daylight and Views—Daylight	1 to 3	
<input type="checkbox"/> Y	Credit 8.2	Daylight and Views—Views	1	
<input type="checkbox"/> Y	Credit 9	Enhanced Acoustical Performance	1	
<input type="checkbox"/> Y	Credit 10	Mold Prevention	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Innovation and Design Process	Possible Points: 6	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 1.1	Innovation in Design: Specific Title	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 1.2	Innovation in Design: Specific Title	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 1.3	Innovation in Design: Specific Title	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 1.4	Innovation in Design: Specific Title	1	
<input type="checkbox"/> Y	Credit 2	LEED Accredited Professional	1	
<input type="checkbox"/> Y	Credit 3	The School as a Teaching Tool	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Regional Priority Credits	Possible Points: 4	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 1.1	Regional Priority: Specific Credit	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 1.2	Regional Priority: Specific Credit	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 1.3	Regional Priority: Specific Credit	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> N	Credit 1.4	Regional Priority: Specific Credit	1	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Total	Possible Points: 110	
				Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

This table is the LEED Checklist as developed by Nexus. It is proposed that the new school building will reach LEED Silver Certification. This is based on site analysis, materials and resources analysis, and innovation analysis by the construction managers. The mechanical engineers performed water efficiency, energy and atmosphere, and indoor environmental quality analyses.

STRUCTURAL STEEL CRANE PICKS

Structural Steel Members			
<i>Member</i>	<i>(ft)</i>	<i>(lbs)</i>	<i>Type</i>
60DLH18	84	1512	Pool roof truss
40LH15	60	900	Gym roof truss
W18X46	42	1932	Typical floor beam
W24x68	42	2856	Largest girder
W18X35	35	1225	Typical east wing floor beam
W18X40	42	1680	Typical roof beam
W12X87	42	3654	Typical column
HSS6X6X1/2	20.5	718	Typical brace member

This table lists the longest structural members of each size utilized throughout the building. As noticed, there are eight typical steel sizes. This helps reduce complications and confusion in the field while erecting the steel.

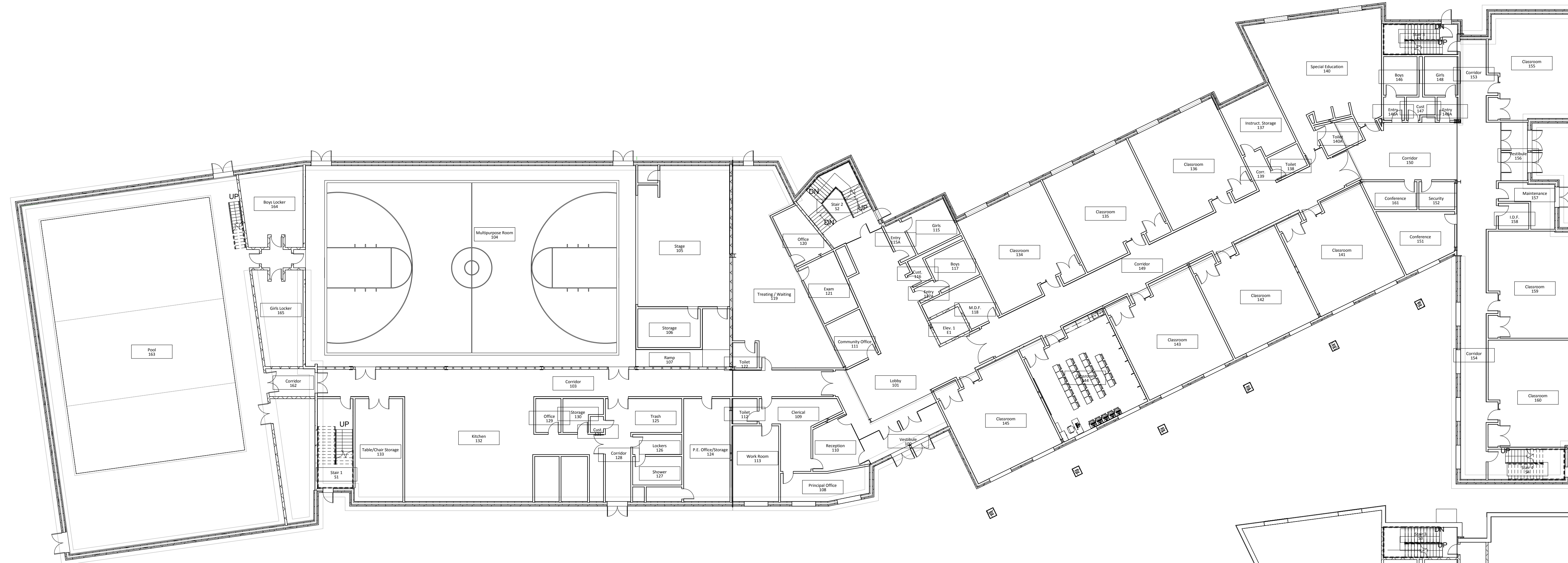
REFERENCES

1. PlanCon data from the Commonwealth of Pennsylvania (2012) <http://www.portal.state.pa.us/portal/server.pt/community/reimbursable_projects/7463#CALCULATIONOF>
2. PA crime rates (2010) <<http://www.cityrating.com/crime-statistics/pennsylvania/reading.html#.UQAdifUrMtg>>
3. The Commonwealth Foundation (2011) <http://www.openpagov.org/education_revenue_and_expenses.asp>



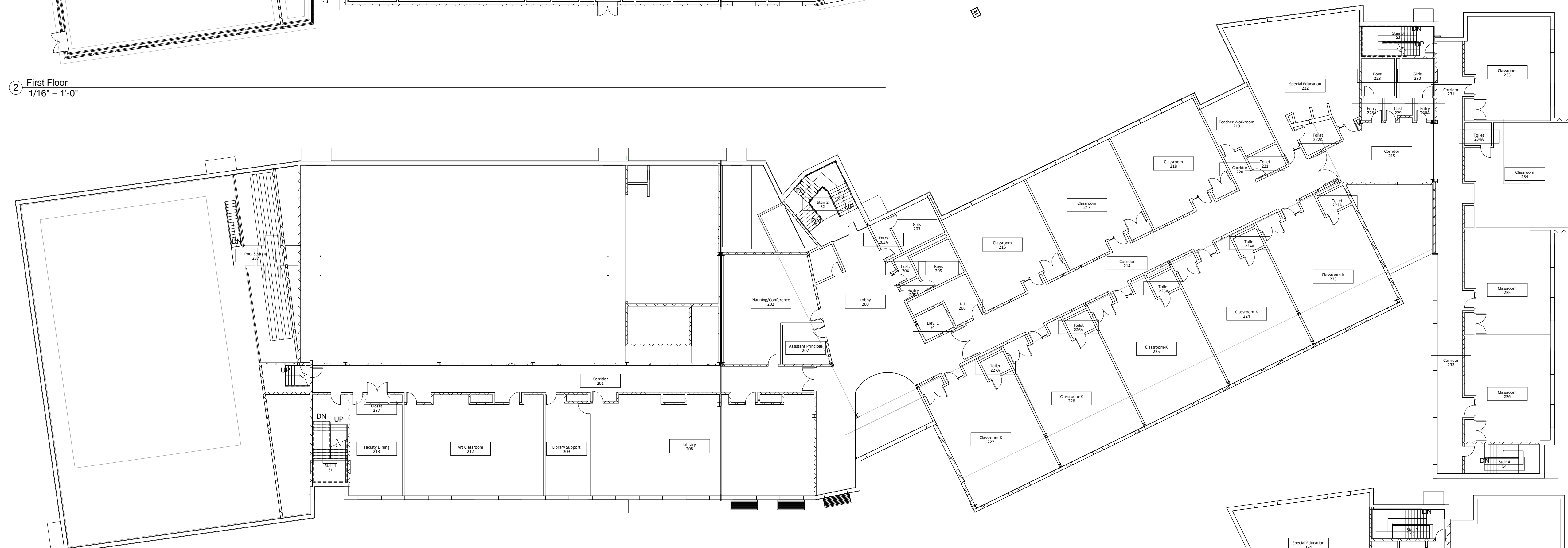
CONSTRUCTION MANAGEMENT

2013 ASCE Charles Pankow Foundation Annual Architectural Student Competition



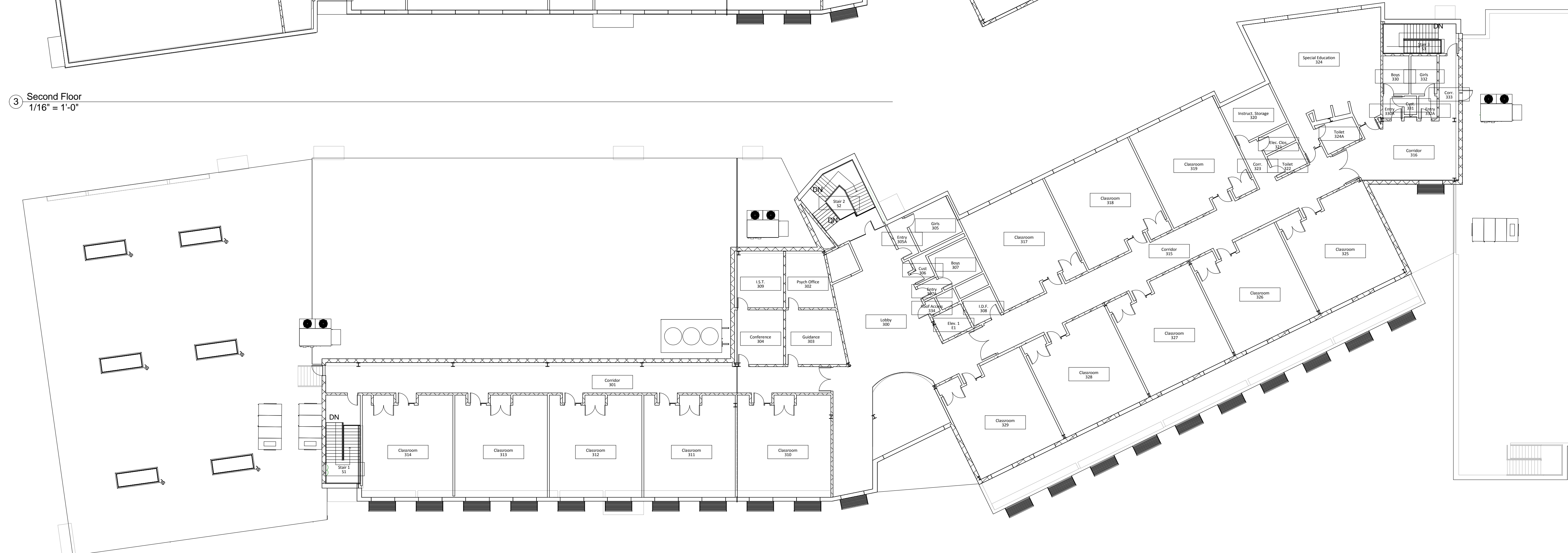
2 First Floor
1/16" = 1'-0"

The first floor plan displays spaces for all different functions of the school. After entering the school through the main entrance on the South side of the school building, the secure main office is located to the left from the vestibule. Then, a student enters the lobby where they have access to the community spaces to the west and access to the academic spaces to the right. The 24-hour health center can also be accessed from the lobby. A typical classroom layout is shown in Room 144. Also shown on this plan is the pool and locker room layout that connects to the multipurpose room. Auxiliary spaces such as the kitchen and custodial room are on this level.



3 Second Floor
1/16" = 1'-0"

The second floor plan displays more classrooms, including special education rooms. Moreover, the library and art rooms along with the teacher's lounge are located in the west wing of this level. Six kindergarten rooms are located on this level. Each of the kindergarten rooms contains an individual restroom and a larger floor area. This larger floor area cantilevers over the first floor exterior walls in each of the six kindergarten rooms.



1 Third Floor
1/16" = 1'-0"

The third floor plan shows the remainder of the classroom spaces. Moreover, there is roof access to the east and west roofs. Lastly, the six pool skylights are shown. These skylights enhance the daylighting aspect in the pool space.

Team Registration Number:
02-2013

Architectural Floor Plans

Date 22 February 2013

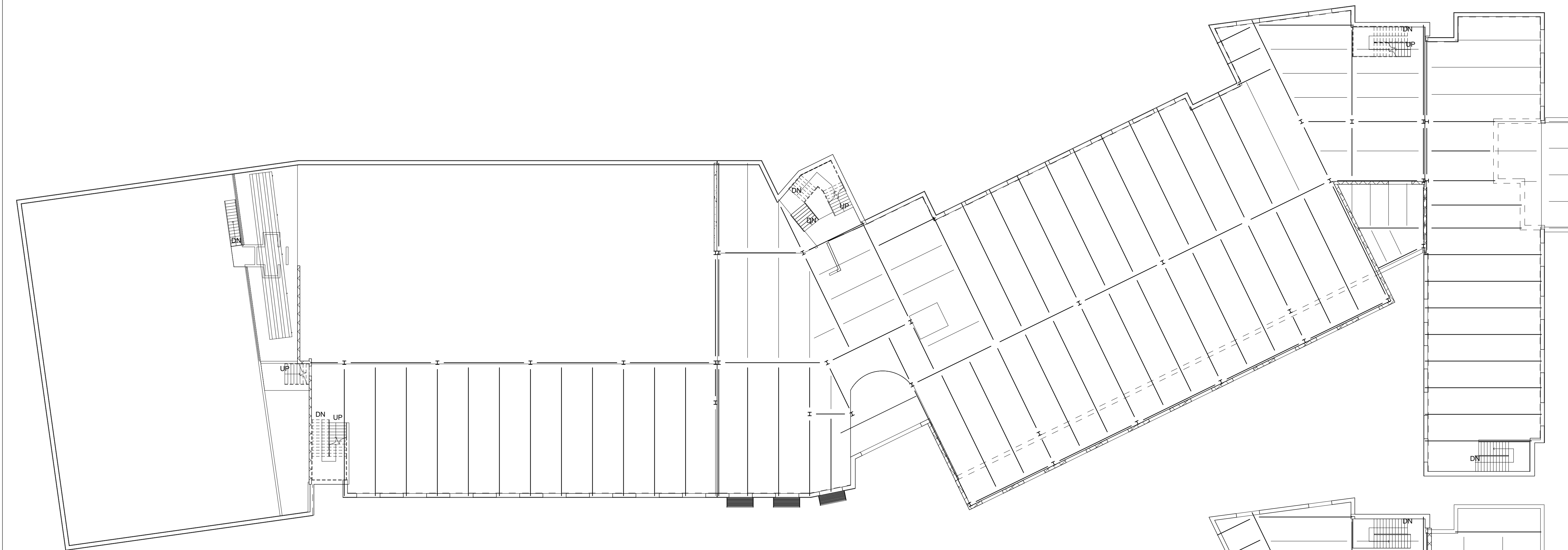
36

Scale 1/16" = 1'-0"



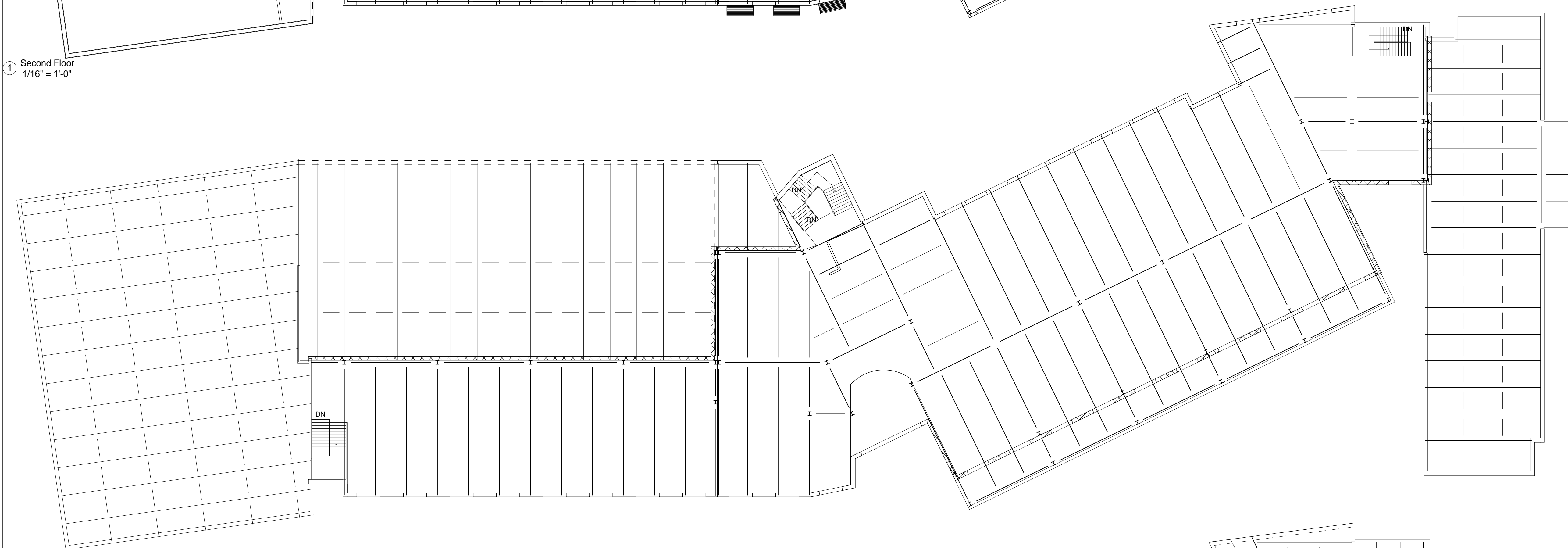
CONSTRUCTION MANAGEMENT

2013 ASCE Charles Pankow Foundation Annual Architectural Engineering Student Competition



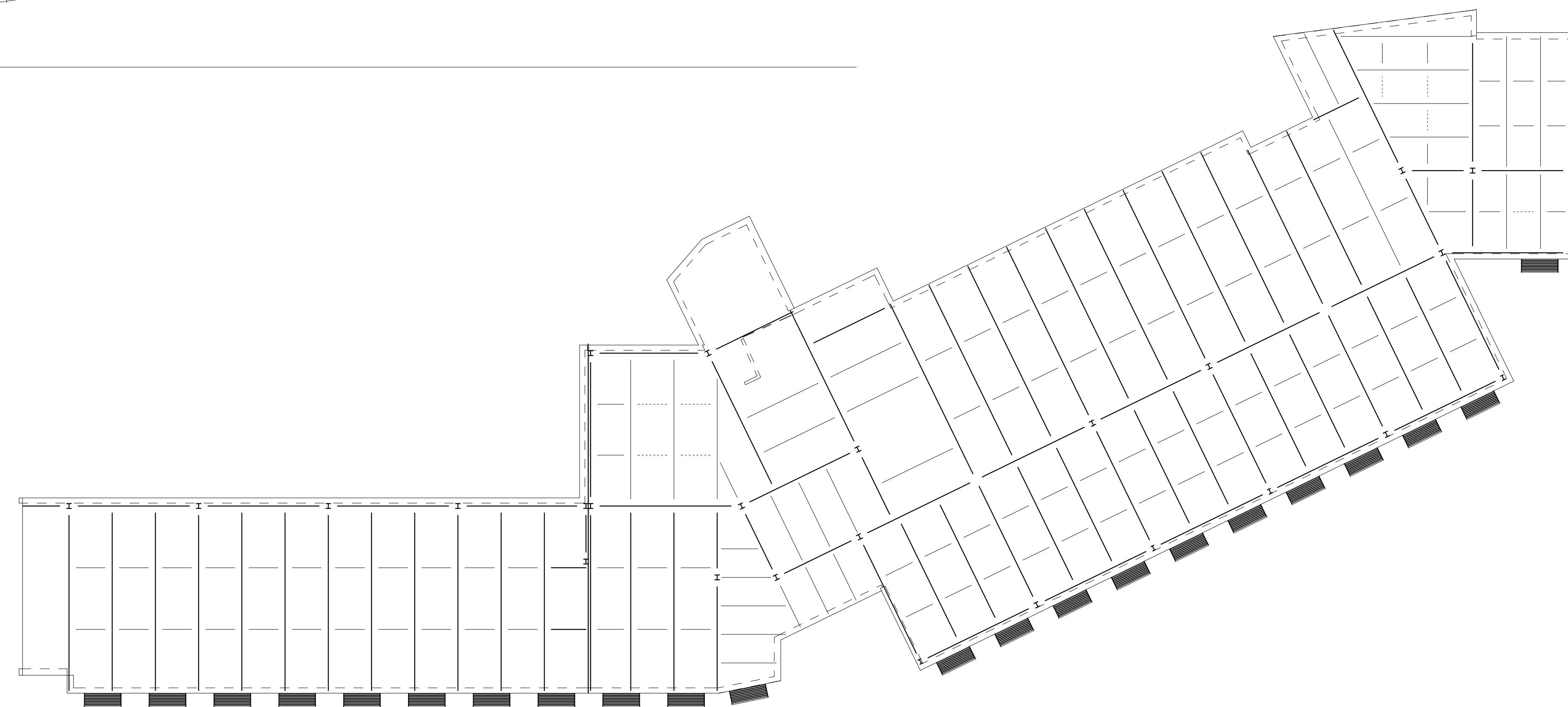
1 Second Floor
1/16" = 1'-0"

The second floor structural floor plan is an adequate representation of the steel structure integrated into the insulated concrete walls (ICFs). In the central classroom wing, the girder run to the exterior brick-encased columns to support the kindergarten classrooms. In nearly all cases, the beams sit in beam pockets in the ICF walls for support. There are two concrete shear walls in the center classroom section as well, to help with lateral support.



2 Third Floor
1/16" = 1'-0"

The third floor structural floor plan is also an adequate representation of the steel structure. However, the pool and multipurpose room trusses are also visible. The pool trusses are five feet in depth and evenly spaced at 8'-6" on center. The pool trusses are between 74 and 83 feet in length and run east to west and have cross bracing in the other direction. The multipurpose room trusses are 40" deep and evenly spaced 8'-0" on center. These trusses are 60 feet in length and run north to south and also have cross bracing in the other direction. The multipurpose room roof is not just metal decking with roofing membrane; rather, it has concrete on the metal decking since the multipurpose room is able to function as a shelter in the event of an emergency.



3 Roof
1/16" = 1'-0"

The roof structural floor plan is a slight variant to the steel and ICF structure. The roof beams that run in the general north-south direction are braced to be able to support snow load. The beams mirror the floors below, one on each edge of the classrooms and two in the middle. Despite the middle two beams resting on the ICF wall above the windows, the concrete is still able to properly distribute the load without compromising the window's integrity.

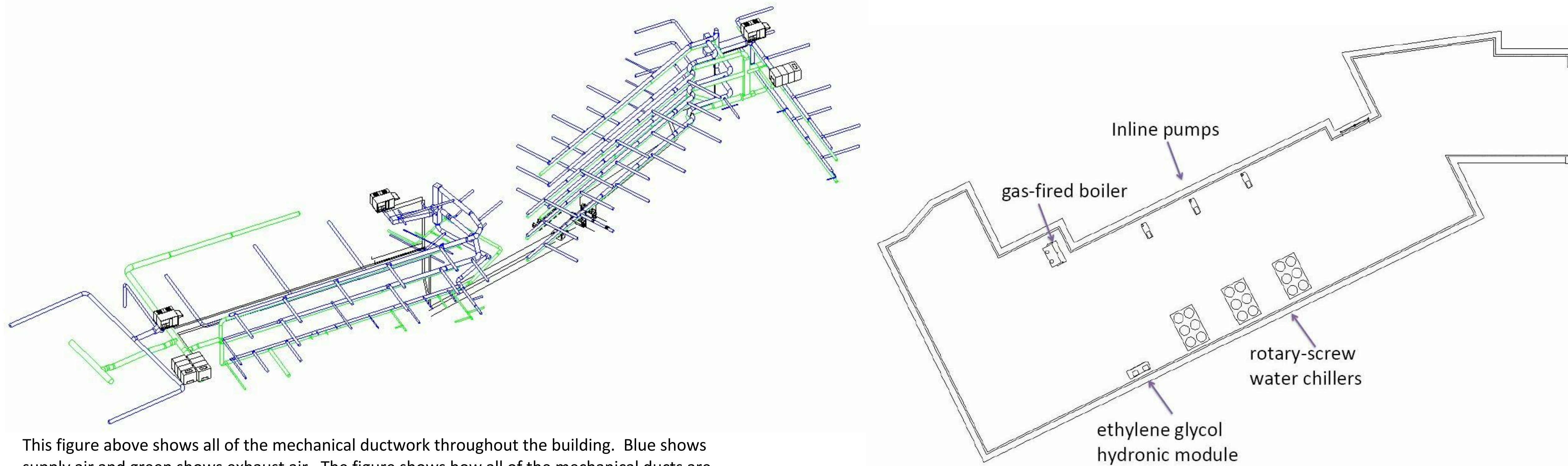
Team Registration Number:
02-2013

Structural Floor Plans

Date 22 February 2013

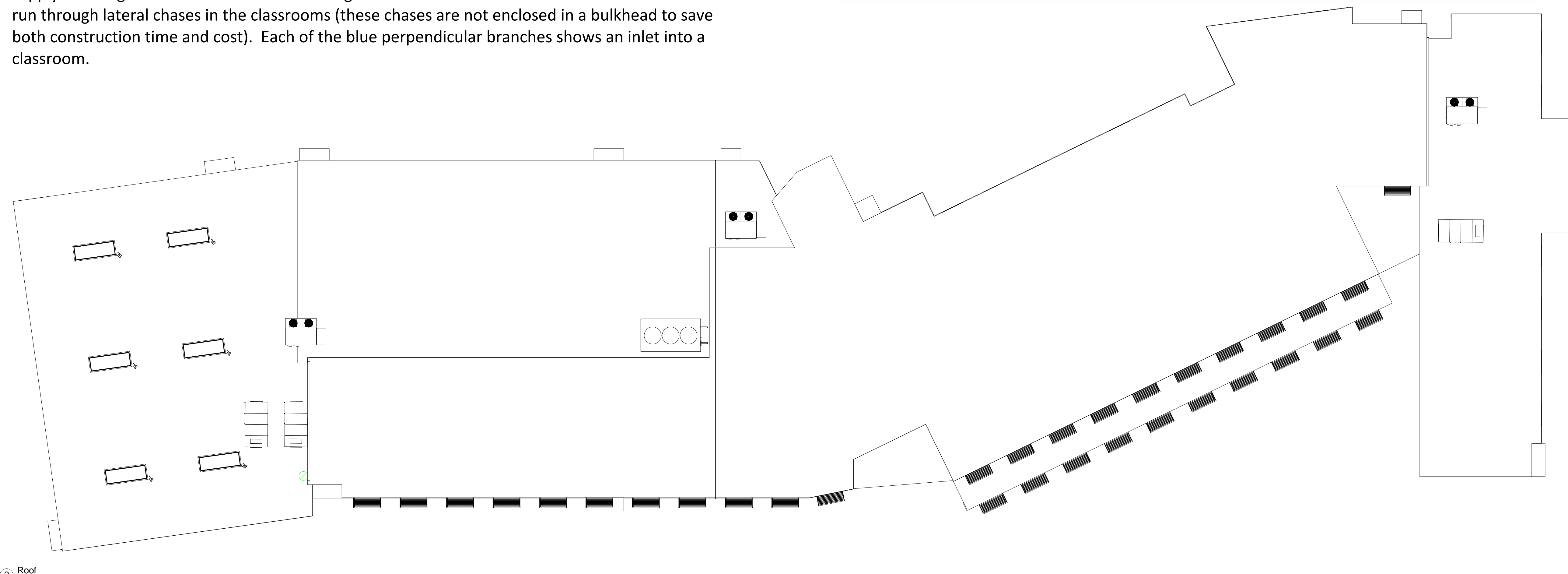
37

Scale 1/16" = 1'-0"



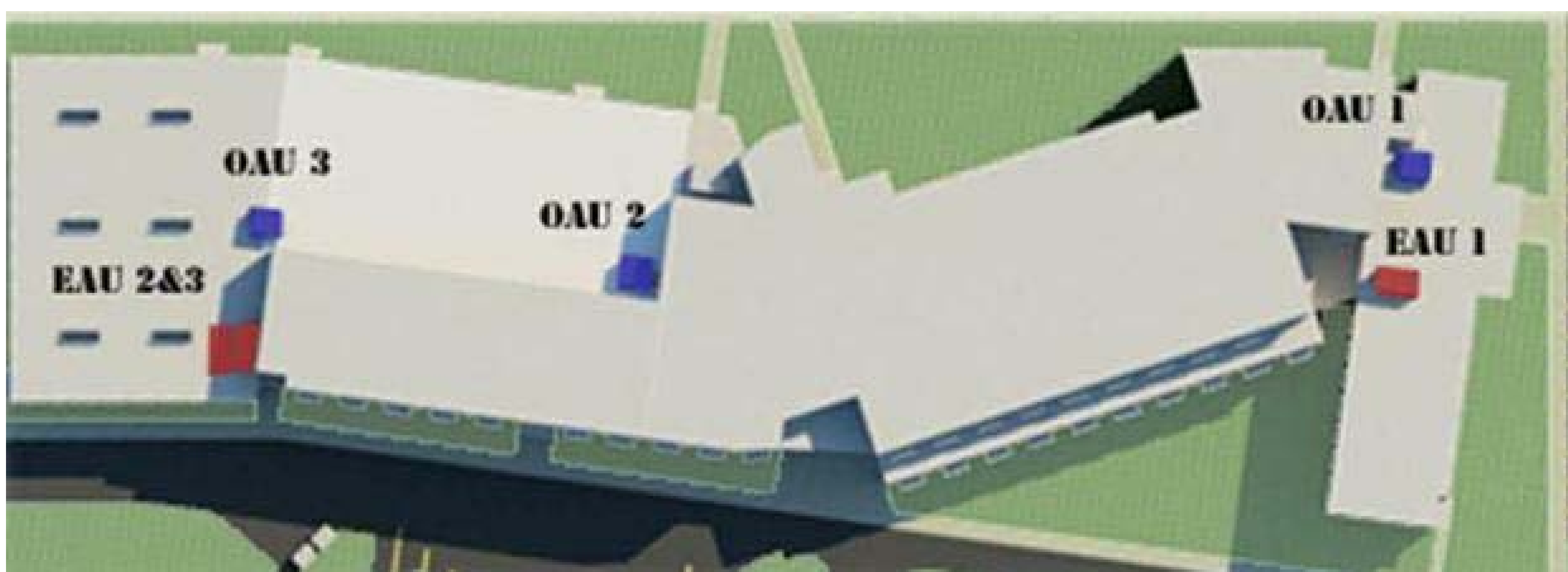
The mechanical basement floor plan shown to the left depicts what equipment is located in the basement. The gas-fired boiler, inline pumps, rotary-screw water chillers, and ethylene glycol hydronic module are all located in the basement. These pieces of equipment serve to pump domestic water throughout the building, heat and cool the air, and recover heat from exhaust air.

This figure above shows all of the mechanical ductwork throughout the building. Blue shows supply air and green shows exhaust air. The figure shows how all of the mechanical ducts are run through lateral chases in the classrooms (these chases are not enclosed in a bulkhead to save both construction time and cost). Each of the blue perpendicular branches shows an inlet into a classroom.



The mechanical roof plan shows where the outdoor air units and exhaust air units are located. As seen in the annotated rendering in the bottom left corner, the units are all labeled. A mechanical equipment schedule listing all of the units, their capacity, and weight is listed in the bottom right corner of this sheet. It is important to note the weight of the units, as compared to typical steel member weights on Drawing Sheet 39. The cooling tower will be the heaviest crane pick for the entire project.

2 - Roof
1/16" = 1'-0"



Mechanical Equipment				
Unit #	Equipment	Description	Capacity	Weight
1	Chiller-1	Rotary-Screw Water Chiller	60 Tons	3,641 lb
2	Chiller-2	Rotary-Screw Water Chiller	60 Tons	3,641 lb
3	Chiller-3	Rotary-Screw Water Chiller	60 Tons	3,641 lb
4	Cooling Tower	Axial Fan, Induced Draft	175 Tons	4,890 lb
5	Boiler-1	Gas-Fired Boiler	800 MBh	2,774 lb
6	Boiler-2 (Pool)	Gas-Fired Boiler	350 MBh	1,411 lb
7	OAU-1	Dedicated Outdoor Air	38,000 CFM	3,830 lb
8	OAU-2	Dedicated Outdoor Air	27,000 CFM	2,980 lb
9	OAU-3 (Pool)	Dedicated Outdoor Air	8,000 CFM	750 lb
10	EAU-1	Exhaust Air Unit	34,500 CFM	2,875 lb
11	EAU-2	Exhaust Air Unit	24,500 CFM	2,235 lb
12	EAU-3 (Pool)	Exhaust Air Unit	9,000 CFM	565 lb

Team Registration Number:
02-2013

Mechanical Floor Plans

Date: 22 February 2013

38

Scale: 1/16" = 1'-0"

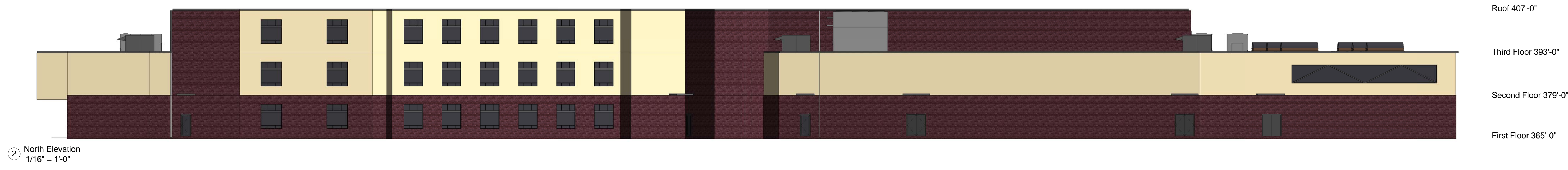


Figure 3 displays the East facade of the school building. The doors seen on the first floor are for emergency exit only. The door seen on the third floor leading to the roof is for access to perform maintenance on the mechanical equipment.

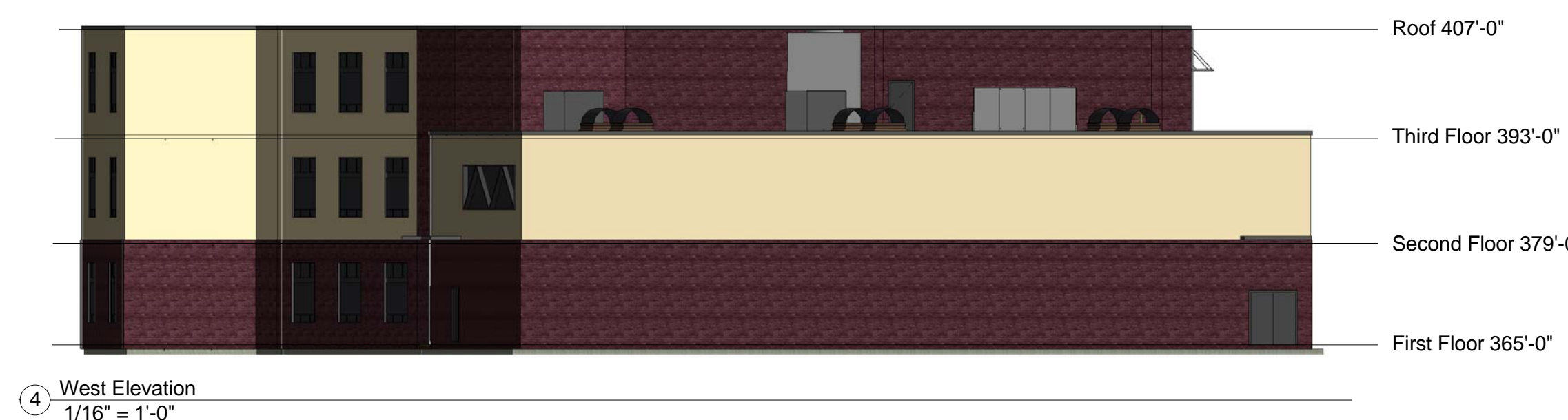


Figure 4 displays the West facade of the school building. The doors seen on the first floor (right side of the image) are emergency exits from the pool. The door seen on the third floor is for access to perform maintenance on the mechanical equipment above the gymnasium.

Figure 1 shows the South facade of the school building. The main entrance is in the center of the image with two sets of double doors. The auxiliary doors to the left are emergency exits from the kitchen area (double doors). The door to the far left acts as an emergency exit during the school day and the visitor entrance to the gymnasium and pool after school hours.

Figure 2 shows the North facade of the school building. The main entrance used to be on this side of the school, but with safety as the top priority and a busy road along this side, the main entrance was moved to the opposite (South) facade. The left emergency exit door is from the northeast stairwell. The health center entrance is also in this view. The next two sets of double doors are emergency exits from the gymnasium. The last set of double doors is an emergency exit from the pool.



This image shows the East facade of the school building. The view looks down the bus lane from the traffic exit. Additionally, the teacher's parking lot is seen in the foreground while the existing school is in the background.



This image from a student's perspective riding the bus to school. This is the bus lane entrance on the West side of campus. The yellow security balusters are shown in this view (however, they would be lowered during the morning and afternoon bus times). These balusters will be raised during the school day as explained in the traffic plan and safety sections of the report. The pool is behind the wall seen to the left (with an emergency exit in the foreground).



This image shows the South facade of the school building. The view is taken from the auxiliary parking lot to the West of the playing field. The main entrance is visible in the background to the left.

Team Registration Number:
02-2013

Building Elevations and Exterior Views

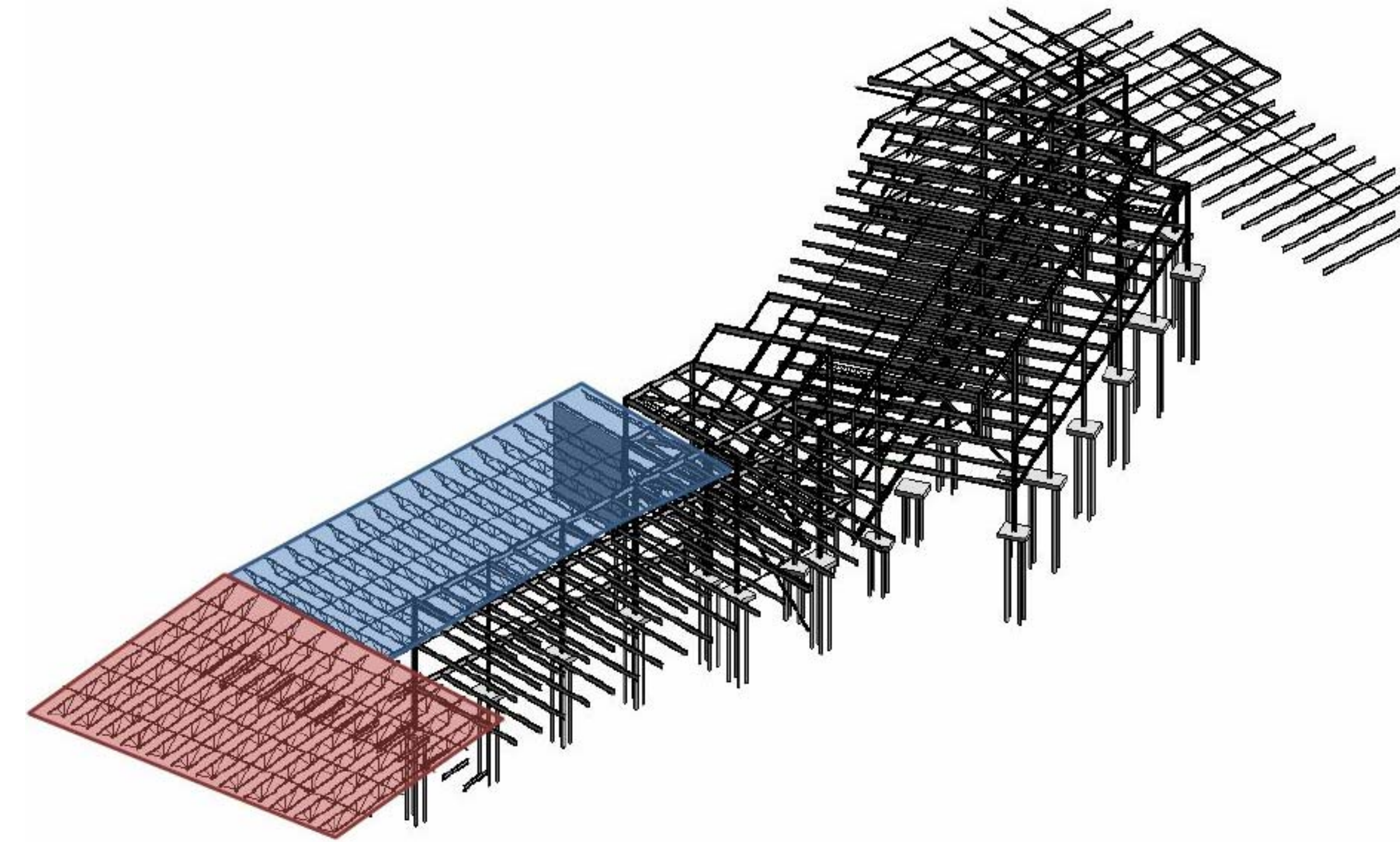
Date 22 February 2013

39

Scale 1/16" = 1'-0"

Structural Steel Members			
Member	(ft)	(lbs)	Type
60DLH18	84	1512	Pool roof truss
40LH15	60	900	Gym roof truss
W18X46	42	1932	Typical floor beam
W24x68	42	2856	Largest girder
W18X35	35	1225	Typical east wing floor beam
W18X40	42	1680	Typical roof beam
W12X87	42	3654	Typical column
HSS6X6X1/2	20.5	718	Typical brace member

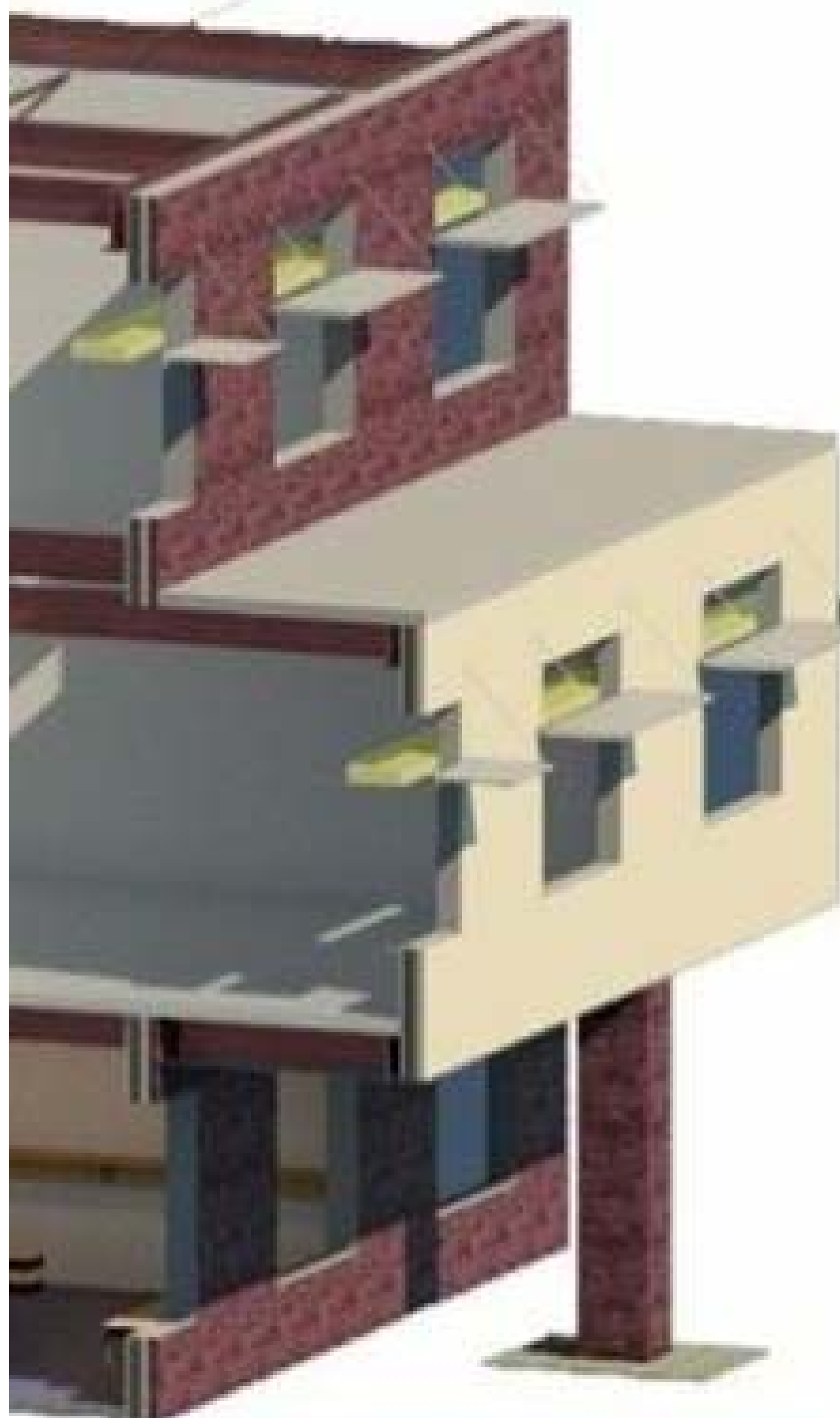
The table above lists the typical sizes of steel members throughout the school building. These members are typical girders, floor and roof beams, and pool and multipurpose room trusses. The heaviest members are the interior columns, while the longest crane picks will be for the northern pool trusses and multipurpose room trusses. The pool trusses are highlighted in red and the multipurpose room trusses are highlighted in blue.



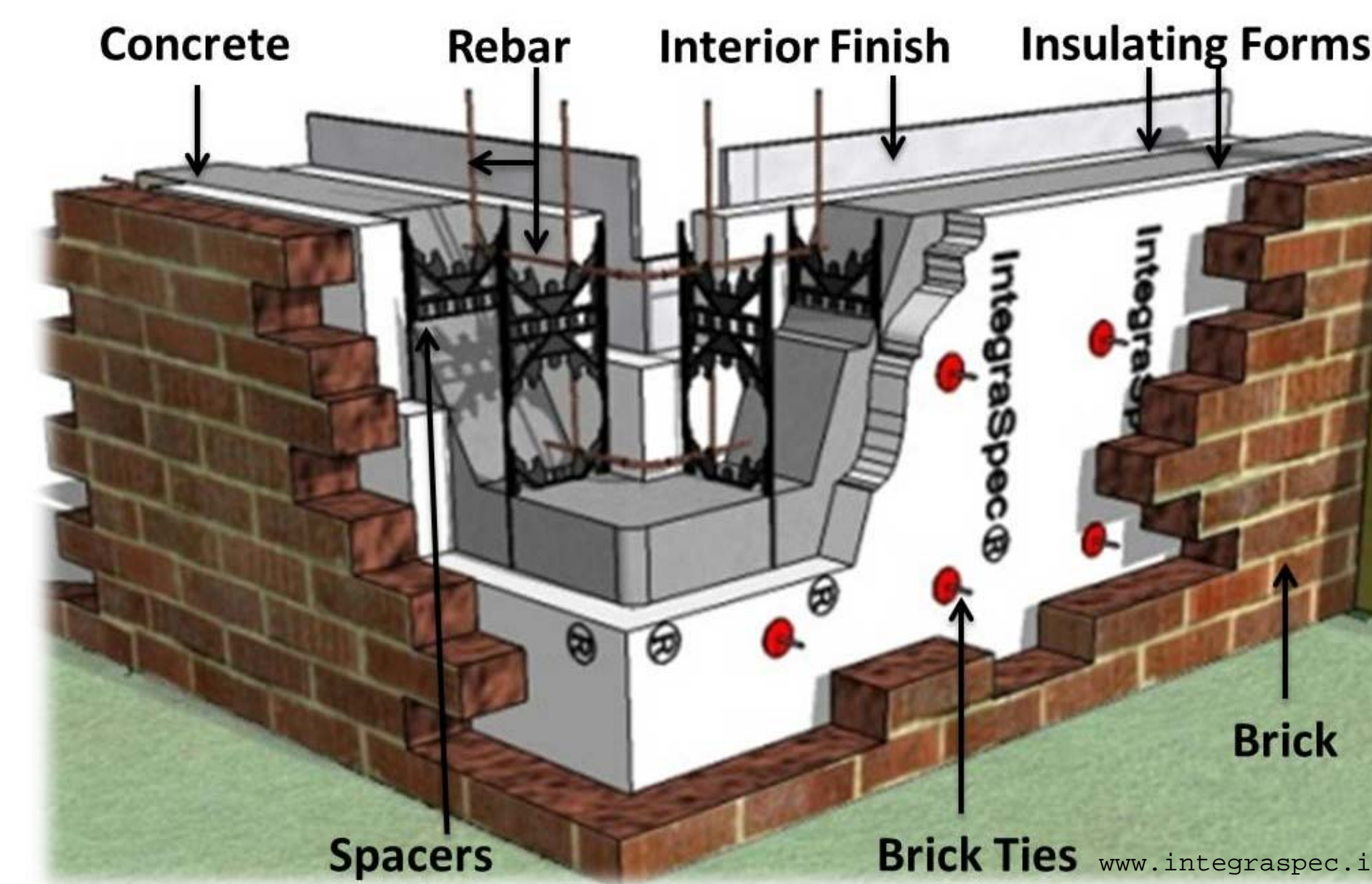
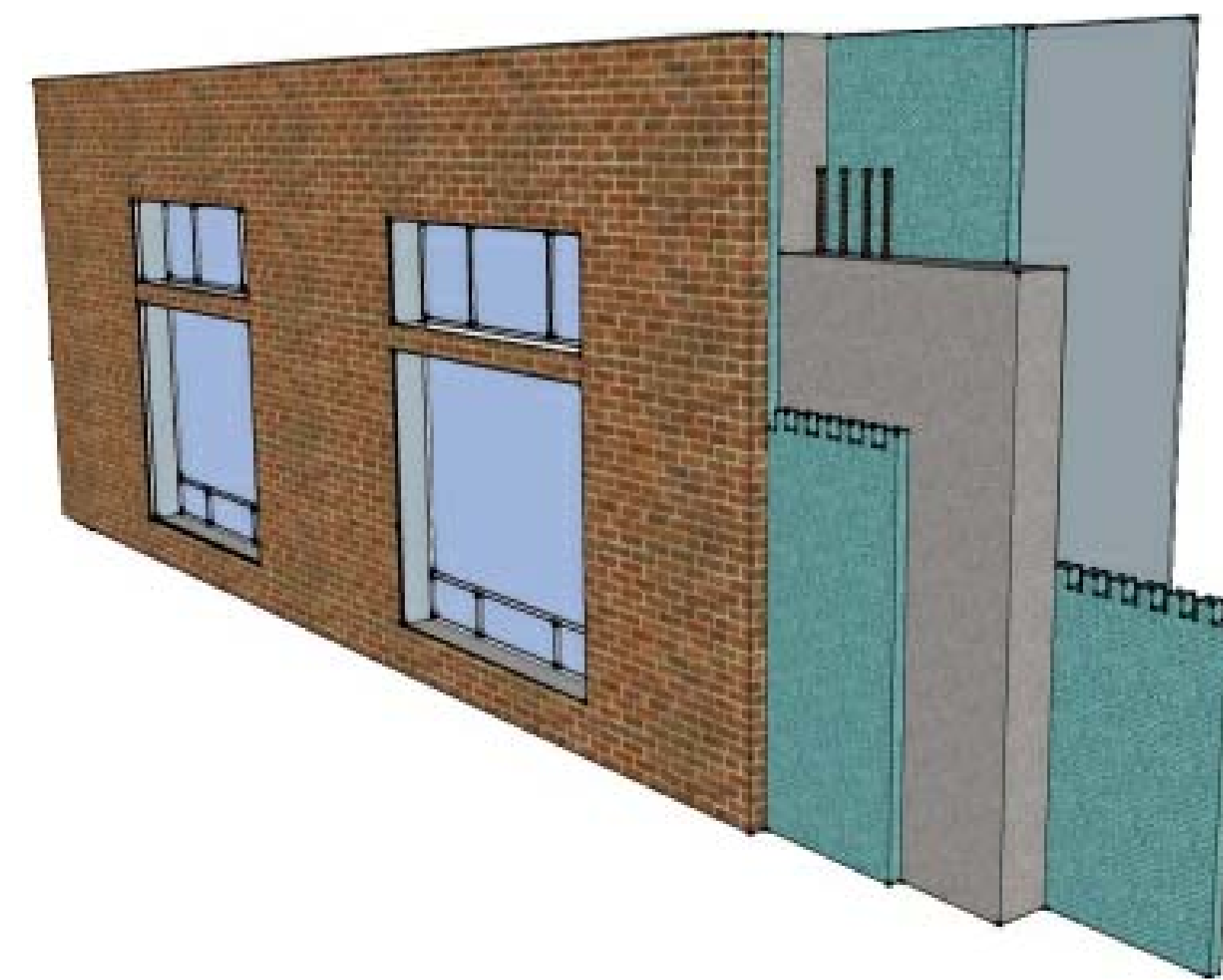
The two images below are depictions of the insulated concrete form walls (ICFs). The ICFs act as exterior bearing walls for the structural system. As discussed on Drawing Sheet 38, the steel structure is integral into the ICFs where the beams sit in beam pockets in the exterior walls.

These concrete walls will be constructed ahead of the steel erection sequence to maintain the construction schedule. The walls will first need to be formed with the insulated panels, braced, and then concrete poured. The walls will be poured in one-floor lifts to allow the crane to easily reach over and place steel members that connect to the interior columns and rest on the ICF walls.

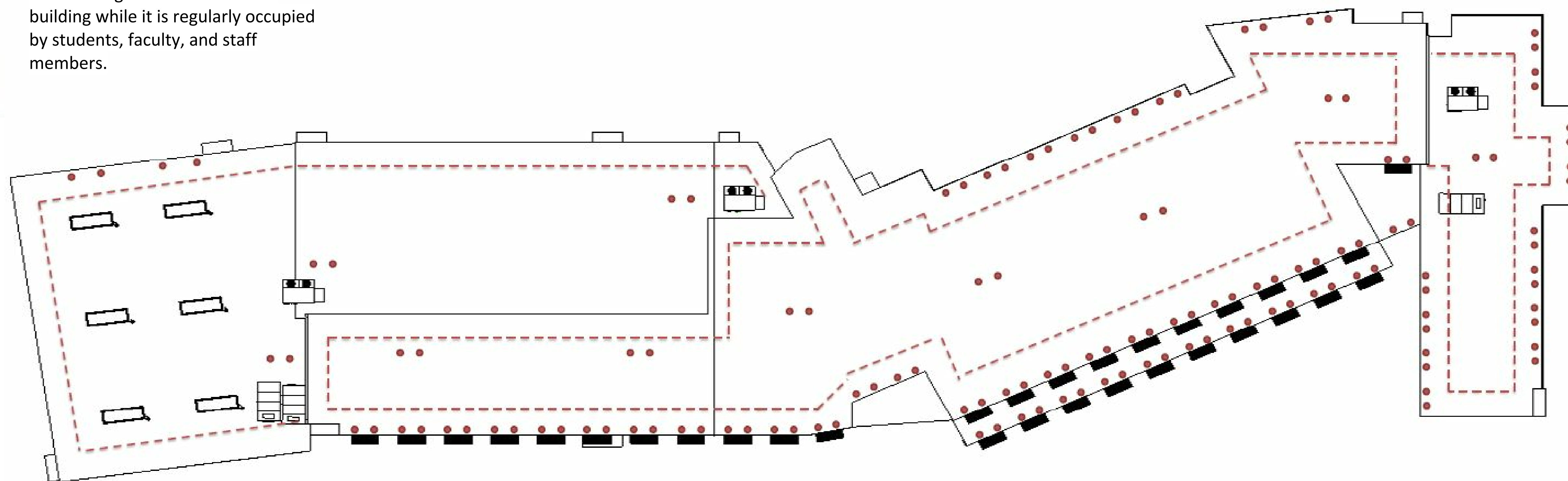
To maintain structural integrity, the walls are reinforced as shown in the middle right figure. Moreover, the insulated panels remain in place to provide thermal insulation that helps with the mechanical system efficiency.



The figure to the left illustrates the exterior window louvers and interior lightshelves. The exterior window louvers will have two dowels that attach (bolt into) to the brick or metal panel facade after the exterior envelope is installed. This process will begin immediately after the brick and metal panels are installed to maintain the construction schedule. Scaffolding will be required for this process. Next, the interior lightshelves will be installed while the interior walls are being framed with metal studs. These lightshelves help direct sunlight that enters the top one foot of the window into deeper interior spaces of the classrooms. Then, the lightshelves will be clad with gypsum wallboard and painted with a reflective paint to help direct the sunlight. These exterior louvers and lightshelves are only placed on the south facade as that will be the only direction in which direct sunlight enters the school building while it is regularly occupied by students, faculty, and staff members.



The roof plan shown to the right has red circles on it that represent the roof davits. Roof davits are tie-off anchoring points for workers on the roof when they come within 15 feet of the edge (indicated with red dotted line). When outside the fifteen foot perimeter, all maintenance workers must be tied-off in case they were to fall off of the roof, their harness would prevent them from falling to the ground. These davits will mainly be used while window washing. The davits also have the capacity to anchor window washing equipment hoists. There are also intermediate interior davits for tie-off points when workers determine the workspace is unsafe to not be tied-off. There are davits located next to all mechanical equipment pieces for worker safety during maintenance procedures.



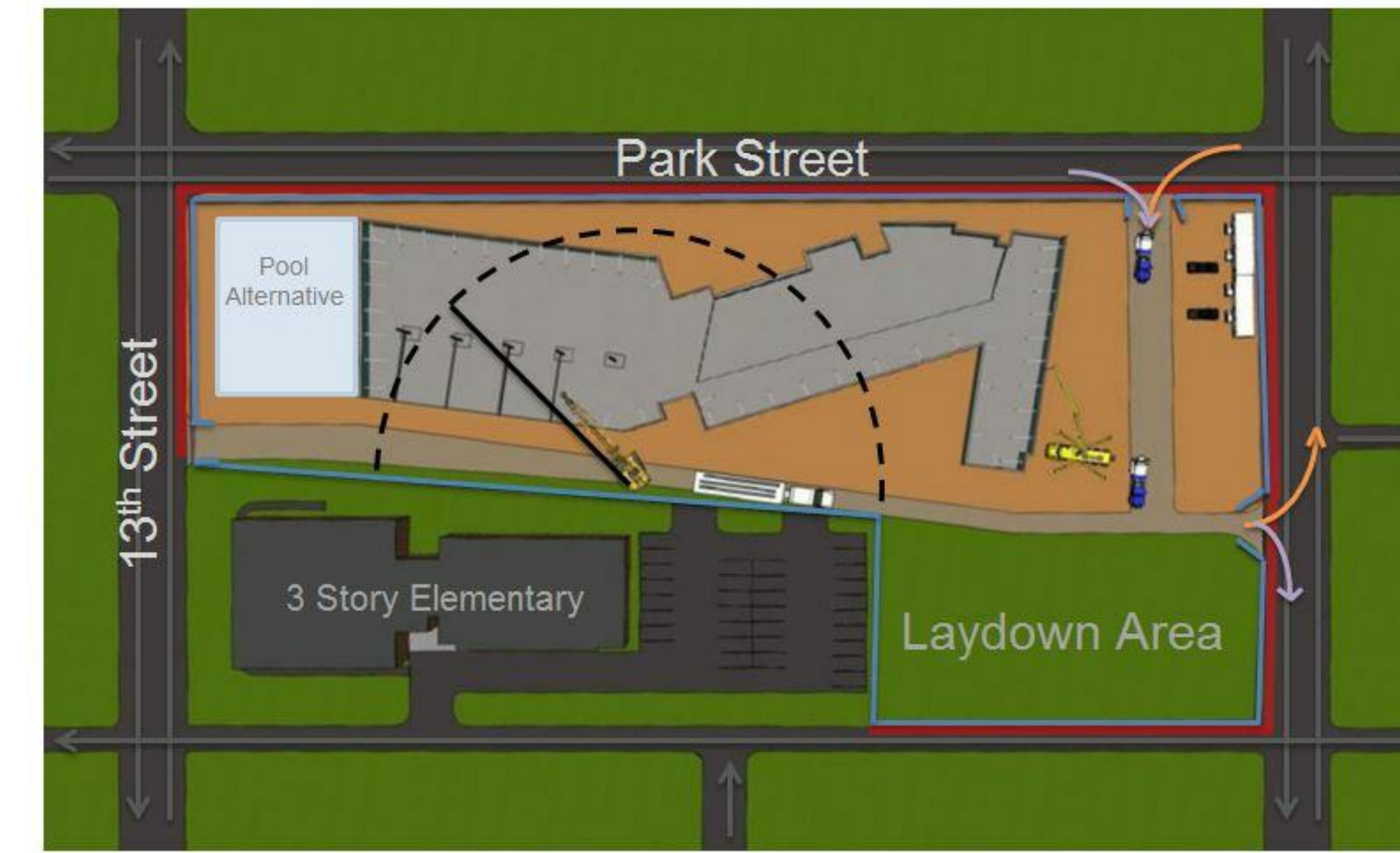


The safety traffic plan shown in the image above is a description of the site after construction is complete on the new Reading Elementary School. Denoted with white circles, traffic balusters help regulate the flow of traffic during the school day. For example, after school busses drop off the students in the morning and before the busses return in the afternoon, the traffic balusters will be raised. They are made of steel and rise three feet in height with a nine inch diameter. The balusters are strategically placed to prevent vehicles from approaching the school building during the day. Any visitors will have to park in the auxiliary parking lot during the school day.

The arrows on this plan denote the flow of vehicular traffic. The bus lane will be maintained as one way at all time, except at the entrance near the teacher parking lot. Maintaining a consistent flow of traffic will decrease the possibility of a traffic accident.



The image above is of the south-facing main entrance to the school building. This entrance was strategically relocated from the north facade to eliminate any possibility of a vehicle accident on the sidewalk while students were entering the school building. The other important thing to note is that all first floor glazing will be made of bullet-resistant glass. This will prevent intruder access through the windows into areas occupied by building occupants. This increase in safety measures aligns with the school district and Nexus' emphasis on building security and occupant safety.



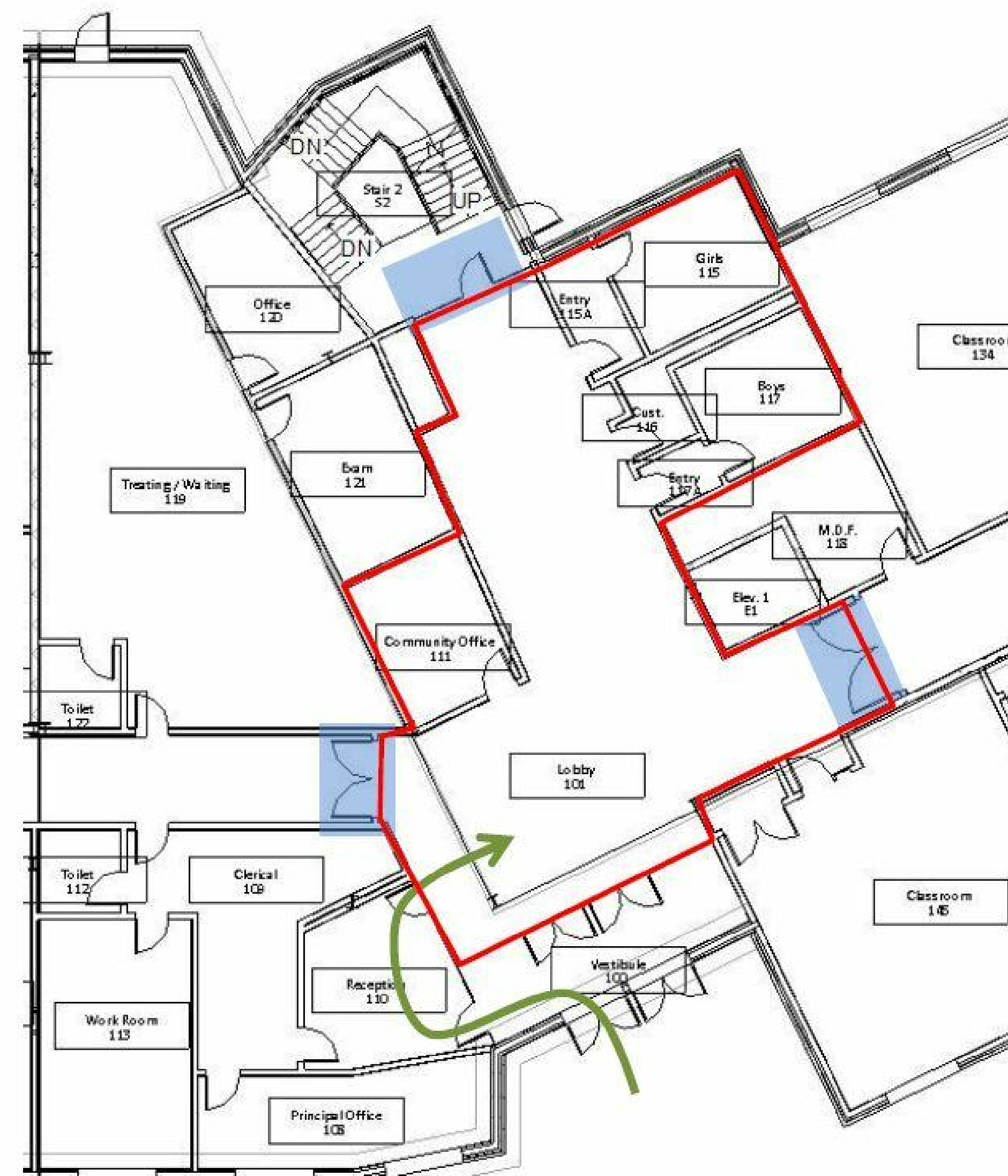
- Side Walk Closures
- Site Fence
- Concrete Truck Turns
- Steel Delivery Truck Turns (40' Radius)
- Crane Swing



The above image is a typical representation of the construction site during the superstructure erection sequences. While under construction, in order to maintain the safety of students and other school members currently in the existing three story elementary school, sidewalks will need to be closed around the construction site. These sidewalks will be closed to protect bystanders from debris, dust, and any other site hazards. Moreover, a crane swing is displayed on this plan to illustrate that the crane will never swing over the existing school boundary, preventing any possibility of an accident. The next important thing to note is the concrete truck and steel delivery truck turns. These turns will be made to increase traffic flow and safety throughout a regular day. The concrete trucks, will shorter lengths, can make right turns in and out of the site; while the steel delivery trucks will need to make left turns across two lanes of traffic due to their larger turning radii.

Priority #1

safety & security



The floor plan shown to the left depicts the secure perimeter established when the intrusion detection system is activated. Should an intruder make it past the two sets of bullet-resistant doors in the vestibule, the three access points to the remainder of the school will be automatically locked (as shaded in blue). Video surveillance will be maintained at the main entrance, with controls being operated in the reception office. Thus, in the event of a security breach, all students will remain in their classrooms since the intruder will be locked into the first floor lobby until authorities arrive.

The interior rendering of a typical classroom below is included with the safety and security items to demonstrate the incorporation of several measures Nexus provides for occupant safety and building security. First, the public address system will have an integral speaker with the classroom clock to voice alert the teacher and student of an security breach. Security alarms in the corridors will double as an alert system. The intrusion detection system located at all exterior doors will trigger the security alarms and public address system. Lastly, manual window shades will be installed on the classroom door window and sidelight to prevent views into the classrooms from the corridors. Teachers will pull these shades when the alarms are sounded.



CONSTRUCTION MANAGEMENT

2013 ASCE Charles Pankow Foundation Annual Architectural Student Engineering Competition

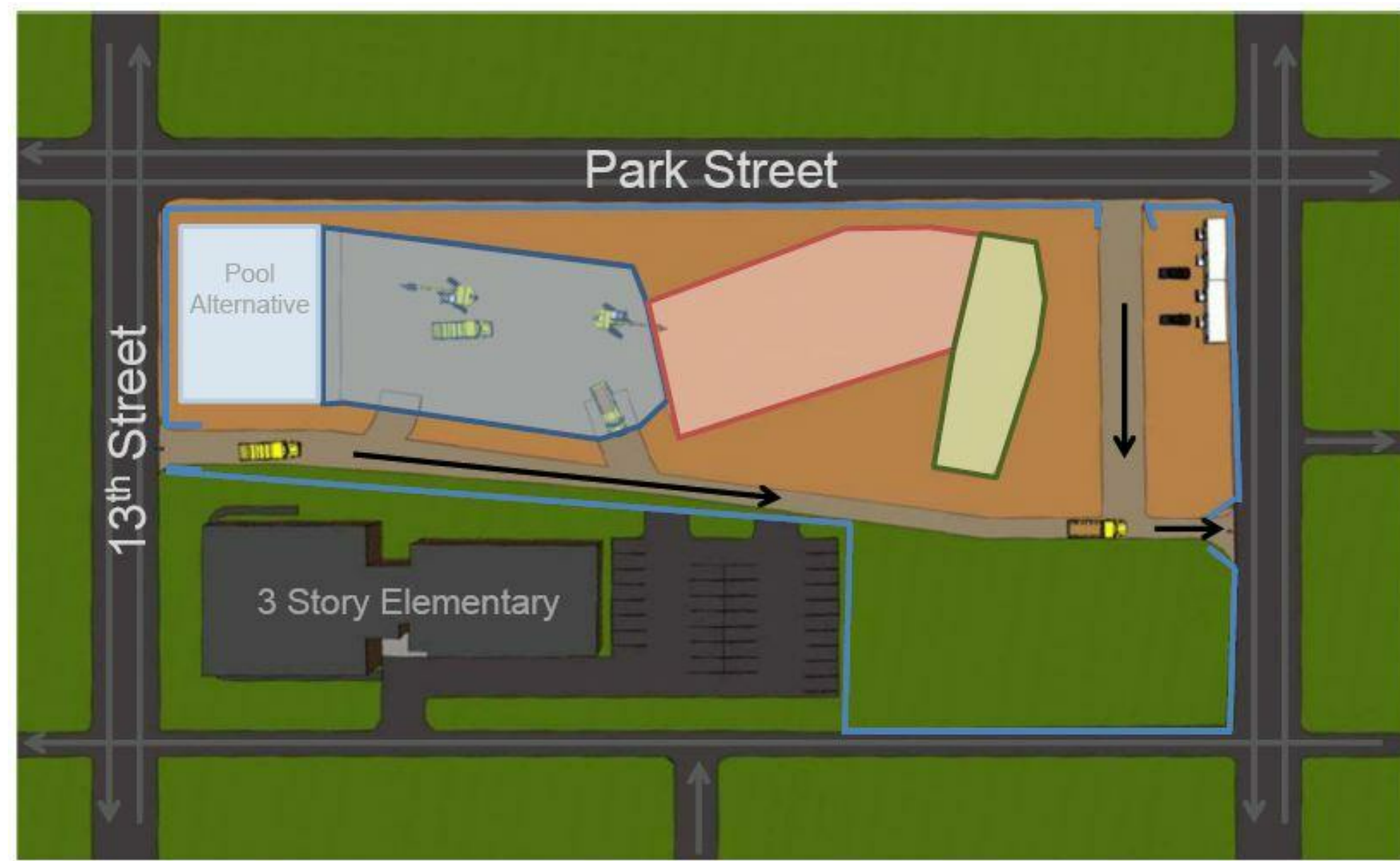
Team Registration Number: 02-2013

Safety and Security

Date: 22 February 2013

41

Scale



Excavation - 6/16/14 to 7/18/14



The excavation site plan on the left (as seen on page 9 of the report) displays the sequencing of the excavation phase of construction. The two 3-dimensional views of the excavation site plan are shown in the right two middle figures. Excavators and dump trucks are shown in Zone 1 of the building footprint in View 1. View 2 is taken from the site trailers perspective.

The superstructure site plan to the right (as seen on page 15 of the report) displays the sequencing of the steel and concrete structure. In general, the steel erection sequences will follow the concrete erection sequences. This is due to the steel being integral into the exterior ICF bearing walls. As the walls are cast in one floor (14 foot) lifts, the steel will follow behind as the concrete cures. The two right bottom figures display these processes. View 1, from the west side of the site, shows the crane erecting first floor beams in the administration area (with the yellow concrete pump in the background). View 2, from the site trailer perspective, shows the concrete pump placing concrete in the first floor east wing classrooms.



Superstructure Erection - 8/29/14 to 1/23/15



CONSTRUCTION MANAGEMENT

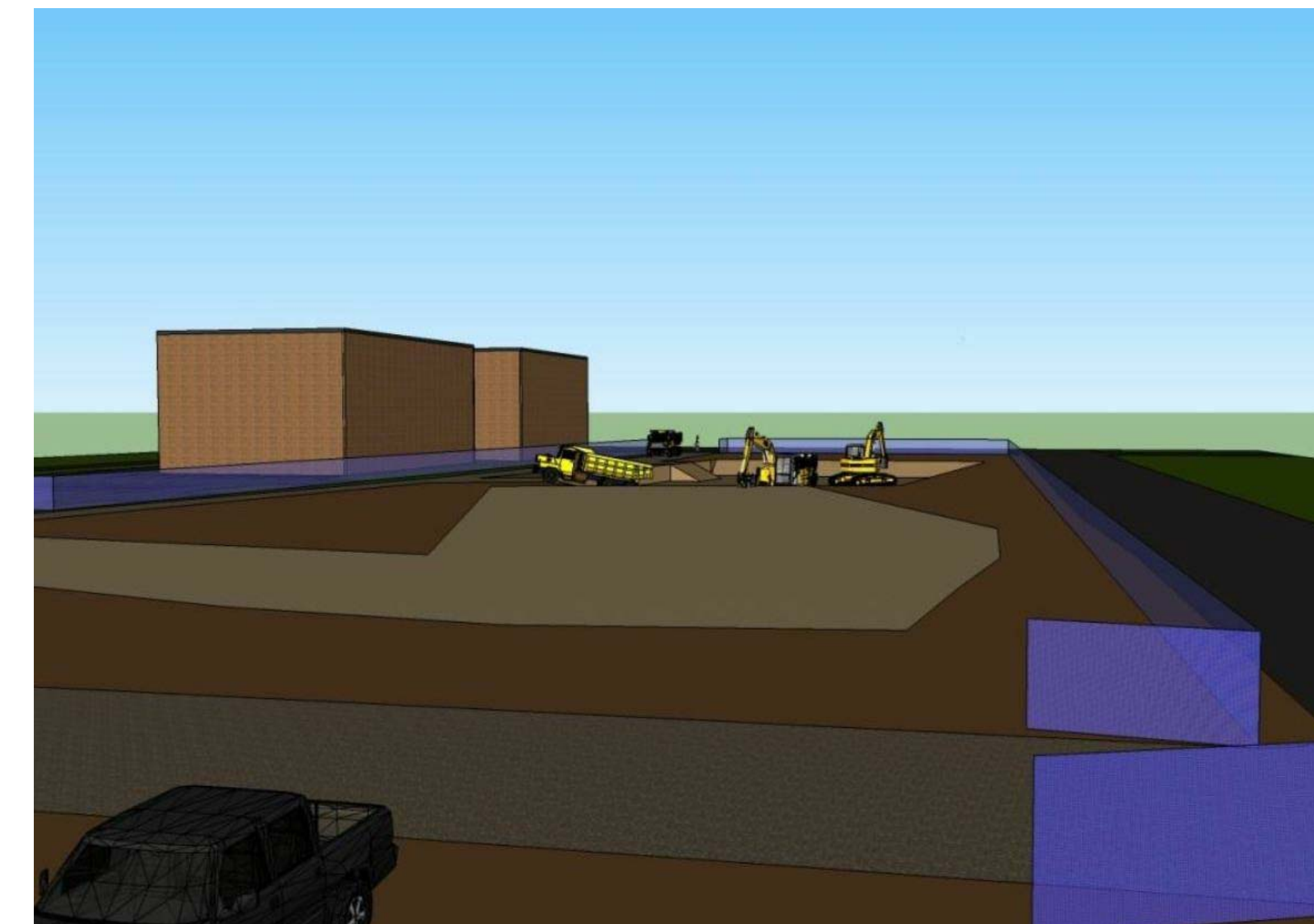
2013 ASCE Charles Pankow Foundation Annual Architectural Engineering Student Competition



Excavation Site Plan



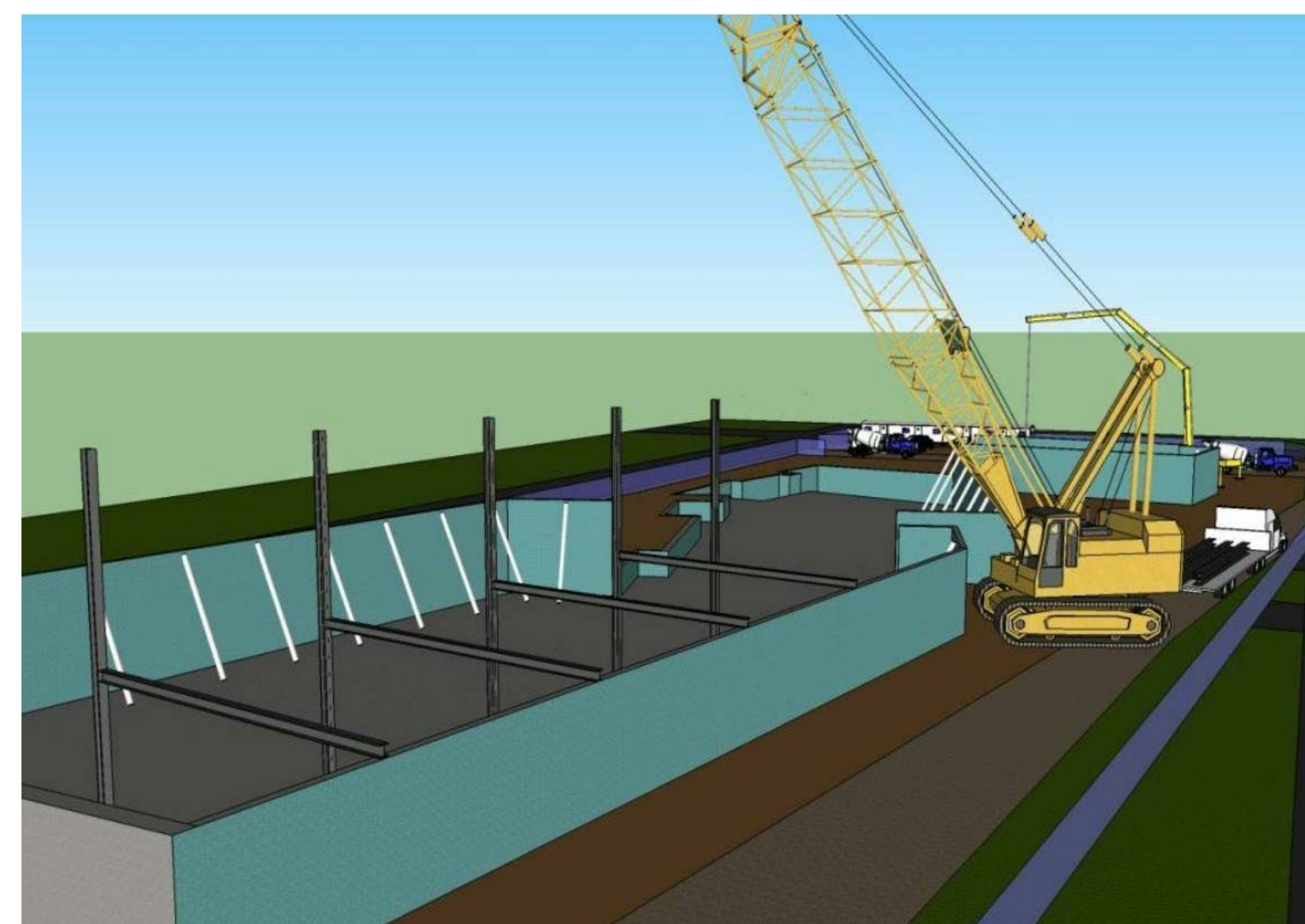
View 1



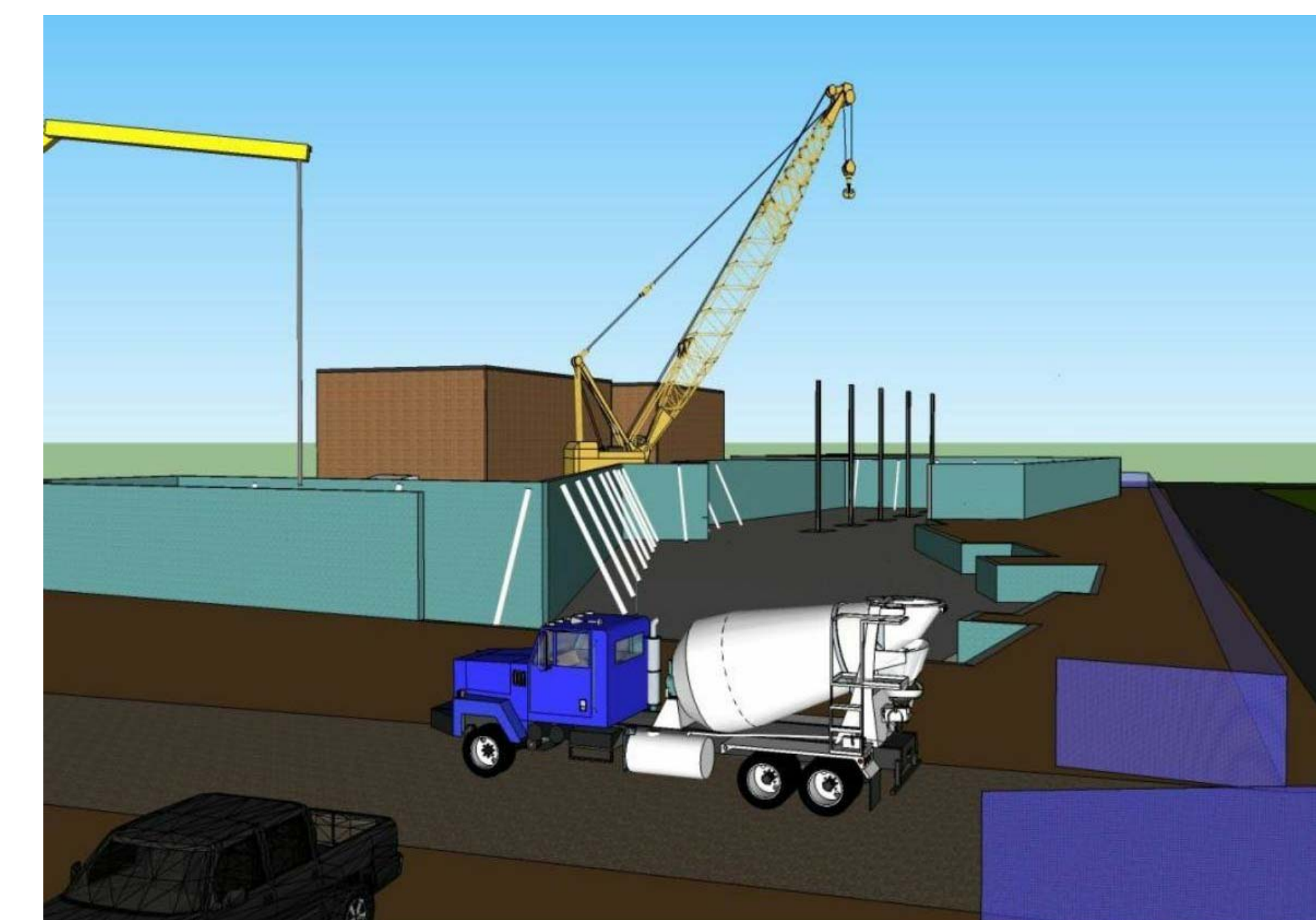
View 2



Superstructure Site Plan



View 1



View 2

Team Registration Number:
02-2013

Site Plans

Date: 22 February 2013

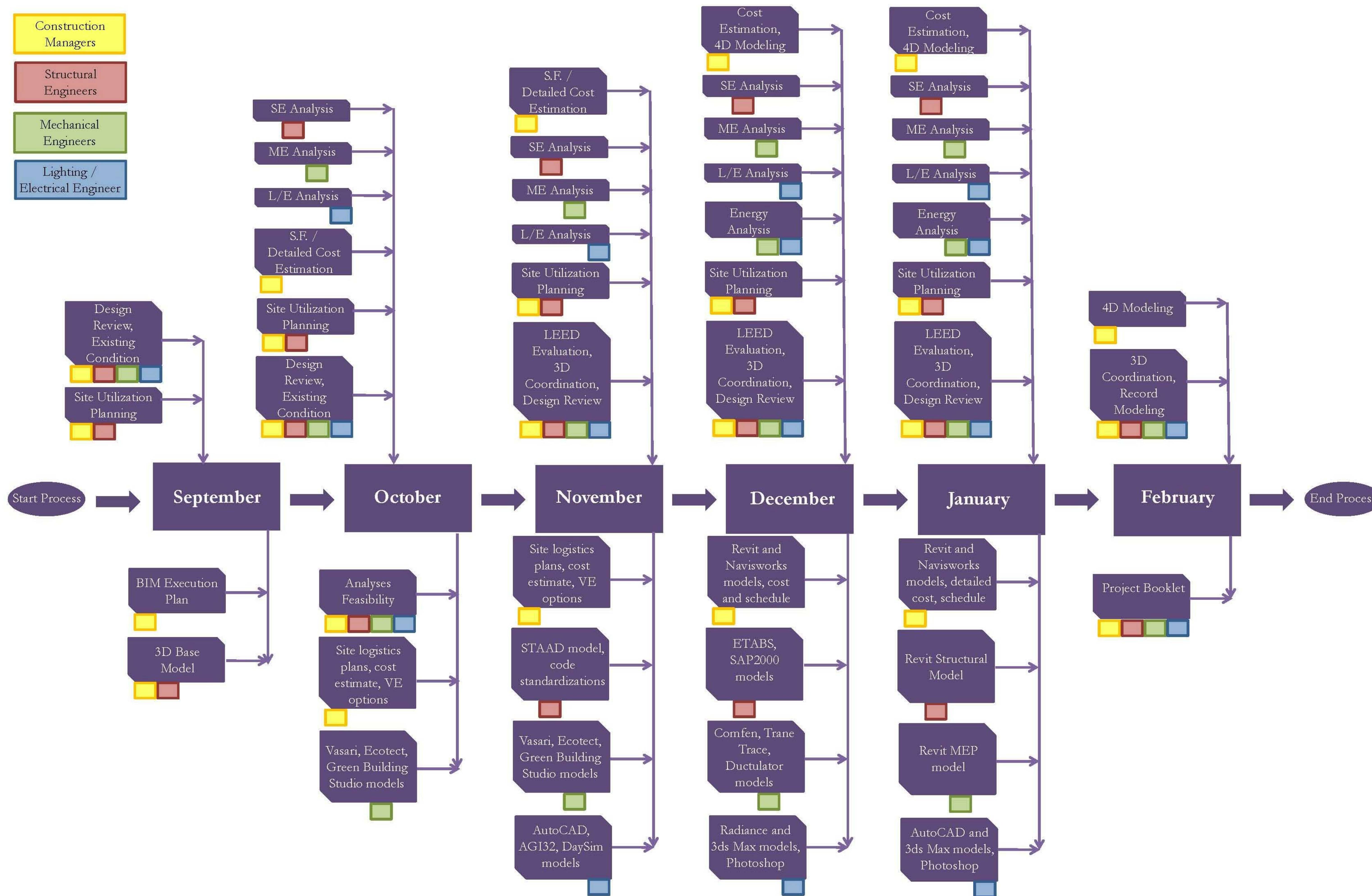
42

Scale



CONSTRUCTION MANAGEMENT

2013 ASCE Charles Pankow Foundation Annual Architectural Engineering Student Competition



The team overall process map depicts all of the teams process for the entire project. The team overall process map is a level one process map that is then further defined by level two process maps developed for each discipline.

Each phase of the project is divided into months (September - February).

The purple shaded boxes above the months represent Building Information Modeling (BIM) uses that each Nexus team member performed. The shaded (yellow, red, green, and blue) smaller boxes below each BIM use is which team members are performing those uses.

The purple boxes below the months are the outputs (or results) of the BIM processes performed by Nexus. The smaller colored boxes below these outputs represent which team members contributed to that deliverable. Many of these deliverables involved sophisticated technology applications to produce analytical models that helped the team integrate and collaborate.

Team Registration Number:
02-2013

Team Overall Process Map

Date: 22 February 2013

43

Scale:



CONSTRUCTION MANAGEMENT

2013 ASCE Charles Pankow Foundation Annual Architectural Engineering Student Competition

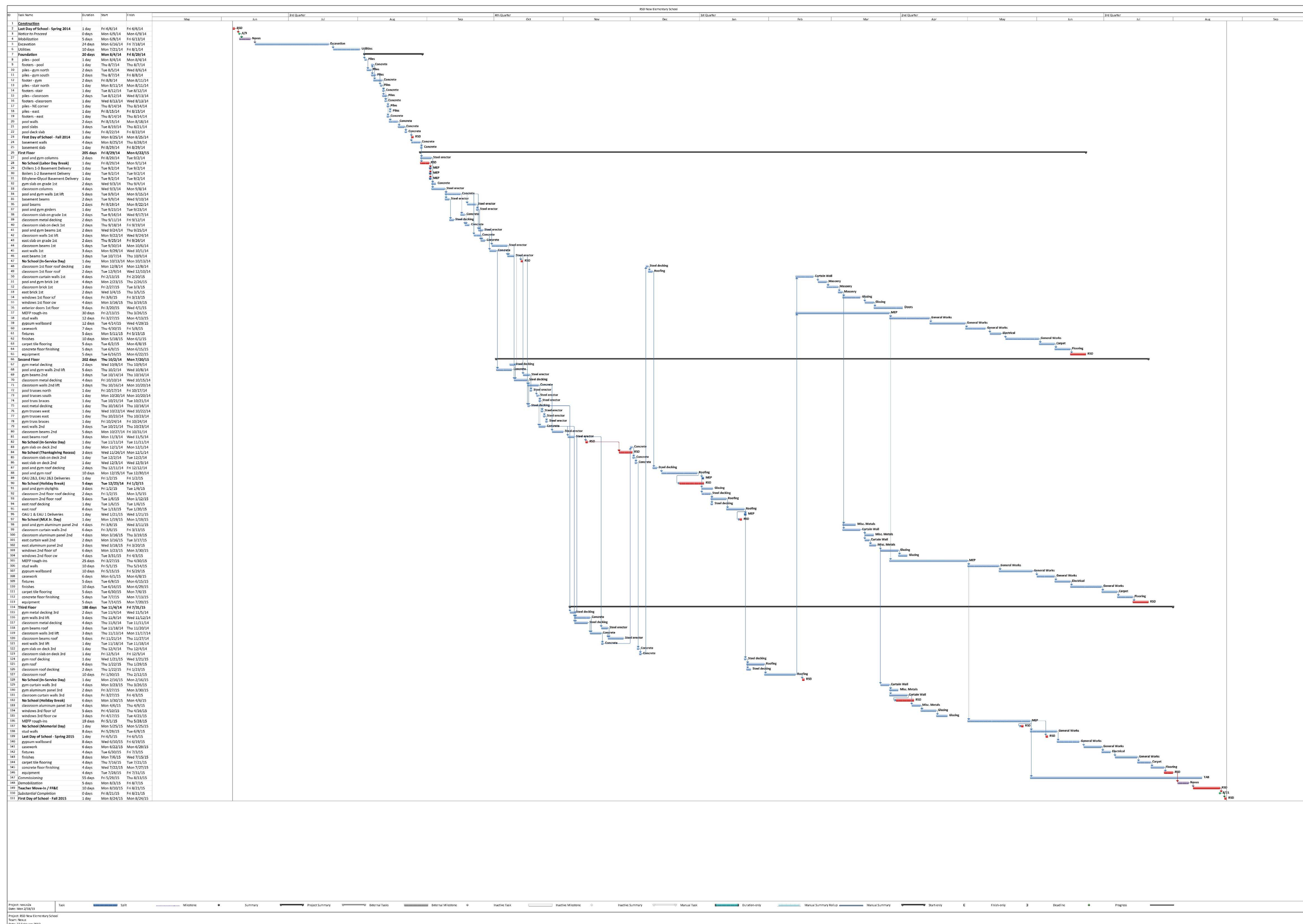
Team Registration Number:
02-2013

Project Schedule

Date: 22 February 2013

44

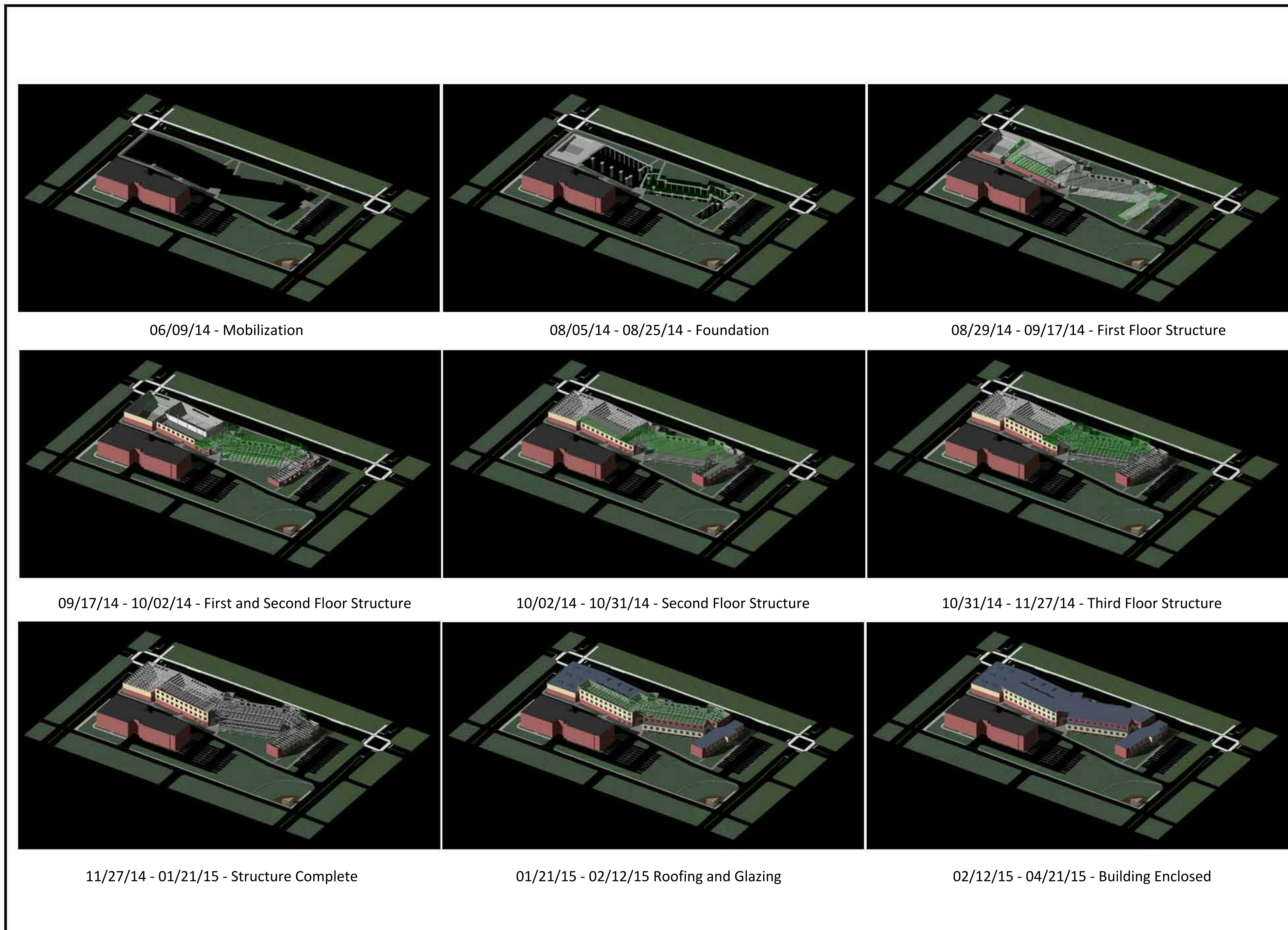
Scale:



The project schedule is divided into sections based on each of the three floors of the school building. This methodology helps contractors sequence their work and effectively manage their crews' productivity. Additionally, this helps the construction manager efficiently sequence the activities to avoid work space conflicts.

Also, this schedule contains pertinent dates relating to the Reading School District's academic schedule. All school breaks, intermittent non-class days, and the first and last days of school are listed. This helps the construction manager safely schedule work around the presence of students in the existing elementary school.

2013 ASCE Charles Pankow Foundation Annual Architectural Engineering Student Competition



The nine tiles shown here are snapshot images from the Navisworks 4-dimensional model. The nine tiles represent a few of the major construction milestones that the building will reach while under construction. The Navisworks model also helped schedule and sequence activities on site to help maintain safety and progress. The model also helped detect and resolve clashes amongst the structural, mechanical, and lighting/electrical trades.

Team Registration Number:
02-2013

Navisworks

Date 22 February 2013

45

Scale