

# Technical Assignment #1



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**Construction Management Option**  
**New Geneva Middle School**  
**Geneva, IL**  
**Messner**

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### **Executive Summary**

The construction of the new Geneva Middle School marks the beginning of an expansion for the Geneva Community Unit School District #304. The current adjacent middle school is overcrowded to the point where it became necessary to bring in trailers to hold excess students. The new middle school will have almost the same footprint as the previous building, and is being delivered using a design-bid-build method with a CM agent. This method is very suitable for the school district as it maintains contractual leverage over all parties while leaving the management of the job to an experienced company.

The building is primarily a structural brick building, although building B utilizes a steel frame and a brick cavity wall. Mechanically, the building uses 2 chillers and 6 air handler units to force conditioned air throughout the building. Heating is provided by a 2-pipe heated water system that runs throughout the school to fan coil units. Additional heating is provided by radiant ceiling tiles.

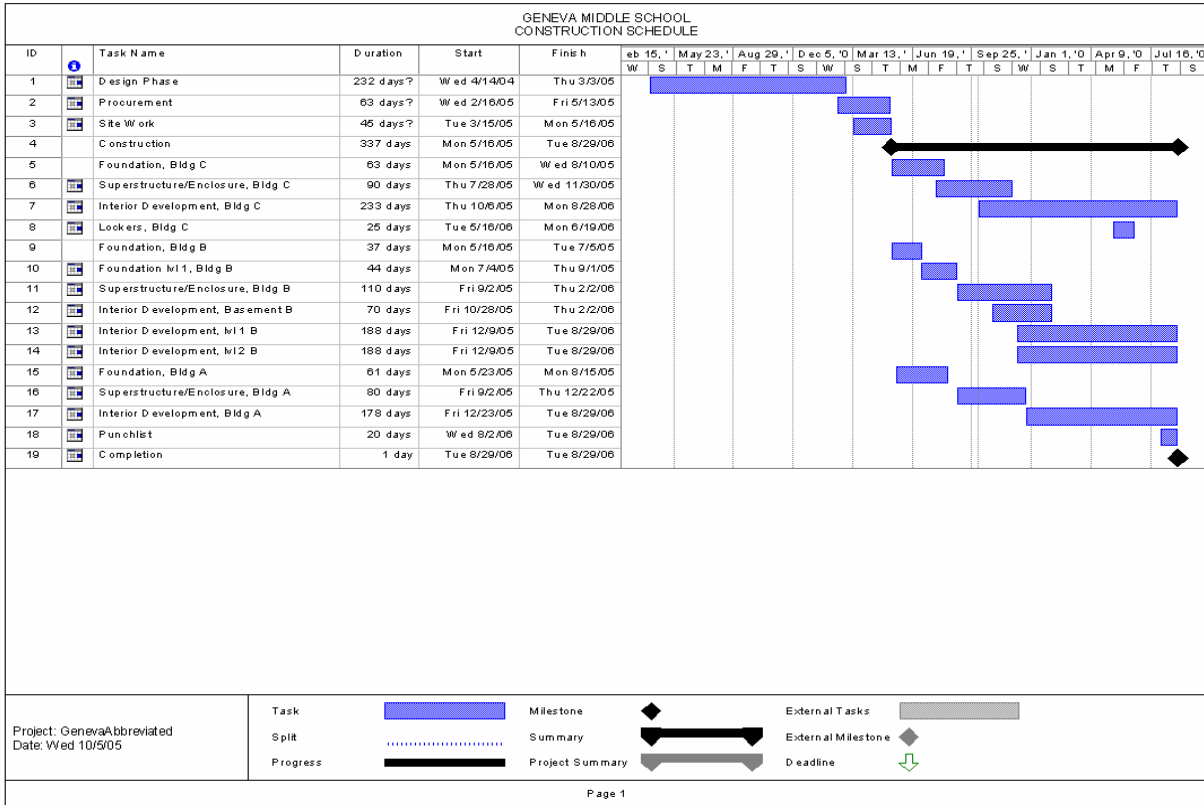
Two square foot cost estimates were generated using both R.S. Means and D4 Cost 2002. Both estimates came in at around \$20 million while the actual construction cost is closer to \$27 million. A comparative analysis of the estimates and the actual budget showed that the majority of the difference arises from the mechanical and electrical systems. Combined, the two account for approximately \$4.5 million of the difference.

The schedule shows that all three parts of the middle school will be erected at the same time and will follow a very similar schedule. The middle must be completed by August 29<sup>th</sup>, 2006 to be ready for the following school year. Aside from keeping the schedule, the chief interests of the owner were cost, durability, and safety.

The site itself is an ideal area for construction. There were no major existing structures that needed to be removed. The site is relatively flat. There weren't utilities that needed to be moved. There is also plenty of room for parking and staging of materials. The soil conditions are relatively poor but, due to the fact that the building is not very deep, this had little affect on the project.



**Project Schedule Summary**



**Key Phases of Construction – Building A**

Foundation Sequence: Layout building, Pour foundations, install under slab sanitary and storm lines, grade building, begin CMU starter and install under slab electrical, pour slab on grade.

Structural Sequence: Erect CMU load bearing walls and begin brick veneer, install steel truss and decking, pour concrete roof, cut roof drains and pour curbs, install roofing system, install windows and doors.

Finish Sequence: Layout building and install heavy equipment (AHUs, Chillers, etc.), erect CMU interior walls and begin electrical rough in, install stairs, HVAC duct rough in, sprinkler system, HWS and HWR, plumbing lines, drywall partitions, overhead partitions, install ceiling grid, trim MEP to ceiling, install lockers, doors, and hardware, misc. finishes, punch list.

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## **Building Systems Summary**

### Structural Steel Frame

- A steel frame structural system is used to building B and for all roof trusses.
- Beam connections are bolted or E70XX welding standards.
- Angle steel is used for bracing around the atrium skylights and roof deck of building B, as well as along the top of masonry walls as a closure angle.
- All reinforcing steel is “deformed new billet steel bars”
- Cross-braced connections use tensioned steel straps
- The cast-in-place topping slab over the structural precast concrete floor in building B is a composite slab

### Cast In Place Concrete

- Wooden edge forms are used for the slab on grade pours.
- Other wooden formwork is used to form column footings.

### Mechanical Systems

- Major mechanical components are located throughout the middle school: on the roof of building A, the basement of building B, and in the boiler room of building C.
- Cooling is provided by a forced air system powered by (2) 300 ton air cooled chillers and 6 AHUs.
- Heating is provided by a 2-pipe heated water system with (2) 250 BHP boilers. The heated water is circulated through fan coil units in the perimeter of the classrooms. Additional heating is provided by 2,340 linear feet of radiant ceiling panels.
- Fire protection is provided by a wet sprinkler system which is broken down in to 4 zones. In addition the building is fully outfitted with smoke detectors and alarms.

### Electrical

- Electrical power is supplied from a 2732 KVA 480/277v line
- The main panel, a 4,000A bolt-on panel, branches off to several other 480/277v panels as well as (2) 500 KVA transformers and a 225 KVA transformers.
- Backup power is provided by a 250 KVA generator which is cross-linked to the existing middle schools emergency generator.

### Masonry

- The new Geneva middle school uses a combination of bearing and non-bearing masonry walls.
- Buildings A and C use a load bearing masonry wall structural system with a course of face brick on the exterior
- Many non-load bearing interior walls use burnished CMU as a finish material
- Building B uses a non-load bearing cavity wall with embedded pieces of precast concrete.

### Support of Excavation

- Dewatering will likely be necessary for the excavation of the basement area of building B

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## Project Cost Evaluation

### Actual Construction Cost

- \$27,065,000
- \$138.08 /SF

### Electrical Systems Cost

- \$3,135,000
- \$15.99 /SF

### Total Project Cost

- \$28,800,000
- \$146.93 /SF

### Structural Systems Cost

- \$6,710,000
- \$34.23 /SF

### Plumbing Cost

- \$2,070,000
- \$10.56 /SF

### Fire Protection Cost

- \$610,000
- \$3.11 /SF

### HVAC Cost

- \$4,385,000
- \$22.37 /SF

## D4Cost 2002 Estimate

A smart estimate of 3 middle schools and high schools between 150 and 250,000 square feet.

<b>CSI Division</b>	<b>Area</b>	<b>D4 Cost Estimate</b>
1	Bidding Requirements	\$ 2,513,239.00
2	General Requirements	\$ 545,680.00
3	Concrete	\$ 1,711,480.00
4	Masonry	\$ 2,210,905.00
5	Metals	\$ 2,245,798.00
6	Wood & Plastics	\$ 946,534.00
7	Thermal/Moisture Protection	\$ 1,757,437.00
8	Doors & Windows	\$ 492,831.00
9	Finishes	\$ 1,857,364.00
10	Specialties	\$ 528,466.00
11	Equipment	\$ 152,798.00
14	Conveying Systems	\$ 27,976.00
15	Mechanical	\$ 3,175,613.00
16	Electrical	\$ 2,230,254.00
<b>Estimated Actual Cost</b>		<b>\$20,396,375.00</b>
<b>Estimated Total Project Cost</b>		<b>\$21,818,029.00</b>

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### **Project Cost Evaluation Cont.**

#### **R.S. Means SF Estimate**

Schools – Jr. High & Middle

Square Foot Cost: \$ 102/SF

Total Cost: \$ 19,993,000

Location multiplier: La Salle, IL (closest) – 1.016

Adjusted total cost: \$ 20,313,000

#### **Comparison of Estimates**

Both the R.S. Means estimate and the D4Cost software returned estimates of around \$20.3 million. This is considerably lower than the \$27.065 million that the project is actually being constructed for. By the R.S. Means national averages, the new Geneva Middle School is well into the upper quarter of middle school construction in regards to cost. Disparities are apparent in the D4Cost estimate for mechanical and electrical systems. The mechanical system is estimated at just over \$3 million while the actual project cost is closer to \$6.5 million. The electrical system also had a large difference where the estimate was \$2.2 million and the actual cost was closer to \$3.1 million. Additionally, the greater cost of durable materials such as the terrazzo tiled flooring and burnished CMU block could account for the lower total cost found in the estimates.



**Site Plan of Existing Conditions**





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### **Local Conditions**

Located 40 miles west of Chicago, Geneva, IL still maintains its quiet town charm. It is a relatively small town of around 20,000 that is drifting away from its rural past. Although it is small, it has seen substantial growth and development, both in residential areas as well as commercial and industrial sectors. Given its close proximity to a major metropolitan area, the town is able to enjoy all the benefits of a much larger town.

Due to its location, the town was able to draw from a large pool of construction expertise from the Chicagoland area. While Chicago tends to be a concrete town, the area has experience in many types of construction. Chicago itself grew from smaller wood framed buildings, to massive masonry buildings, and eventually into towering skyscrapers of steel and glass. Therefore, it is no surprise that the new middle school in Geneva utilizes both masonry and steel systems.

The site of the new construction is directly adjacent to the existing middle school on open land that used to be farmland. The open fields surrounding the schools provide excellent space for parking and staging of materials, especially when school is not in session. There are existing parking lots as well as an existing detention pond to the west of the school. Local recycling and tipping fees are higher than in surrounding areas, so it is likely that material from the site will be hauled to neighboring towns for processing.

The soil at the new middle school was found to be 1-3ft of topsoil and then a varying mix of clays and silty clay. The end result of this soil type is that some of the footings had to be undercut by 2 feet and filled with crushed stone structural fill. Groundwater was found at depths as shallow as 2 to 10 feet; therefore site dewatering could become a major issue.

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### **Client Information**

The owner of the new middle school in Geneva will be the Community Unit School District #304 of Geneva, IL. As an owner they are fairly knowledgeable and experienced, as they are currently overseeing 5 elementary schools, 1 middle school, and a high school. The construction of the new middle school comes about directly as a result of the growth of the area. With 5 elementary schools feeding a single middle school, overcrowding became a problem. In the 2004-2005 school year trailers were used outside the existing middle school to supplement classroom space. The new middle school comes as only a part of the expansion plan for CUSD #304.

The new building will double the amount of class, gym, and cafeteria space that is currently available, and it is the hope of the school district that the similar design of the buildings will keep a sense of equity between students.

Aside from their need for space, cost, durability, safety, and schedule were the chief concerns of the community. Obviously, because this is a public building paid for largely through local tax dollars, cost was obviously a major concern. The school district opened the project to competitive bidding to find the best value contractors.

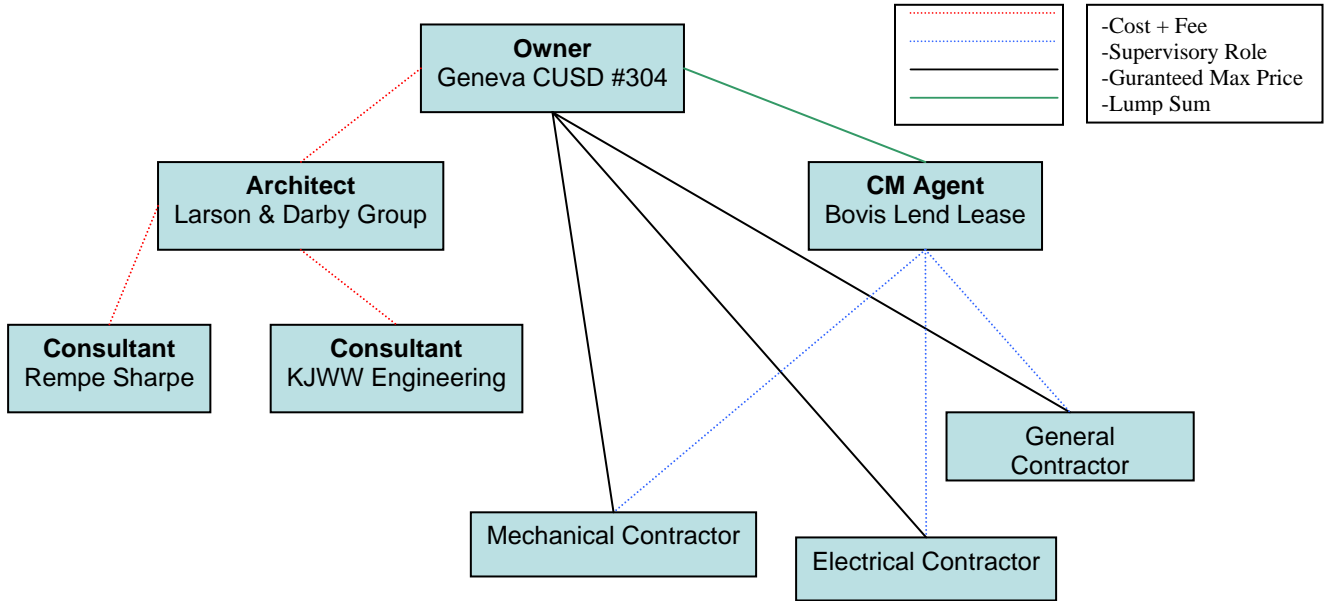
Durability of materials was another major concern. In selecting materials, the architect used very durable material such as terrazzo tiled flooring and burnished CMU block for interior walls in major walkways. Both of these materials are highly durable and will be relatively easy to replace if a block or tile does become damaged.

Safety was also a major concern. The Geneva school district expects nothing less than zero incidents involving students being injured on the adjacent construction site while in class next door. To help assure site safety, chain link fencing was installed along the border of the construction site adjacent to the current middle school. As construction progresses, a night security guard may be hired to keep the site secure.

The omnipresent deadline associated with the construction of any new school is the beginning of the following school year. In the case of the new middle school, classes will begin August 29<sup>th</sup>, 2006. The middle school, if completed to schedule, will spend the month of August completing the punch list to hand the building over.



**Project Delivery System**



The new Geneva Middle School is being delivered using a traditional design-bid-build system with a CM agent. This process allowed the school board to select the building type they wanted and then seek competitive bids on the project. All major contractors bidding on the project were required to be bonded. A CM agent was hired due to the fact that while the owner is relatively experienced with construction, the school district does not have any full time employees familiar with managing a construction project. I believe the contract structure being utilized is appropriate for this application. While the school district still holds all the contracts, the actual management of the construction is left to a CM agent with much more experience in educational construction.

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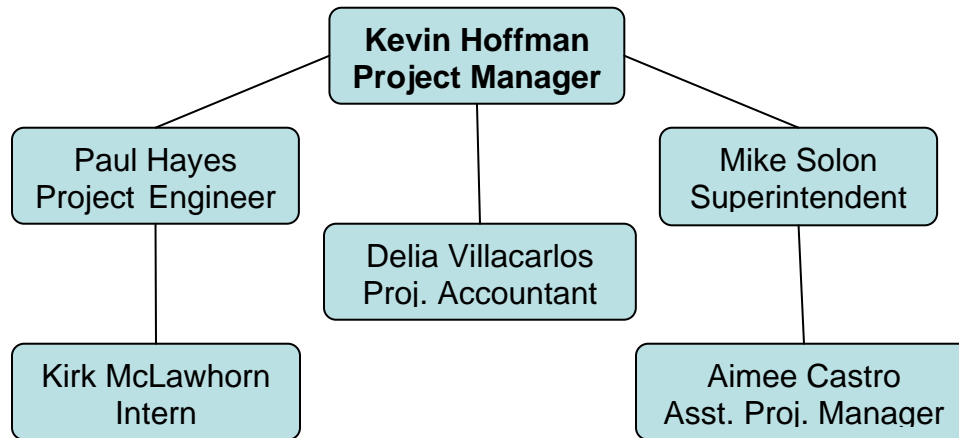
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### Staffing Plan



The one man responsible for the entire project running smoothly is Kevin Hoffman, the project manager. Working under him is a new hire, Paul Hayes, and Kirk McLawhorn, an intern over the summer of 2005. These employees work on the contractual side of the project.

Working the field side of operations are Mike Solon and Aimee Castro. They are responsible for ensuring that the work in the field meets specifications, that all work is properly coordinated, and that all workers are safe.