Landis Run Intermediate School

Lancaster, PA

Technical Report One

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Construction Management

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Executive Summary

After writing this report on various aspects of the design and construction of Landis Run Intermediate School I've made some key conclusions about the project. The project's largest driver is the schedule. The school must be ready for occupancy for the 2012-2013 academic year because the district has nowhere else to place the 5th and 6th grade students that are scheduled to occupy the building.

Another key finding is that installation of the new switch gear is a vital activity in the critical path of the project. The power for the building will come from switch gear in the high school which currently feeds power to the high school and two other buildings on the campus. New switch gear is required to handle the additional load of LRI. If the installation goes awry the whole campus could be out of power. In addition, if the switch gear is not installed in a timely manner than construction activities that rely on the use of power could lag.

Although the site is relatively large and the building does have a significant land and forest buffer, the building is surrounded on three sides by residents. In consideration of the surrounding residents as well as a noise ordinance, construction before 7 a.m. has been strictly condemned.

The project is striving for LEED Silver certification which is an ambitious goal. The strategy conceived to reach this goal is a combination of design features and construction practices. The specific design features and construction practices are listed in the environment building systems summary.

It should be noted that the building was designed in Autodesk Revit by the Architect over a period of about 6 months. Some renderings of the building model can be found on the cover page of this report.

In terms of additional forthcoming research, the author is concerned about the fact that the project is a multiple prime contract type. Due to the relative segregation of responsibility for building systems it could be hard to make contact or receive cooperation with other primes to obtain information about building systems that the general contractor cannot obtain.

Project Schedule Summary

The schedule, found in Appendix A, for Landis Run Intermediate School is broken down by construction area as shown in Figure 1. It is broken down in such a way because the project's size makes it impractical to do a given activity all at once (i.e. install all the ducts at the same time). By breaking the building up into four sections the efficiency of construction is increased. A phase schedule of the project can be found in Appendix A.

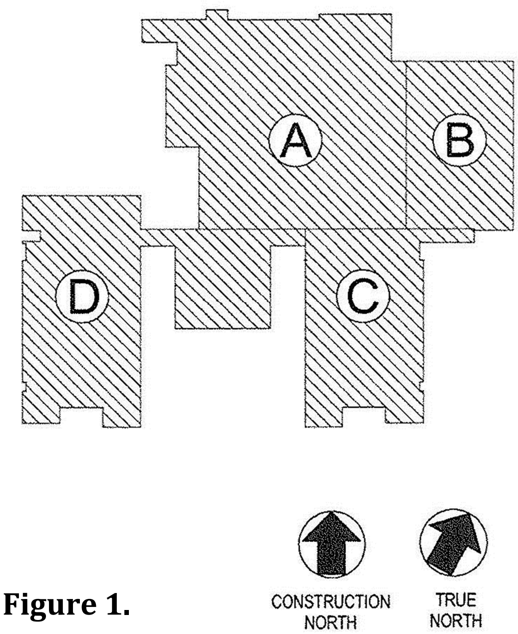


Figure 1.

The key activities in getting the foundations installed are the preparation of the building pad by the site contractor, the digging of the footers by the concrete contractor, and the timely pouring of the concrete. This is true especially in areas C & D which are downhill from areas A & B. When it rains enough on site the prepping of the building pad, the digging of footers, and the pouring of concrete are delayed. While some water is good for compaction, most of the time when it rains the soil receives too much water and loses its ability to be compacted. When this soil is located at the bottom of a slope the problem is compounded water from the hill top runs down to the lower ground. Therefore excessive water accumulates and creates an unsuitable soil. The three activities listed above rely on good compaction and therefore are key elements of getting the foundations ready.

The key elements in installing the structure are the pouring of the slabs, constructing the load bearing masonry walls, and installation of joists. The pouring of slabs is important because the masons cannot bring up the interior masonry walls without the slabs having been poured and cured. Door frames are important for the same reason. It is important to note that if the door frames are not installed then the walls around the doors cannot be brought up to full bearing height. In order for the joists to be installed all of the load bearing masonry walls have to be up to bearing height. Once the slabs are poured, the walls can come up to height provided all door frames are installed. Then the joists can be installed and the composite decking welded to the joists. Once the decking is installed the next floor can be poured and the cycle will repeat. As you can see the three activities listed above are major activities in the critical path of completing the superstructure.

The most important key in the finishing sequence is the "dry-in" milestones. This refers to the point at which the building becomes impenetrable to water. The finishes cannot be installed until the building is water proof due to the fact that water will ruin the finishes if the two come into contact. Once the building is enclosed the finishes can be started and phased during which many different activities could be occurring at the same time. Another important key to the finishing sequence is the completion of MEP work. A great deal of finish work such as drywall, ceiling grid, and light fixtures cannot be completed until all the “rough in” mechanical, electrical, and plumbing work is completed in a given area.

Building Systems Summary

Excavation

Figure 2. *Courtesy of Crabtree, Rohrbaugh, & Associates*

Landis Run Intermediate School was built nearly entirely on grade. It was able to do this by utilizing an existing grade differential as shown in figure 2. The only substantial excavation required was for the partial basement in Area B. It was simply excavated out of the side of a hill and was sloped back as oppose to using any sort of excavation support system. In addition, as predicted by the geotechnical report no sub-surface water was found on site and therefore no dewatering system was needed. There was no required demolition on site.

Concrete

Due to the fact that Landis Run Intermediate is a load bearing masonry wall concrete was not used as extensively as compared to a precast or cast-in-place structure. The main use of cast-in-place concrete for LRI are the building slabs which are part of the structure. The concrete binds to the metal decking to provide a composite material which resists the compression and tension forces placed on it. All of the cast-in-place concrete on LRI was placed with concrete pump trucks. No formwork is required, besides dimensional lumber for pour breaks, since they are simply poured up to the surrounding walls or steel angles which are welded to the decking. Precast concrete was utilized to a lesser extent in the building. The only significant amount of precast concrete that is being used for LRI is for lintels in which the use of steel is unneccessary such as over doors and some smaller windows.

Masonry

Courtesy of Warfel Construction

Figure 3.

The building is supported by load bearing concrete masonry unit (CMU) walls, which are 8” and 16” thick and are filled with grout and rebar. A veneer made up of brick and decorative CMUs is supported by the load bearing walls as shown in Figure 3. Spray foam insulation is sprayed onto the exterior face of the CMU’s in the air space between the veneer and the load bearing wall. A weep system is also placed at the bottom of the airspace to allow for the efficient shedding of water from the assembly. The veneer is attached to the load bearing wall using a two piece anchor. The masons on LRI are using manual scaffolding for the majority of the walls on LRI. However, a hydraulic scaffolding system was used for the gymnasium due to its substantial height.

Steel


Figure 4. *Courtesy of Warfel Construction*

As stated before the building utilizes load bearing CMU walls which obviously negates the need for steel beams and columns. The main use of steel on LRI is for floor support. Steel K joists are used to support the composite deck and roof throughout the building. The largest joists, seen in figure 4, are found in the gymnasium and total over 70' long. The smallest joist can be found in the hallways throughout the building. A 70 ton mobile crane is used to lift these joists onto the bearing plates which in turn rest on the load bearing walls. Once lifted into place the joists are welded to the base plates and laterally braced using steel angles to resist wind and other lateral forces. Since joists are not lifted into place everyday the crane is not a permanent fixture on site and is only brought in on days which are scheduled to place joists. The crane simply finds acceptably level around of ground and extends its outriggers for added balance. A truck is pulled up along side of the crane with the joists loaded on its bed. Once the joists are installed the crane leaves the site until it will be needed again.

Mechanical

The mechanical room in LRI is located in the North East corner of area B. It is seperated from all other rooms by hallways which provides a noise buffer to the surrounding music rooms and faculty room. The system is a variable air volume (VAV) system and uses a combination of rectangular metal ducks and flex ducts to distribute the air flow. Flex ducts are round ducts made of various materials and are not rigid allowing them to be directed along non-linear paths. In LRI the metal ducts are used for the main branches throughout the school and the sub branches which go into the individual rooms. The flex ducts run from the sub branches to the diffusers in the rooms. This was done so that the ducts could be routed around other objects that may be in the plenum space.

LRI utilizes a wet pipe fire protection system. This means that the sprinkler pipes are dry (no water is standing in the pipes) but will quickly fill with water if a sprinkler is tripped due to heat. LRI has six large precast concrete


Figure 5. *Courtesy of Warfel Construction*

water storage tanks, seen in figure 5 on the previous page, in the basement of area B which hold the water to supply the fire supression system in case of a fire.

Electrical

Landis Run Intermediate has two distribution panels. One operates at a building uitilization voltage of 120/208V for its receptacles, lights, and other low voltage equipment. The other distribution panel operates at 277/480V for its higher voltage equipment. The electrical system has a total capacity of 2500A. The system is partially redundant. While not everything has backup power a 130 kW natural gas generator provides backup power for emergency lighting, essential mechanical equipment, and the fire supression system. There is also an uninterruptible power supply (UPS) which will provide power for all essential equipment and emergency lighting during couple of minutes it will take for the generator to start up.

Curtain Wall & Roof

There is a variety of types of glazing used for the windows and curtain walls on this project. Different glazing used on the project includes: Monolithic Float Glass, heat-treated float glass, and insulating glass. Depending on where they are located in the building they may be acid etched or low e and will have varying performance requirements. The windows and curtain walls utilize aluminum for the mullions. The curtain walls and larger windows will be mechanically attached to the concrete floor or concrete block that they rest on as well as to the wood blocking or concrete block above them. They were initally designed by the Architect and were reviewed and finalized with shop drawings provided by the window manufacturer. The roofing system is comprised of EPDM, Thermoplastic Polyolefin (TPO), and sheet metal systems.

Environmental

Landis Run Intermediate is seeking a LEED Silver rating from the United States Green Building Councils. The strategies set to meet that standard are mix of design features and construction standards. The building will utilize a white roof to reduce the heat island effect and it will also use light shades in the parking lot to reduce light pollution in the area. In addition, it will have water efficient fixtures to reduce water consumption. Bike racks will be located on site to encourage alternative transportation to the building. There was also extensive use of rapidly renewable resources such as bamboo and low volatile organic compound materials used throughout the project. Other green construction methods were employed during the construction of the site such as diverting construction waste for recycling or reuse. Another construction method implemented was disturbing as little of the surrounding environment as possible.

Project Cost Evaluation

Building & Project Costs

Table 1, shown below, shows the cost of the building construction cost, total project cost, and the cost of various building systems. Each cost is provided as a total cost and a cost per square foot (SF).

Table 1.

	Total Cost	Cost per Square Foot
Construction Cost	$26,400,000.00	$125.71
Total Project Cost	$28,400,000.00	$135.24
Structural System	$5,700,000.00	$27.14
Mechanical System	$4,900,000.00	$23.33
Electrical System	$2,800,000.00	$13.33
Plumbing System	$2,100,000.00	$10.00
Low Voltage System	$1,400,000.00	$6.67

As will be discussed in a later section, LRI is a multi-prime project which means that the work for each major building system is owned by a separate contractor which holds a contract directly with the owner. The systems costs in the table above are simply the contract values for each of the primes. The construction cost is the cost of constructing the building and does not include site work or any other costs associated with the project. The total project cost is the construction cost plus the site work. There are no land purchasing costs associated with the project due to the fact that the owner already owned the land on which LRI is being constructed. In addition, according to parties involved with the project, the permitting fees are negligible due to the high amount of previous engineering and construction (i.e. existing storm water systems, etc.) on the campus on which LRI is being built.

Square Foot Estimate

Table 2 is a summary of a square foot estimate based off of R.S. Means values. It takes into account rough parameters of the project such as building type, square footage, and building type. The results of this estimate should be accurate to within 10-15% of the actual building cost according to R.S. Means. A full breakdown of the square foot estimate can be found in Appendix B. This square foot

Square Foot Cost Estimate Report	
Estimate Name:	Landis Run Intermediate School
Building Type:	School, Elementary with Face Brick with Concrete Block Back-up / Bearing Walls
Location:	National Average
Story Count:	1
Story Height (L.F.):	12
Floor Area (S.F.):	210000
Labor Type:	Union
Basement Included:	No
Data Release:	Year 2008 Quarter 1
Cost Per Square Foot:	$85.21
Building Cost:	$17,894,500

Table 2.

estimate was produced under the assumption that LRI has two stories that were 105,000 SF each. This is obviously a false assumption but a necessary one due to rigid choices in R.S. Means. Another assumption is that the local labor and material rates are near the national average

Table 3.

	Square Foot Cost Estimate Report
Estimate Name:	Landis Run Intermediate School
Building Type:	School, Elementary with Face Brick with Concrete Block Back-up / Bearing Walls
Location:	National Average
Story Count:	1
Story Height (L.F.):	12
Floor Area (S.F.):	210000
Labor Type:	Union
Basement Included:	No
Data Release:	Year 2008 Quarter 1
Cost Per Square Foot:	$85.21
Building Cost:	$20,453,865

Assemblies Estimate

Table 3 is a more accurate estimate of the square foot cost of the building. The values for key pieces of the mechanical, electrical, plumbing, and fire protection systems were removed from the square foot estimate in the previous section. Estimates for these key pieces of equipment were then compiled based on R.S. Means Assemblies data and the actual equipment in LRI. Those estimates were then placed back into the square foot estimate resulting in a more realistic square foot estimate. Specific assemblies that were estimated using assemblies data include the sprinkler system, switchgear, generator, air-handler units, and boilers.

Estimate Accuracy

The original square foot estimate was 67.8% of the actual cost of the building. This lack of accuracy is the cumulative error of many inaccuracies. The largest of these inaccuracies were the false but necessary assumptions made due to the rigid structure of the input fields in R.S. Means. In addition, there are a great deal of variables such as types of piping, types of fixtures, level of finishes, etc. that can reduce the accuracy of the estimate if they don’t match what R.S. Means assumes. The assemblies estimate was 77.4% accurate. The increase in accuracy is due to a more accurate estimate of the main components of the MEPFP systems in the building. The tables used to perform the estimates can be found in Appendix D. The next step in obtaining a more accurate estimate would be to take into account more detailed takeoffs and quality of finishes.

Site Layout

Four site plans, which can be found at the end of this document show four different phases of construction at LRI. The first is the existing conditions plan which simply shows the building footprint and its varying number of stories, the site utilities, the site boundary, and the access drive. This plan is intended to show the layout of the site before any actual construction activities occur. The utilities and building footprint are shown to give an idea of the scale of the building and site as well as to identify where the utilities are. It should be noted that the site boundary is also where the site fencing is located.

The excavation phase plan shows the layout of the site as footers and any necessary grading is taking place. It shows where the job trailers for the prime contractors are located along with available parking. These trailers are the only temporary facilities on site. The plan also shows the general area where the stockpile is located. A site entrance/exit could not be shown on the plans due to the fact that it is located farther down the access drive and including it in the plans would have made the scale of the plan too small to distinguish any detail. This plan also shows the flow of traffic that workers and civilians coming to site will utilize.

The superstructure phase plan shows the layout of the site as the walls, slabs, joists, and roofs are being installed. It shows the laydown areas for each of the major trades that require it. Notice that the MEP laydown area is one big area. This is due to the fact that at this point in construction the MEP trades are simply running lines and pipes underground and through walls and therefore do not have as much to store as the main structural trades, masonry and steel. Construction traffic is also shown on this plan which shows how any construction equipment and/or vehicles will traverse the site. Notice that at the North West corner of the building the civilian traffic and construction traffic cross paths. This is a dangerous spot and can result in a severe accident if caution is not paid by both drivers of construction equipment as well as civilian vehicles where driving around the site. Notice that no crane is shown on site due to the fact that there is no permanent crane. As discussed before the crane is mobile and is only on site on days which require setting joists.

The finished plan shows the layout of the site as the vast majority of work has moved to the inside of the building and grading around the building is complete. Lay down areas are no longer necessary. The only storage needed are the storage trailers for materials which will later be installed in the building.

Due to the openness of the site and its relative seclusion there are no out of the ordinary safety procedures. The site is spacious enough to accommodate for all required parking and laydown areas as well as for the easy maneuvering of construction equipment.

Local Conditions

Landis Run Intermediate School is located in Lancaster, Pennsylvania. Although there are many common types of construction in the area, the most common method of construction is load bearing masonry. Within this type of construction joists are by far the most common method of supporting any floor slabs above on the load bearing walls. It is also typical for a building of this construction type and size to not have a permanent crane on site due to the relatively small amount of things to be lifted. Since joists are not set every day and most other building materials can be lifted to significant heights with front loaders it is not cost effective to have a crane on site for a majority of the project.

One way in which LRI is trying to achieve its LEED Silver rating is by minimizing the disturbance on site during construction. This inherently reduces the amount of available parking for workers. However, even with the reduced site disturbance there is still a sufficient amount of parking available to workers even during peak construction periods. There is enough space for two lanes of parking in front of the job trailers of the primes and the access road, which is of substantial length, is wide enough for parking on one side. There are also many open areas that when not being used for storage could be utilized for parking. Overall, although parking has the potential to be tight at times the site certainly has the capacity to accommodate all vehicles and has no need to bus workers in from off-site parking lots.

As found on the website of the Lancaster County Solid Waste Management Authority, it cost $53.00 per ton to dispose of construction/demolition waste in its landfills. Recyclables cost $10.00 per ton to either dump at a landfill, resource recovery facility (RRF), or transfer station. That price is steady for all types of recyclables. A complete list of dumping fees for the LCSWMA can be found in Appendix D.

According to the Geotechnical report provided by the owner there are approximately six different soil types on the site. The soils were classified in accordance with ASTM D2488 and are the following: silt, silt with sand (ML), shale, silty sand (SM), lean clay with sand (CL), dolomite, and schist. In general, the soil contained variable amounts of sand and rock fragments and is generally firm, stiff, and compactible. Under normal conditions the soil found on site is suitable for construction. However, as is the case with all soils excessive rain can create unsuitable soils and will need to be given time to dry. The site experienced this with a period of steady rain in the summer. Remediation efforts were made via aerating to dry the soil as quickly possible.

In addition, the Geotechnical report states that there was no groundwater found during any excavations of test pits. Therefore, due to the geotechnical report and the lack of significant excavation, groundwater is not anticipated to be encountered during the construction of LRI.

Client Information

Client Goals & Expectations

The owner of the project is the Manheim Township School District. They are constructing the 210,000 SF building in order to prepare for the growth that the district is experiencing. The new 5th and 6th grade school will also allow the district to expand its services, specifically the addition of full day kindergarten.

The school district's number one goal is ensuring the turnover deadline is met. It has set a strict deadline for building turnover for August 28th, 2012 so that the building will be ready for occupancy for the 2012-2013 academic year. It is an essential goal because they have no alternative locations to place the 5th and 6th grade students scheduled to occupy the building. They have shared some of the burden in ensuring that the deadline is reached. One example was the district's willingness to purchase hundreds of thousands of dollars' worth of stone so that the project would not be delayed due to rain and the lack of a suitable building footer. They purchased the stone so that a suitable building pad could be made and footings could start sooner than if they waited for the soil to dry out.

The second most important goal for the district is staying on budget. So far the project is actually under budget and it is important to the district that it stays that way. The board recognizes that the money being spent is taxpayer dollars and should be spent responsibly. They tried to ensure responsible spending by striving to compile complete construction documents that were very detailed in order to reduce change orders.

The district has set high expectations for the quality of LRI and its construction. Part of the district's vision as listed on its website is to create a learning environment that is "a place that stimulates curiosity and creativity" as well as "a place that provides opportunities for critical thinking and problem solving" among other goals. In order to achieve this goal the district pursued the latest technology in teaching as exemplified in the building's "STEM" labs. Another way it is trying to achieve an exceptional learning environment is striving for a LEED Silver Rating which will provide for an environment more conducive to learning through better air quality, comfort, and day lighting. To ensure the quality of the project members of the school board along with the owner's representative often take walking tours of the site for visual inspection of the construction.

The district is also striving to minimize the impact on the surrounding area. The site is surrounded by houses on three sides. In recognition of this and a township noise ordinance the district has restricted construction starting time to 7 am sharp. No loud noises before this time will be tolerated. Other examples exist as well such as the tire wash station at the exit of the site to prevent the tracking of mud onto the township roads.

Phasing & Occupancy Requirements

Since the project is not attached to any other buildings and is relatively isolated from the other schools that are located on the campus there are no phased or dual occupancy requirements. The order in which the construction flow in the building goes allows the district to start moving into areas A and B early in august, while areas C and especially D will not be ready for occupancy until the end of August. The township plans to take full advantage of this by using the larger rooms such as the cafeteria and gymnasium to act as staging areas for furniture and equipment which will later be moved to other areas of the building after turnover.

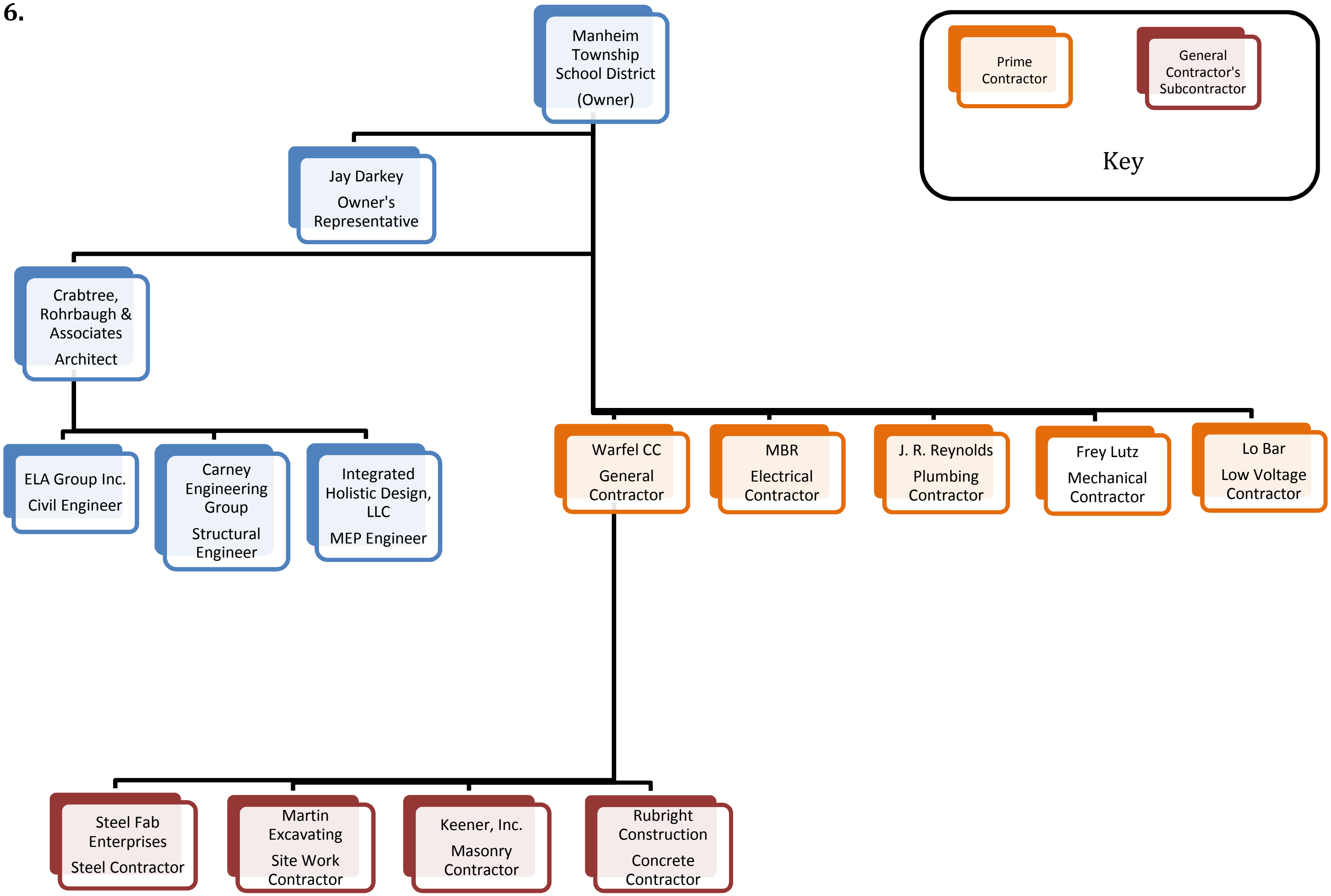
Due to the engineering of the campus there is a critical sequencing issue during construction. The issue at hand is the installation of the new switch gear for the campus. After the completion of LRI there will be four schools which will have their electricity fed through the high school's electrical room. In order to accommodate the new load that LRI will place on the existing switch gear new switch gear must be installed. However, the electricity must be shut off for installation to occur therefore the entire campus must go without electricity during the installation of the gear. Obviously, this cannot occur while school is in session. In addition, if the installation does not occur in a timely manner other construction activities that rely on power could lag due to the lack of available power. Originally, the installation was supposed to occur over the summer months of 2011 but due to unforeseen circumstances that did not happen. The new plan is to have the switch gear installed over three different shut down periods. The first shut down was Labor Day weekend and the next two shut downs will be at the end of October and Christmas Break.

Project Delivery System

The project delivery system for Landis Run Intermediate School is Design-Bid-Build with multiple primes. Design-Bid-Build was the only possible delivery system for the project because by law any project for which state and/or federal funds account for more than 50% of the funding must be Design-Bid-Build projects. Figure 6 on the following page shows the major parties involved in the design and construction of LRI and their contract relationships. In this project delivery system the five prime contractors all hold an individual contract with the owner, Manheim Township School District. Although they communicate and coordinate with one another, no one prime is responsible for or controls another prime. Although, it should be noted that certain primes do hold certain responsibilities for the entire site. For instance, the GC is deemed the "lead contractor" with respect to safety and is in charge of inspecting and maintaining safe working condition on the job site, mitigating safety conflicts (i.e. when the work of one contractor puts the safety of another contractor's worker in jeopardy), and other responsibilities relating to safety. The GC is also in charge of providing and maintaining the construction schedule. In addition, the architect only holds a contract with the owner and none of the primes. Although the architect will assist in monitoring the construction process and resolving conflicts between contractors, he has no legal obligation to any of the primes or vice versa. Furthermore, any of the primes may have sub-contractors to perform parts of their contract with the owner. However, the sub-contractors only hold a contract with and only report to the prime, not the owner. In this case, the owner has a representative who monitors the progression of the project full-time. Although the owner walks the site and receives regular reports about the project, outside of occasional observation the owner is not directly involved in the project.

The contractors were selected according to who bid the lowest. This is another stipulation of the law. Any project for which state and/or federal funds account for more than 50% of the funding the owner must award the contract to the lowest bidder on a contract.

Figure 6.


Manheim Township School District (Owner)
Jay Darkey Owner's Representative
Crabtree, Rohrbaugh & Associates Architect
ELA Group Inc. Civil Engineer
Carney Engineering Group Structural Engineer
Integrated Holistic Design, LLC MEP Engineer
Warfel CC General Contractor
MBR Electrical Contractor
J. R. Reynolds Plumbing Contractor
Frey Lutz Mechanical Contractor
Lo Bar Low Voltage Contractor
Steel Fab Enterprises Steel Contractor
Martin Excavating Site Work Contractor
Keener, Inc. Masonry Contractor
Rubright Construction Concrete Contractor
Prime Contractor
General Contractor's Subcontractor
Key

Staffing Plan

The management staff structure implemented by the General Contractor on Landis Run Intermediate School is split into two basic areas: office and field personnel. It consists of four office personnel and two field personnel.

Office Personnel

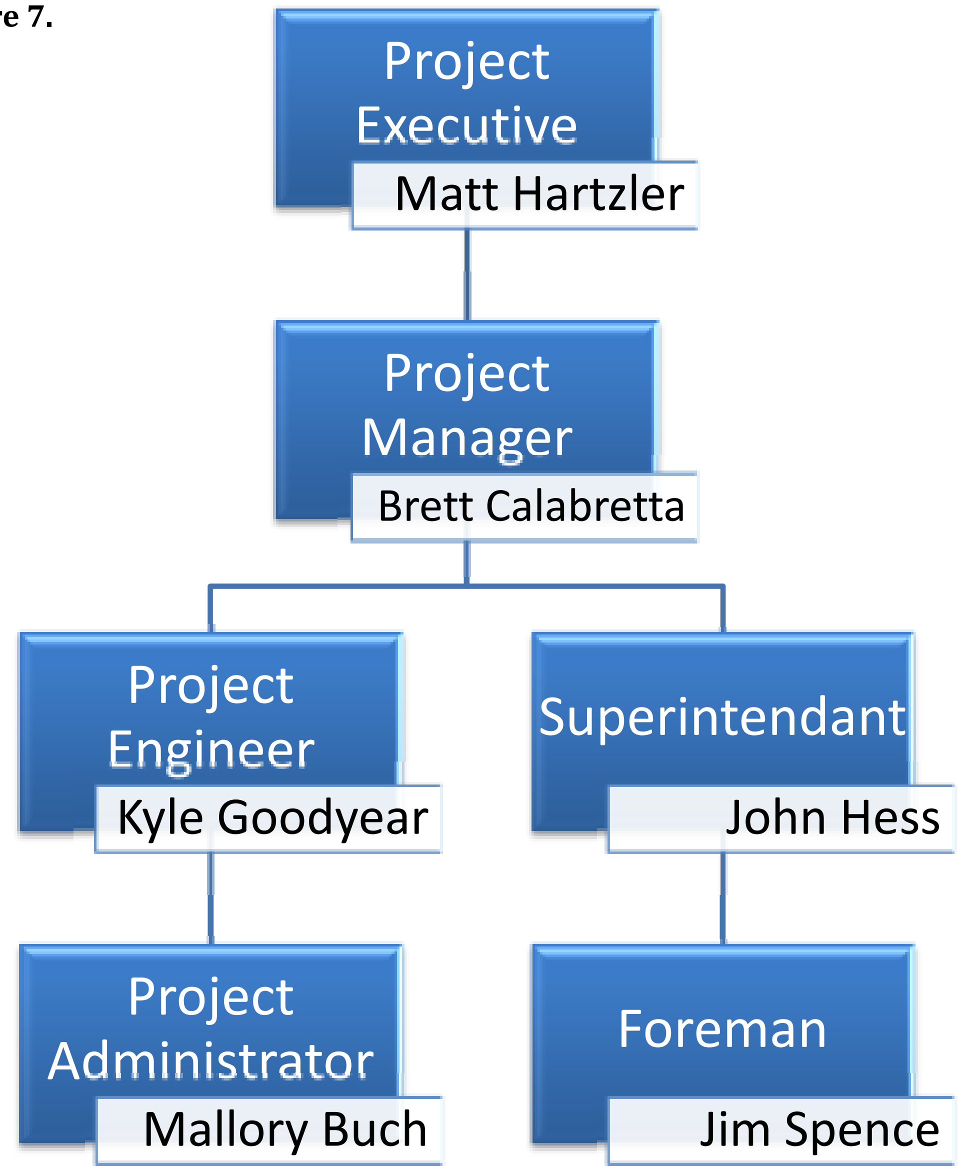
The project executive analyzes and tracks the project from a broad standpoint by monitoring the overall project cost and progression of the schedule. He relies on the project manager to alert him of any major issues that may need his attention. The project executive also provides advice and information based on experience to the project manager and project engineer if something arises that they may not have much experience with. The project manager is the person who holds the highest level of responsibility for the success or failure of the project. He examines the budget and schedule on a weekly or bi-weekly basis and is constantly looking into the near future to make sure the project runs smoothly. The PM also performs and array of activities on a day to day basis that change as the project progresses. Some of these tasks include scoping bids, buying contracts, resolving conflicts with subcontractors or other contractors, as well as confronting any other issues that may arise on the project. The project engineer works hand in hand with the project manager. His main responsibilities are composing RFI's, buying out contracts, scoping out bids, writing scopes of work, staying with contact with field personnel and resolving any issues they may raise, as well as taking meeting minutes and any miscellaneous tasks they may be assigned by the project engineer. It is important to note that many of the tasks listed above are shared with the project manager and whoever completes them for a given issue or contract is decided by the project manager. The project manager delegates the work load to members of the project team that he sees fit based on time and experience. The project administrator coordinates, submits, and files all documents relating to the project such as RFIs, LOIs, and correspondence with other parties involved in the project. They may also track down any withstanding documents or correspondence that should have been submitted to the company but is still outstanding.

Field Personnel

Supervision, utilization, and activity planning of the site as well as communicating with the other prime contractors is the responsibility of the superintendent. The superintendent submits daily reports about the progress, conditions, and weather on the site as well as any delays that were experienced and why. He walks the site to ensure that the quality of work is acceptable and coordinates with his foreman if he sees anything that needs to be fixed or changed. The superintendent also looks ahead and makes sure that everything is in place so that the construction activities planned for the near future will be carried out smoothly and on time. The superintendent reports on a regular basis to the PM. He reports any major issues with the project and any concerns he may have. The foreman spends the majority of his day on the site directly supervising and communicating with other contractors and sub-contractors. He also ensures that the quality of work on the site is acceptable and that the other contractors are progressing as scheduled. He reports any concerns he may have with the superintendent.

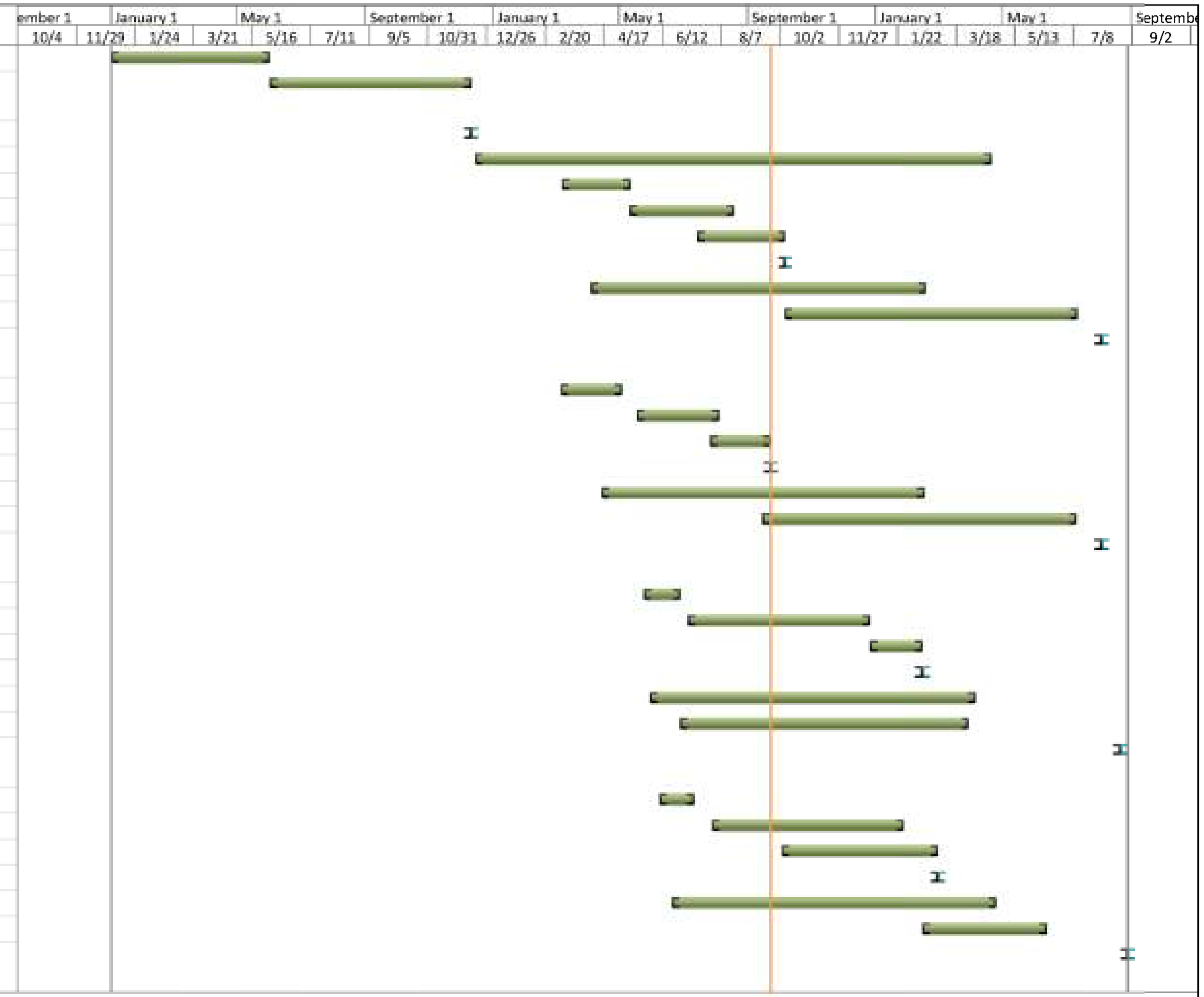
Below, figure 7 depicts the Staffing Plan for LRI that is utilized by Warfel Construction Company.

Figure 7.



Appendix A

ID	Task Name	Duration	Start	Finish	Predecessors
1	Design Phase	108 days	Fri 1/1/10	Tue 6/1/10	
2	Procurement of Construction Services	138 days	Wed 6/2/10	Fri 12/10/10	
3	Notice to Proceed	1 day	Fri 12/10/10	Fri 12/10/10	
4	Sitework	353 days	Wed 12/15/10	Fri 4/20/12	
5	Area A Foundations	47 days	Tue 3/8/11	Wed 5/11/11	
6	Area A Superstructure	72 days	Wed 5/11/11	Thu 8/18/11	
7	Area A Enclosure	60 days	Fri 7/15/11	Thu 10/6/11	
8	Area A Dry In	1 day	Thu 10/6/11	Thu 10/6/11	
9	Area A MEP Installation	230 days	Mon 4/4/11	Fri 2/17/12	
10	Area A Finishes	199 days	Fri 10/7/11	Wed 7/11/12	
11	Area A Substantially Complete	1 day	Fri 8/3/12	Fri 8/3/12	
12	Area B Foundations	42 days	Mon 3/7/11	Tue 5/3/11	
13	Area B Superstructure	57 days	Wed 5/18/11	Thu 8/4/11	
14	Area B Enclosure	42 days	Wed 7/27/11	Thu 9/22/11	
15	Area B Dry In	1 day	Thu 9/22/11	Thu 9/22/11	
16	Area B MEP Installation	220 days	Fri 4/15/11	Thu 2/16/12	
17	Area B Finishes	214 days	Thu 9/15/11	Tue 7/10/12	
18	Area B Substantially Complete	1 day	Fri 8/3/12	Fri 8/3/12	
19	Area C Foundations	25 days	Wed 5/25/11	Tue 6/28/11	
20	Area C Superstructure	124 days	Wed 7/6/11	Mon 12/26/11	
21	Area C Enclosure	36 days	Tue 12/27/11	Tue 2/14/12	
22	Area C Dry In	1 day	Tue 2/14/12	Tue 2/14/12	
23	Area C MEP Installation	223 days	Tue 5/31/11	Thu 4/5/12	
24	Area C Finishes	197 days	Wed 6/29/11	Thu 3/29/12	
25	Area C Substantially Complete	1 day	Tue 8/21/12	Tue 8/21/12	
26	Area D Foundations	23 days	Thu 6/9/11	Mon 7/11/11	
27	Area D Superstructure	131 days	Fri 7/29/11	Fri 1/27/12	
28	Area D Enclosure	107 days	Tue 10/4/11	Wed 2/29/12	
29	Area D Dry In	1 day	Wed 2/29/12	Wed 2/29/12	
30	Area D MEP Installation	221 days	Tue 6/21/11	Tue 4/24/12	
31	Area D Finishes	85 days	Wed 2/15/12	Tue 6/12/12	
32	Area D Substantially Complete	1 day	Tue 8/28/12	Tue 8/28/12	



Appendix B

	Square Foot Cost Estimate Report			
Estimate Name:	Landis Run Intermediate School			
Building Type:	School, Elementary with Face Brick with Concrete Block Back-up / Bearing Walls			
Location:	National Average			
Story Count:	2			
Story Height (L.F.):	12			
Floor Area (S.F.):	105000			
Labor Type:	Union			
Basement Included:	No			
Data Release:	Year 2008 Quarter 1	Costs are derived from a building model with basic components.		
Cost Per Square Foot:	$85.21	Scope differences and market conditions can cause costs to vary significantly.		
Building Cost:	$17,894,500	Parameters are not within the ranges recommended by RSMeans.		
		% of Total	Cost Per S.F.	Cost
A Substructure		8.50%	$7.26	$1,525,000
A1010	**Standard Foundations**		$1.33	$279,500
	12" deep x 24" wide			
A1030	**Slab on Grade**		$4.61	$968,000
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		$0.14	$29,500
	storage			
A2020	**Basement Walls**		$1.18	$248,000
	thick			
B Shell		17.30%	$14.78	$3,103,000
B1020	**Roof Construction**		$3.85	$808,500
	40 PSF superimposed load, 60 PSF total load			
B2010	**Exterior Walls**		$2.48	$521,500
	perlite core fill			
B2020	**Exterior Windows**		$1.03	$215,500
	Windows, aluminum, awning, insulated glass, 4'-5" x 5'-3"			
B2030	**Exterior Doors**		$0.54	$113,500
	6'-0" x 10'-0" opening			
	opening			
B3010	**Roof Coverings**		$6.88	$1,444,000
	strps			
	Insulation, rigid, roof deck, polyisocyanurate, 2#/CF, 2" thick, R14.29			
	Insulation, rigid, roof deck, polyisocyanurate, tapered for drainage			
	counter flashing			
	Roof edges, aluminum, duranodic, .050" thick, 8" face			
	Flashing, aluminum, no backing sides, .019"			
C Interiors		26.70%	$22.73	$4,773,500
C1010	**Partitions**		$4.22	$886,000
	Concrere block (CMU) partition, regular weight, hollow, 8" thick, no finish			
C1020	**Interior Doors**		$1.20	$252,500
	0" x 7'-0" x 1-3/8"			
C1030	**Fittings**		$1.73	$364,000
	Toilet partitions, cubicles, ceiling hung, stainless steel			
	Chalkboards, liquid chalk type, aluminum frame & chalktrough			
C3010	**Wall Finishes**		$3.22	$677,000
	2 coats paint on masonry with block filler			
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	Painting, masonry or concrete, latex, brushwork, addition for block filler			
	Wall coatings, acrylic glazed coatings, maximum			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		$6.50	$1,365,500

	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, minimum			
	Terrazzo, maximum			
	Vinyl, composition tile, maximum			
C3030	**Ceiling Finishes**		$5.85	$1,228,500
	grid, suspended support			
D Services		47.30%	$40.32	$8,467,000
D2010	**Plumbing Fixtures**		$7.19	$1,509,000
	Water closet, vitreous china, bowl only with flush valve, floor mount			
	Urinal, vitreous china, stall type			
	Lavatory w/trim, wall hung, PE on CI, 20" x 18"			
	Kitchen sink w/trim, countertop, stainless steel, 43" x 22" double bowl			
	Service sink w/trim, PE on CI, corner floor, wall hung w/rim guard, 24" x 20"			
	Shower, stall, baked enamel, terrazzo receptor, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		$0.09	$19,000
	Gas fired water heater, commercial, 100< F rise, 300 MBH input, 278 GPH			
D2040	**Rain Water Drainage**		$0.10	$20,500
	Roof drain, CI, soil,single hub, 5" diam, 10' high			
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add			
D3010	**Energy Supply**		$8.35	$1,753,500
	10,000 SF, 100,000 CF, total 2 floors			
D3050	**Terminal & Package Units**		$10.86	$2,280,500
	ton			
D4010	**Sprinklers**		$2.26	$474,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 50,000 SF			
D5010	**Electrical Service/Distribution**		$0.28	$58,500
	4 wire, 120/208 V, 800 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 800 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 800 A			
D5020	**Lighting and Branch Wiring**		$9.22	$1,936,000
	transformer			
	Wall switches, 2.0 per 1000 SF			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	fixtures @40 watt per 1000 SF			
D5030	**Communications and Security**		$1.90	$398,500
	sound systems, 12 outlets			
	fire detection systems, 50 detectors			
	master clock systems, 10 rooms			
	master TV antenna systems, 12 outlets			
	Internet wiring, 2 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		$0.08	$17,000
	operated, 3 phase, 4 wire, 277/480 V, 15 kW			
E Equipment & Furnishings		0.20%	$0.12	$26,000
E1020	**Institutional Equipment**		$0.12	$26,000
	Architectural equipment, laboratory equipment, counter tops, stainless steel			
E1090	**Other Equipment**		$0.00	$0
F Special Construction		0.00%	$0.00	$0
G Building Sitework		0.00%	$0.00	$0
SubTotal		100%	$85.21	$17,894,500
Contractor Fees (General Conditions,Overhead,Profit)		0.00%	$0.00	$0
Architectural Fees		0.00%	$0.00	$0
User Fees		0.00%	$0.00	$0
Total Building Cost			$85.21	$17,894,500

Appendix C

	Square Foot Cost Estimate Report	
Estimate Name:	Landis Run Intermediate School	
Building Type:	School, Elementary with Face Brick with Concrete Block Back-up / Bearing Walls	
Location:	National Average	
Story Count:	1	
Story Height (L.F.):	12	
Floor Area (S.F.):	210000	
Labor Type:	Union	
Basement Included:	No	
Data Release:	Year 2008 Quarter 1	Costs are derived from a building model with basic components.
Cost Per Square Foot:	$85.21	Scope differences and market conditions can cause costs to vary significantly.
Building Cost:	$17,894,500	Parameters are not within the ranges recommended by RSMeans.

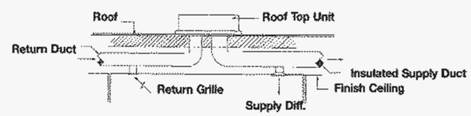
		% of Total	Cost Per S.F.	Cost
A Substructure		8.50%	$7.26	$1,525,000
A1010	Standard Foundations		$1.33	$279,500
	12" deep x 24" wide			
A1030	Slab on Grade		$4.61	$968,000
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	Basement Excavation		$0.14	$29,500
	storage			
A2020	Basement Walls		$1.18	$248,000
	thick			
B Shell		17.30%	$14.78	$3,103,000
B1020	Roof Construction		$3.85	$808,500
	40 PSF superimposed load, 60 PSF total load			
B2010	Exterior Walls		$2.48	$521,500
	perlite core fill			
B2020	Exterior Windows		$1.03	$215,500
	Windows, aluminum, awning, insulated glass, 4'-5" x 5'-3"			
B2030	Exterior Doors		$0.54	$113,500
	6'-0" x 10'-0" opening			
	opening			
B3010	Roof Coverings		$6.88	$1,444,000
	strps			
	Insulation, rigid, roof deck, polyisocyanurate, 2#/CF, 2" thick, R14.29			
	Insulation, rigid, roof deck, polyisocyanurate, tapered for drainage			
	counter flashing			
	Roof edges, aluminum, duranodic, .050" thick, 8" face			
	Flashing, aluminum, no backing sides, .019"			
C Interiors		26.70%	$22.73	$4,773,500
C1010	Partitions		$4.22	$886,000
	Concrere block (CMU) partition, regular weight, hollow, 8" thick, no finish			
C1020	Interior Doors		$1.20	$252,500
	0" x 7'-0" x 1-3/8"			
C1030	Fittings		$1.73	$364,000
	Toilet partitions, cubicles, ceiling hung, stainless steel			
	Chalkboards, liquid chalk type, aluminum frame & chalktrough			
C3010	Wall Finishes		$3.22	$677,000
	2 coats paint on masonry with block filler			
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	Painting, masonry or concrete, latex, brushwork, addition for block filler			
	Wall coatings, acrylic glazed coatings, maximum			
	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	Floor Finishes		$6.50	$1,365,500

	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Carpet, padding, add to above, minimum			
	Terrazzo, maximum			
	Vinyl, composition tile, maximum			
C3030	**Ceiling Finishes**		$5.85	$1,228,500
	grid, suspended support			
D Services		47.30%	$40.32	$11,026,365
D2010	**Plumbing Fixtures**		$7.19	$1,509,000
	Water closet, vitreous china, bowl only with flush valve, floor mount			
	Urinal, vitreous china, stall type			
	Lavatory w/trim, wall hung, PE on CI, 20" x 18"			
	Kitchen sink w/trim, countertop, stainless steel, 43" x 22" double bowl			
	Service sink w/trim, PE on CI, corner floor, wall hung w/rim guard, 24" x 20"			
	Shower, stall, baked enamel, terrazzo receptor, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		$0.09	$19,000
	Gas fired water heater, commercial, 100< F rise, 300 MBH input, 278 GPH			
D2040	**Rain Water Drainage**		$0.10	$20,500
	Roof drain, CI, soil,single hub, 5" diam, 10' high			
	Roof drain, CI, soil,single hub, 5" diam, for each additional foot add			
D3030	**Energy Supply**		$8.35	$2,499,000
	Cooling Generating Systems			
D3050	**Terminal & Package Units**		$10.86	$3,864,000
	95.83 ton			
D4010	**Sprinklers**		$2.26	$625,500
	Dry Pipe, one story 50,000 ft2 and (2) three story 25000ft2			
D5010	**Electrical Service/Distribution**		$0.28	$82,650
	phase, 4 wire, 277/480A, 2500A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 800 A			
	2500A			
D5020	**Lighting and Branch Wiring**		$9.22	$1,936,000
	transformer			
	Wall switches, 2.0 per 1000 SF			
	Miscellaneous power, 1.2 watts			
	Central air conditioning power, 4 watts			
	fixtures @40 watt per 1000 SF			
D5030	**Communications and Security**		$1.90	$398,500
	sound systems, 12 outlets			
	fire detection systems, 50 detectors			
	master clock systems, 10 rooms			
	master TV antenna systems, 12 outlets			
	Internet wiring, 2 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		$0.08	$72,215
	operated, 3 phase, 4 wire, 277/480 V, 130 kW			
E Equipment & Furnishings		0.20%	$0.12	$26,000
E1020	**Institutional Equipment**		$0.12	$26,000
	Architectural equipment, laboratory equipment, counter tops, stainless steel			
E1090	**Other Equipment**		$0.00	$0
F Special Construction		0.00%	$0.00	$0
G Building Sitework		0.00%	$0.00	$0
SubTotal		100%	$85.21	$17,894,500
Contractor Fees (General Conditions,Overhead,Profit)		0.00%	$0.00	$0
Architectural Fees		0.00%	$0.00	$0
User Fees		0.00%	$0.00	$0
Total Building Cost			$85.21	$20,453,865

Appendix D

D30 HVAC

D3050 Terminal & Package Units



System Description: Rooftop single zone units are electric cooling and gas heat. Duct systems are low velocity, galvanized steel supply and return. Price variations between sizes are due to several factors. Jumps in the cost of the rooftop unit occur when the manufacturer shifts from the largest capacity unit on a small frame to the smallest capacity on the next larger frame, or changes from one compressor to two. As the unit capacity increases for larger areas the duct distribution grows in proportion. For most applications there is a tradeoff point where it is less expensive and more efficient to utilize smaller units with short simple distribution systems. Larger units also require larger initial supply and return ducts which can create a space problem. Supplemental heat may be desired in colder locations. The table below is based on one unit supplying the area listed. The 10,000 S.F. unit for bars and taverns is not listed because a nominal 110 ton unit would be required and this is above the normal single zone rooftop capacity.

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D3050 150 1280					
ROOFTOP, SINGLE ZONE, AIR CONDITIONER					
APARTMENT CORRIDORS, 500 S.F., .92 TON					
Rooftop air conditioner, 1 zone, electric cool, standard controls, curb	1.000	Ea.	1,759.50	736	2,495.50
Ductwork package for rooftop single zone units	1.000	System	229.08	1,035	1,264.08
TOTAL			1,988.58	1,771	3,759.58
COST PER S.F.			3.98	3.54	7.52

D3050 150	Rooftop Single Zone Unit Systems		COST PER S.F. MAT.	COST PER S.F. INST.	COST PER S.F. TOTAL
1260	Rooftop, single zone, air conditioner				
1280	Apartment corridors, 500 S.F., .92 ton		4	3.55	7.55
1480	10,000 S.F., 18.33 ton	RD3030 -010	2.67	2.39	5.06
1560	Banks or libraries, 500 S.F., 2.08 ton		9	8	17
1760	10,000 S.F., 41.67 ton		4.86	5.40	10.26
1840	Bars and taverns, 500 S.F. 5.54 ton		13.25	10.65	23.90
2000	5,000 S.F., 55.42 ton		11	8.10	19.10
2080	Bowling alleys, 500 S.F., 2.83 ton		8	9	17
2280	10,000 S.F., 56.67 ton		6.35	7.35	13.70
2360	Department stores, 500 S.F., 1.46 ton		6.30	5.60	11.90
2560	10,000 S.F., 29.17 ton		3.46	3.77	7.23
2640	Drug stores, 500 S.F., 3.33 ton		9.40	10.55	19.95
2840	10,000 S.F., 66.67 ton		7.45	8.60	16.05
2920	Factories, 500 S.F., 1.67 ton		7.20	6.40	13.60
3120	10,000 S.F., 33.33 ton		3.95	4.31	8.26
3200	Food supermarkets, 500 S.F., 1.42 ton		6.15	5.45	11.60
3400	10,000 S.F., 28.33 ton		3.36	3.67	7.03
3480	Medical centers, 500 S.F., 1.17 ton		5.05	4.50	9.55
3680	10,000 S.F., 23.33 ton		3.39	3.03	6.42
3760	Offices, 500 S.F., 1.58 ton		6.85	6.10	12.95
3960	10,000 S.F., 31.67 ton		3.76	4.10	7.86
4000	Restaurants, 500 S.F., 2.50 ton		10.80	9.65	20.45
4200	10,000 S.F., 50.00 ton		5.60	6.45	12.05
4240	Schools and colleges, 500 S.F., 1.92 ton		8.30	7.40	15.70
4440	10,000 S.F., 38.33 ton		4.47	4.96	9.43

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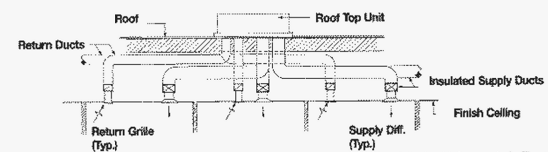
HVAC

050 Terminal & Package Units



System Description: Rooftop units are multizone with up to 12 zones, and include electric cooling, gas heat, thermostats, filters, supply and return fans complete. Duct systems are low velocity, galvanized steel supply and return with insulated supplies.

Multizone units cost more per ton of cooling than single zone. However, they offer flexibility where load conditions are varied due to heat generating areas or exposure to radiational heating. For example, perimeter offices on the "sunny side" may require cooling at the same time "shady side" or central offices may require heating. It is possible to accomplish similar results using duct heaters in branches of the single zone unit. However, heater location could be a problem and total system operating energy efficiency could be lower.

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D3050 155 1280					
ROOFTOP, MULTIZONE, AIR CONDITIONER					
APARTMENT CORRIDORS, 3,000 S.F., 5.50 TON					
Rooftop multizone unit, standard controls, curb	1.000	Ea.	27,500	1,716	29,216
Ductwork package for rooftop multizone units	1.000	System	1,787.50	11,825	13,612
TOTAL			29,287.50	13,541	42,828
COST PER S.F.			9.76	4.51	14.[illegible]

Note A: Small single zone unit recommended

D3050 155	Rooftop Multizone Unit Systems		COST PER S.F. MAT.	COST PER S.F. INST.	COST PER S.F. TOTAL
1240	Rooftop, multizone, air conditioner				
1260	Apartment corridors, 1,500 S.F., 2.75 ton. See Note A.				
1280	3,000 S.F., 5.50 ton	RD3030 -010	9.77	4.50	[illegible]
1440	25,000 S.F., 45.80 ton		6.45	4.36	[illegible]
1520	Banks or libraries, 1,500 S.F., 6.25 ton		22	10.25	[illegible]
1640	15,000 S.F., 62.50 ton		10.80	9.85	[illegible]
1720	25,000 S.F., 104.00 ton		9.65	9.80	[illegible]
1800	Bars and taverns, 1,500 S.F., 16.62 ton		48	14.80	[illegible]
1840	3,000 S.F., 33.24 ton		40	14.25	[illegible]
1880	10,000 S.F., 110.83 ton		24	14.20	[illegible]
2080	Bowling alleys, 1,500 S.F., 8.50 ton		30	13.95	[illegible]
2160	10,000 S.F., 56.70 ton		19.90	13.50	[illegible]
2240	20,000 S.F., 113.00 ton		13.10	13.30	[illegible]
2640	Drug stores, 1,500 S.F., 10.00 ton		36.50	16.40	[illegible]
2680	3,000 S.F., 20.00 ton		24.50	15.80	[illegible]
2760	15,000 S.F., 100.00 ton		15.45	15.70	[illegible]
3760	Offices, 1,500 S.F., 4.75 ton. See Note A				
3880	15,000 S.F., 47.50 ton		11.15	7.55	[illegible]
3960	25,000 S.F., 79.16 ton		8.20	7.50	[illegible]
4000	Restaurants, 1,500 S.F., 7.50 ton		26.50	12.30	[illegible]
4080	10,000 S.F., 50.00 ton		17.55	11.90	[illegible]
4160	20,000 S.F., 100.00 ton		11.60	11.80	[illegible]
4240	Schools and colleges, 1,500 S.F., 5.75 ton		20.50	9.45	[illegible]
4360	15,000 S.F., 57.50 ton		9.95	9.05	[illegible]
4441	25,000 S.F., 95.83 ton		9.35	9.05	[illegible]

D30 HVAC

D3020 Heat Generating Systems

D3020 315	Chimney, Stainless Steel, Insulated, Wood & Oil	COST PER V.L.F.		
		MAT.	INST.	TOTAL
0530	Chimney, stainless steel, insulated, diameter, 6"	62	17.85	79.85
0540	7"	80.50	19.10	99.60
0550	8"	95	20.50	115.50
0560	10"	137	22.50	159.50
0570	12"	184	24.50	208.50
0580	14"	241	25.50	266.50

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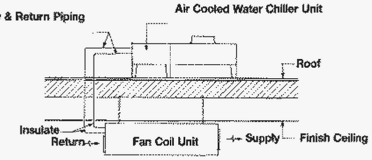
HVAC

030 Cooling Generating Systems



Design Assumptions: The chilled water, air cooled systems priced, utilize reciprocating hermetic compressors and propeller-type condenser fans. Piping with pumps and expansion tanks is included based on a two pipe system. No ducting is included and the fan-coil units are cooling only. Water treatment and balancing are not included. Chilled water piping is insulated. Area distribution is through the use of multiple fan coil units. Fewer but larger fan coil units with duct distribution would be approximately the same S.F. cost.

System Components	QUANTITY	UNIT	COST EACH		
			MAT.	INST.	TOTAL
SYSTEM D3030 110 1200					
PACKAGED CHILLER, AIR COOLED, WITH FAN COIL UNIT					
APARTMENT CORRIDORS, 3,000 S.F., 5.50 TON					
Fan coil air conditioning unit, cabinet mounted & filters chilled water	1.000	Ea.	3,482.70	513.24	3,995.94
Water chiller, air conditioning unit, air cooled	1.000	Ea.	7,122.50	1,918.13	9,040.63
Chilled water unit coil connections	1.000	Ea.	1,300	1,400	2,700
Chilled water distribution piping	440.000	L.F.	7,854	18,920	26,774
TOTAL			19,759.20	22,751.37	42,510.57
COST PER S.F.			6.59	7.58	14.17

D3030 110	Chilled Water, Air Cooled Condenser Systems	COST PER S.F.		
		MAT.	INST.	TOTAL
1180	Packaged chiller, air cooled, with fan coil unit			
1200	Apartment corridors, 3,000 S.F., 5.50 ton	6.60	7.60	14.20
1360	40,000 S.F., 73.33 ton	4.16	3.35	7.51
1440	Banks and libraries, 3,000 S.F., 12.50 ton RD3030 -010	10.40	8.95	19.35
1560	20,000 S.F., 83.33 ton	7.50	4.56	12.06
1680	Bars and taverns, 3,000 S.F., 33.25 ton	17.40	10.60	28
1760	10,000 S.F., 110.83 ton	13.25	2.63	15.88
1920	Bowling alleys, 3,000 S.F., 17.00 ton	13.25	10.05	23.30
2040	20,000 S.F., 113.33 ton	8.45	4.63	13.08
2160	Department stores, 3,000 S.F., 8.75 ton	9.30	8.45	17.75
2320	40,000 S.F., 116.66 ton	5.40	3.47	8.87
2400	Drug stores, 3,000 S.F., 20.00 ton	15.05	10.35	25.40
2520	20,000 S.F., 133.33 ton	10.45	4.89	15.34
2640	Factories, 2,000 S.F., 10.00 ton	9.05	8.60	17.65
2800	40,000 S.F., 133.33 ton	5.95	3.58	9.53
2880	Food supermarkets, 3,000 S.F., 8.50 ton	9.15	8.40	17.55
3040	40,000 S.F., 113.33 ton	5.10	3.48	8.58
3120	Medical centers, 3,000 S.F., 7.00 ton	8.20	8.20	16.40
3280	40,000 S.F., 93.33 ton	4.62	3.41	8.03
3360	Offices, 3,000 S.F., 9.50 ton	8.40	8.35	16.75
3520	40,000 S.F., 126.66 ton	5.85	3.59	9.44
3600	Restaurants, 3,000 S.F., 15.00 ton	11.70	9.30	21
3720	20,000 S.F., 100.00 ton	8.60	4.85	13.45
3840	Schools and colleges, 3,000 S.F., 11.50 ton	9.85	8.80	18.65
3960	20,000 S.F., 76.66 ton	7.30	4.60	11.90

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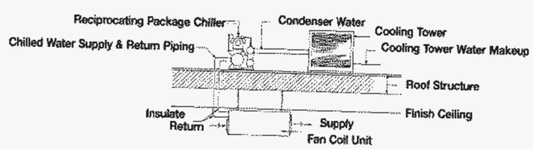
D30 HVAC

D3030 Cooling Generating Systems



General: Water cooled chillers are available in the same sizes as air cooled units. They are also available in larger capacities.

Design Assumptions: The chilled water systems with water cooled condenser include reciprocating hermetic compressors, water cooling tower, pumps, piping and expansion tanks and are based on a two pipe system. Chilled water piping is insulated. No ducts are included and fan-coil units are cooling only. Area distribution is through use of multiple fan coil units. Fewer but larger fan coil units with duct distribution would be approximately the same S.F. cost. Water treatment and balancing are not included.

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D3030 115 1320					
PACKAGED CHILLER, WATER COOLED, WITH FAN COIL UNIT					
APARTMENT CORRIDORS, 4,000 S.F., 7.33 TON					
Fan coil air conditioner unit, cabinet mounted & filters, chilled water	2.000	Ea.	4,641.70	684.04	5,325.74
Water chiller, water cooled, 1 compressor, hermetic scroll,	1.000	Ea.	5,358.60	3,343.40	8,702
Cooling tower, draw thru single flow, belt drive	1.000	Ea.	1,312.07	141.84	1,453.91
Cooling tower pumps & piping	1.000	System	656.04	337.18	993.22
Chilled water unit coil connections	2.000	Ea.	2,600	2,800	5,400
Chilled water distribution piping	520.000	L.F.	9,282	22,360	31,642
TOTAL			23,850.41	29,666.46	53,516.87
COST PER S.F.			5.96	7.42	13.38

*Cooling requirements would lead to choosing a water cooled unit.

D3030 115	Chilled Water, Cooling Tower Systems	COST PER S.F. MAT.	COST PER S.F. INST.	COST PER S.F. TOTAL
1300	Packaged chiller, water cooled, with fan coil unit			
1320	Apartment corridors, 4,000 S.F., 7.33 ton	5.98	7.43	13.41
1600	Banks and libraries, 4,000 S.F., 16.66 ton	10.40	8.15	18.55
1800	60,000 S.F., 250.00 ton RD3030 -010	7.40	6.55	13.95
1880	Bars and taverns, 4,000 S.F., 44.33 ton	18.75	10.30	29.05
2000	20,000 S.F., 221.66 ton	18.50	8.55	27.05
2160	Bowling alleys, 4,000 S.F., 22.66 ton	12.45	8.95	21.40
2320	40,000 S.F., 226.66 ton	10.30	6.25	16.55
2440	Department stores, 4,000 S.F., 11.66 ton	6.75	8.05	14.80
2640	60,000 S.F., 175.00 ton	6.60	6	12.60
2720	Drug stores, 4,000 S.F., 26.66 ton	13.20	9.20	22.40
2880	40,000 S.F., 266.67 ton	10.20	7.05	17.25
3000	Factories, 4,000 S.F., 13.33 ton	8.95	7.75	16.70
3200	60,000 S.F., 200.00 ton	6.60	6.30	12.90
3280	Food supermarkets, 4,000 S.F., 11.33 ton	6.65	8	14.65
3480	60,000 S.F., 170.00 ton	6.55	6	12.55
3560	Medical centers, 4,000 S.F., 9.33 ton	5.70	7.35	13.05
3760	60,000 S.F., 140.00 ton	5.30	6.05	11.35
3840	Offices, 4,000 S.F., 12.66 ton	8.65	7.70	16.35
4040	60,000 S.F., 190.00 ton	6.35	6.25	12.60
4120	Restaurants, 4,000 S.F., 20.00 ton	11.10	8.30	19.40
4320	60,000 S.F., 300.00 ton	8.30	6.80	15.10
4400	Schools and colleges, 4,000 S.F., 15.33 ton	9.85	8	17.85
4600	60,000 S.F., 230.00 ton	6.80	6.35	13.15

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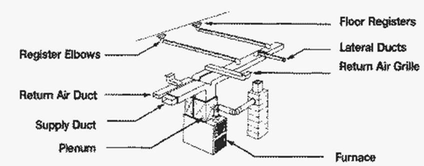
D30 HVAC

D3030 Cooling Generating Systems



System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D3030 214 1200					
HEATING/COOLING, GAS FIRED FORCED AIR,					
ONE ZONE, 1200 SF BLDG, SEER 14					
Thermostat manual	1.000	Ea.	48	74.50	122.50
Intermittent pilot	1.000	Ea.	165		165
Furnace, 3 Ton cooling, 115 MBH	1.000	Ea.	1,975	355	2,330
Cooling tubing 25 feet	1.000	Ea.	259		259
Ductwork	158.000	Lb.	82.16	1,121.80	1,203.96
Ductwork connection	12.000	Ea.	354	214.20	568.20
Supply ductwork	176.000	SF Surf	149.60	837.76	987.36
Supply grill	2.000	Ea.	52	54	106
Duct insulation	1.000	L.F.	377.28	593.28	970.56
Return register	1.000	Ea.	342	223.20	565.20
TOTAL			3,804.04	3,473.74	7,277.78

D3030 214	Heating/Cooling System	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
1200	Heating/Cooling system, gas fired, SEER 14, 1200 SF Bldg	3,800	3,475	7,275
1300	2000 SF Bldg	4,975	5,500	10,475
1400	Heating/Cooling system, heat pump 3 ton, SEER 14, 1200 SF Bldg	6,575	4,525	11,100
1500	5 ton, SEER 14, 2000 SF Bldg	8,850	5,150	14,000

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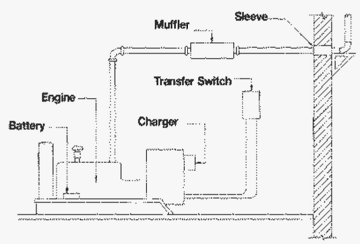
D50 Electrical

D5090 Other Electrical Systems



Description: System below tabulates the installed cost for generators by kW. Included in costs are battery, charger, muffler, and transfer switch.
No conduit, wire, or terminations included.

System Components	QUANTITY	UNIT	COST PER kW MAT.	COST PER kW INST.	COST PER kW TOTAL
SYSTEM D5090 210 0200					
GENERATOR SET, INCL. BATTERY, CHARGER, MUFFLER & TRANSFER SWITCH GAS/GASOLINE OPER., 3 PHASE, 4 WIRE, 277/480V, 7.5 kW					
Generator set, gas or gasoline operated, 3 ph 4 W, 277/480 V, 7.5 kW	.133	Ea.	1,163.33	254.40	1,417.73
TOTAL			1,163.33	254.40	1,417.73

D5090 210	Generators (by kW)	COST PER kW MAT.	COST PER kW INST.	COST PER kW TOTAL
0190	Generator sets, include battery, charger, muffler & transfer switch			
0200	Gas/gasoline operated, 3 phase, 4 wire, 277/480 volt, 7.5 kW	1,175	255	1,430
0240	11.5 kW RD5010 -110	1,075	195	1,270
0280	20 kW	730	126	856
0320	35 kW	495	83	578
0360	80 kW	355	50	405
0400	100 kW	310	48	358
0440	125 kW	510	45.50	555.50
0480	185 kW	455	34.50	489.50
0560	Diesel engine with fuel tank, 30 kW	740	96.50	836.50
0600	50 kW	550	75.50	625.50
0720	125 kW	335	43.50	378.50
0760	150 kW	320	41	361
0800	175 kW	297	36.50	333.50
0840	200 kW	268	33	301
0880	250 kW	252	27.50	279.50
0920	300 kW	228	24.50	252.50
0960	350 kW	220	22.50	242.50
1000	400 kW	239	21	260
1040	500 kW	240	17.65	257.65
1200	750 kW	263	11	274
1400	1000 kW	245	11.60	256.60

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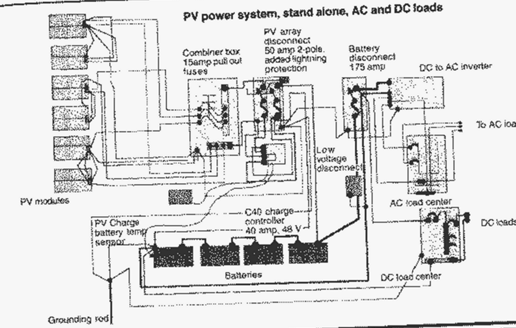
Electrical

090 Special Construction

PV power system, stand alone, AC and DC loads



System Components	QUANTITY	UNIT	MAT.	INST.	TOTAL
SYSTEM D5090 420 0100					
PHOTOVOLTAIC POWER SYSTEM, STAND ALONE					
Alternative energy sources, photovoltaic module, 75 watt, 17 volts	12.000	Ea.	5,220	876	6,096
DC to AC inverter for, 48V, 5,500 watt	1.000	Ea.	3,625	291	3,916
PV components, combiner box, 10 lug, NEMA 3R enclosure	1.000	Ea.	177	146	323
Alternative energy sources, PV components, fuse, 15 A for combiner box	10.000	Ea.	135.50	145.50	281
Battery charger controller w/temperature sensor	1.000	Ea.	540	146	686
Digital readout panel, displays hours, volts, amps, etc	1.000	Ea.	145	146	291
Deep cycle solar battery, 6 V, 180 Ah (C/20)	4.000	Ea.	976	292	1,268
Battery interconnection, 15" AWG #2/0, sealed w/copper ring lugs	3.000	Ea.	78	109.50	187.50
Battery intercon, 24" AWG #2/0, sealed w/copper ring lugs	2.000	Ea.	27.30	73	100.30
Battery intercon, 60" AWG #2/0, sealed w/copper ring lugs	2.000	Ea.	40	73	113
Batt temp computer probe, RJ11 jack, 15' cord	1.000	Ea.	21	36.50	57.50
System disconnect, DC 175 amp circuit breaker	1.000	Ea.	148	73	221
Conduit box for inverter	1.000	Ea.	72.50	73	145.50
Low voltage disconnect	1.000	Ea.	66	73	139
Vented battery enclosure, wood	1.000	Ea.	196	256	452
Grounding, rod, copper clad, 8' long, 5/8" diameter	1.000	Ea.	20	106	126
Grounding, clamp, bronze, 5/8" dia	1.000	Ea.	5.60	18.20	23.80
Bare copper wire, stranded, #8	1.000	Ea.	33.50	53	86.50
Wire, 600 volt, type THW, copper, stranded, #12	1.000	C.L.F.	50.22	190.80	241.02
Wire, 600 volt, type THW, copper, stranded, #8	3.600	C.L.F.	38.33	76.65	114.98
Rigid galvanized steel conduit, 3/4", including fittings	1.050	C.L.F.	376.80	876	1,252.80
Conduit,to 15' H,incl 2 term,2 elb&11 bm clp per 100',(EMT), 1" dia	120.000	L.F.	56.10	151.50	207.60
Lightning surge suppressor	30.000	L.F.	56.50	18.20	74.70
General duty 240 volt, 2 pole NEMA 1, nonfusible, NEMA 3R, 60 amp	1.000	Ea.	283	253	536
Load centers, 3 wire, 120/240V, 100 amp main lugs, indoor, 8 circuits	1.000	Ea.	398	830	1,228
Plug-in panel or load center, 120/240 volt, to 60 amp, 1 pole	2.000	Ea.	68.25	242.50	310.75
Roof mounting frame, metal, for 6 modules	5.000	Ea.	2,600	236	2,836
Fuses, dual element, time delay, 250 volt, 50 amp	2.000	Ea.	22.20	23.30	45.50
TOTAL			15,475.80	5,884.65	21,360.45

D5090 420	Photovoltaic System, EACH	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
0100	Photovoltaic power system, stand alone, AC and DC loads	15,500	5,875	21,375

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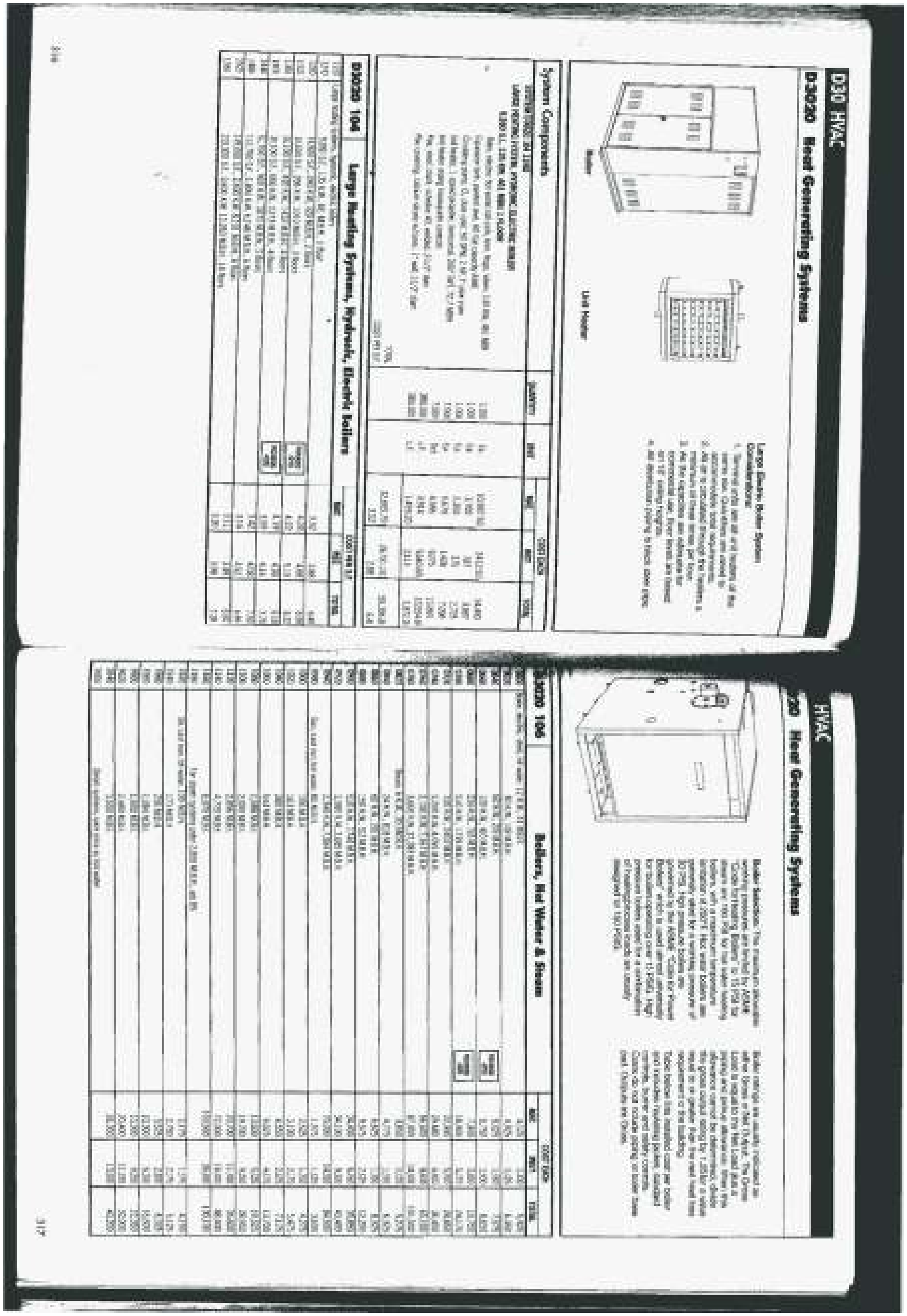
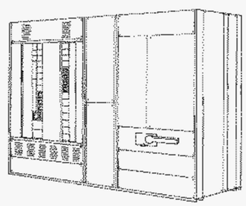

D30 HVAC
D3020 Heat Generating Systems
Boiler
Unit Heater
System Components
D3020 104 Large Heating Systems, Hydronic, Electric Boilers
HVAC
D3020 Heat Generating Systems
D3020 106 Boilers, Hot Water & Steam

D50 Electrical

D5010 Electrical Service/Distribution



System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D5010 240 0240					
SWITCHGEAR INSTALLATION, INCL SWBD, PANELS & CIRC BREAKERS, 600 A					
Panelboard, NQOD 225A 4W 120/208V main CB, w/20A bkrs 42 circ	1.000	Ea.	2,425	2,075	4,500
Switchboard, alum. bus bars, 120/208V, 4 wire, 600V	1.000	Ea.	4,775	1,175	5,950
Distribution sect., alum. bus bar, 120/208 or 277/480 V, 4 wire, 600A	1.000	Ea.	2,500	1,175	3,675
Feeder section circuit breakers, KA frame, 70 to 225 A	3.000	Ea.	4,125	546	4,671
TOTAL			13,825	4,971	18,796

D5010 240	Switchgear		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
[illegible]	Switchgear inst., incl. swbd., panels & circ bkr, 400 A, 120/208volt		4,425	3,675	8,100
[illegible]	600 A		13,800	4,975	18,775
[illegible]	800 A	RD5010 -110	17,500	7,075	24,575
[illegible]	1200 A		21,000	10,900	31,900
[illegible]	1600 A		28,300	15,200	43,500
[illegible]	2000 A		35,700	19,400	55,100
[illegible]	Add 20% for 277/480 volt				

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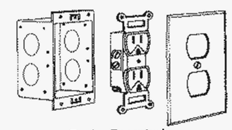
D50 Electrical

D5020 Lighting and Branch Wiring



Duplex Receptacle

System Components	QUANTITY	UNIT	COST PER S.F. MAT.	COST PER S.F. INST.	COST PER S.F. TOTAL
SYSTEM D5020 110 0200					
RECEPTACLES INCL. PLATE, BOX, CONDUIT, WIRE & TRANS. WHEN REQUIRED					
2.5 PER 1000 S.F., .3 WATTS PER S.F.					
Steel intermediate conduit, (IMC) 1/2" diam	167.000	L.F.	.35	.98	1.33
Wire 600V type THWN-THHN, copper solid #12	3.382	C.L.F.	.04	.18	.22
Wiring device, receptacle, duplex, 120V grounded, 15 amp	2.500	Ea.		.04	.04
Wall plate, 1 gang, brown plastic	2.500	Ea.		.02	.02
Steel outlet box 4" square	2.500	Ea.	.01	.07	.08
Steel outlet box 4" plaster rings	2.500	Ea.	.01	.02	.03
TOTAL			.41	1.31	1.72

D5020 110	Receptacle (by Wattage)		COST PER S.F. MAT.	COST PER S.F. INST.	COST PER S.F. TOTAL
0190	Receptacles include plate, box, conduit, wire & transformer when required				
0200	2.5 per 1000 S.F., .3 watts per S.F.		.41	1.31	1.72
0240	With transformer	RD5010 -110	.48	1.37	1.85
0280	4 per 1000 S.F., .5 watts per S.F.		.47	1.53	2
0320	With transformer		.57	1.63	2.20
0360	5 per 1000 S.F., .6 watts per S.F.		.55	1.80	2.35
0400	With transformer		.68	1.93	2.61
0440	8 per 1000 S.F., .9 watts per S.F.		.58	1.99	2.57
0480	With transformer		.76	2.17	2.93
0520	10 per 1000 S.F., 1.2 watts per S.F.		.61	2.16	2.77
0560	With transformer		.91	2.45	3.36
0600	16.5 per 1000 S.F., 2.0 watts per S.F.		.70	2.70	3.40
0640	With transformer		1.22	3.20	4.42
0680	20 per 1000 S.F., 2.4 watts per S.F.		.74	2.93	3.67
0720	With transformer		1.34	3.51	4.85

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Appendix E

LANCASTER COUNTY SOLID WASTE MANAGEMENT AUTHORITY
RATE SCHEDULE
EFFECTIVE JANUARY 1, 2011

MATERIAL TYPE	LOCATION	TIP FEES
Refuse(2)(4)	RRF/TS or LF (Case-By-Case)	$73.00 per ton
Non-Processable Waste(1)(4)	LF	$73.00 per ton
Non-Processable Waste (Oversize)(1)(4)	LF	$110.00 per ton
Construction/Demolition(1)(3)(4)	LF/TS or RRF (Case-By-Case)	$53.00 per ton
Putrescible(1)(4)	LF	Case-By-Case
Sewage Sludge(1)(4)	LF/RRF	Case-By-Case
Processed Infectious/Pathological(1)(4)	LF	Case-By-Case
Ash Residue(1)(4)	LF	Case-By-Case
Contaminated Soil(1)(4)	LF	Case-By-Case
Friable Asbestos(1)(4)	LF	Case-By-Case
Tires (Recyclable) - 15 And Under	ALL	$3.00 per tire (cars & motorcycles) $10.00 per tire (trucks - rim size >20")
Tires (Recyclable) - Over 15 (by appointment only)	LF/TS	$145.00 per ton
Tires (Non-Recyclable)(1)(4)	LF	$150.00 per ton
White Goods Which May Contain Refrigerants	ALL	$15.00 per White Good In a mixed load with Municipal Waste $8.00 per White Good plus applicable waste rate per ton
All Other White Goods	ALL	$10.00 per White Good In a mixed load with Municipal Waste first White Good waste rate per ton only. Second White Good and each additional unit $5.00 per White Good
Any Single Item 200 lbs. or less	ALL	$15.00
Commingled Recyclables(6)	ALL	$10.00 per ton
Single Stream Recyclables(6)	TS/LF	$10.00 per ton
Newsprint and Office Paper(6)	TS/RRF	$10.00 per ton
Yard Waste(5)	LF	$30.00 per ton
Wood - Small(4)	RRF	$50.00 per ton
Wood - Large(4)	LF	$60.00 per ton
Wood - Oversize(4)	LF	Case-By-Case
Residual(1)(4)	LF/RRF or TS (Case-By-Case)	Case-By-Case
Public Scale Fee	ALL	$8.00

A fee equal to the greater of i.) $50.00 or ii.) actual cost incurred, may be imposed on mixed loads.

(1) A $4.00 per ton Growing Greener Fee will be applied to each ton of Waste to be disposed at the LF with the exception of Refuse.
(2) A $3.00 per ton Transfer Fee will be applied to each ton of Refuse delivered to the TS.
(3) A $9.00 per ton Transfer Fee will be applied to each ton of Construction/Demolition Waste delivered to the TS.
(4) Minimum Fee $30.00
(5) Minimum Fee $15.00
(6) Minimum Fee $10.00

LF - Landfill
RRF - Resource Recovery Facility
TS - Transfer Station

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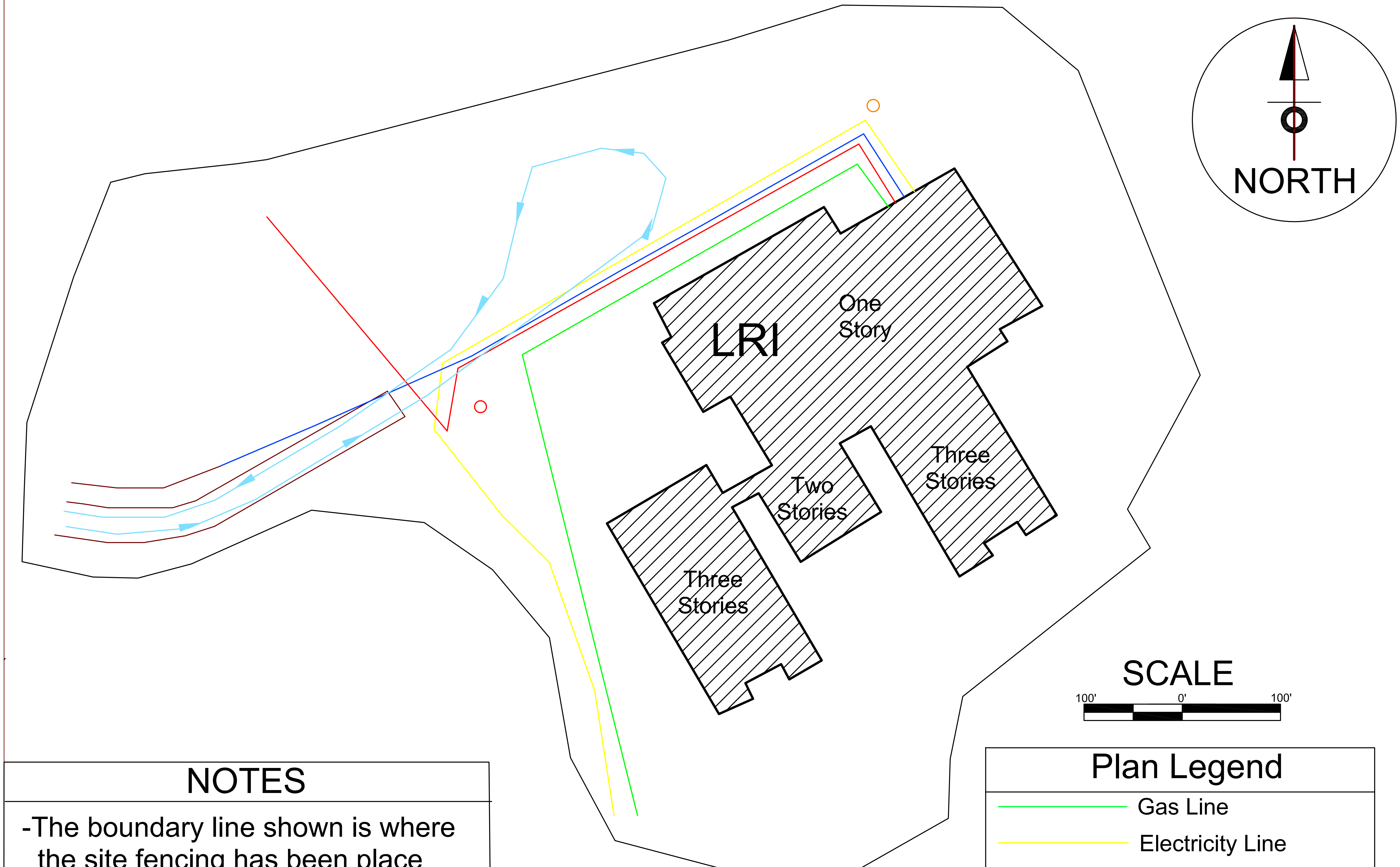


Plan Legend

- Gas Line
- Electricity Line
- Water Line
- Communications Line
- Traffic Pattern
- Fire Hydrant

NOTES

- The boundary line shown is where the site fencing has been place
- There is no pedestrian traffic on site
- There is no temporary lighting on site
- No overhead protection is required
- There are no surrounding buildings in the immediate area

Landis Run Intermediate School

Lancaster, PA

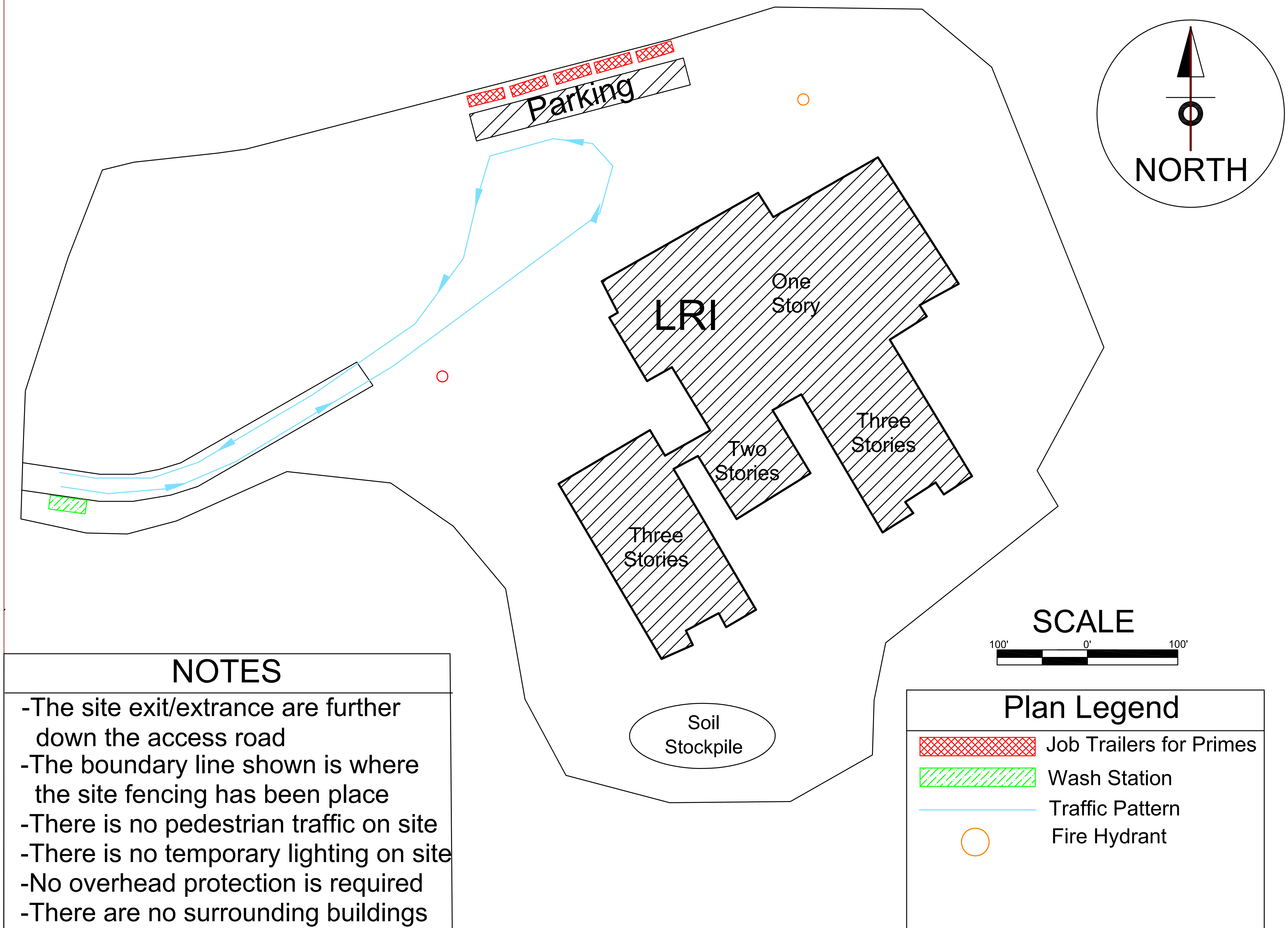
Matthew Stevenson

Construction Management

9/21/11

C101

Existing Conditions



NOTES

- The site exit/extrance are further down the access road
- The boundary line shown is where the site fencing has been place
- There is no pedestrian traffic on site
- There is no temporary lighting on site
- No overhead protection is required
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Landis Run Intermediate School

Lancaster, PA

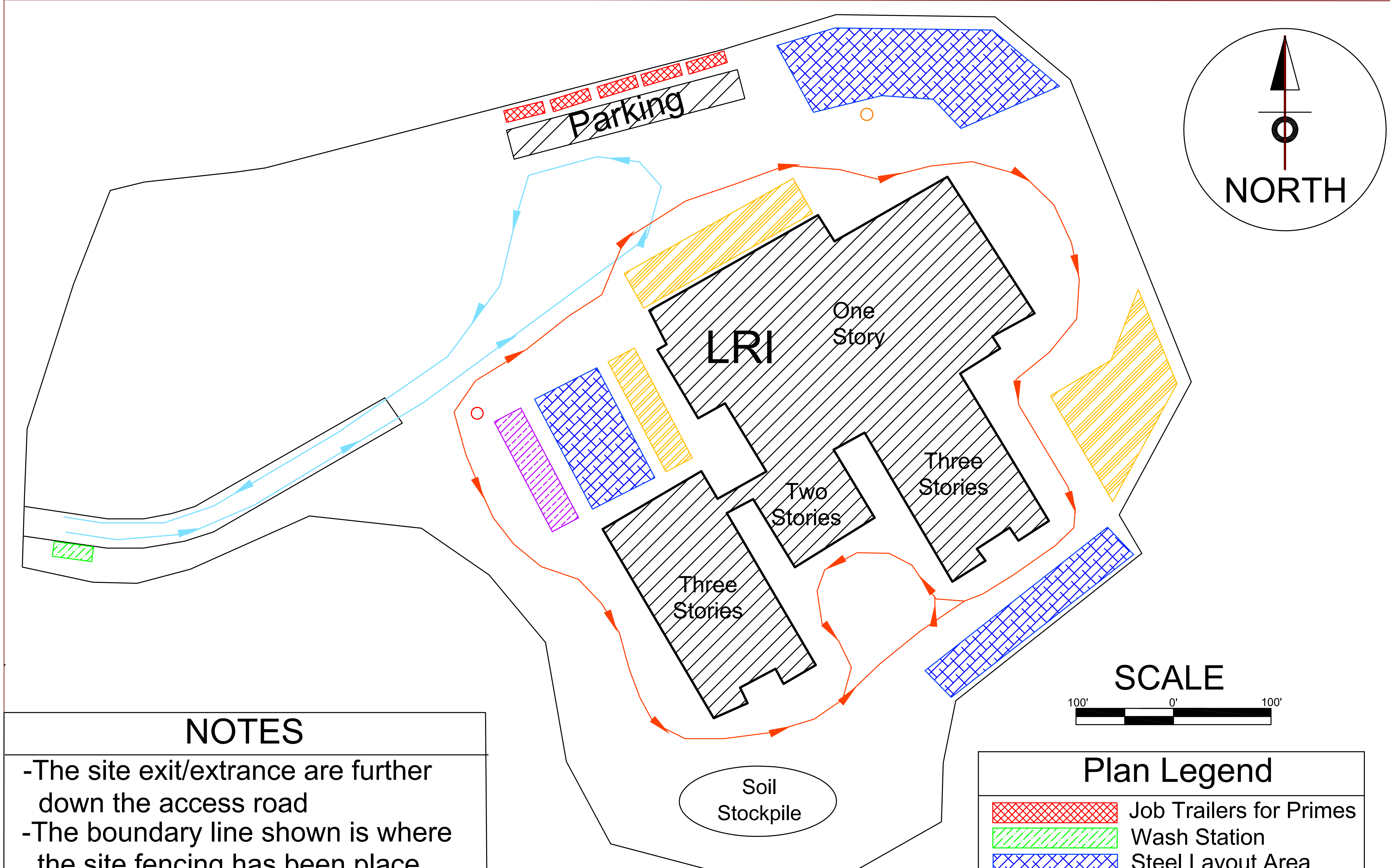
Matthew Stevenson

Construction Management

9/21/11

C102

Excavation Phase Conditions



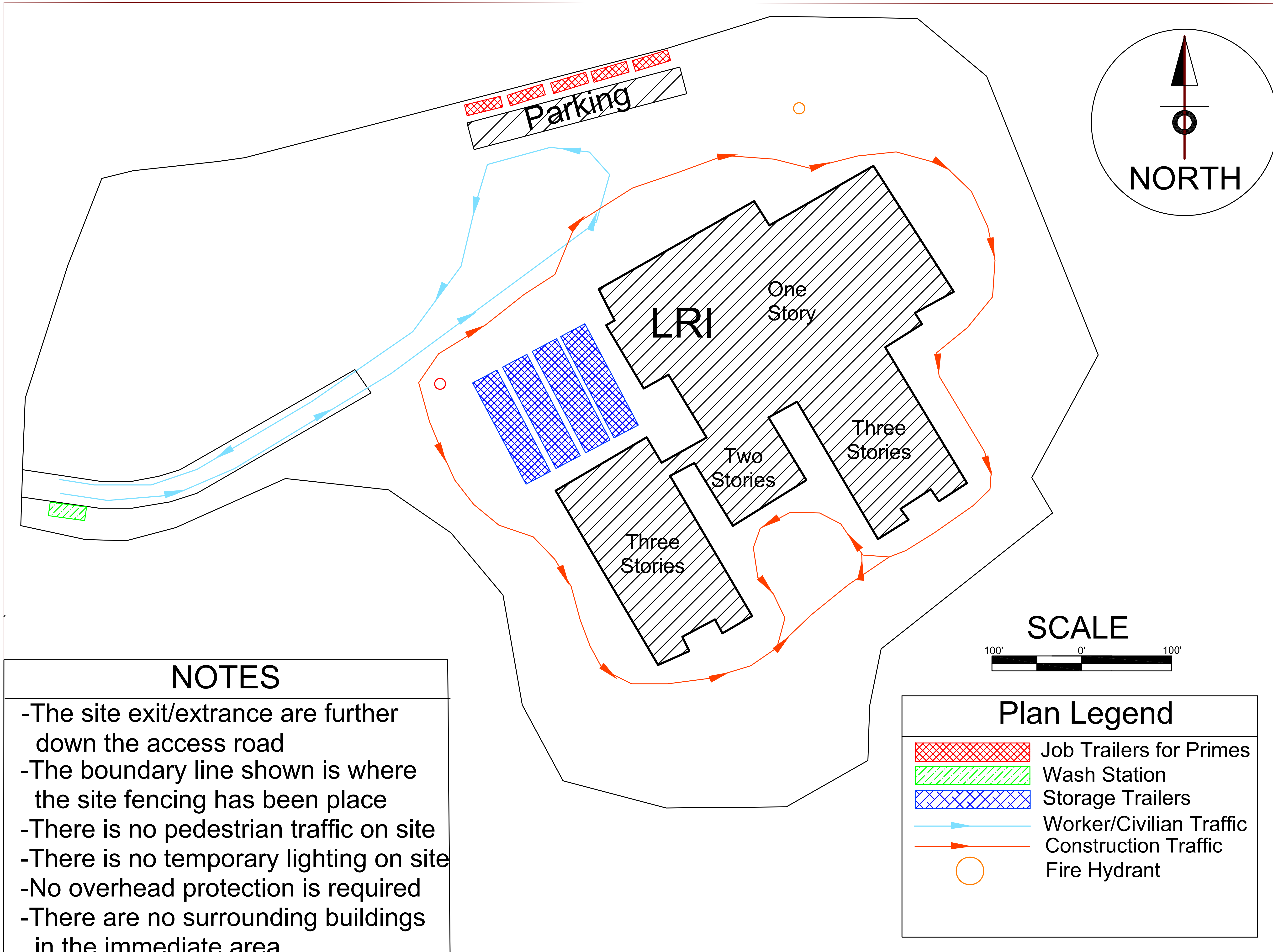
NOTES

- The site exit/extrance are further down the access road
- The boundary line shown is where the site fencing has been place
- There is no pedestrian traffic on site
- There is no temporary lighting on site
- No overhead protection is required
- There are no surrounding buildings in the immediate area

Plan Legend

- Job Trailers for Primes
- Wash Station
- Steel Layout Area
- Masonry Layout Area
- MEP Layout Area
- Worker/Civilian Traffic
- Construction Traffic
- Fire Hydrant

Landis Run Intermediate School
Lancaster, PA
Matthew Stevenson
Construction Management
9/21/11
C103
Superstructure Phase Site Plan



NOTES

- The site exit/extrance are further down the access road
- The boundary line shown is where the site fencing has been place
- There is no pedestrian traffic on site
- There is no temporary lighting on site
- No overhead protection is required
- There are no surrounding buildings in the immediate area

Landis Run Intermediate School
Lancaster, PA
Matthew Stevenson
Construction Management
9/21/11
C104
Finishes Phase Site Plan