# **CAMPUS SQUARE BUILDING**

1426 North Third Street, Harrisburg, PA

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Construction Management

Tech Assignment #2 October 28, 2009 Dr. Chris Magent



# Harrisburg, PA

## Technical Assignment 2

#### Andrew Martin | Construction Management | Advisor: Dr. Chris Magent

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#### **Executive Summary**

The objective of this technical report is to familiarize the reader to the Campus Square building in Harrisburg, Pennsylvania. Within the report contains a detailed project schedule, site layout plans for major phases of construction, a detailed structural systems estimate, a general conditions estimate, and a reflection of the 2009 PACE Roundtable Conference.

Construction on the Campus Square building was scheduled to begin late April, 2008, once Wohlsen received a formal Notice to Proceed. The core and shell portion of the project was completed late August, 2009. Structural steel was scheduled to be inspected by early January, 2009, and have the building shell watertight by the end of December, 2008.

The construction of the Campus Square can be broken down into four major phases: demolition & excavation, substructure, superstructure, and finishes. Because of the urban location of the project, site logistics was extremely important in ensuring the successful delivery of the building. Located in downtown Harrisburg, Pennsylvania, the site is confined by existing overhead electrical lines, surrounding structures, as well as vehicular and pedestrian traffic flow. Furthermore, throughout construction, the power lines were required to be active, as well as ensuring traffic would not be impeded. These constraints led to unique logistical strategies during the construction phase.

A detailed structural system estimate was performed which includes all structural members and assemblies, both substructure and superstructure. Using the structural quantities collected in various typical bays, an estimated total cost and square foot cost was determined to be \$2,195,414.67 (\$29.27/SF).

Estimated general conditions costs for the project was determined to be \$1,061,419, which is approximately 11% of the total project cost. The estimated sum is assumed to be slightly higher than the actual estimate due to the summarized unit costs used.

The Energy and the Building Industry breakout session at the 2009 PACE Roundtable Conference covered various topics related to energy usage and preservation, in particular, how it related to the construction industry. Furthermore, the session highlighted several potential thesis research topics, including building lifecycle studies and solar technologies.

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#### A. Detailed Project Schedule

Design and pre-construction activities on the Campus Square building began June 4, 2007. Substantial completion was originally scheduled for March 20, 2009. A condensed version of the detailed schedule, organized by trade, can be seen in the table below. Please view **Appendix A** of this technical assignment for the complete detailed project schedule.

| ID | Task Name                  | Duration | Start        | Finish       |   |   |     | Half | 1.20 | 800 |   |   |     | H | alf 2.   | 2008         |   |          |   |          | Ha  | df 1. | 2009 |               | $\neg$ |
|----|----------------------------|----------|--------------|--------------|---|---|-----|------|------|-----|---|---|-----|---|----------|--------------|---|----------|---|----------|-----|-------|------|---------------|--------|
|    |                            |          |              |              | 0 | N | D   | J    | F    | M   | Α | М | J   | J | 7        | A   3        | S | 0        | N | D        | J   | F     | - N  | Л .           | A      |
| 1  | Pre-Construction           | 380 days | Mon 6/4/07   | Fri 11/14/08 |   |   |     |      | _    |     |   |   |     |   | Ė        |              |   | _        | - |          | -   |       |      |               | $\neg$ |
| 15 | Sitework/Rough Grading     | 48 days  | Mon 5/19/08  | Wed 7/23/08  | 1 |   |     |      |      |     |   | ₩ |     | ÷ | $\nabla$ |              |   |          |   |          | ;   |       |      |               |        |
| 22 | Concrete                   | 85 days  | Wed 6/25/08  | Tue 10/21/08 |   |   |     |      |      |     |   |   | - 9 | , |          |              |   | -        |   |          | :   |       |      |               |        |
| 29 | Mechanical                 | 184 days | Wed 6/25/08  | Mon 3/9/09   | 1 |   |     |      |      |     |   |   | -   | - |          |              | _ |          | _ |          | ÷   |       | _    |               |        |
| 47 | Structural Steel           | 39 days  | Thu 8/21/08  | Tue 10/14/08 |   |   |     |      |      |     |   |   |     |   |          | <del>-</del> |   | ₩        |   |          | :   |       |      |               |        |
| 54 | Exterior Façade / Framing  | 53 days  | Wed 10/22/08 | Fri 1/2/09   |   |   |     |      |      |     |   |   |     |   |          |              |   | $\nabla$ |   |          | Ψ̈. |       |      |               |        |
| 60 | Masonry                    | 42 days  | Wed 10/22/08 | Thu 12/18/08 |   |   | - 3 |      |      |     |   |   |     |   |          |              |   | $\nabla$ |   | _        | 1   |       |      |               |        |
| 63 | Interior Framing & Drywall | 64 days  | Wed 11/5/08  | Mon 2/2/09   |   |   |     |      |      |     |   |   |     |   |          |              |   | (        | Ų |          | ÷   | -     |      |               |        |
| 76 | Doors and Metal Frames     | 76 days  | Wed 11/19/08 | Wed 3/4/09   |   |   |     |      |      |     |   |   |     | i |          |              |   |          | ₩ |          | ÷   |       | -    |               |        |
| 85 | Roof                       | 15 days  | Fri 11/21/08 | Thu 12/11/08 |   |   |     |      |      |     |   |   |     |   |          |              |   |          | Ţ | <b>_</b> | i   |       |      |               |        |
| 87 | Painting                   | 41 days  | Mon 12/15/08 | Mon 2/9/09   | 1 |   |     |      |      |     |   |   |     |   |          |              |   |          |   | ₩        | ÷   | —     |      |               |        |
| 92 | Flooring                   | 44 days  | Wed 12/31/08 | Mon 3/2/09   |   |   |     |      |      |     |   |   |     |   |          |              |   |          |   |          | ÷-  |       | -    |               |        |
| 97 | Closeout                   | 37 days  | Tue 2/24/09  | Wed 4/15/09  |   |   |     |      |      |     |   |   |     |   |          |              |   |          |   |          |     |       | Ψ-   | $\overline{}$ | 7      |

Key dates of the Campus Square schedule are as follows:

Demolition & Tank Removal: October 1, 2007

Notice to Proceed: April 21, 2008

Foundations Walls Complete: July 17, 2008

Structural Steel Topped Out:

Elevated Slabs Complete:

Roofing Complete:

Building Watertight:

Mechanical Finishes Complete:

Certification of Occupancy:

September 10, 2008

November 15, 2008

November 21, 2008

February 17, 2009

March 19, 2009

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#### **B. Site Layout Planning**

The construction of the Campus Square building can be broken into four main phases of work: demolition/excavation, substructure, superstructure, and finishes.

#### Demolition/Excavation

Campus Square is located on an existing site of a service station, and required the removal of the existing fuel tanks, as well as soil remediation. The service station was demolished, as well as all of the existing asphalt and concrete used in the parking areas. Access to the site was limited during all phases of construction due to its urban location, which limited site utilization. Below is a map of the general area which indicates important off-site spaces used as parking, material and equipment storage, dumpster locations, and lay-down space. Because space was limited during construction, soil stockpiling could not be used, and required removal from the site.



## Substructure

Once excavation was completed, access to the excavation pit was accomplished by means of an earth ramp into the space in order to allow for geothermal work to be accomplished, as well as pouring of the foundation walls and spread footings for the concrete piers. The mechanical basement space was constructed first, with work then arraying outward from the center of the site. Concrete was pumped into the site from vehicles staged around the perimeter of the

Campus Square Site
Dumpster Storage
Contractor Parking Lot

Material Storage & Lay-down

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building. After the foundation walls and piers were finished, backfilling of the area was performed from the limited space surrounding the building site along the adjacent roads.

#### <u>Superstructure</u>

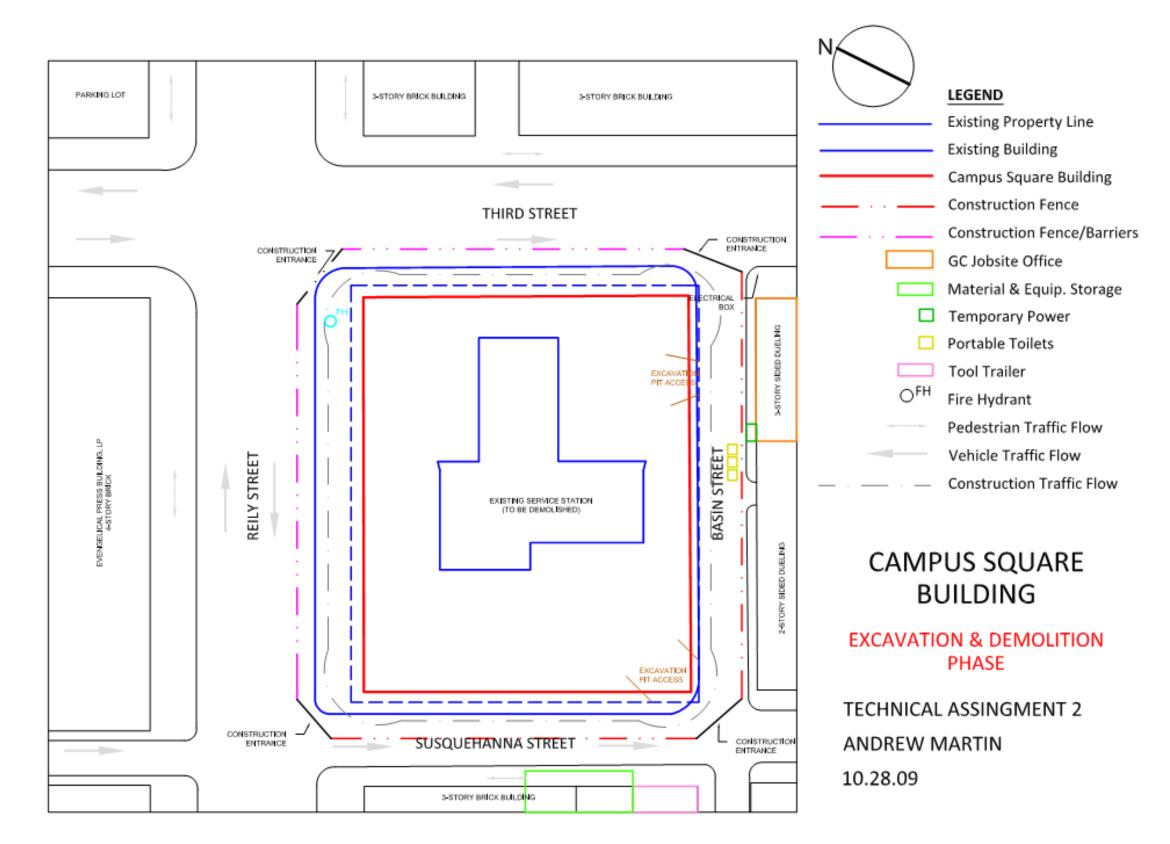
Erection of steel on the Campus Square building was scheduled to begin August 21, 2008. The erection process began with steel located in the center of the building, above the basement space. Once steel in the core of the building was completed, the remainder of the steel was erected from site south to north. This erection strategy was chosen in order to efficiently sequence the elevated deck work with the steel placement, as well as providing adequate space for the crane to operate within the confines of the site. Material storage and lay-down space was first done offsite on the Susquehanna Street lot or the space provided adjacent to the building site.

#### <u>Finishes</u>

Once the building was enclosed and watertight, interior work would begin. Wohlsen sequenced this work by performing interior work from the top floor, down to the first. This was done in order to protect finish work, as well as mitigate workflow traffic within the building. Construction debris needed to be taken and recycled into various dumpsters adjacent to the site.

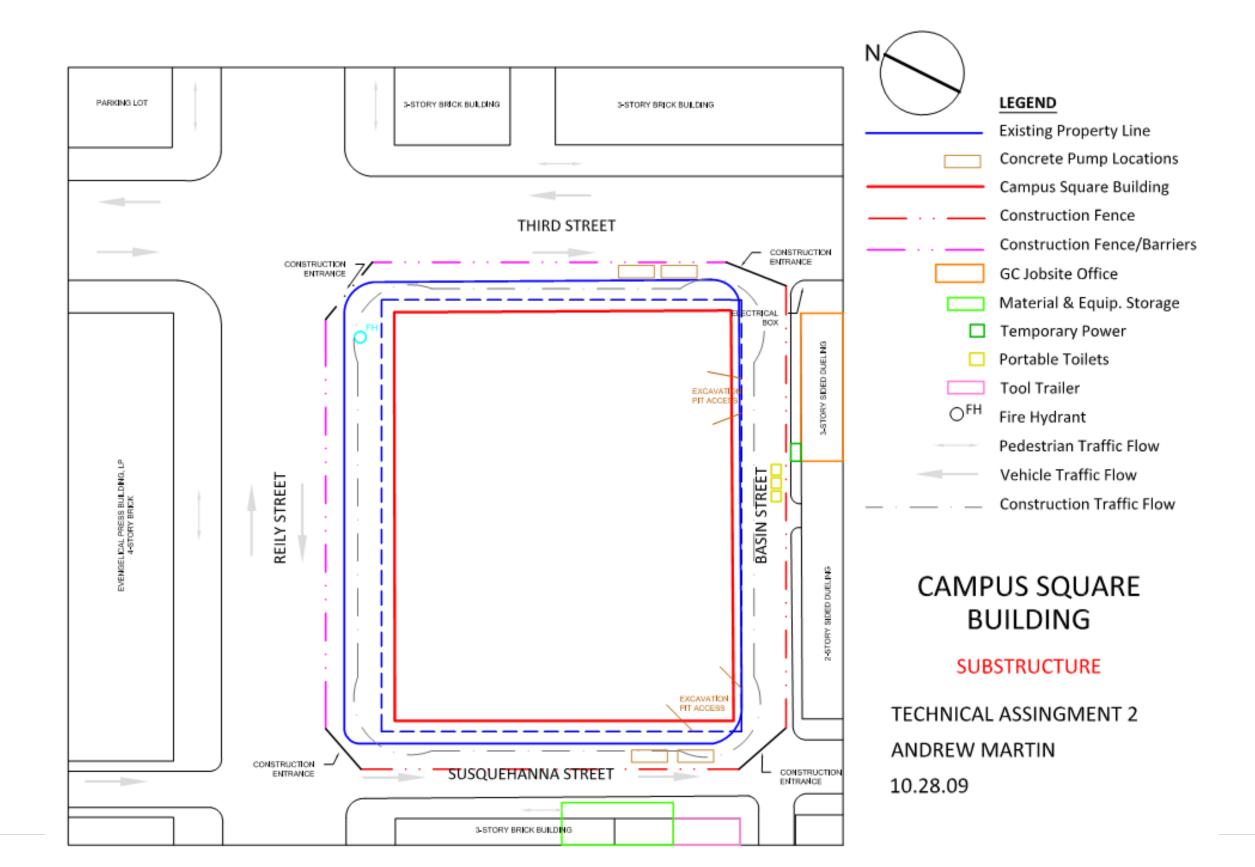
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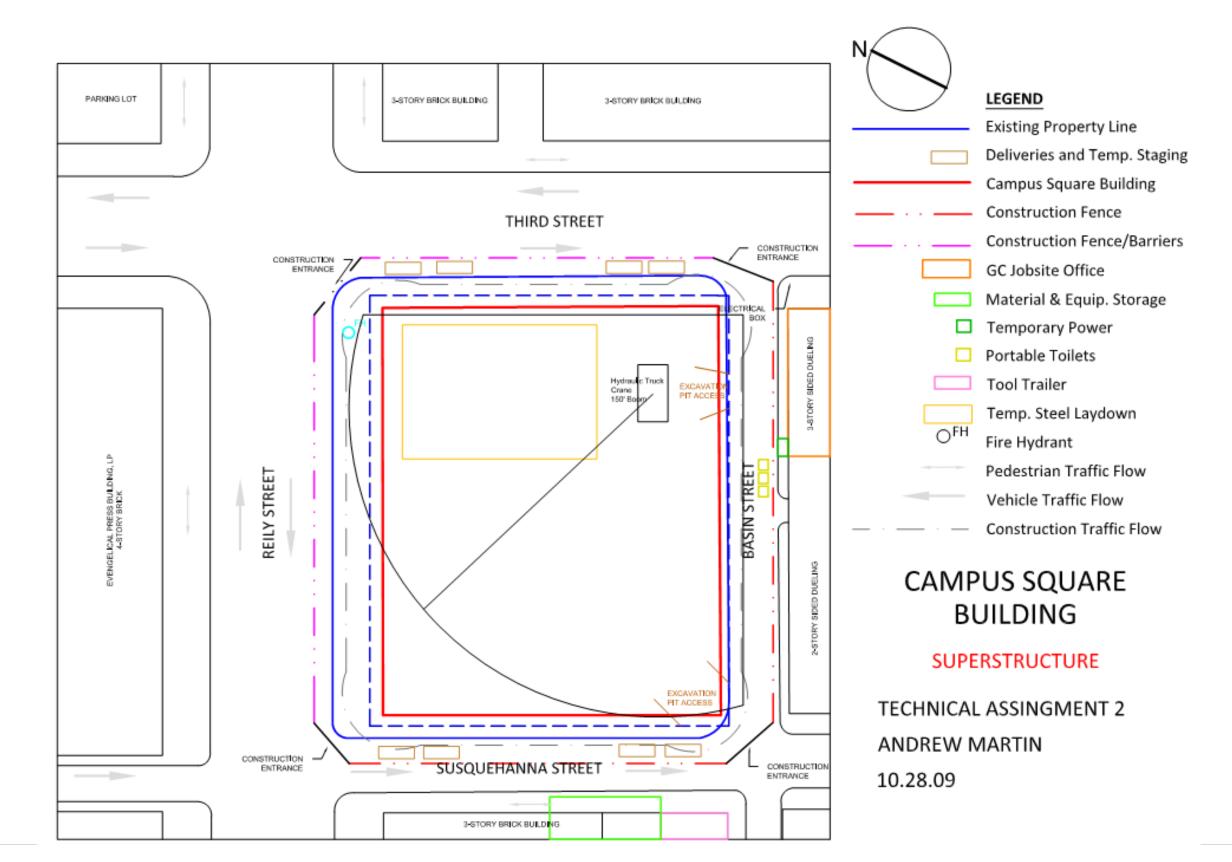
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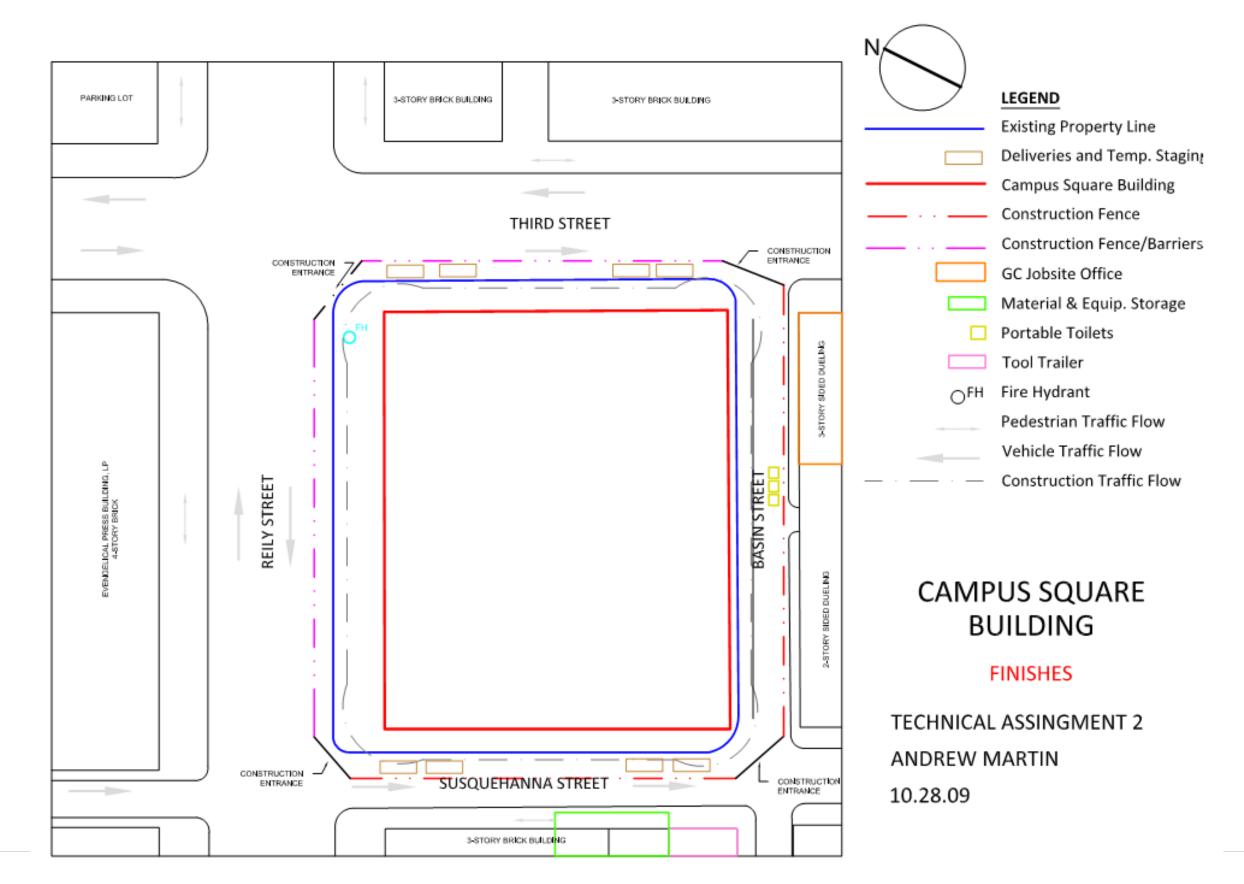
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#### C. Detailed Structural Systems Estimate

A detailed structural estimate was performed for the Campus Square building. The results are summarized in the tables shown below. Complete takeoff notes can be found in **Appendix B** of this technical report.

RS Means was utilized in determining material, labor, and equipment costs for the estimate. Costs were also adjusted for the project location and timeframe of the project. When performing the structural estimate for steel, specific bays were chosen which reflected typical spaces throughout the building. Four bays were chosen, which are described in **Appendix B**. Once the structural system was estimated for the highlighted bays, the associated costs for each bay were extrapolated throughout the typical spaces. Concrete was estimated by analyzing the entire structure for structural assemblies, rather than an extrapolated figure.

#### **Steel Costs**

| Material         | Ext. Mat. O&P |              | Ε  | xt. Labor O&P | Ex | t. Equip. O&P | Ext. Total O&P     |
|------------------|---------------|--------------|----|---------------|----|---------------|--------------------|
| Structural Steel | \$            | 1,313,929.47 | \$ | 69,982.80     | \$ | 37,284.87     | \$<br>1,421,196.99 |
| Metal Deck       | \$            | 203,148.00   | \$ | 47,196.00     | \$ | 2,736.00      | \$<br>253,080.00   |
| WWF              | \$            | 25,348.68    | \$ | 27,139.14     | \$ | -             | \$<br>52,487.82    |
| TOTAL            | \$            | 1,542,426.15 | \$ | 144,317.94    | \$ | 40,020.87     | \$<br>1,726,764.81 |

#### **Concrete Costs**

| Material         | Ex | ct. Mat. O&P | Е  | xt. Labor O&P | Ex | t. Equip. O&P | E  | ext. Total O&P |
|------------------|----|--------------|----|---------------|----|---------------|----|----------------|
| Piers            | \$ | 37,334.85    | \$ | 25,855.97     | \$ | 2,467.90      | \$ | 65,658.72      |
| Spread Footings  | \$ | 49,674.23    | \$ | 16,757.37     | \$ | 104.81        | \$ | 66,536.41      |
| Slab on Grade    | \$ | 30,609.39    | \$ | 5,353.72      | \$ | 1,993.38      | \$ | 37,956.49      |
| Elevated Deck    | \$ | 120,555.00   | \$ | 95,931.00     | \$ | 36,936.00     | \$ | 253,422.00     |
| Foundation Walls | \$ | 37,698.11    | \$ | 5,380.77      | \$ | 1,997.36      | \$ | 45,076.24      |
| TOTAL            | \$ | 275,871.58   | \$ | 149,278.83    | \$ | 43,499.45     | \$ | 468,649.86     |

The detailed structural estimate was determined to be \$2,195,414.67 (\$29.27/SF); somewhat higher than the actual cost. This may be in-part due to Wohlsen self-performing concrete work, as well as other value engineering and cost saving methods. Furthermore, the assumed overhead and profit may have been higher than the actual percentage.

#### **Total Cost**

| Material | laterial Ext. Mat. O&P |              | Ext. Labor O&P   |    | Ext. Equip. O&P | Ext. Total O&P     |
|----------|------------------------|--------------|------------------|----|-----------------|--------------------|
| Steel    | \$                     | 1,542,426.15 | \$<br>144,317.94 | \$ | 40,020.87       | \$<br>1,726,764.81 |
| Concrete | \$                     | 275,871.58   | \$<br>149,278.83 | \$ | 43,499.45       | \$<br>468,649.86   |
| Totals   | \$:                    | 1,818,297.73 | \$293,596.77     | _  | \$83,520.32     | \$2,195,414.67     |

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#### **D. General Conditions Estimate**

A general conditions estimate was prepared for the Campus Square building. The estimate includes any applicable items that were implemented directly by the project team and construction crew, but does not include Wohlsen's home office overhead costs. This general conditions estimate is based on the 10-month construction schedule utilized for the project. If alterations are made to the original construction schedule, the estimate can easily accommodate adjustments.

In the table below, the main categories of the general conditions estimate have been outlined. Please see **Appendix C** for the complete detailed general conditions estimate.

| Description                            | Cost        |
|--|-------------|
| Staffing                               | \$590,440   |
| Administrative Facilities and Supplies | \$39,650    |
| Safety                                 | \$4,000     |
| Cleanup                                | \$125,655   |
| Jobsite Work Requirements              | \$129,500   |
| Permitting                             | \$66,686    |
| Bonds and Insurance                    | \$105,488   |
| <b>Total General Conditions Cost</b>   | \$1,061,419 |

Staffing costs account for the majority of the general conditions costs, which can be attributed to key project team personnel assigned full time to this specific job. Durations and costs associated with the entire project team are detailed in the GC estimate. An adjacent building was provided by the owner to act as the jobsite office at no cost to Wohlsen. Due to the limited sight conditions, a material shakeout space was prepared adjacent to the site. Two row homes were demolished and cleared in order to provide the shakeout space. Furthermore, an off-site parking lot was also needed in order to accommodate subcontractor parking and storage. The owner also assumed the builder's risk for this particular job. These aforementioned items were included into the general conditions estimate. All durations and quantities used in the estimate are accurate; approximate cost figures were provided by Wohlsen Construction Company.

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#### **Critical Industry Issues**

The breakout session I chose to attend at the Annual PACE Roundtable, was "Energy and the Building Industry". This session focused on the new standards for energy performance, and new priorities for energy in buildings which are being set by clients, as well as how increased attention to energy will change contracting, design method, and profitability. I chose to attend this session because of the dramatic rise in public awareness about our current environmental impacts, and the methodology and practices being implemented to prevent further environmental downturn.

The session opened with concerns about why energy consumption and efficiency is so important, not only to the construction industry, but as a global population. Energy consumption impacts nearly every global market, from fuel and electricity costs, to ever rising food and product costs. Soon, Pennsylvania will face deregulation in electricity costs which will inevitably result in higher utility costs for the consumer. It is important to observe how the increase in energy will, in-turn, result in higher costs of other goods in order to compensate for increased production costs.

Recently, a dramatic "Go-Green" trend has emerged as the status-quo when considering new construction. Owners are now beginning to have a great interest in reducing building life-cycle costs, as well as increasing energy efficiency. Energy and environmentally conscience buildings not only save the owner money on energy costs, but also help better the environment. Unfortunately, a trend is emerging amongst owners to obtain "green" buildings in order to use them as marketing tools for higher tenant fees, and "green-washing" barely sustainable ideas and products. Fortunately, efforts are being implemented through government and private agencies to monitor the status of sustainable buildings. The United States Green Board Council (USGBC) will soon be establishing programs requiring previously LEED certified buildings to be audited for performance standards according to the rating initially awarded. If a building is no longer performing to standard, the certification may be stripped from the owner. Energy labeling was another program discussed in which every building will be labeled according to energy consumption, similar to Energy Star ratings on appliances and electronics. These efforts will help maintain the legitimacy of sustainable efforts.

Current economic conditions and the impact on the construction industry was also an issue brought up in the Industry Panel discussion. Construction companies are trying to find new methods and strategies in order to decrease costs so lower bids can be made. In-turn, this has resulted in General Contractors and Construction Managers hiring low-bid subcontractors, which may not be qualified to perform the work, resulting in increased risk for the project's

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success. The current economic downturn has also resulted in an increase in joint ventures between companies (sometimes competitors) in an attempt to secure work, many times, at a lower profit margin.

I was surprised how positive the industry members were about the economic situation, and the overall downturn in business. It seemed as though they truly believed their companies had the right strategy to get through this tough period. Many explained how this current market is not one that has not been seen before, and the general cyclical nature to construction. Diversification among project types and markets was said by many of the industry members as the key to success in this recession.

When considering my specific thesis building, a few topics discussed during the conference could be applied to my project. For instance, the owner of the Campus Square Building: GreenWorks Development, puts a strong emphasis in sustainability. Therefore, one idea could be establishing or researching their means of maintaining sustainability once tenants occupy the structure. Another topic could be a study into the implementation of Solyndra's cylindrical PV panels over the conventional array installed on the building. Lifecycle costs could be calculated in determining which system would better suite Campus Square.

The contacts listed below, whom I met at the conference, may be able to assist me with the above listed ideas:

Mr. Daniel P. Kerr, P.E. McClure Company

Mr. Jeremy Sibert
Hensel Phelps Construction Company

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#### Appendix A – Detailed Project Schedule

| 2      |   |                   | Stant                       | 2007 | Qtr 3, 2007 | Otr 4, 2007 | TOT: 1, 2008                | Qtr 2, 2008           | 1Qtr 3, 2008     | Qtr.4, 2008 Qtr.1, 2009       | Otr 2, 2009 Otr 3, 2009  | Qtr 4, 2009   | Qtr 1. |
|--------|---|-------------------|-----------------------------|------|-------------|-------------|-----------------------------|-----------------------|------------------|-------------------------------|--|---------------|--------|
| 2      | Construction                                | 505 days          |                             |      |             | Oct Nov Dec | Jan Feb Mar                 | r Apr May Ju          | n Jul Aug Se     | p Oct Now Dec Jan Feb Ma      | r Apr May Jun Jul Aug Se   | p Oct Nov Dec |        |
|        |   | 380 days          | Mon 6/4/07                  | _    |             | 1           |                             | 'Dro Construe         | tion             | ■ Pre-Construction            |  | : :           |        |
|        | Pre-Construction                            | 213 days          | Mon 6/4/07                  |      |             | Damolition  | 2. Tank Barrous             | Pre-Construc          | ·                | 1                             |  | : :           |        |
|        | Demolition & Tank Removal                   | 10 days           | Mon 10/1/07                 |      |             |             | & Tank Remova<br>Finalize D |                       |                  | 1                             |  | : :           |        |
|        | Finalize Drawings                           | 60 days           | Thu 11/1/07<br>Mon 11/19/07 | ;    | 1           |             | ple Well Drill Te           |                       | 1                | 1                             | 1  | : :           |        |
|        | Sample Well Drill Testing                   | 5 days            |                             |      |             | g Sam       |                             | sung<br>➡ Bidding/Fin | aliza CMD        | 1                             |  | : :           |        |
|        | Bidding/Finalize GMP<br>Review and Sign GMP | 20 days           | Mon 3/10/08<br>Mon 4/7/08   |      | !<br>!      | 1           |                             |                       | nd Sign GMP      | :                             | :  | : :           |        |
|        | Submittals                                  | 10 days           | Mon 4/7/08                  |      |             | 1           | 1                           | - neview a            | Submittals       | 1                             |  | : :           |        |
| _      | Notice to Proceed                           | 60 days<br>0 days | Fri 4/18/08                 |      |             | 1           | 1                           | <b>♦</b> 4/18         | Cabilitans       |                               | : :  | : :           |        |
|        | Subcontracts                                | 10 days           | Mon 4/21/08                 |      |             |             | 1                           | Subcor                | ntracts          |                               |  |               |        |
|        | Aquire Permits                              | 20 days           | Mon 4/21/08                 |      |             | 1           | 1                           |                       | ire Permits      |                               |  | : :           |        |
| _      | Elevator Procurement (12 weeks)             | 60 days           | Mon 4/21/08                 |      |             | 1           | į.                          | - Adam                |                  | ocurement (12 weeks)          |  |               |        |
|        | Steel Procurement (16 weeks)                | 80 days           | Mon 4/21/08                 |      |             |             |                             |                       |                  | Procurement (16 weeks)        |  |               |        |
|        | Release Transformer (30 weeks)              | 150 days          | Mon 4/21/08                 |      |             |             |                             |                       | Jielel           | Release Transformer           | (30 weeks)   |               |        |
|        | work/Rough Grading                          | 48 days           | Mon 5/19/08                 |      |             |             |                             |                       | Sitework         | Rough Grading                 | ,  |               |        |
|        | Mobilization                                | 3 days            | Mon 5/19/08                 |      |             | 1           | į                           | Mol                   | oilization       |                               |  |               | 1      |
|        | Erosion Control Measures                    | 3 days            | Thu 5/22/08                 |      | 1           |             | 1                           | T                     | osion Control Me | asures                        |  |               |        |
|        | Geothermal Well Drilling                    | 20 days           | Wed 5/28/08                 |      | 1           | 1           | 1                           |                       | Geothermal W     |                               |  | : :           | :      |
|        | Footer Excavation                           | 10 days           | Wed 5/25/08                 |      | l           | 1           | 1                           | -                     | Footer Exca      |                               | !  | : :           |        |
|        | Relocate Utilities                          | 10 days           | Thu 7/10/08                 | ;    | 1           | 1           | 1                           | 1                     | Relocate         |                               |  | : :           | :      |
|        | Install New Utilities                       | 10 days           | Thu 7/10/08                 |      |             | 1           | 1                           | 1                     | in stall Ne      |                               | :  | : :           | :      |
| 22 Con |   | 85 days           | Wed 6/25/08                 |      | 1           | 1           | 1                           | 1                     |                  | Concrete                      | :  | : :           | :      |
|        | F/R/P Concrete Piers                        | 10 days           | Wed 6/25/08                 |      | 1           | 1           | 1                           | -                     | F/R/P Conc       | 1 -                           | 1 1  | : :           |        |
|        | Pour Footers                                | 10 days           | Thu 7/10/08                 |      | I<br>I      | 1           | 1                           | 1                     | Pour Foo         | '                             | :  | : :           |        |
| -      | Basement Walls                              | 5 days            | Thu 7/10/08                 |      | I           | 1           | 1                           | 1                     | Basement         |                               | 1  | : :           | 1      |
|        | Backfill Foundation Walls                   | 5 days            | Thu 7/17/08                 | ;    | 1           | 1           | 1                           | 1                     |                  | oundation Walls               |  | : :           | :      |
| -      | Stone Prep                                  | 5 days            | Thu 7/24/08                 |      | I<br>I      | 1           | 1                           | 1                     | Stone P          | 1                             | 1  |               | 1      |
|        | Pour Slabs on Deck.                         | 5 days            | Wed 10/15/08                | ;    |             | 1           | 1                           |                       | : "              | Pour Slabs on Back            | : :  | : :           |        |
|        | ictural Steel                               | 39 days           | Thu 8/21/08                 |      |             | 1           | 1                           |                       |                  | Structural Steel              |  |               |        |
|        | Set Steel Columns/Beams                     | 10 days           | Thu 8/21/08                 |      |             | i           | i                           | i                     |                  | et Steel Columns/Beams        |  |               |        |
|        | Final Connections/Welds                     | 3 days            | Fri 9/5/08                  | !    |             | 1           | 1                           | :                     |                  | Final Connections/Welds       | : :  | : :           | :      |
|        | Erect Bar Joists                            | 10 days           | Wed 9/10/08                 |      |             | 1           | 1                           |                       |                  | Erect Bar Joists              |  |               |        |
|        | Set Metal Decking/Pour Stops                | 10 days           | Wed 9/24/08                 |      |             |             | 1                           |                       |                  | Set Metal Decking/Pour Sto    | PS   |               |        |
|        | Set Stairs                                  | 5 days            | Wed 10/8/08                 |      |             | 1           | 1                           |                       |                  | Set Stairs                    |  |               | -      |
|        | Steel Inspection                            | 5 days            | Wed 10/8/08                 |      |             |             | 1                           | 1                     | :                | Steel Inspection              | :  |               |        |
| 36 Med | hanical                                     | 184 days          | Wed 6/25/08                 |      | 1           | 1           | 1                           |                       | <del>_</del>     |                               | Mechanical   |               |        |
|        | Geothermal Piping                           | 10 days           | Wed 6/25/08                 |      |             | 1           | 1                           |                       | Geothermal       |                               |  | : :           |        |
|        | MEP Rough Ins- Basement                     | 15 days           | Thu 7/24/08                 |      |             | 1           | 1                           |                       |                  | Rough Ins-Basement            |  |               |        |
|        | MEP/S Finishes and Connections- Basement    | 5 days            | Thu 8/14/08                 |      |             | 1           | 1                           |                       | -                | S Fin ishes and Connections I | Basement   |               |        |
|        | Exterior MEP Rough Ins                      | 10 days           | Wed 10/22/08                |      | i<br>I      | 1           | 1                           | i                     | : -              | Exterior MEP Rough In         |  | 1 1           |        |
|        | MEP/S Rough Ins Overhead- 1st Floor         | 10 days           | Wed 10/22/08                | :    | 1           | 1           | 1                           | 1                     | :                | MEP'S Rough Ins Over          |  | : :           | :      |
|        | MEP Rough Ins- 1st Floor                    | 5 days            | Wed 11/12/08                | ;    | 1           |             | 1                           | 1                     | :                | MEP Rough Ins- 1st            |  | : :           |        |
|        | MEP/S Finishes & Connections- 1st Floor     | 5 days            | Wed 12/31/08                |      | !<br>!      | 1           | 1                           |                       | :                |                               | hes & Connections-1st Floor  | : :           |        |
|        | MEP/S Rough Ins Overhead- 2nd Floor         | 10 days           | Wed 11/5/08                 |      | !<br>!      | 1           | 1                           | 1                     | :                | MEP/S Rough Ins Ov            |  | : :           |        |
|        | MEP Rough ins- 2nd Floor                    | 10 days           | Wed 11/26/08                | ;    | !<br>!      | 1           | 1                           | 1                     | 1                | MEP Rough Ins-                | The second secon | : :           |        |
| 46     | MEP/S Finishes & Connections- 2nd Floor     | 5 days            | Thu 1/15/09                 |      | !<br>!      | 1           | 1                           | 1                     | :                |                               | nishes & Connections- 2nd Flo  | or.           |        |
|        | MEP/S Rough Ins Overhead- 3rd Floor         | 10 days           | Wed 11/19/08                |      | I<br>I      | 1           | 1                           | 1                     | 1                | MEP/S Rough Ins               |  | : :           | 1      |
|        | MEP Rough Ins- 3rd Floor                    | 10 days           | Thu 12/11/08                |      | I<br>I      | 1           | 1                           | 1                     | :                | MEP Rough In                  |  | : :           | :      |
|        | MEP/S Finishes & Connections- 3rd Floor     | 5 days            | Thu 1/29/09                 |      | ı<br>I      | 1           | 1                           | 1                     | 1                |                               | Finishes & Connections- 3rd F  | 100           |        |
|        | MEP/S Rough Ins Overhead- 4th Floor         | 10 days           | Thu 12/4/08                 |      | 1           | 1           | 1                           | !                     | :                |                               | ns Overhead- 4th Floor   | : :           |        |
|        | MEP Rough Ins- 4th Floor                    | 10 days           | Mon 12/29/08                |      | I<br>I      | 1           | 1                           | 1                     | 1                |                               | Ins-4th Floor  | : :           |        |
|        | MEP/S Finishes & Connections- 4th Floor     | 5 days            | Tue 2/17/09                 |      |             | i           | i                           | 1                     | 1                | _                             | P/S Finishes & Connections-4t  | h Floo        |        |
|        | HVAC Testing and Balancing                  | 10 days           | Tue 2/24/09                 |      |             |             | į.                          |                       |                  |                               | IVAC Testing and Balancing   |               | 1      |

## Harrisburg, PA

#### Technical Assignment 2

| ID. Took Name                                  | Duntin   | Chart         | [0007   0007                            | 10-4 0007                      | T-0-1 0000                     | 0-0.000                        | Io- 0 0000                 | On 4 0000   On 4 0000   On 0 0000   On 0 0000   | 0-1000   0-1                          |
|--|----------|---------------|---|--------------------------------|--------------------------------|--------------------------------|----------------------------|---|---------------------------------------|
| ID Task Name                                   | Duration | Start         | 2007 Otr 3, 2007<br>May Jun Jul Aug Sep | Otr 4, 2007<br>Oct   Nov   Dec | Qtr 1, 2008<br>Jan   Feb   Mar | Otr 2, 2008<br>Apr   May   Jun | Otr 3, 2008<br>Jul Aug Sep | Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep | Otr 4, 2009 Otr 1<br>Oct Nov Dec Jan  |
| 54 Exterior Façade / Framing                   | 53 days  | Wed 10/2:2/08 |   | 1                              | 1                              | 1                              | :                          | Exterior Façade / Framing                       |                                       |
| 55 Exterior Wall Framing                       | 10 days  | Wed 10/22/08  |   | 1                              | 1                              | 1                              | 1                          | Exterior Wall Framing                           |                                       |
| 56 Exterior Sheathing                          | 10 days  | Wed 11/5/08   |   |                                | 1                              | 1                              | :                          | Exterior Sheathing                              | : :                                   |
| 57 Dryvit Application                          | 5 clays  | Fri 11/1-4/08 |   | !                              | -                              | -                              | !                          | ② Dryvit Application                            |                                       |
| 58 Fascia/Gutters/Downspouts                   | 10 days  | Mon 12/15/08  |   | 1                              | 1                              | 1                              | 1                          | Fascia/Gutters/Downspouts                       |                                       |
| 59 Install Windows                             | 10 days  | Mon 12/22/08  | 1 :                                     |                                | 1                              | 1                              | :                          | ☐ Install Windows                               | : :                                   |
| 60 Roof  | 15 days  | Fri 11/21/08  |   |                                | -                              | 1                              |                            | —  Roof   |                                       |
| 61 Install Roof Sheathing/Shingles             | 15 days  | Fri 11/21/08  |   | i                              |                                | 1                              |                            | in stall Roof Sheathing/Shingles                |                                       |
| 62 Masonry                                     | 42 days  | Wed 10/2:2/08 |   |                                |                                | 1                              |                            | □ Masonry                                       | -                                     |
| 63 CMU for stairs and elevator shaft           | 10 days  | Wed 10/22/08  |   |                                |                                |                                |                            | CMU for stairs and elevator shaft               |                                       |
| 64 Exterior Brick                              | 20 days  | Fri 11/21/08  |   | i                              |                                |                                | ;                          | Exterior Brick                                  | - I                                   |
| 65 Interior Framing & Drywall                  | 64 days  | Wed 11/5/08   |   | :                              |                                | 1                              | :                          | □ Interior Framing & Drywall                    |                                       |
| 66 Metal Stud Framing- 1st Floor               | 5 days   | Wed 11/5/08   |   |                                | -                              | 1                              | :                          | Metal Stud Framing-1st Floor                    |                                       |
| 67 Hang Drywall- 1st Floor                     | 5 days   | Fri 11/21/08  |   | 1                              |                                |                                | :                          | All Hang Drywall- 1st Floor                     |                                       |
| 68 Tape/Finish Drywall- 1st Floor              | 5 days   | Mon 12/1/08   |   | 1                              | 1                              | 1                              | 1                          | @ Tape/Finish Drywall-1st Floor                 |                                       |
| 69 Metal Stud Framing- 2nd Floor               | 5 days   | Wed 11/19/08  |   |                                | :                              | :                              | :                          | Metal Stud Framing- 2nd Floor                   | : :                                   |
| 70 Hang Drywall- 2nd Floor                     | 5 days   | Mon 12/1:5/08 |   | 1                              | 1                              | !                              | !                          | g Hang Drywall- 2nd Floor                       | : : : : : : : : : : : : : : : : : : : |
| 71 Tape/Finish Drywall- 2nd Floor              | 5 days   | Mon 12/22/08  |   | 1                              | 1                              |                                | :                          | 1 Tape/Finish Drywall- 2nd Floor                | - 1                                   |
| 72 Metal Stud Framing- 3rd Floor               | 5 days   | Thu 12/4/08   |   |                                |                                |                                |                            | Metal Stud Framing- 3rd Floor                   | - E                                   |
| 73 Hang Drywall- 3rd Floor                     | 5 days   | Wed 12/31/08  |   |                                |                                |                                |                            | ☐ Hang Drywall- 3rd Floor                       | - E                                   |
| 74 Tape/Finish Drywall- 3rd Floor              | 5 days   | Thu 1/8/09    |   | :                              |                                | :                              | :                          | ☐ Tape/Finish Drywall- 3rd Floor                | = :                                   |
| 75 Metal Stud Framing -4th Floor               | 5 days   | Thu 12/18/08  |   | 1                              | 1                              | 1                              | :                          | Metal Stud Framing -4th Floor                   |                                       |
| 76 Hang Drywall- 4th Floor                     | 2 days   | Tue 1/27/09   |   | 1                              | -                              | !                              | :                          | I Hang Drywall- 4th Floor                       |                                       |
| 77 Tape/Finish Drywall- 4th Floor              | 5 days   | Tue 1/27/09   |   | 1                              | 1                              | 1                              | :                          | ↑ Tape/Finish Drywall-4th Floor                 |                                       |
| 78 Doors and Metal Frames                      | 76 days  | Wed 11/19/08  |   |                                | 1                              | 1                              | :                          | Doors and Metal Frames                          | E :                                   |
| 79 Hang Door Frames- 1st Floor                 | 2 days   | Wed 11/19/08  |   | 1                              | 1                              | 1                              | :                          | I Hang Door Frames- 1st Floor                   | 1                                     |
| 80 Hang Doors- 1st Floor                       | 2 days   | Thu 1/8/09    |   |                                | 1                              | 1                              | :                          | 1 Hang Doors- 1st Floor                         |                                       |
| 81 Hang Door Frames 2nd Floor                  | 2 days   | Thu 12/11/08  |   |                                | 1                              | 1                              | :                          | Hang Door Frames- 2nd Floor                     |                                       |
| 82 Hang Doors- 2nd Floor                       | 2 days   | Thu 1/22/09   |   |                                | i                              |                                |                            | I Hang Doors- 2nd Floor                         | E :                                   |
| 83 Hang Door Frames- 3rd Floor                 | 2 days   | Mon 12/29/08  |   | i                              | į                              | i                              | i                          | Hang Door Frames- 3rd Floor                     |                                       |
| 84 Hang Doors- 3rd Floor                       | -        | Thu 2/5/09    |   | i                              | i                              | i                              | i                          | I Hang Doors- 3rd Floor                         | = 1                                   |
| )  | 2 days   | Tue 1/13/09   |   | !                              | -                              |                                |                            | Hang Door Frames 4th Floor                      |                                       |
|  | 10 days  |               |   |                                | -                              |                                | :                          |   |                                       |
|  | 2 days   | Tue 3/3/09    |   | 1                              | 1                              |                                | :                          | I Hang Doors- 4th Floor                         |                                       |
| 87 Painting                                    | 41 days  | Mon 12/1/5/08 |   | 1                              | 1                              | 1                              | :                          | Painting 4th Floor                              | 1                                     |
| 88 Painting- 4th Floor  89 Painting- 3rd Floor | 5 days   | Mon 12/15/08  |   | !                              | -                              | -                              | !                          | Painting-4th Floor                              |                                       |
| - canting or a river                           | 5 days   | Wed 12/31/08  |   | 1                              | 1                              | 1                              | :                          | Painting- 3rd Floor                             | - :                                   |
| · among and · res                              | 5 days   | Thu 1/1/5/09  |   |                                | 1                              | 1                              | 1                          | Painting- 2nd Floor                             |                                       |
|  | 5 days   | Tue 2/3/09    |   |                                | -                              | 1                              |                            | Painting- 1st Floor                             |                                       |
| 92 Flooring                                    | 44 days  | Wed 12/31/08  |   |                                |                                |                                |                            | Flooring  | - E                                   |
| 93 Flooring- 4th Floor                         | 5 clays  | Wed 12/31/08  |   |                                |                                |                                |                            | Flooring- 4th Floor                             |                                       |
| 94 Flooring- 3rd Floor                         | 5 days   | Thu 1/15/09   |   |                                |                                |                                |                            | ☐ Flooring- 3rd Floor                           |                                       |
| 95 Flooring- 2nd Floor                         | 5 days   | Thu 1/29/09   |   | i                              | i                              | i                              | i                          | G Flooring- 2nd Floor                           |                                       |
| 96 Flooring- 1st Floor                         | 5 days   | Tue 2/24/09   |   | 1                              | 1                              | 1                              | :                          | ☐ Flooring 1st Floor                            | : :                                   |
| 97 Closeout                                    | 37 days  | Tue 2/24/09   |   | 1                              | 1                              | 1                              | :                          | Closeout  |                                       |
| 98 Electrical Inspection                       | 2 days   | Tue 2/24/09   |   | 1                              | 1                              |                                | :                          | I Ele ctrical Inspection                        | 1                                     |
| 99 HVAC Testing and Balancing                  | 10 days  | Tue 2/24/09   |   | 1                              | 1                              | :                              | :                          | HVAC Testing and Balancing                      | : :                                   |
| 100 Plumbing/Sprinkler Inspection              | 2 days   | Tue 2/24/09   |   | 1                              | 1                              | :                              | :                          | TPlumbing/Sprinkler Inspection                  | : :                                   |
| 101 L&I Elevator Inspection                    | 5 days   | Tue 2/24/09   |   | !                              | 1                              | !                              | 1                          | L&I Elevator Inspection                         | :                                     |
| 102 Final Cleaning                             | 10 days  | Thu 3/5/09    |   |                                |                                | 1                              |                            | Final Cleaning                                  |                                       |
| 103 Punch List Items                           | 20 days  | Thu 3/19/09   |   |                                |                                |                                |                            | Punch List hems                                 |                                       |
| 104 Final Inspection/CO                        | 2 days   | Thu 3/19/09   |   |                                |                                |                                |                            | Ţ Final Inspection/GO                           |                                       |
| 105 Tunerover to Owner                         | 0 clays  | Fri 3/20/09   |   | :                              | 1                              |                                | :                          | ♠ 3/20  |                                       |

Harrisburg, PA
Technical Assignment 2

Andrew Martin | Construction Management | Advisor: Dr. Chris Magent

## Appendix B – Structural Systems Takeoff Calculation

| Column Lines (5) and (6) |          |        |                |               |          |           |    |        |
|--------------------------|----------|--------|----------------|---------------|----------|-----------|----|--------|
| Row Lines (F) and (E)    |          |        |                |               |          |           |    |        |
| Shape                    | Quantity | Wt./lf | Length<br>(ft) | Weight (tons) | Total LF |           |    |        |
| Second Floor Beams       |          |        |                |               |          |           | LF |        |
| W14x22                   | 2        | 22     | 7.8            | 0.17          | 15.60    | W14x22/26 |    | 251.61 |
| W14x26                   | 2        | 26     | 28.7           | 0.75          | 57.40    | W18x35    |    | 70.23  |
| W18x35                   | 1        | 35     | 23.4           | 0.41          | 23.42    | W18x40    |    | 114.70 |
| W18x40                   | 1        | 40     | 28.7           | 0.57          | 28.67    | W18x55    |    | 23.40  |
| W27x178                  | 1        | 178    | 23.4           | 2.08          | 23.42    | W21x178   |    | 52.08  |
|                          | 1        | 178    | 28.7           | 2.55          | 28.67    | W21x50    |    | 46.82  |
| Third Floor Beams        |          |        |                |               |          | W21x83    |    | 28.67  |
| W14x22                   | 2        | 22     | 28.7           | 0.63          | 57.33    | W21x62    |    | 28.70  |
| W14x26                   | 2        | 26     | 7.8            | 0.20          | 15.61    | W14x30    |    | 57.40  |
| W18x35                   | 1        | 35     | 23.4           | 0.41          | 23.42    | 22k7      |    | 86.10  |
| W18x40                   | 1        | 40     | 28.7           | 0.57          | 28.67    |           |    |        |
| W21x50                   | 1        | 50     | 23.4           | 0.59          | 23.42    |           |    |        |
| W21x83                   | 1        | 83     | 28.7           | 1.19          | 28.67    |           |    |        |
| Fourth Floor Beams       |          |        |                |               |          |           |    |        |
| W14x22                   | 2        | 22     | 7.8            | 0.17          | 15.60    |           |    |        |
|                          |          |        |                |               |          |           |    |        |
| W14x26                   | 2        | 26     | 28.7           | 0.75          | 57.40    |           |    |        |
| W18x35                   | 1        | 35     | 23.4           | 0.41          | 23.40    |           |    |        |
| W18x40                   | 1        | 40     | 28.7           | 0.57          | 28.70    |           |    |        |
| W21x50                   | 1        | 50     | 23.4           | 0.59          | 23.40    |           |    |        |
| W21x62                   | 1        | 62     | 28.7           | 0.89          | 28.70    |           |    |        |
| Roof Beams               |          |        |                |               |          |           |    |        |
| 22k7                     | 3        |        | 28.7           | 0.00          | 86.10    |           |    |        |
| W14x22                   | 1        | 22     | 28.7           | 0.32          | 28.67    |           |    |        |
|                          | 1        | 22     | 4.0            | 0.04          | 4.00     |           |    |        |
| W14x30                   | 2        | 30     | 28.7           | 0.86          | 57.40    |           |    |        |
| W18x40                   | 1        | 40     | 28.7           | 0.57          | 28.67    |           |    |        |
| W18x55                   | 1        | 55     | 23.4           | 0.64          | 23.40    |           |    |        |
|                          |          |        |                |               |          |           |    |        |
|                          |          |        |                |               |          |           |    |        |
|                          |          |        |                |               |          |           |    |        |
|                          |          |        |                |               |          |           |    |        |
| Second Floor Beams       |          |        |                |               |          |           |    |        |
| W14x26                   | 2        | 26     | 28.7           | 0.75          | 57.40    |           | LF |        |
| W16x31                   | 1        | 31     | 28.7           | 0.44          | 28.70    | W14x22/26 |    | 229.60 |
| W18x40                   | 1        | 40     | 23.8           | 0.48          | 23.75    | W16x31    |    | 52.50  |
| W27x178                  | 1        | 178    | 23.8           | 2.12          | 23.80    | W18x40    |    | 71.35  |
| Third Floor Beams        |          |        |                |               | 0.00     | W16x26    |    | 28.70  |
| W14x26                   | 3        | 26     | 28.7           | 1.12          | 86.10    | W21x178   |    | 23.80  |

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| •                        | artin   Cons | ı   | 1    | 1    | •      |           |    |        |
|--------------------------|--------------|-----|------|------|--------|-----------|----|--------|
| W18x40                   | 1            | 40  | 23.8 | 0.48 | 23.80  | W21x50    |    | 47.60  |
| W21x50                   | 1            | 50  | 23.8 | 0.60 | 23.80  | W22x55    |    | 23.80  |
| Fourth Floor Beams       |              |     |      |      |        | W14x30    |    | 57.40  |
| W14x26                   | 3            | 26  | 28.7 | 1.12 | 86.10  | 22k7      |    | 57.40  |
| W18x40                   | 1            | 40  | 23.8 | 0.48 | 23.80  |           |    |        |
| W21x50                   | 1            | 50  | 23.8 | 0.60 | 23.80  |           |    |        |
|                          |              |     |      |      |        |           |    |        |
| Roof Beams               |              |     |      |      | 0.00   |           |    |        |
| 22k7                     | 2            |     | 28.7 | 0.00 | 57.40  |           |    |        |
| W14x30                   | 2            | 30  | 28.7 | 0.86 | 57.40  |           |    |        |
| W16x26                   | 1            | 26  | 28.7 | 0.37 | 28.70  |           |    |        |
| W16x31                   | 1            | 31  | 23.8 | 0.37 | 23.80  |           |    |        |
| W22x55                   | 1            | 55  | 23.8 | 0.65 | 23.80  |           |    |        |
|                          |              |     |      |      |        |           |    |        |
| Column Lines (5) and (6) |              |     |      |      |        |           |    |        |
|                          |              |     |      |      |        |           |    |        |
| Row Lines (E) and (D)    |              |     |      |      |        |           |    |        |
| Second Floor Beams       |              |     |      |      |        |           |    |        |
| W14x22                   | 2            | 22  | 7.8  | 0.17 | 15.61  |           | LF |        |
| W14x26                   | 2            | 26  | 29.0 | 0.75 | 58.00  | W14x22/26 |    | 249.83 |
| W21x44                   | 1            | 44  | 29.0 | 0.64 | 29.00  | W18x40    |    | 29.00  |
|                          | 1            | 44  | 23.4 | 0.52 | 23.42  | W21x44    |    | 157.25 |
| W27x178                  | 1            | 178 | 29.0 | 2.58 | 29.00  | W21x178   |    | 29.00  |
| Third Floor Beams        |              | 170 | 23.0 | 2.50 | 23.00  | W21x68    |    | 29.00  |
| Time Floor Bearing       |              |     |      |      |        | WZIXOO    |    | 23.00  |
| W14x22                   | 2            | 22  | 7.8  | 0.17 | 15.61  | W21x48    |    | 23.42  |
| W14x26                   | 2            | 26  | 29.0 | 0.75 | 58.00  | 22k6      |    | 145.00 |
| W21x44                   | 1            | 44  | 29.0 | 0.64 | 29.00  | ZZRO      |    | 143.00 |
| VVZ1A44                  | 1            | 44  | 23.4 | 0.52 | 23.42  |           |    |        |
| W21x83                   | 1            | 83  | 29.0 | 1.20 | 29.00  |           |    |        |
| WZ1X03                   | 1            | 63  | 25.0 | 1.20 | 25.00  |           |    |        |
|                          |              |     |      |      |        |           |    |        |
| Fourth Floor Beams       |              |     |      |      |        |           |    |        |
| Tourth Hoor Beams        |              |     |      |      |        |           |    |        |
| W14x22                   | 2            | 22  | 7.8  | 0.17 | 15.61  |           |    |        |
| W14x26                   | 2            | 26  | 29.0 | 0.75 | 58.00  |           |    |        |
| W21x44                   | 1            | 44  | 29.0 | 0.64 | 29.00  |           |    |        |
| ** <u>~ 1</u> /\         | 1            | 44  | 23.4 | 0.52 | 23.42  |           |    |        |
| W21x68                   | 1            | 68  | 29.0 | 0.99 | 29.00  |           |    |        |
| Roof Beams               | 1            | 00  | 23.0 | 0.33 | 23.00  |           |    |        |
| 22K6                     | 5            |     | 29.0 | 0.00 | 145.00 |           |    |        |
| W14x22                   | 1            | 22  | 29.0 | 0.32 | 29.00  |           |    |        |
| W18x40                   | 1            | 40  | 29.0 | 0.58 | 29.00  |           |    |        |
|                          |              |     |      |      |        |           |    |        |
| W21x48                   | 1            | 48  | 23.4 | 0.56 | 23.42  |           |    |        |
| Column Lines (4) and (5) |              |     |      |      |        |           |    |        |
| Column Lines (4) and (5) |              |     |      |      |        |           |    |        |
| Row Lines (E) and (D)    |              |     |      |      |        |           |    |        |

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Andrew Martin | Construction Management | Advisor: Dr. Chris Magent

| Second Floor Beams |   |    |      |      |       |           |        |
|--------------------|---|----|------|------|-------|-----------|--------|
| W14x26             | 3 | 26 | 29.0 | 1.13 | 87.00 |           | LF     |
| W21x44             | 1 | 44 | 23.8 | 0.52 | 23.75 | W14x22/26 | 290.00 |
| Third Floor Beams  |   |    |      |      |       | 22k6      | 87.00  |
| W14x26             | 3 | 26 | 29.0 | 1.13 | 87.00 | W21x44    | 71.25  |
| W21x44             | 1 | 44 | 23.8 | 0.52 | 23.75 | W24x55    | 23.75  |
| Fourth Floor Beams |   |    |      |      |       |           | _      |
| W14x26             | 3 | 26 | 29.0 | 1.13 | 87.00 |           |        |
| W21x44             | 1 | 44 | 23.8 | 0.52 | 23.75 |           |        |
| Roof Beams         |   |    |      |      |       |           |        |
| 22k6               | 3 |    | 29.0 | 0.00 | 87.00 |           |        |
| W14x22             | 1 | 22 | 29.0 | 0.32 | 29.00 |           |        |
| W24x55             | 1 | 55 | 23.8 | 0.65 | 23.75 |           |        |

#### Column Lines (5) and (6)

Row Lines (F) and (E)

|              | Ext. N | lat. O&P  | Ext. | Labor O&P | Ext. | Equip. O&P | Ext. T | otal O&P   |
|--------------|--------|-----------|------|-----------|------|------------|--------|------------|
|              |        |           |      |           |      |            |        |            |
|              |        |           |      |           |      |            |        |            |
| W14x22/26    | \$     | 10,703.06 | \$   | 893.18    | \$   | 543.46     | \$     | 12,139.70  |
| W18x35       | \$     | 4,036.12  | \$   | 388.37    | \$   | 169.25     | \$     | 4,593.74   |
| W18x40       | \$     | 7,525.47  | \$   | 634.29    | \$   | 276.43     | \$     | 8,436.19   |
| W18x55       | \$     | 2,117.70  | \$   | 136.66    | \$   | 59.20      | \$     | 2,313.56   |
| W21x178      | \$     | 13,762.66 | \$   | 240.61    | \$   | 104.68     | \$     | 14,107.95  |
| W21x50       | \$     | 3,856.10  | \$   | 233.63    | \$   | 101.60     | \$     | 4,191.33   |
| W21x83       | \$     | 3,918.04  | \$   | 152.24    | \$   | 66.23      | \$     | 4,136.51   |
| W21x62       | \$     | 2,935.15  | \$   | 147.23    | \$   | 64.00      | \$     | 3,146.38   |
| W14x30       | \$     | 2,830.97  | \$   | 224.43    | \$   | 137.19     | \$     | 3,192.59   |
| 22k7         | \$     | 831.73    | \$   | 235.05    | \$   | 106.76     | \$     | 1,173.54   |
| Subtotals    | \$ 5   | 2,517.00  | \$   | 3,285.69  | \$   | 1,628.80   | \$     | 57,431.49  |
| Typical Bays |        | 4         |      |           |      |            |        |            |
| Total        | \$ 21  | 0,068.00  | \$ 1 | 13,142.76 | \$   | 6,515.20   | \$ 2   | 229,725.96 |

#### Harrisburg, PA Technical Assignment 2

#### Andrew Martin | Construction Management | Advisor: Dr. Chris Magent

Column Lines (4) and (5)

Row Lines (F) and (E)

|              | Ext. M | at. O&P  | Ext. L | abor O&P | Ext. E | quip. O&P | Ext. T | otal O&P   |
|--------------|--------|----------|--------|----------|--------|-----------|--------|------------|
|              |        |          |        |          |        |           |        |            |
| W14x22/26    | \$     | 9,767.18 | \$     | 815.08   | \$     | 495.94    | \$     | 11,078.20  |
| W16x31       | \$     | 2,684.33 | \$     | 205.28   | \$     | 125.48    | \$     | 3,015.08   |
| W18x40       | \$     | 4,681.27 | \$     | 394.57   | \$     | 171.95    | \$     | 5,247.79   |
| W16x26       | \$     | 1,220.90 | \$     | 101.02   | \$     | 61.71     | \$     | 1,383.63   |
| W21x178      | \$     | 6,289.39 | \$     | 109.96   | \$     | 47.84     | \$     | 6,447.18   |
| W21x50       | \$     | 3,920.34 | \$     | 237.52   | \$     | 103.29    | \$     | 4,261.15   |
| W22x55       | \$     | 2,153.90 | \$     | 113.76   | \$     | 49.74     | \$     | 2,317.41   |
| W14x30       | \$     | 2,830.97 | \$     | 224.43   | \$     | 137.19    | \$     | 3,192.59   |
| 22k7         | \$     | 554.48   | \$     | 156.70   | \$     | 71.18     | \$     | 782.36     |
| Subtotal     | \$ 34  | ,102.76  | \$ :   | 2,358.32 | \$ 1,  | 264.32    | \$     | 37,725.39  |
| Typical Bays |        | 6        |        |          |        |           |        |            |
| Total        | \$ 204 | ,616.56  | \$ 14  | 1,149.92 | \$ 7,  | ,585.92   | \$ 2   | 226,352.34 |

Column Lines (5) and (6)

Row Lines (E) and (D)

|              | Ext. N | /lat. O&P | Ext. | Labor O&P | Ext. | Equip. O&P | Ext. | Total O&P  |
|--------------|--------|-----------|------|-----------|------|------------|------|------------|
|              |        |           |      |           |      |            |      |            |
| W14x22/26    | \$     | 10,627.77 | \$   | 886.90    | \$   | 539.63     | \$   | 12,054.30  |
| W18x40       | \$     | 1,902.69  | \$   | 160.37    | \$   | 69.89      | \$   | 2,132.95   |
| W21x44       | \$     | 11,384.90 | \$   | 784.68    | \$   | 341.23     | \$   | 12,510.81  |
| W21x178      | \$     | 7,663.54  | \$   | 133.98    | \$   | 58.29      | \$   | 7,855.81   |
| W21x68       | \$     | 3,228.28  | \$   | 148.77    | \$   | 64.67      | \$   | 3,441.72   |
| W21x48       | \$     | 1,928.87  | \$   | 116.87    | \$   | 50.82      | \$   | 2,096.56   |
| 22k6         | \$     | 1,400.70  | \$   | 395.85    | \$   | 179.80     | \$   | 1,976.35   |
| Subtotal     | \$ 3   | 88,136.75 | \$   | 2,627.42  | \$   | 1,304.33   | \$   | 42,068.50  |
| Typical Bays |        | 6         |      |           |      |            |      |            |
| Total        | \$ 22  | 28,820.50 | \$ 1 | 5,764.52  | \$   | 7,825.98   | \$   | 252,411.00 |

Column Lines (4) and (5)

Row Lines (E) and (D)

|                  | Ext. M | at. O&P   | Ext. La | bor O&P  | Ext. E | quip. O&P | Ext. To | tal O&P   |
|------------------|--------|-----------|---------|----------|--------|-----------|---------|-----------|
|                  |        |           |         |          |        |           |         |           |
| W14x22/26        | \$     | 12,336.60 | \$      | 1,029.50 | \$     | 626.40    | \$      | 13,992.50 |
| 22k6             | \$     | 840.42    | \$      | 237.51   | \$     | 107.88    | \$      | 1,185.81  |
| W21x44           | \$     | 5,158.50  | \$      | 355.54   | \$     | 154.61    | \$      | 5,668.65  |
| W24x55           | \$     | 2,149.38  | \$      | 113.53   | \$     | 49.64     | \$      | 2,312.54  |
| Subtotal         | \$ 20  | ,484.90   | \$ 1    | ,736.08  | \$     | 938.53    | \$      | 23,159.50 |
| Typical Bays     |        | 9         |         |          |        |           |         |           |
| Total            | \$ 184 | 1,364.10  | \$ 15,  | 624.72   | \$ 8,  | 446.77    | \$ 20   | 08,435.50 |
| TOTAL BEAM COSTS | \$ 827 | 7,869.16  | \$ 58,  | 681.92   | \$ 30, | ,373.87   | \$ 9:   | 16,924.80 |

## Harrisburg, PA

### Technical Assignment 2

Andrew Martin | Construction Management | Advisor: Dr. Chris Magent

| Assumed 12x50                 |         | LF       | 354.0  |             |               |
|-------------------------------|---------|----------|--------|-------------|---------------|
| Assumed 12x190                |         | LF       | 155.7  |             |               |
| Columns 1st-3rd Floor Splice  |         |          |        |             |               |
| Name                          | Shape   | Quantity | Wt./If | Length (ft) | Weight (tons) |
| D-4                           | W12x58  | 1        | 40.0   | 34.5        | 0.69          |
| D-5                           | W12x210 | 1        | 210.0  | 29.7        | 3.12          |
| D-6                           | W12X50  | 1        | 50.0   | 31.5        | 0.79          |
| E-4                           | W12x210 | 1        | 210.0  | 31.5        | 3.31          |
| E-5                           | W12x210 | 1        | 210.0  | 31.5        | 3.31          |
| E-6                           | W12x170 | 1        | 170.0  | 31.5        | 2.68          |
| F-4                           | W12x53  | 1        | 53.0   | 31.5        | 0.83          |
| F-5                           | W12X170 | 1        | 170.0  | 31.5        | 2.68          |
| F-6                           | W12x40  | 1        | 40.0   | 31.5        | 0.63          |
| Columns 3rd Floor Splice-Roof |         |          |        |             |               |
| Name                          | Shape   | Quantity | Wt./lf | Length (ft) | Weight (tons) |
| D-4                           | W12x40  | 1        | 40.0   | 25.0        | 0.50          |
| D-5                           | W12x65  | 1        | 65.0   | 25.0        | 0.81          |
| D-6                           | W12X40  | 1        | 40.0   | 25.0        | 0.50          |
| E-4                           | W12x65  | 1        | 65.0   | 25.0        | 0.81          |
| E-5                           | W12x65  | 1        | 65.0   | 25.0        | 0.81          |
| E-6                           | W12x65  | 1        | 65.0   | 25.0        | 0.81          |
| F-4                           | W12x40  | 1        | 40.0   | 25.0        | 0.50          |
| F-5                           | W12x65  | 1        | 65.0   | 25.0        | 0.81          |
| F-6                           | W12x40  | 1        | 40.0   | 25.0        | 0.50          |

### COLUMNS

| Assumed 12x50                         |       |              | 354       |               |           |            |              |              |  |
|---------------------------------------|-------|--------------|-----------|---------------|-----------|------------|--------------|--------------|--|
| Assumed 12x190                        |       |              | 155       | 5.7           |           |            |              |              |  |
|                                       | Ext.  | Mat. O&P     | Ext<br>O& | . Labor<br>.P | Ext.      | Equip. O&P | Ext          | . Total O&P  |  |
| W12x50                                | \$ 29 | 9,155.44     | \$ 1      | ,207.14       | \$ 73     | 39.86      | \$ 3         | 1,102.44     |  |
| W12x190                               | \$ 48 | 3,614.21     | \$ 601.00 |               | \$ 365.90 |            | \$ 49,581.11 |              |  |
| Subtotal                              | \$    | 77,769.65    | \$        | 1,808.14      | \$        | 1,105.76   | \$           | 80,683.55    |  |
| Typical Bays (25 total, 4 calculated) |       |              |           |               | 6.25      |            |              |              |  |
| TOTAL COLUMN COST                     | \$    | 486,060.31   | \$ :      | 11,300.88     | \$        | 6,911.00   | \$           | 504,272.19   |  |
| TOTAL STEEL COST                      | \$    | 1,313,929.47 | \$ (      | 69,982.80     | \$        | 37,284.87  | \$ :         | 1,421,196.99 |  |

#### Harrisburg, PA Technical Assignment 2

Andrew Martin | Construction Management | Advisor: Dr. Chris Magent

| Metal Deck |           |       |               |      |              |    |                 |     |               |  |
|------------|-----------|-------|---------------|------|--------------|----|-----------------|-----|---------------|--|
| Floor      | Area (SF) | Ext   | . Mat. O&P    | Ext. | Labor O&P    |    | . Equip.<br>O&P | Ext | . Total O&P   |  |
| Floor 2-4  |           |       |               |      |              |    |                 |     |               |  |
| Approx.    | 51300     | \$    | 152,361.00    | \$   | 35,397.00    | \$ | 2,052.00        | \$  | 189,810.00    |  |
| Roof Deck  | 17100     | \$    | 50,787.00     | \$   | 11,799.00    | \$ | 684.00          | \$  | 63,270.00     |  |
| Total Area | 68400     | \$ 20 | \$ 203,148.00 |      | \$ 47,196.00 |    | \$ 2,736.00     |     | \$ 253,080.00 |  |

| WWF           |           |      |           |      |           |                  |    |      |           |
|---------------|-----------|------|-----------|------|-----------|------------------|----|------|-----------|
| Floor         | Area (SF) | Ext. | Mat. O&P  | Ext. | Labor O&P | Ext. Equi<br>O&P | p. | Ext. | Total O&P |
| Total Area    | 85500     | \$   | 25,348.68 | \$   | 27,139.14 | \$               | -  | \$   | 52,487.82 |
| Floor (2-4)   | 51300     |      |           |      |           |                  |    |      |           |
| Roof Deck     | 17100     |      |           |      |           |                  |    |      |           |
| Slab on Grade | 17100     |      |           |      |           |                  |    |      |           |

| Concrete<br>Piers |                |          |                |      |            |      |           |                    |                   |
|-------------------|----------------|----------|----------------|------|------------|------|-----------|--------------------|-------------------|
| Size (SF)         | Length<br>(FT) | Quantity | Volume<br>(CY) | Ext. | . Mat. O&P | Ext. | Labor O&P | Ext. Equip.<br>O&P | Ext. Total<br>O&P |
| 4                 | 10             | 25       | 37.0           | \$   | 37,334.85  | \$   | 25,855.97 | \$ 2,467.90        | \$ 65,658.72      |

| Slab on Grade |                   |             |                  |                   |                 |                   |
|---------------|-------------------|-------------|------------------|-------------------|-----------------|-------------------|
| Area (SF)     | Thickness<br>(FT) | Volume (CY) | Ext. Mat.<br>O&P | Ext. Labor<br>O&P | Ext. Equip. O&P | Ext. Total<br>O&P |
| 2100          | 0.42              | 32.41       |                  |                   |                 |                   |
| 500           | 0.50              | 9.26        |                  |                   |                 |                   |
| 14500         | 0.42              | 223.77      |                  |                   |                 |                   |
| Total         |                   | 265.43      | \$ 30,609.39     | \$ 5,353.72       | \$ 1,993.38     | \$ 37,956.49      |

| Elevated Deck |           |                |             |               |                |                    |                   |
|---------------|-----------|----------------|-------------|---------------|----------------|--------------------|-------------------|
| Floor         | Area (SF) | Thickness (FT) | Volume (CY) | Ext. Mat. O&P | Ext. Labor O&P | Ext. Equip.<br>O&P | Ext. Total<br>O&P |
| 2nd-4th       | 51300     | 0.54           | 1029.17     | \$ 120,555.00 | \$ 95,931.00   | \$ 36,936.00       | \$ 253,422.00     |

#### **Foundation Walls**

| . canaation trains |                   |                   |             |               |                |                    |                   |
|--------------------|-------------------|-------------------|-------------|---------------|----------------|--------------------|-------------------|
| Height (FT)        | Thickness<br>(FT) | Perimeter<br>(FT) | Volume (CY) | Ext. Mat. O&P | Ext. Labor O&P | Ext. Equip.<br>O&P | Ext. Total<br>O&P |
| 5                  | 1.5               | 535               | 148.6       | \$ 37,698.11  | \$ 5,380.77    | \$ 1,997.36        | \$ 45,076.24      |

10% overhead and profit assumed in all estimates.

Harrisburg, PA
Technical Assignment 2

Andrew Martin | Construction Management | Advisor: Dr. Chris Magent

## Appendix C – General Conditions Estimate

| Campus Square General Cond             | itions Estima | ate  |          |           |
|--|---------------|------|----------|-----------|
|  |               |      | Unit     |           |
| Description                            | Quantity      | Unit | Price    | Total     |
| Supervision/Project Management         |               |      |          |           |
| Customer Captain/VP                    | 20            | HR   | \$175    | \$3,500   |
| Project Executive                      | 68            | HR   | \$175    | \$11,900  |
| Director of Field Operations           | 205           | HR   | \$150    | \$30,750  |
| Director of Safety                     | 200           | HR   | \$50     | \$10,000  |
| Project Manager                        | 2056          | HR   | \$100    | \$205,600 |
| Project Superintendent                 | 2384          | HR   | \$100    | \$238,400 |
| Project Engineer                       | 276           | HR   | \$75     | \$20,700  |
| Job Foreman                            | 4             | HR   | \$75     | \$300     |
| Project Assistant                      | 1060          | HR   | \$50     | \$53,000  |
| Project Accountant                     | 216           | HR   | \$65     | \$14,040  |
| Contract Administrator                 | 18            | HR   | \$125    | \$2,250   |
|  |               |      | Subtotal | \$590,440 |
| Administrative Facilities and Supplies |               |      |          |           |
| Contractor's Office Set-Up             | 1             | EA   | \$2,500  | \$2,500   |
| Job Office Expenses                    | 10            | MTH  | \$250    | \$2,500   |
| Furniture                              | 1             | EA   | \$1,000  | \$1,000   |
| Copy Machine                           | 10            | MTH  | \$100    | \$1,000   |
| Personal Computers                     | 10            | MTH  | \$100    | \$1,000   |
| Local Area Network/Data                | 10            | MTH  | \$100    | \$1,000   |
| Telephone - Setup                      | 1             | EA   | \$150    | \$150     |
| Monthly Telephone Bills                | 10            | MTH  | \$100    | \$1,000   |
| Cell Phone Bills                       | 10            | MTH  | \$100    | \$1,000   |
| Jobsite Storage - Fence/Barriers       | 10            | MTH  | \$1,200  | \$12,000  |
| Drawings and Specifications            | 10            | MTH  | \$200    | \$2,000   |
| Photographs                            | 10            | MTH  | \$50     | \$500     |
| Motor Vehicle Expenses (Gas/Maint.)    | 10            | MTH  | \$500    | \$5,000   |
| Postage and Shipping                   | 10            | MTH  | \$250    | \$2,500   |
| Travel Expenses                        | 10            | MTH  | \$500    | \$5,000   |
| As-Built Drawings                      | 1             | EA   | \$1,000  | \$1,000   |
| Engineering Instruments/Supplies       | 10            | MTH  | \$50     | \$500     |
|  |               |      | Subtotal | \$39,650  |
| Safety                                 |               |      |          |           |
| Job Safety Expenses                    | 10            | MTH  | \$200    | \$2,000   |
| Safety Materials                       | 10            | MTH  | \$100    | \$1,000   |

## Harrisburg, PA

## Technical Assignment 2

| Fire Protection (Extinguishers)                          | 10          | EA  | \$100    | \$1,000   |
|--|-------------|-----|----------|-----------|
|  |             |     | Subtotal | \$4,000   |
| Clean-up   |             |     |          |           |
| Periodic Clean-up (Laborer)                              | 2933        | HR  | \$35     | \$102,655 |
| Construction Cleaning                                    | 1           | LS  | \$11,000 | \$11,000  |
| Dumpter Service  | 10          | MTH | \$1,000  | \$10,000  |
| Waste management Consultant                              | 10          | MTH | \$200    | \$2,000   |
|  |             |     | Subtotal | \$125,655 |
| Jobsite Work Requirements                                |             |     |          |           |
| Fences/Barricades  | 10          | MTH | \$500    | \$5,000   |
| Signage  | 1           | LS  | \$5,000  | \$5,000   |
| Misc. Tools & Equipment                                  | 10          | MTH | \$3,000  | \$30,000  |
| Drinking Water   | 10          | MTH | \$100    | \$1,000   |
| Protect Floors & Walls                                   | 1           | LS  | \$8,000  | \$8,000   |
| Patch FP   | 1           | LS  | \$5,000  | \$5,000   |
| Elevator Protection                                      | 1           | LS  | \$1,500  | \$1,500   |
| Temporary Heating/Cooling (for job office)               | 10          | MTH | \$400    | \$4,000   |
| Monthly Electric Bill (for job office)                   | 10          | MTH | \$100    | \$1,000   |
| Fuel/Oil (misc.)   | 4           | MTH | \$200    | \$800     |
| Temporary Toilets  | 10          | MTH | \$500    | \$5,000   |
| Temporary Water / Electric (for construction activities) | 10          | MTH | \$250    | \$2,500   |
| Temporary Heat   | 4           | MTH | \$200    | \$800     |
| Construction Site Access                                 | 1           | LS  | \$2,500  | \$2,500   |
| 80' Pettibone  | 10          | MTH | \$2,200  | \$22,000  |
| 60' Man Lift   | 8           | MTH | \$1,800  | \$14,400  |
| Contractor Parking Lot                                   | 1           | LS  | \$11,000 | \$11,000  |
| Laydown Space Preparation                                | 1           | LS  | \$10,000 | \$10,000  |
|  |             |     | Subtotal | \$129,500 |
| Permitting   | Cost        |     |          |           |
| Building Permit  | \$65,256    |     |          |           |
| Street Cut Permit  | \$1,430     |     |          |           |
| Subtotal   | \$66,686    |     |          |           |
| Bonds and Insurance                                      |             |     |          |           |
| Liability Insurance                                      | \$88,456    |     |          |           |
| Mercantile Tax   | \$17,032    |     |          |           |
| Subtotal   | \$105,488   |     |          |           |
| Total General Conditions Cost                            | \$1,061,419 |     |          |           |