Washington, DC



Todd Povell Construction Management

Consultant, Dr. John Messner November 2, 2007



## 77 K Street

Technical Assignment #2

#### Table of Contents

| Executive Summary                    | 3 |
|--------------------------------------|---|
| Detailed Project Schedule            | 4 |
| Site Layout Plan                     |   |
| Roofing Assemblies Estimate          |   |
| Detailed Structural Systems Estimate |   |
| General Conditions Estimate          |   |



#### Executive Summary

Technical assignment #2 was a means of delving deeper into the 77 K Street project and beginning to explore possible topics for future research. Through this report one will find many of the topics studied in technical report #1 but in much greater detail. This report contains a more detailed project schedule, a site layout plan for the structural concrete sequence, an assemblies estimate of the roofing system, a detailed concrete estimate, and a general conditions estimate.

Through the process of creating the critical path method (CPM) schedule, I began to see opportunities for the implementation of a short interval production schedule (SIPS). By beginning to utilize the labor force more efficiently the project could begin to operate in a more lean and productive manner, not only saving time but saving money as well. I also see opportunities for incorporating building information modeling to help plan crew movement and prevent interference in the schedule.

The creation of the critical path method schedule also opened up the opportunity to exploring the precast and glazing façade in further detail. The interesting sequencing of the facades utilizing both mobile as well as tower cranes in combination with the owner's desire to get the building enclosed as soon as possible presents an area to study further.

The project also did consider pursuing LEED certification but not until well into the design and planning. Another area to research could be the feasibility and cost implications of making this building green earlier in the development of the project.



#### Detailed Project Schedule

A project schedule was developed in order to assess the current status of the project, as well as begin exploring potential solutions to reduce the overall schedule duration. Being a core and shell office building with typical floor layouts, the potential to maximize crew productivity became of particular interest. The repetition of activities being performed lends well to a crew improving their production as they proceed through the building.

In order to begin analyzing these work flows, the construction schedule was broken down into floors, rather than trades. By seeing the flow of activities, one could begin to develop a sense of the "parade of trades" throughout the building. The critical path method schedule posed a particular challenge at assessing this flow and consequently, an activity grid was developed. The grid plots out the exact dates each activity will take place, as well as on which floors of the building. The grid helps visually depict not only when and where activities are taking place but also gaps in the work sequence and inefficiencies in the schedule.

The ultimate goal of developing the activity grid is to pursue the development of a short interval production schedule (SIPS) as part of my future research. When looking at one activity, white space in the grid indicates gaps in an activity's work sequence. A crew is being pulled off of their task and diverted to another activity, only to return to such task on another floor at a later time. By balancing work crews and production rates, an efficient flow of trades can be developed where workers are operating most efficiently and activities are scheduled sequentially.

Additionally, I hope to take the SIPS schedule one step further. By displaying in tandem both the current schedule and lean SIPS schedule in a 4D model of 77 K Street, the user can show interested parties how production has increased and the construction is operating in a efficient manner. Using building information modeling to allocate work areas, the user will be capable of easily displaying the efficiency of the SIPS schedule as well as detecting any collisions between trades. A visual "parade of trades" will flow through the building. With each crew highlighted in a different color within the model, a flow of colors, representing the flow of crews, will travel through the model in a smooth, efficient manner.

| 77 K Street           |  |           |                        |                        |                         |      |                 |                     |       |                   | Classic                                   | WBS Layout   |                  |               |         |                  |                |                  |   |   |   |                    |
|-----------------------|--|-----------|------------------------|------------------------|-------------------------|------|-----------------|---------------------|-------|-------------------|---|--|------------------|---------------|---------|------------------|----------------|------------------|---|---|---|--------------------|
| Activity ID           | Activity Name  | Du        | Start                  | Finish                 |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   |   |                    |
|                       |  |           |                        |                        |                         | lon  | Eab             | Mor                 | Apr   | Mov               | 2007                                      |  | For              | Oct           | Nov     | Dee              | lon            | Fab              | Mor                                     | Anr                                     | 2008  | un T               |
| 77 K Stre             | et   | 952       | 03-Jan-05              | 18-Sep-08              | DV Dec                  | Jan  | Feb             | Iviar               | Арг   | way               | Jun                                       | Jui Aug  | Sep              | UCI           | INOV    | Dec              | Jan            | Feb              | IVIAI                                   | Арг                                     | iliay J   | un                 |
| Pre-Con               | struction  | 470       | 03-Jan-05              | 03-Nov-06              | pv-06, Pre-Construction |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   |   |                    |
| A1000                 | Initial Planning through Construction Documents  | 293       | 03-Jan-05              | 24-Feb-06              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   |   |                    |
| A1010                 | General Contractor Selection   | 33        | 20-Sep-06              | 03-Nov-06              | ral Contractor Selectio | n    |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   |   |                    |
| Constru               | ction  | 468       | 28-INOV-06             | 18-Sep-08              | •                       |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   |   |                    |
| Excava                | tion   | 126       | 28-Nov-06              | 24-May-07              | -                       |      |                 |                     |       |                   | 24-May-07, Excavation                     |  |                  |               |         |                  |                |                  |   |   |   |                    |
| A1020                 | Excavation Dewatering: Installation & Set-Up   | 126<br>32 | 28-Nov-06<br>12-Dec-06 | 24-May-07<br>26-Jan-07 |                         |      | Dewatering: In: | stallation & Set-Up |       |                   | Excavation                                |  |                  |               |         |                  |                |                  |   |   |   |                    |
| A1040                 | Sheeting & Shoring   | 107       | 19-Dec-06              | 18-May-07              |                         |      |                 | ·                   |       | She               | eeting & Shoring                          | 04 Aug 07 0  |                  |               |         |                  |                |                  |   |   |   |                    |
| Substr                | ucture   | 92        | 23-Mar-07              | 01-Aug-07              |                         |      |                 |                     |       |                   |   | 🗸 01-Aug-07, S   | Substructure     |               |         |                  |                |                  |   |   |   |                    |
| Garage Leve<br>A1050  | F/R/P Mat Foundation   | 55<br>51  | 23-Mar-07<br>23-Mar-07 | 08-Jun-07<br>01-Jun-07 |                         |      |                 | -                   |       |                   | O8-Jun-07, Garag     F/R/P Mat Foundation | e Level P3   |                  |               |         |                  |                |                  |   |   |   |                    |
| A1060                 | Slab Waterproofing   | 40        | 02-Apr-07              | 25-May-07              |                         |      |                 |                     |       |                   | Slab Waterproofing                        |  |                  |               |         |                  |                |                  |   |   |   |                    |
| A1070                 | Erect Northern Tower Crane   | 43        | 16-Apr-07              | 16-Apr-07              |                         |      |                 |                     | I Ere | ct Northern Tower | r Crane                                   |  |                  |               |         |                  |                |                  |   |   |   |                    |
| A1290<br>Garage Leve  | Erect Southern Tower Crane   | 1         | 08-Jun-07              | 08-Jun-07              |                         |      |                 |                     | -     |                   | Erect Southern To<br>19-Jun-07,           | ower Crane<br>Garage Level P2                          |                  |               |         |                  |                |                  |   |   |   |                    |
| A1090                 | Exterior Wall Waterproofing  | 34        | 17-Apr-07              | 01-Jun-07              |                         |      |                 |                     |       |                   | Exterior Wall Waterpr                     | pofing   |                  |               |         |                  |                |                  |   |   |   |                    |
| Garage Leve           | PR/P Wails, Columns, Slabs   | 35<br>21  | 02-May-07<br>07-Jun-07 | 19-Jun-07<br>06-Jul-07 |                         |      |                 |                     |       |                   | • • • • • • • • • • • • • • • • • • •     | 6-Jul-07, Garage Level P1                              |                  |               |         |                  |                |                  |   |   |   |                    |
| A1100<br>A1110        | F/R/P Walls, Columns, Slabs<br>Exterior Wall Waterproofing                               | 22<br>20  | 07-Jun-07<br>08-Jun-07 | 06-Jul-07<br>05-Jul-07 |                         |      |                 |                     |       |                   |   | R/P Walls, Columns, Slabs<br>terior Wall Waterproofing | s                |               |         |                  |                |                  |   |   |   |                    |
| Building Lev          | rel 1<br>Exterior Wall Waterproofing   | 26<br>16  | 26-Jun-07              | 01-Aug-07              |                         |      |                 |                     |       |                   | *   | 01-Aug-07, B<br>Exterior Wall Wateron                  | Building Level 1 |               |         |                  |                |                  |   |   |   |                    |
| A1130                 | F/R/P Walls, Columns, Slabs  | 18        | 09-Jul-07              | 01-Aug-07              | -                       |      |                 |                     |       |                   |   | F/R/P Walls,   | Columns, Slabs   |               |         |                  |                |                  |   |   |   |                    |
| Supers                | tructure Concrete  | 166       | 03-Aug-07              | 24-Mar-08              |                         |      |                 |                     |       |                   |   | *  |                  |               |         |                  |                |                  | ₹ 24                                    | -Mar-08, Superstru                      | icture Concrete                                 |                    |
| A1140<br>A1150        | Level 2  | 10        | 03-Aug-07              | 16-Aug-07<br>30-Aug-07 | -                       |      |                 |                     |       |                   |   | Leve   | el 2<br>Level 3  |               |         |                  |                |                  |   |   |   |                    |
| A1160                 | Level 4  | 11        | 29-Aug-07              | 12-Sep-07              |                         |      |                 |                     |       |                   |   |  | Level 4          |               |         |                  |                |                  |   |   |   |                    |
| A1170                 | Level 5  | 10        | 11-Sep-07<br>21-Sep-07 | 24-Sep-07<br>04-Oct-07 |                         |      |                 |                     |       |                   |   |  |                  | Level 5       |         |                  |                |                  |   |   |   |                    |
| A1190                 | Level 7  | 10        | 03-Oct-07              | 16-Oct-07              |                         |      |                 |                     |       |                   |   |  |                  | Level 7       | 7       |                  |                |                  |   |   |   |                    |
| A1200<br>A1210        | Level 8<br>Level 9   | 9         | 15-Oct-07<br>25-Oct-07 | 25-Oct-07<br>07-Nov-07 |                         |      |                 |                     |       |                   |   |  |                  |               | Level 9 |                  |                |                  |   |   |   |                    |
| A1220                 | Level 10   | 10        | 06-Nov-07              | 19-Nov-07              |                         |      |                 |                     |       |                   |   |  |                  |               | Leve    | 110              |                |                  |   |   |   |                    |
| A1230<br>A1240        | Level 11<br>Main Roof  | 12<br>12  | 16-Nov-07<br>04-Dec-07 | 03-Dec-07<br>19-Dec-07 | -                       |      |                 |                     |       |                   |   |  |                  |               |         | Level 11<br>Mair | Roof           |                  |   |   |   |                    |
| A1250                 | Penthouse Roof   | 6         | 20-Dec-07              | 27-Dec-07              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  | Penthouse Roof | Remove S         | Southern Tower (                        | Crane                                   |   |                    |
| A1260<br>A1270        | Infill Slab Openings at Southern Tower Crane   | 10        | 11-Feb-08<br>12-Feb-08 | 25-Feb-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  | fill Slab Opening                       | s at Southern Tow                       | er Crane  |                    |
| A1300                 | Remove Northern Tower Crane  | 1         | 10-Mar-08              | 10-Mar-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  | Remove N                                | orthern Tower Cra                       | ne<br>t Southern Tower Crane                    |                    |
| Exterio               | r Facade & Roof  | 140       | 20-Nov-07              | 02-Jun-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   | ▼ 02-Ji   | Jn-08, Exte        |
| A1400                 | Substantially Watertight   | 0         |                        | 09-Apr-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   | <ul> <li>Substantiall</li> </ul>        | / Watertight                                    |                    |
| East Elevati<br>A1320 | on<br>Precast Using Mobile Crane   | 140<br>68 | 20-Nov-07<br>20-Nov-07 | 02-Jun-08<br>21-Feb-08 |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                | Prec             | cast Using Mobil                        | Crane                                   | <b>▼</b> 02-Ji                                  | in-08, East        |
| A1330                 | Windows  | 124       | 12-Dec-07              | 02-Jun-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   | Wind<br>13-May-08, North                        | ows<br>h Elevation |
| A1340                 | Precast Using Mobile Crane   | 32        | 12-Dec-07              | 24-Jan-08              | -                       |      |                 |                     |       |                   |   |  |                  |               |         |                  | Preca          | ast Using Mobile | e Crane                                 |   | Windows   |                    |
| A1350<br>South Eleva  | tion   | 87<br>98  | 14-Jan-08<br>28-Dec-07 | 13-May-08<br>13-May-08 |                         |      |                 |                     |       |                   |   |  |                  |               |         | •                |                |                  |   |   | 13-May-08, Sout                                 | h Elevation        |
| A1360<br>A1370        | Precast Using Tower Crane<br>Windows   | 21<br>77  | 28-Dec-07<br>28-Jan-08 | 25-Jan-08<br>13-Mav-08 |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  | Prec           | cast Using Towe  | er Crane                                |   | Windows   |                    |
| West Elevat           | ion<br>Brocost Using Tower Cross   | 77        | 28-Jan-08              | 13-May-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  | Precast Liei                            | ng Tower Crane                          | 13-May-08, Wes                                  | t Elevation        |
| A1380<br>A1390        | Windows  | 67        | 20-Jan-08<br>11-Feb-08 | 13-May-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   | Windows   |                    |
| Main Roof &<br>A1410  | Penthouse<br>Main Roof Installation  | 83<br>83  | 14-Jan-08<br>14-Jan-08 | 07-May-08<br>07-May-08 |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  | ¥              |                  |   |   | 🔫 07-May-08, Main Ro<br>🔲 Main Roof Installatio | of & Pentho<br>n   |
| A1420                 | Penthouse Steel, Framing, and EIFS Installation  | 48        | 14-Jan-08              | 19-Mar-08              | -                       |      |                 |                     |       |                   |   |  |                  |               |         |                  |                | -                | Penti<br>Penti                          | ouse Steel, Frami                       | ng, and EIFS Installation                       |                    |
| Core                  |  | 15        | 20-Feb-08<br>05-Oct-07 | 09-Jun-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  | Fellu                                   | - soo . cooning in St                   | <b>*</b> (                                      | /9-Jun-08          |
| A2930                 | PEPCO Work   | 40        | 14-Jan-08              | 07-Mar-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  | PEPCO Wa                                | rk                                      |   |                    |
| A1440                 | Elevator Installation  | 100       | 22-Jan-08              | 09-Jun-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  | Energize Perergize                      | rmanent Power                           | E   | levator Inst       |
| A2950                 | Pull MCC Feeder Cable and Terminate  | 15        | 27-Mar-08              | 16-Apr-08              | _                       |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  | •                                       | Pull MC                                 | C Feeder Cable and Ter                          | minate             |
| A2960<br>Building Lev | MEP System Start-Up  | 15<br>123 | 21-Apr-08              | 09-May-08              |                         |      |                 |                     |       |                   |   |  |                  | -             |         |                  |                |                  | 2                                       | -Mar-08, Building                       | MEP System Start-<br>Level 2                    | Up                 |
| Interiors<br>A1450    | CMLL Drywall & Acoustical Ceiling Tile   | 39<br>30  | 28-Dec-07              | 20-Feb-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         | •                |                | 20-F             | eb-08, Interiors<br>all, & Acoustical ( | ceiling Tile                            |   |                    |
| A1460                 | Tile, Stone, Bathrooms, & Paint  | 19        | 25-Jan-08              | 20-Feb-08              | -                       |      |                 |                     |       |                   |   |  |                  |               | <u></u> |                  |                | Tile,            | Stone, Bathroon                         | is, & Paint                             | 8 Diumbing                                      |                    |
| A1470                 | al, Fire Protection, & Plumbing Install Risers   | 100<br>2  | 05-Oct-07<br>05-Oct-07 | 21-Feb-08<br>08-Oct-07 |                         |      |                 |                     |       |                   |   |  |                  | Install Riser | rs      |                  |                | ¥ 21-F           | -eb-08, Mechani                         | al, Fire Protection                     | & Plumbing                                      |                    |
| A1480                 | Set SCU     Ductwork, Mechanical, Plumbing, & Sprinkler Rough-In                         | 2         | 15-Nov-07              | 16-Nov-07<br>23-Jan-08 | -                       |      |                 |                     |       |                   |   |  |                  |               | Set SC  | cu               | Ductv          | vork, Mechanica  | al, Plumbing, & S                       | prinkler Rough-In                       |   |                    |
| A1300                 | Ductwork and Insulation Installation   | 17        | 26-Dec-07              | 17-Jan-08              | -                       |      |                 |                     |       |                   |   |  |                  |               |         |                  | Ductwork       | k and Insulation | Installation                            |   |   |                    |
| A1510<br>A1520        | Set VAV's and Mechanical Connections to Equipment           Trim-Out & Plumbing Fixtures | 3         | 03-Jan-08<br>18-Feb-08 | 07-Jan-08<br>21-Feb-08 | -                       |      |                 |                     |       |                   |   |  |                  |               |         |                  | Set VAV's and  | wechanical Col   | nections to Equin-Out & Plumbing        | pment<br>Fixtures                       |   |                    |
| Electrical            | ) Install Risers (Conduit) & Electrical Eiro Alarm Dough In                              | 56        | 08-Jan-08              | 25-Mar-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  | Install        | Risers (Conduit  | t) & Electrical. Fi                     | -Mar-08, Electrica<br>re Alarm Rough-In |   |                    |
| A1530                 | Set Panel Boards and Transformers  | 3         | 25-Jan-08              | 22-Jan-08<br>29-Jan-08 |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  | Se             | et Panel Boards  | and Transforme                          | rs                                      |   |                    |
| A1550                 | Terminations (Devices and Fire Alarm) and Trim Out                                       | 9         | 08-Feb-08              | 20-Feb-08              |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                | Term             | ninations (Device                       | s and Fire Alarm) a                     | ana Trim Out                                    |                    |
|                       | octual Work  | oma:      |                        | ork 💻                  | Cumm                    | any  |                 |                     |       |                   | Pa  | ge 1 of 4  |                  |               |         |                  |                |                  |   |   |   |                    |
|                       |  | verrial   | ining w                |                        | ▼ Summ                  | ui y |                 |                     |       |                   |   | -  |                  |               |         |                  |                |                  |   |   |   |                    |
|                       |  | e         |                        |                        |                         |      |                 |                     |       |                   |   |  |                  |               |         |                  |                |                  |   |   |   |                    |

|                                |  |                              |                             |                  |          | 31-Oct-07     | 20:07              |
|--------------------------------|--|------------------------------|-----------------------------|------------------|----------|---------------|--------------------|
|                                |  |                              |                             |                  |          |               |                    |
| Eeb Mar                        | Apr  | 20<br>May                    | 08                          | [11]             | Δυα      | Son           | Oct                |
|                                | Арі  | way                          | Juli                        | Jui              | Aug      | 3ep<br>18-Se  | ep-08, 77 K Stree  |
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|                                |  |                              |                             |                  |          |               |                    |
|                                |  |                              |                             |                  |          | <b>1</b> 8-Se | p-08, Construction |
|                                |  |                              |                             |                  |          |               |                    |
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|                                |  |                              |                             |                  |          |               |                    |
|                                |  |                              |                             |                  |          |               |                    |
|                                | 24-Mar-08, Superstructu                      | ire Concrete                 |                             |                  |          |               |                    |
|                                |  |                              |                             |                  |          |               |                    |
|                                |  |                              |                             |                  |          |               |                    |
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|                                |  |                              |                             |                  |          |               |                    |
|                                |  |                              |                             |                  |          |               |                    |
| Remove Southern Towe           | r ¢rane                                      |                              |                             |                  |          |               |                    |
| Infill Slab Openir             | igs at Southern Tower C                      | Crane                        |                             |                  |          |               |                    |
|                                | nfill Slab Openings at S                     | outhern Towe                 | er Crane                    | orior Foodda 9 F | loof     |               |                    |
|                                | Substantially W                              | /stertight                   | ▼ 02-Juli-06, Ex            | enor racade & r  | 001      |               |                    |
| Precast Using Mon              | le Crane                                     |                              | 🔻 02-Jun-08, Ea             | st Elevation     |          |               |                    |
|                                |  | - 40 Marca                   | Windows                     | _                |          |               |                    |
| ast Using Mobile Crane         |  | 13-May-0                     |                             | n                |          |               |                    |
|                                |  | 13-May-0                     | 08, South Elevation         | n                |          |               |                    |
| ast Using Tower Crane          |  | Windows                      | 3                           |                  |          |               |                    |
| Precast U                      | sing Tower Crane                             | 13-May-0                     | 08, West Elevatio           | h                |          |               |                    |
|                                | -  | Windows<br>07-May-08,        | s<br>Main Roof & Pen        | house            |          |               |                    |
| Per                            | nthouse Steel, Framing,                      | Main Roof Ir<br>and EIFS Ins | nstallation<br>tallation    |                  |          |               |                    |
| Per                            | nthouse Roofing Installa                     | tion                         | • 09-Jun-08                 | Core             |          |               |                    |
| PEPCO W                        | /ork   |                              |                             |                  |          |               |                    |
| ♦ Energize F                   | Permanent Power                              |                              | Elevator Ir                 | stallation       |          |               |                    |
|                                | Pull MCC F                                   | eeder Cable                  | and Terminate<br>m Start-Up |                  |          |               |                    |
| 20-Feb-08. Interior            | 25-Mar-08, Building Lev                      | /el 2                        | op                          |                  |          |               |                    |
| CMU, Drywall, & Acoustica      | l Ceiling Tile<br>oms, & Paint               |                              |                             |                  |          |               |                    |
| 21-Feb-08, Mecha               | nical, Fire Protection, &                    | Plumbing                     |                             |                  |          |               |                    |
| ork Mechanical Diumbia-        | Sprinkler Pouch In                           |                              |                             |                  |          |               |                    |
| and Insulation Installation    | Sprinkier Rough-In                           |                              |                             |                  |          |               |                    |
| Mechanical Connections to Ed   | quipment<br>ng Fixtures                      |                              |                             |                  |          |               |                    |
| Risers (Conduit) & Electrical, | 25-Mar-08, Electrical<br>Fire Alarm Rough-In |                              |                             |                  |          |               |                    |
| et Panel Boards and Transforn  | ners<br>ces and Fire Alarm) and              | Trim Out                     |                             |                  |          |               |                    |
| • *                            | 1 ,  |                              |                             | l                |          |               |                    |
|                                |  |                              |                             |                  |          | Todd I        | Povell             |
|                                |  |                              |                             |                  | Technica | al Assignme   | nt #2              |

| 77 K Str | K Street             |   |                             |                               |        |     |     |        |                       | Classic WB | S Layout |      |  | 31-Oct-07 20:07  |   |             |               |  |  |  |  |
|----------|----------------------|---|-----------------------------|-------------------------------|--------|-----|-----|--------|-----------------------|------------|----------|------|--|--|---|-------------|---------------|--|--|--|--|
| Activity | ID                   | Activity Name   | Du Start                    | t Finish                      |        |     |     |        |                       |            |          |      |  |  |   |             |               |  |  |  |  |
|          |                      |   |                             |                               |        | lon | Fab |        | Mov                   | 2007       | Aug Sc   |      | Ant Nev Dee                                      | lan Eab Mar  | 2008  |             | Son Oot       | _  |  |  |  |
|          | A1560                | Install Bus Duct Risers & Major Equipment Terminations  | 4 20-Mar-0                  | 08 25-Mar-08                  | Dv Dec | Jan | Fed | war Ar | or <sub> </sub> iviay | Jun Jui    | Aug Se   | ip U | ict NOV Dec                                      | Jan Feb Mar  | nstall Bus Duct Risers & Major Equipment Terminations   | Jui Aug     | Sep Oct       | <u>.                                    </u> |  |  |  |
| В        | ilding Level         | 3   | 117 17-Oct-0<br>42 31-Dec-0 | 07 27-Mar-08<br>07 26-Feb-08  |        |     |     |        |                       |            |          |      | -  | 26-Feb-08, Interi  | 27-Mar-08, Building Level 3<br>ors  |             |               |  |  |  |  |
|          | A1580                | CMU, Drywall, & Acoustical Ceiling Tile   | 32 31-Dec-0                 | 07 12-Feb-08                  |        |     |     |        |                       |            |          |      |  | CMU, Drywall, & Acousti  | cal Ceiling Tile  |             |               |  |  |  |  |
|          | Mechanical,          | Fire Protection, & Plumbing   | 20 30-Jan-0<br>96 17-Oct-0  | 07 27-Feb-08                  |        |     |     |        |                       |            |          |      | *  | ▼ 27-Feb-08, Mec   | hanical, Fire Protection, & Plumbing  |             |               |  |  |  |  |
|          | A1590<br>A1640       | Install Risers & Mechanical Piping Rough-In and Insulat<br>Set SCU  | 4 17-Oct-0<br>2 15-Nov-0    | 07 22-Oct-07<br>07 16-Nov-07  |        |     |     |        |                       |            |          |      | Install Risers & Mechanical Piping Ro<br>Set SCU | bugh-In and Insulation   |   |             |               |  |  |  |  |
|          | A1610                | Ductwork and Insulation Installation  | 17 26-Dec-0                 | 07 17-Jan-08                  |        |     |     |        |                       |            |          |      | _  | Ductwork and Insulation Installation   |   |             |               |  |  |  |  |
|          | A1600                | Ductwork, Plumbing, & Sprinkler Rough-In<br>Set VAV's and Mechanical Connections to Equipment                 | 17 31-Dec-0<br>3 10-Jan-0   | 07 22-Jan-08                  |        |     |     |        |                       |            |          |      |  | Ductwork, Plumbing, & Sprinkler Rou<br>Set VAV's and Mechanical Connections to | gh-In<br>Equipment  |             |               |  |  |  |  |
|          | A1630                | Trim-Out & Plumbing Fixtures  | 4 22-Feb-0                  | 08 27-Feb-08                  |        |     |     |        |                       |            |          |      |  | Trim-Out & Plun  | bing Fixtures   |             |               |  |  |  |  |
|          | Electrical<br>A1650  | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In  | 57 09-Jan-0<br>13 09-Jan-0  | 08 27-Mar-08<br>08 25-Jan-08  |        |     |     |        |                       |            |          |      |  | Install Risers (Conduit) & Electrical  | 27-Mar-08, Electrical<br>Fire Alarm Rough-In  |             |               |  |  |  |  |
|          | A1660                | Set Panel Boards and Transformers   | 3 30-Jan-0                  | 08 01-Feb-08                  |        |     |     |        |                       |            |          |      |  | Set Panel Boards and Transfor Torminations (De                                 | mers  |             |               |  |  |  |  |
|          | A1670<br>A1680       | I erminations (Devices and Fire Alarm) and Trim Out<br>Install Bus Duct Risers & Major Equipment Terminations | 10 13-Feb-0<br>4 24-Mar-0   | 08 26-Feb-08<br>08 27-Mar-08  |        |     |     |        |                       |            |          |      |  |  | Install Bus Duct Risers & Major Equipment Terminations  |             |               |  |  |  |  |
| В        | ilding Level         | 4   | 111 29-Oct-0                | 07 31-Mar-08                  |        |     |     |        |                       |            |          |      | v  | 28-Feb-08. Inte  | <ul> <li>31-Mar-08, Building Level 4<br/>ribrs</li> </ul>   |             |               |  |  |  |  |
|          | A1700                | CMU, Drywall, & Acoustical Ceiling Tile   | 33 02-Jan-0                 | 08 15-Feb-08                  |        |     |     |        |                       |            |          |      |  | CMU, Drywall, & Acous  | tical Ceiling Tile  |             |               |  |  |  |  |
|          | A1690<br>Mechanical, | Tile, Stone, Bathrooms, & Paint<br>Fire Protection, & Plumbing  | 19 04-Feb-0<br>90 29-Oct-0  | 08 28-Feb-08<br>07 29-Feb-08  |        |     |     |        |                       |            |          |      |  | v 29-Feb-08, Me  | nrooms, & Paint<br>chanical, Fire Protection, & Plumbing  |             |               |  |  |  |  |
|          | A1710                | Install Risers & Mechanical Piping Rough-In and Insulat   | 4 29-Oct-0                  | 07 01-Nov-07                  |        |     |     |        |                       |            |          |      | Install Risers & Mechanical Pipi<br>set SCU      | ing Rough-In and Insulation  |   |             |               |  |  |  |  |
|          | A1760                | Ductwork and Insulation Installation  | 16 04-Jan-0                 | 07 16-1400-07<br>08 25-Jan-08 |        |     |     |        |                       |            |          |      |  | Ductwork and Insulation Installation   |   |             |               |  |  |  |  |
|          | A1720                | Ductwork, Plumbing, & Sprinkler Rough-In  | 16 10-Jan-0                 | 08 31-Jan-08                  |        |     |     |        |                       |            |          |      |  | Ductwork, Plumbing, & Sprinkle   | r Rough-In  |             |               |  |  |  |  |
|          | A1740<br>A1750       | Trim-Out & Plumbing Fixtures  | 3 17-Jan-0<br>4 26-Feb-0    | 08 21-Jan-08<br>08 29-Feb-08  |        |     |     |        |                       |            |          |      |  | Trim-Out & Plu   | mbing Fixtures  |             |               |  |  |  |  |
|          | Electrical           | Install Risers (Conduit) & Electrical Fire Alarm Rough-In   | 57 11-Jan-0                 | 08 31-Mar-08                  |        |     |     |        |                       |            |          |      |  | Install Risers (Conduit) & Electric  | 31-Mar-08, Electrical<br>al, Fire Alarm Rough-In  |             |               |  |  |  |  |
|          | A1780                | Set Panel Boards and Transformers   | 3 04-Feb-0                  | 08 06-Feb-08                  |        |     |     |        |                       |            |          |      |  | Set Panel Boards and Trans   | formers   |             |               |  |  |  |  |
|          | A1790                | Terminations (Devices and Fire Alarm) and Trim Out  | 9 18-Feb-0                  | 08 28-Feb-08                  |        |     |     |        |                       |            |          |      |  | Terminations (E  | evices and Fire Alarm) and Trim Out   |             |               |  |  |  |  |
| В        | ilding Level         | 5   | 105 08-Nov-0                | 07 02-Apr-08                  |        |     |     |        |                       |            |          |      | <b>r</b>   |  | • 02-Apr-08, Building Level 5   |             |               |  |  |  |  |
|          | A1820                | CMU, Drywall, & Acoustical Ceiling Tile   | 44 03-Jan-0<br>35 03-Jan-0  | 08 04-Mar-08<br>08 20-Feb-08  |        |     |     |        |                       |            |          |      |  | CMU, Drywall, & Ac   | pustical Ceiling Tile   |             |               |  |  |  |  |
|          | A1810                | Tile, Stone, Bathrooms, & Paint   | 19 07-Feb-0                 | 08 04-Mar-08                  |        |     |     |        |                       |            |          |      | -  | Tile, Stone, I   | Bathrooms, & Paint  |             |               |  |  |  |  |
|          | A1830                | Install Risers & Mechanical Piping Rough-In and Insulat   | 4 08-Nov-0                  | 07 05-Mar-08<br>07 13-Nov-07  |        |     |     |        |                       |            |          |      | Install Risers & Mechani                         | cal Piping Rough-In and Insulation   |   |             |               |  |  |  |  |
|          | A1880                | Set SCU Ductwork and Insulation Installation  | 2 08-Nov-0                  | 07 09-Nov-07                  |        |     |     |        |                       |            |          |      | Set SCU  | Ductwork and Insulation Installa   | iøn   |             |               |  |  |  |  |
|          | A1840                | Ductwork, Plumbing, & Sprinkler Rough-In  | 14 17-Jan-0                 | 08 05-Feb-08                  |        |     |     |        |                       |            |          |      |  | Ductwork, Plumbing, & Sprin  | ker Rough-In  |             |               |  |  |  |  |
|          | A1860                | Set VAV's and Mechanical Connections to Equipment<br>Trim-Out & Plumbing Extures                              | 3 24-Jan-0<br>4 29-Eeb-0    | 08 28-Jan-08                  |        |     |     |        |                       |            |          |      |  | Set VAV's and Mechanical Conne<br>Trim-Out &                                   | dtions to Equipment Pumbing Fixtures  |             |               |  |  |  |  |
|          | Electrical           |   | 56 16-Jan-0                 | 08 02-Apr-08                  |        |     |     |        |                       |            |          |      |  |  | 02-Apr-08, Electrical   |             |               |  |  |  |  |
|          | A1890<br>A1900       | Set Panel Boards and Transformers   | 14 16-Jan-0<br>3 07-Feb-0   | 08 04-Feb-08<br>08 11-Feb-08  |        |     |     |        |                       |            |          |      |  | Set Panel Boards and Tra   | ansformers  |             |               |  |  |  |  |
|          | A1910                | Terminations (Devices and Fire Alarm) and Trim Out  | 9 21-Feb-0                  | 08 04-Mar-08                  |        |     |     |        |                       |            |          |      |  | Terminations   | Devices and Fire Alarm) and Trim Out  |             |               |  |  |  |  |
| В        | A1920                | Install Bus Duct Risers & Major Equipment Terminations  | 4 28-Mar-0<br>99 20-Nov-0   | 08 02-Apr-08<br>07 04-Apr-08  |        |     |     |        |                       |            |          |      | ·  |  | ▼ 04-Apr-08, Building Level 6   |             |               |  |  |  |  |
|          | A1940                | CMU, Drywall, & Acoustical Ceiling Tile   | 45 04-Jan-0<br>36 04-Jan-0  | 08 06-Mar-08<br>08 22-Feb-08  |        |     |     |        |                       |            |          |      |  | CMU, Drywall, & Av   | Interiors<br>opustical Ceiling Tile   |             |               |  |  |  |  |
|          | A1930                | Tile, Stone, Bathrooms, & Paint   | 18 12-Feb-0                 | 06-Mar-08                     |        |     |     |        |                       |            |          |      |  | Tile, Stone,   | Bathrooms, & Paint  |             |               |  |  |  |  |
|          | A1950                | Install Risers  | 2 20-Nov-0<br>2 20-Nov-0    | 07 11-Mar-08<br>07 21-Nov-07  |        |     |     |        |                       |            |          |      | Install Risers                                   | V I I-Wal-u  |   |             |               |  |  |  |  |
|          | A2000                | Set SCU   | 2 20-Nov-0                  | 07 21-Nov-07                  |        |     |     |        |                       |            |          |      | Set SCU  | Ductwork and Insulation Inst   | allation  |             |               |  |  |  |  |
|          | A1960                | Ductwork, Mechanical, Plumbing, & Sprinkler Rough-In  | 11 24-Jan-0                 | 08 07-Feb-08                  |        |     |     |        |                       |            |          |      |  | Ductwork, Mechanical, Plun   | nbing, & Sprinkler Rough-In   |             |               |  |  |  |  |
|          | A1980                | Set VAV's and Mechanical Connections to Equipment   | 3 31-Jan-0                  | 08 04-Feb-08                  |        |     |     |        |                       |            |          |      |  | Set VAV's and Mechanical Co  | nnections to Equipment<br>& Plumbing Fixtures   |             |               |  |  |  |  |
|          | Electrical           |   | 55 21-Jan-0                 | 08 04-Apr-08                  |        |     |     |        |                       |            |          |      |  | · · · · · · · · · · · · · · · · · · ·  | 04-Apr-08, Electrical   |             |               |  |  |  |  |
|          | A2010<br>A2020       | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In<br>Set Panel Boards and Transformers               | 14 21-Jan-0<br>3 12-Feb-0   | 08 07-Feb-08<br>08 14-Feb-08  |        |     |     |        |                       |            |          |      |  | Install Risers (Conduit) & El  | ectrical, Fire Alarm Rough-In<br>ransformers  |             |               |  |  |  |  |
|          | A2030                | Terminations (Devices and Fire Alarm) and Trim Out  | 9 25-Feb-0                  | 08 06-Mar-08                  |        |     |     |        |                       |            |          |      |  | Termination  | s (Devices and Fire Alarm) and Trim Out   |             |               |  |  |  |  |
| В        | A2040                | Install Bus Duct Risers & Major Equipment Terminations  | 4 01-Apr-0                  | 08 04-Apr-08<br>07 08-Apr-08  |        |     |     |        |                       |            |          |      |  |  | <ul> <li>Install Bus Duct Risers &amp; Major Equipment Terminations</li> <li>08-Apr-08, Building Level 7</li> </ul> | 5           |               |  |  |  |  |
|          | A2060                | CMU, Drywall, & Acoustical Ceiling Tile   | 46 07-Jan-0<br>37 07-Jan-0  | 08 10-Mar-08                  |        |     |     |        |                       |            |          |      |  | T0-Mar-0<br>CMU, Drywall, &  | 8 Interiors<br>Acoustical Ceiling Tile  |             |               |  |  |  |  |
|          | A2050                | Tile, Stone, Bathrooms, & Paint   | 17 15-Feb-0                 | 08 10-Mar-08                  |        |     |     |        |                       |            |          |      |  | Tile, Stor   | e, Bathrooms, & Paint   |             |               |  |  |  |  |
|          | Mechanical,<br>A2070 | Fire Protection, & Plumbing<br>Install Risers   | 71 04-Dec-0<br>2 04-Dec-0   | 07 11-Mar-08<br>07 05-Dec-07  |        |     |     |        |                       |            |          |      | Install Riser                                    | rs 11-Mar-0  | 8, Mechanical, Fire Protection, & Plumbing  |             |               |  |  |  |  |
|          | A2120                | Set SCU   | 2 04-Dec-0                  | 07 05-Dec-07                  |        |     |     |        |                       |            |          |      | Set SCU  | Ductwork and Inculation  | Installation  |             |               |  |  |  |  |
|          | A2090<br>A2080       | Ductwork and Insulation Installation<br>Ductwork, Mechanical, Plumbing, & Sprinkler Rough-In                  | 19 17-Jan-0<br>8 31-Jan-0   | 08 12-Feb-08<br>08 11-Feb-08  |        |     |     |        |                       |            |          |      |  | Ductwork, Mechanical, Pl   | umbing, & Sprinkler Rough-In  |             |               |  |  |  |  |
|          | A2100                | Set VAV's and Mechanical Connections to Equipment   | 3 07-Feb-0                  | 08 11-Feb-08                  |        |     |     |        |                       |            |          |      |  | Set VAV's and Mechanica  | Connections to Equipment  |             |               |  |  |  |  |
|          | A2110<br>Electrical  | Trim-Out & Plumbing Fixtures  | 4 06-Mar-0<br>54 24-Jan-0   | 08 11-Mar-08<br>08 08-Apr-08  |        |     |     |        |                       |            |          |      |  | Tim-Ou   | • 08-Apr-08, Electrical   |             |               |  |  |  |  |
|          | A2130                | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In  | 14 24-Jan-0                 | 08 12-Feb-08                  |        |     |     |        |                       |            |          |      |  | Install Risers (Conduit) &   | Electrical, Fire Alarm Rough-In   |             |               |  |  |  |  |
|          | A2140                | Terminations (Devices and Fire Alarm) and Trim Out  | 9 27-Feb-0                  | 08 10-Mar-08                  |        |     |     |        |                       |            |          |      |  | Terminat   | dns (Devices and Fire Alarm) and Trim Out   |             |               |  |  |  |  |
|          | A2160                | Install Bus Duct Risers & Major Equipment Terminations  | 4 03-Apr-0                  | 08 08-Apr-08                  |        |     |     |        |                       |            |          |      |  |  | Install Bus Duct Risers & Major Equipment Termination   | ons         |               |  |  |  |  |
|          | Interiors            |   | 47 08-Jan-0                 | 08 12-Mar-08                  |        |     |     |        |                       |            |          |      | •  | 12-Mar-  | 08, Interiors   |             |               |  |  |  |  |
|          | A2180<br>A2170       | Tile, Stone, Bathrooms, & Paint   | 38 U8-Jan-0<br>16 20-Feb-0  | 00 ∠8-Feb-08<br>08 12-Mar-08  |        |     |     |        |                       |            |          |      |  | Tile, Sto  | ne, Bathrooms, & Paint  |             |               |  |  |  |  |
|          | Mechanical,          | Fire Protection, & Plumbing   | 61 20-Dec-0                 | 07 13-Mar-08                  |        |     |     |        |                       |            |          |      | ■ Ins  | ▼ 13-Mar<br>stall Risers   | 08, Mechanical, Fire Protection, & Plumbing   |             |               |  |  |  |  |
|          | A2240                | Set SCU   | 2 20-Dec-0                  | 07 21-Dec-07                  |        |     |     |        |                       |            |          |      | ∎ Se   | et SCU   |   |             |               |  |  |  |  |
|          | A2210                | Ductwork and Insulation Installation  | 21 22-Jan-0                 | 08 19-Feb-08                  |        |     |     |        |                       |            |          |      |  | Ductwork and Insula  | ion Installation  |             |               |  |  |  |  |
|          | <b>_</b> ^           |   | Demolat                     | N/a.rl                        |        |     |     |        |                       | Page 2     | of 4     |      |  |  |   |             | Todd Povell   | -  |  |  |  |
|          | Ac                   | tual work Critical F  | kemaining V                 | VOIK                          | Summar | у   |     |        |                       | 1 490 2    |          |      |  |  |   |             | 100010000     |  |  |  |  |
|          | Re                   | maining Work   Mileston   | е                           |                               |        |     |     |        |                       |            |          |      |  |  |   | Technical A | Assignment #2 |  |  |  |  |

| 77 K Str | eet                  |  |                        |                                      |          |     |        |        | C       | lassic WBS Layo | out    |        |                | 31-Oct-07 20:07   |
|----------|----------------------|--|------------------------|--------------------------------------|----------|-----|--------|--------|---------|-----------------|--------|--------|----------------|---|
| Activity | חו                   | Activity Name  | Du St                  | art Finish                           |          |     |        |        |         |                 |        |        |                |   |
| Activity |                      |  | Du 50                  |                                      |          |     |        |        |         | 2007            |        |        |                | 2008  |
|          |                      | -  |                        |                                      | ov Dec   | Jan | Feb Ma | ır Apr | May Jun | Jul A           | Aug Se | ep Oct | Nov Dec        | Jan Feb Mar Apr May Jun Jul Aug Sep Oct   |
|          | A2200<br>A2220       | Ductwork, Mechanical, Plumbing, & Sprinkler Rough-In<br>Set VAV's and Mechanical Connections to Equipment    | 10 05-Fe<br>3 14-Fe    | eb-08 18-Feb-08<br>eb-08 18-Feb-08   | 1        |     |        |        |         |                 |        |        |                | Doctwork, mechanical running, s Spiniker Kouginin     Set VAVs and Mechanical Connections to Equipment  |
|          | A2230                | Trim-Out & Plumbing Fixtures   | 4 10-M                 | far-08 13-Mar-08                     | 1        |     |        |        |         |                 |        |        |                | Trim-Out & Plumbing Fixtures  |
|          | A2250                | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In   | 53 29-Ja<br>n 15 29-Ja | an-08 10-Apr-08<br>an-08 18-Feb-08   |          |     |        |        |         |                 |        |        |                | Install Risers (Condut) & Electrical, if each Alarm Rough-In  |
|          | A2260                | Set Panel Boards and Transformers  | 3 20-Fe                | eb-08 22-Feb-08                      | 1        |     |        |        |         |                 |        |        |                | Set Panel Boards and Transformers   |
|          | A2270<br>A2280       | Terminations (Devices and Fire Alarm) and Trim Out<br>Install Bus Duct Risers & Major Equipment Terminations | 9 29-Fe<br>3 4 07-A    | eb-08 12-Mar-08<br>0r-08 10-Apr-08   |          |     |        |        |         |                 |        |        |                | errimitations (Devices and Fire Auarm) and Trim Out   |
| Bu       | ilding Level         | 9  | 66 14-Ja               | an-08 14-Apr-08                      |          |     |        |        |         |                 |        |        |                | v 14-Apr-08, Building Level 9   |
|          | A2300                | CMU, Drywall, & Acoustical Ceiling Tile  | 46 14-Ja<br>37 14-Ja   | an-08 17-Mar-08<br>an-08 04-Mar-08   |          |     |        |        |         |                 |        |        |                | CMU brywall & Acoustical Celling Tile   |
|          | A2290                | Tile, Stone, Bathrooms, & Paint  | 16 25-Fe               | eb-08 17-Mar-08                      |          |     |        |        |         |                 |        |        |                | Tele, Stone, Bathrooms, & Paint   |
|          | A2310                | Fire Protection, & Plumbing<br>Install Risers  | 47 14-Ja<br>2 14-Ja    | an-08 18-Mar-08<br>an-08 15-Jan-08   |          |     |        |        |         |                 |        |        |                | Install Risers  |
|          | A2360                | Set SCU  | 2 14-Ja                | an-08 15-Jan-08                      |          |     |        |        |         |                 |        |        |                | D Set SCU   |
|          | A2330<br>A2320       | Ductwork and Insulation Installation Ductwork Mechanical Plumbing & Sprinkler Rough-In                       | 23 25-Ja<br>10 08-Fe   | an-08 26-Feb-08                      | <u>.</u> |     |        |        |         |                 |        |        |                | Ductwork and inselation installation Ductwork Mechanical Plumbing, & Sprinkler Rough-In   |
|          | A2340                | Set VAV's and Mechanical Connections to Equipment  | 3 21-Fe                | eb-08 25-Feb-08                      |          |     |        |        |         |                 |        |        |                | Set VAV's and Mechanical Connections to Equipment   |
|          | A2350                | Trim-Out & Plumbing Fixtures   | 4 13-M                 | 18-Mar-08                            |          |     |        |        |         |                 |        |        |                | Trim-Out & Plumbing Fixtures  |
|          | A2370                | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In   | 17 01-Fe               | eb-08 25-Feb-08                      |          |     |        |        |         |                 |        |        |                | Install Risers (ConBuil) & Electrical, Frie Alarm Rough-In  |
|          | A2380                | Set Panel Boards and Transformers  | 3 25-Fe                | eb-08 27-Feb-08                      | i        |     |        |        |         |                 |        |        |                | Set Panel Boards and Transformers Target information (During on participation) and Trian Out  |
|          | A2390<br>A2400       | Terminations (Devices and Fire Alarm) and Trim Out<br>Install Bus Duct Risers & Maior Equipment Terminations | 9 05-M<br>s 4 09-A     | Mar-08 17-Mar-08                     |          |     |        |        |         |                 |        |        |                | Install bus Duck Risers & Major Equipment Terminations  |
| Bu       | ilding Level         | 10   | 68 14-Ja               | an-08 16-Apr-08                      |          |     |        |        |         |                 |        |        |                | 16-Apr-08, Building Level 10  |
|          | A2420                | CMU, Drywall, & Acoustical Ceiling Tile  | 48 15-Ja<br>39 15-Ja   | an-08 20-Mar-08<br>an-08 07-Mar-08   |          |     |        |        |         |                 |        |        |                | 20-Mar-Us, Interiors<br>CMU, Drywąli, & Acoustical Ceiling Tile   |
|          | A2410                | Tile, Stone, Bathrooms, & Paint  | 16 28-Fe               | eb-08 20-Mar-08                      | 1        |     |        |        |         |                 |        |        |                | Tile, Stone, Bathrooms, & Paint   |
|          | Mechanical,<br>A2480 | Fire Protection, & Plumbing<br>Set SCU   | 50 14-Ja<br>2 14-Ja    | an-08 21-Mar-08<br>an-08 15-Jan-08   |          |     |        |        |         |                 |        |        |                | Set SCU     Set SCU   |
|          | A2430                | Install Risers   | 2 16-Ja                | an-08 17-Jan-08                      |          |     |        |        |         |                 |        |        |                | g Install Risers  |
|          | A2450                | Ductwork and Insulation Installation   | 25 30-Ja               | an-08 04-Mar-08                      |          |     |        |        |         |                 |        |        |                | Ductwork and insulation installation  |
|          | A2460                | Set VAV's and Mechanical Connections to Equipment  | 3 28-Fe                | eb-08 03-Mar-08                      | -<br>-   |     |        |        |         |                 |        |        |                | Set VAV's and Mechanical Connections to Equipment   |
|          | A2470                | Trim-Out & Plumbing Fixtures   | 4 18-M                 | far-08 21-Mar-08                     |          |     |        |        |         |                 |        |        |                | Trim-Out & Plumbing Fixtures  |
|          | A2490                | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In   | 51 06-Fe<br>n 19 06-Fe | eb-08 16-Apr-08<br>eb-08 03-Mar-08   |          |     |        |        |         |                 |        |        |                | Install Risers (Conduit) & Electrical Fire Alarm Rough-In   |
|          | A2500                | Set Panel Boards and Transformers  | 3 28-Fe                | eb-08 03-Mar-08                      | i .      |     |        |        |         |                 |        |        |                | Set Panel Boards and Transformers   |
|          | A2510<br>A2520       | Terminations (Devices and Fire Alarm) and Trim Out<br>Install Bus Duct Risers & Major Equipment Terminations | 9 10-M                 | Mar-08 20-Mar-08                     |          |     |        |        |         |                 |        |        |                | Install Bus Duck Rises & Major Equipment Terminations   |
| Bu       | ilding Level         | 11   | 68 16-Ja               | an-08 18-Apr-08                      |          |     |        |        |         |                 |        |        |                | 18-Apr-08, Building Level 11  |
|          | A2540                | CMU, Drywall, & Acoustical Ceiling Tile  | 50 16-Ja<br>41 16-Ja   | an-08 25-Mar-08<br>an-08 12-Mar-08   |          |     |        |        |         |                 |        |        |                | CMU, Drywar-06, mientus<br>CMU, Drywar-06, mientus<br>CMU, Drywar-06, mientus   |
|          | A2530                | Tile, Stone, Bathrooms, & Paint  | 16 04-M                | lar-08 25-Mar-08                     |          |     |        |        |         |                 |        |        |                | Tile, Stone, Bathrooms, & Paint   |
|          | A2600                | Fire Protection, & Plumbing<br>Set SCU   | 51 16-Ja<br>2 16-Ja    | an-08 26-Mar-08<br>an-08 17-Jan-08   |          |     |        |        |         |                 |        |        |                | i Set SCU   |
|          | A2550                | Install Risers   | 2 18-Ja                | an-08 21-Jan-08                      |          |     |        |        |         |                 |        |        |                | Install Risers  |
|          | A2570                | Ductwork and Insulation Installation Ductwork Mechanical Plumbing & Sprinkler Rough-In                       | 27 04-Fe               | eb-08 11-Mar-08                      | 1        |     |        |        |         |                 |        |        |                | Ductwork jand Insulation Installation Ductwork Machanical, Plumbing, & Sprinkler Rough-In Ductwork, Michanical, Plumbing, & Sprinkler Rough-In  |
|          | A2580                | Set VAV's and Mechanical Connections to Equipment  | 3 06-M                 | far-08 10-Mar-08                     | -<br>-   |     |        |        |         |                 |        |        |                | Set VAVs and Mechanical Connections to Equipment  |
|          | A2590                | Trim-Out & Plumbing Fixtures   | 4 21-M                 | lar-08 26-Mar-08                     |          |     |        |        |         |                 |        |        |                | Tim-Out & Plumbing Fixtures   |
|          | A2610                | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In   | 11-Fe                  | eb-08 18-Apr-08                      |          |     |        |        |         |                 |        |        |                | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In  |
|          | A2620                | Set Panel Boards and Transformers  | 3 04-M                 | Mar-08 06-Mar-08                     |          |     |        |        |         |                 |        |        |                | Set Panel Bdards and Transformers   |
|          | A2630<br>A2640       | Install Bus Duct Risers & Major Equipment Terminations   | 9 13-M                 | Apr-08 25-Mar-08                     |          |     |        |        |         |                 |        |        |                | install Bus Duct Research and Company and Comp  |
| Pe       | nthouse              |  | 86 14-Ja               | an-08 12-May-08                      | 3        |     |        |        |         |                 |        |        |                | 12-May-08, Penthouse  |
|          | A2660                | Drywall & Acoustical Ceiling Tile  | 38 17-M                | ar-08 09-May-08<br>Mar-08 07-May-08  |          |     |        |        |         |                 |        |        |                | Drymal & Acoustical Ceiling Tile  |
|          | A2650                | Paint  | 2 08-M                 | lay-08 09-May-08                     | 3        |     |        |        |         |                 |        |        |                | Paint     P |
|          | A2720                | Set Cooling Towers & Major Mechanical Equipment  | 5 14-Ja                | an-08 18-Jan-08                      |          |     |        |        |         |                 |        |        |                | Set Cooling Towers & Major Mechanical Equipment   |
|          | A2680                | Ductwork, Mechanical, Plumbing, & Sprinkler Rough-In   | 65 21-Ja               | an-08 18-Apr-08                      |          |     |        |        |         |                 |        |        |                | n Install Risers  |
|          | A2690                | Ductwork and Insulation Installation   | 2 22-Ja<br>58 07-Fe    | eb-08 28-Apr-08                      |          |     |        |        |         |                 |        |        |                | Ductwork and Insulation Installation  |
|          | A2700                | Set Fans & Louvers and Mechanical Connections to Eq  | 5 31-M                 | Mar-08 04-Apr-08                     |          |     |        |        |         |                 |        |        |                | Set Fans & Louvers and Mechanical Connections to Equipment  |
|          | A2710                | Trim-Out & Connect Roof Drains   | 16 21-Aj<br>38 20-M    | Apr-08 12-May-08<br>Mar-08 12-May-08 |          |     |        |        |         |                 |        |        |                | 12-Mo-08. Electrical  |
|          | A2740                | Set MCC, Panel Boards, &Transformers   | 10 20-M                | Mar-08 02-Apr-08                     |          |     |        |        |         |                 |        |        |                | Set MCC, Panel Boards, &Transformers  |
|          | A2730<br>A2760       | Install Risers (Conduit) & Electrical, Fire Alarm Rough-In<br>Major Equipment Terminations                   | 14 26-M                | Mar-08 14-Apr-08                     |          |     |        |        |         |                 |        |        |                | Instail Risers (Conour) & Execution, Fire Ajam Rough-in   |
|          | A2750                | Terminations (Devices and Fire Alarm) and Trim Out   | 3 08-M                 | lay-08 12-May-08                     | 3        |     |        |        |         |                 |        |        |                | Terminations (Devices and Fire Alarm) and Trim Out  |
| Bu       | ilding               | Level 1 (Lobby)  | 133 28-D               | 01-Jul-08                            |          |     |        |        |         |                 |        |        | 7              | 01-Jul-08, Building Level 1 (Lobby)   |
| Lo       | bby                  |  | 133 28-D               | 0ec-07 01-Jul-08                     |          |     |        |        |         |                 |        |        | 3              | 01-Jul-08, Lobby  |
|          | A2780                | Drywall & Acoustical Ceiling Tile  | 101 28-D               | Dec-07 16-May-08                     | 3        |     |        |        |         |                 |        |        |                | Drywall & Acoustical Celling The  |
|          | A2770                | Stone, Ornamental Metals, Millwork, Handrails, Floorin   | . 62 02-A              | Apr-08 26-Jun-08                     |          |     |        |        |         |                 |        |        |                | \$tone, Ornamental Metals, Millwork, Handrails, Flooring, & Paint   |
|          | A2790                | Mechanical & Sprinkler Rough-In  | 78 14-M<br>5 14-M      | nar-08 01-Jul-08<br>Mar-08 20-Mar-08 |          |     |        |        |         |                 |        |        |                | Mechanical & Sprinkler Rough-In   |
|          | A2800                | HVAC Trim-Out  | 3 27-Ju                | un-08 01-Jul-08                      |          |     |        |        |         |                 |        |        |                | HVAC Trim-Out   |
|          | A2810                | Electrical Wall Rough-In   | 123 11-Ja<br>3 11-Ja   | an-08 01-Jul-08<br>an-08 15-Jan-08   |          |     |        |        |         |                 |        |        |                | Electrical Wall Rough-In  |
|          | A2820                | Electrical Ceiling Rough-In  | 3 14-M                 | Mar-08 18-Mar-08                     |          |     |        |        |         |                 |        |        |                | Electrical Ceiling Rough-In   |
|          | A2830                |  | 3 27-Ju<br>194 13-Se   | un-08 01-Jul-08<br>ep-07 10-Jun-08   |          |     |        |        |         |                 | -      |        |                | 10-Jun-08, Sitework   |
| SI       |                      | Site Hillition   | 25 42 0                | on 07 21 Oct 07                      |          |     |        |        |         |                 |        |        | Site Utilities |   |
| A2<br>A2 | 850                  | Streetlights   | 35 13-Se<br>7 10-M     | Mar-08 18-Mar-08                     |          |     |        |        |         |                 | _      |        |                | Streetlights  |
| A2       | 860                  | Site Concrete and Landscaping  | 46 08-Aj               | pr-08 10-Jun-08                      |          |     |        |        |         |                 |        |        |                | Site Concrete and Landscaping   |
|          | Ac                   | tual Work Critical   | Remaining              | a Work                               |          | irv |        |        |         | Page 3 of 4     |        |        |                | Todd Povell   |
|          |                      |  |                        | J                                    | , canina | ,   |        |        |         |                 |        |        |                |   |
|          | _ ке                 |  |                        |                                      |          |     |        |        |         |                 |        |        |                | Technical Assignment #2   |
| L        |                      |  |                        |                                      |          |     |        |        |         |                 |        |        |                |   |

| 77 K Street | 7 K Street                            |    |           |           |      |     |     |     | Classic WBS Layout |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-------------|---------------------------------------|----|-----------|-----------|------|-----|-----|-----|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Activity ID | Activity Name                         | Du | Start     | Finish    |      |     |     |     |                    |     |     |     |     |     |     |     |     |     |     |     |     |  |
|             |                                       |    |           |           |      |     |     |     |                    |     |     | 2   | 007 |     |     |     |     |     |     |     |     |  |
|             |                                       |    |           |           | ov 🛛 | Dec | Jan | Feb | Mar                | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar |  |
| Inspecti    | ons and Close-Out                     | 83 | 27-May-08 | 18-Sep-08 |      |     |     |     |                    |     |     |     |     |     |     |     |     |     |     |     |     |  |
| A2870       | As-Builts, O&M's, Warranties          | 20 | 27-May-08 | 23-Jun-08 |      |     |     |     |                    |     |     |     |     |     |     |     |     |     |     |     |     |  |
| A2900       | System Training and MEP Commissioning | 31 | 01-Jul-08 | 12-Aug-08 |      |     |     |     |                    |     |     |     |     |     |     |     |     |     |     |     |     |  |
| A2880       | Final Inspections                     | 11 | 02-Jul-08 | 16-Jul-08 |      |     |     |     |                    |     |     |     |     |     |     |     |     |     |     |     |     |  |
| A2890       | Substantial Completion                | 0  |           | 17-Jul-08 |      |     |     |     |                    |     |     |     |     |     |     |     |     |     |     |     |     |  |
| A2910       | Punchlist                             | 45 | 18-Jul-08 | 18-Sep-08 |      |     |     |     |                    |     |     |     |     |     |     |     |     |     |     |     |     |  |
| A2920       | Final Completion                      | 0  |           | 18-Sep-08 |      |     |     |     |                    |     |     |     |     |     |     |     |     |     |     |     |     |  |

| Actual Work    |   | Critical Remaining Work |  |
|----------------|---|-------------------------|--|
| Remaining Work | • | ♦ Milestone             |  |

| 31-Oct-07 20:07 |
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|     |     | 2008 |     |                    |                        |                 |                      |
|-----|-----|------|-----|--------------------|------------------------|-----------------|----------------------|
| Apr | May | 2000 | Jun | Jul                | Aug                    | Sep             | Oct                  |
|     |     |      | As  | s-Builts, O&M's, ' | Warranties<br>System T | Taining and MEF | ep-08, Inspectior    |
|     |     |      |     | ♦ Subs             | stantial Completion    | Pun<br>♦ Fina   | chlist<br>Completion |
|     |     |      |     |                    |                        |                 |                      |
|     |     |      |     |                    |                        |                 |                      |
|     |     |      |     |                    |                        |                 |                      |
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|     |     |      |     |                    |                        |                 |                      |
|     |     |      |     |                    |                        |                 |                      |

Todd Povell

Technical Assignment #2

77 K STREET ACTIVITY GRID





#### Site Layout Plan

A site layout was developed for the concrete sequence of the project, which extends from April through December 2007. Concrete trucks will enter the site from K Street at the northwestern corner of the site or from the single entrance on 1<sup>st</sup> street. Their entrance location will depend on which tower crane they will be supplying concrete to.

Also of note, the layout plan has lay down areas for structural steel rebar and formwork awaiting placement within the building. One critical feature of the site plan is the placement of the southern tower crane. The crane's placement intentionally just allowed the crane to reach the southwestern corner of the rear courtyard. At this location, the crane will make a critical precast concrete pick during the façade sequence of the project.

Included on the plan are the locations of Davis' trailer and spaces for subcontractor trailers. During this sequence, Miller & Long, the concrete subcontractor, will occupy one of the two remaining trailer locations. Port-O-Johns and dumpsters are also provided on the site plan. Both can be serviced via the 1<sup>st</sup> Street entrance.

Additionally, pedestrian safety is of paramount importance so pedestrian walkways have been added to protect from vehicular traffic and site equipment. Additionally, site traffic cannot exit directly at the intersection of 1<sup>st</sup> and K Street as this would be a danger to pedestrians and other vehicles alike.

The site plan developed by Davis Construction is not only appropriate but highly effective as well. It best utilizes the limited space available in an efficient, safe manner.



SENIOR THESIS

SCALE: NTS

Structural Concrete Sequence

Technical Assignment #2

November 2, 2007



Todd Povell | Construction Management | Consultant: Dr. John Messner

#### **Roofing Assemblies Estimate**

The roofing system of the 77 K Street project is comprised of a hot fluid-applied roofing membrane directly above the concrete slab. Type VI rigid polystyrene insulation is placed above the roofing membrane. Finally, either a size 4 aggregate ballast ranging in size from 3/4" to 1-1/2" or two foot square roof pavers are placed above.

R.S. Means was used to perform the estimate. Because the Assemblies Cost Data guide did not contain an exact match to the roofing system used in this building, an assembly was created using detailed cost data for each item in the typical and terrace roofing systems. R.S. Means did contain the flashing detail used so the assembly data could be used for that item. A location factor of 0.981 was used based on R.S. Means' division 7 data.

In order to simplify the assembly estimate, an assumption was made that the slopes of the rigid insulation could be considered trivial. Additionally, Means did not contain cost data for 215 millimeter thick fluid-applied membrane. As a result an estimated square foot cost was extrapolated from thicknesses that were contained in the manual.

Of note, the actual cost of the roofing contract was approximately \$356,000. The estimate that was developed produced a value of roughly \$375,800 differing by less than \$20,000, or 5.5% from the actual construction cost.

|             |        |                                |          |      |            |           |            | 20       | 07 R.S. Me | ans Cost D | ata             |               |                      |                                |
|-------------|--------|--------------------------------|----------|------|------------|-----------|------------|----------|------------|------------|-----------------|---------------|----------------------|--------------------------------|
|             |        |                                | Quantity | Unit | Mat        | erial     | Lal        | oor      | Equip      | ment       | TO              | TAL           | TOTAL, I             | NCL. O&P                       |
|             |        |                                |          |      | Nat'l Cost | 77K       | Nat'l Cost | 77K      | Nat'l Cost | 77K        | Nat'l Cost      | 77K           | Nat'l Cost           | 77K                            |
|             | Typica | al Roof Assembly               |          |      |            |           |            |          |            |            |                 |               |                      |                                |
| 07 56 10 10 | 120    | Fluid Applied Asphalt 215 r    | nils     | SE   | \$4.56     |           | \$1.49     |          | \$0.20     |            | \$6.25          |               | \$7.75               |                                |
| 07 22 16.10 | 1956   | Rigid Insulation, 4" thick, 40 | ) psi    | SE   | \$1.88     |           | \$0.26     |          | \$0.00     |            | \$2.14          |               | \$2.52               |                                |
|             |        | Ballast, 15 lb/SF              |          | SF   | \$0.25     |           | \$0.50     |          | \$0.00     |            | \$0.75          |               | \$0.90               |                                |
|             |        | TOTAL ASSEMBLY                 | 26850    | SF   | \$6.69     | \$179,546 | \$2.25     | \$60,359 | \$0.20     | \$5,410    | \$9.14          | \$245,315     | \$11.13              | \$298,843                      |
|             | Roof 1 | Ferrace Assembly               |          |      |            |           |            |          |            |            |                 |               |                      |                                |
| 07 56 10.10 | 120    | Fluid Applied Asphalt, 215 r   | nils.    | SF   | \$3.09     |           | \$1.01     |          | \$0.25     |            | \$4.35          |               | \$5.22               |                                |
| 07 22 16.10 | 1956   | Rigid Insulation, 4" thick, 40 | ) psi    | SF   | \$1.88     |           | \$0.26     |          | \$0.00     |            | \$2.14          |               | \$2.21               |                                |
| 07 51 13.50 | 300    | Roof Paver, 2' x 2'            |          | SF   | \$1.55     |           | \$2.10     |          | \$0.00     |            | \$3.65          |               | \$4.92               |                                |
|             |        | TOTAL ASSEMBLY                 | 4375     | SF   | \$6.52     | \$28,512  | \$3.37     | \$14,735 | \$0.25     | \$1,109    | \$10.14         | \$44,356      | \$12.35              | \$54,031                       |
|             | Base F | Flashing Assembly              |          |      |            |           |            |          |            |            |                 |               |                      |                                |
| B3010 410   | 2700   | 4000 psi concrete              | 1141     | LF   | \$8.08     | \$9,219   | \$13.09    | \$14,936 | \$0.00     | \$0        | \$21.17         | \$24,155      | \$26.46              | \$30,194                       |
|             |        |                                |          |      |            |           |            |          |            |            | Wasington<br>TO | i, D.C. Locat | Total<br>tion Factor | \$383,065<br>0.981<br>\$375,78 |



Todd Povell | Construction Management | Consultant: Dr. John Messner

#### Detailed Structural Systems Estimate

77 K Street utilizes a cast in place concrete structural system. The foundation is a 4'-0" thick, 4,000 psi concrete mat foundation resting on a 4" mud mat. Below grade parking levels are 9" reinforced concrete flat slabs with 5-1/2" drop panels at select column locations. Floors above grade are 10" or 11" post-tensioned two-way slabs with 4-1/4" drop panels at all columns and around the slab perimeter. The upper roof of the mechanical penthouse is framed using a combination of concrete and hollow structural steel members with a 8" one-way slab roof. Typical columns have a compressive strength of 5,000 psi with select columns having increased capacity up to 10,000 psi. Slab concrete capacities range from 3,000 psi at the lowest garage level to 5,000 psi for above grade slabs. Concrete is placed using two tower cranes, both staged within the footprint of the building.

The estimating process began by breaking down the column schedule provided in the construction documents into concrete compressive strengths. Based on column size and strength, an estimate for the amount of 5000, 6000, 8000, and 10000 psi concrete was created. Using the R.S. Means rebar guides, an estimate for the amount of reinforcing steel was calculated. Additionally, a calculation for the surface area of formwork was developed.

Slab calculations were based off of a system estimate that included reinforcing steel, concrete, and formwork and an additional value was added for the post tensioning cable found on floors two through the roof. Foundations and shear wall estimates were calculated in a manner similar to that of the slabs and columns.

Adjustments were made to account for the locale of the project. Washington, D.C. time multipliers for division 3 cost data were as follows:

| Divisi                      | ion 3: Concrete  | 1      |        |  |  |  |  |  |  |  |  |  |  |
|-----------------------------|------------------|--------|--------|--|--|--|--|--|--|--|--|--|--|
| Washington                  | n, DC Location F | actors |        |  |  |  |  |  |  |  |  |  |  |
| Madavial Installation Total |                  |        |        |  |  |  |  |  |  |  |  |  |  |
| Material Installation Total |                  |        |        |  |  |  |  |  |  |  |  |  |  |
| Forming & Accessories       | 99.5%            | 82.3%  | 84.7%  |  |  |  |  |  |  |  |  |  |  |
| Steel Reinforcement         | 102.1%           | 90.2%  | 96.4%  |  |  |  |  |  |  |  |  |  |  |
| Cast-In-Place Concrete      | 125.5%           | 88.0%  | 111.6% |  |  |  |  |  |  |  |  |  |  |
| OVERALL                     | 118.4%           | 87.0%  | 103.9% |  |  |  |  |  |  |  |  |  |  |

Data was taken from the 2008 R.S. Means Construction Data manual which contains costs based on projects from 2007 and the latter part of 2006. Because the project was bid in this time frame, no time factor was required.

Assumptions were made in order to simplify the detailed estimate. For example, systems estimates as mentioned above were used when available rather than item by item (formwork, concrete, rebar, etc.) estimates. Slab thicknesses were considered uniform throughout each floor though there were areas with thicker or thinner slab depths. An overall average was utilized and considered uniform throughout. Waste factors were considered and are included in the take-offs. Crane usage was included in the equipment subcategory of the concrete placement estimates.



Washington, DC

Todd Povell | Construction Management | Consultant: Dr. John Messner

The estimate predicted a cost of \$13.75 million or \$30.64 per square foot. The actual cost was closer to \$11.25 million. There are a few reasons for this large disparity. For one, the concrete contractor is an extremely large specialty contractor. In fact, Miller & Long for the third consecutive year has been named the #1 Concrete Contractor in the United States by Engineering News Record magazine based upon annual revenue. R.S. Means bases its data on the average of many projects. Miller & Long is above the average. Few concrete contractors own their own fleet of tower cranes but Miller & Long does. This is a very large cost savings. Additionally, because they are so large and they admittedly bid low on this project in order to win the project, their overhead and profit is likely far below what R.S. Means estimates. The R.S. Means estimate based solely on cost and not overhead and profit yielded a result of \$10.15 million. It is likely that the savings resulting from the tower crane in combination with their low profit margin, accounts for the \$2.5 million difference between actual and estimated costs.

|             |  |          |      |            |          |             | STRUCTU    | RAL DETAIL | ED ESTIMAT  | E          |                |             |                     |               |              |             |               |              |
|-------------|--|----------|------|------------|----------|-------------|------------|------------|-------------|------------|----------------|-------------|---------------------|---------------|--------------|-------------|---------------|--------------|
|             |  |          |      |            |          |             |            |            |             | 2008       | R.S. Means Cos | t Data      |                     |               |              |             |               |              |
|             |  | Quantity | Unit |            | Material |             |            | Labor      |             |            | Equipment      |             |                     | TOTAL         |              | TOTAL, INCL | UDING OVERHI  | EAD & PROFIT |
|             |  |          |      | Nat'l Avg. | D.C. Avg | 77 K Street | Nat'l Avg. | D.C. Avg   | 77 K Street | Nat'l Avg. | D.C. Avg       | 77 K Street | Nat'l Avg.          | D.C. Avg      | 77 K Street  | Nat'l Avg.  | D.C. Avg      | 77 K Street  |
|             | Foundation (Includes F/R/P, concrete, and finish | ing)     |      |            |          |             |            |            |             |            |                |             |                     |               |              |             |               |              |
| 03 30 53.40 | 4650 Mud Mat, 4" thick                           | 423      | CY   | \$122.00   | \$144.45 | \$61,102    | \$55.00    | \$47.85    | \$20,241    | \$0.41     | \$0.43         | \$180       | \$177.41            | \$192.72      | \$81,519     | \$221.00    | \$229.62      | \$97,129     |
| 03 30 53.40 | 4050 Foundation Mat, over 20 CY                  | 5072     | CY   | \$173.00   | \$204.83 | \$1,038,908 | \$72.50    | \$63.08    | \$319,916   | \$0.44     | \$0.46         | \$2,319     | \$245.94            | \$268.36      | \$1,359,070  | \$305.00    | \$316.90      | \$1,607,291  |
|             | Existing Building Abutment Foundation            |          |      |            |          |             |            |            |             |            |                |             |                     |               |              |             |               |              |
| 03 31 05 35 | 150 3000 nsi concrete                            | 609      | CY   | \$100.00   | \$125 50 | \$76.430    | \$0.00     | \$0.00     | \$0         | \$0.00     | \$0.00         | \$0         | \$100.00            | \$125 50      | \$76 530     | \$110.00    | \$122.76      | \$74 761     |
| 03 31 05.70 | 4700 Concrete placement                          | 609      | CY   | \$0.00     | \$0.00   | \$0         | \$16.30    | \$14.34    | \$8,735     | \$8.20     | \$9.15         | \$5,573     | \$24.50             | \$23.50       | \$8,760      | \$34.00     | \$37.94       | \$23,108     |
|             |  |          | -    | ,          |          | 1 -         | ,          |            |             |            |                | 1-7         | ,                   | ,             | 1 - 7        |             | ,             | ,            |
|             | Foundation Walls                                 |          |      |            |          |             |            |            |             |            |                |             |                     |               |              |             |               |              |
| 03 31 05.35 | 300 4000 psi concrete                            | 935      | CY   | \$106.00   | \$125.50 | \$117,346   | \$0.00     | \$0.00     | \$0         | \$0.00     | \$0.00         | \$0         | \$106.00            | \$125.50      | \$117,452    | \$117.00    | \$130.57      | \$122,085    |
| 03 31 05.70 | 5200 Concrete placement                          | 935      | CY   | \$0.00     | \$0.00   | \$0         | \$26.50    | \$23.32    | \$21,804    | \$13.20    | \$14.73        | \$13,774    | \$39.70             | \$38.05       | \$21,844     | \$55.00     | \$61.38       | \$57,390     |
| 03 21 10.60 | 700 Reinforcing Steel, #3 to #7                  | 40.5     | ton  | \$890.00   | \$908.69 | \$36,802    | \$460.00   | \$414.92   | \$16,804    | \$0.00     | \$0.00         | \$0         | \$1,350.00          | \$1,323.61    | \$54,956     | \$1,725.00  | \$1,662.90    | \$67,347     |
| 03 11 13.85 | 4230 Below grade wall formwork                   | 25240    | SFCA | \$1.23     | \$1.22   | \$30,890    | \$7.90     | \$6.50     | \$164,103   | \$0.00     | \$0.00         | \$0         | \$9.13              | \$7.73        | \$195,002    | \$13.70     | \$11.60       | \$292,882    |
|             | Columns  |          |      |            |          |             |            |            |             |            |                |             |                     |               |              |             |               |              |
| 03 31 05.35 | 400 5000 psi concrete                            | 1115     | CY   | \$109.00   | \$136.80 | \$152,526   | \$0.00     | \$0.00     | \$0         | \$0.00     | \$0.00         | \$0         | \$109.00            | \$136.80      | \$152,635    | \$120.00    | \$133.92      | \$149,321    |
| 03 31 05.35 | 411 6000 psi concrete                            | 136      | CY   | \$124.00   | \$155.62 | \$21,164    | \$0.00     | \$0.00     | \$0         | \$0.00     | \$0.00         | \$0         | \$124.00            | \$155.62      | \$21,288     | \$137.00    | \$152.89      | \$20,793     |
| 03 31 05.35 | 412 8000 psi concrete                            | 182      | CY   | \$203.00   | \$254.77 | \$46,367    | \$0.00     | \$0.00     | \$0         | \$0.00     | \$0.00         | \$0         | \$203.00            | \$254.77      | \$46,570     | \$223.00    | \$248.87      | \$45,294     |
| 03 31 05.35 | 413 10000 psi concrete                           | 73       | CY   | \$288.00   | \$361.44 | \$26,385    | \$0.00     | \$0.00     | \$0         | \$0.00     | \$0.00         | \$0         | \$288.00            | \$361.44      | \$26,673     | \$315.00    | \$351.54      | \$25,662     |
| 03 21 10.60 | 250 Reinforcing Steel, #8 to #18                 | 413.7    | ton  | \$935.00   | \$954.64 | \$394,932   | \$600.00   | \$541.20   | \$223,894   | \$0.00     | \$0.00         | \$0         | \$1 <i>,</i> 535.00 | \$1,495.84    | \$620,362    | \$2,000.00  | \$1,928.00    | \$797,614    |
| 03 31 05.70 | 850 Concrete placement                           | 1506     | CY   | \$0.00     | \$0.00   | \$0         | \$34.00    | \$29.92    | \$45,060    | \$16.95    | \$18.92        | \$28,488    | \$50.95             | \$48.84       | \$45,110     | \$70.50     | \$78.68       | \$118,489    |
| 03 11 13.25 | 7750 Steel framed column formwork                | 77730    | SFCA | \$1.58     | \$1.57   | \$122,199   | \$2.63     | \$2.16     | \$168,246   | \$0.00     | \$0.00         | \$0         | \$4.21              | \$3.74        | \$290,449    | \$5.65      | \$4.79        | \$371,981    |
|             | Shear Walls                                      |          |      |            |          |             |            |            |             |            |                |             |                     |               |              |             |               |              |
| 03 31 05.35 | 400 5000 psi concrete                            | 678      | CY   | \$109.00   | \$136.80 | \$92,747    | \$0.00     | \$0.00     | \$0         | \$0.00     | \$0.00         | \$0         | \$109.00            | \$136.80      | \$92,856     | \$120.00    | \$133.92      | \$90,798     |
| 03 21 10.60 | 700 Reinforcing Steel, #3 to #7                  | 36.4     | ton  | \$890.00   | \$908.69 | \$33,076    | \$460.00   | \$414.92   | \$15,103    | \$0.00     | \$0.00         | \$0         | \$1 <i>,</i> 350.00 | \$1,323.61    | \$49,529     | \$1,725.00  | \$1,662.90    | \$60,530     |
| 03 31 05.70 | 5200 Concrete placement                          | 678      | CY   | \$0.00     | \$0.00   | \$0         | \$26.50    | \$23.32    | \$15,811    | \$13.20    | \$14.73        | \$9,988     | \$39.70             | \$38.05       | \$15,851     | \$55.00     | \$61.38       | \$41,616     |
| 03 11 13.85 | 9260 Steel framed wall formwork                  | 30840    | SFCA | \$0.37     | \$0.37   | \$11,354    | \$3.96     | \$3.26     | \$100,510   | \$0.00     | \$0.00         | \$0         | \$4.33              | \$3.63        | \$111,868    | \$6.55      | \$5.55        | \$171,096    |
|             | Slabs (Includes F/R/P, concrete, and finishing)  |          |      |            |          |             |            |            |             |            |                |             |                     |               |              |             |               |              |
| 03 30 53.40 | 1950 30' span flat slab with drop panels         | 14638    | CY   | \$275.00   | \$325.60 | \$4,766,133 | \$156.00   | \$135.72   | \$1,986,669 | \$14.75    | \$15.33        | \$224,331   | \$445.75            | \$476.65      | \$6,753,248  | \$560.00    | \$581.84      | \$8,516,974  |
| 03 23 05.50 | 1650 Post tensioning cable                       | 545450   | Lb.  | \$0.51     | \$0.52   | \$284,021   | \$0.82     | \$0.74     | \$403,437   | \$0.02     | \$0.02         | \$10,516    | \$1.35              | \$1.28        | \$687,459    | \$1.92      | \$1.85        | \$1,009,562  |
|             |  |          |      |            |          |             |            |            |             |            |                |             |                     | Tota          | \$10 141 575 |             | Tota          | \$13 761 723 |
|             |  |          |      |            |          |             |            |            |             |            |                |             |                     | Total Cost/SF | \$22.58      |             | Total Cost/Si | \$30.64      |
|             |  |          |      |            |          |             |            |            |             |            |                |             |                     |               |              |             |               |              |



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#### General Condition Estimate

The general conditions cover various management and operational expenses not necessarily directly dependent on one trade or activity. Please note that the supervisory and miscellaneous labor categories of the general conditions account only for an employee's base salaries. Additional expenses resulting from employee insurance coverage and benefits is added at the end of the report at a rate of 55% of the base salary. Note that the staff base salary to volume (SV) ratio is approximately 2.2%. With a goal of achieving an SV ratio of between 2 and 3 percent, 77 K Street is adequately staffed and managed.

Also of importance, there is no crane expense included in the general conditions. The crane is owned and operated by the concrete contractor and is included in their scope of work. The general conditions estimate does not include project overhead expenses of profit. These would be included in the general contractor's fee.

The general conditions estimate yielded a cost of \$2.34 million dollars or approximately 5.7% of the GMP value of the project's contract. This is a fair value of what to expect for a project of this size and type.

Washington, DC



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Washington, DC

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| Document Reproduction for Bid                                | 1        | Ls        | \$25,000         | \$25,000           |           |
|--|----------|-----------|------------------|--------------------|-----------|
| Security Service   | 1        | Ls        | \$6,000          | \$6,000            |           |
| Travel Expense   | 0        | Ls        | \$50,000         | \$0                |           |
| Miscellaneous Items  | 88       | Wks       | \$50             | \$4,400            |           |
| Subtotal   |          |           |                  | \$201,180          |           |
| Sales Tax (Materials)  | 5.75     | %         |                  | \$7,162            |           |
| Total General Costs  |          |           |                  |                    | \$208,342 |
|  |          |           |                  |                    |           |
| RENTALS  |          |           |                  |                    |           |
| Pickup truck (sup't)   | 140      | Wks       | \$300            | \$41,944           |           |
| Courier vehicle  | 344      | Hrs       | \$7.49           | \$2,577            |           |
| Dump truck   | 86       | Hrs       | \$28             | \$2,408            |           |
| Field office trailer   | 20       | Mos       | \$350            | \$7,113            |           |
| Storage/change house trailer                                 | 12       | Mos       | \$150            | \$1,819            |           |
| Industrial vacuum  | 2        | Ls        | \$150            | \$300              |           |
| Surveying instruments  | 15       | Mos       | \$161.77         | \$2,354            |           |
| Gang box   | 20       | Mos       | \$72             | \$1,463            |           |
| Vehicle (Senior Project Manager)                             | 1,800    | Hrs       | \$7.49           | \$13,482           |           |
| Vehicle (Proj. Manager)                                      | 92       | Wks       | \$300            | \$27,563           |           |
| Pickup truck (Layout Engineer)                               | 924      | Hrs       | \$7.49           | \$6,921            |           |
| Cell Phone   | 14,937   | Hrs       | \$0.58           | \$8,624            |           |
| Computer/IT/Fax/Lan/Phone System                             | 14,937   | Hrs       | \$2.30           | \$34,356           |           |
| Copier/Fax   | 1        | Ls        | \$5,000          | \$5,000            |           |
| Hoist installation   | 1        | Ls        | \$25,000         | \$25,000           |           |
| Hoist rental   | 6        | Mos       | \$3,500          | \$21,000           |           |
| Allowance  | 1        | Ls        | \$10,000         | \$10,000           |           |
| Subtotal   |          |           |                  | \$211,923          |           |
| Sales Tax (Materials)  | 5.75     | %         |                  | \$12,186           |           |
| Total Rentals  |          |           |                  | \$224,109          | \$224,109 |
|  |          |           |                  |                    |           |
| TEMPORARY FACILITIES   |          |           |                  |                    |           |
| Field telephone - hookup                                     | 1        | Ls        | \$1,000          | \$1,000            |           |
| - calls  | 20       | Mos       | \$500            | \$10,000           |           |
| Field phone - Owner  | 1        | Ls        | \$4,000          | \$4,000            |           |
| Temporary partitions   | 0        | Ls        | By Trade         |                    |           |
| Temporary protection   | 0        | Wks       | By Trade         |                    |           |
| Pest Control   | 10       | Mos       | \$500            | \$5,000            |           |
| Field Office Set-up  | 1        | Ls        | \$10,000         | \$10,000           |           |
| Field office expense   | 88       | Wks       | \$50             | \$4,400            |           |
| Subtotal   |          |           |                  | \$34,400           |           |
| Sales Tax (Materials)  | 5.75     | %         |                  | \$1,978            |           |
| Total Temporary Facilities                                   |          |           |                  |                    | \$36,378  |
|  |          |           |                  |                    |           |
| PUNCH LIST / WARRANTY  | 360      | Hrs       | \$25.89          | \$9,320            | \$9,320   |
| PUNCH LIST / WARRANTY  | 360      | Hrs       | \$25.89          | \$9,320            | \$9,320   |
| PUNCH LIST / WARRANTY<br>HEALTH                              | 360      | Hrs       | \$25.89          | \$9,320            | \$9,320   |
| PUNCH LIST / WARRANTY<br>HEALTH<br>First aid kits & supplies | 360<br>3 | Hrs<br>Ea | \$25.89<br>\$500 | \$9,320<br>\$1,500 | \$9,320   |

Washington, DC



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| Toilets   | 20         | Mos  | \$1,250         | \$25,000            |                          |
|---|------------|------|-----------------|---------------------|--------------------------|
| General area illumination (Bulbs  | 450,000    | SF   | \$0.02          | \$9,000             |                          |
| only)   |            |      |                 | ¢41 EOO             |                          |
| Subtotal  | 5 75       | 0/   |                 | \$41,300<br>\$2,386 |                          |
| Sales Tax (Materials)   | 5.75       | 70   |                 | φ <b>2</b> ,300     | \$13 886                 |
|   |            |      |                 |                     | ψ43,000                  |
| PROTECTECTION & LIFE SAVING<br>EQUIPMENT                                      |            |      |                 |                     |                          |
| Head protection   | 12         | Ctns | \$100           | \$1,200             |                          |
| Hearing protection  | 1          | Ls   | \$500           | \$500               |                          |
| Eye & Face protection   | 1          | Ls   | \$1,500         | \$1,500             |                          |
| Respiratory protection  | 1          | Ls   | \$500           | \$500               |                          |
| Fire Extinguishers  | 300        | Ea   | \$25            | \$7,500             |                          |
| Signs, Signals, & Barricades  | 1          | LS   | \$20,802        | \$20,802            |                          |
| Subtotal  |            |      |                 | \$32,002            |                          |
| Sales Tax (Materials)   | 5.75       | %    |                 | \$644               |                          |
| Total Protection & Life Savir   | ng Equipme | nt   |                 |                     | \$32,646                 |
| MATERIAL STORAGE &  |            |      |                 |                     |                          |
| DISPOSAL  |            |      |                 |                     |                          |
| Clean up labor  | 61         | Wks  | \$571.10        | \$34,837            |                          |
| Disposal chute (Rental)   | 0          | Mos  | By <sup>-</sup> | Frade               |                          |
| Disposal Service  | 111        | Pull | \$425           | \$47,175            |                          |
| Dump fees   | 10         | Ea   | \$125           | \$1,250             |                          |
| Subtotal  |            |      |                 | \$83,262            |                          |
| Sales Tax (Materials)   | 5.75       | %    |                 | \$2,784             |                          |
| Total Material Storage & Dis  | posal      |      |                 |                     | \$86,046                 |
| TEMPORARY POWER   |            |      |                 |                     |                          |
| Electrical Energy   | 1          | Ls   | \$170,807       | \$170,807           |                          |
| Sales Tax (Materials)   | 5.75       | %    |                 | \$9,821             |                          |
| Total Temporary Power   |            |      |                 |                     | \$180,629                |
| PERSONNEL PROTECTION  |            |      |                 |                     |                          |
| Construction fence  | 1          | Ls   | \$5,000.00      | \$5,000.00          |                          |
| Guard rails & toeboards   | 26,400     | Lf   | \$1.00          | \$26,400.00         |                          |
| Floor opening protection  | 60         | Ea   | \$62.87         | \$3,772.20          |                          |
| Temp, stair rails   | 22,400     | Lf   | \$1.25          | \$28,000.00         |                          |
| Subtotal  | -          |      |                 | \$63,172.20         |                          |
| Sales Tax (Materials)   | 5.75       | %    |                 | \$2,473             |                          |
|   |            | -    |                 |                     | \$65.645                 |
| Total Personnel Protection  |            |      |                 |                     |                          |
| Total Personnel Protection  |            |      |                 |                     |                          |
| Total Personnel Protection  |            |      |                 |                     | \$1,818,690              |
| Total Personnel Protection<br>SUBTOTAL<br>Insurances and Employee<br>Benefits | 55         | %    | Base Salarie    | 25                  | \$1,818,690<br>\$522,363 |