**Technical Assignment 2**

**Cost and Methods Analysis**

# *The Wilmer Eye Institute Outpatient Surgery & Laboratory Building*

# *Baltimore, Maryland*

**Tyler M. Smith**

**Construction Management**

**Thesis Advisor: Dr. John Messner**

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**Executive Summary**

The key findings in this technical report are as follows:

- All interior tasks in schedule (walls, rough-ins, finishes, etc.) are grouped together by floor and type of space within the floor, reflecting the manner in which things will be constructed. The format/sequence of the schedule could potentially be an area that could be improved upon further investigation.
- Utilities have been run straight across North Broadway Street from the adjacent Weinberg Building.
- There is no area designated for material lay-down. All material deliveries will either be directly constructed into the building or staged within the building footprint.
- Exterior wall assembly consists primarily of face brick cavity wall with CMU block backup and double-pane ¼" insulating glazing with tubular aluminum mullions.
- Cast-in-place concrete building will require an estimated 12,650 cubic yards of concrete and 760 tons of rebar to construct the superstructure.

Overall, this report has provided a general technical familiarity with the building and its systems. Learning the many details of the different engineered systems has provided much insight into the construction processes that will occur, and will be extremely helpful in future analysis to come.

Temporary scaffold bridge over tunnel excavation

**Schedule Narrative**

The schedule compiled for this second technical report is notably more extensive than the previously submitted summary schedule. Activities related directly to the construction of the project (i.e. excluding design and procurement of services) have been expanded upon showing sub-tasks and their durations.

It is easily noticed with this format of schedule that the activities are organized by space, rather than by trade. This represents the fashion in which the building is to be constructed.

In general, the interior work will commence by floor from bottom to top as the superstructure is constructed, and work within the floor is organized by type of space (i.e. general sterile, laboratory, operating room, etc.).

The detailed schedule is located in the Appendix at the end of this document.


Looking North from Southeast corner of site.

**Site Logistics**

As with the detailed schedule, the site logistics plan included in this report expands upon the previously submitted plan while also highlighting the excavation process. As the plan illustrates, the major earthwork will commence to three different elevations, and all other non-shaded areas on the plan will be sloped accordingly.

Additionally included are the locations of the temporary subcontractor office trailers, temporary utility connections, tower crane, man/material hoist, and the construction ramp needed for excavation prior to the crane erection.

There will also be a temporary scaffold bridge for foot traffic over the tunnel trench throughout the duration of the tunnel construction. After the tunnel is completed the earth will be backfilled and the construction gate on Jefferson Street can function as a vehicle exit.

Temporary electric, as well as future permanent electric and water services have been routed straight across North Broadway Street from the adjacent Weinberg Building. This deviates from the original infrastructure utility documents. There is a fee associated with running utilities and like objects under public roadways, and this option essentially costs less because there is less length underneath the street. In the northeast corner of the site is the hub for the campus utilities located underground that will be the future connection point for all permanent HVAC lines.

Also note that there is no area designated for material lay-down. All material deliveries will either be directly constructed into the building or staged within the building footprint.

The updated site logistics plan can be found in the Appendix at the end of this document.

Temporary excavation ramp to be removed.

**Exterior Enclosures Costs**

| Exterior Enclosures Summary<br>Total Exterior Enclosures Costs: | | | |
|---|---|---|---|
| | Material | Installation | Total |
| Brick Face Cavity Wall | $379,401 | $698,023 | $1,077,424 |
| Tubular Aluminum Framing | $284,325 | $266,938 | $551,262 |
| Curtain Wall Glazing | $187,163 | $194,323 | $381,486 |
| Total | $850,888 | $1,159,284 | $2,010,172 |

The exterior wall assembly consists of a brick face cavity wall and glass curtain wall glazing with tubular aluminum framing. The cavity wall primarily consists of standard bricks with an 8" CMU back-up, 2" polystyrene insulation and a 2" air space.

For simplicity in this estimate, it was assumed that all curtain wall glazing is double-pane ¼" insulated glass. Cavity wall figures include a brick shelf, ties to the backups and necessary dampproofing, flashing, and control joints every 20'. All unit prices were referenced from R.S. Means Assemblies Cost Data 2008.

| Square Foot Extrapolation<br>Exterior Enclosures Costs Per S.F. of Building Floor Area: | |
|---|---|
| Material | $4.21 |
| Installation | $5.73 |
| Total | $9.93 |

A more detailed estimate broken down by elevation can be found in the Appendix at the end of this document.

**Detailed Structural Systems Costs**

| Structural Systems Summary<br>Total Structure Costs: | |
|---|---|
| Material | $2,240,986 |
| Labor | $598,658 |
| Equipment | $48,865 |
| Total | $288,509 |
| Total w/ Overhead & Profit | $3,508,646 |

The superstructure of the Wilmer Eye Institute building consists of a mildly reinforced two-way concrete slab system with drop panels around the columns. Typical slab depth is 9½" with 5½" drop panels at the interior columns and 7½" drop panels at the exterior columns. Typical column size is 21"x 21" from the third floor up, and 24"x 24" in the basement and first floor. The foundation walls are cast-in-place concrete as well as the mat foundations and strip wall footings.

The building will require an estimated 12,650 cubic yards of concrete and 760 tons of rebar.

| Square Foot Extrapolation<br>Structural System Costs Per S.F. of Building Floor Area: | |
|---|---|
| Material | $11.07 |
| Labor | $2.96 |
| Equipment | $0.24 |
| Total | $14.27 |
| Total (O&P) | $17.34 |

The detailed structural estimate and calculations can be found in the Appendix at the end of this document.

**General Conditions Costs**

| General Conditions Summary | |
|---|---|
| Personnel | $1,425,173 |
| Trash Removal | $101,000 |
| Temporary Building Enclosure | $63,240 |
| Temporary Facilities/Utilities | $52,552 |
| Other | $168,244 |
| Total | $1,810,209 |

General conditions for this project are fairly straightforward. A few items of interest are the scaffolding bridge for foot traffic over the tunnel trench, and the temporary building enclosure so interior work can commence in the winter of 2009.

Personnel salaries were estimated based on average numbers from R.S. Means 2008, and their durations on the project were established by the area in which each staff member is managing (i.e. shell/core manager is on for the scheduled duration of the shell/core construction).

| Monthly Cost Breakdown | |
|---|---|
| Category | Cost per Month |
| Personnel | $56,080 |
| Office Supplies | $415 |
| Temporary Offices | $700 |
| Temporary Utilities | $527 |
| Trash Disposal | $2,760 |
| Temporary Facilities | $685 |
| Total Monthly Costs | $61,167 |

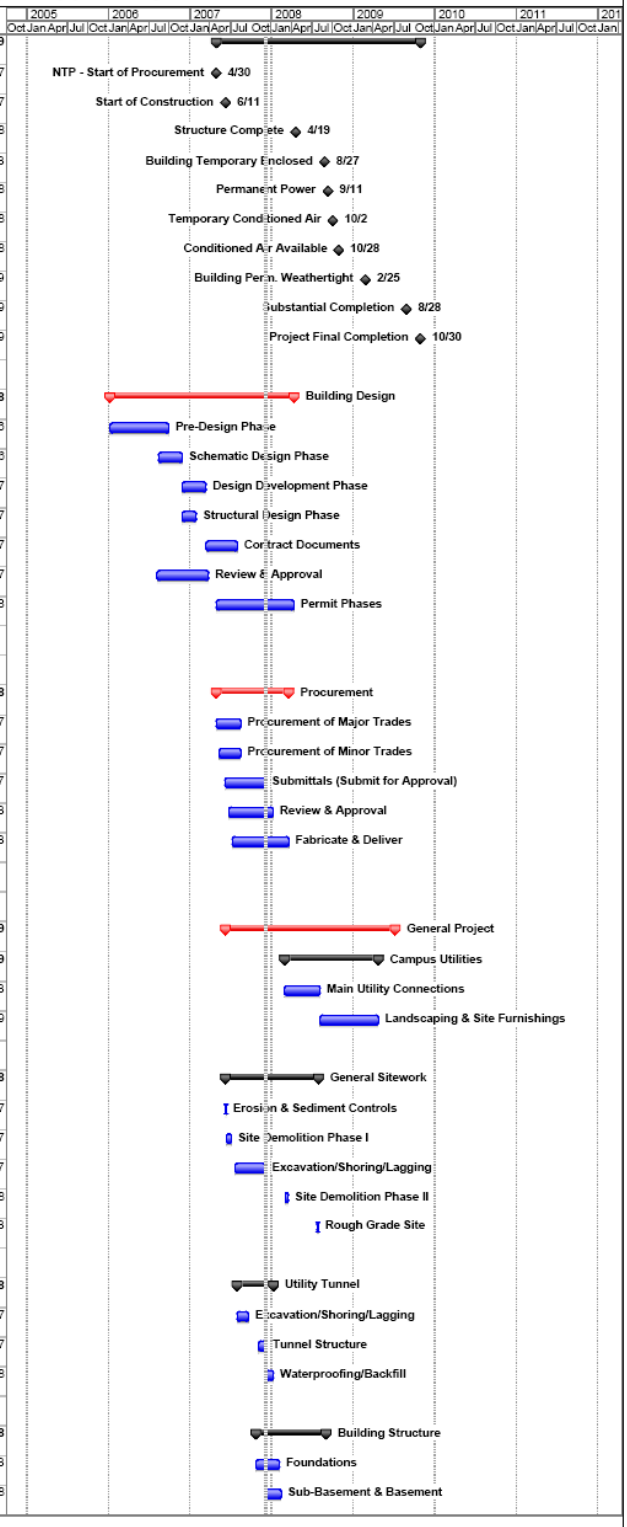
A detailed breakdown of the general conditions costs can be found in the Appendix at the end of this document.

**Appendix**

# Detailed Project Schedule

The Wilmer Eye Institue Outpatient Surgery & Lab Buidling

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Major Project Milestones** | **658 days** | **Mon 4/30/07** | **Fri 10/30/09** |
| 2 | NTP - Start of Procurement | 0 days | Mon 4/30/07 | Mon 4/30/07 |
| 3 | Start of Construction | 0 days | Mon 6/11/07 | Mon 6/11/07 |
| 4 | Structure Complete | 0 days | Sat 4/19/08 | Sat 4/19/08 |
| 5 | Building Temporary Enclosed | 0 days | Wed 8/27/08 | Wed 8/27/08 |
| 6 | Permanent Power | 0 days | Thu 9/11/08 | Thu 9/11/08 |
| 7 | Temporary Conditioned Air | 0 days | Thu 10/2/08 | Thu 10/2/08 |
| 8 | Conditioned Air Available | 0 days | Tue 10/28/08 | Tue 10/28/08 |
| 9 | Building Perm. Weathertight | 0 days | Wed 2/25/09 | Wed 2/25/09 |
| 10 | Substantial Completion | 0 days | Fri 8/28/09 | Fri 8/28/09 |
| 11 | Project Final Completion | 0 days | Fri 10/30/09 | Fri 10/30/09 |
| 12 | | | | |
| 13 | **Building Design** | **592 days?** | **Mon 1/9/06** | **Fri 4/11/08** |
| 14 | Pre-Design Phase | 190 days? | Mon 1/9/06 | Fri 9/29/06 |
| 15 | Schematic Design Phase | 77 days? | Mon 8/14/06 | Tue 11/28/06 |
| 16 | Design Development Phase | 78 days? | Tue 11/28/06 | Thu 3/15/07 |
| 17 | Structural Design Phase | 46 days? | Tue 11/28/06 | Tue 1/30/07 |
| 18 | Contract Documents | 101 days? | Thu 3/15/07 | Thu 8/2/07 |
| 19 | Review & Approval | 165 days? | Tue 8/8/06 | Mon 3/26/07 |
| 20 | Permit Phases | 252 days? | Mon 4/30/07 | Fri 4/11/08 |
| 21 | | | | |
| 22 | | | | |
| 23 | **Procurement** | **235 days?** | **Mon 4/30/07** | **Wed 3/19/08** |
| 24 | Procurement of Major Trades | 80 days? | Mon 4/30/07 | Fri 8/17/07 |
| 25 | Procurement of Minor Trades | 70 days? | Mon 5/14/07 | Fri 8/17/07 |
| 26 | Submittals (Submit for Approval) | 129 days? | Fri 6/8/07 | Wed 12/5/07 |
| 27 | Review & Approval | 144 days? | Mon 8/25/07 | Wed 1/9/08 |
| 28 | Fabricate & Deliver | 183 days? | Wed 7/11/07 | Wed 3/19/08 |
| 29 | | | | |
| 30 | | | | |
| 31 | **General Project** | **547 days?** | **Mon 6/11/07** | **Thu 7/9/09** |
| 32 | **Campus Utilities** | **302 days?** | **Sat 3/1/08** | **Fri 4/24/09** |
| 33 | Main Utility Connections | 115 days? | Sat 3/1/08 | Wed 8/6/08 |
| 34 | Landscaping & Site Furnishings | 187 days? | Thu 8/7/08 | Fri 4/24/09 |
| 35 | | | | |
| 36 | **General Sitework** | **301 days?** | **Mon 6/11/07** | **Wed 7/30/08** |
| 37 | Erosion & Sediment Controls | 4 days? | Mon 6/11/07 | Thu 6/14/07 |
| 38 | Site Demolition Phase I | 16 days? | Fri 6/15/07 | Fri 7/6/07 |
| 39 | Excavation/Shoring/Lagging | 98 days? | Mon 7/23/07 | Wed 12/5/07 |
| 40 | Site Demolition Phase II | 10 days? | Tue 3/4/08 | Mon 3/17/08 |
| 41 | Rough Grade Site | 5 days? | Thu 7/24/08 | Wed 7/30/08 |
| 42 | | | | |
| 43 | **Utility Tunnel** | **118 days?** | **Wed 8/1/07** | **Thu 1/10/08** |
| 44 | Excavation/Shoring/Lagging | 37 days? | Wed 8/1/07 | Thu 9/20/07 |
| 45 | Tunnel Structure | 25 days? | Tue 11/6/07 | Sat 12/8/07 |
| 46 | Waterproofing/Backfill | 24 days? | Mon 12/10/07 | Thu 1/10/08 |
| 47 | | | | |
| 48 | **Building Structure** | **227 days?** | **Thu 10/25/07** | **Tue 9/2/08** |
| 49 | Foundations | 76 days? | Thu 10/25/07 | Wed 2/6/08 |
| 50 | Sub-Basement & Basement | 54 days? | Tue 12/4/07 | Thu 2/14/08 |



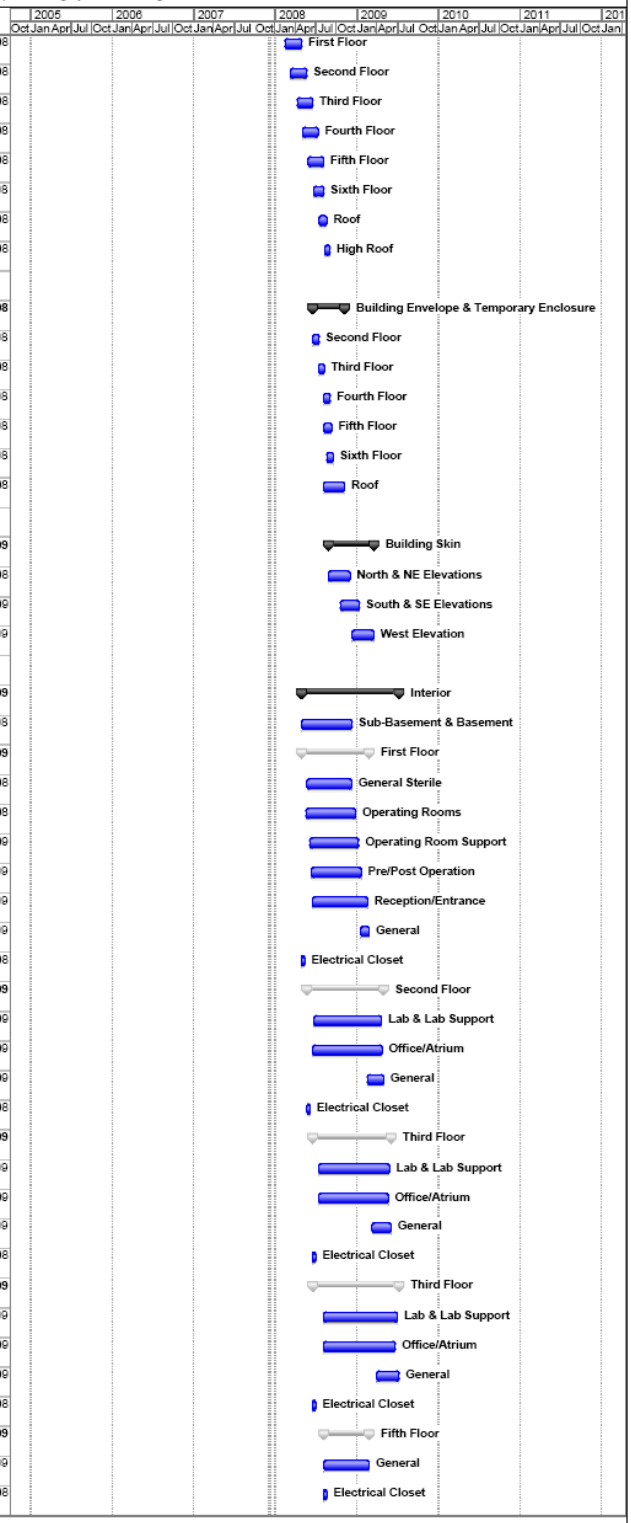

Project: Wilmer Eye Institute Detailed

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

# Detailed Project Schedule

The Wilmer Eye Institue Outpatient Surgery & Lab Buidling

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 51 | First Floor | 56 days? | Fri 2/15/08 | Tue 4/29/08 |
| 52 | Second Floor | 54 days? | Tue 3/11/08 | Thu 5/22/08 |
| 53 | Third Floor | 50 days? | Thu 4/10/08 | Tue 6/17/08 |
| 54 | Fourth Floor | 50 days? | Mon 5/5/08 | Fri 7/11/08 |
| 55 | Fifth Floor | 49 days? | Thu 5/29/08 | Tue 8/5/08 |
| 56 | Sixth Floor | 33 days? | Mon 6/23/08 | Wed 8/6/08 |
| 57 | Roof | 24 days? | Thu 7/17/08 | Tue 8/19/08 |
| 58 | High Roof | 16 days? | Tue 8/12/08 | Tue 9/2/08 |
| 59 | | | | |
| 60 | **Building Envelope & Temporary Enclosure** | **103 days?** | **Wed 6/18/08** | **Fri 11/7/08** |
| 61 | Second Floor | 21 days? | Wed 6/18/08 | Wed 7/16/08 |
| 62 | Third Floor | 20 days? | Mon 7/14/08 | Fri 8/8/08 |
| 63 | Fourth Floor | 21 days? | Wed 8/6/08 | Wed 9/3/08 |
| 64 | Fifth Floor | 25 days? | Thu 8/7/08 | Wed 9/10/08 |
| 65 | Sixth Floor | 21 days? | Wed 8/20/08 | Wed 9/17/08 |
| 66 | Roof | 69 days? | Tue 8/5/08 | Fri 11/7/08 |
| 67 | | | | |
| 68 | **Building Skin** | **146 days?** | **Wed 8/27/08** | **Wed 3/18/09** |
| 69 | North & NE Elevations | 70 days? | Wed 8/27/08 | Tue 12/2/08 |
| 70 | South & SE Elevations | 61 days? | Mon 10/20/08 | Mon 1/12/09 |
| 71 | West Elevation | 69 days? | Fri 12/12/08 | Wed 3/18/09 |
| 72 | | | | |
| 73 | **Interior** | **312 days?** | **Wed 4/30/08** | **Thu 7/9/09** |
| 74 | Sub-Basement & Basement | 161 days? | Wed 4/30/08 | Wed 12/10/08 |
| 75 | **First Floor** | **216 days?** | **Wed 4/30/08** | **Wed 2/25/09** |
| 76 | General Sterile | 143 days? | Fri 5/23/08 | Tue 12/9/08 |
| 77 | Operating Rooms | 160 days? | Mon 5/19/08 | Fri 12/26/08 |
| 78 | Operating Room Support | 157 days? | Thu 6/5/08 | Fri 1/9/09 |
| 79 | Pre/Post Operation | 160 days? | Thu 6/12/08 | Wed 1/21/09 |
| 80 | Reception/Entrance | 177 days? | Tue 6/17/08 | Wed 2/18/09 |
| 81 | General | 28 days? | Mon 1/19/09 | Wed 2/25/09 |
| 82 | Electrical Closet | 9 days? | Wed 4/30/08 | Mon 5/12/08 |
| 83 | **Second Floor** | **246 days?** | **Fri 5/23/08** | **Fri 5/1/09** |
| 84 | Lab & Lab Support | 216 days? | Tue 6/24/08 | Tue 4/21/09 |
| 85 | Office/Atrium | 223 days? | Wed 6/18/08 | Fri 4/24/09 |
| 86 | General | 53 days? | Wed 2/18/09 | Fri 5/1/09 |
| 87 | Electrical Closet | 10 days? | Fri 5/23/08 | Thu 6/5/08 |
| 88 | **Third Floor** | **251 days?** | **Wed 6/18/08** | **Wed 6/3/09** |
| 89 | Lab & Lab Support | 228 days? | Mon 7/14/08 | Wed 5/27/09 |
| 90 | Office/Atrium | 225 days? | Mon 7/14/08 | Fri 5/22/09 |
| 91 | General | 61 days? | Wed 3/11/09 | Wed 6/3/09 |
| 92 | Electrical Closet | 9 days? | Wed 6/18/08 | Mon 6/30/08 |
| 93 | **Third Floor** | **277 days?** | **Wed 6/18/08** | **Thu 7/9/09** |
| 94 | Lab & Lab Support | 236 days? | Wed 8/6/08 | Wed 7/1/09 |
| 95 | Office/Atrium | 229 days? | Wed 8/6/08 | Mon 6/22/09 |
| 96 | General | 72 days? | Wed 4/1/09 | Thu 7/9/09 |
| 97 | Electrical Closet | 9 days? | Wed 6/18/08 | Mon 6/30/08 |
| 98 | **Fifth Floor** | **145 days?** | **Thu 8/7/08** | **Wed 2/25/09** |
| 99 | General | 145 days? | Thu 8/7/08 | Wed 2/25/09 |
| 100 | Electrical Closet | 9 days? | Thu 8/7/08 | Tue 8/19/08 |

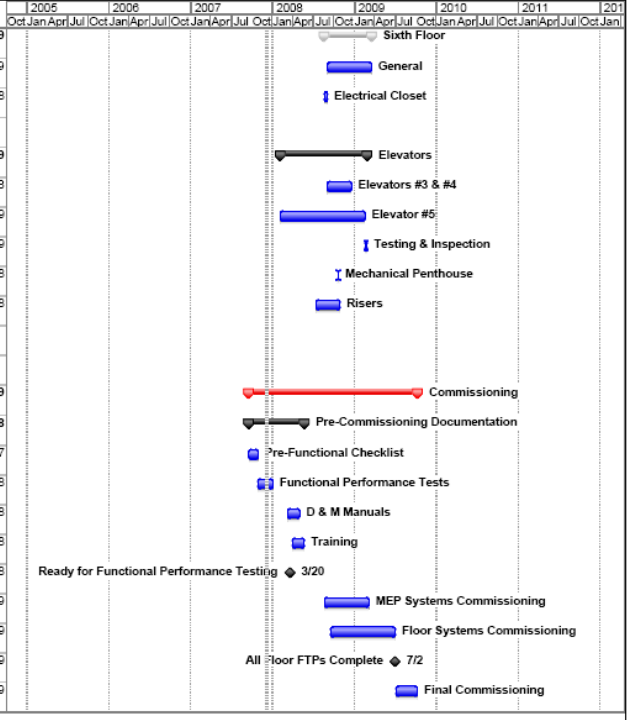



| Project: Wilmer Eye Institute Detailed | Task | Milestone | External Tasks |
|---|---|---|---|
| | Split | Summary | External Milestone |
| | Progress | Project Summary | Deadline |

# Detailed Project Schedule

The Wilmer Eye Institue Outpatient Surgery & Lab Buidling

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 101 | **Sixth Floor** | **151 days?** | **Wed 8/20/08** | **Wed 3/18/09** |
| 102 | General | 141 days? | Wed 9/3/08 | Wed 3/18/09 |
| 103 | Electrical Closet | 10 days? | Wed 8/20/08 | Tue 9/2/08 |
| 104 | | | | |
| 105 | **Elevators** | **279 days?** | **Wed 2/6/08** | **Thu 2/26/09** |
| 106 | Elevators #3 & #4 | 78 days? | Wed 9/3/08 | Fri 12/19/08 |
| 107 | Elevator #5 | 272 days? | Wed 2/6/08 | Tue 2/17/09 |
| 108 | Testing & Inspection | 7 days? | Wed 2/18/09 | Thu 2/26/09 |
| 109 | Mechanical Penthouse | 1 day? | Tue 10/21/08 | Tue 10/21/08 |
| 110 | Risers | 77 days? | Mon 7/14/08 | Tue 10/28/08 |
| 111 | | | | |
| 112 | | | | |
| 113 | **Commissioning** | **542 days?** | **Tue 9/18/07** | **Fri 10/9/09** |
| 114 | **Pre-Commissioning Documentation** | **181 days?** | **Tue 9/18/07** | **Thu 5/22/08** |
| 115 | Pre-Functional Checklist | 30 days? | Tue 9/18/07 | Mon 10/29/07 |
| 116 | Functional Performance Tests | 50 days? | Mon 10/29/07 | Thu 1/3/08 |
| 117 | D & M Manuals | 40 days? | Mon 3/10/08 | Thu 5/1/08 |
| 118 | Training | 40 days? | Mon 3/31/08 | Thu 5/22/08 |
| 119 | Ready for Functional Performance Testing | 0 days | Thu 3/20/08 | Thu 3/20/08 |
| 120 | MEP Systems Commissioning | 142 days? | Thu 8/21/08 | Fri 3/6/09 |
| 121 | Floor Systems Commissioning | 207 days? | Wed 9/17/08 | Thu 7/2/09 |
| 122 | All Floor FTPs Complete | 0 days | Thu 7/2/09 | Thu 7/2/09 |
| 123 | Final Commissioning | 70 days? | Mon 7/6/09 | Fri 10/9/09 |




Project: Wilmer Eye Institute Detailed

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

# Exterior Building Enclosure Estimate

The Wilmer Eye Institute Outpatient Surgery and Laboratory Building

Quick Building Stats: $65M Cost of Construction
7 Storeys, 202,000 SF

| Material Description | Quantity | Units | Material | Installation | Total | Material | Installation | Total |
|---|---|---|---|---|---|---|---|---|
| **East Elevation** | | | | | | | | |
| Brick Face Cavity Wall<br>Standard face brick, 8" conc. block backup<br>Polystyrene cavity insulation | 6620 | S.F. | 10.30 | 18.95 | 29.25 | 68,186 | 125,449 | 193,635 |
| Tubular Aluminum Framing<br>For 1/4" glass, one intermediate horizontal | 9830 | S.F. | 13.90 | 13.05 | 26.95 | 136,637 | 128,282 | 264,919 |
| Curtain Wall Panels<br>Glazing panel, insulating, 1/2" thick, 2 lites | 9830 | S.F. | 9.15 | 9.50 | 18.65 | 89,945 | 93,385 | 183,330 |
| **South Elevation** | | | | | | | | |
| Brick Face Cavity Wall<br>Standard face brick, 8" conc. block backup<br>Polystyrene cavity insulation | 5790 | S.F. | 10.30 | 18.95 | 29.25 | 59,637 | 109,721 | 169,358 |
| Tubular Aluminum Framing<br>For 1/4" glass, one intermediate horizontal | 4280 | S.F. | 13.90 | 13.05 | 26.95 | 59,492 | 55,854 | 115,346 |
| Curtain Wall Panels<br>Glazing panel, insulating, 1/2" thick, 2 lites | 4280 | S.F. | 9.15 | 9.50 | 18.65 | 39,162 | 40,660 | 79,822 |
| **West Elevation** | | | | | | | | |
| Brick Face Cavity Wall<br>Standard face brick, 8" conc. block backup<br>Polystyrene cavity insulation | 16855 | S.F. | 10.30 | 18.95 | 29.25 | 173,607 | 319,402 | 493,009 |
| Tubular Aluminum Framing<br>For 1/4" glass, one intermediate horizontal | 3435 | S.F. | 13.90 | 13.05 | 26.95 | 47,747 | 44,827 | 92,573 |
| Curtain Wall Panels<br>Glazing panel, insulating, 1/2" thick, 2 lites | 3435 | S.F. | 9.15 | 9.50 | 18.65 | 31,430 | 32,633 | 64,063 |
| **North Elevation** | | | | | | | | |
| Brick Face Cavity Wall<br>Standard face brick, 8" conc. block backup<br>Polystyrene cavity insulation | 7570 | S.F. | 10.30 | 18.95 | 29.25 | 77,971 | 143,452 | 221,423 |
| Tubular Aluminum Framing<br>For 1/4" glass, one intermediate horizontal | 2910 | S.F. | 13.90 | 13.05 | 26.95 | 40,449 | 37,976 | 78,425 |
| Curtain Wall Panels<br>Glazing panel, insulating, 1/2" thick, 2 lites | 2910 | S.F. | 9.15 | 9.50 | 18.65 | 26,627 | 27,645 | 54,272 |
| | | | | | Totals: | Material | Installation | Total |
| | | | | | | $850,888 | $1,159,284 | $2,010,172 |

*Cavity wall assembly includes brick shelf, ties to the backups and necessary dampproofing, flashing, and control joints every 20'.
*Figures referenced from R.S. Means Assemblies Cost Data 2008

# Detailed Structural Systems Estimate

The Wilmer Eye Institute Outpatient Surgery & Lab Building

Quick Building Stats: $65M Cost of Construction
7 Storeys, 202,000 SF

| Description | Quantity | Units | Material | Labor | Equipment | Total | Total (O&P) | Material | Labor | Equipment | Total | Total (O&P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Slab on Grade** | | | | | | | | | | | | |
| WWF 6 x 6 - W2.1 x 2.1 (8 x 8) 30 lb. per C.S.F | 286 | CSF | 15.40 | 21.50 | | 36.90 | 53.50 | 4,397 | 6,138 | 0 | 10,535 | 15,274 |
| Normal Weight Concrete, 3,000 psi | 440 | CY | 106.00 | | | 106.00 | 116.00 | 46,640 | 0 | 0 | 46,640 | 51,040 |
| Concrete placement, slab on grade, pumped | 440 | CY | | 15.30 | 5.80 | 21.10 | 31.50 | 0 | 6,732 | 2,552 | 9,284 | 13,860 |
| Slab on grade, incl. troweled finish, not incl. f | 28550 | SF | 2.01 | 0.72 | 0.01 | 2.74 | 3.37 | 57,386 | 20,556 | 286 | 78,227 | 96,214 |
| or reinforcing, over 10,000 S.F., 6" thick | | | | | | | | | | **Subtotal:** | **144,686** | **176,388** |
| **Mat Footings** | | | | | | | | | | | | |
| Normal Weight Concrete, 3,000 psi | 647 | CY | 104.00 | | | 104.00 | 114.00 | 67,246 | 0 | 0 | 67,246 | 73,712 |
| Concrete placement, foundation mats, over 2 | 647 | CY | | 4.97 | 1.88 | 6.85 | 10.15 | 0 | 3,214 | 1,216 | 4,429 | 6,563 |
| Reinforcing steel, footings, #4-#7 | 9820 | lb | 0.47 | 0.31 | | 0.78 | 1.05 | 4,615 | 3,044 | 0 | 7,660 | 10,311 |
| Reinforcing steel, footings, #8-#18 | 37260 | lb | 0.47 | 0.18 | | 0.65 | 0.82 | 17,512 | 6,707 | 0 | 24,219 | 30,553 |
| | | | | | | | | | | **Subtotal:** | **103,554** | **121,140** |
| **Pile Caps** | | | | | | | | | | | | |
| Normal Weight Concrete, 5,000 psi | 102 | CY | 114.00 | | | 114.00 | 125.00 | 11,639 | 0 | 0 | 11,639 | 12,763 |
| Concrete placement, pile caps, over 10 C.Y., | 102 | CY | | 8.30 | 3.13 | 11.43 | 16.95 | 0 | 847 | 320 | 1,167 | 1,731 |
| Reinforcing steel, footings, #8-#18 | 9960 | lb | 0.47 | 0.18 | | 0.65 | 0.82 | 4,681 | 1,793 | 0 | 6,474 | 8,167 |
| | | | | | | | | | | **Subtotal:** | **19,280** | **22,660** |
| **Column Footings** | | | | | | | | | | | | |
| Normal Weight Concrete, 8,000 psi | 701 | CY | 212.00 | | | 212.00 | 233.00 | 148,612 | 0 | 0 | 148,612 | 163,333 |
| Concrete placement, spread footings, over 5 | 701 | CY | | 13.25 | 5.00 | 18.25 | 27.00 | 0 | 9,288 | 3,505 | 12,793 | 18,927 |
| Reinforcing steel, footings, #8-#18 | 41300 | lb | 0.47 | 0.18 | | 0.65 | 0.82 | 19,411 | 7,434 | 0 | 26,845 | 33,866 |
| | | | | | | | | | | **Subtotal:** | **188,250** | **216,126** |
| **Wall Footings** | | | | | | | | | | | | |
| Normal Weight Concrete, 3,000 psi | 516 | CY | 104.00 | | | 104.00 | 114.00 | 53,664 | 0 | 0 | 53,664 | 58,824 |
| Concrete placement, footings, continuous, sl | 516 | CY | | 13.25 | 5.00 | 18.25 | 27.00 | 0 | 6,837 | 2,580 | 9,417 | 13,932 |
| Reinforcing steel, footings, #4-#7 | 23880 | lb | 0.47 | 0.31 | | 0.78 | 1.05 | 11,224 | 7,403 | 0 | 18,626 | 25,074 |
| | | | | | | | | | | **Subtotal:** | **81,707** | **97,830** |
| **Foundation Walls** | | | | | | | | | | | | |
| Normal Weight Concrete, 4,000 psi | 1506 | CY | 108.00 | | | 108.00 | 119.00 | 162,648 | 0 | 0 | 162,648 | 179,214 |
| Concrete placement, walls, pumped | 1506 | CY | | 14.50 | 0.43 | 14.93 | 24.50 | 0 | 21,837 | 648 | 22,485 | 36,897 |
| Reinforcing steel, walls, #3-#7 | 78520 | lb | 0.47 | 0.22 | | 0.69 | 0.89 | 36,904 | 17,274 | 0 | 54,179 | 69,883 |
| Reinforcing steel, walls, #8-#18 | 158460 | lb | 0.47 | 0.17 | | 0.64 | 0.79 | 74,476 | 26,938 | 0 | 101,414 | 125,183 |
| | | | | | | | | | | **Subtotal:** | **340,726** | **411,177** |
| **Interior Basement Walls** | | | | | | | | | | | | |
| Normal Weight Concrete, 4,000 psi | 102 | CY | 108.00 | | | 108.00 | 119.00 | 11,016 | 0 | 0 | 11,016 | 12,138 |
| Concrete placement, walls, pumped | 102 | CY | | 14.50 | 0.43 | 14.93 | 24.50 | 0 | 1,479 | 44 | 1,523 | 2,499 |
| Reinforcing steel, walls, #3-#7 | 7400 | lb | 0.47 | 0.22 | | 0.69 | 0.89 | 3,478 | 1,628 | 0 | 5,106 | 6,586 |
| CMU Wall, solid, reinforced alternate courses | 11570 | SF | 3.27 | 3.81 | | 7.08 | 9.80 | 37,834 | 44,082 | 0 | 81,916 | 113,386 |
| | | | | | | | | | | **Subtotal:** | **99,560** | **134,609** |
| **Shear Walls** | | | | | | | | | | | | |
| Normal Weight Concrete, 5,000 psi | 709 | CY | 114.00 | | | 114.00 | 125.00 | 80,826 | 0 | 0 | 80,826 | 88,625 |
| Concrete placement, walls, pumped | 709 | CY | | 14.50 | 0.43 | 14.93 | 24.50 | 0 | 10,281 | 305 | 10,585 | 17,371 |
| Reinforcing steel, walls, #3-#7 | 44000 | lb | 0.47 | 0.22 | | 0.69 | 0.89 | 20,680 | 9,680 | 0 | 30,360 | 39,160 |
| Reinforcing steel, walls, #8-#18 | 60520 | lb | 0.47 | 0.17 | | 0.64 | 0.79 | 28,444 | 10,288 | 0 | 38,733 | 47,811 |
| | | | | | | | | | | **Subtotal:** | **160,504** | **192,966** |
| **Columns** | | | | | | | | | | | | |
| Normal Weight Concrete, 5,000 psi | 1093 | CY | 114.00 | | | 114.00 | 125.00 | 124,556 | 0 | 0 | 124,556 | 136,575 |
| Concrete placement, columns, pumped | 1093 | CY | | 21.50 | 8.15 | 29.65 | 44.50 | 0 | 23,491 | 8,905 | 32,396 | 48,621 |
| Reinforcing steel, columns, #3-#7 | 54422 | lb | 0.47 | 0.44 | | 0.91 | 1.26 | 25,578 | 23,946 | 0 | 49,524 | 68,572 |
| Reinforcing steel, columns, #8-#18 | 261446 | lb | 0.47 | 0.29 | | 0.76 | 1.00 | 122,880 | 75,819 | 0 | 198,699 | 261,446 |
| | | | | | | | | | | **Subtotal:** | **405,175** | **515,213** |
| **Elevated Slabs** | | | | | | | | | | | | |
| Normal Weight Concrete, 3,000 psi | 6836 | CY | 104.00 | | | 104.00 | 114.00 | 710,944 | 0 | 0 | 710,944 | 779,304 |
| Concrete placement, slabs over 10" thick, pu | 6836 | CY | | 11.05 | 4.17 | 15.22 | 22.50 | 0 | 75,538 | 28,506 | 104,044 | 153,810 |
| Reinforcing steel, elevated slabs, #4-#7 | 578540 | lb | 0.49 | 0.23 | | 0.72 | 0.93 | 283,485 | 133,064 | 0 | 416,549 | 538,042 |
| Reinforcing steel, elevated slabs, #8-#18 | 149380 | lb | 0.47 | 0.29 | | 0.76 | 1.00 | 70,209 | 43,320 | 0 | 113,529 | 149,380 |
| | | | | | | | | | | **Subtotal:** | **1,345,066** | **1,620,536** |

| Total Material | Total Labor | Total Equip. | Total | Total (O&P) |
|---|---|---|---|---|
| $2,240,986 | $598,658 | $48,865 | **$4,431,953** | **$5,396,755** |

*Assuming area well wall reinforcement is similar to typical foundation wall
*Assuming all foundation walls are 34'-0" due to conflicts in structural and architectural drawings
*Assuming typical dowel length of 4'-0"
*Assuming similar elevated slabs aside from deduction for atrium space
*Assuming all concrete is pumped
*All unit-cost data referenced from R.S. Means Facilities Construction Cost Data 2007, 22nd Annual Edition

# General Conditions Cost Estimate

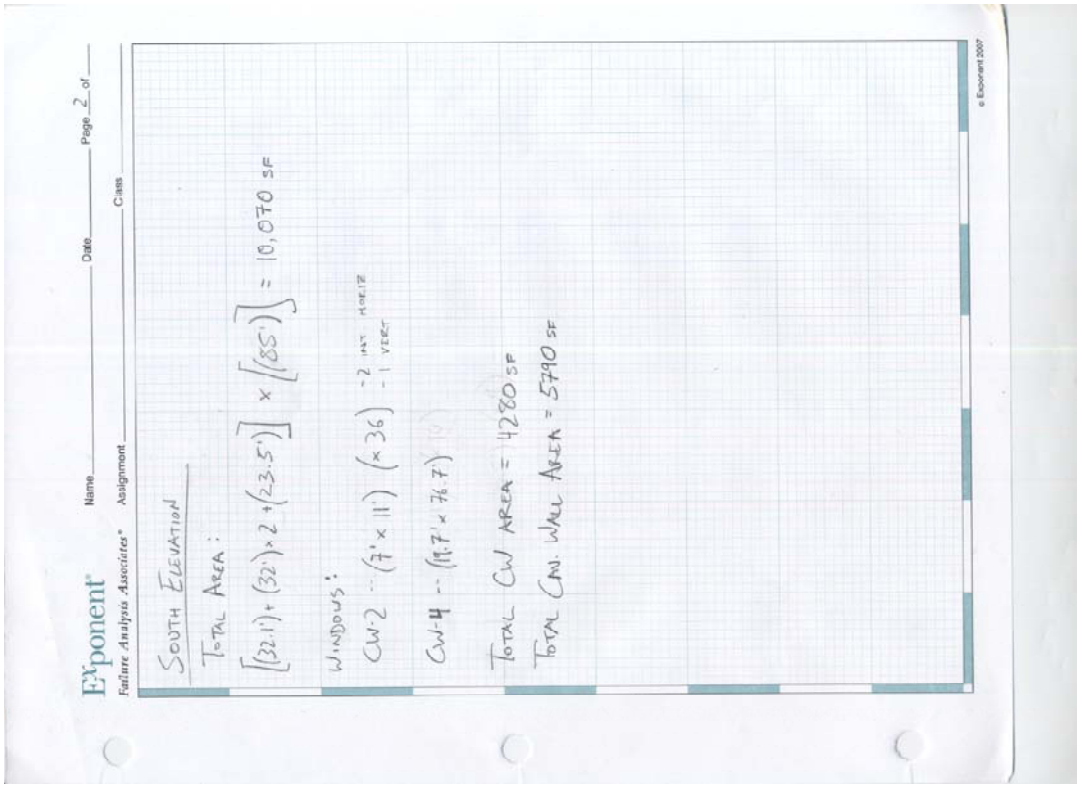
The Wilmer Eye Institute Outpatient Surgery & Laboratory Building

Quick Building Stats: $65M Cost of Construction
7 Storeys, 202,000 SF

| Category | Description | $/Unit | Unit | Qty. | Total |
|---|---|---|---|---|---|
| Personnel | Project Executive | 10000 | mo | 2 | $20,000 |
| | Senior Project Manager | 8333 | mo | 31 | $258,323 |
| | Shell/Core PM | 7500 | mo | 17 | $127,500 |
| | Finishes PM | 7500 | mo | 14 | $105,000 |
| | MEP Manager | 7500 | mo | 15 | $112,500 |
| | Labs/OR Manager | 7500 | mo | 14 | $105,000 |
| | Senior Superintendent | 7500 | mo | 15 | $112,500 |
| | Superintendent | 7100 | mo | 31 | $220,100 |
| | Asst. Superintendent | 6250 | mo | 31 | $193,750 |
| | Project Engineer | 5500 | mo | 17 | $93,500 |
| | Project Engineer | 5500 | mo | 14 | $77,000 |
| Office Supplies | General | 95 | mo | 31 | $2,945 |
| | Office Elec./HVAC | 110 | mo | 31 | $3,410 |
| | Phone Bills | 210 | mo | 31 | $6,510 |
| Temporary Offices | Trailer Rental | 700 | mo | 31 | $21,700 |
| Temporary Utilities | Water | 62 | mo | 31 | $1,922 |
| | Electric | 75 | mo | 31 | $2,325 |
| | Lighting | 15 | CSF | 202 | $3,030 |
| | Heating | 390 | mo | 6 | $2,340 |
| Trash Disposal | Dumpsters | 690 | wk | 140 | $96,600 |
| | Trash Chutes | 55 | LF | 80 | $4,400 |
| Temporary Facilities | Toilet | 685 | mo | 31 | $21,235 |
| Temporary Fencing | Chain link, 11 ga, 6' high | 7.15 | LF | 1120 | $8,008 |
| Signage | | 16.55 | SF | 20 | $331 |
| Scaffold Bridge | Catwalk, 10' span | 190 | ea | 1 | $190 |
| Surveying | | 1200 | LS | 1 | $1,200 |
| Temporary Building Enclosure | Framing over openings | 1 | SF | 63240 | $63,240 |
| Photographic Documentation | Photographs | 450 | set | 2 | $900 |
| | Cameraman/Film | 1375 | visit | 2 | $2,750 |
| Scheduling | CPM Scheduling | 15000 | LS | 1 | $15,000 |
| Construction Clean-up | | 115000 | LS | 1 | $115,000 |
| Man/Material Hoist | | 6000 | LS | 1 | $6,000 |
| Miscellaneous/Unforseen | | 6,000 | LS | 1 | $6,000 |
| | | | | Total: | $1,810,209 |

insert site plan here

**Exterior Enclosures Estimate Calculations**



Exponent
Failure Analysis Associates
Name
Date
Page 2 of
Assignment
Class

SOUTH ELEVATION

TOTAL AREA:

$[(32.1')+(32')\times 2+(23.5')] \times [(85')] = 10,070$ SF

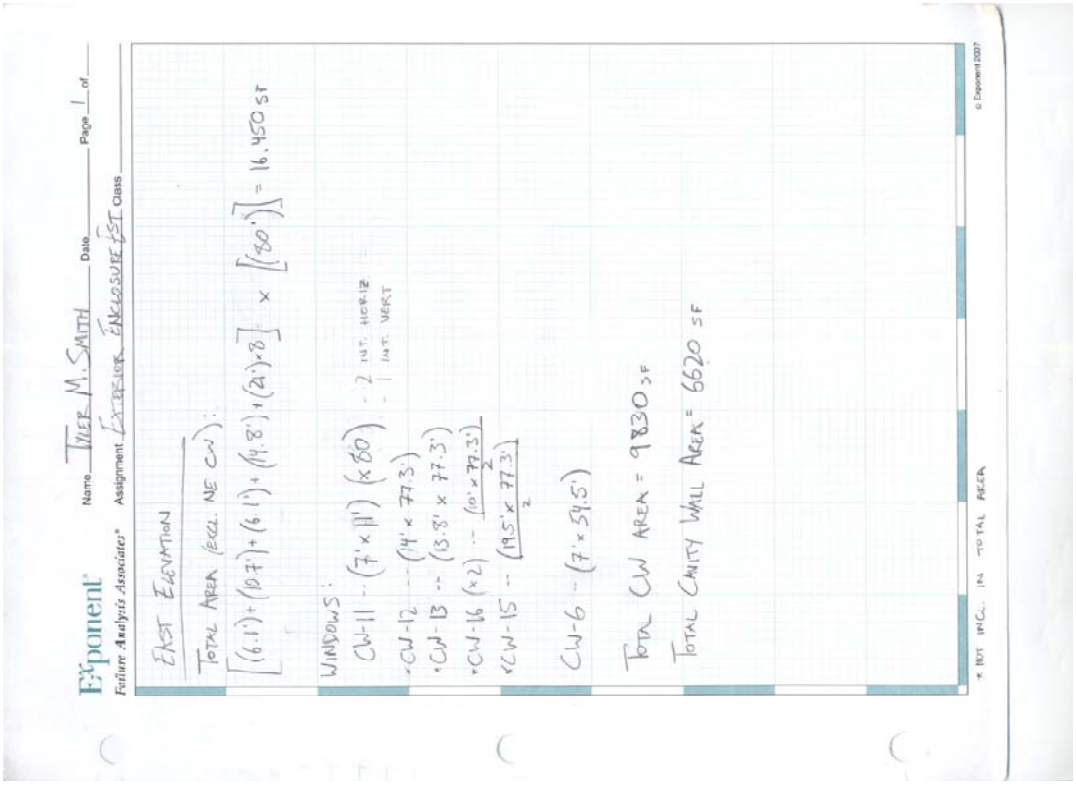
WINDOWS:

CW-2 -- $(7' \times 11') (\times 36)$ - 2 INT. HORIZ - 1 VERT

CW-4 -- $(19.7' \times 7.7')$

TOTAL CW AREA = 4280 SF

TOTAL CNU. WALL AREA = 5790 SF



Exponent
Failure Analysis Associates
Name TYLER M. SMITH
Date
Page 1 of
Assignment EXTERIOR ENCLOSURE EST
Class

EAST ELEVATION

TOTAL AREA (EXCL. NE CW):

$[(6.1')+(10.7')+(6.1')+(14.8')+(2')\times 8] \times [(80')] = 16,450$ SF

WINDOWS:

CW-11 - $(7' \times 11') (\times 80)$ - 2 INT. HORIZ - 1 INT. VERT

-CW-12 -- $(14' \times 7.7')$

-CW-13 -- $(13.8' \times 7.7')$

-CW-16 $(\times 2)$ -- $\frac{(10' \times 7.7')}{2}$

-CW-15 -- $\frac{(19.5' \times 7.7')}{2}$

CW-6 -- $(7' \times 54.5')$

TOTAL CW AREA = 9830 SF

TOTAL CNUTY WALL AREA = 6620 SF

* NOT INCL. IN TOTAL AREA

Exponent
Failure Analysis Associates®
Name _____ Date _____ Page 3 of _____
Assignment _____ Class _____

## WEST ELEVATION

TOTAL AREA:

$[(12.5') + (20.5') + (21') \times 8 + (14.8') + (6.1') + (10.7') + (6.1')] \times [(85')] = 20290$ SF

WINDOWS/LOUVERS:

CW-11 -- (7' x 11') (x 20)
CW-3 -- (13.5' x 8.5') (x 5)
CW-3 -- (7' x 11') (x 10)
CW-1 -- (10.5' x 10.5') (x 5)

TOTAL CW AREA = 3435 SF
TOTAL CAV. WALL AREA = 16,855 SF



Exponent
Failure Analysis Associates®
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Assignment _____ Class _____

## NORTH ELEVATION

TOTAL AREA (EXCL. NE CW):

$[(105')(48.2') + (21.5')(92') + (42')(82')] = 10,480$ SF

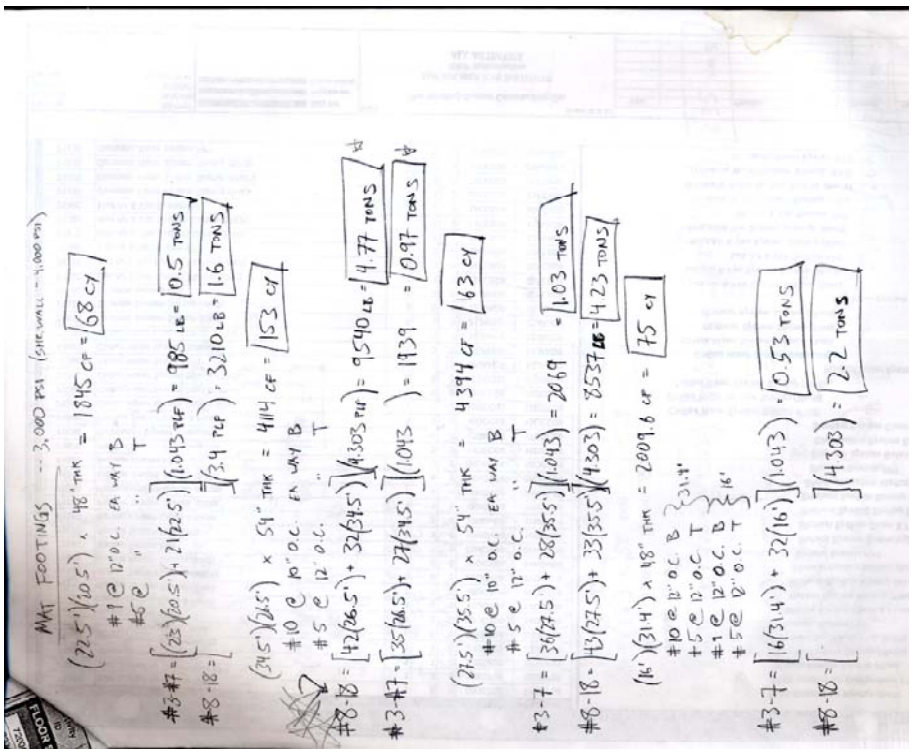
WINDOWS:

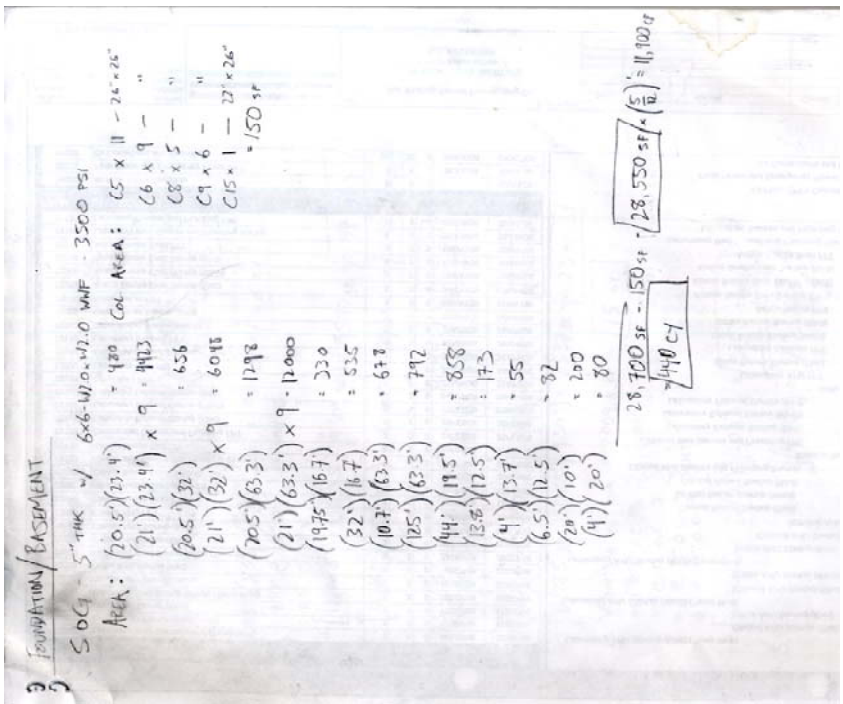
CW-9 -- (7.3' x 14.8')
CW-10 -- (7.3' x 54.7')
CW-7 -- (7.2' x 10.7') (x2)

CW-8 -- (19.7' x 74.7')
CW-14 -- (10' x 77.3')

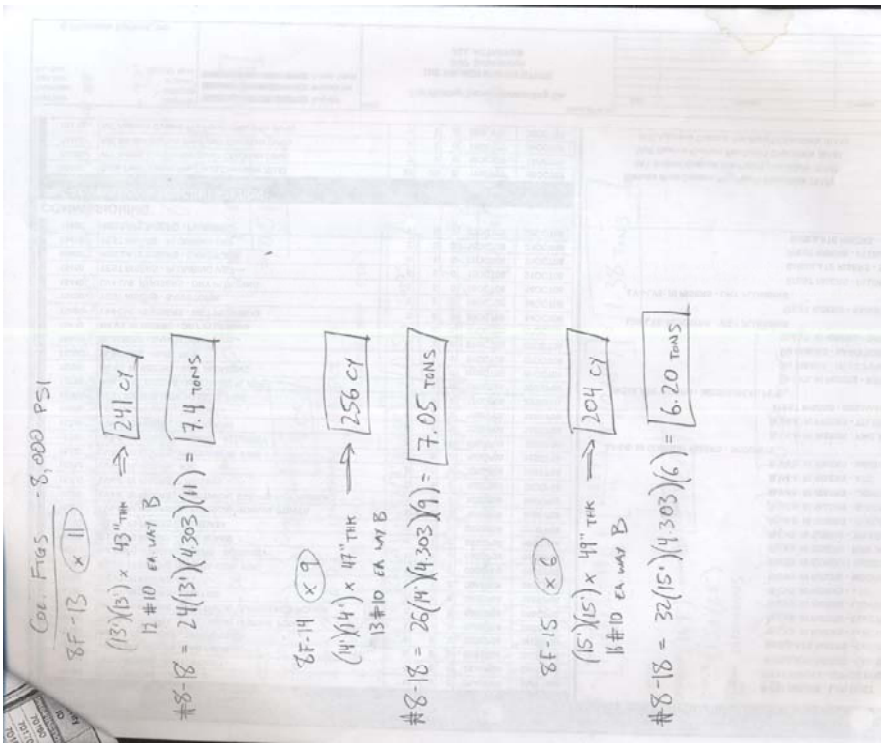
TOTAL CW AREA = 2910 SF
TOTAL CAV. WALL AREA = 7570 SF

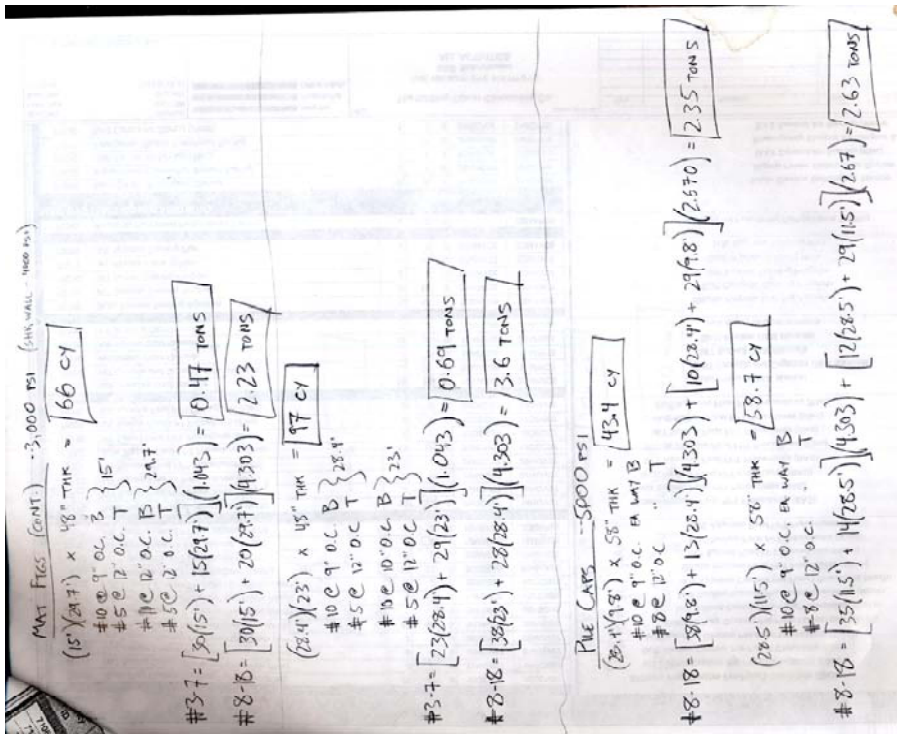
**Structural Estimate Calculations**



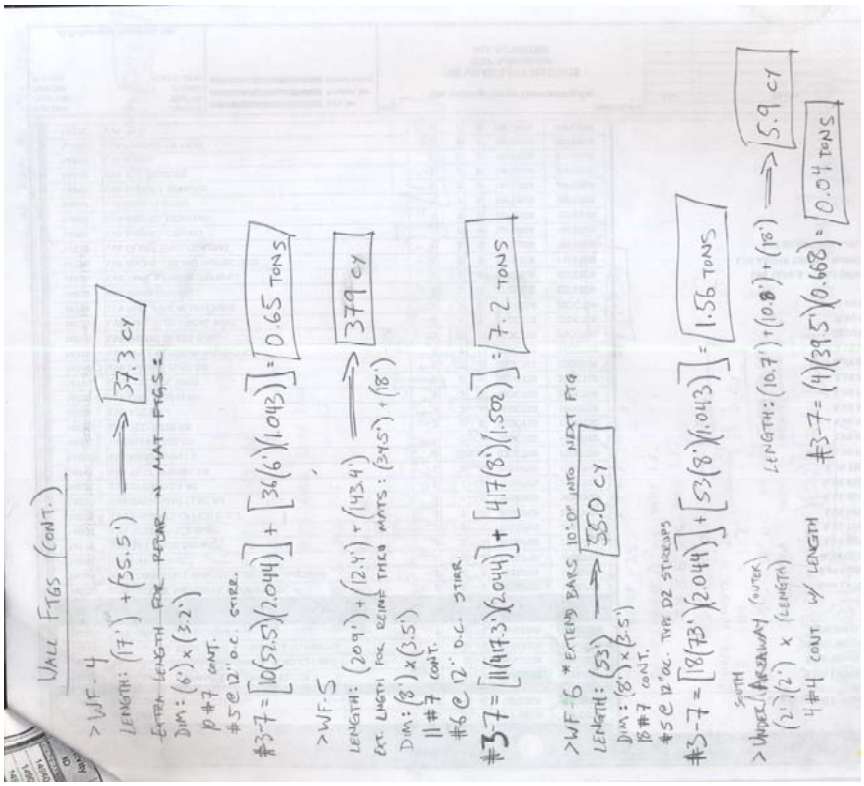



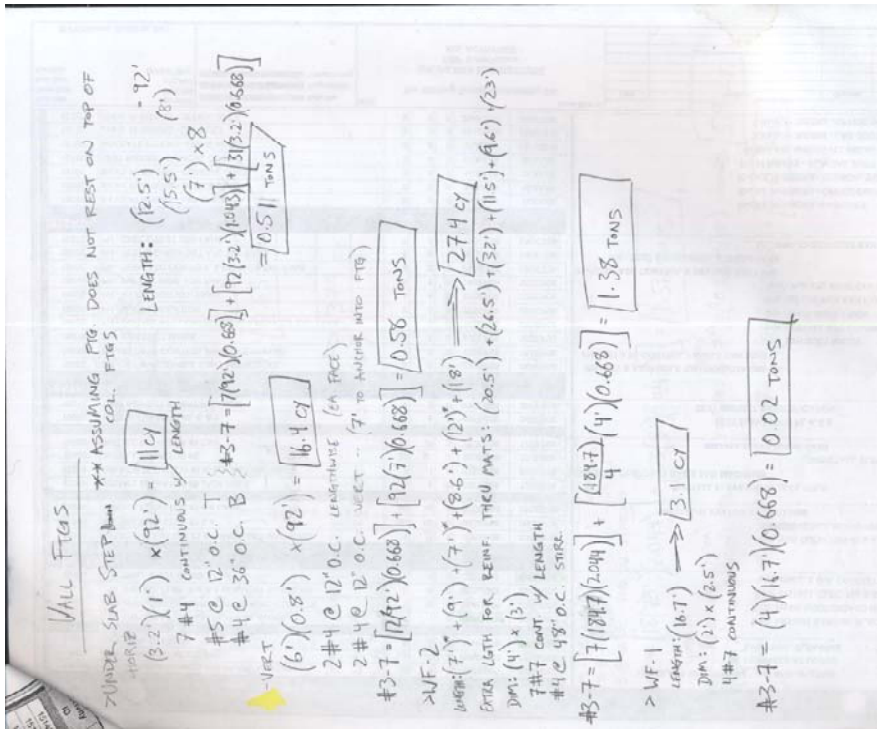
**Structural Estimate Calculations**



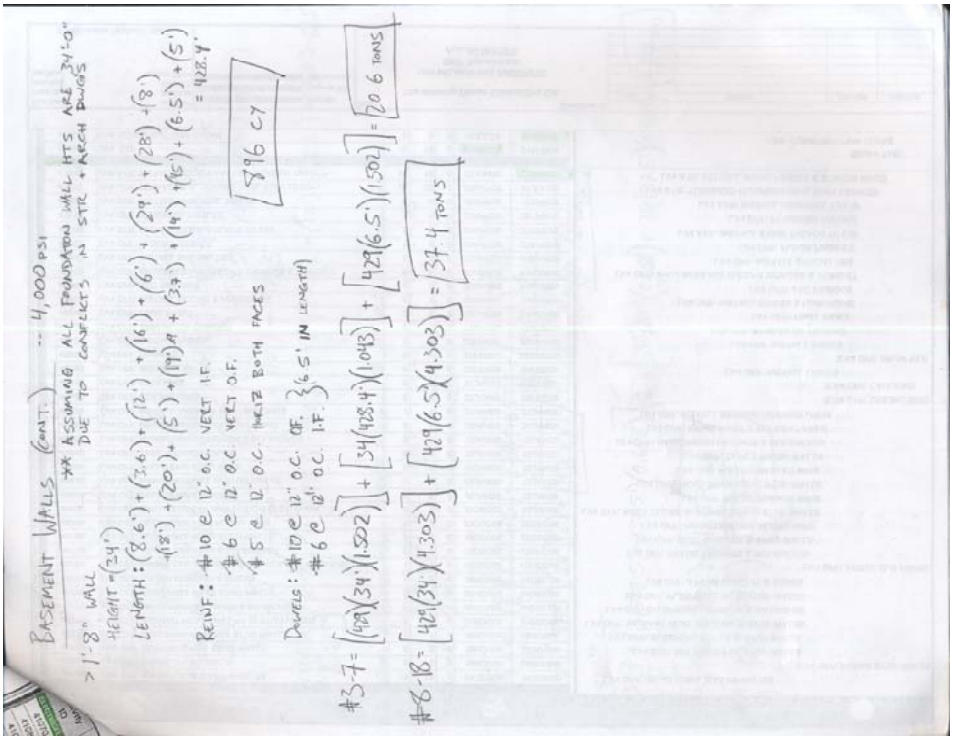



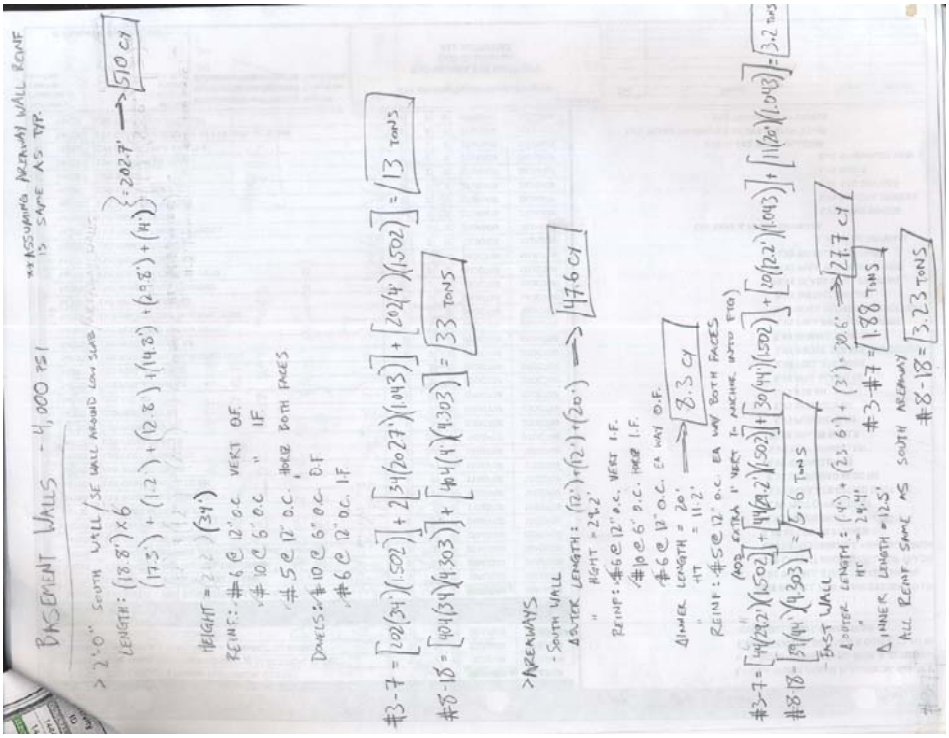
**Structural Estimate Calculations**

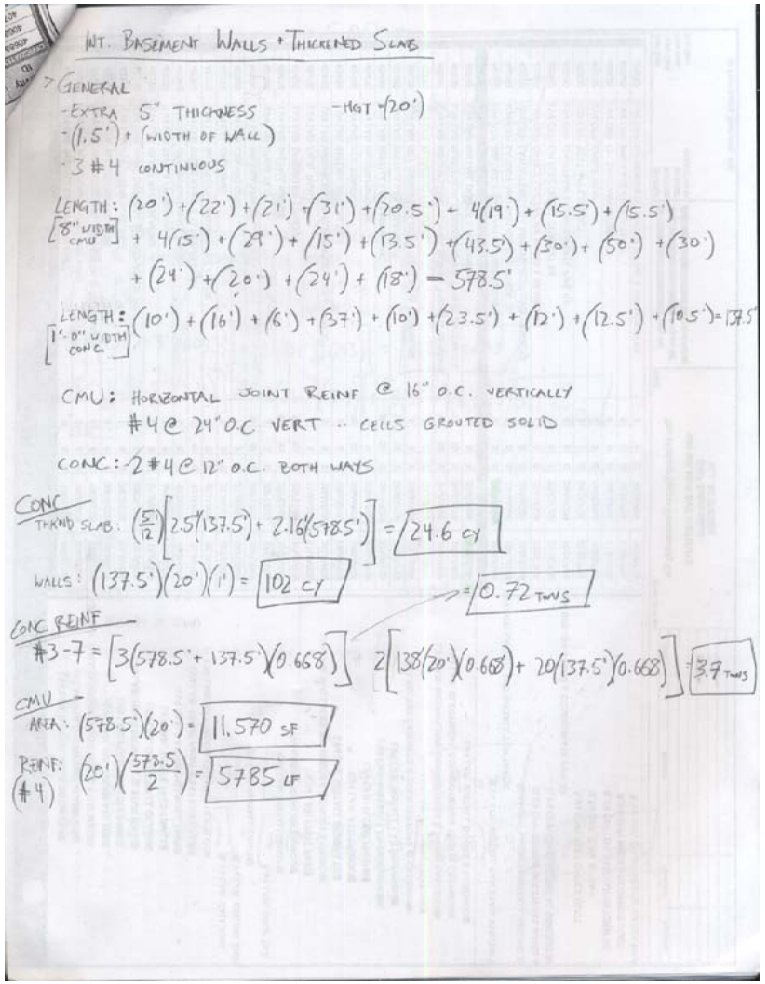


**Structural Estimate Calculations**





WT. BASEMENT WALLS + THICKENED SLAB

GENERAL
- EXTRA 5" THICKNESS — HGT (20')
- (1.5') + (WIDTH OF WALL)
- 3 #4 CONTINUOUS

LENGTH: (20') + (22') + (21') + (31') + (20.5') + 4(19') + (15.5') + (15.5')
[8" WIDTH CMU] + 4(15') + (29') + (15') + (13.5') + (43.5') + (30') + (50') + (30')
+ (24') + (20') + (24') + (18') = 578.5'

[LENGTH: 1'-8" WIDTH CONC.] (10') + (16') + (6') + (37') + (10') + (23.5') + (12') + (12.5') + (10.5') = 137.5'

CMU: HORIZONTAL JOINT REINF @ 16" O.C. VERTICALLY
#4 @ 24" O.C VERT .. CELLS GROUTED SOLID

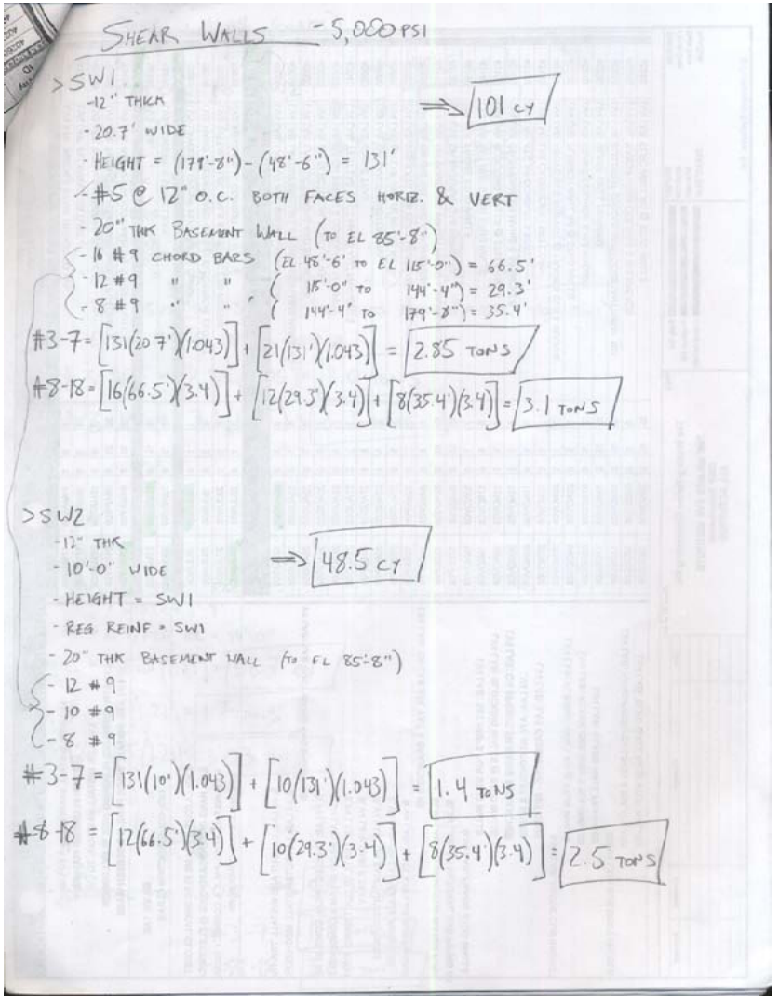
CONC: 2 #4 @ 12" O.C. BOTH WAYS

CONC
THKND SLAB: $\left(\frac{5'}{12}\right)\left[2.5'(137.5') + 2.16'(578.5')\right] =$ 24.6 CY

WALLS: (137.5')(20')(1') = 102 CY

CONC REINF
#3-7 = [3(578.5' + 137.5')(0.668)] = 0.72 TONS
2[138(20')(0.668) + 20(137.5')(0.668)] = 37 TONS

CMU
AREA: (578.5')(20') = 11,570 SF
REINF (#4): (20')(578.5'/2) = 5785 LF



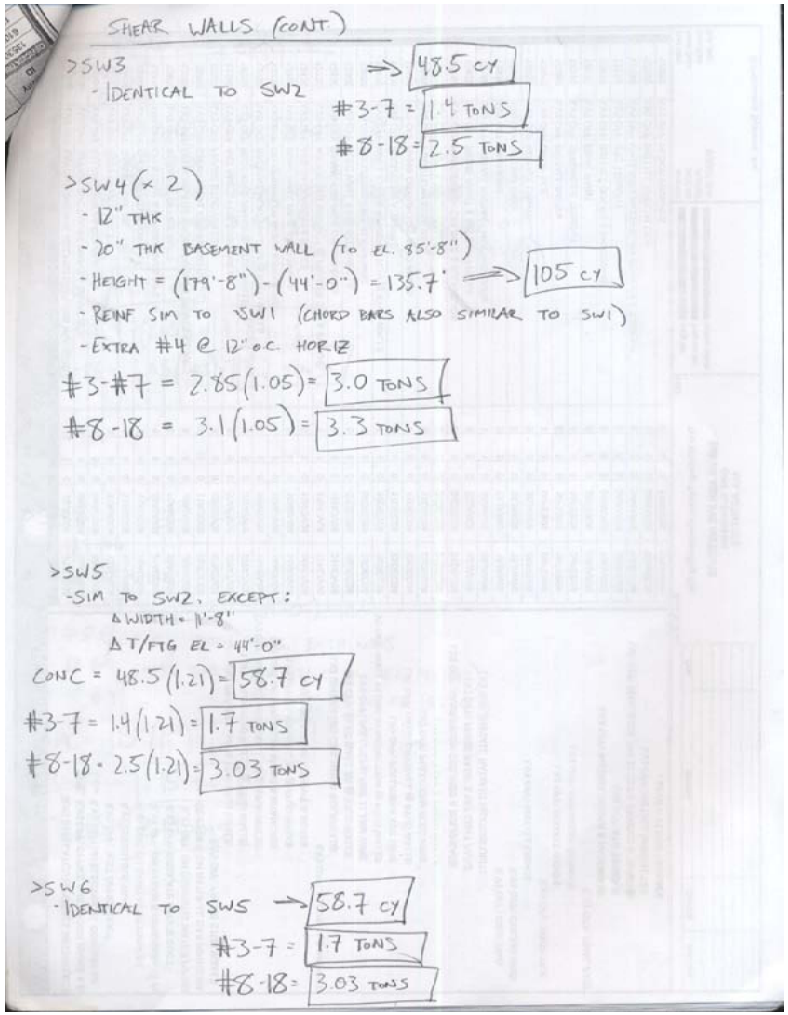
SHEAR WALLS - 5,000 PSI

> SW1
- 12" THICK ⇒ 101 CY
- 20.7' WIDE
- HEIGHT = (179'-8") - (48'-6") = 131'
- #5 @ 12" O.C. BOTH FACES HORIZ. & VERT
- 20" THK BASEMENT WALL (TO EL 85'-8")
- 16 #9 CHORD BARS (EL 48'-6" TO EL 115'-0") = 66.5'
- 12 #9 " " { 115'-0" TO 144'-4" = 29.3'
- 8 #9 " " { 144'-4" TO 179'-8" = 35.4'

#3-7 = [131(20.7')(1.043)] + [21(131')(1.043)] = 2.85 TONS
#8-18 = [16(66.5')(3.4)] + [12(29.3')(3.4)] + [8(35.4')(3.4)] = 3.1 TONS

> SW2
- 12" THK
- 10'-0" WIDE ⇒ 48.5 CY
- HEIGHT = SW1
- REG REINF = SW1
- 20" THK BASEMENT WALL (TO EL 85'-8")
- 12 #9
- 10 #9
- 8 #9

#3-7 = [131(10')(1.043)] + [10(131')(1.043)] = 1.4 TONS
#8-18 = [12(66.5')(3.4)] + [10(29.3')(3.4)] + [8(35.4')(3.4)] = 2.5 TONS



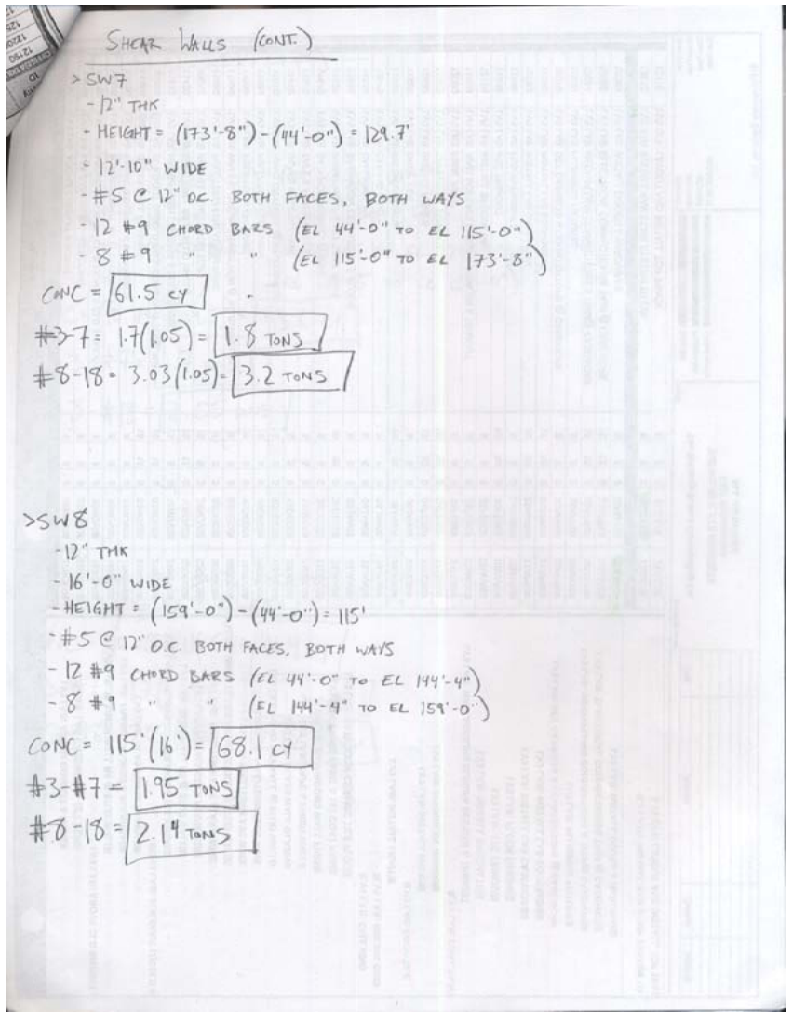
SHEAR WALLS (CONT.)

>SW3
- IDENTICAL TO SW2 → 48.5 CY
#3-7 = 1.4 TONS
#8-18 = 2.5 TONS

>SW4 (x 2)
- 12" THK
- 20" THK BASEMENT WALL (TO EL. 85'-8")
- HEIGHT = (179'-8") - (44'-0") = 135.7' → 105 CY
- REINF SIM TO SW1 (CHORD BARS ALSO SIMILAR TO SW1)
- EXTRA #4 @ 12" O.C. HORIZ
#3-#7 = 2.85(1.05) = 3.0 TONS
#8-18 = 3.1(1.05) = 3.3 TONS

>SW5
- SIM TO SW2, EXCEPT:
  Δ WIDTH = 11'-8"
  Δ T/FTG EL = 44'-0"
CONC = 48.5(1.21) = 58.7 CY
#3-7 = 1.4(1.21) = 1.7 TONS
#8-18 = 2.5(1.21) = 3.03 TONS

>SW6
- IDENTICAL TO SW5 → 58.7 CY
#3-7 = 1.7 TONS
#8-18 = 3.03 TONS

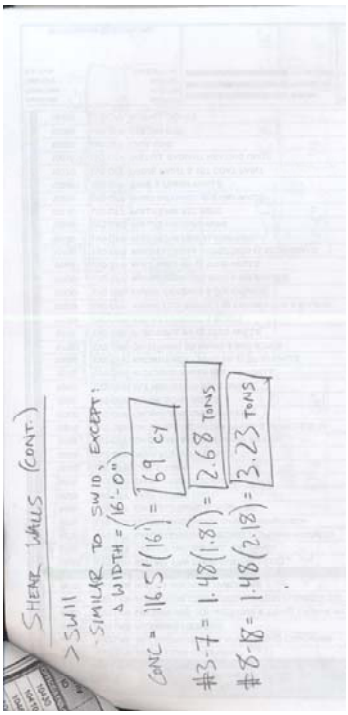


SHEAR WALLS (CONT.)

>SW7
- 12" THK
- HEIGHT = (173'-8") - (44'-0") = 129.7'
- 12'-10" WIDE
- #5 @ 12" OC BOTH FACES, BOTH WAYS
- 12 #9 CHORD BARS (EL 44'-0" TO EL 115'-0")
- 8 #9 " " (EL 115'-0" TO EL 173'-8")
CONC = 61.5 CY
#3-7 = 1.7(1.05) = 1.8 TONS
#8-18 = 3.03(1.05) = 3.2 TONS

>SW8
- 12" THK
- 16'-0" WIDE
- HEIGHT = (159'-0") - (44'-0") = 115'
- #5 @ 12" O.C. BOTH FACES, BOTH WAYS
- 12 #9 CHORD BARS (EL 44'-0" TO EL 144'-4")
- 8 #9 " " (EL 144'-4" TO EL 159'-0")
CONC = 115'(16') = 68.1 CY
#3-#7 = 1.95 TONS
#8-18 = 2.14 TONS

**Structural Estimate Calculations**

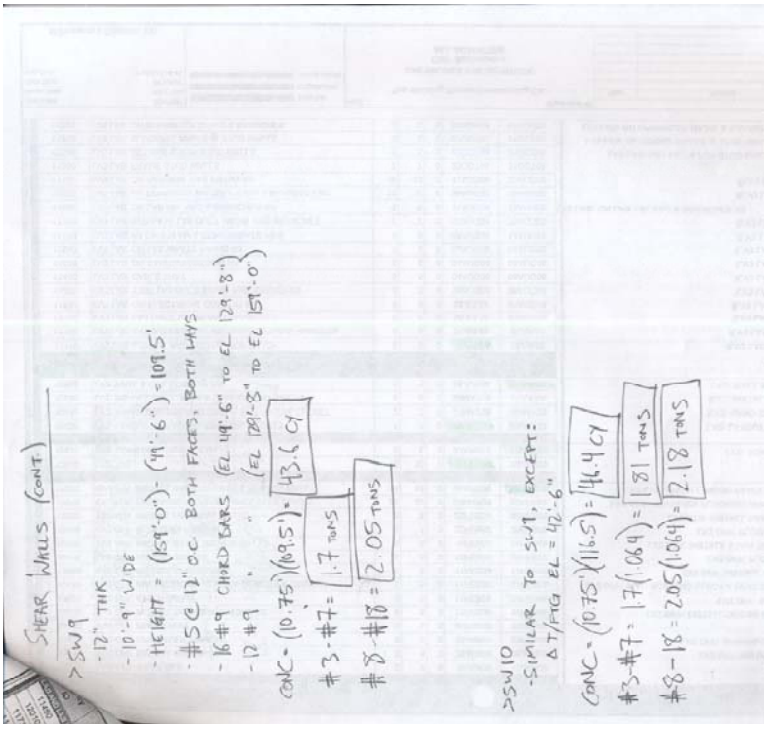

SHEAR WALLS (CONT.)

>SW11
-SIMILAR TO SW10, EXCEPT:
Δ WIDTH = (16'-0")

CONC = 116.5'(16') = 69 CY

#3-7 = 1.48(1.81) = 2.68 TONS

#8-18 = 1.48(2.18) = 3.23 TONS


SHEAR WALLS (CONT)

>SW9
-12" THK
-10'-9" WIDE
-HEIGHT = (159'-0") - (141'-6") = 109.5'
-#5 @ 12" OC BOTH FACES, BOTH WAYS
-16 #9 CHORD BARS (EL 141'-6" TO EL 129'-8")
-12 #9 " (EL 129'-8" TO EL 151'-0")

CONC = (10.75')(69.5') = 43.6 CY

#3-#7 = 1.7 TONS

#8-#18 = 12.05 TONS

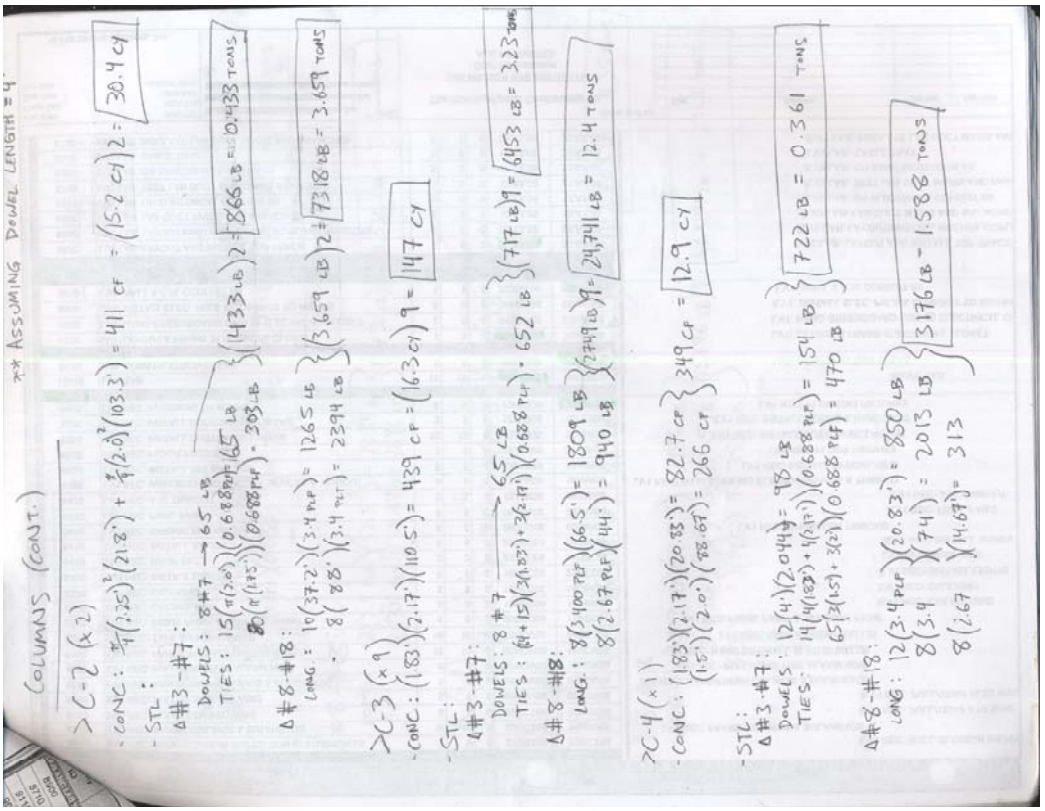
>SW10
-SIMILAR TO SW9, EXCEPT:
Δ T/FTG EL = 42'-6"

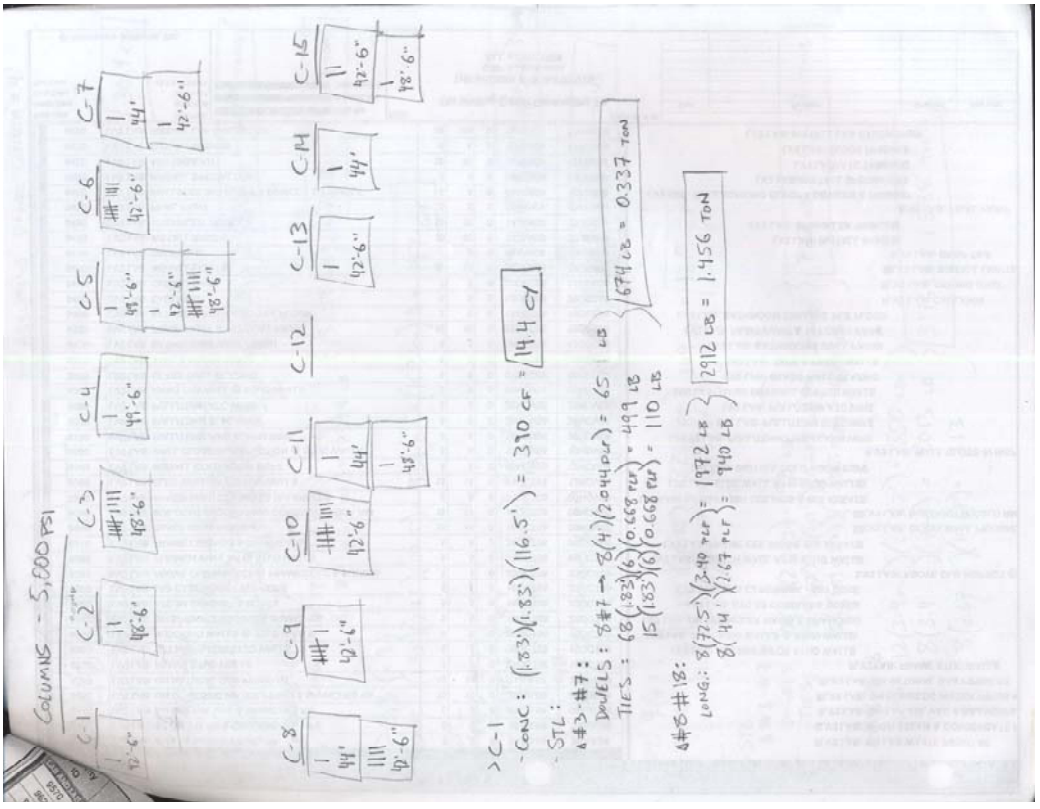
CONC = (10.75')(116.5') = 44.4 CY

#3-#7 = 1.7(1.064) = 1.81 TONS

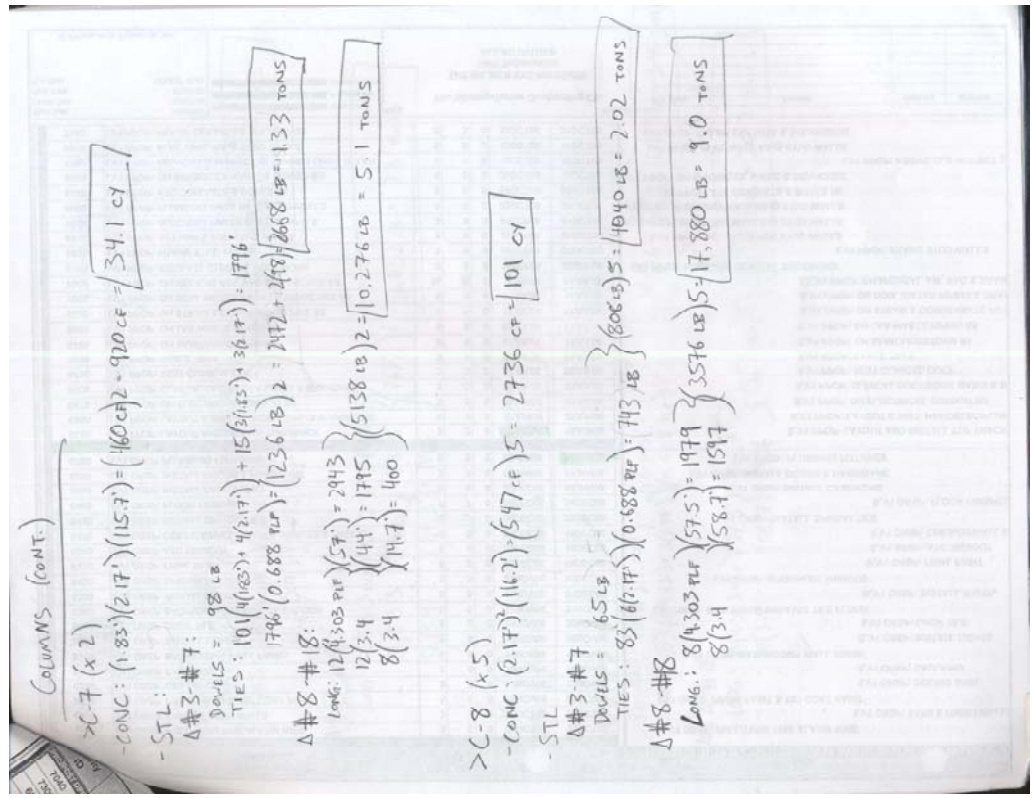
#8-18 = 2.05(1.064) = 2.18 TONS

**Structural Estimate Calculations**





**Structural Estimate Calculations**


COLUMNS (CONT.)

>C-7 (x 2)

-CONC: (1.83')(2.17')(15.7') = (160 CF)2 = 320 CF = 34.1 CY

- STL:

Δ #3-#7:

DOWELS = 98 LB

TIES: 10 [4(1.83') + 4(2.17') + 15(3.67') + 36 LF] = 1796'

1796'(0.688 PLF) = (1236 LB)2 = 2472 LB = 2668 LB = 1.33 TONS

Δ #8-#18:

LONG: 12(4.303 PLF)(57') = 2943

12(3.4) (44') = 1795

8(3.4) (14.7') = 400

(5138 LB)2 = 10,276 LB = 5.1 TONS

>C-8 (x 5)

-CONC (2.17')(116.2')(547 CF)5 = 2736 CF = 101 CY

- STL

Δ #3-#7

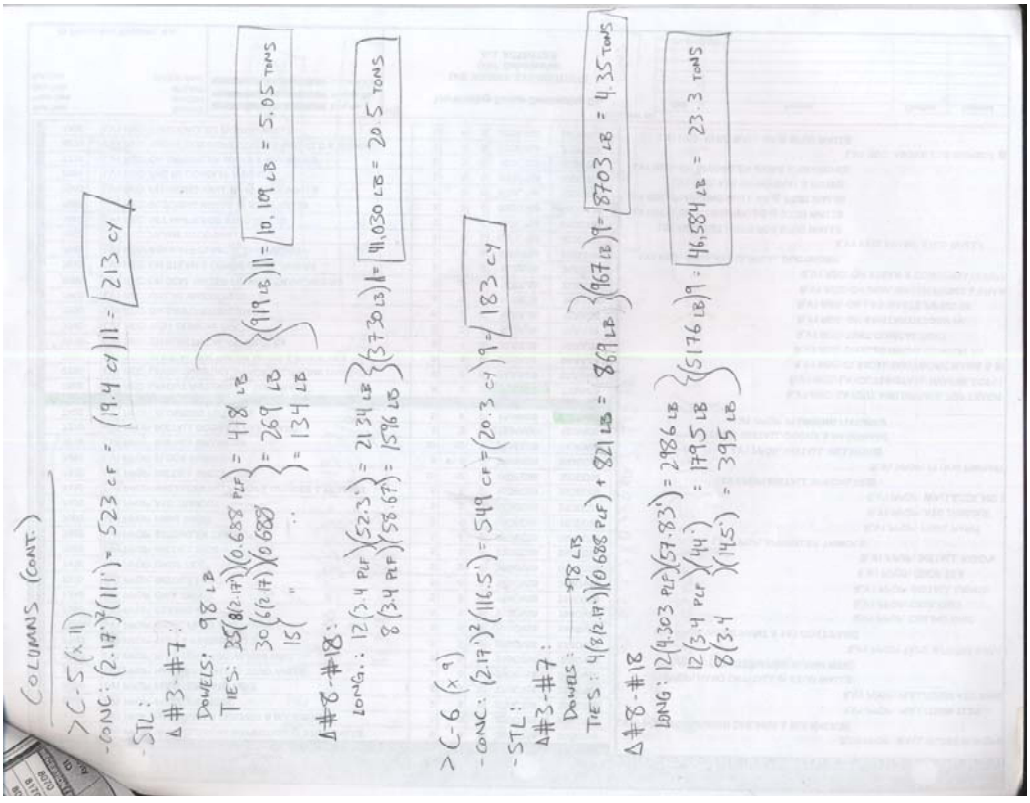
DOWELS = 65 LB

TIES: 83 (61.7') (0.688 PLF) = 743 LB (806 LB)5 = 4040 LB = 2.02 TONS

Δ #8-#18

LONG.: 8(4.303 PLF)(57.5') = 1979

8(3.4) (58.7') = 1597 (3576 LB)5 = 17,880 LB = 9.0 TONS


COLUMNS (CONT.)

>C-5 (x 11)

-CONC: (2.17')²(111') = 523 CF = (19.4 CY)11 = 213 CY

- STL:

Δ #3-#7:

DOWELS: 98 LB

TIES: 25 (8(2.17')) (0.688 PLF) = 418 LB

30 (6(2.17')) (0.688) = 269 LB

15 " " = 134 LB

(819 LB)11 = 10,109 LB = 5.05 TONS

Δ #8-#18:

LONG.: 12(3.4 PLF)(52.3') = 2134 LB

8(3.4 PLF)(58.6') = 1596 LB

(3730 LB)11 = 41,030 LB = 20.5 TONS

>C-6 (x 9)

-CONC: (2.17')²(116.5') = 549 CF = (20.3 CY)9 = 183 CY

- STL:

Δ #3-#7:

DOWELS: ——— 978 LB

TIES: 4(8(2.17')) (0.688 PLF) + 821 LB = 869 LB (967 LB)9 = 8703 LB = 4.35 TONS

Δ #8-#18

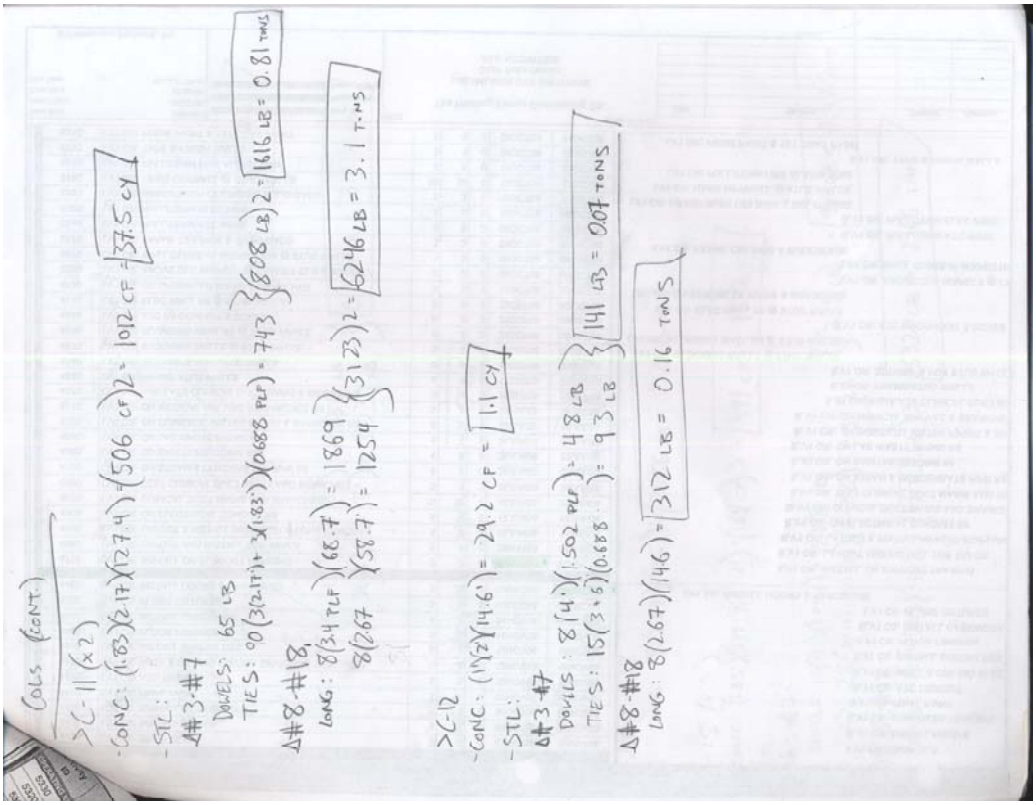
LONG: 12(4.303 PLF)(57.83') = 2986 LB

12(3.4 PLF)(44') = 1795 LB

8(3.4) (14.5') = 395 LB

(5176 LB)9 = 46,584 LB = 23.3 TONS

**Structural Estimate Calculations**


COLS (CONT.)

>C-11 (x2)

-CONC: (1.83)(2.17)(27.4') = (506 CF)2 = 1012 CF = 37.5 CY

-STL:

#3-#7

DOWELS: 65 LB

TIES: 90 (3'(2.17') + 2(1.83')) (0.688 PLF) = 743 (808 LB) 2 = 1616 LB = 0.81 TONS

#8-#18

LONG: 8 (3.4 PLF) (68.7') = 1869 (3.173) 2 = 6246 LB = 3.1 TONS

8 (2.67) (58.7') = 1254

>C-12

-CONC: (1.42)(14.6') = 29.2 CF = 1.1 CY

-STL:

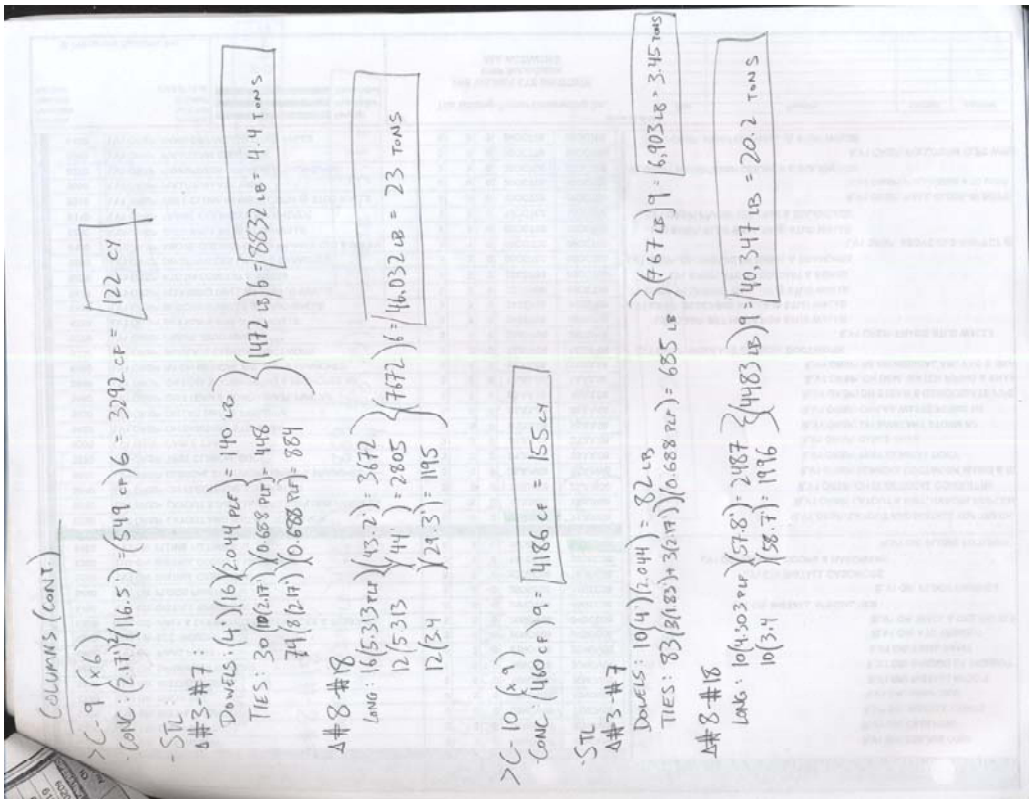
#3-#7

DOWELS: 8 (4') (1.502 PLF) = 48 LB

TIES: 15 (3'+5') (0.688) = 93 LB (141 LB = 007 TONS)

#8-#18

LONG: 8 (2.67) (14.6') = 312 LB = 0.16 TONS


COLUMNS (CONT.)

>C-9 (x6)

-CONC: (2.17')(116.5') = (549 CF)6 = 3292 CF = 122 CY

-STL:

#3-#7:

DOWELS: (4')(16)(2.044 PLF) = 140 LB

TIES: 30 (10(2.17') (0.688 PLF) = 448

74 (8(2.17') (0.688 PLF) = 884

(1472 LB)6 = 8832 LB = 4.4 TONS

#8-#18

LONG: 16 (5.313 PLF) (43.2') = 3672

12 (5.313) (44') = 2805

12 (3.4) (21.3') = 1195

(7672)6 = 46,032 LB = 23 TONS

>C-10 (x9)

CONC: (460 CF)9 = 4186 CF = 155 CY

-STL

#3-#7

DOWELS: 10(4)(2.044) = 82 LB

TIES: 83 (8(1.83') + 3(2.17')) (0.688 PLF) = 685 LB (467 LB)9 = 6,903 LB = 3.45 TONS

#8-#18

LONG: 10 (4.303 PLF) (57.8') = 2487 (4483 LB)9 = 40,347 LB = 20.2 TONS

10 (3.4) (58.7') = 1996

**Structural Estimate Calculations**