7700 ARLINGTON BLVD.
FALLS CHURCH, VA

TECHNICAL ASSIGNMENT II

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CONSTRUCTION MANAGEMENT

2012 CAPSTONE PROJECT

ADVISOR: CRAIG DUBLER

SUBMITTED: 10/19/2011

Executive Summary

Technical Assignment Two is intended to analyze the key features of 7700 Arlington Blvd. that affect project execution. The project is made up of three existing structures, the Northwest, Southwest, and Main building, that have a total square footage of 684,651. The Northwest and Southwest buildings are four stories tall and the Main building is two stories tall. This project overall incorporates a variety of complex systems in order to comply with BRAC BP 198. The largest challenge for this project is to complete the job on time and under budget. Raytheon, the prior tenants, will be occupying the structure for the beginning construction mobilization while DHHQ, the future tenants, will be occupying two out of the three buildings during the second phase of construction.

The project is scheduled for completion in May 2012 with initial mobilization in October 2010. For information regarding the construction phasing sequence, refer to the ***detailed project schedule*** section in the following pages. A detailed project schedule was developed in order to show the breakdown of different trades throughout construction as well as show the critical phases. A ***detailed estimate*** was performed for the progressive collapse steel system since it is was one of the main structural systems being implemented into the renovation. Segment A & B were estimated at $589,407.73 and Segment C was estimated at $364,277.09, which gives a grand total estimate at $953,684.82 for the progressive collapse steel system. Due to detailed structural construction documents, the detailed estimate was within 0.3% of the actual cost for the system. The ***general conditions***, provided by Davis Construction, were broken down into five different categories; personnel, jobsite operations, safety, clean up, & health, permits, insurance, & bonds, and punch list & close out. $3,293,004.80 was the total general conditions estimate for 7700 Arlington Blvd. which equates to about 6.25% of the total construction cost.

A ***LEED Scorecard*** was completed in order to analyze the results and appropriateness to 7700 Arlington Blvd. The project will be obtaining LEED Silver for Commercial Interiors, but since the tenant information was not released all assumptions were made for this section of the report. Lastly, the ***building information modeling use evaluation*** section summarizes the different BIM implementations and processes for 7700 Arlington Bvld. Three different charts were developed in order to perform a critical evaluation on the five BIM uses used on this project.

Overall, the findings of this technical assignment and the first technical assignment propose interesting opportunities for future thesis research. Looking at how to reduce the amount of time and money through the use of different software programs could potentially be one area of research. Another interesting focus that has resulted from these technical assignments has been how to incorporate LEED and BIM into a project successfully.

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Detailed Project Schedule

Reference Appendix A for the Detailed Project Schedule

The project was awarded to James G. Davis Construction Corporation on July 12, 2010 after about six months of evaluating the SFO responses. SFO stands for solicitation from offer which is where an agency, in this case DHHQ, posts all their requirements for a space they would like to occupy. It is a public posting where different property owners will send in a bid that attempts to meet their requirements and costs. Three months later Davis Construction was able to mobilize on the construction site.

Since there are three buildings on this jobsite a lot of coordination had to be done in order to figure out the correct sequence for the job. The 2-phase construction sequence, shown below, was developed because Raytheon would still be occupying the space during construction and DHHQ would be moving into the space as construction is finishing up.

Figure 1 | 2-phase Construction Sequence

The preconstruction for this job was broken down into the major components due to the complexity of the existing structure and the fact that no one was allowed into the building until Raytheon moved out. The designer, contractor, and subcontractor for each main component communicated to make the design as efficient and as cheap as possible since the budget for the renovation was not as much as everyone would have liked it to be. The first phase which is to include the Northwest building and Main building is to begin November 2010 and end July 2011. The second phase which is to include the Annex (or Southwest) building is to begin January 2011 and end May 2012. The sequence within each phase begins with Raytheon vacating the building, followed by the demolition, structure, façade/roof, building core/shell infrastructure, elevators, and tenant work. There will also be site improvements that will take about four months to complete. Refer to Appendix A for the Detailed Project Schedule.

Table 1 below is a detailed schedule breakdown for final completion and inspections for each phase of construction. Staying on schedule is crucial for the success of this project because if these completion dates are not hit than a good deal of money will be wasted.

Table 1 | Final Completion & Inspections Breakdown for Phase I & II		
Task Name	**Start Date**	**Finish Date**
Base Bldg Systems Start-up & Commissioning – Main	4/22/11	6/17/11
Base Bldg Final Inspections – Main	6/20/11	7/1/11
Base Bldg Final Inspections Completed – Main	7/1/11	7/1/11
Base Bldg Systems Start-up & Commissioning – NW	3/23/11	5/17/11
Base Bldg Final Inspections – NW	5/18/11	6/1/11
Base Bldg Final Inspections Completed – NW	6/1/11	6/1/11
Base Bldg Systems Start-up & Commissioning – SW	10/20/11	12/23/11
Base Bldg Final Inspections – SW	12/27/11	1/17/12
Base Bldg Final Inspections Completed – SW	1/17/12	1/17/12
Tenant Improvements Complete – Main & NW	5/2/11	7/29/11
Tenant Improvements Complete - SW	12/27/11	5/1/12

Detailed Structural Systems Estimate

Reference Appendix B for the Detailed Structural System Estimate

Since this project is a renovation there was already a structural system in place that would remain. Additional structural systems will be added to the building because it is a government building and the need for certain protection has to be addressed. The structural system that was analyzed for this part of the technical assignment was the Progressive Collapse Steel System. This system will be installed on the perimeter of the Northwest and Southwest buildings. The breakdown of the Progressive Collapse Steel System includes structural members like HSS columns, W beams, Channels, Kickers, and more. Each part of this system was broken down and estimated using the *2011 RS Means Facilities Construction Cost Data* book. Table 2 shows the overall estimate pricing with Segment A and Segment B being the Northwest building and Segment C being the Southwest building. Appendix B shows a detailed breakdown of each segment for the Progressive Collapse Steel System. *(RS Means, 2010)*

Table 2 | Progressive Collapse Steel Overall Estimate Pricing	
Segment A & B Total Estimate Pricing	**$589,407.73**
Segment C Total Estimate Pricing	**$364,277.09**
Overall Total System Estimate Pricing	**$953,684.82**

Table 3 shows the comparison between the actual cost of the Progressive Collapse Steel System and the estimated cost. Due to detailed structural construction documents, the detailed estimate was within 0.3% or $3,330.18 of the actual cost for the system. There is most likely a few items missing since RS Means does not include every little detail for a system like this, but overall the estimate turned out better than expected.

Table 3 | Progressive Collapse Steel Actual vs. Estimated Cost Comparison				
	Actual		**Estimated**	
System	**Total**	**$/SF**	**Total**	**$/SF**
Progressive Collapse Steel	**$957,015.00**	**$2.24**	**$953,684.82**	**$2.24**

Figure 2 shows the Progressive Collapse Steel System installed in the Northwest and Southwest buildings.

Figure 2 | Progressive Collapse System Installed

Below in Table 4 and Figure 3 is the breakdown by CSI Masterformat Divisions for the Progressive Collapse Steel System. The steel columns and steel beams make up most of the estimate for this particular system. 10% waste was included in the concrete footings due to any items that were missed between the translation of RS Means and the construction documents. 5% waste was used for the kickers because on-site cutting would potentially have to be done if they were shipped in longer lengths than needed for installation.

Table 4 | Progressive Collapse Steel Estimate Summary by CSI Masterformat Divisions

CSI Masterformat Division	Unit Cost	Unit	Quantity	Total Cost
033053 Cast-In-Place Concrete Footings (includes 10% waste)	$445.00	CY	13.68	**$6089.38**
050523 Anchor Bolts	$55.50	SET	109	**$6,049.50**
051223 Steel Columns	$1,027.93	EA	396.0	**$407,060.00**
051223 Steel Beams	$154.47	LF	2,526.4	**$390,258.18**
051223 Column Plates	$2.08	LB	19,513.81	**$40,577.25**
051223 Angle Framing (includes 5% waste)	$44.24	LF	798	**$35,301.00**
051223 Channel Framing	$64.15	LF	1,065.5	**$68,349.51**
			Total	**$953,684.82**

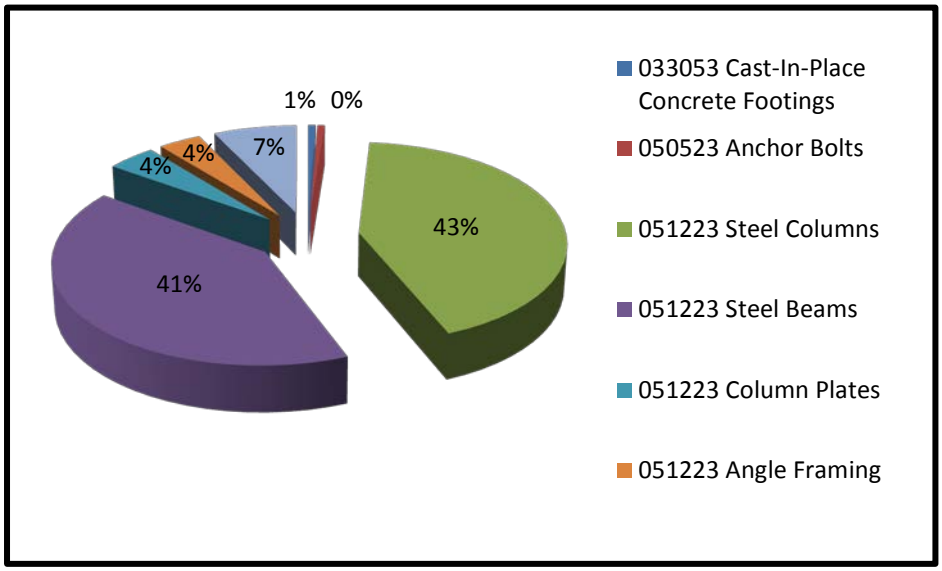


Figure 3 | CSI Masterformat Division Breakdown

In order to produce as accurate of an estimate as possible interpolation was done to get certain pricing for some steel beams. Refer to Appendix B for pricing calculations. Also, since not every HSS column was in RS Means the closest category was used in order to do the pricing. The biggest size in RS Means was used for the kickers to account for the quality and price of this system. Overall, different assumptions were made in order to get the best estimate for such a complex system. Refer to Appendix B for more assumptions that were made for this estimate.

General Conditions Estimate

Reference Appendix C for the General Conditions Estimate

The General Conditions estimate, provided by Davis Construction, consists of the following elements:

- Personnel
- Jobsite Operations
- Safety, Clean Up, Health
- Permits, Insurance, Bonds
- Punch List & Close Out

Table 5 outlines what it costs in total, per day, and per week for the General Conditions for 7700 Arlington Blvd. The total cost is $3,293,004.80 which is approximately 6.25% of the total construction cost.

Table 5 | General Conditions Summary			
	Total	**$ / Day**	**$ / Week**
General Conditions	**$3,293,004.80**	**$7,973.38**	**$39,866.9**

Each category is broken down in Table 6 and Figure 4 to show what makes up the total General Conditions Estimate. Personnel makes up about 84% of the total cost with Safety, Clean up, and Health making up the next biggest percent at 9%.

Table 6 | 7700 Arlington Blvd. General Conditions Breakdown Estimate Summary	
Category	**Total Cost**
Personnel	$2,752,775.20
Jobsite Operations	$185,750.00
Safety, Clean up, Health	$298,479.60
Permits, Insurance, Bonds	$17,000.00
Punch List & Close Out	$39,000.00
General Conditions Total Estimate	**$3,293,004.80**

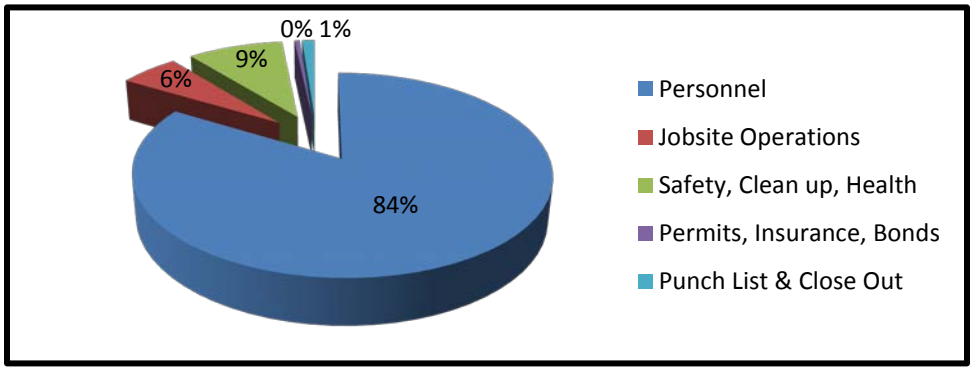


Figure 4 | General Conditions Breakdown Estimate Summary

There were quite a few items within the General Conditions Estimate that Davis Construction included directly into the job costs. The items that were charged directly to the job are outlined in Table 7.

Table 7 | 7700 Arlington Blvd. General Conditions Job Cost Items	
Category	**Item**
Jobsite Operations	Travel Expenses
	Owner Office Expense / Trailer Rental
	Owner Office Cleaning (weekly)
	Field Office Set Up & Relocation
	Field Office Trailer Rental – Field Staff
	Field Office Trailer Rental – Office Staff
	Trailer Rental – Delivery & Removal
	Construction Signage
	Construction Site Fence
	Temporary Power – Consumption
	Temporary Power – Installation
	Temporary Water / Sanitary Supply
	Temporary Heat
	Temporary Lighting
	Winter Protection – Labor & Material
	Scaffolding
	Scissors / Telescoping Lift
	Minor Tools & Equipment
	Major Tools & Equipment
	Protection of Existing Conditions – Labor & Material
	Protect Work in Place – Labor & Material
	Temporary Partitions – Labor & Material
Safety, Clean up, Health	Final Clean – Parking Areas & Buildings
	Trash Chute – Erect, Dismantle, & Rental
	Misc. Fire Protection
	Respiratory Protection
	Guard Rails & Toe Boards – Labor & Material
	Floor Opening Protection – Labor & Material
Permits, Insurance, Bonds	Misc. Trade Permits
	Wall Check
	Pollution Control Liability Insurance
	Builders Risk Insurance
	Davis Construction Bond

It is clear that if the General Conditions were to account for all these items that the total cost would increase by an immense amount. Davis Construction could have carried the job cost items as a General Conditions cost; however, they decided to carry them as a job cost of the work for this estimate. This way the money is distributed into the appropriate areas instead of having every item in the General Conditions Estimate. If there are any drastic changes with the schedule for the project, the General Conditions Estimate and the items listed in Table 7 will be directly affected and costs will increase. This is because most costs incur on a weekly or monthly basis.

LEED Evaluation

Reference Appendix D for the LEED Scorecard

The following analysis is based off of all assumptions because the tenant information was not released for review and information and; therefore, will not reflect Davis Construction. The only information that is known from the DHHQ main website is that the tenant improvements will meet LEED Silver Commercial Interiors Standards. Instead of doing the LEED Scorecard for New Construction and Major Renovations, the LEED Scorecard for Commercial Interiors has been completed. Refer to Appendix D for the LEED Scorecard. *(GBA Associates LP, 2011)*

The requirement for obtaining LEED Silver for Commercial Interiors is between 50-59 points. Therefore, the LEED Scorecard was filled out to reflect a LEED Silver rating. Table 8 summarizes the LEED Scorecard showing the possible points in each category followed by the points that could potentially be obtained for 7700 Arlington Blvd. *(U.S. Green Building Council, 2011)*

Table 8 | LEED 2009 for Commercial Interiors

Project Checklist	Possible Points	Points Obtained
Sustainable Sites	21	10
Water Efficiency	11	6
Energy and Atmosphere	37	16
Materials and Resources	14	5
Indoor Environmental Quality	17	16
Innovation and Design Process	6	1
Regional Priority Credits	4	0
Total	**110**	**54**

Sustainable Sites is the first category within the LEED Scorecard that was analyzed with there being four subcategories that could obtain points. Everything in this category has to deal with alternative transportation to 7700 Arlington Blvd. Public transportation access, bicycle storage and changing rooms, as well as parking availability are all valid points for this type of project. There is a major highway right next to the site as well as residential developments in the vicinity, and there is existing parking that will remain. The goal for this part of the LEED system is to reduce the amount of pollution and land development impacts from automobile use.

The second category is Water Efficiency and the employment of using less water throughout the building. The main areas that will use less water include the toilets, urinals, restroom faucets, pre-rinse spray valves, as well as other items that require a heavy amount of water usage. The reason that reducing water is so important to DHHQ is that it not only decreases the water bill but also reduces the burden on municipal water supplies and wastewater systems. Many projects employ these items into their buildings nowadays because it is a rather inexpensive way to reduce water consumption and still help the environment.

Energy and Atmosphere is the next category and it encompasses quite a few different LEED credits. In order to become LEED certified for Commercial Interiors there are certain required credits. This category

happens to have three which are, fundamental commissioning of building energy systems, minimum energy performance, and fundamental refrigerant management. The idea is that if these three requirements are not satisfied than it would not make sense to have any of the other categories within Energy and Atmosphere. The commissioning for both the base building and tenant work are extremely detailed which is beneficial for the government because they want their space to be designed and constructed accurately. The rest of the categories focus on optimizing energy performance by using light controls, occupancy sensors, zoning controls for HVAC, and ENERGY STAR appliances throughout the building. The assumption is made that each office will have different sensors to personalize the space for when he/she is in the room. Also, in the cafeteria and/or lunch break rooms there will be energy efficient appliances to reduce excessive energy use. Overall, this category is responsible for a large percentage of the LEED rating for Commercial Interiors and if done properly can save the tenants money and help the environment immensely.

Materials and Resources is the fourth category in which LEED credits can be obtained and in this case credits can be easily obtained during construction. The easiest way to summarize the points that could be obtained in this category is that if Davis Construction does their part during construction and pays particular attention to recycling and reusing then not only is waste being diverted from landfills, but it helps out the owner too. Since this is a government building, the idea would be that DHHQ would occupy the space for a minimum of 10 years in order to conserve resources, reduce waste and reduce the impacts moving has on the environment. Also, another huge factor that comes into play during construction is where the different materials are being shipped from. Points are awarded if materials and products are manufactured regionally and with 7700 Arlington Blvd. being located in such a populated and growing area, there should be plenty of opportunities to receive local products for the project.

The next biggest points category for 7700 Arlington Blvd. is the Indoor Environmental Quality. The comfort and well-being of the occupants is based on this category because if he/she is not comfortable in the space then there will inevitably be a decrease in productivity. Multiplying that by a whole building of occupants is not what a company like DHHQ would like. The two minimum requirements that contribute to the well being of others are minimum indoor air quality performance and environmental tobacco smoke control. The other categories chosen for this project includes items like increase ventilation, low-emitting materials, controllability of systems, thermal comfort, and daylight and views. By choosing adhesives, sealants, paints, and other finishes with low volatile organic compounds there is a reduction in the amount of indoor air contaminants which can be harmful to the occupant's comfort level.

Innovation and Design Process is the last category where points can be earned. This category earned one point for having a LEED Accredited Profession on the project. Davis Construction has plenty of LEED Accredited Professionals and will definitely have one to be a part of the tenant work for 7700 Arlington Blvd.

After assuming all the LEED credits for this project, all in all it turned out seemingly appropriate for what the interiors might actually turn out to be. Granted there will be some aspects that are different, but overall by using the LEED Scorecard for Commercial Interiors it proved to be useful and educational.

Building Information Modeling Use Evaluation

Reference Appendix E for the BIM Use Evaluation

The first part to implementing BIM into any project is to define and rank the different goals for the project. The major goals for 7700 Arlington Blvd. include reducing the project schedule duration, reducing the project cost, increasing the overall quality of the project, and identifying concerns with the 2-phase construction sequence. Efficient design documentation, field conflict elimination, increase in project productivity levels, and construction tracking are other project goals that were taken into consideration. From outlining the BIM goals, which are shown in Appendix E under the BIM Goals Worksheet, different BIM uses were defined. The uses that were considered to be the most relevant and useful for this project were Design Authoring, 3D Coordination, 4D Modeling, Construction System Design, and Record Modeling.

To clearly understand each BIM use for this project each use is defined below. The definitions are from the *BIM Project Execution Planning Guide*. The reason for doing is to clearly organize the BIM uses when analyzing the BIM Use Analysis Worksheet and Process Map which can be found in Appendix E. Only the BIM uses that were utilized on the project are defined and thoroughly analyzed. *(CIC, 2010)*

- Design Authoring – "A process in which 3D software is used to develop a Building Information Model based on criteria that is important to the translation of the building's design."

- 3D Coordination – "A process in which Clash Detection software is used during the coordination process to determine field conflicts by comparing 3D models of building systems."

- 4D Modeling – "A process in which a 4D model is utilized to effectively plan the phased occupancy in a renovation, retrofit, addition, or to show the construction sequence and space requirements on a building site."

- Construction System Design – "A process in which 3D System Design Software is used to design and analyze the construction of a complex building system in order to increase planning."

- Record Modeling – "A process used to depict an accurate representation of the physical conditions, environment, and assets of a facility."

For 7700 Arlington Blvd., the Design Authoring use has a reasonable amount of value to the project with the responsible parties to include the Architect, MEP Engineer, Structural Engineer, and Civil Engineer. Each party has a good capability rating as well as self value. The Design Authoring takes place at the beginning of the schematic design phase, design development phase, and construction documents phase. The reason for doing this is to ensure that the appropriate designs are being implemented into the project efficiently. Coordination between trades for different complex systems took place through each phase of construction and issues were resolved by using 3D software.

3D Coordination on the job is the most critical BIM use for 7700 Arlington Blvd. because by detecting clashes prior to installation, everyone involved in the project is able to save time and money. Saving time and money is important on every job, but in this case there was a demand for DHHQ to move into a new building and they did not have these resources readily available. The responsible parties involved with 3D Coordination include the Architect, MEP Engineer, Structural Engineer, and Contractor. Each play a vital role when it comes down to making sure the project runs smoothly. Ultimately, the contractor is responsible for the coordination between trades. For this job, weekly meetings are held where updated models are put through clash detection. Once the models are combined and clash detection software is run, everyone at the table must resolve the issue. After the issue is taken care of and the meeting is adjourned, Davis Construction and each subcontractor will go back to his/her office and update the model for the next week's meeting. 3D Coordination is done through the schematic design phase, design development phase, and construction documents phase. It is important for this coordination to be a part of each phase because there will inevitably be errors and clash detection can catch most, if not all the issues prior to installation.

Following 3D Coordination is 4D Modeling which is another vital BIM use for this project because it involves thorough analysis in order to help with the construction sequence. The main player for this use is the Contractor because they are the ones responsible for making sure the project is done on time. Not only is 4D Modeling beneficial to the Contractor, but it is extremely beneficial to the owner due to the fact that the schedule could be decreased by a decent percentage through the use of 4D Modeling. For 7700 Arlington Blvd., 4D Modeling was used in the schematic design phase, design development phase, and construction documents phase in order to develop an appropriate construction sequence as well as stay on par with the 3D Coordination. It is important, especially for this project to keep everything updated because time and money are so important to the owner. Where 4D Modeling came into play the most was with the new structural systems that were being installed. These systems include the blast proof façade, seismic bracing, and the progressive collapse system. Being able to sequence these systems in the appropriate manner took the BIM coordinator for Davis Construction a lot of time and effort to ensure the most logical sequence would be preformed.

Construction System Design was implemented in the design development phase in order to help ease any type of confusion with the complex structural systems. The idea behind the Construction System Design BIM use is to build a 3D mock-up of some system or a part of a building in order to eliminate certain construction issues and any other errors. This use is another way to not only help the Architect and Contractor, but the Owner as well due to the fact that there is the potential for the team to save the Owner once again, time and money. In order to fully understand this BIM use there will need to be training for the Architect especially if they will be the ones designing these mock-ups.

The last BIM use that was not necessarily used on 7700 Arlington, but could greatly benefit from would be Record Modeling. The benefit to using Record Modeling is to help in the future if say DHHQ would ever decide to renovate again in certain areas. By having a model already created, it would reduce the amount of time spent trying to figure out what is in the building. This was a huge issue with 7700 Arlington Blvd. because no one was allowed into the building before Raytheon vacated the space. If a Record Model was already created than the Architect and Contractor would not have had to wait to get some of the information that they needed due to having a Record Model. There would need to be training

for the Facility Managers of the building in order to make sure the Record Model is kept up to date for any future renovations, but overall it would have been a smart thing to do to help aid this project.

Overall, each BIM use is appropriate for this type of job because the most important aspect of this project is coordination amongst everyone involved. 3D Coordination and 4D Modeling were implemented exceptionally well on 7700 Arlington Blvd. and as a result the construction sequence ran nice and smooth. The other three BIM uses could have been utilized more throughout the project, but all in all the BIM coordinator for Davis Construction encompassed the main issues for this job.

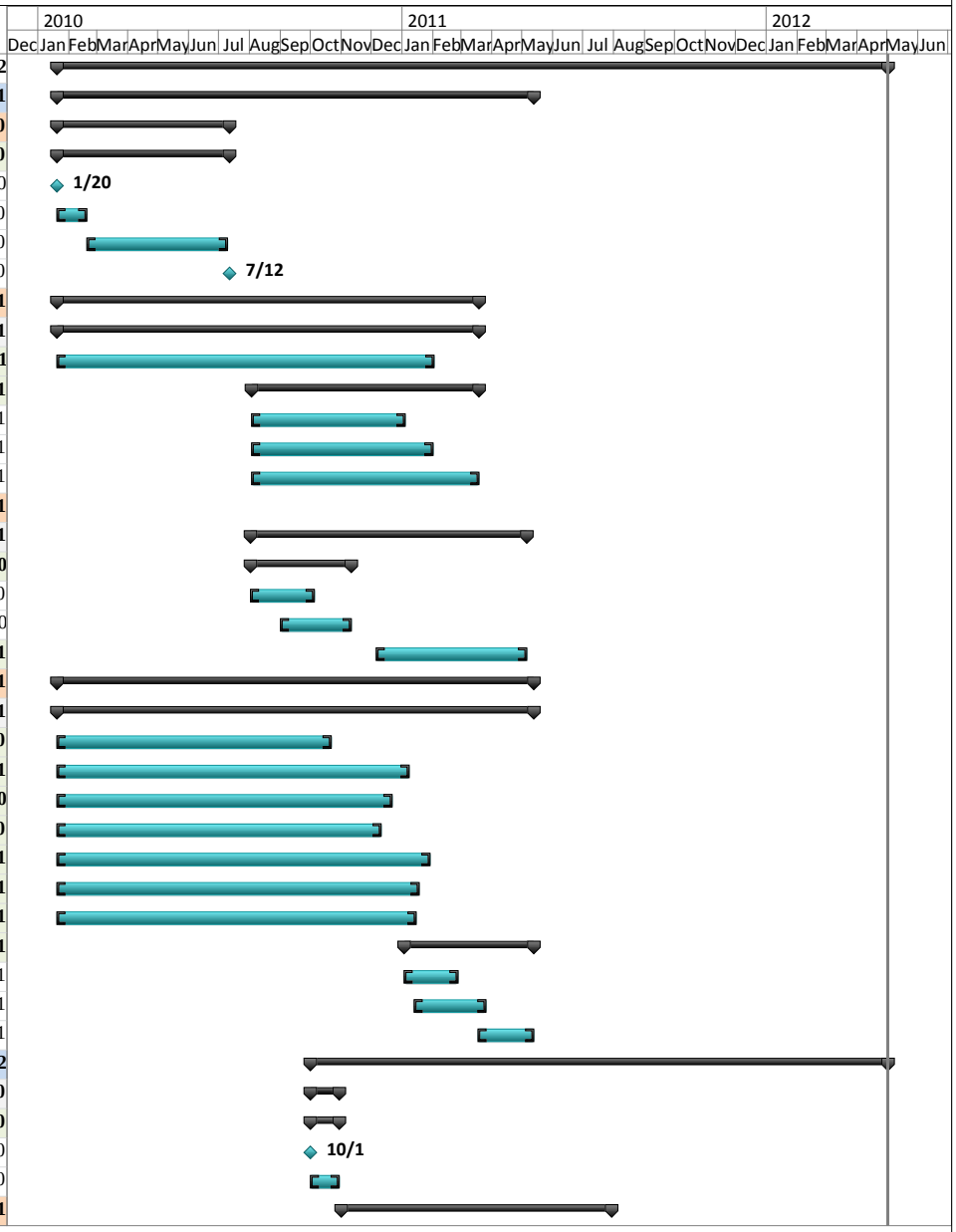
Figure 5 shows a 4D Model of 7700 Arlington Blvd. The progressive collapse system is highlighted in red on the Northwest and Southwest buildings. This model is used for clash detection as well as construction sequencing and has proved to be a valuable resource for this job.

Figure 5 | 4D Model | Photo Courtesy of James G. Davis Construction

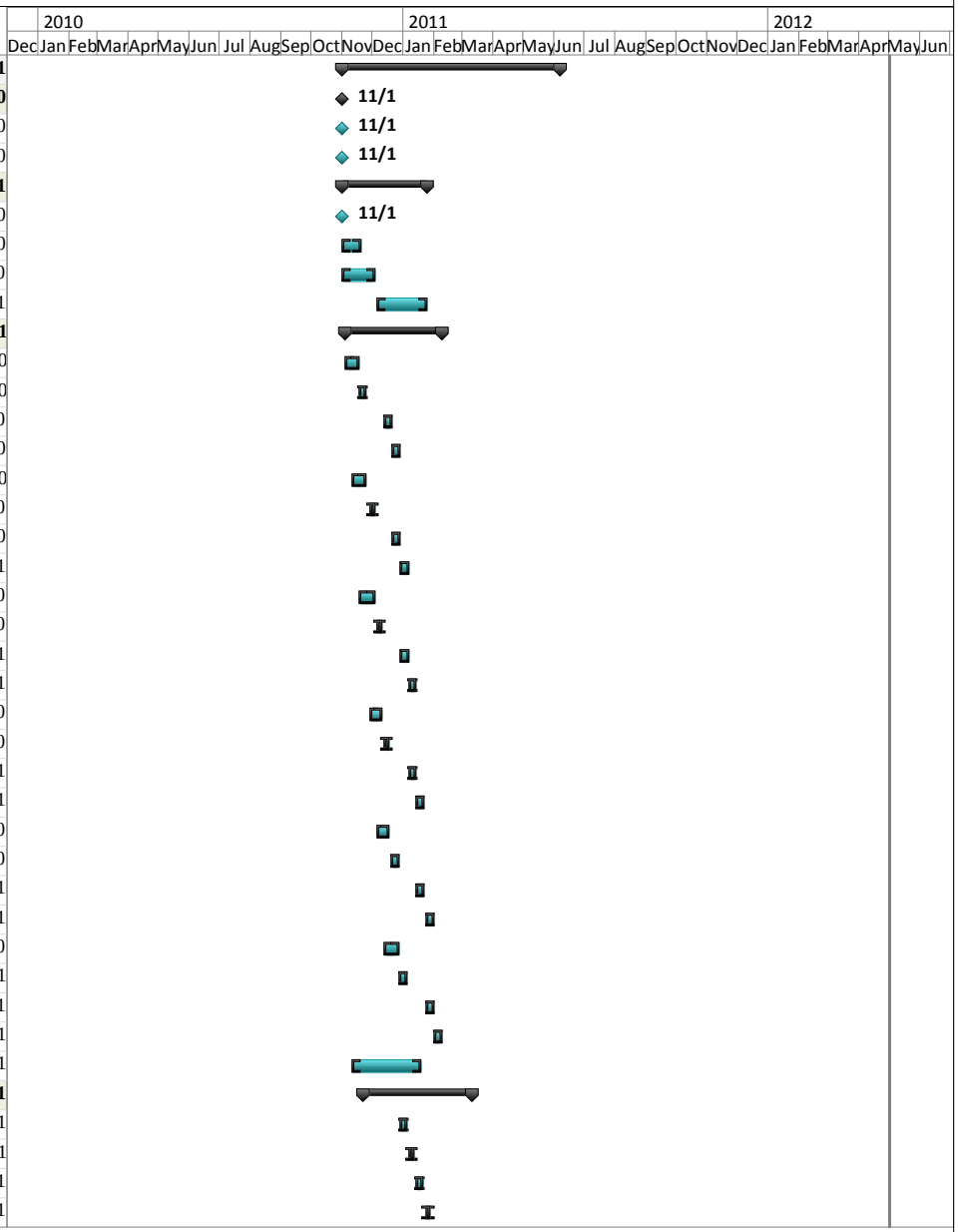
Appendix A

Detailed Project Schedule

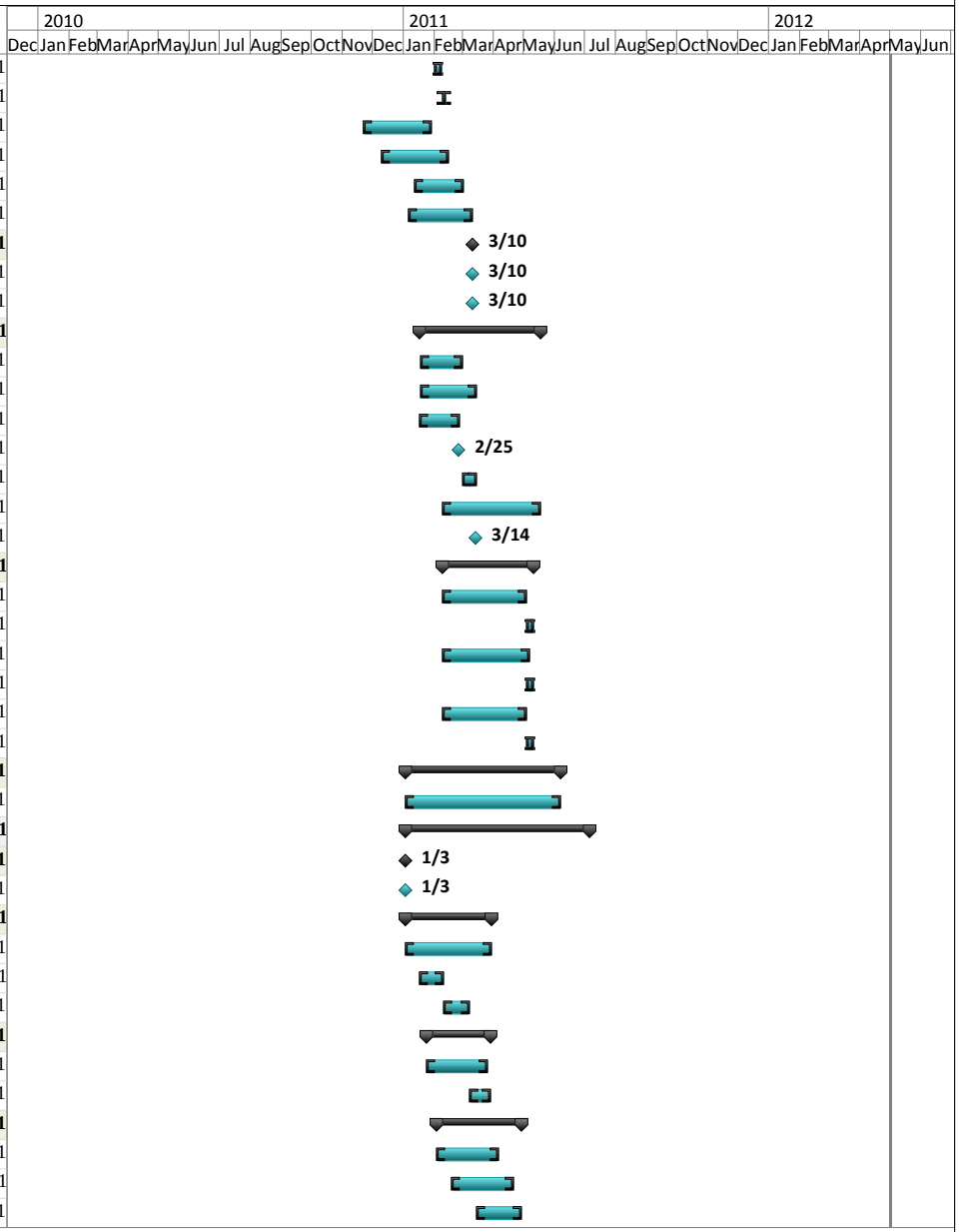
ID	Task Name	Duration	Start	Finish
1	**Schedule Summary**	**595 days**	**Wed 1/20/10**	**Tue 5/1/12**
3	**Pre-Construction**	**342 days**	**Wed 1/20/10**	**Thu 5/12/11**
4	**CMHQ SFO Release**	**123 days**	**Wed 1/20/10**	**Mon 7/12/10**
5	**General**	**123 days**	**Wed 1/20/10**	**Mon 7/12/10**
6	Re-Issue SFO	0 days	Wed 1/20/10	Wed 1/20/10
7	Prepare SFO Response	22 days	Wed 1/20/10	Thu 2/18/10
8	Evaluate SFO Responses	101 days	Fri 2/19/10	Fri 7/9/10
9	Award Contract	0 days	Mon 7/12/10	Mon 7/12/10
10	**Design**	**303 days**	**Wed 1/20/10**	**Fri 3/18/11**
11	**General**	**303 days**	**Wed 1/20/10**	**Fri 3/18/11**
12	**Base Building Procurement**	**270 days**	**Wed 1/20/10**	**Tue 2/1/11**
13	**Tenant Package**	**164 days**	**Tue 8/3/10**	**Fri 3/18/11**
14	Tenant Package Phase 1 - NW Bldg	110 days	Tue 8/3/10	Mon 1/3/11
15	Tenant Package Phase 1 - Main Bldg	130 days	Tue 8/3/10	Mon 1/31/11
16	Tenant Package Phase 2 - SW Bldg	164 days	Tue 8/3/10	Fri 3/18/11
17	**Permits**	**199 days**	**Mon 8/2/10**	**Thu 5/5/11**
18	**General**	**199 days**	**Mon 8/2/10**	**Thu 5/5/11**
19	**Base Building Procurement**	**73 days**	**Mon 8/2/10**	**Wed 11/10/10**
20	Obtain Demo Permits	46 days	Mon 8/2/10	Mon 10/4/10
21	Obtain Base Building Permits	51 days	Wed 9/1/10	Wed 11/10/10
22	**Tenant Improvements**	**109 days**	**Mon 12/6/10**	**Thu 5/5/11**
23	**Procurement**	**342 days**	**Wed 1/20/10**	**Thu 5/12/11**
24	**General**	**342 days**	**Wed 1/20/10**	**Thu 5/12/11**
25	**Demo / Abatement Procurement**	**197 days**	**Wed 1/20/10**	**Thu 10/21/10**
26	**Façade Procurement**	**253 days**	**Wed 1/20/10**	**Fri 1/7/11**
27	**Precast Procurement**	**240 days**	**Wed 1/20/10**	**Tue 12/21/10**
28	**Progressive Collapse Procurement**	**233 days**	**Wed 1/20/10**	**Fri 12/10/10**
29	**Elevator Procurement**	**268 days**	**Wed 1/20/10**	**Fri 1/28/11**
30	**Mechanical Procurement**	**259 days**	**Wed 1/20/10**	**Mon 1/17/11**
31	**Electrical Procurement**	**258 days**	**Wed 1/20/10**	**Fri 1/14/11**
32	**Tenant Package Procurement**	**94 days**	**Mon 1/3/11**	**Thu 5/12/11**
33	Tenant Package Phase 1 - NW Bldg	40 days	Mon 1/3/11	Fri 2/25/11
34	Tenant Package Phase 1 - Main Bldg	52 days	Thu 1/13/11	Fri 3/25/11
35	Tenant Package Phase 2 - SW Bldg	40 days	Fri 3/18/11	Thu 5/12/11
36	**Construction**	**413 days**	**Fri 10/1/10**	**Tue 5/1/12**
37	**General**	**21 days**	**Fri 10/1/10**	**Fri 10/29/10**
38	**General**	**21 days**	**Fri 10/1/10**	**Fri 10/29/10**
39	Mobilize on Site	0 days	Fri 10/1/10	Fri 10/1/10
40	Mobilize / Site Preparation	21 days	Fri 10/1/10	Fri 10/29/10
41	**Phase 1 - 500,000 sf**	**195 days**	**Mon 11/1/10**	**Fri 7/29/11**



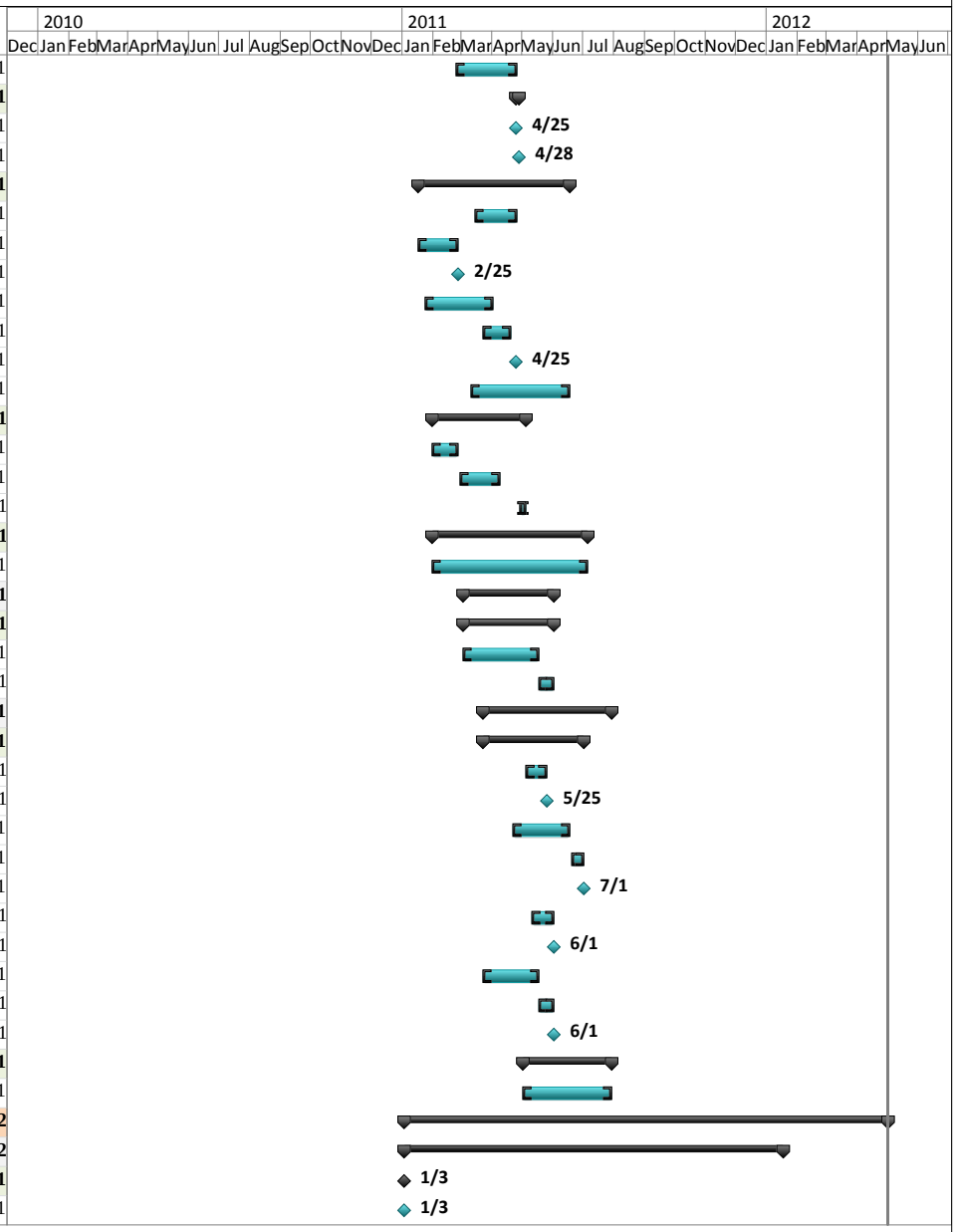
ID	Task Name	Duration	Start	Finish
42	**NW Building**	**156 days**	**Mon 11/1/10**	**Mon 6/6/11**
43	**General**	**0 days**	**Mon 11/1/10**	**Mon 11/1/10**
44	NW Building Addition Vacated	0 days	Mon 11/1/10	Mon 11/1/10
45	Begin NW Bldg Renovation	0 days	Mon 11/1/10	Mon 11/1/10
46	**Demo / Abatement**	**61 days**	**Mon 11/1/10**	**Mon 1/24/11**
47	Begin Demolition - NW	0 days	Mon 11/1/10	Mon 11/1/10
48	Interior Demo at Perm for Progressive Collapse - NW	15 days	Mon 11/1/10	Fri 11/19/10
49	Exterior Demo - NW	25 days	Mon 11/1/10	Fri 12/3/10
50	Demo / Structural Work Roof Equipment - NW	36 days	Mon 12/6/10	Mon 1/24/11
51	**Structure**	**69 days**	**Thu 11/4/10**	**Tue 2/8/11**
52	Core Drill / FRP Ftgs for Prog Collapse - Seq 1 - NW	10 days	Thu 11/4/10	Wed 11/17/10
53	FRP Cols & Beams for Prog Collapse - Seq 1 - NW	5 days	Thu 11/18/10	Wed 11/24/10
54	Erect Steel for Prog Collapse - Seq 1 - NW	6 days	Mon 12/13/10	Mon 12/20/10
55	Detail Steel for Prog Collapse - Seq 1 - NW	6 days	Tue 12/21/10	Tue 12/28/10
56	Core Drill / FRP Ftgs for Prog Collapse - Seq 2 - NW	10 days	Thu 11/11/10	Wed 11/24/10
57	FRP Cols & Beams for Prog Collapse - Seq 2 - NW	5 days	Mon 11/29/10	Fri 12/3/10
58	Erect Steel for Prog Collapse - Seq 2 - NW	6 days	Tue 12/21/10	Tue 12/28/10
59	Detail Steel for Prog Collapse - Seq 2 - NW	7 days	Wed 12/29/10	Thu 1/6/11
60	Core Drill / FRP Ftgs for Prog Collapse - Seq 3 - NW	12 days	Thu 11/18/10	Fri 12/3/10
61	FRP Cols & Beams for Prog Collapse - Seq 3 - NW	5 days	Mon 12/6/10	Fri 12/10/10
62	Erect Steel for Prog Collapse - Seq 3 - NW	7 days	Wed 12/29/10	Thu 1/6/11
63	Detail Steel for Prog Collapse - Seq 3 - NW	5 days	Fri 1/7/11	Thu 1/13/11
64	Core Drill / FRP Ftgs for Prog Collapse - Seq 4 - NW	10 days	Mon 11/29/10	Fri 12/10/10
65	FRP Cols & Beams for Prog Collapse - Seq 4 - NW	5 days	Mon 12/13/10	Fri 12/17/10
66	Erect Steel for Prog Collapse - Seq 4 - NW	5 days	Fri 1/7/11	Thu 1/13/11
67	Detail Steel for Prog Collapse - Seq 4 - NW	6 days	Fri 1/14/11	Fri 1/21/11
68	Core Drill / FRP Ftgs for Prog Collapse - Seq 5 - NW	10 days	Mon 12/6/10	Fri 12/17/10
69	FRP Cols & Beams for Prog Collapse - Seq 5 - NW	6 days	Mon 12/20/10	Mon 12/27/10
70	Erect Steel for Prog Collapse - Seq 5 - NW	6 days	Fri 1/14/11	Fri 1/21/11
71	Detail Steel for Prog Collapse - Seq 5 - NW	6 days	Mon 1/24/11	Mon 1/31/11
72	Core Drill / FRP Ftgs for Prog Collapse - Seq 6 - NW	11 days	Mon 12/13/10	Mon 12/27/10
73	FRP Cols & Beams for Prog Collapse - Seq 6 - NW	6 days	Tue 12/28/10	Tue 1/4/11
74	Erect Steel for Prog Collapse - Seq 6 - NW	6 days	Mon 1/24/11	Mon 1/31/11
75	Detail Steel for Prog Collapse - Seq 6 - NW	6 days	Tue 2/1/11	Tue 2/8/11
76	Seismic Bracing - NW	49 days	Thu 11/11/10	Tue 1/18/11
77	**Façade / Roof**	**79 days**	**Mon 11/22/10**	**Thu 3/10/11**
78	Erect Precast - Seq 1 - NW	5 days	Wed 12/29/10	Tue 1/4/11
79	Erect Precast - Seq 2 - NW	3 days	Fri 1/7/11	Tue 1/11/11
80	Erect Precast - Seq 3 - NW	5 days	Fri 1/14/11	Thu 1/20/11
81	Erect Precast - Seq 4 - NW	4 days	Mon 1/24/11	Thu 1/27/11



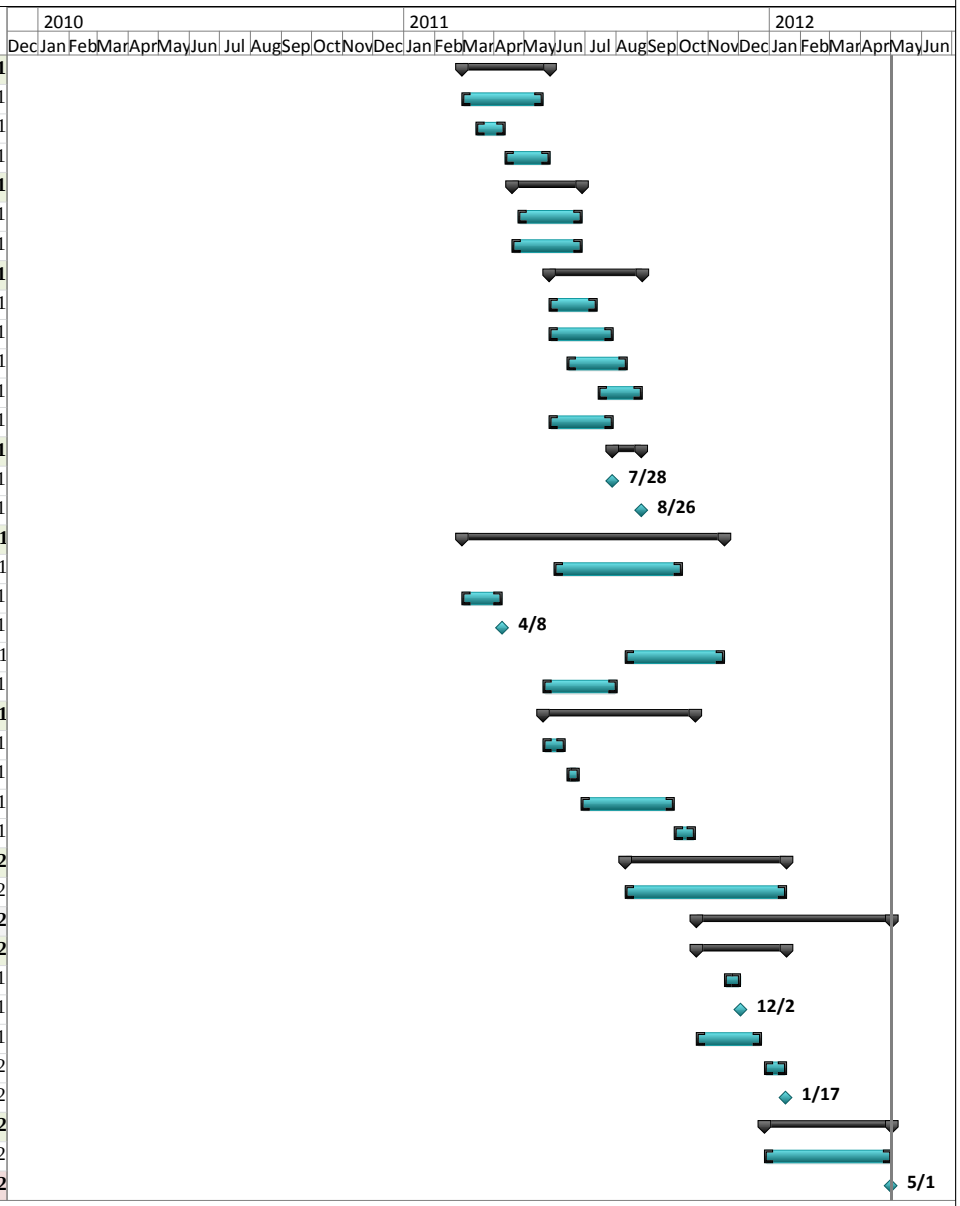
ID	Task Name	Duration	Start	Finish
82	Erect Precast - Seq 5 - NW	5 days	Tue 2/1/11	Mon 2/7/11
83	Erect Precast - Seq 6 - NW	3 days	Wed 2/9/11	Fri 2/11/11
84	Interior Structural Framing for Windows - NW	50 days	Mon 11/22/10	Fri 1/28/11
85	Façade Hardening - NW	47 days	Fri 12/10/10	Mon 2/14/11
86	Replace Windows - NW	35 days	Wed 1/12/11	Tue 3/1/11
87	New Roofing - NW	46 days	Thu 1/6/11	Thu 3/10/11
88	**Enclosure Milestones**	**0 days**	**Thu 3/10/11**	**Thu 3/10/11**
89	Roof Complete - NW	0 days	Thu 3/10/11	Thu 3/10/11
90	Building Dry - NW	0 days	Thu 3/10/11	Thu 3/10/11
91	**Building Cores / Shell Infrastructure**	**87 days**	**Mon 1/17/11**	**Tue 5/17/11**
92	Refurbish MEP & Equipment (Existing) - NW	30 days	Tue 1/18/11	Mon 2/28/11
93	MEP Rough-ins & Equipment - NW	40 days	Tue 1/18/11	Mon 3/14/11
94	Set & Energize Switchboard - NW	30 days	Mon 1/17/11	Fri 2/25/11
95	Permanent Power Available - NW	0 days	Fri 2/25/11	Fri 2/25/11
96	Equipment Checkout / Startup (Existing) - NW	10 days	Tue 3/1/11	Mon 3/14/11
97	Finishes - NW	70 days	Wed 2/9/11	Tue 5/17/11
98	Conditioned Air Available - NW	0 days	Mon 3/14/11	Mon 3/14/11
99	**Elevators**	**65 days**	**Wed 2/9/11**	**Tue 5/10/11**
100	Refurbish Ex Elevators N - NW	60 days	Wed 2/9/11	Tue 5/3/11
101	Install Elevator Cabs N - NW	5 days	Wed 5/4/11	Tue 5/10/11
102	Refurbish Ex Elevators C - NW	63 days	Wed 2/9/11	Fri 5/6/11
103	Install Elevator Cabs C - NW	5 days	Wed 5/4/11	Tue 5/10/11
104	Refurbish Ex Elevators S - NW	60 days	Wed 2/9/11	Tue 5/3/11
105	Install Elevator Cabs S - NW	5 days	Wed 5/4/11	Tue 5/10/11
106	**Tenant Improvements**	**111 days**	**Mon 1/3/11**	**Mon 6/6/11**
107	Tenant Improvements - NW	111 days	Mon 1/3/11	Mon 6/6/11
108	**Main Building**	**132 days**	**Mon 1/3/11**	**Tue 7/5/11**
109	**General**	**0 days**	**Mon 1/3/11**	**Mon 1/3/11**
110	Main Building Vacated	0 days	Mon 1/3/11	Mon 1/3/11
111	**Demo / Abatement**	**62 days**	**Mon 1/3/11**	**Tue 3/29/11**
112	Abatement / Interior Demo - Main	62 days	Mon 1/3/11	Tue 3/29/11
113	Demo Café Structure - Main	18 days	Mon 1/17/11	Wed 2/9/11
114	Demo / Structural Work Roof Equipment - NW	18 days	Thu 2/10/11	Mon 3/7/11
115	**Structure**	**46 days**	**Mon 1/24/11**	**Mon 3/28/11**
116	Seismic Bracing - Main	45 days	Mon 1/24/11	Fri 3/25/11
117	Structure @ MEP Roof Equipment - Main	15 days	Tue 3/8/11	Mon 3/28/11
118	**Façade / Roof**	**61 days**	**Thu 2/3/11**	**Thu 4/28/11**
119	Interior Structural Framing for Windows - Main	44 days	Thu 2/3/11	Tue 4/5/11
120	Façade Hardening - Main	44 days	Fri 2/18/11	Wed 4/20/11
121	Replace Windows - Main	33 days	Tue 3/15/11	Thu 4/28/11



ID	Task Name	Duration	Start	Finish
122	Repair / New Roofing - Main	43 days	Thu 2/24/11	Mon 4/25/11
123	**Enclosure Milestones**	**3 days**	**Mon 4/25/11**	**Thu 4/28/11**
124	Roof Complete - Main	0 days	Mon 4/25/11	Mon 4/25/11
125	Building Dry - Main	0 days	Thu 4/28/11	Thu 4/28/11
126	**Building Cores / Shell Infrastructure**	**110 days**	**Mon 1/17/11**	**Fri 6/17/11**
127	Set MEP Equipment - Main	30 days	Tue 3/15/11	Mon 4/25/11
128	Set & Energize Switchboard - Main	30 days	Mon 1/17/11	Fri 2/25/11
129	Permanent Power Available - Main	0 days	Fri 2/25/11	Fri 2/25/11
130	Rough-In MEP - Main	50 days	Mon 1/24/11	Fri 4/1/11
131	Equipment Checkout / Startup Roof Equipment - Main	20 days	Wed 3/23/11	Tue 4/19/11
132	Conditioned Air Available - Main	0 days	Mon 4/25/11	Mon 4/25/11
133	Finishes - Main	71 days	Fri 3/11/11	Fri 6/17/11
134	**Elevators**	**68 days**	**Mon 1/31/11**	**Wed 5/4/11**
135	Modify Ex Elevator Shaft - Main	20 days	Mon 1/31/11	Fri 2/25/11
136	Install New Holeless Hydraulic Elevator - Main	30 days	Mon 2/28/11	Fri 4/8/11
137	Install Elevator Cab - Main	4 days	Fri 4/29/11	Wed 5/4/11
138	**Tenant Improvements**	**112 days**	**Mon 1/31/11**	**Tue 7/5/11**
139	Tenant Improvements - Main	112 days	Mon 1/31/11	Tue 7/5/11
140	**Sitework**	**65 days**	**Thu 3/3/11**	**Wed 6/1/11**
141	**General**	**65 days**	**Thu 3/3/11**	**Wed 6/1/11**
142	Site Improvements	54 days	Thu 3/3/11	Tue 5/17/11
143	Final Inspections Site Improvements	11 days	Wed 5/18/11	Wed 6/1/11
144	**Complete / Inspections**	**93 days**	**Wed 3/23/11**	**Fri 7/29/11**
145	**Building Cores / Shell Infrastructure**	**73 days**	**Wed 3/23/11**	**Fri 7/1/11**
146	Elevator Final Inspections - Main	15 days	Thu 5/5/11	Wed 5/25/11
147	Elevators Complete - Main	0 days	Wed 5/25/11	Wed 5/25/11
148	Base Bldg Systems Start-up & Commissioning - Main	41 days	Fri 4/22/11	Fri 6/17/11
149	Base Bldg Final Inspections - Main	10 days	Mon 6/20/11	Fri 7/1/11
150	Base Bldg Final Inspections Completed - Main	0 days	Fri 7/1/11	Fri 7/1/11
151	Elevator Final Inspections - NW	16 days	Wed 5/11/11	Wed 6/1/11
152	Elevators Complete - NW	0 days	Wed 6/1/11	Wed 6/1/11
153	Base Bldg Systems Start-up & Commissioning - NW	40 days	Wed 3/23/11	Tue 5/17/11
154	Base Bldg Final Inspections - NW	11 days	Wed 5/18/11	Wed 6/1/11
155	Base Bldg Final Inspections Completed - NW	0 days	Wed 6/1/11	Wed 6/1/11
156	**Tenant Improvements**	**65 days**	**Mon 5/2/11**	**Fri 7/29/11**
157	Tenant Improvements Complete - Main & NW	65 days	Mon 5/2/11	Fri 7/29/11
158	**Phase 2 - 147,000 sf**	**347 days**	**Mon 1/3/11**	**Tue 5/1/12**
159	**SW Building**	**272 days**	**Mon 1/3/11**	**Tue 1/17/12**
160	**General**	**0 days**	**Mon 1/3/11**	**Mon 1/3/11**
161	SW Bldg Building Vacated	0 days	Mon 1/3/11	Mon 1/3/11



ID	Task Name	Duration	Start	Finish
162	**Demo / Abatement**	**64 days**	**Mon 2/28/11**	**Thu 5/26/11**
163	Abatement / Interior Demo - SW	59 days	Mon 2/28/11	Thu 5/19/11
164	Exterior Demo - SW	21 days	Mon 3/14/11	Mon 4/11/11
165	Demo / Structural Work Roof Equipment - SW	33 days	Tue 4/12/11	Thu 5/26/11
166	**Structure**	**50 days**	**Tue 4/19/11**	**Mon 6/27/11**
167	Seismic Bracing - SW	46 days	Mon 4/25/11	Mon 6/27/11
168	Progressive Collapse - SW	50 days	Tue 4/19/11	Mon 6/27/11
169	**Façade / Roof**	**67 days**	**Thu 5/26/11**	**Fri 8/26/11**
170	Precast - SW	34 days	Thu 5/26/11	Tue 7/12/11
171	Interior Structural Framing for Windows - SW	46 days	Thu 5/26/11	Thu 7/28/11
172	Façade Hardening - SW	44 days	Mon 6/13/11	Thu 8/11/11
173	Replace Windows - SW	32 days	Thu 7/14/11	Fri 8/26/11
174	Repair / New Roofing - SW	46 days	Thu 5/26/11	Thu 7/28/11
175	**Enclosure Milestones**	**21 days**	**Thu 7/28/11**	**Fri 8/26/11**
176	Roof Complete - SW	0 days	Thu 7/28/11	Thu 7/28/11
177	Building Dry - SW	0 days	Fri 8/26/11	Fri 8/26/11
178	**Building Cores / Shell Infrastructure**	**188 days**	**Mon 2/28/11**	**Wed 11/16/11**
179	Rough-In MEP & Equipment - SW	92 days	Tue 5/31/11	Wed 10/5/11
180	Set & Energize Switchboard - SW	30 days	Mon 2/28/11	Fri 4/8/11
181	Permanent Power Available - SW	0 days	Fri 4/8/11	Fri 4/8/11
182	Finishes - SW	71 days	Wed 8/10/11	Wed 11/16/11
183	Floor Infill @ Ramp - SW	52 days	Fri 5/20/11	Mon 8/1/11
184	**Elevators**	**108 days**	**Fri 5/20/11**	**Tue 10/18/11**
185	Erect Steel / Structural Demo at New Elevator - SW	16 days	Fri 5/20/11	Fri 6/10/11
186	Construct Shaft & Enclosure at New Elevator - SW	10 days	Mon 6/13/11	Fri 6/24/11
187	Install New Elevators - SW	67 days	Mon 6/27/11	Tue 9/27/11
188	Install New Elevators Cabs - SW	15 days	Wed 9/28/11	Tue 10/18/11
189	**Tenant Improvements**	**115 days**	**Wed 8/10/11**	**Tue 1/17/12**
190	Tenant Improvements - SW	115 days	Wed 8/10/11	Tue 1/17/12
191	**Complete / Inspections**	**139 days**	**Thu 10/20/11**	**Tue 5/1/12**
192	**Building Cores / Shell Infrastructure**	**64 days**	**Thu 10/20/11**	**Tue 1/17/12**
193	Elevator Final Inspections - SW	12 days	Thu 11/17/11	Fri 12/2/11
194	New Elevators Complete - SW	0 days	Fri 12/2/11	Fri 12/2/11
195	Base Bldg Systems Start-up & Commissioning - SW	47 days	Thu 10/20/11	Fri 12/23/11
196	Base Bldg Final Inspections - SW	16 days	Tue 12/27/11	Tue 1/17/12
197	Base Bldg Final Inspections Completed - SW	0 days	Tue 1/17/12	Tue 1/17/12
198	**Tenant Improvements**	**91 days**	**Tue 12/27/11**	**Tue 5/1/12**
199	Tenant Improvements Complete - SW	91 days	Tue 12/27/11	Tue 5/1/12
200	**Building Completion**	**0 days**	**Tue 5/1/12**	**Tue 5/1/12**



7700 Arlington Blvd.
Falls Church, VA

Milestone ◆ Project Summary Start-only
Summary Manual Task Finish-only

Appendix B

Detailed Structural Systems Estimate

Table B-1 | Progressive Collapse Steel Estimate Take-Off Charts (Segments A & B)					
Columns					
Type	**Length (ft)**	**# of Sections (12'=4, 14'=4, 16'=3)**	**Quantity**	**Total Columns w/ Sections**	
HSS 6x6x5/16	47	4	6	24	
HSS 7x7x5/16	47	4	3	12	
HSS 8x8x5/16	47	4	4	16	
HSS 9x9x1/2	47	4	42	168	
HSS 10x10x1/2	47	3	9	27	
HSS 12x12x5/8	47	3	1	3	
HSS 12x12x1/2	47	3	2	6	
Channels					
Type	**Length**	**Quantity**	**Total LF**		
C6x8.2	2'-3"	43	96.75		
C6x8.2	2'-9"	38	104.5		
C6x8.2	3'-0"	7	21		
C6x8.2	4'-6"	4	18		
C6x8.2	5'-0"	1	5		
C8x11.5	2'-9"	74	203.5		
C8x11.5	3'-0"	4	12		
C8x11.5	3'-6"	31	108.5		
C8x11.5	5'-0"	3	15		
C8x11.5	6'-0"	10	60		
C8x11.5	8'-6"	5	42.5		
Cap Plates					
Type	**Unit**	**Volume (in3)**	**Density of Steel (lbs/in^3)**	**Weight (lbs)**	**Quantity**
17x10x1	LB	170	0.284	48.28	6
18x10x1	LB	180	0.284	51.12	1
18x10x1-1/4	LB	225	0.284	63.9	5
18x10x1-1/2	LB	270	0.284	76.68	1
19x10x2	LB	380	0.284	107.92	1
20x10x1-1/2	LB	300	0.284	85.2	2
20x10x1-3/4	LB	350	0.284	99.4	27
20x10x2	LB	400	0.284	113.6	1
20x11x1-3/4	LB	385	0.284	109.34	1
22-1/2x10x1-1/2	LB	337.5	0.284	95.85	1
22-1/2x10x2	LB	450	0.284	127.8	9
33-1/2x10x2	LB	670	0.284	190.28	1
33-1/2x11x1-3/4	LB	644.875	0.284	183.14	5
35-1/2x11x1-3/4	LB	683.375	0.284	194.08	3
36x13x1-3/4	LB	819	0.284	232.6	3
Base Plates					
Type	**Unit**	**Volume (in3)**	**Density of Steel (lbs/in^3)**	**Weight (lbs)**	**Quantity**
12x12x3/4	LB	108	0.284	30.67	6
13x13x3/4	LB	126.75	0.284	36	3
14x14x3/4	LB	147	0.284	41.75	4
15x15x3/4	LB	168.75	0.284	47.93	3
15x15x1	LB	225	0.284	63.9	5
15x15x1-1/4	LB	281.25	0.284	79.88	13
15x15x1-1/2	LB	337.5	0.284	95.85	2
16x16x1-1/2	LB	384	0.284	109.06	12
16x16x1-1/4	LB	320	0.284	90.88	3
17x17x1-1/2	LB	433.5	0.284	123.11	1
18x18x1-1/2	LB	486	0.284	138.02	7
18x18x1-1/4	LB	405	0.284	115.02	8

Table B-1 | Progressive Collapse Steel Estimate Take-Off Charts (Segments A & B)			
Beams			
Type	**Length (ft)**	**Quantity**	**Total LF**
W24x103	11	2	22
W24x103	22	55	1210
W24x131	22	14	308
W24x146	31.1	4	124.4
W14x61	22	1	22
Angle Framing			
Type	**Length (ft)**	**Quantity**	**Total LF**
Kickers – 3x3x3/8	8	55	440
Anchor Bolts			
Type	**Quantity**	**Unit**	**Total # Sets**
¾" Diameter x 12" long	67	Set	67

Assumptions:

- The HSS columns that were taken off were placed into the closest category listed in RS Means.
- Columns will be connected to existing footings for Segments A & B
- Interpolation was done in order to take off the steel members
- Assuming the biggest size for the kickers based on the type of system
- Assuming any welding that needs to be done is included with the column and steel member pricing
- Used http://hypertextbook.com/facts/2004/KarenSutherland.shtml to get the density of steel

Table B-2 | Progressive Collapse Steel Estimate Pricing (Segments A & B)								
Columns								
Description	**Quantity**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
HSS 6x6x1/4 (12' Section)	36	Ea.	$305.00	$49.00	$30.00	$384.00	$455.00	$16,380.00
HSS 8x8x3/8 (14' Section)	184	Ea.	$660.00	$53.00	$32.50	$745.50	$855.00	$157,320.00
HSS 10x10x1/2 (16' Section)	36	Ea.	$1,225.00	$55.50	$34.00	$1,314.50	$1,475.00	$53,100.00
							Total	**$226,800.00**
Channels								
Description	**Total LF**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
C6x8.2	245.25	LF	$5.35	$21.50	$1.98	$28.83	$47.50	$11,649.38
C8x11.5	441.5	LF	$7.75	$33	$3.03	$43.78	$72.50	$32,008.75
							Total	**$43,658.13**
Cap Plates								
Description	**Weight (lbs)**	**Quantity**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
17x10x1	48.28	6	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$599.64
18x10x1	51.12	1	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$105.82
18x10x1-1/4	63.9	5	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$661.37
18x10x1-1/2	76.68	1	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$158.73
19x10x2	107.92	1	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$223.39
20x10x1-1/2	85.2	2	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$352.73
20x10x1-3/4	99.4	27	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$5,555.47
20x10x2	113.6	1	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$235.15
20x11x1-3/4	109.34	1	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$226.33
22-1/2x10x1-1/2	95.85	1	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$198.41
22-1/2x10x2	127.8	9	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$2,380.91
33-1/2x10x2	190.28	1	LB	$1.29	$0.35	$0.22	$1.86	$2.28	$433.84
33-1/2x11x1-3/4	183.14	5	LB	$1.29	$0.35	$0.22	$1.86	$2.28	$2,087.80
35-1/2x11x1-3/4	194.08	3	LB	$1.29	$0.35	$0.22	$1.86	$2.28	$1,327.51
36x13x1-3/4	232.6	3	LB	$1.29	$0.35	$0.22	$1.86	$2.28	$1,590.98
								Total	**$16,138.08**
Base Plates								
Description	**Weight (lbs)**	**Quantity**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
12x12x3/4	30.67	6	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$63.49
13x13x3/4	36	3	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$223.56
14x14x3/4	41.75	4	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$345.69
15x15x3/4	47.93	3	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$297.65
15x15x1	63.9	5	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$661.37
15x15x1-1/4	79.88	13	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$2,149.57
15x15x1-1/2	95.85	2	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$396.82
16x16x1-1/2	109.06	12	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$2,709.05
16x16x1-1/4	90.88	3	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$564.36
17x17x1-1/2	123.11	1	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$254.84
18x18x1-1/2	138.02	7	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$1,999.91
18x18x1-1/4	115.02	8	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$1,904.73
								Total	**$11,571.04**

Table B-2 | Progressive Collapse Steel Estimate Pricing (Segments A & B)									
Beams									
Description	**Total LF**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**	
W24x103	22	LF	$127.75	$3.27	$1.47	$132.49	$147.33	$3,241.26	
W24x103	1210	LF	$127.75	$3.27	$1.47	$132.49	$147.33	$178,269.30	
W24x131	308	LF	$162.24	$3.38	$1.53	$167.14	$186.37	$57,401.96	
W24x146	124.4	LF	$181.03	$3.30	$1.49	$185.81	$205.61	$25,577.88	
W14x61	22	LF	$75.59	$3.40	$2.08	$81.07	$91.39	$2,010.58	
							Total	**$266,500.98**	
Angle Framing									
Description	**Total LF**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Waste Factor**	**Total Cost**
Kickers - 3x3x3/8	440	LF	4.86	20.50	1.91	27.27	45.50	5%	$21,021.00
								Total	**$21,021.00**
Anchor Bolts									
Description	**Quantity**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**	
¾” Dia. x 12” long	67	Set	$20.50	$20.50	$0.00	$41.00	$55.50	$3,718.50	
							Total	**$3,718.50**	
							Total Progressive Collapse Steel Estimate Pricing (Segments A & B)	**$589,407.73**	

Table B-3 | Progressive Collapse Estimate Steel Take-Off Charts (Segments C)					
Columns					
Type	**Length (ft)**	**# of Sections (12'=4, 14'=4, 16'=3)**		**Quantity**	**Total Columns w/ Sections**
HSS 7x7x3/8	43'-10"	4		4	16
HSS 8x8x3/8	43'-10"	4		4	16
HSS 9x9x3/8	43'-10"	3		32	96
HSS 10x10x3/8	43'-10"	3		4	12
Channels					
Type	**Length**	**Quantity**	**Total LF**		
C6x8.2	2'-6"	20	50		
C6x10.5	2'-9"	69	189.75		
C8x11.5	3'-6"	30	105		
C8x11.5	3'-8"	6	22		
C8x18.7	3'-0"	4	12		
Cap Plates					
Type	**Unit**	**Volume (in3)**	**Density of Steel (lbs/in^3)**	**Weight (lbs)**	**Quantity**
17x10x1/4	LB	42.5	0.284	12.07	4
19x10x1-1/2	LB	285	0.284	80.94	32
20-1/2x10x2	LB	410	0.284	116.44	8
Base Plates					
Type	**Unit**	**Volume (in3)**	**Density of Steel (lbs/in^3)**	**Weight (lbs)**	**Quantity**
13x13x3/4	LB	126.75	0.284	36	4
14x14x3/4	LB	147	0.284	41.75	4
15x15x1	LB	225	0.284	63.9	32
16x16x1	LB	256	0.284	72.7	4
Beams					
Type	**Length (ft)**	**Quantity**		**Total LF**	
W24x103	20	42		840	
Angle Framing					
Type	**Length (ft)**	**Quantity**		**Total LF**	
Kickers – 3x3x3/8	8	40		320	
CIP Concrete Footings (3000 PSI)					
Width (ft)	**Length (ft)**	**Depth (ft)**	**Concrete (CY)**	**Quantity**	**Total Concrete (CY)**
2	2	2	0.296	42	12.44
Anchor Bolts					
Type	**Quantity**	**Unit**		**Total # Sets**	
¾" Dia. x 12" long	42	Set		42	

Assumptions:

- The HSS columns that were taken off were placed into the closest category listed in RS Means.
- Columns will be connected to the new spread footings for Segment C
- Interpolation was done in order to take off the steel members
- Assuming the biggest size for the kickers based on the type of system
- Assuming any welding that needs to be done is included with the column and steel member pricing
- Assuming the CIP concrete footing includes the rebar and dowel pricing
- Used http://hypertextbook.com/facts/2004/KarenSutherland.shtml to get the density of steel

Table B-4 | Progressive Collapse Steel Estimate Pricing (Segments C)								
Columns								
Description	**Quantity**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
HSS 6x6x1/4 (12' Section)	16	Ea.	$305.00	$49.00	$30.00	$384.00	$455.00	$7,280.00
HSS 8x8x3/8 (14' Section)	16	Ea.	$660.00	$53.00	$32.50	$745.50	$855.00	$13,680.00
HSS 10x10x1/2 (16' Section)	108	Ea.	$1,225.00	$55.50	$34.00	$1,314.50	$1,475.00	$159,300.00
							Total	**$180,260.00**
Channels								
Description	**Total LF**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
C6x8.2	50	LF	$5.35	$21.50	$1.98	$28.83	$47.50	$2,375.00
C6x10.5	189.75	LF	$6.60	$29.50	$2.72	$38.82	$64.50	$12,238.88
C8x11.5	105	LF	$7.75	$33	$3.03	$43.78	$72.50	$7,612.50
C8x11.5	22	LF	$7.75	$33	$3.03	$43.78	$72.50	$1,595.00
C8x18.7	12	LF	$7.75	$33	$3.03	$43.78	$72.50	$870.00
							Total	**$24,691.38**
Cap Plates								
Description	**Weight (lbs)**	**Quantity**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
17x10x1/4	12.07	4	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$99.94
19x10x1-1/2	80.94	32	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$5,361.47
20-1/2x10x2	116.44	8	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$1,928.25
								Total	**$7,389.66**
Base Plates								
Description	**Weight (lbs)**	**Quantity**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
13x13x3/4	36	4	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$298.08
14x14x3/4	41.75	4	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$345.69
15x15x1	63.9	32	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$4,232.74
16x16x1	72.7	4	LB	$1.24	$0.39	$0.00	$1.63	$2.07	$601.96
								Total	**$5,478.47**
Beams								
Description	**Total LF**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
W24x103	840	LF	$127.75	$3.27	$1.47	$132.49	$147.33	$123,757.20
							Total	**$123,757.20**
Angle Framing									
Description	**Total LF**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Waste Factor**	**Total Cost**
Kickers - 3x3x3/8	320	LF	4.86	20.50	1.91	27.27	45.50	5%	$14,280.00
								Total	**$14,280.00**
Anchor Bolts								
Description	**Quantity**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Total Cost**
¾" Dia. x 12" long	42	Set	$20.50	$20.50	$0.00	$41.00	$55.50	$2,331.00
							Total	**$2,331.00**
CIP Concrete Footings (3000 PSI)									
Description	**Total Concrete (CY)**	**Unit**	**Bare Material**	**Bare Labor**	**Bare Equipment**	**Bare Total**	**Total Incl O&P**	**Waste Factor**	**Total Cost**
Spread under 1 CY	12.44	CY	158	165	0.84	323.84	445.00	10%	$6,089.38
								Total	**$6,089.38**
Total Progressive Collapse Steel Estimate Pricing (Segments C)								**$364,277.09**

	03 30 53.40 Concrete In Place	Crew	Daily Output	Labor-Hours	Unit	2011 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
3540	Equipment pad (3000 psi), 3' x 3' x 6" thick	C-14H	45	1.067	Ea.	40.50	45.50	.51	86.51	119
3550	4' x 4' x 6" thick		30	1.600		62	68	.77	130.77	180
3560	5' x 5' x 8" thick		18	2.667		111	113	1.28	225.28	305
3570	6' x 6' x 8" thick		14	3.429		150	146	1.65	297.65	405
3580	8' x 8' x 10" thick		8	6		320	255	2.88	577.88	775
3590	10' x 10' x 12" thick		5	9.600		550	410	4.61	964.61	1,275
3800	Footings (3000 psi), spread under 1 C.Y.	C-14C	28	4	C.Y.	158	165	.84	323.84	445
3825	1 C.Y. to 5 C.Y.		43	2.605		185	108	.55	293.55	380
3850	Over 5 C.Y.		75	1.493		171	61.50	.31	232.81	289
3900	Footings, strip (3000 psi), 18" x 9", unreinforced	C-14L	40	2.400		119	96.50	.58	216.08	289
3920	18" x 9", reinforced	C-14C	35	3.200		141	132	.67	273.67	370
3925	20" x 10", unreinforced	C-14L	45	2.133		116	85.50	.51	202.01	268
3930	20" x 10", reinforced	C-14C	40	2.800		134	116	.59	250.59	335
3935	24" x 12", unreinforced	C-14L	55	1.745		114	70	.42	184.42	240
3940	24" x 12", reinforced	C-14C	48	2.333		132	96.50	.49	228.99	305
3945	36" x 12", unreinforced	C-14L	70	1.371		111	55	.33	166.33	212
3950	36" x 12", reinforced	C-14C	60	1.867		127	77	.39	204.39	266
4000	Foundation mat (3000 psi), under 10 C.Y.		38.67	2.896		192	120	.61	312.61	410
4050	Over 20 C.Y.		56.40	1.986		169	82	.42	251.42	320
4200	Wall, free-standing (3000 psi), 8" thick, 8' high	C-14D	45.83	4.364		160	187	16.65	363.65	500
4250	14' high		27.26	7.337		192	315	28	535	755
4260	12" thick, 8' high		64.32	3.109		146	133	11.90	290.90	390
4270	14' high		40.01	4.999		155	214	19.10	388.10	540
4300	15" thick, 8' high		80.02	2.499		140	107	9.55	256.55	340
4350	12' high		51.26	3.902		140	167	14.90	321.90	445
4500	18' high		48.85	4.094		156	176	15.65	347.65	475
4520	Handicap access ramp (4000 psi), railing both sides, 3' wide	C-14H	14.58	3.292	L.F.	278	140	1.58	419.58	535
4525	5' wide		12.22	3.928		288	167	1.89	456.89	590
4530	With 6" curb and rails both sides, 3' wide		8.55	5.614		287	238	2.69	527.69	710
4535	5' wide		7.31	6.566		292	279	3.15	574.15	780
4650	Slab on grade (3500 psi), not including finish, 4" thick	C-14E	60.75	1.449	C.Y.	117	61.50	.38	178.88	230
4700	6" thick	"	92	.957	"	113	41	.25	154.25	191
4701	Thickened slab edge (3500 psi), for slab on grade poured									
4702	monolithically with slab; depth is in addition to slab thickness;									
4703	formed vertical outside edge, earthen bottom and inside slope									
4705	8" deep x 8" wide bottom, unreinforced	C-14L	2190	.044	L.F.	3.18	1.76	.01	4.95	6.35
4710	8" x 8", reinforced	C-14C	1670	.067		5.30	2.77	.01	8.08	10.40
4715	12" deep x 12" wide bottom, unreinforced	C-14L	1800	.053		6.55	2.14	.01	8.70	10.70
4720	12" x 12", reinforced	C-14C	1310	.086		10.40	3.53	.02	13.95	17.20
4725	16" deep x 16" wide bottom, unreinforced	C-14L	1440	.067		11.10	2.68	.02	13.80	16.60
4730	16" x 16", reinforced	C-14C	1120	.100		15.70	4.13	.02	19.85	24
4735	20" deep x 20" wide bottom, unreinforced	C-14L	1150	.083		16.85	3.35	.02	20.22	24
4740	20" x 20", reinforced	C-14C	920	.122		22.50	5.05	.03	27.58	33
4745	24" deep x 24" wide bottom, unreinforced	C-14L	930	.103		24	4.14	.02	28.16	33
4750	24" x 24", reinforced	C-14C	740	.151		31.50	6.25	.03	37.78	44.50
4751	Slab on grade (3500 psi), incl. troweled finish, not incl. forms									
4760	or reinforcing, over 10,000 S.F., 4" thick	C-14F	3425	.021	S.F.	1.29	.82	.01	2.12	2.72
4820	6" thick		3350	.021		1.89	.84	.01	2.74	3.41
4840	8" thick		3184	.023		2.59	.88	.01	3.48	4.25
4900	12" thick		2734	.026		3.88	1.02	.01	4.91	5.90
4950	15" thick		2505	.029		4.88	1.12	.01	6.01	7.15
5000	Slab on grade (3000 psi), incl. textured finish, not incl. forms									
5001	or reinforcing, 4" thick	C-14G	2873	.019	S.F.	1.29	.75	.01	2.05	2.61

05 05 23.05 Anchor Bolts			Crew	Daily Output	Labor-Hours	Unit	2011 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
0600	30" long	G	2 Carp	29	.552	Set	83.50	24		107.50	131
0610	36" long	G		28	.571		95	24.50		119.50	144
0620	42" long	G		27	.593		106	25.50		131.50	159
0630	48" long	G		26	.615		116	26.50		142.50	172
0640	54" long	G		26	.615		144	26.50		170.50	202
0650	60" long	G		25	.640		155	27.50		182.50	216
0660	2" diameter x 24" long	G		27	.593		96.50	25.50		122	148
0670	30" long	G		27	.593		108	25.50		133.50	161
0680	36" long	G		26	.615		119	26.50		145.50	175
0690	42" long	G		25	.640		132	27.50		159.50	191
0700	48" long	G		24	.667		152	28.50		180.50	214
0710	54" long	G		23	.696		180	30		210	247
0720	60" long	G		23	.696		194	30		224	262
0730	66" long	G		22	.727		207	31.50		238.50	279
0740	72" long	G		21	.762		227	33		260	305
1000	4-bolt pattern, including job-built 4-hole template, per set										
1100	J-type, incl. hex nut & washer, 1/2" diameter x 6" long	G	1 Carp	19	.421	Set	6.90	18.15		25.05	37
1110	12" long	G		19	.421		8.15	18.15		26.30	38.50
1120	18" long	G		18	.444		9.95	19.15		29.10	42.50
1130	3/4" diameter x 8" long	G		17	.471		16.70	20.50		37.20	51.50
1140	12" long	G		17	.471		20.50	20.50		41	55.50
1150	18" long	G		17	.471		26	20.50		46.50	61.50
1160	1" diameter x 12" long	G		16	.500		37.50	21.50		59	76
1170	18" long	G		15	.533		44.50	23		67.50	86.50
1180	24" long	G		15	.533		54	23		77	96.50
1190	36" long	G		15	.533		73	23		96	118
1200	1-1/2" diameter x 18" long	G		13	.615		118	26.50		144.50	174
1210	24" long	G		12	.667		140	28.50		168.50	202
1300	L-type, incl. hex nut & washer, 3/4" diameter x 12" long	G		17	.471		19.25	20.50		39.75	54
1310	18" long	G		17	.471		24	20.50		44.50	59.50
1320	24" long	G		17	.471		29	20.50		49.50	65
1330	30" long	G		16	.500		36	21.50		57.50	75
1340	36" long	G		16	.500		41	21.50		62.50	80
1350	1" diameter x 12" long	G		16	.500		31.50	21.50		53	69.50
1360	18" long	G		15	.533		38.50	23		61.50	80
1370	24" long	G		15	.533		47	23		70	89.50
1380	30" long	G		15	.533		55.50	23		78.50	98.50
1390	36" long	G		15	.533		63	23		86	107
1400	42" long	G		14	.571		76	24.50		100.50	124
1410	48" long	G		14	.571		85	24.50		109.50	134
1420	1-1/4" diameter x 18" long	G		14	.571		58	24.50		82.50	104
1430	24" long	G		14	.571		68.50	24.50		93	115
1440	30" long	G		13	.615		79	26.50		105.50	130
1450	36" long	G		13	.615		89.50	26.50		116	142
1460	42" long	G	2 Carp	25	.640		101	27.50		128.50	156
1470	48" long	G		24	.667		115	28.50		143.50	173
1480	54" long	G		23	.696		135	30		165	197
1490	60" long	G		23	.696		148	30		178	211
1500	1-1/2" diameter x 18" long	G		25	.640		85	27.50		112.50	139
1510	24" long	G		24	.667		99	28.50		127.50	156
1520	30" long	G		23	.696		112	30		142	172
1530	36" long	G		22	.727		128	31.50		159.50	192
1540	42" long	G		22	.727		146	31.50		177.50	211

	05 12 23.17 Columns, Structural		Crew	Daily Output	Labor-Hours	Unit	2011 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
0010	**COLUMNS, STRUCTURAL**	R051223-20									
0015	Made from recycled materials	G									
0020	Shop fab'd for 100-ton, 1-2 story project, bolted connections										
0800	Steel, concrete filled, extra strong pipe, 3-1/2" diameter		E-2	660	.085	L.F.	37	4.02	2.46	43.48	51
0830	4" diameter			780	.072		41.50	3.40	2.08	46.98	54
0890	5" diameter			1020	.055		49.50	2.60	1.59	53.69	60.50
0930	6" diameter			1200	.047		65.50	2.21	1.35	69.06	77.50
0940	8" diameter			1100	.051		65.50	2.41	1.47	69.38	78
1100	For galvanizing, add					Lb.	.20			.20	.22
1300	For web ties, angles, etc., add per added lb.		1 Sswk	945	.008		1.13	.41		1.54	2
1500	Steel pipe, extra strong, no concrete, 3" to 5" diameter	G	E-2	16000	.004		1.13	.17	.10	1.40	1.64
1600	6" to 12" diameter	G		14000	.004		1.13	.19	.12	1.44	1.70
1700	Steel pipe, extra strong, no concrete, 3" diameter x 12'-0"	G		60	.933	Ea.	138	44	27	209	260
1750	4" diameter x 12'-0"	G		58	.966		202	45.50	28	275.50	335
1800	6" diameter x 12'-0"	G		54	1.037		385	49	30	464	545
1850	8" diameter x 14'-0"	G		50	1.120		685	53	32.50	770.50	880
1900	10" diameter x 16'-0"	G		48	1.167		985	55.50	34	1,074.50	1,200
1950	12" diameter x 18'-0"	G		45	1.244		1,325	59	36	1,420	1,600
3300	Structural tubing, square, A500GrB, 4" to 6" square, light section	G		11270	.005	Lb.	1.13	.24	.14	1.51	1.82
3600	Heavy section	G		32000	.002	"	1.13	.08	.05	1.26	1.45
4000	Concrete filled, add					L.F.	4.03			4.03	4.43
4500	Structural tubing, sq, 4" x 4" x 1/4" x 12'-0"	G	E-2	58	.966	Ea.	186	45.50	28	259.50	315
4550	6" x 6" x 1/4" x 12'-0"	G		54	1.037		305	49	30	384	455
4600	8" x 8" x 3/8" x 14'-0"	G		50	1.120		660	53	32.50	745.50	855
4650	10" x 10" x 1/2" x 16'-0"	G		48	1.167		1,225	55.50	34	1,314.50	1,475
5100	Structural tubing, rect, 5" to 6" wide, light section	G		8000	.007	Lb.	1.13	.33	.20	1.66	2.05
5200	Heavy section	G		12000	.005		1.13	.22	.14	1.49	1.78
5300	7" to 10" wide, light section	G		15000	.004		1.13	.18	.11	1.42	1.67
5400	Heavy section	G		18000	.003		1.13	.15	.09	1.37	1.60
5500	Structural tubing, rect, 5" x 3" x 1/4" x 12'-0"	G		58	.966	Ea.	180	45.50	28	253.50	310
5550	6" x 4" x 5/16" x 12'-0"	G		54	1.037		281	49	30	360	430
5600	8" x 4" x 3/8" x 12'-0"	G		54	1.037		410	49	30	489	570
5650	10" x 6" x 3/8" x 14'-0"	G		50	1.120		660	53	32.50	745.50	855
5700	12" x 8" x 1/2" x 16'-0"	G		48	1.167		1,225	55.50	34	1,314.50	1,450
6800	W Shape, A992 steel, 2 tier, W8 x 24	G		1080	.052	L.F.	29.50	2.46	1.50	33.46	38.50
6850	W8 x 31	G		1080	.052		38.50	2.46	1.50	42.46	48
6900	W8 x 48	G		1032	.054		59.50	2.57	1.57	63.64	72
6950	W8 x 67	G		984	.057		83	2.70	1.65	87.35	97.50
7000	W10 x 45	G		1032	.054		55.50	2.57	1.57	59.64	68
7050	W10 x 68	G		984	.057		84	2.70	1.65	88.35	99
7100	W10 x 112	G		960	.058		139	2.76	1.69	143.45	159
7150	W12 x 50	G		1032	.054		62	2.57	1.57	66.14	74.50
7200	W12 x 87	G		984	.057		108	2.70	1.65	112.35	125
7250	W12 x 120	G		960	.058		149	2.76	1.69	153.45	170
7300	W12 x 190	G		912	.061		235	2.91	1.78	239.69	266
7350	W14 x 74	G		984	.057		91.50	2.70	1.65	95.85	108
7400	W14 x 120	G		960	.058		149	2.76	1.69	153.45	170
7450	W14 x 176	G		912	.061		218	2.91	1.78	222.69	247
8090	For projects 75 to 99 tons, add					All	10%				
8092	50 to 74 tons, add						20%				
8094	25 to 49 tons, add						30%	10%			
8096	10 to 24 tons, add						50%	25%			

	05 12 23.17 Columns, Structural		Crew	Daily Output	Labor-Hours	Unit	2011 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
8098	2 to 9 tons, add					All	75%	50%			
8099	Less than 2 tons, add					↓	100%	100%			
9000	Minimum labor/equipment charge		1 Sswk	1	8	Job		390		390	715
	05 12 23.20 Curb Edging										
0010	**CURB EDGING**										
0020	Steel angle w/anchors, shop fabricated, on forms, 1" x 1", 0.8#/L.F.	G	E-4	350	.091	L.F.	1.44	4.48	.31	6.23	10.15
0100	2" x 2" angles, 3.92#/L.F.	G		330	.097		5.65	4.76	.33	10.74	15.20
0200	3" x 3" angles, 6.1#/L.F.	G		300	.107		8.90	5.25	.36	14.51	19.90
0300	4" x 4" angles, 8.2#/L.F.	G		275	.116		11.75	5.70	.40	17.85	24
1000	6" x 4" angles, 12.3#/L.F.	G		250	.128		17.30	6.30	.44	24.04	31
1050	Steel channels with anchors, on forms, 3" channel, 5#/L.F.	G		290	.110		7.10	5.40	.38	12.88	18.15
1100	4" channel, 5.4#/L.F.	G		270	.119		7.65	5.80	.40	13.85	19.50
1200	6" channel, 8.2#/L.F.	G		255	.125		11.75	6.15	.43	18.33	24.50
1300	8" channel, 11.5#/L.F.	G		225	.142		16.20	7	.49	23.69	31
1400	10" channel, 15.3#/L.F.	G		180	.178		21.50	8.70	.61	30.81	40
1500	12" channel, 20.7#/L.F.	G	↓	140	.229	↓	28.50	11.20	.78	40.48	53
2000	For curved edging, add						35%	10%			
9000	Minimum labor/equipment charge		E-4	4	8	Job		390	27.50	417.50	750
	05 12 23.40 Lightweight Framing										
0010	**LIGHTWEIGHT FRAMING**	R051223-35 G									
0015	Made from recycled materials										
0200	For load-bearing steel studs see Section 05 41 13.30										
0400	Angle framing, field fabricated, 4" and larger	R051223-45 G	E-3	440	.055	Lb.	.65	2.69	.25	3.59	5.90
0450	Less than 4" angles	G		265	.091	"	.68	4.46	.41	5.55	9.40
0460	1/2" x 1/2" x 1/8"	G		200	.120	L.F.	.14	5.90	.54	6.58	11.60
0462	3/4" x 3/4" x 1/8"	G		160	.150		.38	7.40	.68	8.46	14.70
0464	1" x 1" x 1/8"	G		135	.178		.54	8.75	.81	10.10	17.55
0466	1-1/4" x 1-1/4" x 3/16"	G		115	.209		1	10.25	.95	12.20	21
0468	1-1/2" x 1-1/2" x 3/16"	G		100	.240		1.22	11.80	1.09	14.11	24
0470	2" x 2" x 1/4"	G		90	.267		2.15	13.15	1.21	16.51	27.50
0472	2-1/2" x 2-1/2" x 1/4"	G		72	.333		2.77	16.40	1.51	20.68	34.50
0474	3" x 2" x 3/8"	G		65	.369		3.98	18.15	1.68	23.81	39.50
0476	3" x 3" x 3/8"	G		57	.421	↓	4.86	20.50	1.91	27.27	45.50
0600	Channel framing, field fabricated, 8" and larger	G		500	.048	Lb.	.68	2.36	.22	3.26	5.30
0650	Less than 8" channels	G		335	.072	"	.68	3.53	.33	4.54	7.55
0660	C2 x 1.78	G		115	.209	L.F.	1.20	10.25	.95	12.40	21
0662	C3 x 4.1	G		80	.300		2.77	14.75	1.36	18.88	31.50
0664	C4 x 5.4	G		66	.364		3.65	17.90	1.65	23.20	39
0666	C5 x 6.7	G		57	.421		4.52	20.50	1.91	26.93	45
0668	C6 x 8.2	G		55	.436		5.35	21.50	1.98	28.83	47.50
0670	C7 x 9.8	G		40	.600		6.60	29.50	2.72	38.82	64.50
0672	C8 x 11.5	G		36	.667		7.75	33	3.03	43.78	72.50
0710	Structural bar tee, field fabricated, 3/4" x 3/4" x 1/8"	G		160	.150		.38	7.40	.68	8.46	14.10
0712	1" x 1" x 1/8"	G		135	.178		.54	8.75	.81	10.10	17.55
0714	1-1/2" x 1-1/2" x 1/4"	G		114	.211		1.58	10.35	.96	12.89	22
0716	2" x 2" x 1/4"	G		89	.270		2.15	13.25	1.22	16.62	28
0718	2-1/2" x 2-1/2" x 3/8"	G		72	.333		3.98	16.40	1.51	21.89	36
0720	3" x 3" x 3/8"	G		57	.421		4.86	20.50	1.91	27.27	45.50
0730	Structural zee, field fabricated, 1-1/4" x 1-3/4" x 1-3/4"	G		114	.211		.51	10.35	.96	11.82	20.50
0732	2-11/16" x 3" x 2-11/16"	G		114	.211		1.20	10.35	.96	12.51	21.50
0734	3-1/16" x 4" x 3-1/16"	G		133	.180		1.82	8.90	.82	11.54	19.25
0736	3-1/4" x 5" x 3-1/4"	G	↓	133	.180	↓	2.48	8.90	.82	12.20	19.90

05 12 23 – Structural Steel for Buildings

			Crew	Daily Output	Labor-Hours	Unit	2011 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
05 12 23.65 Plates											
0100	1/4" thick (10.2 lb./S.F.)	G				S.F.	11.50			11.50	12.60
0300	3/8" thick (15.3 lb./S.F.)	G					17.20			17.20	18.95
0400	1/2" thick (20.4 lb./S.F.)	G					23			23	25.50
0450	3/4" thick (30.6 lb./S.F.)	G					34.50			34.50	38
0500	1" thick (40.8 lb./S.F.)	G					46			46	50.50
2000	Steel plate, warehouse prices, no shop fabrication										
2100	1/4" thick (10.2 lb./S.F.)	G				S.F.	7.15			7.15	7.85
05 12 23.70 Stressed Skin Steel Roof and Ceiling System											
0010	**STRESSED SKIN STEEL ROOF & CEILING SYSTEM**	G	E-2	1150	.049	S.F.	9	2.31	1.41	12.72	15.50
0020	Double panel flat roof, spans to 100'	G		960	.058		14.65	2.76	1.69	19.10	23
0100	Double panel convex roof, spans to 200'	G		760	.074		22.50	3.49	2.13	28.12	33.50
0200	Double panel arched roof, spans to 300'	G									
05 12 23.75 Structural Steel Members											
0010	**STRUCTURAL STEEL MEMBERS** R051223-10	G									
0015	Made from recycled materials										
0020	Shop fab'd for 100-ton, 1-2 story project, bolted connections										
0102	W 6 x 9 R051223-15	G	E-2	600	.093	L.F.	11.15	4.42	2.70	18.27	23
0302	W 8 x 10	G		600	.093		12.40	4.42	2.70	19.52	24.50
0502	x 31	G		550	.102		38.50	4.82	2.95	46.27	53.50
0702	W 10 x 22	G		600	.093		27	4.42	2.70	34.12	41
0902	x 49	G		550	.102		60.50	4.82	2.95	68.27	78
1102	W 12 x 16	G		880	.064		19.80	3.01	1.84	24.65	29.50
1302	x 22	G		880	.064		27	3.01	1.84	31.85	37.50
1502	x 26	G		880	.064		32	3.01	1.84	36.85	43
1702	x 72	G		640	.088		89	4.14	2.53	95.67	108
1902	W 14 x 26	G		990	.057		32	2.68	1.64	36.32	42
2102	x 30	G		900	.062		37	2.95	1.80	41.75	48
2302	x 34	G		810	.069		42	3.27	2	47.27	54.50
2502	x 120	G		720	.078		149	3.68	2.25	154.93	172
2702	W 16 x 26	G		1000	.056		32	2.65	1.62	36.27	42
2902	x 31	G		900	.062		38.50	2.95	1.80	43.25	49
3102	x 40	G		800	.070		49.50	3.32	2.03	54.85	62.50
3302	W 18 x 35	G	E-5	960	.083		43.50	3.99	1.80	49.29	56.50
3502	x 40	G		960	.083		49.50	3.99	1.80	55.29	63.50
3702	x 50	G		912	.088		62	4.20	1.90	68.10	77.50
3902	x 55	G		912	.088		68	4.20	1.90	74.10	84.50
4102	W 21 x 44	G		1064	.075		54.50	3.60	1.63	59.73	68
4302	x 50	G		1064	.075		62	3.60	1.63	67.23	76
4502	x 62	G		1036	.077		76.50	3.70	1.67	81.87	93
4702	x 68	G		1036	.077		84	3.70	1.67	89.37	101
4902	W 24 x 55	G		1110	.072		68	3.45	1.56	73.01	83
5102	x 62	G		1110	.072		76.50	3.45	1.56	81.51	92
5302	x 68	G		1110	.072		84	3.45	1.56	89.01	100
5502	x 76	G		1080	.074		94	3.45	1.56	99.01	111
5702	x 84	G		1190	.067		104	3.55	1.60	109.15	122
5902	W 27 x 94	G		1200	.067		116	3.22	1.45	120.67	135
6102	W 30 x 99	G		1200	.067		123	3.19	1.44	127.63	142
6302	x 108	G		1160	.069		134	3.19	1.44	138.63	154
6502	x 116	G		1176	.068		144	3.31	1.49	148.80	166
6702	W 33 x 118	G		1134	.071		146	3.26	1.47	150.73	168
6902	x 130	G		1134	.071		161	3.38	1.53	165.91	185
7102	x 141	G					174	3.38	1.53	178.91	200

	05 12 23.75 Structural Steel Members		Crew	Daily Output	Labor-Hours	Unit	2011 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
7302	W 36 x 135	G	E-5	1170	.068	L.F.	167	3.28	1.48	171.76	191
7502	x 150	G		1170	.068		186	3.28	1.48	190.76	211
7702	x 194	G		1125	.071		240	3.41	1.54	244.95	272
7902	x 231	G		1125	.071		286	3.41	1.54	290.95	325
8102	x 302	G		1035	.077		375	3.70	1.67	380.37	420
8490	For projects 75 to 99 tons, add						10%				
8492	50 to 74 tons, add						20%				
8494	25 to 49 tons, add						30%	10%			
8496	10 to 24 tons, add						50%	25%			
8498	2 to 9 tons, add						75%	50%			
8499	Less than 2 tons, add						100%	100%			
9000	Minimum labor/equipment charge		E-2	2	28	Job		1,325	810	2,135	3,250

	05 12 23.77 Structural Steel Projects										
0010	**STRUCTURAL STEEL PROJECTS** R050516-30										
0015	Made from recycled materials	G									
0020	Shop fab'd for 100-ton, 1-2 story project, bolted connections										
0200	Apartments, nursing homes, etc., 1 to 2 stories R050523-10	G	E-5	10.30	7.767	Ton	2,250	370	168	2,788	3,325
0300	3 to 6 stories	G	"	10.10	7.921		2,300	380	171	2,851	3,400
0400	7 to 15 stories R051223-10	G	E-6	14.20	9.014		2,350	430	133	2,913	3,500
0500	Over 15 stories	G	"	13.90	9.209		2,425	440	136	3,001	3,625
0700	Offices, hospitals, etc., steel bearing, 1 to 2 stories R051223-15	G	E-5	10.30	7.767		2,250	370	168	2,788	3,325
0800	3 to 6 stories	G	E-6	14.40	8.889		2,300	425	131	2,856	3,425
0900	7 to 15 stories R051223-20	G		14.20	9.014		2,350	430	133	2,913	3,500
1000	Over 15 stories	G		13.90	9.209		2,425	440	136	3,001	3,625
1100	For multi-story masonry wall bearing construction, add R051223-25	G						30%			
1300	Industrial bldgs., 1 story, beams & girders, steel bearing	G	E-5	12.90	6.202		2,250	297	134	2,681	3,150
1400	Masonry bearing	G	"	10	8		2,250	385	173	2,808	3,350
1500	Industrial bldgs., 1 story, under 10 tons,										
1510	steel from warehouse, trucked	G	E-2	7.50	7.467	Ton	2,700	355	216	3,271	3,850
1600	1 story with roof trusses, steel bearing	G	E-5	10.60	7.547		2,650	360	163	3,173	3,750
1700	Masonry bearing	G	"	8.30	9.639		2,650	460	209	3,319	3,975
1900	Monumental structures, banks, stores, etc., minimum	G	E-6	13	9.846		2,250	470	146	2,866	3,475
2000	Maximum	G	"	9	14.222		3,725	680	210	4,615	5,550
2200	Churches, minimum	G	E-5	11.60	6.897		2,100	330	149	2,579	3,050
2300	Maximum	G	"	5.20	15.385		2,800	735	335	3,870	4,775
2800	Power stations, fossil fuels, minimum	G	E-6	11	11.636		2,250	560	172	2,982	3,675
2900	Maximum	G		5.70	22.456		3,375	1,075	330	4,780	6,025
2950	Nuclear fuels, non-safety steel, minimum	G		7	18.286		2,250	875	270	3,395	4,350
3000	Maximum	G		5.50	23.273		3,375	1,125	345	4,845	6,100
3040	Safety steel, minimum	G		2.50	51.200		3,275	2,450	755	6,480	8,850
3070	Maximum	G		1.50	85.333		4,325	4,100	1,250	9,675	13,500
3100	Roof trusses, minimum	G	E-5	13	6.154		3,150	295	133	3,578	4,150
3200	Maximum	G		8.30	9.639		3,825	460	209	4,494	5,250
3210	Schools, minimum	G		14.50	5.517		2,250	264	119	2,633	3,075
3220	Maximum	G		8.30	9.639		3,275	460	209	3,944	4,675
3400	Welded construction, simple commercial bldgs., 1 to 2 stories	G	E-7	7.60	10.526		2,300	505	242	3,047	3,700
3500	7 to 15 stories	G	E-9	8.30	15.422		2,650	740	261	3,651	4,525
3700	Welded rigid frame, 1 story, minimum	G	E-7	15.80	5.063		2,350	243	116	2,709	3,150
3800	Maximum	G	"	5.50	14.545		3,050	695	335	4,080	4,975
3810	Fabrication shop costs (included in project material cost, above)										
3820	Mini mill base price, A992	G				Ton	770			770	845
3830	Mill extra for delivery to shop						240			240	264

Christie Smith | 10/19/11 | TECH II

Structural steel membos Interpolation

-In order to find a price that reflects the members on the project, I interpolated what was given in RS Means to what I needed. $y_2 = \frac{(x_2 - x_1)(y_3 - y_1)}{(x_3 - x_1)} + y_1$

W24X103	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total (Incl O&P)
W24X84	104	3.55	1.60	109.15	122
W30X108	134	3.19	1.44	138.63	154

using interpolation

W24X103	127.75	3.27	1.47	132.49	147.33

W24X131	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total (Incl O&P)
W24X84	104	3.55	1.60	109.15	122
W33X130	161	3.38	1.53	165.91	185

using interpolation

W24X131	162.24	3.38	1.53	167.14	186.37

W24X146	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total (Incl O&P)
W24X84	104	3.55	1.60	109.15	122
W36X150	186	3.28	1.48	190.76	211

using interpolation

W24X146	181.03	3.30	1.49	185.81	205.61

W14X61					
W14X34	42	3.27	2	47.27	54.5
W14X120	149	3.68	2.25	154.93	172

using interpolation

W14X61	75.59	3.40	2.08	81.07	91.39

05 12 Structural Steel Framing

05 12 23 – Structural Steel for Buildings

	05 12 23.77 Structural Steel Projects		Crew	Daily Output	Labor-Hours	Unit	2011 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
3840	Shop extra for shop drawings and detailing					Ton	270			270	297
3850	Shop fabricating and handling						730			730	805
3860	Shop sandblasting and primer coat of paint						135			135	149
3870	Shop delivery to the job site						105			105	116
3880	Total material cost, shop fabricated, primed, delivered						2,250			2,250	2,475
3900	High strength steel mill spec extras:										
3950	A529, A572 (50 ksi) and A36: same as A992 steel (no extra)										
4000	Add to A992 price for A572 (60, 65 ksi)	G				Ton	100			100	110
4100	A242 and A588 Weathering	G				"	85			85	93.50
4200	Mill size extras for W-Shapes: 0 to 30 plf: no extra charge										
4210	Member sizes 31 to 65 plf, deduct	G				Ton	.01			.01	.01
4220	Member sizes 66 to 100 plf, deduct	G					8.40			8.40	9.25
4230	Member sizes 101 to 387 plf, add	G					58			58	64
4300	Column base plates, light, up to 150 lb	G	2 Sswk	2000	.008	Lb.	1.24	.39		1.63	2.07
4400	Heavy, over 150 lb	G	E-2	7500	.007	"	1.29	.35	.22	1.86	2.28
4600	Castellated beams, light sections, to 50#/L.F., minimum	G		10.70	5.234	Ton	2,375	248	152	2,775	3,200
4700	Maximum	G		7	8		2,600	380	232	3,212	3,775
4900	Heavy sections, over 50# per L.F., minimum	G		11.70	4.786		2,475	227	139	2,841	3,275
5000	Maximum	G		7.80	7.179		2,700	340	208	3,248	3,800
5390	For projects 75 to 99 tons, add						10%				
5392	50 to 74 tons, add						20%				
5394	25 to 49 tons, add						30%	10%			
5396	10 to 24 tons, add						50%	25%			
5398	2 to 9 tons, add						75%	50%			
5399	Less than 2 tons, add						100%	100%			

05 12 23.80 Subpurlins

0010	SUBPURLINS	R051223-50 G									
0015	Made from recycled materials										
0020	Bulb tees, shop fabricated, painted, 32-5/8" O.C., 40 psf L.L.										
0100	Type 178, max 8'-9" span, 2.15 plf, 2" high x 1-5/8" wide	G	E-1	4200	.006	S.F.	1.56	.27	.03	1.86	2.22
0200	Type 218, max 10'-2" span, 3.19 plf, 2-1/8" high x 2-1/8" wide	G	"	3100	.008		1.81	.37	.04	2.22	2.65
1420	For 24-5/8" spacing, add						33%	33%			
1430	For 48-5/8" spacing, deduct						50%	50%			

05 14 Structural Aluminum Framing

05 14 23 – Non-Exposed Structural Aluminum Framing

05 14 23.05 Aluminum Shapes

0010	ALUMINUM SHAPES	G									
0015	Made from recycled materials	G	E-2	1050	.053	Lb.	2.98	2.53	1.54	7.05	9.40
0020	Structural shapes, 1" to 10" members, under 1 ton	G		1330	.042		2.73	1.99	1.22	5.94	7.80
0050	1 to 5 tons	G		1330	.042		2.61	1.99	1.22	5.82	7.70
0100	Over 5 tons	G		1330	.042		3.10	1.99	1.22	6.31	8.25
0300	Extrusions, over 5 tons, stock shapes	G		1330	.042		3.10	1.99	1.22	6.31	8.25
0400	Custom shapes										

Appendix C

General Conditions Estimate

Table C-1 | 7700 Arlington Blvd. General Conditions Estimate				
Personnel				
Title	**Unit Rate**	**Unit**	**Quantity**	**Total Cost**
Senior Superintendent	$4,082.00	Week	47.9	$195,527.80
Superintendent – Main Bldg	$3,627.00	Week	37	$134,199.00
Assistant Superintendent – Main Bldg	$1,979.00	Week	34.7	$68,671.30
Senior Superintendent – NW & SW Bldg	$3,521.00	Week	56.3	$198,232.30
Assistant Superintendent – NW Bldg	$2,884.00	Week	30.3	$87,385.20
Superintendent – NW & SW Bldg	$2,662.00	Week	12.1	$32,210.20
Assistant Superintendent – Site	$2,070.00	Week	47.9	$99,153.00
Safety Manager	$2,360.00	Week	56.4	$133,104.00
Layout Engineer	$2,342.00	Week	52.1	$122,018.20
Assistant Layout Engineer	$4,093.00	Week	39.0	$159,627.00
Project Executive	$1,789.00	Week	86.9	$155,464.10
Senior Project Manager	$3,536.00	Week	74.0	$261,664.00
Project Manager	$4,138.00	Week	30.3	$125,381.40
Project Manager – NW & SW Bldg	$2,812.00	Week	60.7	$170,688.40
Project Coordinator	$2,678.00	Week	58.6	$156,930.80
MEP Coordinator	$2,149.00	Week	78.3	$168,266.70
Project Scheduler	$672.00	Week	52.1	$35,011.20
Project Engineer – Main Bldg	$1,759.00	Week	73.9	$129,990.10
Project Engineer – NW & SW Bldg	$1,638.00	Week	69.4	$113,677.20
Project Engineer – NW & SW Bldg	$1,789.00	Week	60.7	$108,592.30
Project Administrator	$547.00	Week	78.3	$42,830.10
Project Accounting	$264.00	Week	87	$22,968.00
Yard Delivery	$198.00	Week	65.1	$12,889.80
Dump Truck Delivery	$281.00	Week	65.1	$18,293.1
			Total	**$2,752,775.20**
Jobsite Operations				
Title	**Unit Rate**	**Unit**	**Quantity**	**Total Cost**
Document Reproduction – Construction	$40,000.00	LS	1	$40,000.00
Document Reproduction – As Builts	$10,000.00	LS	1	$10,000.00
Progress Photos	$500.00	Month	20	$10,000.00
Overnight & Hand Delivery	$750.00	Month	21	$15,750.00
Field Office Expense	$1,500.00	Month	18	$27,000.00
Misc Job Expense – Office	$200.00	Month	18	$3,600.00
Misc Job Expense – Field	$200.00	Month	18	$3,600.00
Copier / Fax / Printer – Monthly	$1,000.00	Month	18	$18,000.00
It / Network – Set up System	$20,000.00	LS	1	$20,000.00
Computer / LAN / Misc. IT	$500.00	Month	21	$10,500.00
Field Telephone – Hook-up	$1,000.00	LS	1	$1,000.00
Field Telephone – Monthly (DSL + Reg)	$750.00	Month	19	$14,250.00
Survey / Layout Equipment	$400.00	Month	9	$3,600.00
Two-way Radio	$75.00	Month	12	$900.00
Equipment Rental	$500.00	Month	15.1	$7,550.00
			Total	**$185,750.00**

Table C-2 | 7700 Arlington Blvd. General Conditions Estimate				
Safety, Clean up, Health				
Title	**Unit Rate**	**Unit**	**Quantity**	**Total Cost**
Trash Carts	$150.00	Month	15.1	$2,265.00
Clean-up Labor 1	$1,306.00	Week	25.8	$33,694.80
Clean-up Labor 2	$1,306.00	Week	25.8	$33,694.80
Clean-up Material	$100.00	Week	65.3	$6,530.00
Dumpers	$450.00	Ld	377	$169,650.00
General Health & Safety	$750.00	Month	15.1	$11,325.00
First Aid Kit & Supplies	$200.00	Month	18	$3,600.00
Fire Extinguishers	$250.00	Month	18	$4,500.00
Temporary Toilets	$2,000.00	Month	15.1	$30,200.00
Portable Water	$200.00	Month	15.1	$3,020.00
Head, Hearing & Eye Protection	$300.00	Month	15.1	$4,530.00
			Total	**$298,479.60**
Permits, Insurance, Bonds				
Title	**Unit Rate**	**Unit**	**Quantity**	**Total Cost**
Permit Expediting	$5,000.00	LS	1	$5,000.00
Certificate of Occupancy	$2,000.00	LS	1	$2,000.00
Preconstruction Survey	$10,000.00	LS	1	$10,000.00
			Total	$17,000.00
Punch List & Close Out				
Title	**Unit Rate**	**Unit**	**Quantity**	**Total Cost**
Warranty / Punchlist – Material	$15,000.00	LS	1	$15,000.00
Wattanty / Punchlist – Labor	$2,000.00	Week	12	$24,000.00
			Total	**$39,000.00**

Assumptions:

- Personnel costs include cell phone, car, and other items
- Items do not include tax

Table C-3 | 7700 Arlington Blvd. General Conditions Estimate Summary	
Category	**Total Cost**
Personnel	$2,752,775.20
Jobsite Operations	$185,750.00
Safety, Clean up, Health	$298,479.60
Permits, Insurance, Bonds	$17,000.00
Punch List & Close Out	$39,000.00
General Conditions Total Estimate	**$3,293,004.80**

Appendix D

LEED Evaluation

LEED 2009 for Commercial Interiors

Project Checklist

7700 Arlington Blvd.

10/19/2011

Y	?	N				
10	2	9		**Sustainable Sites**	Possible Points:	**21**
0	2	3	d	Credit 1	Site Selection	1 to 5
				0	Option 1: Select a LEED Certified Building	5
					OR	
				0	Path 1: Brownfield Redevelopment	1
				0	Path 2: Stormwater Design—Quantity Control	1
				0	Path 3: Stormwater Design—Quality Control	1
				0	Path 4: Heat Island Effect—Nonroof	1
				0	Path 5: Heat-Island Effect—Roof	1
				0	Path 6: Light Pollution Reduction	1
				0	Path 7: Water Efficient Landscaping—Reduce by 50%	2
				2	Path 8: Water Efficient Landscaping—No Potable Water Use or Irrigation	2
				0	Path 9: Innovative Wastewater Technologies	2
				0	Path 10: Water Use Reduction—30% Reduction	1
				0	Path 11: On-site Renewable Energy	2
				0	Path 12: Other Quantifiable Environmental Performance	1
0	0	6	d	Credit 2	Development Density and Community Connectivity	6
6	0	0	d	Credit 3.1	Alternative Transportation—Public Transportation Access	6
2	0	0	d	Credit 3.2	Alternative Transportation—Bicycle Storage and Changing Rooms	2
2	0	0	d	Credit 3.3	Alternative Transportation—Parking Availability	2

Y	?	N				
6	0	5		**Water Efficiency**	Possible Points:	**11**
Y			d	Prereq 1	Water Use Reduction—20% Reduction	
6	0	5	d	Credit 1	Water Use Reduction	6 to 11

Y	?	N				
16	0	21		**Energy and Atmosphere**	Possible Points:	**37**
Y			C	Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			d	Prereq 2	Minimum Energy Performance	
Y			d	Prereq 3	Fundamental Refrigerant Management	
2	0	3	d	Credit 1.1	Optimize Energy Performance—Lighting Power	1 to 5
				0	15% Reduction	1
				2	20% Reduction	2
				0	25% Reduction	3
				0	30% Reduction	4
				0	35% Reduction	5
2	0	1	d	Credit 1.2	Optimize Energy Performance—Lighting Controls	1 to 3
				1	Daylight Controls for Daylit Areas	1
				0	Daylight Controls for 50% of the Lighting Load	1
				1	Occupancy Sensors for 75% of the Connected Lighting Load	1
5	0	5	d	Credit 1.3	Optimize Energy Performance—HVAC	5 to 10
				0	Equipment Efficiency	5
				5	Zoning Controls	5
					OR	
				0	Reduce Design Energy Cost and 15% Improvement	5
				0	Reduce Design Energy Cost and 30% Improvement	10
2	0	2	d	Credit 1.4	Optimize Energy Performance—Equipment and Appliances	1 to 4
				0	70% ENERGY STAR	1
				2	77% ENERGY STAR	2
				0	84% ENERGY STAR	3
				0	90% ENERGY STAR	4
5	0	0	C	Credit 2	Enhanced Commissioning	5
0	0	5	d	Credit 3	Measurement and Verification	2 to 5
				0	Install Sub-Metering Equipment	2
				0	Tenant Pays for Energy	3
					OR	
				0	Metering, Measurement and Payment Accountability	5
0	0	5	d	Credit 4	Green Power	5

Y	?	N				
5	0	9		**Materials and Resources**	Possible Points:	**14**
Y			d	Prereq 1	Storage and Collection of Recyclables	
1	0	0	d	Credit 1.1	Tenant Space—Long-Term Commitment	1
0	0	2	d	Credit 1.2	Building Reuse	1 to 2
				0	40% Reuse	1
				0	60% Reuse	2
1	0	1	C	Credit 2	Construction Waste Management	1 to 2
				1	Divert 50% from Disposal	1
				0	Divert 75% from Disposal	2
1	0	1	C	Credit 3.1	Materials Reuse	1 to 2
				1	5% Reuse	1
				0	10% Reuse	2
0	0	1	C	Credit 3.2	Materials Reuse—Furniture and Furnishings	1
0	0	2	C	Credit 4	Recycled Content	1 to 2
				0	10% of Content	1
				0	20% of Content	2
1	0	1	C	Credit 5	Regional Materials	1 to 2
				1	20% of Materials Manufactured	1
				0	20% of Materials Manufactured and 10% Extracted	2
0	0	1	C	Credit 6	Rapidly Renewable Materials	1
1	0	0	C	Credit 7	Certified Wood	1

Y	?	N				
16	0	1			**Indoor Environmental Quality**	Possible Points: 17
Y	?	N				
Y			d	Prereq 1	Minimum IAQ Performance	
Y			d	Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1	0	0	d	Credit 1	Outdoor Air Delivery Monitoring	1
1	0	0	d	Credit 2	Increased Ventilation	1
1	0	0	C	Credit 3.1	Construction IAQ Management Plan—During Construction	1
1	0	0	C	Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1	0	0	C	Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1	0	0	C	Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1	0	0	C	Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1	0	0	C	Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
1	0	0	C	Credit 4.5	Low-Emitting Materials—Systems Furniture and Seating	1
1	0	0	d	Credit 5	Indoor Chemical & Pollutant Source Control	1
1	0	0	d	Credit 6.1	Controllability of Systems—Lighting	1
1	0	0	d	Credit 6.2	Controllability of Systems—Thermal Comfort	1
1	0	0	d	Credit 7.1	Thermal Comfort—Design	1
1	0	0	d	Credit 7.2	Thermal Comfort—Verification	1
1	0	1	d	Credit 8.1	Daylight and Views—Daylight	1 to 2
		1			75% of Spaces	1
		0			90% of Spaces	2
1	0	0	d	Credit 8.2	Daylight and Views—Views for Seated Spaces	1

Y	?	N				
1	0	5			**Innovation and Design Process**	Possible Points: 6
Y	?	N				
0	0	1	d/C	Credit 1.1	Innovation in Design: Specific Title	1
0	0	1	d/C	Credit 1.2	Innovation in Design: Specific Title	1
0	0	1	d/C	Credit 1.3	Innovation in Design: Specific Title	1
0	0	1	d/C	Credit 1.4	Innovation in Design: Specific Title	1
0	0	1	d/C	Credit 1.5	Innovation in Design: Specific Title	1
1	0	0	d	Credit 2	LEED Accredited Professional	1

Y	?	N				
0	0	4			**Regional Priority Credits**	Possible Points: 4
Y	?	N				
0	0	1	d/C	Credit 1.1	Regional Priority: Specific Credit	1
0	0	1	d/C	Credit 1.2	Regional Priority: Specific Credit	1
0	0	1	d/C	Credit 1.3	Regional Priority: Specific Credit	1
0	0	1	d/C	Credit 1.4	Regional Priority: Specific Credit	1

54	2	54			**Total**	Possible Points: 110

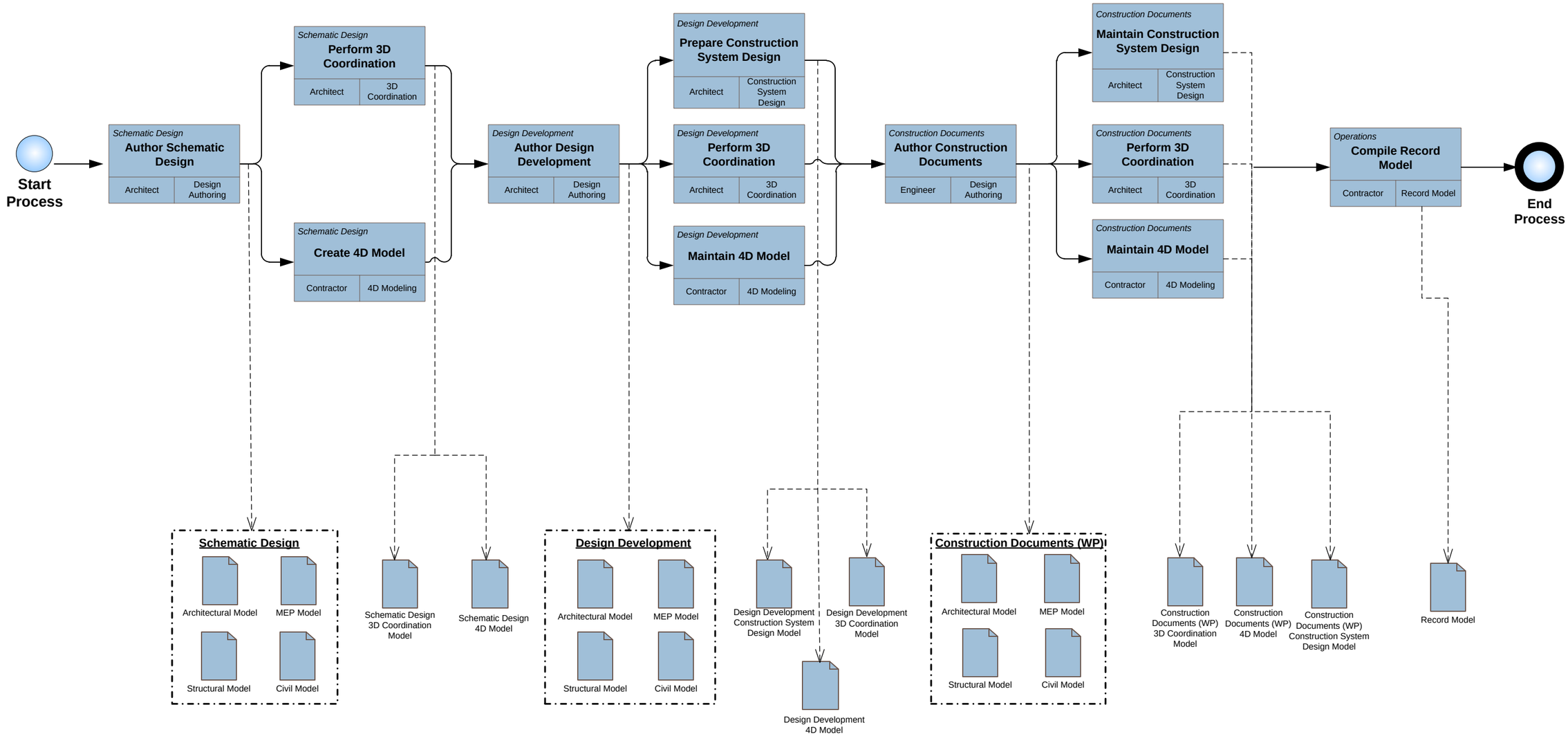
Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Appendix E

BIM Use Evaluation

Table E-1 | BIM Goals Worksheet		
Priority (1-3)	**Goal Description**	**Potential BIM Uses**
1 – Most Important	**Value added objectives**	
1	Reduce the project schedule duration	4D Modeling, Construction System Design
1	Reduce the project cost	4D Modeling, Existing Conditions Modeling
1	Increase the overall quality of the project	Design Reviews, 3D Coordination, Record Modeling, Engineering Analysis
2	Efficient design documentation	Design Authoring, Design Reviews, 3D Coordination
3	Automated takeoffs	Cost Estimation
2	Eliminate field conflicts	3D Coordination
2	Increase project productivity levels	Design Reviews, 3D Coordination, Programming
2	Track progress during construction	4D Modeling
1	Identify concerns with the 2-phase construction sequence	4D Modeling
3	Easily analyze different costs from design changes	Cost Estimation

Table E-2 | BIM Use Analysis Worksheet									
BIM Use	**Value to Project**	**Responsible Party**	**Value to Resp Party**	**Capability Rating**			**Additional Resources / Competencies Required to Implement**	**Notes**	**Proceed with Use**
	High / Med / Low		High / Med / Low	Scale 1-3 (1=low)					Yes / No / Maybe
				Resources	Competency	Experience			
Record Modeling	Med	Contractor	Med	3	3	3			Yes
		Facility Manager	High	1	1	1	Requires training & software		
		Architect	Med	3	3	3			
Construction System Design	High	Architect	Med	3	2	2	Requires training & software		Yes
		Contractor	High	3	3	3			
3D Coordination	High	Architect	High	3	2	2			Yes
		MEP Engineer	Med	3	2	2	Coordination software required as well as some training		
		Structural Engineer	High	3	2	2			
		Contractor	High	3	3	3		Contractors to facilitate coordination	
Design Authoring	Med	Architect	High	3	3	3			Yes
		MEP Engineer	Med	3	3	3			
		Structural Engineer	High	3	3	3			
		Civil Engineer	Low	2	1	1	Large learning curve	Not required	
Engineering Analysis	Med	MEP Engineer	Med	2	2	2			Maybe
		Architect	High	2	2	2			
Programming	Med	Architect	Low	1	2	1			No
Design Reviews	High	Architect	Low	2	2	2	Requires training & software		Maybe
4D Modeling	High	Contractor	High	3	3	3		Huge benefit to Owner	Yes
Cost Estimation	High	Contractor	High	2	1	1			Maybe
Existing Conditions Modeling	Low	Architect	Med	1	1	1			No
		Civil Engineer	Med	1	1	1			
		Contractor	Med	2	1	1	Large learning curve		


Start Process
Schematic Design
Author Schematic Design
Architect
Design Authoring
Schematic Design
Perform 3D Coordination
Architect
3D Coordination
Schematic Design
Create 4D Model
Contractor
4D Modeling
Design Development
Author Design Development
Architect
Design Authoring
Design Development
Prepare Construction System Design
Architect
Construction System Design
Design Development
Perform 3D Coordination
Architect
3D Coordination
Design Development
Maintain 4D Model
Contractor
4D Modeling
Construction Documents
Author Construction Documents
Engineer
Design Authoring
Construction Documents
Maintain Construction System Design
Architect
Construction System Design
Construction Documents
Perform 3D Coordination
Architect
3D Coordination
Construction Documents
Maintain 4D Model
Contractor
4D Modeling
Operations
Compile Record Model
Contractor
Record Model
End Process
Schematic Design
Architectural Model
MEP Model
Structural Model
Civil Model
Schematic Design 3D Coordination Model
Schematic Design 4D Model
Design Development
Architectural Model
MEP Model
Structural Model
Civil Model
Design Development Construction System Design Model
Design Development 3D Coordination Model
Design Development 4D Model
Construction Documents (WP)
Architectural Model
MEP Model
Structural Model
Civil Model
Construction Documents (WP) 3D Coordination Model
Construction Documents (WP) 4D Model
Construction Documents (WP) Construction System Design Model
Record Model

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