

**REPORT TO CONGRESS**

**TECHNOLOGIES TO ACHIEVE PROGRESSIVE  
COLLAPSE RESISTANCE**



**Office of the Under Secretary of Defense  
for Acquisition, Technology, and Logistics**

**September 2012**

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This report responds to House Report 111-491 accompanying  
H.R. 5136, the National Defense Authorization Act for Fiscal Year 2011.

## **Technologies to Achieve Progressive Collapse Resistance**

The report of the House Committee on Armed Services (H.R. 111-491, page 513) to accompany H.R. 5136, the National Defense Authorization Act for Fiscal Year 2011, requests the Secretary of Defense report on technologies and costs to achieve progressive collapse resistance in facilities construction. In response to this request, the U.S. Army Corps of Engineers Protective Design Center (PDC) evaluated the methods prescribed in Unified Facilities Criteria (UFC) 4-023-03, "Design of Buildings to Resist Progressive Collapse," for specific cost impacts, using examples provided in the UFC for four typical types of construction: reinforced concrete, structural steel, wood, and cold-formed steel.

House Report 111-491 asked for information in the three areas enumerated below, with the Department of Defense (DoD) response following each.

### **1. An assessment of technologies available to meet requirements for construction compliant with progressive collapse resistance requirements.**

Progressive collapse is the disproportionate or catastrophic failure of a structure due to the sudden loss of a single support member (usually a column) that induces failure in adjacent members, causing a larger domino effect. DoD requires progressive collapse resistance in buildings of three or more stories as part of the minimum antiterrorism protection standards. Technologies supporting designs to resist progressive collapse are focused on stiffening and strengthening the building structural systems against such a loss, and therefore share some characteristics with technologies to strengthen buildings to resist seismic events.

The design approaches to resist progressive collapse vary by the type of construction involved, but in all cases are modifications of the basic building design that a structural engineer would evaluate using common structural analysis tools and the associated construction trade would incorporate during the construction process. Special-purpose design and construction methods are not required. DoD UFC 4-023-03, "Design of Buildings to Resist Progressive Collapse," identifies the following solutions for the four common types of structural framing:

Reinforced concrete: A typical reinforced concrete frame is stiffened by adding an integrated system of ties (reinforcing steel) around the periphery of the structural frame and throughout the floor and roof slabs.

Structural steel: A typical structural steel frame is stiffened by increasing the size of beams (horizontal members) and columns (vertical members) in conjunction with increasing the capacity of beam-column connections to provide additional resistance.

Wood: A typical wood frame is stiffened by strengthening the header/sill plates along both interior and exterior walls and adding laminated wood beams that run along the top of the exterior walls.

Cold-formed steel: A cold-formed steel frame is stiffened by strengthening the header/sill plates along both interior and exterior walls, strengthening the shear wall connections, and adding steel tube beams that run along the top of the exterior walls.

**2. An assessment of the cost to incorporate such requirements in new construction.**

As with the technologies to resist progressive collapse, the cost premium to resist progressive collapse varies by type of construction as well as by the building occupancy category defined in Table 2-2 of UFC 3-301-01, “Structural Engineering” (Appendix A). Most DoD buildings fall into occupancy categories II and III. Occupancy category III includes general administrative and training buildings with more than 500 occupants and health care facilities without surgery or emergency treatment facilities with 50 or more resident patients.

Table 2-2 of UFC 4-023-03 defines the progressive collapse design requirements for each occupancy category (Appendix B), with requirements increasing from category I to V.

To estimate costs for various construction types and occupancy levels, the U.S. Army Corps of Engineers PDC evaluated the building examples provided in UFC 4-023-03. (Full report at Appendix C.) Although these examples are not exhaustive, they nonetheless represent four common construction types and the two most common occupancy categories (II and III). The progressive collapse cost premiums are as follows:

Construction type	Modeled building type	Modeled building size (square ft)	Modeled building occupancy category	Modeled building baseline cost	Modeled building cost (incl. progressive collapse resistance)	Progressive collapse resistance cost premium
Reinforced concrete	7-story office	149,625	II	\$46,348,152	\$46,980,919	+ 1.4%
Structural steel	4-story health care	86,400	III	\$25,838,943	\$26,795,040	+ 3.7%
Wood	3-story barracks	19,597	II	\$6,490,981	\$6,512,950	+ 0.3%
Cold-formed steel	3-story barracks	19,597	II	\$7,576,265	\$7,665,941	+ 1.2%

These cost premiums for progressive collapse resistance represent typical buildings without positive access controls in areas with low seismic activity. Buildings with positive access controls would not need protection against collapse of interior columns, and would entail a lower cost premium. Buildings in high seismic areas would already include some frame stiffening to resist seismic forces and therefore require less additional stiffening (and associated cost) solely

to resist progressive collapse. Conversely, a building in a higher occupancy category than that shown in the table for its construction type would require additional protective design features at marginally higher cost. For example, a reinforced concrete building in occupancy category III would approach the cost premium for a structural steel building in occupancy category III (+3.7 percent).

### **3. A discussion of incorporation of affordable progressive collapse protection into planning for new construction.**

During the planning phase for a new construction project, planners identify general project parameters such as functional user requirements, project site characteristics, and building footprint. For purposes of progressive collapse resistance, planners identify whether the project will require (or allow) buildings of three or more stories in height to meet site constraints and space requirements. If so, the planner considers the possible impact on costs and whether the project budget adequately accommodates progressive collapse resistance. Project cost estimates developed from DoD guidance unit costs include allowance for progressive collapse resistance for building types that are typically three stories or greater, such as barracks or hospitals. (The guidance unit costs are based upon actual project award amounts during the last 3 years.) If project cost estimates do not use guidance unit costs that already include an allowance for progressive collapse resistance, planners may increase cost estimates for primary facilities expected to exceed two stories in height by up to 2.5 percent in accordance with Component cost guidance. This allowance is consistent with the findings of the PDC report.

#### Appendices:

- A. Pages 6-7 extracted from DoD UFC 3-301-01, "Structural Engineering," January 27, 2010, with change 3, Table 2-2
- B. Pages 17-20 extracted from DoD UFC 4-023-03, "Design of Buildings to Resist Progressive Collapse," July 14, 2009, Section 2-2 with Tables 2-2
- C. U.S. Army Corps of Engineers PDC study, "Cost Estimates to Incorporate Progressive Collapse Prevention into Various Structural Framing Systems" (March 2012)

# APPENDIX A

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**TABLE 2-2 - OCCUPANCY CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

Occupancy Category	Nature of Occupancy	Seismic Factor $I_E$	Snow Factor $I_S$	Wind Factor $I_W$	Ice Factor $I_I$
I	<b>Buildings and other structures that represent a low hazard to human life in the event of failure, including, but not limited to:</b> <ul style="list-style-type: none"> <li>• Agricultural facilities</li> <li>• Certain temporary facilities</li> <li>• Minor storage facilities</li> </ul>	1.00	0.8	0.87 <sup>a</sup>	0.80
II	<b>Buildings and other structures except those listed in Categories I, III, IV and V</b>	1.00	1.00	1.00	1.00
III	<b>Buildings and other structures that represent a substantial hazard to human life or represent significant economic loss in the event of failure, including, but not limited to:</b> <ul style="list-style-type: none"> <li>• Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300 people</li> <li>• Buildings and other structures containing elementary school, secondary school, or daycare facilities with an occupant load greater than 250</li> <li>• Buildings and other structures with an occupant load greater than 500</li> <li>• Group I-2 occupancies with an occupant load of 50 or more resident patients, but not having surgery or emergency treatment facilities</li> <li>• Group I-3 occupancies</li> <li>• Power-generating stations; water treatment facilities for potable water, waste water treatment facilities, and other public utility facilities that are not included in Categories IV and V</li> <li>• Buildings and other structures not included in Categories IV and V containing sufficient quantities of toxic, flammable, or explosive substances to be dangerous to the public if released</li> <li>• Facilities having high-value equipment, as designated by the authority having jurisdiction</li> </ul>	1.25	1.10	1.15	1.25

IV	<p><b>Buildings and other structures designed as essential facilities, including, but not limited to:</b></p> <ul style="list-style-type: none"> <li>• Group I-2 occupancies having surgery or emergency treatment facilities</li> <li>• Fire, rescue, and police stations, and emergency vehicle garages</li> <li>• Designated earthquake, hurricane, or other emergency shelters</li> <li>• Designated emergency preparedness, communication, and operation centers, and other facilities required for emergency response</li> <li>• Emergency backup power-generating facilities required for primary power for Category IV</li> <li>• Power-generating stations and other utility facilities required for primary power for Category IV, if emergency backup power generating facilities are not available</li> <li>• Structures containing highly toxic materials as defined by Section 307, where the quantity of material exceeds the maximum allowable quantities of Table 307.7(2)</li> <li>• Aviation control towers and air traffic control centers required for post earthquake operations where lack of system redundancy does not allow for immediate control of airspace and the use of alternate temporary control facilities is not feasible. Contact the authority having jurisdiction for additional guidance.</li> <li>• Emergency aircraft hangars that house aircraft required for post-earthquake emergency response; if no suitable back up facilities exist</li> <li>• Buildings and other structures not included in Category V, having DoD mission-essential command, control, primary communications, data handling, and intelligence functions that are not duplicated at geographically separate locations, as designated by the using agency</li> <li>• Water storage facilities and pump stations required to maintain water pressure for fire suppression</li> </ul>	1.50	1.20	1.15	1.25
V <sup>b</sup>	<p><b>Facilities designed as national strategic military assets, including, but not limited to:</b></p> <ul style="list-style-type: none"> <li>• Key national defense assets (e.g. National Missile Defense facilities), as designated by the authority having jurisdiction.</li> <li>• Facilities involved in operational missile control, launch, tracking, or other critical defense capabilities</li> <li>• Emergency backup power-generating facilities required for primary power for Category V occupancy</li> <li>• Power-generating stations and other utility facilities required for primary power for Category V occupancy, if emergency backup power generating facilities are not available</li> <li>• Facilities involved in storage, handling, or processing of nuclear, chemical, biological, or radiological materials, where structural failure could have widespread catastrophic consequences, as designated by the authority having jurisdiction.</li> </ul>	Not Required	1.50	1.70	1.50

# APPENDIX B

**2-2 DESIGN REQUIREMENTS FOR NEW AND EXISTING CONSTRUCTION.**

The design requirements for each Occupancy Category (OC) are shown in Table 2-2. The details are provided in the following sections.

**Table 2-2. Occupancy Categories and Design Requirements**

Occupancy Category	Design Requirement
I	No specific requirements
II	Option 1: Tie Forces for the entire structure and Enhanced Local Resistance for the corner and penultimate columns or walls at the first story. <p style="text-align: center;"><b>OR</b></p> Option 2: Alternate Path for specified column and wall removal locations.
III	Alternate Path for specified column and wall removal locations; Enhanced Local Resistance for all perimeter first story columns or walls.
IV	Tie Forces; Alternate Path for specified column and wall removal locations; Enhanced Local Resistance for all perimeter first and second story columns or walls.

**2-2.1 Occupancy Category I Design Requirement.**

Progressive collapse design is not required for these structures.

**2-2.2 Occupancy Category II Design Requirement.**

For OC II structures, one of two options may be chosen. In the first, the designer shall incorporate the Tie Force requirement for the entire structure and Enhanced Local Resistance for the first story corner and penultimate columns and walls (a penultimate column or wall is the closest column or wall to the corner). In the second option, the designer shall design or analyze the building with the Alternate Path method to show that the structure can bridge over the removal of columns, load-bearing walls, or beams supporting columns or walls at specified locations.

The requirements for Occupancy Category II are further discussed in Appendix C.

### **2-2.2.1 Option 1 for Occupancy Category II: Tie Force and Enhanced Local Resistance.**

The requirements in 2-2.2.1.1 and 2-2.2.1.2 for Tie Forces and Enhanced Local Resistance shall be satisfied, if this option is chosen.

#### **2-2.2.1.1 Tie Force Requirement for OC II Option 1.**

The procedure and requirements for Tie Forces for framed and load-bearing wall structures are presented in Section 3-1.

If a vertical structural member cannot provide the required vertical tie force capacity, either re-design the member or use the AP method to prove that the structure can bridge over the element when it is removed.

For elements with inadequate horizontal tie force capacity, the designer shall re-design the element in the case of new construction or retrofit the element in the case of existing construction. The AP method cannot be used as an alternative for inadequate horizontal ties.

#### **2-2.2.1.2 Enhanced Local Resistance Requirement for OC II, Option 1.**

The Enhanced Local Resistance requirement is applied to the first story corner and penultimate columns and walls only. For this requirement for OC II Option 1, the flexural capacity of the column or wall is not increased; however, the shear capacity of the column or wall and the connections to the slabs, floor system or other lateral load resisting elements shall be greater than the flexural capacity. The procedure is presented in Section 3-3.

#### **2-2.2.2 Option 2 for Occupancy Category II: Alternate Path.**

If the Alternate Path requirement is chosen, then the structure shall be able to bridge over vertical load-bearing elements that are notionally removed one at a time from the structure at specific plan and elevation locations, as required in Section 3-2. The procedures and general requirements for the Alternate Path method are provided in Section 3-2 with specific requirements for each material given in Chapters 4 through 8. If bridging cannot be demonstrated for one of the removed load-bearing elements, the structure shall be re-designed or retrofitted to increase the bridging capacity.

If the results of the analyses are similar for multiple locations due to the redundancy of the building, a formal analysis is not required for every location, provided that one typical analysis is performed and that this observation is annotated in the design documents.

Note: for load-bearing wall structures, the Alternate Path approach will often be the most practical choice.

### **2-2.3 Occupancy Category III Design Requirement.**

For Occupancy Category III, two requirements shall be satisfied: Alternate Path and Enhanced Local Resistance as discussed in the following sections.

#### **2-2.3.1 Alternate Path Requirement for Occupancy Category III.**

The structure shall be able to bridge over vertical load-bearing elements that are notionally removed one at a time from the structure at specific plan and elevation locations, as required in Section 3-2. If bridging cannot be demonstrated for one of the removed load-bearing elements, the structure shall be re-designed or retrofitted to increase the bridging capacity. Note that the structural re-design or retrofit is not applied to just the deficient element, i.e., if a structure cannot be shown to bridge over a removed typical column at the center of the long side, the engineer shall develop suitable or similar re-designs or retrofits for that column and other similar columns.

The procedures and general requirements for the Alternate Path method are provided in Section 3-2 with specific requirements for each material given in Chapters 4 through 8.

#### **2-2.3.2 Enhanced Local Resistance Requirement for Occupancy Category III.**

The Enhanced Local Resistance requirement is applied to all first story perimeter columns and walls. For this requirement, for OC III, the flexural capacity of the column or wall need not be increased; however, the shear capacity of the column or wall and the connections to the slabs, floor system or other lateral load resisting elements shall be greater than the flexural capacity. The procedure is presented in Section 3-3.

### **2-2.4 Occupancy Category IV Design Requirement.**

The design requirements for Occupancy Category IV include Alternate Path, Tie Forces and Enhanced Local Resistance as discussed in the following paragraphs. Some OC V facilities designed as military protective construction may be exempted from all minimum standards, including progressive collapse requirements.

#### **2-2.4.1 Tie Force Requirement for Occupancy Category IV.**

For OC IV, the designer shall provide adequate internal, peripheral and vertical Tie Force capacities. The procedure and requirements for applying the Tie Force approach are provided in Section 3-1.

If a structural member cannot provide the required vertical tie force capacity, the designer shall either re-design the member or use the Alternate Path method to prove that the structure can bridge over the element when it is removed. For elements with inadequate horizontal tie force capacity, the Alternate Path method cannot be used. In this case, the designer shall re-design the element in the case of new construction or retrofit the element for existing construction.

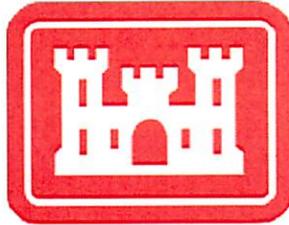
**2-2.4.2 Alternate Path Requirement for Occupancy Category IV.**

For OC IV, use the same AP requirement as for OC III; see Section 2-2.3.1.

**2-2.4.3 Enhanced Local Resistance Requirement for Occupancy Category IV.**

For the first two stories on the building perimeter, the flexural capacity of the columns and walls shall be increased by a factor of 2 and a factor of 1.5, respectively, over the design flexural strength determined from the Alternate Path procedure in Paragraph 2-2.4.2. The shear capacity of the column or wall and the connections to the slabs, floor system or other lateral load resisting elements shall be greater than the flexural capacity. Procedures for Enhanced Local Resistance are given in Section 3-3.

# **APPENDIX C**



**US Army Corps  
of Engineers®**

# **Cost Estimates to Incorporate Progressive Collapse Prevention into Various Structural Framing Systems**

**Prepared for the Protective Design Center, Omaha District**

**3-1-12**

Prepared By:

Crawford Consulting Services, Inc.

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East Pittsburgh, PA 15112



# Summary of Cost Estimates to Incorporate Progressive Collapse Prevention Into Various Structural Framing Systems

David Stevens  
Protection Engineering Consultants  
March 1, 2012

Crawford Consulting provided cost estimates for the four progressive collapse design examples in Appendices D through G in UFC 4-023-03 Design of Buildings to Resist Progressive Collapse. These cost estimates are provided in the following pages. As the cost for each example problem was addressed differently due to the different methods used for each example, a description of the example, the cost estimate approach, and a summary are provided here.

## Appendix D Reinforced Concrete Example

The reinforced concrete (RC) example is a commercial building with a 7-story moment resisting frame that employs Tie Forces and enhanced local resistance (ELR) at the corner and penultimate ground floor columns, per on center (OC) II Option 1. The plan view of the building is shown in Figure 1. The total floor area is 149,625-ft<sup>2</sup>.

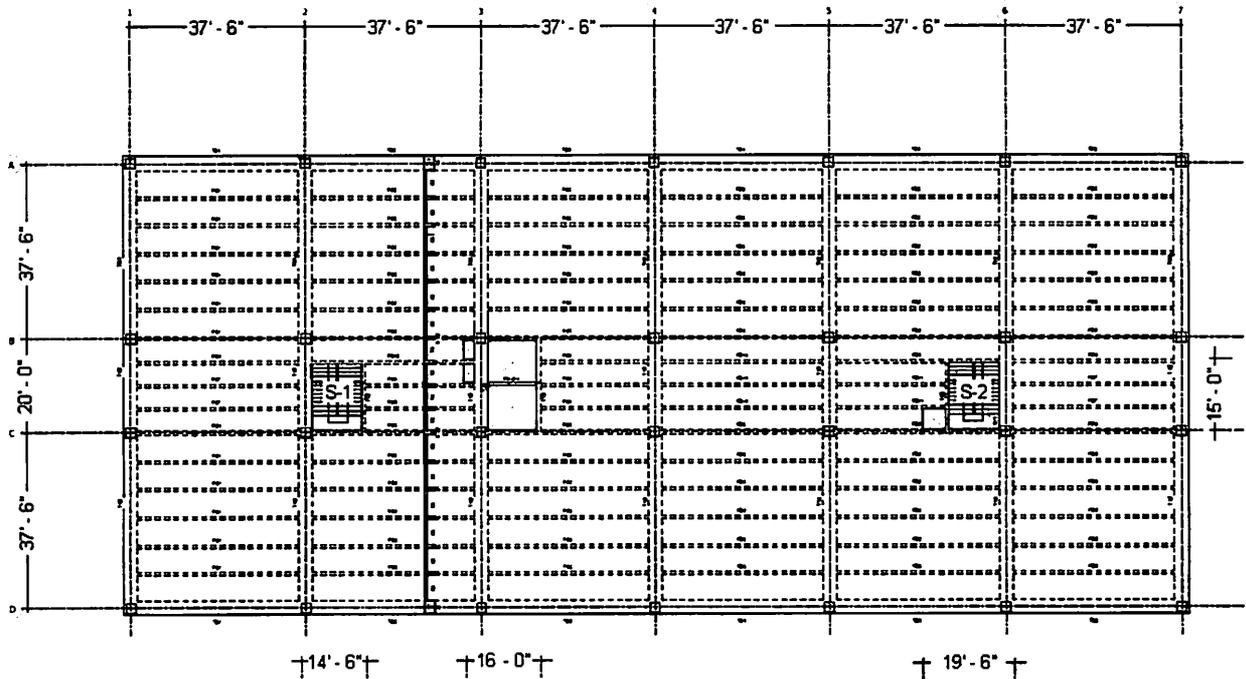


Figure 1. Reinforced Concrete Building Used in Example Problem

Two baseline costs were estimated by Crawford: 1. Just the structural frame and 2. The entire building. In addition, the cost for Scenario 1 was calculated as shown in the Crawford

Consulting report, appended to this report; Scenario 1 is the building with the rebar material cost and labor for the Tie Forces and ELR. The results are summarized in Table 1.

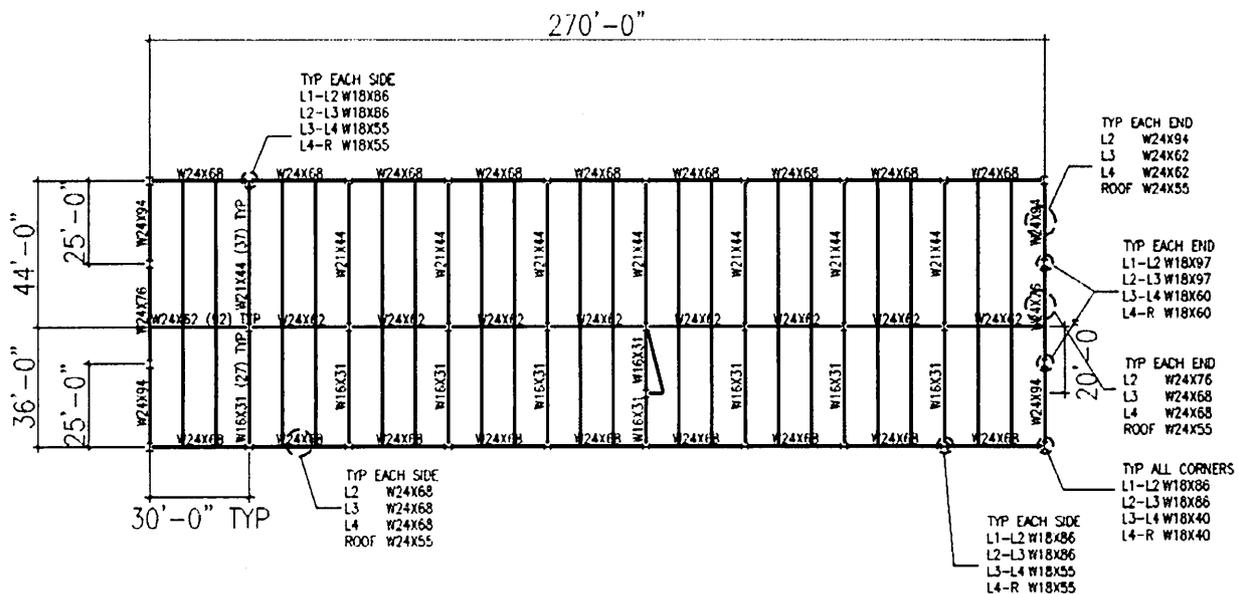
	Baseline Cost	Baseline plus Scenario 1 (TF and ELR)	
		Cost	% Increase
Structural Frame	\$6,796,812	\$7,429,580	9.31
Entire Building	\$46,348,152	\$46,980,919	1.38

**Table 1. Reinforced Concrete Example Costs**

It is noted that Crawford commented that the majority of the cost increase was for the internal (transverse and longitudinal) ties and little was due to the peripheral ties or ELR reinforcement.

### Appendix E Structural Steel Example

The steel example is a health care facility with a 4-story moment resisting frame, that employs the Alternate Path method and ELR applied at the perimeter ground floor columns, per OC III. The plan view of the building is shown in Figure 2. The total floor area is 86,400-ft<sup>2</sup>.



1. Scenario 1. Removal of perimeter columns for Linear Static design and, also, application of ELR. In the Steel Structure example problem in Appendix E of UFC 4-023-03, three column removal locations were considered and the results of the three resulting design changes were combined to create a final design for the Linear Static procedure; this overall design is Scenario 1.
2. Scenario 2. Removal of perimeter columns for Nonlinear Dynamic design and, also, application of ELR. In the Steel Structure example problem in Appendix E of UFC 4-023-03, three column removal locations were considered and the results of the three resulting design changes were combined to create a final design for the Nonlinear Dynamic procedure; this overall design is Scenario 2.
3. Scenario 3. Removal of interior columns for Linear Static design. Designs for interior column removals were not performed in the Steel Structure example
4. Scenario 4. Removal of interior columns for Nonlinear Dynamic design. Designs for interior column removals were not performed in the Steel Structure example.

The costs associated with considering internal column removal locations were also requested. Because the example problem in UFC 4-023-03 did not consider interior column removal, a design was not available from which Crawford could directly provide a cost estimate. Instead, the costs for the removal of external columns for Linear Static and Nonlinear Dynamic solutions were used. The main differences from the external column removals in Scenarios 1 and 2 are that: 1) the tributary area and loads on internal frames are larger and 2) ELR requirements are not needed for interior columns. Crawford considered Scenario 3 to be the building with the interior frame in the long direction replaced with the external frame determined in Scenario 1 (Linear Static), minus the ELR required stiffeners. Scenario 4 is the building with the interior frame in the long direction replaced with the external frame determined in Scenario 2 (Nonlinear Dynamic), minus the ELR required stiffeners.

Some additional analysis was required to determine a realistic cost as the internal frames support loads from both sides (a full bay), as opposed to the external frames that support load from one side only (half bay). Physically, the interior and exterior frames are similar in that they run in the long direction of the building and the gravity beams have pinned connections, as shown in Figure 2. However, the load on the exterior frames is approximately half that of the interior frames, due to the larger tributary area of the interior frames. If the load is doubled, then the interior frame beams will need a moment of inertia roughly twice that of the project collapse (PC)-designed exterior frame beams. Keeping the depth at 24-in, a scan of the American Institute of Steel Construction (AISC) steel tables shows that doubling the moment of inertia for a W24 results in a section that is approximately twice as heavy, i.e., a W24x146 has an area moment of inertia (I) of 4580-in<sup>4</sup> and a W24x279 has an I of 9600-in<sup>4</sup>; a W24x94 has 2700-in<sup>4</sup> and a W24x176 has 5680-in<sup>4</sup>. It is assumed that the columns will also need twice the area for double the loads. Therefore, the tonnage for the PC-designed interior frame will be approximately twice that of the PC-designed exterior frame. According to Crawford, the additional labor does not increase significantly with larger steel sizes, for both erection and connection fabrication and therefore, a double framed

weight results in double the frame cost. Thus, the cost of the internal frame designed for a removed interior column will be twice the costs provided for Scenarios 3 and 4, in the Crawford Consulting report, appended to this report.

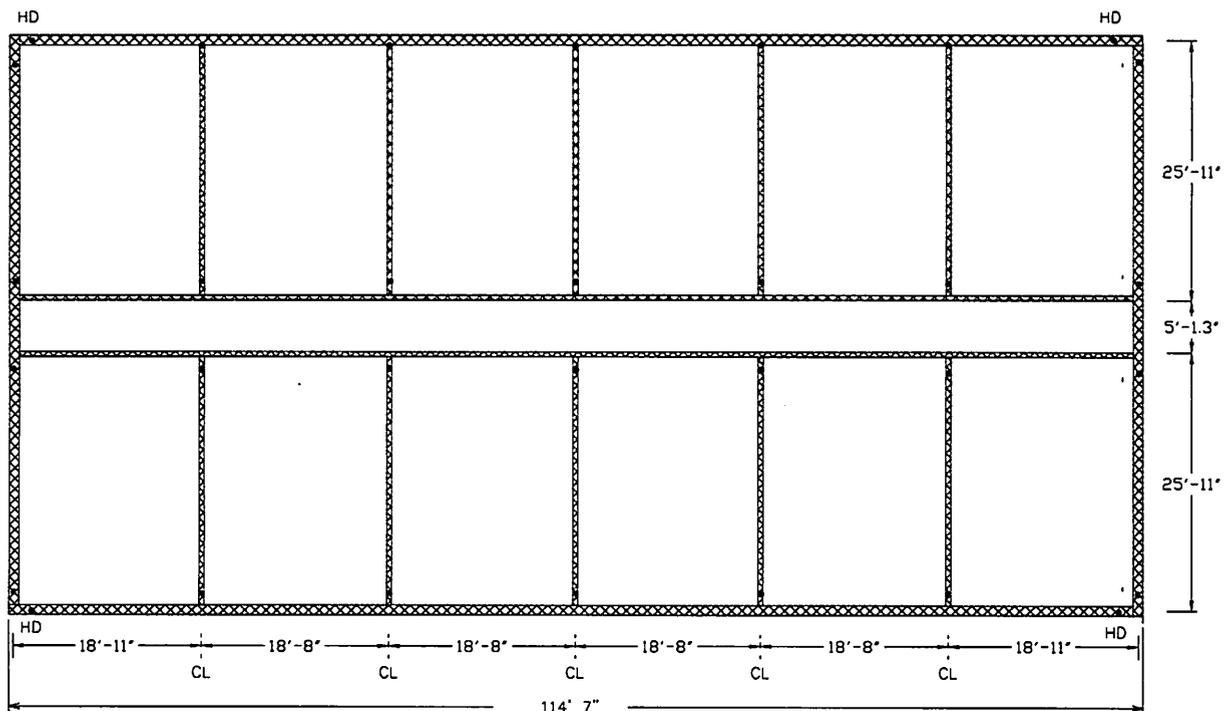
The results of this logic are shown in Table 2.

	Baseline Cost	Baseline plus Linear Static AP and ELR Reqmts				Baseline plus Nonlinear Dynamic AP and ELR Reqmts			
		Ext Col Removal, Scenario 1		Ext and Int Col Removal, Scenarios 1 and 3		Ext Col Removal, Scenario 2		Ext and Int Col Removal, Scenarios 2 and 4	
		Cost	% Incr.	Cost	% Incr.	Cost	% Incr.	Cost	% Incr.
Structural Frame	\$1,541,318	\$2,043,315	32.6%	\$2,497,415	62.0%	\$1,737,671	12.7%	\$1,907,959	23.8%
Entire Building	\$25,838,943	\$26,340,940	1.9%	\$26,795,040	3.7%	\$26,035,296	0.8%	\$26,205,584	1.4%

Table 2. Structural Steel Example Costs

### Appendix F Wood Example

The wood example is a 3-story load-bearing wall barracks that employs the Alternate Path method, per OC II Option II. The plan view of the building is shown in Figure 3. The total floor area is 19,597-ft<sup>2</sup>.



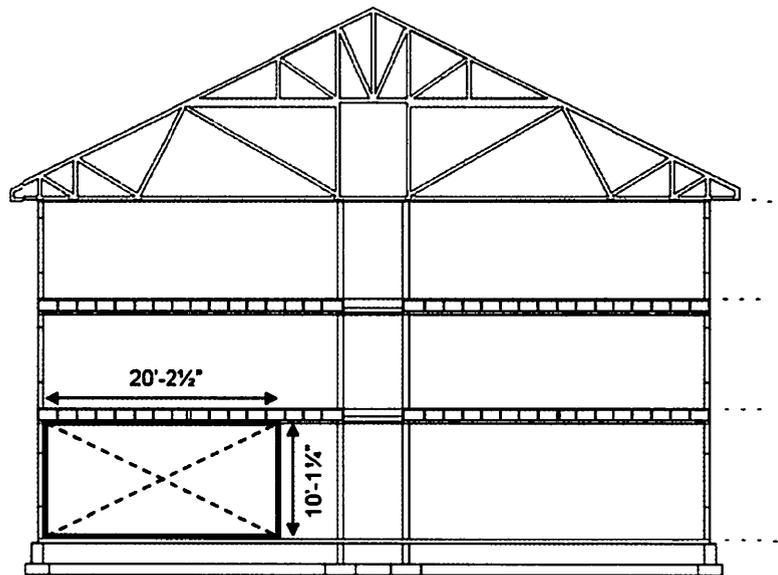
**Figure 3. Wood Building Used in Example Problem**

Two baseline costs were estimated by Crawford: 1. Just the structural frame and 2. The entire building.

Crawford created costs for 4 “Scenarios”, which, in this example, are based on the design changes that are required for each of the 4 wall section removals. These scenarios are:

1. Scenario 1 Removal of Interior Load-bearing Wall (in short direction); see Figure 4.

Modification: Short direction wall header and sill plates (double 2x6) to be stagger spliced with nailing or have splice plates (splicing of chord forces not needed for typical building)



**Figure 4. Interior Load Bearing Wall Removal**

2. Scenario 2 Removal of Exterior Load-bearing Wall at 2<sup>nd</sup> Story, Not Including Window (in long direction); see Figure 5.

Modification: Long direction wall header and sill plates (double 2x6) to be stagger spliced with nailing or have splice plates (splicing of chord forces not needed for typical building)

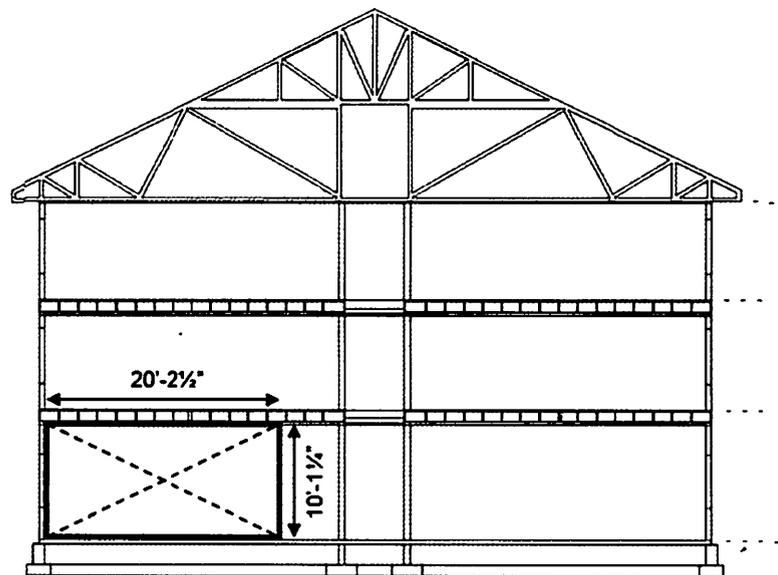
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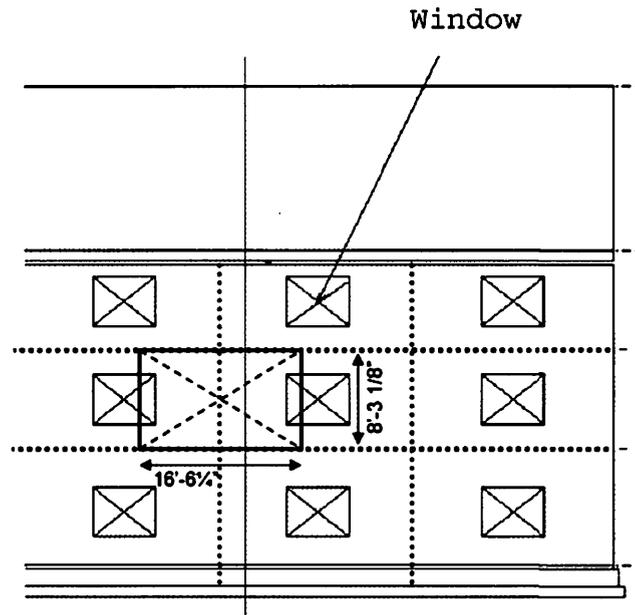
Modification: Short direction wall header and sill plates (double 2x6) to be stagger spliced with nailing or have splice plates (splicing of chord forces not needed for typical building)



**Figure 4. Interior Load Bearing Wall Removal**

2. Scenario 2 Removal of Exterior Load-bearing Wall at 2<sup>nd</sup> Story, Not Including Window (in long direction); see Figure 5.

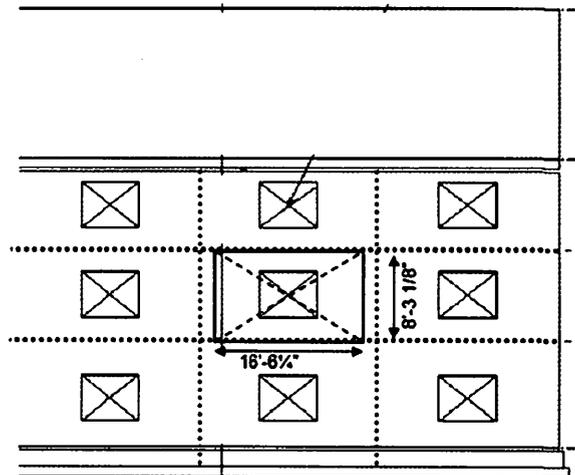
Modification: Long direction wall header and sill plates (double 2x6) to be stagger spliced with nailing or have splice plates (splicing of chord forces not needed for typical building)



**Figure 5. Exterior Load Bearing Wall Removal, Without Window**

3. Scenario 3 Removal of Exterior Load-bearing Wall at 2<sup>nd</sup> Story, Including Window (in long direction); see Figure 6.

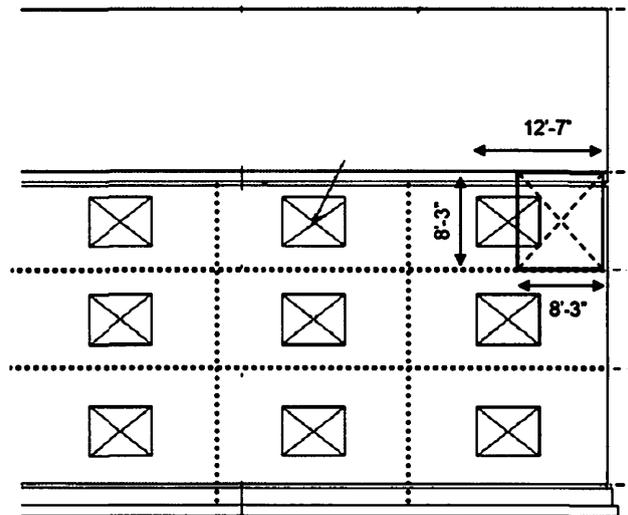
Modification: Long direction wall header and sill plates (double 2x6) to be stagger spliced with nailing or have splice plates (splicing of chord forces not needed for typical building)



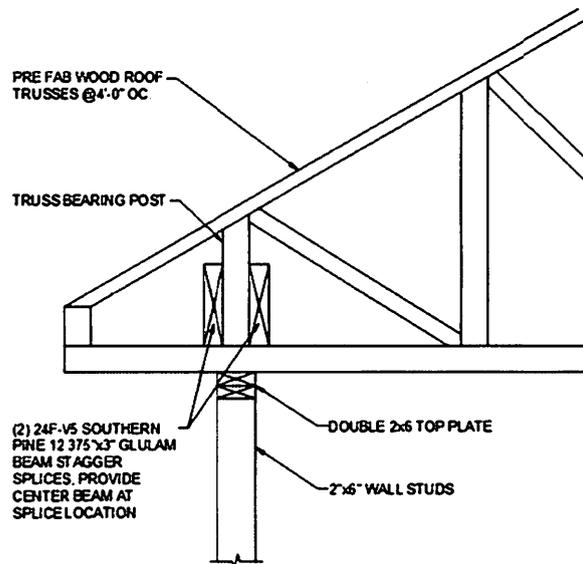
**Figure 6. Exterior Load Bearing Wall Removal, With Window**

4. Scenario 4 Removal of Exterior Load-bearing Wall at 3<sup>rd</sup> Story (in long direction, at corner); see Figure 7.

Modifications: 1) Addition of two 24F-V5 Southern Pine 12.375-in x 3-in Glulam Beam with stagger splices on top of lower roof truss chord over long direction; and 2) Addition of two Simpson HD9B hold-down anchors at each corner (8 total); see Figure 8.



**Figure 7. Exterior Load Bearing Wall Removal at 3<sup>rd</sup> Story Corner**



**Figure 8. Hold-down Anchor for Removal of 3<sup>rd</sup> Story Wall**

The additional costs to provide each of the 4 scenarios **applied to the entire building** is shown in the Crawford Consulting report, appended to this report. Thus, the modifications required for Scenario 1 (stagger splice of wall header and sill plates) are applied to all of the short walls in the structure and the total cost of that is \$1,480. The modifications for Scenarios 2 and 3 are the same and are applied for all long walls in the structure; since the modifications for the 2 scenarios are the same, the scenario costs are the same, \$1,820. Scenario 4, for AP for wall

removal at the third floor in the long direction, requires glulam beams and hold downs in the roof trusses and the total cost to do that for the whole building is \$16,847.

The costs for three cases are assembled in the table below: 1. All PC modifications applied at once (interior and exterior walls), 2. PC modifications for only interior wall removal and 3. PC modifications for only exterior wall removal.

	Baseline Cost	Baseline plus All PC Mods		Baseline plus Interior Wall Removal Mods (Scen 1)		Baseline plus Exterior Wall Removal Mods (Scen 2 and Scen 4)	
		Cost	% Increase	Cost	% Increase	Cost	% Increase
Structural Frame	\$623,057	\$643,206	3.23%	\$624,539	0.24%	\$641,724	3.00%
Entire Building	\$6,490,981	\$6,511,130	0.31%	\$6,492,463	0.02%	\$6,509,648	0.29%

Table 3. Wood Example Costs

### Appendix G Cold-Formed Steel Example

The cold-formed steel example is of a 3-story load-bearing wall barracks that employs the Alternate Path method, per OC II Option II. The plan view of the building is shown in Figure 9 and is similar to the wood structure. The total floor area is 19,597-ft<sup>2</sup>.

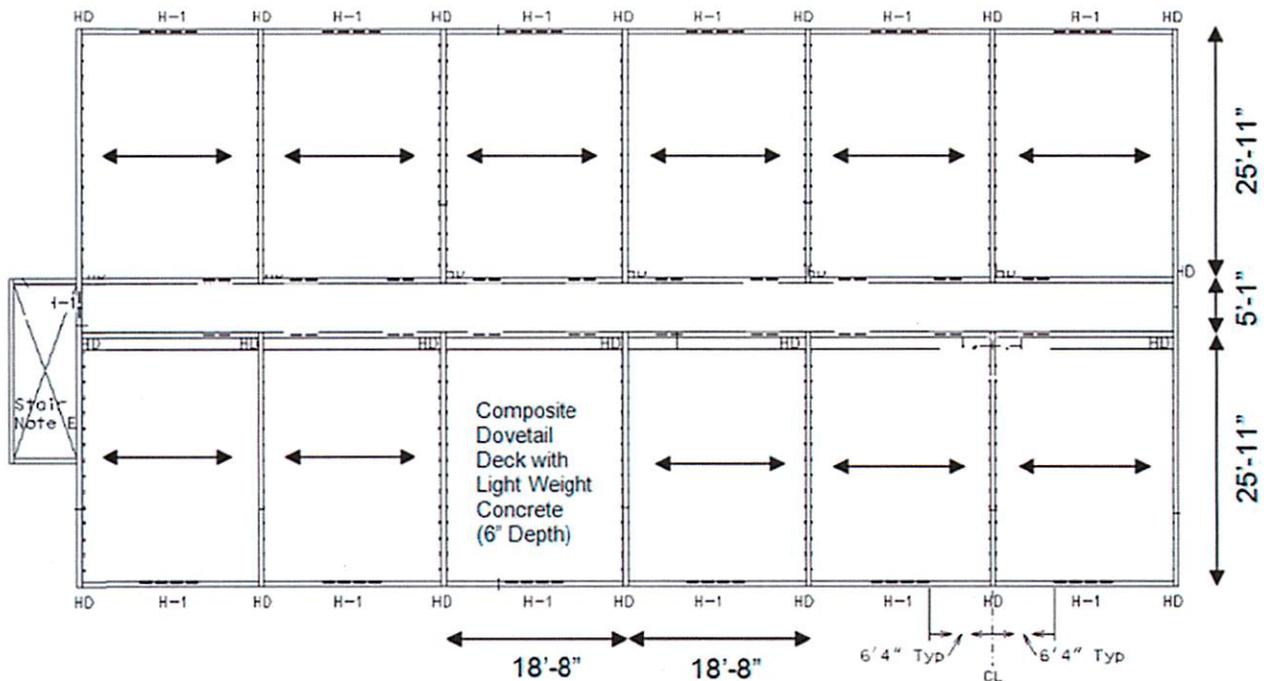


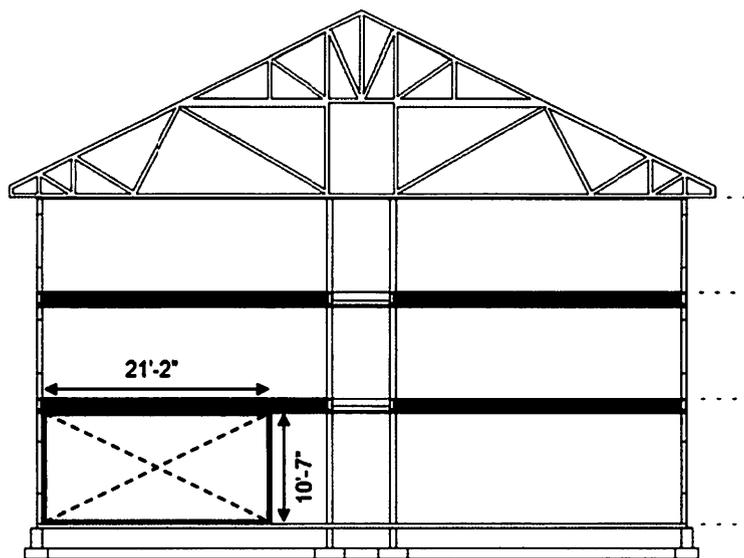
Figure 9. Cold-Formed Steel Building Used in Example Problem

Two baseline costs were estimated by Crawford: 1. Just the structural frame and 2. The entire building.

Crawford created costs for 3 “Scenarios”, which, in this example, are based on the design changes that are required for each of the 3 wall section removals. These scenarios are:

1. Scenario 1 Removal of Interior Load-bearing Wall (in short direction); see Figure 10.

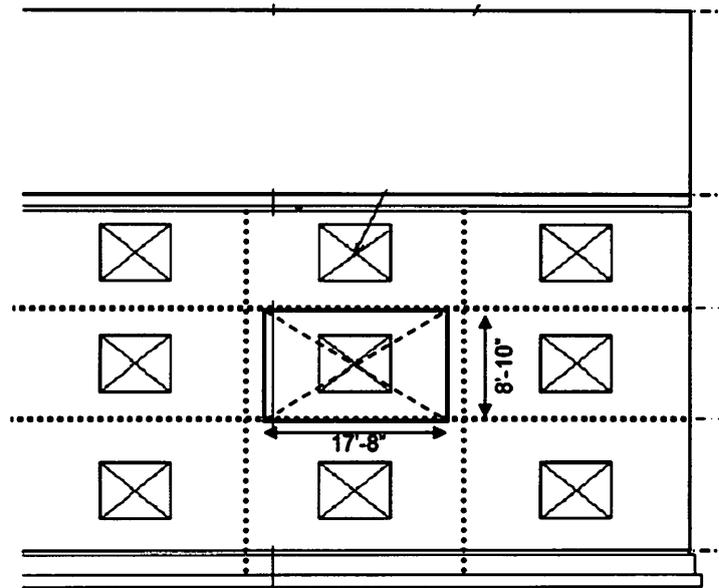
Modification for short direction walls: 1) Tighten wall fastener spacing to 4” oc max for short walls (1.5 times fasteners) and 2) Track splice ( $A = 0.56 \text{ in}^2$ ) at all short direction wall top/bottom track chords



**Figure 10. Interior Load Bearing Wall Removal**

2. Scenario 2 Removal of Exterior Load-bearing Wall at 2<sup>nd</sup> Story, Including Window (in long direction) ; see Figure 11.

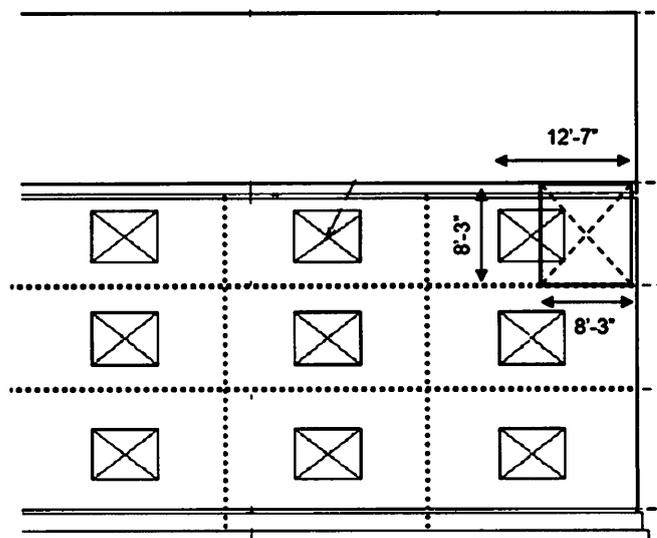
Modification for long direction walls: 1) Tighten wall fastener spacing to 4” oc max for long walls (1.5 times fasteners) and 2) Track splice ( $A = 0.11 \text{ in}^2$ ) at all long direction wall top/bottom track chords



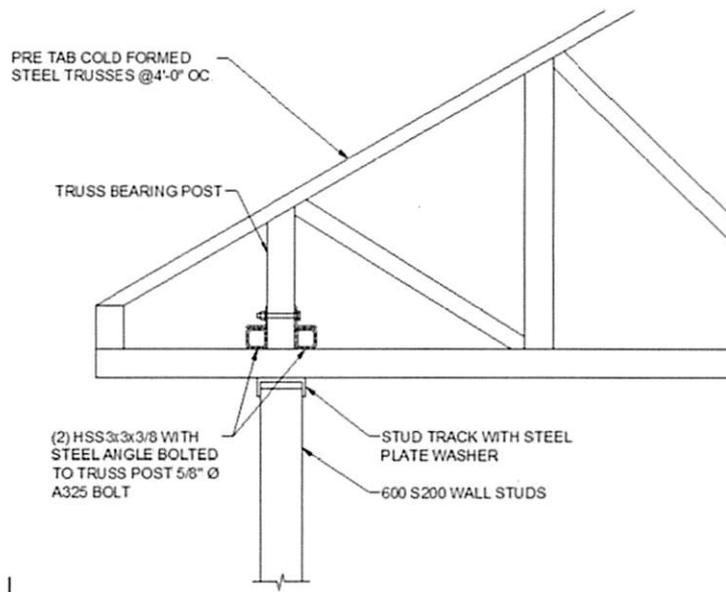
**Figure 11. Exterior Load Bearing Wall Removal, With Window**

3. Scenario 3 Removal of Exterior Load-bearing Wall at 3<sup>rd</sup> Story (in long direction, at corner) ; see Figure 12

Modifications: 1) Addition of two HSS 3x3x3/8 with steel angle bolted to truss post with 5/8-in A325 bolt at lower roof truss chord; and; 2 Addition of two Simpson HD7B hold-down anchors at each corner (8 total); see Figure 13.



**Figure 12. Exterior Load Bearing Wall Removal at 3<sup>rd</sup> Story Corner**



**Figure 13. Hold-down Anchor for Removal of 3<sup>rd</sup> Story Wall**

The additional costs to provide each of the 3 scenarios **applied to the entire building** is shown in the Crawford Consulting report, appended to this report. Thus, the modifications required for Scenario 1 are applied to all of the short walls in the structure and the total cost of that is \$35,539. The modifications for Scenario 2 are applied for all long walls in the structure and the cost is \$43,183. Scenario 3 for wall removal at the third floor in the long direction costs \$10,954.

So, the costs for three cases are assembled in the table below: 1. All PC modifications applied at once (interior and exterior walls), 2. PC modifications for only interior wall removal and 3. PC modifications for only exterior wall removal.

	Baseline Cost	Baseline plus All PC Mods		Baseline plus Interior Wall Removal Mods (Scen 1)		Baseline plus Exterior Wall Removal Mods (Scen 2 and Scen 3)	
		Cost	% Increase	Cost	% Increase	Cost	% Increase
Structural Frame	\$1,708,341	\$1,798,017	5.25%	\$1,743,880	2.08%	\$1,762,478	3.17%
Entire Building	\$7,576,265	\$7,665,941	1.18%	\$7,611,804	0.47%	\$7,630,402	0.71%

**Table 4. Cold-formed Steel Example Costs**

## **APPENDIX A**

### **Cost Tables for Framing and Scenario Options**

## Incorporate Progressive Collapse Prevention Estimate Break-Down Structural Frame Comparison

### Framing Example Baseline & Alternate Scenario Costs

Framing Example	Baseline Cost	Scenario #1 Cost	Scenario #2 Cost	Scenario #3 Cost	Scenario #4 Cost
Concrete Frame	\$6,796,812	\$7,429,580			
Steel Frame	\$1,541,318	\$2,043,316	\$1,737,672	\$1,768,368	\$1,626,462
Wood Frame	\$623,057	\$624,539	\$624,876	\$624,876	\$639,903
Cold-Formed Steel Frame	\$1,708,341	\$1,743,880	\$1,751,524	\$1,719,294	

\*Above Costs Reflect The Structural Frame Only. Each Scenario Contains the Baseline Frame Design & The Supplemental Framing Members Needed To Resist Progressive Collapse

### Percentage Increase From The Baseline

Framing Example	Scenario #1	Scenario #2	Scenario #3	Scenario #4
Concrete Frame	9.31%			
Steel Frame	32.57%	12.74%	14.73%	5.52%
Wood Frame	0.24%	0.29%	0.29%	2.70%
Cold-Formed Steel Frame	2.08%	2.53%	0.64%	

\* Add above percentages to the baseline for scenario totals

# Incorporate Progressive Collapse Prevention Estimate Break-Down Complete Building Comparison

## Framing Example Baseline & Alternate Scenario Costs

Framing Example	Baseline Cost	Scenario #1 Cost	Scenario #2 Cost	Scenario #3 Cost	Scenario #4 Cost
Concrete Frame	\$46,348,152	\$632,767			
Steel Frame	\$25,838,943	\$501,997	\$196,353	\$227,050	\$85,144
Wood Frame	\$6,490,981	\$1,482	\$1,820	\$1,820	\$16,847
Cold-Formed Steel Frame	\$7,576,265	\$35,539	\$43,183	\$10,954	

\*Above Costs Reflect The Entire Building From Foundations To MEPs. Each Scenario Contains The Supplemental Framing Members Needed To Resist Progressive Collapse Only

## Percentage Increase From The Baseline

Framing Example	Scenario #1	Scenario #2	Scenario #3	Scenario #4
Concrete Frame	1.38%			
Steel Frame	1.98%	0.77%	0.89%	0.33%
Wood Frame	0.02%	0.03%	0.03%	0.26%
Cold-Formed Steel Frame	0.47%	0.57%	0.14%	

\* Add above percentages to the baseline for scenario totals

## **APPENDIX B**

### **Detailed Cost Estimates**

Cost Estimates To Incorporate Progressive Collapse Prevention Into Various Structural Framing Systems  
Estimate includes Structural Frame only for baselines & structural frame plus supplemental framing/reinforcing to resist progressive collapse for each scenario.

Estimated by Crawford Consulting Services  
Designed by Protection Engineering Consultants  
Prepared by Brandon Blak

Preparation Date 3/1/2012  
Effective Date of Pricing 3/1/2012  
Estimated Construction Time Days

This report is not copyrighted, but the information contained herein is For Official Use Only.

Designed by  
 Protection Engineering Consultants  
 Estimated by  
 Crawford Consulting Services  
 Prepared by  
 Brandon Bilak

Design Document Final Submission  
 Document Date 3/1/2012  
 District USACE Omaha, Protective Design Center  
 Contact  
 Budget Year 2012  
 UOM System Original

**Direct Costs**

LaborCost  
 EQCost  
 MatlCost  
 SubBidCost

**Timeline/Currency**

Preparation Date 3/1/2012  
 Escalation Date 3/1/2012  
 Eff. Pricing Date 3/1/2012  
 Estimated Duration 0 Day(s)  
 Currency US dollars  
 Exchange Rate 1.000000

**Costbook CB10EB: MII English Cost Book 2010**

**Labor NLS2010: National Labor Library - Seattle 2010**

bl.gov is the website for current Davis Bacon & Service Labor Rates. Fringes paid to the laborers are taxable. In a non-union job the whole fringes are taxable. In a union job, the vacation pay fringe

**Labor Rates**

LaborCost1  
 LaborCost2  
 LaborCost3  
 LaborCost4

**Equipment EP09R08: MII Equipment Region 8 2009**

**08 NORTHWEST**

Sales Tax 6.00  
 Working Hours per Year 1,540  
 Labor Adjustment Factor 1.01  
 Cost of Money 4.88  
 Cost of Money Discount 25.00  
 Tire Recap Cost Factor 1.50  
 Tire Recap Wear Factor 1.80  
 Tire Repair Factor 0.15  
 Equipment Cost Factor 1.00  
 Standby Depreciation Factor 0.50

**Fuel**

Electricity 0.067  
 Gas 3.130  
 Diesel Off-Road 2.870  
 Diesel On-Road 3.410

**Shipping Rates**

Over 0 CWT 27.78  
 Over 240 CWT 26.06  
 Over 300 CWT 23.69  
 Over 400 CWT 21.52  
 Over 500 CWT 11.26  
 Over 700 CWT 9.51  
 Over 800 CWT 6.48

Date Author Note

---

**Direct Cost Markups**

	Category			Method		
	Productivity	Overtime	Productivity	Overtime	Productivity	Overtime
	Days/Week	Hours/Shift	Shifts/Day	1st Shift	2nd Shift	3rd Shift
Standard	5.00	8.00	1.00	8.00	0.00	0.00
Actual	5.00	8.00	1.00	8.00	0.00	0.00
Day	OT Factor	Working	OT Percent	FCCM Percent		
Monday	1.50	Yes	0.00	0.00		
Tuesday	1.50	Yes				
Wednesday	1.50	Yes				
Thursday	1.50	Yes				
Friday	1.50	Yes				
Saturday	1.50	No				
Sunday	2.00	No				

Sales Tax	TaxAdj	Running % on Selected Costs
MatlCost		

**Contractor Markups**

	Category		Method	
	Value	Weight	Percentage	
Prime JOOH	0.100	20	2.00	
Sub JOOH	0.100	15	1.50	
HOOH	0.090	15	1.35	
Prime Profit	0.090	15	1.35	
Guideline	0.100	5	0.50	
Risk	0.110	5	0.55	
Difficulty	0.110	25	2.75	
Size	0.110	100	10.00	
Period				
Invest (Contractor's)				
Assist (Assistance by)				
SubContracting				
Total				
Sub Profit	Profit	Direct %		
Bond	Bond	Running %		
Excise Tax	Excise	Running %		

**Owner Markups**

	Category			Method	
	Escalation	Escalation	Escalation	Escalation	Escalation
	StartDate	StartIndex	EndDate	EndIndex	Escalation
Escalation	12/13/2011	2,550.00	12/13/2012	2,593.00	1.69
Contingency	Contingency	Running %			
SIOH	SIOH	Running %			

Description	Quantity	UOM	DirectCost	SubCMU	CostToPrime	PrimeCMU	ContractCost	Contingency	SIOH	ProjectCost
<b>Owner Costs</b>			<b>19,086,062</b>	<b>3,564,322</b>	<b>22,650,384</b>	<b>6,592,598</b>	<b>29,242,982</b>	<b>1,486,859</b>	<b>1,779,771</b>	<b>33,003,819</b>
<b>Buildings - Concrete Frame</b>	<b>1.00</b>	<b>LS</b>	<b>8,227,102</b>	<b>1,536,411</b>	<b>9,763,514</b>	<b>2,841,759</b>	<b>12,605,272</b>	<b>640,915</b>	<b>767,175</b>	<b>14,226,392</b>
Superstructure - Baseline	1.00	LS	3,930,587	734,037	4,664,624	1,357,681	6,022,305	306,204	366,526	6,796,812
Superstructure - Tie Forces	1.00	LS	4,296,515	802,374	5,098,890	1,484,078	6,582,967	334,711	400,649	7,429,580
<b>Buildings - Steel Frame</b>	<b>1.00</b>	<b>LS</b>	<b>5,041,107</b>	<b>941,427</b>	<b>5,982,534</b>	<b>1,741,270</b>	<b>7,723,805</b>	<b>392,717</b>	<b>470,082</b>	<b>8,717,136</b>
Superstructure - Baseline	1.00	LS	891,342	166,458	1,057,800	307,882	1,365,683	69,438	83,117	1,541,318
Superstructure - Linear Static Procedure - Exterior Columns	1.00	LS	1,181,647	220,672	1,402,319	408,158	1,810,477	92,054	110,188	2,043,316
Superstructure - Non-Linear Dynamic Procedure - Exterior Columns	1.00	LS	1,004,893	187,664	1,192,557	347,104	1,539,661	78,284	93,706	1,737,672
Superstructure - Linear Static Procedure - Interior Columns	1.00	LS	1,022,645	190,979	1,213,624	353,236	1,566,860	79,667	95,361	1,768,368
Superstructure - Non-Linear Dynamic Procedure - Interior Columns	1.00	LS	940,581	175,653	1,116,234	324,890	1,441,124	73,274	87,709	1,626,462
<b>Buildings - Wood Frame</b>	<b>1.00</b>	<b>LS</b>	<b>1,814,268</b>	<b>338,815</b>	<b>2,153,083</b>	<b>626,674</b>	<b>2,779,757</b>	<b>141,337</b>	<b>169,180</b>	<b>3,137,252</b>
Superstructure - Baseline	1.00	LS	360,313	67,288	427,601	124,457	552,058	28,069	33,599	623,057
Superstructure - Removal Scenario 1	1.00	LS	361,170	67,449	428,619	124,753	553,372	28,136	33,679	624,539
Superstructure - Removal Scenario 2	1.00	LS	361,365	67,485	428,850	124,821	553,671	28,151	33,697	624,876
Superstructure - Removal Scenario 3	1.00	LS	361,365	67,485	428,850	124,821	553,671	28,151	33,697	624,876
Superstructure - Removal Scenario 4	1.00	LS	370,055	69,108	439,163	127,822	566,985	28,828	34,508	639,903
<b>Buildings - Cold-Formed Steel Frame</b>	<b>1.00</b>	<b>LS</b>	<b>4,003,584</b>	<b>747,669</b>	<b>4,751,253</b>	<b>1,382,895</b>	<b>6,134,148</b>	<b>311,891</b>	<b>373,333</b>	<b>6,923,039</b>
Superstructure - Baseline	1.00	LS	987,931	184,496	1,172,427	341,245	1,513,673	76,963	92,124	1,708,341
Superstructure - Removal Scenario 1	1.00	LS	1,008,483	188,334	1,196,818	348,345	1,545,162	78,564	94,041	1,743,880
Superstructure - Removal Scenario 2	1.00	LS	1,012,904	189,160	1,202,064	349,871	1,551,935	78,908	94,453	1,751,524
Superstructure - Removal Scenario 3	1.00	LS	994,266	185,679	1,179,945	343,434	1,523,378	77,456	92,715	1,719,294

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>Direct Costs</b>			<b>7,865,781.66</b>	<b>384,344.86</b>	<b>10,835,935.43</b>	<b>19,086,061.95</b>	
<b>Buildings - Concrete Frame</b>	<b>1.00</b>	<b>LS</b>	<b>4,224,695.75</b>	<b>166,291.38</b>	<b>3,836,115.32</b>	<b>8,227,102.45</b>	<b>Concrete Subcontractor</b>
<b>Superstructure - Baseline</b>	<b>1.00</b>	<b>LS</b>	<b>2,043,718.08</b>	<b>83,145.69</b>	<b>1,803,723.23</b>	<b>3,930,587.00</b>	<b>Concrete Subcontractor</b>
<b>(Note: 7-Story Concrete Moment Frame with Concrete Column &amp; Girder Frame &amp; Pan Form Beams &amp; Slab.)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>2,043,718.08</b>	<b>83,145.69</b>	<b>1,803,723.23</b>	<b>3,930,587.00</b>	<b>Concrete Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>759,549.23</b>	<b>23,060.01</b>	<b>685,642.24</b>	<b>1,468,251.47</b>	<b>Concrete Subcontractor</b>
Cast-In-Place Concrete Column, Square, Comer	56.00	CY	26,141.75	426.30	19,239.48	45,807.53	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Cast-In-Place Concrete Column, Square, Long Side	141.00	CY	106,805.11	1,073.37	120,672.11	228,550.59	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Cast-In-Place Concrete Column, Square, Interior	141.00	CY	73,434.24	1,073.37	61,859.47	136,367.08	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Cast-In-Place Concrete Column, Square, Short Side	56.00	CY	26,141.75	426.30	19,239.48	45,807.53	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Cast-In-Place Concrete Girder	1,807.00	CY	527,026.38	20,060.66	464,631.69	1,011,718.73	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
<b>Floor Decks and Slabs</b>	<b>1.00</b>	<b>LS</b>	<b>1,284,168.86</b>	<b>60,085.68</b>	<b>1,118,080.99</b>	<b>2,462,335.53</b>	<b>Concrete Subcontractor</b>
Concrete Beam Floor System, 5" Slab, 6"Wx20"H Beams @ 6' O.C.	145,095.00	SF	1,284,168.86	60,085.68	1,118,080.99	2,462,335.53	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Re-Bar Reinforcing (#3 EW @12"OC), Finishing, & Forming.)							
<b>Superstructure - Tie Forces</b>	<b>1.00</b>	<b>LS</b>	<b>2,180,977.66</b>	<b>83,145.69</b>	<b>2,032,392.09</b>	<b>4,296,515.45</b>	<b>Concrete Subcontractor</b>
<b>(Note: Alternate Method For Longitudinal, Transverse, &amp; Peripheral Mechanical Ties.)</b>							
<b>Floor Construction</b>	<b>1.00</b>	<b>LS</b>	<b>2,180,977.66</b>	<b>83,145.69</b>	<b>2,032,392.09</b>	<b>4,296,515.45</b>	<b>Concrete Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>762,254.94</b>	<b>23,060.01</b>	<b>690,149.85</b>	<b>1,475,464.80</b>	<b>Concrete Subcontractor</b>
<b>(Note: Verticle Reinforcing Remains The Same As Baseline. Peripheral Ties Added To Frame.)</b>							
Cast-In-Place Concrete Girder	1,807.00	CY	527,026.38	20,060.66	464,631.69	1,011,718.73	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Cast-In-Place Concrete Column, Square, Comer	56.00	CY	26,141.75	426.30	19,239.48	45,807.53	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Cast-In-Place Concrete Column, Square, Long Side	141.00	CY	106,805.11	1,073.37	120,672.11	228,550.59	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Cast-In-Place Concrete Column, Square, Interior	141.00	CY	73,434.24	1,073.37	61,859.47	136,367.08	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Cast-In-Place Concrete Column, Square, Short Side	56.00	CY	26,141.75	426.30	19,239.48	45,807.53	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, & Forming)							
Reinforcing steel, in place, peripheral ties, #3 to #7	0.83	TON	627.30	0.00	1,045.06	1,672.36	Concrete Subcontractor
(Note: Assuming A Crew Of 4 Rodmen At 0.35 Tons or 700 lbs. per Hour. Material Pricing Per Fastenal.com - 8-11-11)							
Reinforcing steel, in place, enhanced local resistance ties, #3 to #7	2.75	TON	2,078.41	0.00	3,462.55	5,540.96	Concrete Subcontractor
(Note: Assuming A Crew Of 4 Rodmen At 0.35 Tons or 700 lbs. per Hour. Material Pricing Per Fastenal.com - 8-11-11)							
<b>Floor Decks and Slabs</b>	<b>1.00</b>	<b>LS</b>	<b>1,418,722.72</b>	<b>60,085.68</b>	<b>1,342,242.24</b>	<b>2,821,050.64</b>	<b>Concrete Subcontractor</b>
<b>(Note: #3 Rebar @ 12" OC Each Way is Replaced By #5 Rebar @ 8" OC Each Way For Longitudinal &amp; Transverse Ties.)</b>							
Concrete Beam Floor System, 5" Slab, 6"Wx20"H Beams @ 6' O.C.	145,095.00	SF	1,418,722.72	60,085.68	1,342,242.24	2,821,050.64	Concrete Subcontractor
(Note: Assembly Item Includes Concrete, Re-Bar Reinforcing (#5 EW @8"OC), Finishing, & Forming.)							

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>Buildings - Steel Frame</b>	<b>1.00</b>	<b>LS</b>	<b>839,158.04</b>	<b>190,005.78</b>	<b>4,011,943.59</b>	<b>5,041,107.41</b>	<b>Structural Steel Subcontractor</b>
<b>Superstructure - Baseline</b>	<b>1.00</b>	<b>LS</b>	<b>149,117.94</b>	<b>33,763.93</b>	<b>708,460.41</b>	<b>891,342.28</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: 4-Story Steel Dual Lateral System With A Perimeter Moment Frame.)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>149,117.94</b>	<b>33,763.93</b>	<b>708,460.41</b>	<b>891,342.28</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>353.00</b>	<b>TON</b>	<b>149,117.94</b>	<b>33,763.93</b>	<b>708,460.41</b>	<b>891,342.28</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	353.00	TON	149,117.94	33,763.93	708,460.41	891,342.28	Structural Steel Subcontractor
<b>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</b>							
<b>Superstructure - Linear Static Procedure - Exterior Columns</b>	<b>1.00</b>	<b>LS</b>	<b>195,585.29</b>	<b>44,285.26</b>	<b>941,775.95</b>	<b>1,181,646.50</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Alternate Path Method For Removing Steel Columns Using The Linear Static Procedure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>195,585.29</b>	<b>44,285.26</b>	<b>941,775.95</b>	<b>1,181,646.50</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>463.00</b>	<b>TON</b>	<b>195,585.29</b>	<b>44,285.26</b>	<b>941,775.95</b>	<b>1,181,646.50</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	463.00	TON	195,585.29	44,285.26	929,227.11	1,169,097.66	Structural Steel Subcontractor
<b>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</b>							
Steel plate, structural, for connections & stiffeners, 1/2" T, shop fabricated, incl shop primer	528.00	SF	0.00	0.00	12,548.84	12,548.84	Structural Steel Subcontractor
<b>Superstructure - Non-Linear Dynamic Procedure - Exterior Columns</b>	<b>1.00</b>	<b>LS</b>	<b>166,015.16</b>	<b>37,589.87</b>	<b>801,288.05</b>	<b>1,004,893.08</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Alternate Path Method For Removing Steel Columns Using The Non-Linear Dynamic Procedure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>166,015.16</b>	<b>37,589.87</b>	<b>801,288.05</b>	<b>1,004,893.08</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>393.00</b>	<b>TON</b>	<b>166,015.16</b>	<b>37,589.87</b>	<b>801,288.05</b>	<b>1,004,893.08</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	393.00	TON	166,015.16	37,589.87	788,739.21	992,344.23	Structural Steel Subcontractor
<b>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</b>							
Steel plate, structural, for connections & stiffeners, 1/2" T, shop fabricated, incl shop primer	528.00	SF	0.00	0.00	12,548.84	12,548.84	Structural Steel Subcontractor
<b>Superstructure - Linear Static Procedure - Interior Columns</b>	<b>1.00</b>	<b>LS</b>	<b>171,084.32</b>	<b>38,737.65</b>	<b>812,822.85</b>	<b>1,022,644.82</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Alternate Path Method For Removing Steel Columns Using The Linear Static Procedure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>171,084.32</b>	<b>38,737.65</b>	<b>812,822.85</b>	<b>1,022,644.82</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>405.00</b>	<b>TON</b>	<b>171,084.32</b>	<b>38,737.65</b>	<b>812,822.85</b>	<b>1,022,644.82</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	405.00	TON	171,084.32	38,737.65	812,822.85	1,022,644.82	Structural Steel Subcontractor
<b>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</b>							
<b>Superstructure - Non-Linear Dynamic Procedure - Interior Columns</b>	<b>1.00</b>	<b>LS</b>	<b>157,355.33</b>	<b>35,629.07</b>	<b>747,596.33</b>	<b>940,580.73</b>	<b>Structural Steel Subcontractor</b>

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>(Note: Alternate Path Method For Removing Steel Columns Using The Non-Linear Dynamic Procedure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>157,355.33</b>	<b>35,629.07</b>	<b>747,596.33</b>	<b>940,580.73</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>372.50</b>	<b>TON</b>	<b>157,355.33</b>	<b>35,629.07</b>	<b>747,596.33</b>	<b>940,580.73</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	372.50	TON	157,355.33	35,629.07	747,596.33	940,580.73	Structural Steel Subcontractor
<i>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</i>							
<b>Buildings - Wood Frame</b>	<b>1.00</b>	<b>LS</b>	<b>999,058.47</b>	<b>5,113.26</b>	<b>810,096.49</b>	<b>1,814,268.23</b>	<b>Carpentry Subcontractor</b>
<b>Superstructure - Baseline</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
<b>(Note: 3-Story Wood Structure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
Exterior Wall Assembly, Wood-Frame	29,080.00	SF	73,530.62	0.00	31,792.31	105,322.92	Carpentry Subcontractor
<i>(Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood &amp; 5/8" Gyp.)</i>							
Interior Wall Assembly, Wood-Frame	41,543.00	SF	82,024.58	0.00	49,367.10	131,391.68	Carpentry Subcontractor
<i>(Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood Each Side.)</i>							
Wood-Frame Floor Assembly	12,750.00	SF	34,405.81	0.00	58,719.72	93,125.53	Carpentry Subcontractor
<i>(Note: Assembly Includes Engineered I Joists, 3/4" Plywood Subfloor &amp; 5/8" Gyp Under Joists)</i>							
Wood framing, joists, 2" x 8", pneumatic nailed	0.95	MBF	546.38	0.00	421.46	967.85	Carpentry Subcontractor
Wood-Framed Roof Assembly	6,375.00	SF	8,684.48	1,022.65	19,797.70	29,504.84	Carpentry Subcontractor
<i>(Note: Assembly Includes Roof Trusses &amp; 1/2" Plywood)</i>							
<b>Superstructure - Removal Scenario 1</b>	<b>1.00</b>	<b>LS</b>	<b>199,756.15</b>	<b>1,022.65</b>	<b>160,391.31</b>	<b>361,170.11</b>	<b>Carpentry Subcontractor</b>
<b>(Note: Interior Load Bearing Wall Removal @ Short Side First Story)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>199,756.15</b>	<b>1,022.65</b>	<b>160,391.31</b>	<b>361,170.11</b>	<b>Carpentry Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
Exterior Wall Assembly, Wood-Frame	29,080.00	SF	73,530.62	0.00	31,792.31	105,322.92	Carpentry Subcontractor
<i>(Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood &amp; 5/8" Gyp.)</i>							
Interior Wall Assembly, Wood-Frame	41,543.00	SF	82,024.58	0.00	49,367.10	131,391.68	Carpentry Subcontractor
<i>(Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood Each Side.)</i>							
Wood-Frame Floor Assembly	12,750.00	SF	34,405.81	0.00	58,719.72	93,125.53	Carpentry Subcontractor
<i>(Note: Assembly Includes Engineered I Joists, 3/4" Plywood Subfloor &amp; 5/8" Gyp Under Joists)</i>							
Wood framing, joists, 2" x 8", pneumatic nailed	0.95	MBF	546.38	0.00	421.46	967.85	Carpentry Subcontractor
Wood-Framed Roof Assembly	6,375.00	SF	8,684.48	1,022.65	19,797.70	29,504.84	Carpentry Subcontractor
<i>(Note: Assembly Includes Roof Trusses &amp; 1/2" Plywood)</i>							
<b>Supplemental 2x6 Framing</b>	<b>365.00</b>	<b>LF</b>	<b>564.28</b>	<b>0.00</b>	<b>293.02</b>	<b>857.30</b>	<b>Carpentry Subcontractor</b>
Double 2x6 Wall Header/Sill Plate	365.00	LF	564.28	0.00	293.02	857.30	Carpentry Subcontractor
<b>Superstructure - Removal Scenario 2</b>	<b>1.00</b>	<b>LS</b>	<b>199,884.46</b>	<b>1,022.65</b>	<b>160,457.94</b>	<b>361,365.06</b>	<b>Carpentry Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Second Story)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>199,884.46</b>	<b>1,022.65</b>	<b>160,457.94</b>	<b>361,365.06</b>	<b>Carpentry Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
Exterior Wall Assembly, Wood-Frame	29,080.00	SF	73,530.62	0.00	31,792.31	105,322.92	Carpentry Subcontractor
<i>(Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood &amp; 5/8" Gyp.)</i>							

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
Interior Wall Assembly, Wood-Frame (Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood Each Side.)	41,543.00	SF	82,024.58	0.00	49,367.10	131,391.68	Carpentry Subcontractor
Wood-Frame Floor Assembly (Note: Assembly Includes Engineered I Joists, 3/4" Plywood Subfloor & 5/8" Gyp Under Joists)	12,750.00	SF	34,405.81	0.00	58,719.72	93,125.53	Carpentry Subcontractor
Wood framing, joists, 2" x 8", pneumatic nailed	0.95	MBF	546.38	0.00	421.46	967.85	Carpentry Subcontractor
Wood-Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	8,684.48	1,022.65	19,797.70	29,504.84	Carpentry Subcontractor
<b>Supplemental 2x6 Framing</b>	<b>448.00</b>	<b>LF</b>	<b>692.60</b>	<b>0.00</b>	<b>359.65</b>	<b>1,052.25</b>	<b>Carpentry Subcontractor</b>
Double 2x6 Wall Header/Sill Plate	448.00	LF	692.60	0.00	359.65	1,052.25	Carpentry Subcontractor
<b>Superstructure - Removal Scenario 3</b>	<b>1.00</b>	<b>LS</b>	<b>199,884.46</b>	<b>1,022.65</b>	<b>160,457.94</b>	<b>361,365.06</b>	<b>Carpentry Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Second Story (Alternate Location))</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>199,884.46</b>	<b>1,022.65</b>	<b>160,457.94</b>	<b>361,365.06</b>	<b>Carpentry Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
Exterior Wall Assembly, Wood-Frame (Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood & 5/8" Gyp.)	29,080.00	SF	73,530.62	0.00	31,792.31	105,322.92	Carpentry Subcontractor
Interior Wall Assembly, Wood-Frame (Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood Each Side.)	41,543.00	SF	82,024.58	0.00	49,367.10	131,391.68	Carpentry Subcontractor
Wood-Frame Floor Assembly (Note: Assembly Includes Engineered I Joists, 3/4" Plywood Subfloor & 5/8" Gyp Under Joists)	12,750.00	SF	34,405.81	0.00	58,719.72	93,125.53	Carpentry Subcontractor
Wood framing, joists, 2" x 8", pneumatic nailed	0.95	MBF	546.38	0.00	421.46	967.85	Carpentry Subcontractor
Wood-Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	8,684.48	1,022.65	19,797.70	29,504.84	Carpentry Subcontractor
<b>Supplemental 2x6 Framing</b>	<b>448.00</b>	<b>LF</b>	<b>692.60</b>	<b>0.00</b>	<b>359.65</b>	<b>1,052.25</b>	<b>Carpentry Subcontractor</b>
Double 2x6 Wall Header/Sill Plate	448.00	LF	692.60	0.00	359.65	1,052.25	Carpentry Subcontractor
<b>Superstructure - Removal Scenario 4</b>	<b>1.00</b>	<b>LS</b>	<b>200,341.53</b>	<b>1,022.65</b>	<b>168,691.00</b>	<b>370,055.18</b>	<b>Carpentry Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Third Story)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>200,341.53</b>	<b>1,022.65</b>	<b>168,691.00</b>	<b>370,055.18</b>	<b>Carpentry Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
Exterior Wall Assembly, Wood-Frame (Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood & 5/8" Gyp.)	29,080.00	SF	73,530.62	0.00	31,792.31	105,322.92	Carpentry Subcontractor
Interior Wall Assembly, Wood-Frame (Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood Each Side.)	41,543.00	SF	82,024.58	0.00	49,367.10	131,391.68	Carpentry Subcontractor
Wood-Frame Floor Assembly (Note: Assembly Includes Engineered I Joists, 3/4" Plywood Subfloor & 5/8" Gyp Under Joists)	12,750.00	SF	34,405.81	0.00	58,719.72	93,125.53	Carpentry Subcontractor
Wood framing, joists, 2" x 8", pneumatic nailed	0.95	MBF	546.38	0.00	421.46	967.85	Carpentry Subcontractor
Wood-Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	8,684.48	1,022.65	19,797.70	29,504.84	Carpentry Subcontractor
<b>Beams &amp; Tie-Downs @ Vertical Truss Posts</b>	<b>448.00</b>	<b>LF</b>	<b>1,149.67</b>	<b>0.00</b>	<b>8,592.70</b>	<b>9,742.37</b>	<b>Carpentry Subcontractor</b>
24F-V5 southern pine or western species, 3" wide x 12.375" deep	448.00	LF	961.94	0.00	8,565.33	9,527.27	Carpentry Subcontractor
Tie-Down Anchors (Note: Includes Angles & Thru-Bolt)	8.00	EA	187.73	0.00	27.38	215.10	Carpentry Subcontractor
<b>Buildings - Cold-Formed Steel Frame</b>	<b>1.00</b>	<b>LS</b>	<b>1,802,869.40</b>	<b>22,934.44</b>	<b>2,177,780.03</b>	<b>4,003,583.87</b>	<b>Structural Steel Subcontractor</b>

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>Superstructure - Baseline</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: 3-Story Cold-Formed Steel Structure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>
Exterior End Wall & Interior Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On Both Sides & 600S200-68 Gr50 Studs @ 24" OC)	51,333.00	SF	290,326.37	0.00	343,774.12	634,100.49	Structural Steel Subcontractor
Exterior Long Direction Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On One Side & 600S200-68 Gr50 Studs @ 24" OC)	19,250.00	SF	97,081.79	0.00	124,442.70	221,524.49	Structural Steel Subcontractor
4" Slab On Deck - W.W.F. Reinforced (Note: Assembly Item Includes Concrete, Welded Wire Reinforcing, Finishing, & Forming)	12,750.00	SF	28,422.27	1,198.30	19,821.68	49,442.25	Structural Steel Subcontractor
Metal decking, steel, galvanized, 2" D, 20 ga (Note: Assuming A Crew Of 1 Steel Worker, 1 Welder, & 1 Welding Machine At 200 Square Feet Per Hour. Material Pricing From Wheeling Corrugating - 2-16-10)	12,750.00	SF	9,156.04	604.18	13,467.83	23,228.05	Structural Steel Subcontractor
Cold-Formed Steel Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	17,573.11	3,140.59	38,922.01	59,635.71	Structural Steel Subcontractor
<b>Superstructure - Removal Scenario 1</b>	<b>1.00</b>	<b>LS</b>	<b>456,886.92</b>	<b>6,302.24</b>	<b>545,294.25</b>	<b>1,008,483.41</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Interior Load Bearing Wall Removal @ Short Side First Story)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>456,886.92</b>	<b>6,302.24</b>	<b>545,294.25</b>	<b>1,008,483.41</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>
Exterior End Wall & Interior Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On Both Sides & 600S200-68 Gr50 Studs @ 24" OC)	51,333.00	SF	290,326.37	0.00	343,774.12	634,100.49	Structural Steel Subcontractor
Exterior Long Direction Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On One Side & 600S200-68 Gr50 Studs @ 24" OC)	19,250.00	SF	97,081.79	0.00	124,442.70	221,524.49	Structural Steel Subcontractor
4" Slab On Deck - W.W.F. Reinforced (Note: Assembly Item Includes Concrete, Welded Wire Reinforcing, Finishing, & Forming)	12,750.00	SF	28,422.27	1,198.30	19,821.68	49,442.25	Structural Steel Subcontractor
Metal decking, steel, galvanized, 2" D, 20 ga (Note: Assuming A Crew Of 1 Steel Worker, 1 Welder, & 1 Welding Machine At 200 Square Feet Per Hour. Material Pricing From Wheeling Corrugating - 2-16-10)	12,750.00	SF	9,156.04	604.18	13,467.83	23,228.05	Structural Steel Subcontractor
Cold-Formed Steel Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	17,573.11	3,140.59	38,922.01	59,635.71	Structural Steel Subcontractor
<b>Wall Fasteners &amp; Track Splice</b>	<b>1.00</b>	<b>LS</b>	<b>14,327.34</b>	<b>1,359.17</b>	<b>4,865.91</b>	<b>20,552.41</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Increased Frequency Of Wall Fasteners &amp; Splice Top/Bottom Wall Track)</b>							
Wall Fastener	548.00	EA	8,324.60	0.00	1,863.90	10,188.51	Structural Steel Subcontractor
Splice Top/Bottom Wall Track	98.00	EA	6,002.74	1,359.17	3,002.00	10,363.91	Structural Steel Subcontractor
<b>Superstructure - Removal Scenario 2</b>	<b>1.00</b>	<b>LS</b>	<b>459,995.63</b>	<b>6,579.62</b>	<b>546,328.66</b>	<b>1,012,903.92</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Second Story)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>
Exterior End Wall & Interior Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On Both Sides & 600S200-68 Gr50 Studs @ 24" OC)	51,333.00	SF	290,326.37	0.00	343,774.12	634,100.49	Structural Steel Subcontractor
Exterior Long Direction Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On One Side & 600S200-68 Gr50 Studs @ 24" OC)	19,250.00	SF	97,081.79	0.00	124,442.70	221,524.49	Structural Steel Subcontractor
4" Slab On Deck - W.W.F. Reinforced (Note: Assembly Item Includes Concrete, Welded Wire Reinforcing, Finishing, & Forming)	12,750.00	SF	28,422.27	1,198.30	19,821.68	49,442.25	Structural Steel Subcontractor
Metal decking, steel, galvanized, 2" D, 20 ga (Note: Assuming A Crew Of 1 Steel Worker, 1 Welder, & 1 Welding Machine At 200 Square Feet Per Hour. Material Pricing From Wheeling Corrugating - 2-16-10)	12,750.00	SF	9,156.04	604.18	13,467.83	23,228.05	Structural Steel Subcontractor
Cold-Formed Steel Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	17,573.11	3,140.59	38,922.01	59,635.71	Structural Steel Subcontractor
<b>Wall Fasteners &amp; Track Splice</b>	<b>1.00</b>	<b>LS</b>	<b>17,436.06</b>	<b>1,636.55</b>	<b>5,900.32</b>	<b>24,972.93</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Increased Frequency Of Wall Fasteners &amp; Splice Top/Bottom Wall Track)</b>							
Wall Fastener	672.00	EA	10,208.27	0.00	2,285.66	12,493.94	Structural Steel Subcontractor
Splice Top/Bottom Wall Track	118.00	EA	7,227.78	1,636.55	3,614.66	12,478.99	Structural Steel Subcontractor
<b>Superstructure - Removal Scenario 3</b>	<b>1.00</b>	<b>LS</b>	<b>443,427.27</b>	<b>5,109.50</b>	<b>545,728.77</b>	<b>994,265.55</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Third Story)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>443,427.27</b>	<b>5,109.50</b>	<b>545,728.77</b>	<b>994,265.55</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>
Exterior End Wall & Interior Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On Both Sides & 600S200-68 Gr50 Studs @ 24" OC)	51,333.00	SF	290,326.37	0.00	343,774.12	634,100.49	Structural Steel Subcontractor
Exterior Long Direction Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On One Side & 600S200-68 Gr50 Studs @ 24" OC)	19,250.00	SF	97,081.79	0.00	124,442.70	221,524.49	Structural Steel Subcontractor
4" Slab On Deck - W.W.F. Reinforced (Note: Assembly Item Includes Concrete, Welded Wire Reinforcing, Finishing, & Forming)	12,750.00	SF	28,422.27	1,198.30	19,821.68	49,442.25	Structural Steel Subcontractor
Metal decking, steel, galvanized, 2" D, 20 ga (Note: Assuming A Crew Of 1 Steel Worker, 1 Welder, & 1 Welding Machine At 200 Square Feet Per Hour. Material Pricing From Wheeling Corrugating - 2-16-10)	12,750.00	SF	9,156.04	604.18	13,467.83	23,228.05	Structural Steel Subcontractor
Cold-Formed Steel Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	17,573.11	3,140.59	38,922.01	59,635.71	Structural Steel Subcontractor
<b>Beams &amp; Tie-Downs @ Vertical Truss Posts</b>	<b>448.00</b>	<b>LF</b>	<b>867.70</b>	<b>166.43</b>	<b>5,300.43</b>	<b>6,334.55</b>	<b>Carpentry Subcontractor</b>
Tie-Down Anchors (Note: Includes Angles & Thru-Bolt)	8.00	EA	187.73	0.00	27.38	215.10	Carpentry Subcontractor
HSS 3x3x3/8 Beams	2.40	TON	679.97	166.43	5,273.05	6,119.45	Carpentry Subcontractor

Cost Estimates to Incorporate Progressive Collapse Prevention into Various Structural Framing Systems  
Estimate includes a complete building for baselines & supplemental framing/reinforcing to resist progressive collapse only for each scenario.

Estimated by Crawford Consulting Services  
Designed by Protection Engineering Consultants  
Prepared by Brandon Bilak

Preparation Date 3/1/2012  
Effective Date of Pricing 3/1/2012  
Estimated Construction Time Days

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Designed by  
Protection Engineering Consultants  
Estimated by  
Crawford Consulting Services  
Prepared by  
Brandon Bilak

Design Document Final Submission  
Document Date 3/1/2012  
District USACE Omaha, Protective Design Center  
Contact  
Budget Year 2012  
UOM System Original

**Direct Costs**

LaborCost  
EQCost  
MatlCost  
SubBidCost

**Timeline/Currency**

Preparation Date 3/1/2012  
Escalation Date 3/1/2012  
Eff. Pricing Date 3/1/2012  
Estimated Duration 0 Day(s)  
  
Currency US dollars  
Exchange Rate 1.000000

**Costbook CB10EB: MII English Cost Book 2010**

**Labor NLS2010: National Labor Library - Seattle 2010**

ol.gov is the website for current Davis Bacon & Service Labor Rates. Fringes paid to the laborers are taxable. In a non-union job the whole fringes are taxable. In a union job, the vacation pay fringe

**Labor Rates**

LaborCost1  
LaborCost2  
LaborCost3  
LaborCost4

**Equipment EP09R08: MII Equipment Region 8 2009**

**08 NORTHWEST**

Sales Tax 6.00  
Working Hours per Year 1,540  
Labor Adjustment Factor 1.01  
Cost of Money 4.88  
Cost of Money Discount 25.00  
Tire Recap Cost Factor 1.50  
Tire Recap Wear Factor 1.80  
Tire Repair Factor 0.15  
Equipment Cost Factor 1.00  
Standby Depreciation Factor 0.50

**Fuel**

Electricity 0.067  
Gas 3.130  
Diesel Off-Road 2.870  
Diesel On-Road 3.410

**Shipping Rates**

Over 0 CWT 27.78  
Over 240 CWT 26.06  
Over 300 CWT 23.69  
Over 400 CWT 21.52  
Over 500 CWT 11.26  
Over 700 CWT 9.51  
Over 800 CWT 6.48

Date Author Note

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**Direct Cost Markups**

	Category			Method		
	Productivity	Overtime	Productivity	Overtime	Productivity	Overtime
	Days/Week	Hours/Shift	Shifts/Day	1st Shift	2nd Shift	3rd Shift
Standard	5.00	8.00	1.00	8.00	0.00	0.00
Actual	5.00	8.00	1.00	8.00	0.00	0.00
Day	OT Factor		Working		OT Percent	FCCM Percent
Monday	1.50		Yes		0.00	0.00
Tuesday	1.50		Yes			
Wednesday	1.50		Yes			
Thursday	1.50		Yes			
Friday	1.50		Yes			
Saturday	1.50		No			
Sunday	2.00		No			

Sales Tax	TaxAdj	Running % on Selected Costs
MatlCost		

**Contractor Markups**

	Category		Method	
	Value	Profit	Weight	Percentage
Prime JOOH	0.100		20	2.00
Sub JOOH	0.100		15	1.50
HOOH	0.090		15	1.35
Prime Profit	0.090		15	1.35
Guideline	0.100		5	0.50
Risk	0.110		5	0.55
Difficulty	0.110		25	2.75
Size	0.110		100	10.00
Period				
Invest (Contractor's)				
Assist (Assistance by)				
SubContracting				
Total				
Sub Profit	Profit	Direct %		
Bond	Bond	Running %		
Excise Tax	Excise	Running %		

**Owner Markups**

Escalation	Category			Method	
	StartDate	StartIndex	EndDate	EndIndex	Escalation
	12/13/2011	2,550.00	12/13/2012	2,593.00	1.69
Contingency		Contingency		Running %	
SIOH		SIOH		Running %	

Description	Quantity	UOM	DirectCost	SubCMU	CostToPrime	PrimeCMU	ContractCost	Contingency	SIOH	ProjectCost
<b>Owner Costs</b>			<b>52,126,556</b>	<b>8,273,860</b>	<b>60,400,416</b>	<b>17,580,085</b>	<b>77,980,501</b>	<b>3,964,919</b>	<b>4,746,008</b>	<b>88,009,297</b>
<b>Buildings - Concrete Frame</b>	<b>1.00</b>	<b>LS</b>	<b>27,831,104</b>	<b>4,411,707</b>	<b>32,242,810</b>	<b>9,384,560</b>	<b>41,627,370</b>	<b>2,116,544</b>	<b>2,533,503</b>	<b>46,980,919</b>
Complete Building - Baseline	145,095.00	SF	27,465,175 <sup>189.29</sup>	4,343,369	31,808,545 <sup>219.23</sup>	9,258,163	41,066,708 <sup>283.03</sup>	2,088,037	2,499,380	46,348,152 <sup>319.43</sup>
Superstructure - Tie Forces	1.00	LS	365,928	68,337	434,266	126,397	560,662	28,507	34,123	632,767
<b>Buildings - Steel Frame</b>	<b>1.00</b>	<b>LS</b>	<b>15,921,285</b>	<b>2,505,407</b>	<b>18,426,691</b>	<b>5,363,254</b>	<b>23,789,946</b>	<b>1,209,600</b>	<b>1,447,891</b>	<b>26,849,487</b>
Complete Building - Baseline	86,400.00	SF	15,336,889 <sup>177.51</sup>	2,396,271	17,733,159 <sup>205.24</sup>	5,161,396	22,894,555 <sup>264.98</sup>	1,164,074	1,393,396	25,838,943 <sup>299.06</sup>
Superstructure - Linear Static Procedure - Exterior Columns	1.00	LS	290,304	54,214	344,519	100,275	444,794	22,616	27,071	501,997
Superstructure - Non-Linear Dynamic Procedure - Exterior Columns	1.00	LS	113,551	21,206	134,756	39,222	173,978	8,846	10,589	196,353
Superstructure - Linear Static Procedure - Interior Columns	1.00	LS	131,303	24,521	155,823	45,354	201,177	10,229	12,244	227,050
Superstructure - Non-Linear Dynamic Procedure - Interior Columns	1.00	LS	49,238	9,195	58,434	17,008	75,441	3,836	4,591	85,144
<b>Buildings - Wood Frame</b>	<b>1.00</b>	<b>LS</b>	<b>3,853,697</b>	<b>616,113</b>	<b>4,469,810</b>	<b>1,300,978</b>	<b>5,770,789</b>	<b>293,416</b>	<b>351,219</b>	<b>6,512,949</b>
Complete Building - Baseline	19,124.00	SF	3,840,993 <sup>200.85</sup>	613,741	4,454,733 <sup>232.94</sup>	1,296,590	5,751,324 <sup>300.74</sup>	292,426	350,034	6,490,981 <sup>339.42</sup>
Superstructure - Removal Scenario 1	1.00	LS	857	160	1,017	296	1,314	67	80	1,482
Superstructure - Removal Scenario 2	1.00	LS	1,052	197	1,249	363	1,612	82	98	1,820
Superstructure - Removal Scenario 3	1.00	LS	1,052	197	1,249	363	1,612	82	98	1,820
Superstructure - Removal Scenario 4	1.00	LS	9,742	1,819	11,562	3,365	14,927	759	908	16,847
<b>Buildings - Cold-Formed Steel Frame</b>	<b>1.00</b>	<b>LS</b>	<b>4,520,471</b>	<b>740,633</b>	<b>5,261,104</b>	<b>1,531,292</b>	<b>6,792,396</b>	<b>345,359</b>	<b>413,395</b>	<b>7,665,942</b>
Complete Building - Baseline	19,124.00	SF	4,468,611 <sup>233.67</sup>	730,948	5,199,559 <sup>271.89</sup>	1,513,379	6,712,938 <sup>351.02</sup>	341,319	408,559	7,576,265 <sup>396.17</sup>
Superstructure - Removal Scenario 1	1.00	LS	20,552	3,838	24,391	7,099	31,490	1,601	1,917	35,539
Superstructure - Removal Scenario 2	1.00	LS	24,973	4,664	29,637	8,626	38,263	1,945	2,329	43,183
Superstructure - Removal Scenario 3	1.00	LS	6,335	1,183	7,518	2,188	9,706	493	591	10,954

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>Direct Costs</b>			<b>18,231,194.18</b>	<b>160,575.08</b>	<b>33,734,786.93</b>	<b>52,126,556.19</b>	
<b>Buildings - Concrete Frame</b>	<b>1.00</b>	<b>LS</b>	<b>10,135,879.70</b>	<b>87,416.69</b>	<b>17,607,807.22</b>	<b>27,831,103.61</b>	<b>Concrete Subcontractor</b>
<b>Complete Building - Baseline</b>	<b>145,095.00</b>	<b>SF</b>	<b>9,998,620.12</b>	<b>87,416.69</b>	<b>17,379,138.36</b>	<b>27,465,175.17</b>	<b>Prime Contractor</b>
<b>(Note: 7-Story Concrete Moment Frame with Concrete Column &amp; Girder Frame &amp; Pan Form Beams &amp; Slab.)</b>							
<b>Substructure</b>	<b>145,095.00</b>	<b>SF</b>	<b>241,865.29</b>	<b>1,095.47</b>	<b>418,410.31</b>	<b>661,371.07</b>	<b>Concrete Subcontractor</b>
<b>(Note: Assuming Shallow Foundations with Perimeter &amp; Interior Continuous Footings @ Load Bearing Walls &amp; Spread Footings @ Columns. Also Includes Slab On Grade, Foundation Walls, &amp; Elevator Pit.)</b>							
Shallow Concrete Foundation System, incl below ground footings & slab on grade	145,095.00	SF	241,865.29	1,095.47	418,410.31	661,371.07	Concrete Subcontractor
<b>Superstructure</b>	<b>145,095.00</b>	<b>SF</b>	<b>2,080,739.43</b>	<b>83,944.28</b>	<b>2,013,892.28</b>	<b>4,178,576.00</b>	<b>Concrete Subcontractor</b>
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>2,043,718.08</b>	<b>83,145.69</b>	<b>1,803,723.23</b>	<b>3,930,587.00</b>	<b>Concrete Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>759,549.23</b>	<b>23,060.01</b>	<b>685,642.24</b>	<b>1,468,251.47</b>	<b>Concrete Subcontractor</b>
Cast-In-Place Concrete Column, Square, Corner	56.00	CY	26,141.75	426.30	19,239.48	45,807.53	Concrete Subcontractor
<b>(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, &amp; Forming)</b>							
Cast-In-Place Concrete Column, Square, Long Side	141.00	CY	106,805.11	1,073.37	120,672.11	228,550.59	Concrete Subcontractor
<b>(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, &amp; Forming)</b>							
Cast-In-Place Concrete Column, Square, Interior	141.00	CY	73,434.24	1,073.37	61,859.47	136,367.08	Concrete Subcontractor
<b>(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, &amp; Forming)</b>							
Cast-In-Place Concrete Column, Square, Short Side	56.00	CY	26,141.75	426.30	19,239.48	45,807.53	Concrete Subcontractor
<b>(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, &amp; Forming)</b>							
Cast-In-Place Concrete Girder	1,807.00	CY	527,026.38	20,060.66	464,631.69	1,011,718.73	Concrete Subcontractor
<b>(Note: Assembly Item Includes Concrete, Rebar Reinforcing, Finishing, &amp; Forming)</b>							
<b>Floor Decks and Slabs</b>	<b>1.00</b>	<b>LS</b>	<b>1,284,168.86</b>	<b>60,085.68</b>	<b>1,118,080.99</b>	<b>2,462,335.53</b>	<b>Concrete Subcontractor</b>
Concrete Beam Floor System, 5" Slab, 6"Wx20"H Beams @ 6' O.C.	145,095.00	SF	1,284,168.86	60,085.68	1,118,080.99	2,462,335.53	Concrete Subcontractor
<b>(Note: Assembly Item Includes Concrete, Re-Bar Reinforcing (#3 EW @12"OC), Finishing, &amp; Forming.)</b>							
<b>Stair Construction</b>	<b>1.00</b>	<b>LS</b>	<b>37,021.35</b>	<b>798.59</b>	<b>210,169.05</b>	<b>247,989.00</b>	<b>Concrete Subcontractor</b>
<b>Metal Pan Stairs</b>	<b>1.00</b>	<b>LS</b>	<b>25,554.56</b>	<b>798.59</b>	<b>172,934.48</b>	<b>199,287.63</b>	<b>Concrete Subcontractor</b>
Metal Pan Stair Risers	264.00	RSR	12,301.59	446.79	129,671.39	142,419.77	Concrete Subcontractor
<b>(Note: Assuming A Crew Of 4 Structural Steel Workers w/ A Welding Machine At 5.6 Risers Per Hour)</b>							
Metal Pan Landings	696.00	SF	9,686.20	351.80	40,949.79	50,987.80	Concrete Subcontractor
<b>(Note: Assuming A Crew Of 4 Structural Steel Workers w/ A Welding Machine At 18.75 Square Feet Per Hour)</b>							
Concrete Infill @ Stair Risers	1,752.00	SF	3,566.77	0.00	2,313.30	5,880.06	Concrete Subcontractor
<b>(Note: Assuming 1 Cement Finisher At 24 Square Feet Per Hour. Material Pricing From Stone &amp; Company - 8-3-11)</b>							
<b>Metal Railings</b>	<b>795.00</b>	<b>LF</b>	<b>11,466.79</b>	<b>0.00</b>	<b>37,234.58</b>	<b>48,701.36</b>	<b>Concrete Subcontractor</b>
Railing, Pipe, Steel, Wall Rail, Primed, 1-1/2" Dia	370.00	LF	5,975.65	0.00	3,107.11	9,082.76	Concrete Subcontractor
<b>(Note: Assuming 2 Structural Steel Workers At 8 Feet Per Hour. Material Pricing Per Wagner Company - 8-29-11)</b>							
Metal Pipe & Picket Guard Railing w/ Attached Handrail, round pickets, straight & sloped, 1-1/2" Dia	425.00	LF	5,491.14	0.00	34,127.47	39,618.61	Concrete Subcontractor
<b>(Note: Assuming 2 Steel Workers At 10 Feet Per Hour. Material Pricing Per Wagner Company - 8-25-11)</b>							
<b>Exterior Closure</b>	<b>145,095.00</b>	<b>SF</b>	<b>916,382.67</b>	<b>0.00</b>	<b>1,434,549.62</b>	<b>2,350,932.29</b>	<b>Masonry Subcontractor</b>
Exterior Masonry Veneer Wall System, Includes Glazing & Doors	145,095.00	SF	916,382.67	0.00	1,434,549.62	2,350,932.29	Masonry Subcontractor
<b>(Note: Costs Includes Glazing, Doors, Veneer, wall back-up system &amp; Trim)</b>							
<b>Roofing</b>	<b>145,095.00</b>	<b>SF</b>	<b>46,794.86</b>	<b>2,376.94</b>	<b>226,687.26</b>	<b>275,859.06</b>	<b>Flat-Applied Roofing Subcontractor</b>

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
Flat Roofing System, including sheathing, insulation & drainage accessories & trim	21,375.00	SF	46,794.86	2,376.94	226,687.26	275,859.06	Flat-Applied Roofing Subcontractor
<b>Interior Construction &amp; Finishes</b>	<b>145,095.00</b>	<b>SF</b>	<b>2,031,160.73</b>	<b>0.00</b>	<b>2,176,346.65</b>	<b>4,207,507.38</b>	<b>Prime Contractor</b>
Interior Construction & Finishes (Note: Costs Include Partitions, Doors, Specialties & Finishes)	145,095.00	SF	2,031,160.73	0.00	2,176,346.65	4,207,507.38	Prime Contractor
<b>Conveying Systems</b>	<b>2.00</b>	<b>EA</b>	<b>72,228.17</b>	<b>0.00</b>	<b>239,780.10</b>	<b>312,008.27</b>	<b>Elevator Subcontractor</b>
Elevators/Lifts, electric passenger, variable voltage collective, standard cab, 6 stop, 150 fpm, 2500 lb capacity	2.00	EA	72,228.17	0.00	239,780.10	312,008.27	Elevator Subcontractor
<b>Plumbing &amp; Fire Protection</b>	<b>145,095.00</b>	<b>SF</b>	<b>388,735.18</b>	<b>0.00</b>	<b>1,443,745.45</b>	<b>1,832,480.63</b>	<b>Plumbing Subcontractor</b>
Plumbing & Fire Protection System (Note: Includes Domestic & Fire Water Lines, Plumbing Fixtures, Sanitary & Storm Drainage, & Sprinkler System.)	145,095.00	SF	388,735.18	0.00	1,443,745.45	1,832,480.63	Plumbing Subcontractor
<b>HVAC</b>	<b>145,095.00</b>	<b>SF</b>	<b>1,562,389.25</b>	<b>0.00</b>	<b>5,057,707.00</b>	<b>6,620,096.25</b>	<b>HVAC Subcontractor</b>
Heating, Ventilating & Air Conditioning System (Note: Includes HVAC Equipment, Duct, Piping, Duct Accessories, Controls, Testing, & Commissioning)	145,095.00	SF	1,562,389.25	0.00	5,057,707.00	6,620,096.25	HVAC Subcontractor
<b>Electric Power &amp; Electrical Systems</b>	<b>145,095.00</b>	<b>SF</b>	<b>2,658,324.54</b>	<b>0.00</b>	<b>4,368,019.68</b>	<b>7,026,344.22</b>	<b>Electrical Subcontractor</b>
Electrical Power, Lighting, & Systems (Note: Includes Power Distribution, Lighting, Telecomm, Fire Alarm, & Other Special Systems For Typical Office Building.)	145,095.00	SF	2,658,324.54	0.00	4,368,019.68	7,026,344.22	Electrical Subcontractor
<b>Superstructure - Tie Forces</b>	<b>1.00</b>	<b>LS</b>	<b>137,259.58</b>	<b>0.00</b>	<b>228,668.86</b>	<b>365,928.44</b>	<b>Concrete Subcontractor</b>
(Note: Alternate Method For Longitudinal, Transverse, & Peripheral Mechanical Ties.)							
<b>Floor Construction</b>	<b>1.00</b>	<b>LS</b>	<b>137,259.58</b>	<b>0.00</b>	<b>228,668.86</b>	<b>365,928.44</b>	<b>Concrete Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>2,705.72</b>	<b>0.00</b>	<b>4,507.61</b>	<b>7,213.33</b>	<b>Concrete Subcontractor</b>
(Note: Verticle Reinforcing Remains The Same As Baseline. Peripheral Ties Added To Frame.)							
Reinforcing steel, in place, peripheral ties, #3 to #7 (Note: Assuming A Crew Of 4 Rodmen At 0.35 Tons or 700 lbs. per Hour. Material Pricing Per Fastenal.com - 8-11-11)	0.83	TON	627.30	0.00	1,045.06	1,672.36	Concrete Subcontractor
Reinforcing steel, in place, enhanced local resistance ties, #3 to #7 (Note: Assuming A Crew Of 4 Rodmen At 0.35 Tons or 700 lbs. per Hour. Material Pricing Per Fastenal.com - 8-11-11)	2.75	TON	2,078.41	0.00	3,462.55	5,540.96	Concrete Subcontractor
<b>Floor Decks and Slabs</b>	<b>1.00</b>	<b>LS</b>	<b>134,553.86</b>	<b>0.00</b>	<b>224,161.25</b>	<b>358,715.12</b>	<b>Concrete Subcontractor</b>
(Note: #3 Rebar @ 12" OC Each Way is Replaced By #5 Rebar @ 8" OC Each Way For Longitudinal & Transverse Ties.)							
Concrete Beam Floor System, 5" Slab, 6"Wx20"H Beams @ 6' O.C. (Note: Assembly Item Includes Concrete, Re-Bar Reinforcing (#5 EW @8"OC), Finishing, & Forming.)	145,095.00	SF	1,418,722.72	60,085.68	1,342,242.24	2,821,050.64	Concrete Subcontractor
Concrete Beam Floor System, 5" Slab, 6"Wx20"H Beams @ 6' O.C. (Note: Assembly Item Includes Concrete, Re-Bar Reinforcing (#3 EW @12"OC), Finishing, & Forming.)	145,095.00	SF	1,284,168.86	60,085.68	1,118,080.99	2,462,335.53	Concrete Subcontractor
<b>Buildings - Steel Frame</b>	<b>1.00</b>	<b>LS</b>	<b>5,167,451.44</b>	<b>63,475.55</b>	<b>10,690,357.82</b>	<b>15,921,284.81</b>	<b>Structural Steel Subcontractor</b>
<b>Complete Building - Baseline</b>	<b>86,400.00</b>	<b>SF</b>	<b>5,073,883.10</b>	<b>42,289.40</b>	<b>10,220,716.28</b>	<b>15,336,888.78</b>	<b>Prime Contractor</b>
(Note: 4-Story Steel Dual Lateral System With A Perimeter Moment Frame.)							
<b>Substructure</b>	<b>86,400.00</b>	<b>SF</b>	<b>144,023.99</b>	<b>652.32</b>	<b>249,151.59</b>	<b>393,827.91</b>	<b>Concrete Subcontractor</b>
(Note: Assuming Shallow Foundations with Perimeter & Interior Continuous Footings @ Load Bearing Walls & Spread Footings @ Columns. Also Includes Slab On Grade, Foundation Walls, & Elevator Pit.)							
Shallow Concrete Foundation System, incl below ground footings & slab on grade	86,400.00	SF	144,023.99	652.32	249,151.59	393,827.91	Concrete Subcontractor
<b>Superstructure</b>	<b>86,400.00</b>	<b>SF</b>	<b>339,257.92</b>	<b>39,235.12</b>	<b>989,913.39</b>	<b>1,368,405.43</b>	<b>Structural Steel Subcontractor</b>

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>320,698.79</b>	<b>38,835.83</b>	<b>884,619.71</b>	<b>1,244,154.33</b>	<b>Structural Steel Subcontractor</b>
Metal decking, steel, galvanized, 1-1/2" D, 20 ga (Note: Assuming A Crew Of 1 Steel Worker, 1 Welder, & 1 Welding Machine At 200 Square Feet Per Hour. Material Pricing From Wheeling Corrugating - 2-16-10)	86,400.00	SF	62,045.63	4,094.24	91,264.32	157,404.19	Structural Steel Subcontractor
3-1/4" Slab On Deck - W.W.F. Reinforced (Note: Assembly Item Includes Concrete, Welded Wire Reinforcing, Finishing, & Forming)	64,800.00	SF	109,535.22	977.66	84,894.98	195,407.87	Structural Steel Subcontractor
<b>Structural Frame</b>	<b>353.00</b>	<b>TON</b>	<b>149,117.94</b>	<b>33,763.93</b>	<b>708,460.41</b>	<b>891,342.28</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members (Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, & A Crane At 1.45 Tons Per Hour. Material Pricing From C&P Welding & Steel Erection, Inc. - 6-30-11)	353.00	TON	149,117.94	33,763.93	708,460.41	891,342.28	Structural Steel Subcontractor
<b>Stair Construction</b>	<b>1.00</b>	<b>LS</b>	<b>18,559.13</b>	<b>399.30</b>	<b>105,293.67</b>	<b>124,252.10</b>	<b>Concrete Subcontractor</b>
<b>Metal Pan Stairs</b>	<b>1.00</b>	<b>LS</b>	<b>12,777.28</b>	<b>399.30</b>	<b>86,467.24</b>	<b>99,643.82</b>	<b>Concrete Subcontractor</b>
Metal Pan Stair Risers (Note: Assuming A Crew Of 4 Structural Steel Workers w/ A Welding Machine At 5.6 Risers Per Hour)	132.00	RSR	6,150.80	223.40	64,835.69	71,209.89	Concrete Subcontractor
Metal Pan Landings (Note: Assuming A Crew Of 4 Structural Steel Workers w/ A Welding Machine At 18.75 Square Feet Per Hour)	348.00	SF	4,843.10	175.90	20,474.90	25,493.90	Concrete Subcontractor
Concrete Infill @ Stair Risers (Note: Assuming 1 Cement Finisher At 24 Square Feet Per Hour. Material Pricing From Stone & Company - 8-3-11)	876.00	SF	1,783.38	0.00	1,156.65	2,940.03	Concrete Subcontractor
<b>Metal Railings</b>	<b>401.00</b>	<b>LF</b>	<b>5,781.85</b>	<b>0.00</b>	<b>18,826.43</b>	<b>24,608.28</b>	<b>Concrete Subcontractor</b>
Railing, Pipe, Steel, Wall Rail, Primed, 1-1/2" Dia (Note: Assuming 2 Structural Steel Workers At 8 Feet Per Hour. Material Pricing Per Wagner Company - 8-29-11)	186.00	LF	3,003.98	0.00	1,561.95	4,565.93	Concrete Subcontractor
Metal Pipe & Picket Guard Railing w/ Attached Handrail, round pickets, straight & sloped, 1-1/2" Dia (Note: Assuming 2 Steel Workers At 10 Feet Per Hour. Material Pricing Per Wagner Company - 8-25-11)	215.00	LF	2,777.87	0.00	17,264.48	20,042.35	Concrete Subcontractor
<b>Exterior Closure</b>	<b>86,400.00</b>	<b>SF</b>	<b>545,680.16</b>	<b>0.00</b>	<b>854,234.04</b>	<b>1,399,914.19</b>	<b>Masonry Subcontractor</b>
Exterior Masonry Veneer Wall System, Includes Glazing & Doors (Note: Costs Includes Glazing, Doors, Veneer, wall back-up system & Trim)	86,400.00	SF	545,680.16	0.00	854,234.04	1,399,914.19	Masonry Subcontractor
<b>Roofing</b>	<b>86,400.00</b>	<b>SF</b>	<b>47,287.43</b>	<b>2,401.96</b>	<b>229,073.44</b>	<b>278,762.84</b>	<b>Flat-Applied Roofing Subcontractor</b>
Flat Roofing System, including sheathing, insulation & drainage accessories & trim	21,600.00	SF	47,287.43	2,401.96	229,073.44	278,762.84	Flat-Applied Roofing Subcontractor
<b>Interior Construction &amp; Finishes</b>	<b>86,400.00</b>	<b>SF</b>	<b>1,209,499.20</b>	<b>0.00</b>	<b>1,295,953.34</b>	<b>2,505,452.55</b>	<b>Prime Contractor</b>
Interior Construction & Finishes (Note: Costs Include Partitions, Doors, Specialties & Finishes)	86,400.00	SF	1,209,499.20	0.00	1,295,953.34	2,505,452.55	Prime Contractor
<b>Conveying Systems</b>	<b>2.00</b>	<b>EA</b>	<b>43,336.90</b>	<b>0.00</b>	<b>129,924.90</b>	<b>173,261.80</b>	<b>Elevator Subcontractor</b>
Elevators/Lifts, electric passenger, variable voltage collective, standard cab, 4 stop, 150 fpm, 2500 lb capacity	2.00	EA	43,336.90	0.00	129,924.90	173,261.80	Elevator Subcontractor
<b>Plumbing &amp; Fire Protection</b>	<b>86,400.00</b>	<b>SF</b>	<b>231,480.89</b>	<b>0.00</b>	<b>859,709.89</b>	<b>1,091,190.78</b>	<b>Plumbing Subcontractor</b>
Plumbing & Fire Protection System (Note: Includes Domestic & Fire Water Lines, Plumbing Fixtures, Sanitary & Storm Drainage, & Sprinkler System.)	86,400.00	SF	231,480.89	0.00	859,709.89	1,091,190.78	Plumbing Subcontractor
<b>HVAC</b>	<b>86,400.00</b>	<b>SF</b>	<b>930,358.95</b>	<b>0.00</b>	<b>3,011,722.56</b>	<b>3,942,081.51</b>	<b>HVAC Subcontractor</b>
Heating, Ventilating & Air Conditioning System (Note: Includes HVAC Equipment, Duct, Piping, Duct Accessories, Controls, Testing, & Commissioning)	86,400.00	SF	930,358.95	0.00	3,011,722.56	3,942,081.51	HVAC Subcontractor
<b>Electric Power &amp; Electrical Systems</b>	<b>86,400.00</b>	<b>SF</b>	<b>1,582,957.65</b>	<b>0.00</b>	<b>2,601,033.12</b>	<b>4,183,990.77</b>	<b>Electrical Subcontractor</b>
Electrical Power, Lighting, & Systems	86,400.00	SF	1,582,957.65	0.00	2,601,033.12	4,183,990.77	Electrical Subcontractor

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>(Note: Includes Power Distribution, Lighting, Telecomm, Fire Alarm, &amp; Other Special Systems For Typical Office Building.)</b>							
<b>Superstructure - Linear Static Procedure - Exterior Columns</b>	<b>1.00</b>	<b>LS</b>	<b>46,467.35</b>	<b>10,521.34</b>	<b>233,315.54</b>	<b>290,304.23</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Alternate Path Method For Removing Steel Columns Using The Linear Static Procedure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>46,467.35</b>	<b>10,521.34</b>	<b>233,315.54</b>	<b>290,304.23</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>110.00</b>	<b>TON</b>	<b>46,467.35</b>	<b>10,521.34</b>	<b>233,315.54</b>	<b>290,304.23</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	110.00	TON	46,467.35	10,521.34	220,766.70	277,755.38	Structural Steel Subcontractor
<b>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</b>							
Steel plate, structural, for connections & stiffeners, 1/2" T, shop fabricated, incl shop primer	528.00	SF	0.00	0.00	12,548.84	12,548.84	Structural Steel Subcontractor
<b>Superstructure - Non-Linear Dynamic Procedure - Exterior Columns</b>	<b>1.00</b>	<b>LS</b>	<b>16,897.22</b>	<b>3,825.94</b>	<b>92,827.64</b>	<b>113,550.80</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Alternate Path Method For Removing Steel Columns Using The Non-Linear Dynamic Procedure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>16,897.22</b>	<b>3,825.94</b>	<b>92,827.64</b>	<b>113,550.80</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>40.00</b>	<b>TON</b>	<b>16,897.22</b>	<b>3,825.94</b>	<b>92,827.64</b>	<b>113,550.80</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	40.00	TON	16,897.22	3,825.94	80,278.80	101,001.96	Structural Steel Subcontractor
<b>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</b>							
Steel plate, structural, for connections & stiffeners, 1/2" T, shop fabricated, incl shop primer	528.00	SF	0.00	0.00	12,548.84	12,548.84	Structural Steel Subcontractor
<b>Superstructure - Linear Static Procedure - Interior Columns</b>	<b>1.00</b>	<b>LS</b>	<b>21,966.38</b>	<b>4,973.72</b>	<b>104,362.44</b>	<b>131,302.54</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Alternate Path Method For Removing Steel Columns Using The Linear Static Procedure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>21,966.38</b>	<b>4,973.72</b>	<b>104,362.44</b>	<b>131,302.54</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>52.00</b>	<b>TON</b>	<b>21,966.38</b>	<b>4,973.72</b>	<b>104,362.44</b>	<b>131,302.54</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	52.00	TON	21,966.38	4,973.72	104,362.44	131,302.54	Structural Steel Subcontractor
<b>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</b>							
<b>Superstructure - Non-Linear Dynamic Procedure - Interior Columns</b>	<b>1.00</b>	<b>LS</b>	<b>8,237.39</b>	<b>1,865.15</b>	<b>39,135.92</b>	<b>49,238.45</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Alternate Path Method For Removing Steel Columns Using The Non-Linear Dynamic Procedure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>8,237.39</b>	<b>1,865.15</b>	<b>39,135.92</b>	<b>49,238.45</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>19.50</b>	<b>TON</b>	<b>8,237.39</b>	<b>1,865.15</b>	<b>39,135.92</b>	<b>49,238.45</b>	<b>Structural Steel Subcontractor</b>
Structural Steel Members	19.50	TON	8,237.39	1,865.15	39,135.92	49,238.45	Structural Steel Subcontractor
<b>(Note: Assuming A Crew Of 7 Steel Workers, 2 Equipment Operators, &amp; A Crane At 1.45 Tons Per Hour. Material Pricing From C&amp;P Welding &amp; Steel Erection, Inc. - 6-30-11)</b>							
<b>Buildings - Wood Frame</b>	<b>1.00</b>	<b>LS</b>	<b>1,327,481.69</b>	<b>1,300.14</b>	<b>2,524,915.10</b>	<b>3,853,696.93</b>	<b>Carpentry Subcontractor</b>
<b>Complete Building - Baseline</b>	<b>19,124.00</b>	<b>SF</b>	<b>1,324,382.55</b>	<b>1,300.14</b>	<b>2,515,310.08</b>	<b>3,840,992.77</b>	<b>Prime Contractor</b>
<b>(Note: 4-Story Steel Dual Lateral System With A Perimeter Moment Frame.)</b>							

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>Substructure</b>	<b>19,124.00</b>	<b>SF</b>	<b>31,878.64</b>	<b>144.39</b>	<b>55,147.86</b>	<b>87,170.89</b>	<b>Concrete Subcontractor</b>
<b>(Note: Assuming Shallow Foundations with Perimeter &amp; Interior Continuous Footings @ Load Bearing Walls &amp; Spread Footings @ Columns. Also Includes Slab On Grade, &amp; Foundation Walls)</b>							
Shallow Concrete Foundation System, incl below ground footings & slab on grade	19,124.00	SF	31,878.64	144.39	55,147.86	87,170.89	Concrete Subcontractor
<b>Superstructure</b>	<b>19,124.00</b>	<b>SF</b>	<b>205,421.31</b>	<b>1,155.75</b>	<b>195,463.85</b>	<b>402,040.91</b>	<b>Carpentry Subcontractor</b>
<b>(Note: 3-Story Wood Structure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>199,191.87</b>	<b>1,022.65</b>	<b>160,098.29</b>	<b>360,312.81</b>	<b>Carpentry Subcontractor</b>
Exterior Wall Assembly, Wood-Frame (Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood & 5/8" Gyp.)	29,080.00	SF	73,530.62	0.00	31,792.31	105,322.92	Carpentry Subcontractor
Interior Wall Assembly, Wood-Frame (Note: Assembly Includes 6" Wood Stud @ 24" OC, 1/2" Plywood Each Side.)	41,543.00	SF	82,024.58	0.00	49,367.10	131,391.68	Carpentry Subcontractor
Wood-Frame Floor Assembly (Note: Assembly Includes Engineered I Joists, 3/4" Plywood Subfloor & 5/8" Gyp Under Joists)	12,750.00	SF	34,405.81	0.00	58,719.72	93,125.53	Carpentry Subcontractor
Wood framing, joists, 2" x 8", pneumatic nailed	0.95	MBF	546.38	0.00	421.46	967.85	Carpentry Subcontractor
Wood-Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	8,684.48	1,022.65	19,797.70	29,504.84	Carpentry Subcontractor
<b>Stair Construction</b>	<b>1.00</b>	<b>LS</b>	<b>6,229.44</b>	<b>133.10</b>	<b>35,365.56</b>	<b>41,728.10</b>	<b>Concrete Subcontractor</b>
<b>Metal Pan Stairs</b>	<b>1.00</b>	<b>LS</b>	<b>4,259.09</b>	<b>133.10</b>	<b>28,822.41</b>	<b>33,214.61</b>	<b>Concrete Subcontractor</b>
Metal Pan Stair Risers (Note: Assuming A Crew Of 4 Structural Steel Workers w/ A Welding Machine At 5.6 Risers Per Hour)	44.00	RSR	2,050.27	74.47	21,611.90	23,736.63	Concrete Subcontractor
Metal Pan Landings (Note: Assuming A Crew Of 4 Structural Steel Workers w/ A Welding Machine At 18.75 Square Feet Per Hour)	116.00	SF	1,614.37	58.63	6,824.97	8,497.97	Concrete Subcontractor
Concrete Infill @ Stair Risers (Note: Assuming 1 Cement Finisher At 24 Square Feet Per Hour. Material Pricing From Stone & Company - 8-3-11)	292.00	SF	594.46	0.00	385.55	980.01	Concrete Subcontractor
<b>Metal Railings</b>	<b>137.00</b>	<b>LF</b>	<b>1,970.35</b>	<b>0.00</b>	<b>6,543.14</b>	<b>8,513.49</b>	<b>Concrete Subcontractor</b>
Railing, Pipe, Steel, Wall Rail, Primed, 1-1/2" Dia (Note: Assuming 2 Structural Steel Workers At 8 Feet Per Hour. Material Pricing Per Wagner Company - 8-29-11)	62.00	LF	1,001.33	0.00	520.65	1,521.98	Concrete Subcontractor
Metal Pipe & Picket Guard Railing w/ Attached Handrail, round pickets, straight & sloped, 1-1/2" Dia (Note: Assuming 2 Steel Workers At 10 Feet Per Hour. Material Pricing Per Wagner Company - 8-25-11)	75.00	LF	969.02	0.00	6,022.49	6,991.52	Concrete Subcontractor
<b>Exterior Closure</b>	<b>19,124.00</b>	<b>SF</b>	<b>120,782.26</b>	<b>0.00</b>	<b>189,078.38</b>	<b>309,860.64</b>	<b>Masonry Subcontractor</b>
Exterior Masonry Veneer Wall System, Includes Glazing & Doors (Note: Costs Includes Glazing, Doors, Veneer, wall back-up system & Trim)	19,124.00	SF	120,782.26	0.00	189,078.38	309,860.64	Masonry Subcontractor
<b>Roofing</b>	<b>19,124.00</b>	<b>SF</b>	<b>91,046.05</b>	<b>0.00</b>	<b>356,138.01</b>	<b>447,184.06</b>	<b>Preformed Metal Roofing/Siding Subcontractor</b>
Sloped Metal Roofing System, including sheathing, insulation & drainage accessories & trim	19,124.00	SF	91,046.05	0.00	356,138.01	447,184.06	Preformed Metal Roofing/Siding Subcontractor
<b>Interior Construction &amp; Finishes</b>	<b>19,124.00</b>	<b>SF</b>	<b>267,713.69</b>	<b>0.00</b>	<b>286,849.67</b>	<b>554,563.36</b>	<b>Prime Contractor</b>
Interior Construction & Finishes (Note: Costs Include Partitions, Doors, Specialties & Finishes)	19,124.00	SF	267,713.69	0.00	286,849.67	554,563.36	Prime Contractor
<b>Plumbing &amp; Fire Protection</b>	<b>19,124.00</b>	<b>SF</b>	<b>51,236.58</b>	<b>0.00</b>	<b>190,290.42</b>	<b>241,527.00</b>	<b>Plumbing Subcontractor</b>
Plumbing & Fire Protection System	19,124.00	SF	51,236.58	0.00	190,290.42	241,527.00	Plumbing Subcontractor

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>(Note: Includes Domestic &amp; Fire Water Lines, Plumbing Fixtures, Sanitary &amp; Storm Drainage, &amp; Sprinkler System.)</b>							
<b>HVAC</b>	<b>19,124.00</b>	<b>SF</b>	<b>205,928.06</b>	<b>0.00</b>	<b>666,622.48</b>	<b>872,550.54</b>	<b>HVAC Subcontractor</b>
Heating, Ventilating & Air Conditioning System	19,124.00	SF	205,928.06	0.00	666,622.48	872,550.54	HVAC Subcontractor
<b>(Note: Includes HVAC Equipment, Duct, Piping, Duct Accessories, Controls, Testing, &amp; Commissioning)</b>							
<b>Electric Power &amp; Electrical Systems</b>	<b>19,124.00</b>	<b>SF</b>	<b>350,375.95</b>	<b>0.00</b>	<b>575,719.41</b>	<b>926,095.36</b>	<b>Electrical Subcontractor</b>
Electrical Power, Lighting, & Systems	19,124.00	SF	350,375.95	0.00	575,719.41	926,095.36	Electrical Subcontractor
<b>(Note: Includes Power Distribution, Lighting, Telecomm, Fire Alarm, &amp; Other Special Systems For Typical Office Building.)</b>							
<b>Superstructure - Removal Scenario 1</b>	<b>1.00</b>	<b>LS</b>	<b>564.28</b>	<b>0.00</b>	<b>293.02</b>	<b>857.30</b>	<b>Carpentry Subcontractor</b>
<b>(Note: Interior Load Bearing Wall Removal @ Short Side First Story)</b>							
<b>Supplemental 2x6 Framing</b>	<b>365.00</b>	<b>LF</b>	<b>564.28</b>	<b>0.00</b>	<b>293.02</b>	<b>857.30</b>	<b>Carpentry Subcontractor</b>
Double 2x6 Wall Header/Sill Plate	365.00	LF	564.28	0.00	293.02	857.30	Carpentry Subcontractor
<b>Superstructure - Removal Scenario 2</b>	<b>1.00</b>	<b>LS</b>	<b>692.60</b>	<b>0.00</b>	<b>359.65</b>	<b>1,052.25</b>	<b>Carpentry Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Second Story)</b>							
<b>Supplemental 2x6 Framing</b>	<b>448.00</b>	<b>LF</b>	<b>692.60</b>	<b>0.00</b>	<b>359.65</b>	<b>1,052.25</b>	<b>Carpentry Subcontractor</b>
Double 2x6 Wall Header/Sill Plate	448.00	LF	692.60	0.00	359.65	1,052.25	Carpentry Subcontractor
<b>Superstructure - Removal Scenario 3</b>	<b>1.00</b>	<b>LS</b>	<b>692.60</b>	<b>0.00</b>	<b>359.65</b>	<b>1,052.25</b>	<b>Carpentry Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Second Story (Alternate Location))</b>							
<b>Supplemental 2x6 Framing</b>	<b>448.00</b>	<b>LF</b>	<b>692.60</b>	<b>0.00</b>	<b>359.65</b>	<b>1,052.25</b>	<b>Carpentry Subcontractor</b>
Double 2x6 Wall Header/Sill Plate	448.00	LF	692.60	0.00	359.65	1,052.25	Carpentry Subcontractor
<b>Superstructure - Removal Scenario 4</b>	<b>1.00</b>	<b>LS</b>	<b>1,149.67</b>	<b>0.00</b>	<b>8,592.70</b>	<b>9,742.37</b>	<b>Carpentry Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Third Story)</b>							
<b>Beams &amp; Tie-Downs @ Vertical Truss Posts</b>	<b>448.00</b>	<b>LF</b>	<b>1,149.67</b>	<b>0.00</b>	<b>8,592.70</b>	<b>9,742.37</b>	<b>Carpentry Subcontractor</b>
24F-V5 southern pine or western species, 3" wide x 12.375" deep	448.00	LF	961.94	0.00	8,565.33	9,527.27	Carpentry Subcontractor
Tie-Down Anchors	8.00	EA	187.73	0.00	27.38	215.10	Carpentry Subcontractor
<b>(Note: Includes Angles &amp; Thru-Bolt)</b>							
<b>Buildings - Cold-Formed Steel Frame</b>	<b>1.00</b>	<b>LS</b>	<b>1,600,381.35</b>	<b>8,382.70</b>	<b>2,911,706.79</b>	<b>4,520,470.84</b>	<b>Structural Steel Subcontractor</b>
<b>Complete Building - Baseline</b>	<b>19,124.00</b>	<b>SF</b>	<b>1,567,750.26</b>	<b>5,220.56</b>	<b>2,895,640.13</b>	<b>4,468,610.95</b>	<b>Prime Contractor</b>
<b>(Note: 4-Story Steel Dual Lateral System With A Perimeter Moment Frame.)</b>							
<b>Substructure</b>	<b>19,124.00</b>	<b>SF</b>	<b>31,878.64</b>	<b>144.39</b>	<b>55,147.86</b>	<b>87,170.89</b>	<b>Concrete Subcontractor</b>
<b>(Note: Assuming Shallow Foundations with Perimeter &amp; Interior Continuous Footings @ Load Bearing Walls &amp; Spread Footings @ Columns. Also Includes Slab On Grade, &amp; Foundation Walls)</b>							
Shallow Concrete Foundation System, incl below ground footings & slab on grade	19,124.00	SF	31,878.64	144.39	55,147.86	87,170.89	Concrete Subcontractor
<b>Superstructure</b>	<b>19,124.00</b>	<b>SF</b>	<b>448,789.02</b>	<b>5,076.17</b>	<b>575,793.90</b>	<b>1,029,659.09</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: 3-Story Cold-Formed Steel Structure)</b>							
<b>Floor &amp; Roof Construction</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>
<b>Structural Frame</b>	<b>1.00</b>	<b>LS</b>	<b>442,559.58</b>	<b>4,943.08</b>	<b>540,428.34</b>	<b>987,930.99</b>	<b>Structural Steel Subcontractor</b>

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
Exterior End Wall & Interior Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On Both Sides & 600S200-68 Gr50 Studs @ 24" OC)	51,333.00	SF	290,326.37	0.00	343,774.12	634,100.49	Structural Steel Subcontractor
Exterior Long Direction Wall Assembly, Cold-Form Framed (Note: Assembly Includes 7/16" OSB Sheathing On One Side & 600S200-68 Gr50 Studs @ 24" OC)	19,250.00	SF	97,081.79	0.00	124,442.70	221,524.49	Structural Steel Subcontractor
4" Slab On Deck - W.W.F. Reinforced (Note: Assembly Item Includes Concrete, Welded Wire Reinforcing, Finishing, & Forming)	12,750.00	SF	28,422.27	1,198.30	19,821.68	49,442.25	Structural Steel Subcontractor
Metal decking, steel, galvanized, 2" D, 20 ga (Note: Assuming A Crew Of 1 Steel Worker, 1 Welder, & 1 Welding Machine At 200 Square Feet Per Hour. Material Pricing From Wheeling Corrugating - 2-16-10)	12,750.00	SF	9,156.04	604.18	13,467.83	23,228.05	Structural Steel Subcontractor
Cold-Formed Steel Framed Roof Assembly (Note: Assembly Includes Roof Trusses & 1/2" Plywood)	6,375.00	SF	17,573.11	3,140.59	38,922.01	59,635.71	Structural Steel Subcontractor
<b>Stair Construction</b>	<b>1.00</b>	<b>LS</b>	<b>6,229.44</b>	<b>133.10</b>	<b>35,365.56</b>	<b>41,728.10</b>	<b>Concrete Subcontractor</b>
<b>Metal Pan Stairs</b>	<b>1.00</b>	<b>LS</b>	<b>4,259.09</b>	<b>133.10</b>	<b>28,822.41</b>	<b>33,214.61</b>	<b>Concrete Subcontractor</b>
Metal Pan Stair Risers (Note: Assuming A Crew Of 4 Structural Steel Workers w/ A Welding Machine At 5.6 Risers Per Hour)	44.00	RSR	2,050.27	74.47	21,611.90	23,736.63	Concrete Subcontractor
Metal Pan Landings (Note: Assuming A Crew Of 4 Structural Steel Workers w/ A Welding Machine At 18.75 Square Feet Per Hour)	116.00	SF	1,614.37	58.63	6,824.97	8,497.97	Concrete Subcontractor
Concrete Infill @ Stair Risers (Note: Assuming 1 Cement Finisher At 24 Square Feet Per Hour. Material Pricing From Stone & Company - 8-3-11)	292.00	SF	594.46	0.00	385.55	980.01	Concrete Subcontractor
<b>Metal Railings</b>	<b>137.00</b>	<b>LF</b>	<b>1,970.35</b>	<b>0.00</b>	<b>6,543.14</b>	<b>8,513.49</b>	<b>Concrete Subcontractor</b>
Railing, Pipe, Steel, Wall Rail, Primed, 1-1/2" Dia (Note: Assuming 2 Structural Steel Workers At 8 Feet Per Hour. Material Pricing Per Wagner Company - 8-29-11)	62.00	LF	1,001.33	0.00	520.65	1,521.98	Concrete Subcontractor
Metal Pipe & Picket Guard Railing w/ Attached Handrail, round pickets, straight & sloped, 1-1/2" Dia (Note: Assuming 2 Steel Workers At 10 Feet Per Hour. Material Pricing Per Wagner Company - 8-25-11)	75.00	LF	969.02	0.00	6,022.49	6,991.52	Concrete Subcontractor
<b>Exterior Closure</b>	<b>19,124.00</b>	<b>SF</b>	<b>120,782.26</b>	<b>0.00</b>	<b>189,078.38</b>	<b>309,860.64</b>	<b>Masonry Subcontractor</b>
Exterior Masonry Veneer Wall System, Includes Glazing & Doors (Note: Costs Includes Glazing, Doors, Veneer, wall back-up system & Trim)	19,124.00	SF	120,782.26	0.00	189,078.38	309,860.64	Masonry Subcontractor
<b>Roofing</b>	<b>19,124.00</b>	<b>SF</b>	<b>91,046.05</b>	<b>0.00</b>	<b>356,138.01</b>	<b>447,184.06</b>	<b>Preformed Metal Roofing/Siding Subcontractor</b>
Sloped Metal Roofing System, including sheathing, insulation & drainage accessories & trim	19,124.00	SF	91,046.05	0.00	356,138.01	447,184.06	Preformed Metal Roofing/Siding Subcontractor
<b>Interior Construction &amp; Finishes</b>	<b>19,124.00</b>	<b>SF</b>	<b>267,713.69</b>	<b>0.00</b>	<b>286,849.67</b>	<b>554,563.36</b>	<b>Prime Contractor</b>
Interior Construction & Finishes (Note: Costs Include Partitions, Doors, Specialties & Finishes)	19,124.00	SF	267,713.69	0.00	286,849.67	554,563.36	Prime Contractor
<b>Plumbing &amp; Fire Protection</b>	<b>19,124.00</b>	<b>SF</b>	<b>51,236.58</b>	<b>0.00</b>	<b>190,290.42</b>	<b>241,527.00</b>	<b>Plumbing Subcontractor</b>
Plumbing & Fire Protection System (Note: Includes Domestic & Fire Water Lines, Plumbing Fixtures, Sanitary & Storm Drainage, & Sprinkler System.)	19,124.00	SF	51,236.58	0.00	190,290.42	241,527.00	Plumbing Subcontractor
<b>HVAC</b>	<b>19,124.00</b>	<b>SF</b>	<b>205,928.06</b>	<b>0.00</b>	<b>666,622.48</b>	<b>872,550.54</b>	<b>HVAC Subcontractor</b>
Heating, Ventilating & Air Conditioning System (Note: Includes HVAC Equipment, Duct, Piping, Duct Accessories, Controls, Testing, & Commissioning)	19,124.00	SF	205,928.06	0.00	666,622.48	872,550.54	HVAC Subcontractor
<b>Electric Power &amp; Electrical Systems</b>	<b>19,124.00</b>	<b>SF</b>	<b>350,375.95</b>	<b>0.00</b>	<b>575,719.41</b>	<b>926,095.36</b>	<b>Electrical Subcontractor</b>
Electrical Power, Lighting, & Systems (Note: Includes Power Distribution, Lighting, Telecomm, Fire Alarm, & Other Special Systems For Typical Office Building.)	19,124.00	SF	350,375.95	0.00	575,719.41	926,095.36	Electrical Subcontractor

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectCost	Contractor
<b>Superstructure - Removal Scenario 1</b>	<b>1.00</b>	<b>LS</b>	<b>14,327.34</b>	<b>1,359.17</b>	<b>4,865.91</b>	<b>20,552.41</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Interior Load Bearing Wall Removal @ Short Side First Story)</b>							
<b>Wall Fasteners &amp; Track Splice</b>	<b>1.00</b>	<b>LS</b>	<b>14,327.34</b>	<b>1,359.17</b>	<b>4,865.91</b>	<b>20,552.41</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Increased Frequency Of Wall Fasteners &amp; Splice Top/Bottom Wall Track)</b>							
Wall Fastener	548.00	EA	8,324.60	0.00	1,863.90	10,188.51	Structural Steel Subcontractor
Splice Top/Bottom Wall Track	98.00	EA	6,002.74	1,359.17	3,002.00	10,363.91	Structural Steel Subcontractor
<b>Superstructure - Removal Scenario 2</b>	<b>1.00</b>	<b>LS</b>	<b>17,436.06</b>	<b>1,636.55</b>	<b>5,900.32</b>	<b>24,972.93</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Second Story)</b>							
<b>Wall Fasteners &amp; Track Splice</b>	<b>1.00</b>	<b>LS</b>	<b>17,436.06</b>	<b>1,636.55</b>	<b>5,900.32</b>	<b>24,972.93</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Increased Frequency Of Wall Fasteners &amp; Splice Top/Bottom Wall Track)</b>							
Wall Fastener	672.00	EA	10,208.27	0.00	2,285.66	12,493.94	Structural Steel Subcontractor
Splice Top/Bottom Wall Track	118.00	EA	7,227.78	1,636.55	3,614.66	12,478.99	Structural Steel Subcontractor
<b>Superstructure - Removal Scenario 3</b>	<b>1.00</b>	<b>LS</b>	<b>867.70</b>	<b>166.43</b>	<b>5,300.43</b>	<b>6,334.55</b>	<b>Structural Steel Subcontractor</b>
<b>(Note: Exterior Load Bearing Wall Removal @ Long Side Third Story)</b>							
<b>Beams &amp; Tie-Downs @ Vertical Truss Posts</b>	<b>448.00</b>	<b>LF</b>	<b>867.70</b>	<b>166.43</b>	<b>5,300.43</b>	<b>6,334.55</b>	<b>Carpentry Subcontractor</b>
Tie-Down Anchors	8.00	EA	187.73	0.00	27.38	215.10	Carpentry Subcontractor
<b>(Note: Includes Angles &amp; Thru-Bolt)</b>							
HSS 3x3x3/8 Beams	2.40	TON	679.97	166.43	5,273.05	6,119.45	Carpentry Subcontractor