Image Courtesy of The Preston Partnership

SOLAIRE WHEATON

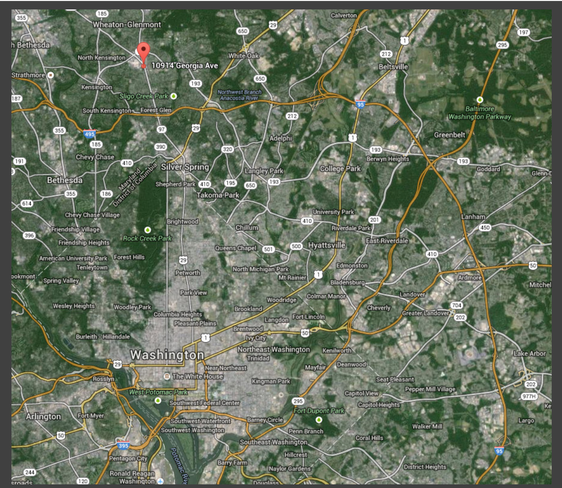
KEVIN MARTYN | CONSTRUCTION OPTION

THE PENNSYLVANIA STATE UNIVERSITY

ARCHITECTURAL ENGINEERING

SENIOR THESIS PROJECT

ADVISER | DR. ROB LEICHT



PROJECT OVERVIEW

Project Name: Solaire Wheaton

Location: Wheaton, MD

Size: 361,000 SF

Stories: 6 Above & 2 Semi-below grade

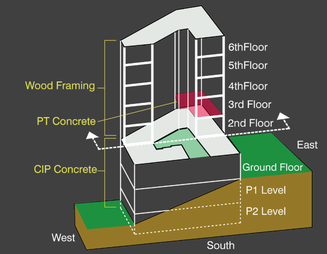
Occupancy Type: Multi-family Residential

Total Cost: $31.5 million

Construction Duration: 21 Months

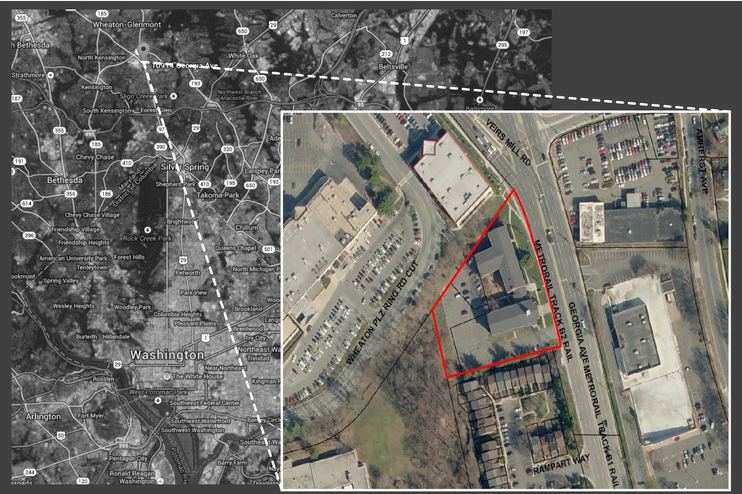
Delivery Method: CM @ Risk

Contract Type: Guaranteed Maximum Price (GMP)



CLARK BUILDERS GROUP

WASHINGTON PROPERTY COMPANY
Development Management Leasing



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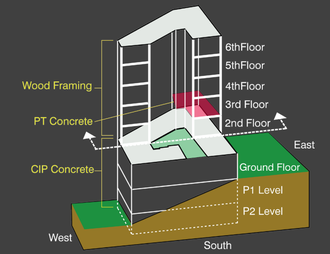

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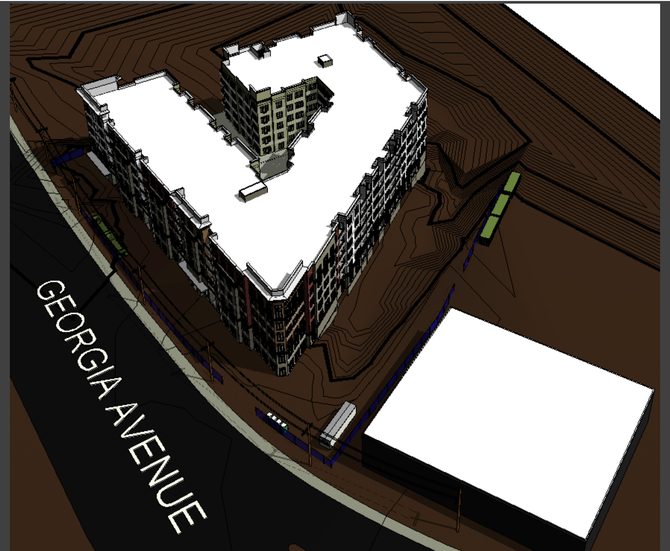
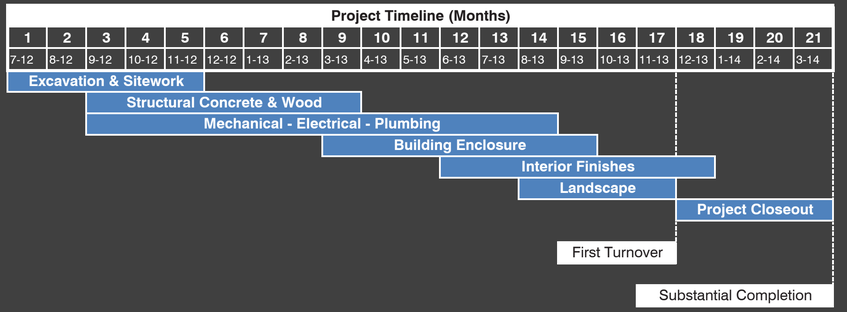
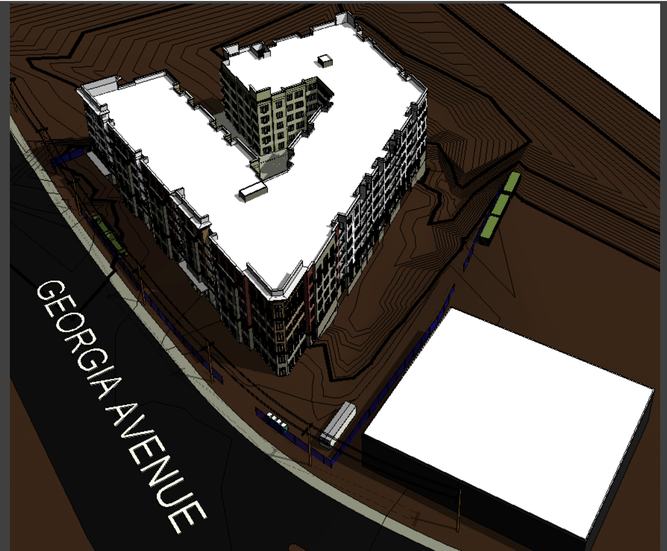




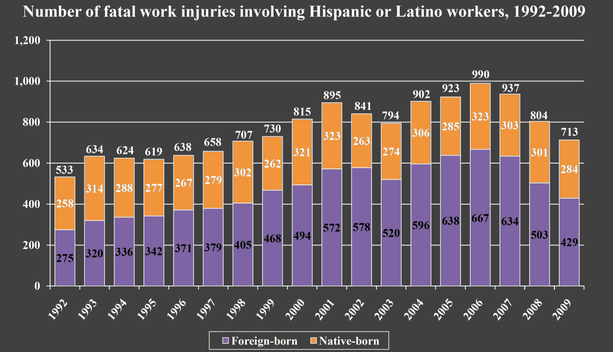


- **Analysis 1 | Critical Industry Research: BIM for Safety Orientation**
  - Use of BIM visuals to beak barriers to effective communication of safety information
- **Analysis 2 | Modularization**
  - 4 Month reduction in on-site work
  - Reduction of fall exposure
  - Cost savings = $175,000
- **Analysis 3 | SIPS for Interiors**
  - 5 week actual schedule reduction
  - Smooth workflow with consistent crew size
  - General conditions cost savings = $118,000
- **Analysis 4 | Weather Clause Analysis**
  - Recommend alternate contract language that is more easily interpreted
  - Grant the contractor a potential time extension of 9 days

PROBLEM IDENTIFICATION

- **Generic safety videos not adaptable to the project**
  - Communication of some irrelevant topics
  - Reiteration of material (Not updated often enough)
  - Complex projects = new safety hazards
- **Worker view of safety orientation**
  - Safety orientation is not seen as a value adding activity

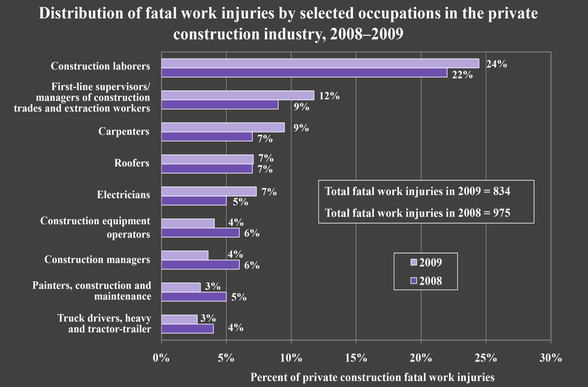
Ineffective Safety Orientation Lost Time Calculation	
400	Estimate of total workers through orientation
$45/hr	Estimated average houry cost for employee
1/2 hr	Typical duration of safety orientation video
200	Estimated hours of lost time
$9,000	Estimated cost for ineffective safety orientation



Courtesy of OSHA 2009 Statistics

BARRIERS TO EFFICIENT SAFETY COMMUNICATION

- **Language Barrier**
  Foreign born Hispanic worker injuries = nearly double native born Hispanic workers



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- **Inadequate Training for Lower Barrier to Entry Trades**
  Laborers account for nearly 25% of work related injuries in private sector

Subpart C of OSHA 1926 addresses employee emergency action plans. It reads:

(a) Scope and application. This section applies to all emergency action plans required by a particular OSHA standard. The emergency action plan shall be in writing and shall cover those designated actions employers and employees must take to ensure employee safety from fire and other emergencies.

(b) Elements. The following elements at a minimum shall be included in the plan:

(1) Emergency escape procedures and emergency escape route assignments;

(2) Procedures to be followed by employees who remain to operate critical operations before they evacuate;

(3) Procedures to account for all employees after emergency evacuation has been completed;

(4) Rescue and medical duties for those employees who are to perform them;

(5) The preferred means of reporting fires and other emergencies;

(6) Names or regular job titles of persons or departments who can be contacted for further information or explanation of duties under the plan;

(c) Alarm System.

(1) The employer shall establish an employee alarm system which complies with 1926.159

(2) If the employee alarm system is used for alerting fire brigade members, or for other purposes, a distinctive signal for each purpose shall be used.

(d) Evacuation. The employer shall establish in the emergency action plan the types of evacuation to be used in emergency circumstances.

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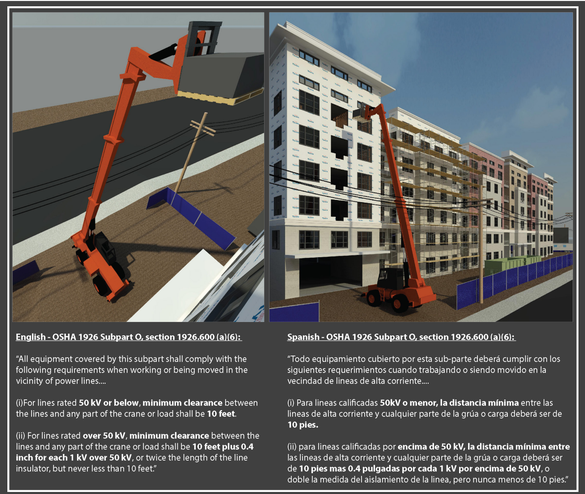
- **No use of Effective Visuals**
  “Some 83% of what we learn derives from what we see, whereas only 11% derives from what we hear.”

(Gatlin, 1988)



English - OSHA 1926 Subpart O, section 1926.600 (a)(6):

"All equipment covered by this subpart shall comply with the following requirements when working or being moved in the vicinity of power lines....

(i)For lines rated **50 kV or below**, **minimum clearance** between the lines and any part of the crane or load shall be **10 feet**.

(ii) For lines rated **over 50 kV**, **minimum clearance** between the lines and any part of the crane or load shall be **10 feet plus 0.4 inch for each 1 kV over 50 kV**, or twice the length of the line insulator, but never less than 10 feet."

Spanish - OSHA 1926 Subpart O, section 1926.600 (a)(6):

"Todo equipamiento cubierto por esta sub-parte deberá cumplir con los siguientes requerimientos cuando trabajando o siendo movido en la vecindad de líneas de alta corriente....

(i) Para líneas calificadas **50kV o menor, la distancia mínima** entre las líneas de alta corriente y cualquier parte de la grúa o carga deberá ser de **10 pies.**

(ii) para líneas calificadas por **encima de 50 kV, la distancia mínima entre** las líneas de alta corriente y cualquier parte de la grúa o carga deberá ser de **10 pies mas 0.4 pulgadas por cada 1 kV por encima de 50 kV**, o doble la medida del aislamiento de la línea, pero nunca menos de 10 pies."

BARRIERS TO EFFICIENT SAFETY COMMUNICATION

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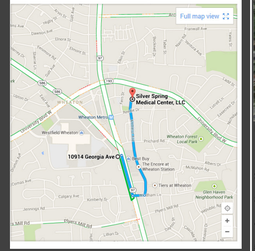
Hospital Directions

(Silver Spring Medical Center, LLC.)

Address: 11301 Amherst Avenue #102, Silver Spring, MD

1. Head south on Georgia Avenue towards Interstate 495
2. Make a U-turn and head north on Georgia Avenue
3. Turn right onto Prichard Road
4. Turn left onto Amherst Avenue
5. Medical Center will be on the right



EMERGENCY MEDICAL CENTER DIRECTIONS

ENGLISH	SPANISH OR OTHER TRANSLATED LANGUAGE
1. Head south on Georgia Avenue toward Interstate 495	
2. Make a U-turn and head north on Georgia Avenue	
3. Turn right onto Prichard Road	
4. Turn left onto Amherst Avenue	
5. Medical Center will be on the right	

SILVER SPRING MEDICAL CENTER, LLC.
11301 AMHERST AVENUE #102, SILVER SPRING, MD

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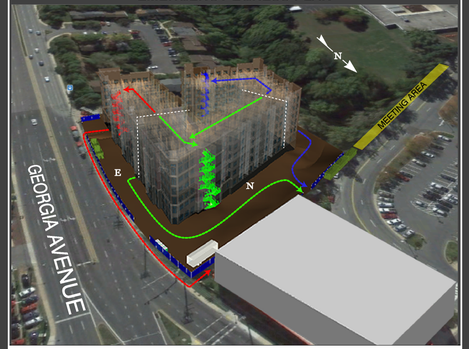
EMERGENCY EGRESS PLAN



Stair A
-Acesses floors 1 through roof
-Only stairwell with roof access
-Exit stairwell on the south side
-Turn right and proceed to the southwest corner
-Turn right and follow along the west side
-Exit site on the north and proceed to meeting area

Stair B
-Acesses level P2 to 6th floor
-Exit stairwell and proceed to the lobby
-Exit building on the east elevation
-Turn left and proceed to the north side of the building
-Exit site and proceed to meeting area

Stair C
-Accesses motor court to 6th floor
-Exit site through the garage entrance
-Turn left and follow the outside of the fence
-Turn left between the fence and the LA Fitness
-Proceed to the meeting area

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Safety Topic Applicability

OSHA Section	Topic	Solaire Wheaton Project	BIM Orientation Capability	Generic Safety Orientation Video
Subpart A	General			
	Safety Statistics (# of fatalities, etc.)			
Subpart B	General Inrepretations			
Subpart C	General Safety & Health Provisions			
	Means of Egress (Fire Egress Plan)			
Subpart D	Occupational Health and Environmental Controls			
	Hospital Directions			
Subpart E	Personal Protective Equipment			
Subpart F	Fire Protection (Fire Extinguisher Locations)			
Subpart G	Signs, Signals, Barricades			
Subpart H	Materials Handling, Storage, Use, and Disposal			
Subpart I	Tools - Hand and Power (Extension Chords)			
Subpart J	Welding and Cutting			
Subpart K	Electrical			
Subpart L	Scaffolding			
	Pump Jack Scaffolding			
	Aerial Lifts			
Subpart M	Fall Protection Safety			
Subpart N	Cranes, Derricks, Hoists, Elevators			
Subpart O	Vehicles & Equipment (Proximity to Overhead Power Lines)			
Subpart P	Excavation and Safety Trenching			
Subpart Q	Concrete & Masonry			
Subpart R	Steel Erections			
Subpart S	Tunnels and Shafts, Caissons, Cofferdams, and Compressed Air			
Subpart T	Demolition			
Subpart U	Blasting and Use of Explosives			
Subpart V	Power Transmission and Distribution			
Subpart W	Rollover Protective Structures; Overhead Protection			
Subpart X	Falls from Ladders			
Subpart Y	Commercial Diving Operations			
Subpart Z	Toxic and Hazardous Substances			

CONCLUSION

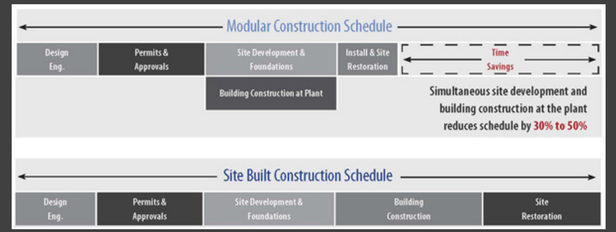
- BIM is more adaptable to specific projects
- Pre-hazard recognition
- Safety visuals are more effective than written safety material
- Safety orientation packets for workers to reference continually
- Updated safety hazard visuals

  Toolbox Talks
  Weekly Superintendent Meetings

Image Courtesy of Clark Builders Group

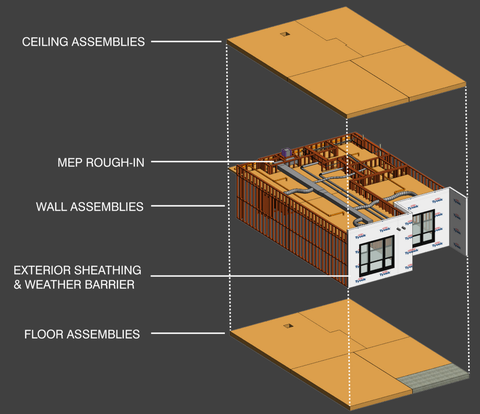
Source: http://weberthompson.com/blog/?p=540

- **PROBLEM IDENTIFICATION**
  - **Market competition**
- **SOLUTION - MODULARIZATION**
  - **Reduction of Schedule 30% - 50%**

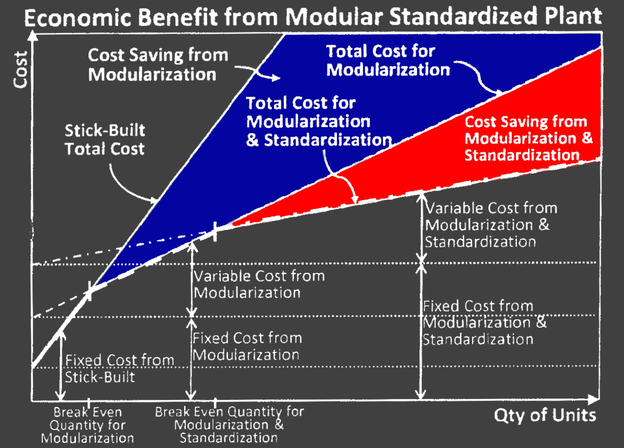


Source: http://www.modular.org/htmlPage.aspx?name=Offsite_Construction_Equal_Green

SOLAIRE WHEATON APARTMENTS
MODULAR UNIT EXPLODED AXONOMETRIC



- **SCOPE OF MODULES**
  - **Wood Framing**
  - **MEP Rough-in**
  - **Exterior Sheathing & Weather Resistant Barrier**
  - **Window Installation**



Source: Construction Industry Institute

- **PROBLEM IDENTIFICATION**
  - 72 Different apartment unit layouts
  - Lost cost savings from non-standardized modules

MODIFIED 6TH FLOOR LAYOUT PLAN

- A1.00
- A2.01
- A4.00
- A6b.00
- A6a.01
- A7.00
- A8.02
- A8.04
- A8.07
- A9.00
- A11.00
- A12.02
- A13a.01
- B1a.00
- B3.03
- B3.05
- B4.00
- B6.0
- B7.02

- **SOLUTION - STANDARDIZATION**
  - **44 apartment units per floor**
  - **Originally 72 layouts**
  - **Consolidation & Vertical Consistency**
    19 total layouts

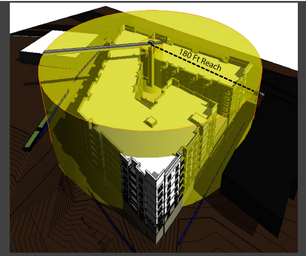
Original Rendering - Southeast Corner

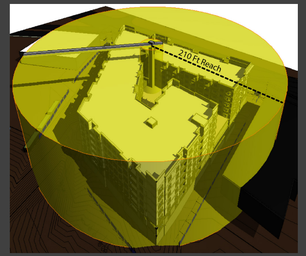
Image Courtesy of The Preston Partnership

Revised Rendering - Southeast Corner

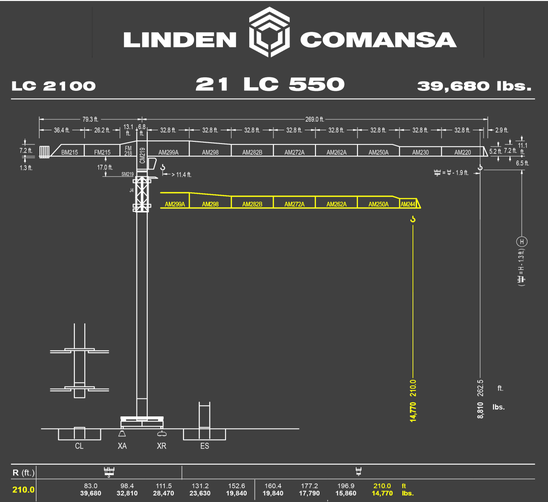
- **STANDARDIZATION - RESULTS**
  - Elimination of 6th floor smoker balconies
  - Corner unit change
  - Changes mostly seen in interior layouts

Image Courtesy of Clark Builders Group





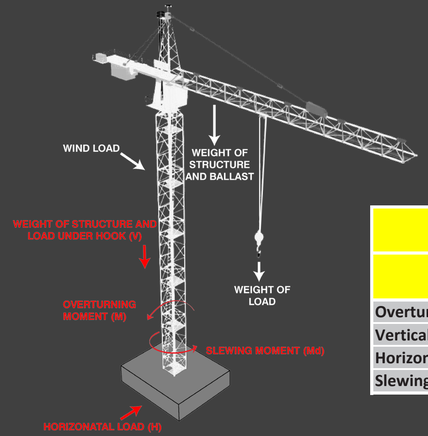
- **TOWER CRANE CONSIDERATIONS**
  - **Jib Reach**
    Original - 180’
    Required - 210’
  - **Lifting Capacity**
  - **Stable Foundation**



Source: Linden Comansa

- **TOWER CRANE CONSIDERATIONS**
  - **Jib Reach**
    - Original - 180’
    - Required - 210’
  - **Lifting Capacity**
    - Tower crane capacity - 14,770 lbs @ 210’
    - Module estimated weight - 9,930 lbs
  - **Stable Foundation**

TOWER CRANE FOUNDATION LOADINGS APPLIED (CAST-IN-ANCHORAGES)



Tower Crane Foundation Reaction Forces			
Load	Units	In-Operation	Out-of-Operation
Overturning Moment, M	ft-kips	3098	3480
Vertical Load, V	kips	268	253
Horizontal Load, H	kips	7	21
Slewing Moment, Md	ft-kips	564	0

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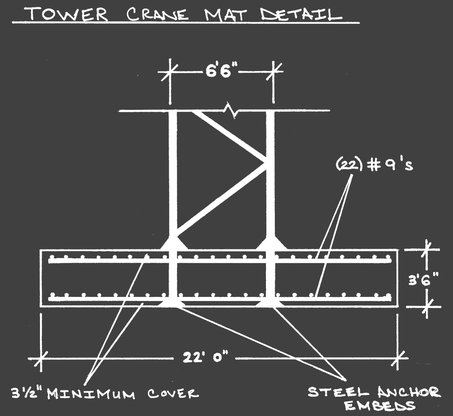

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- **Jib Reach**
  - Original - 180’
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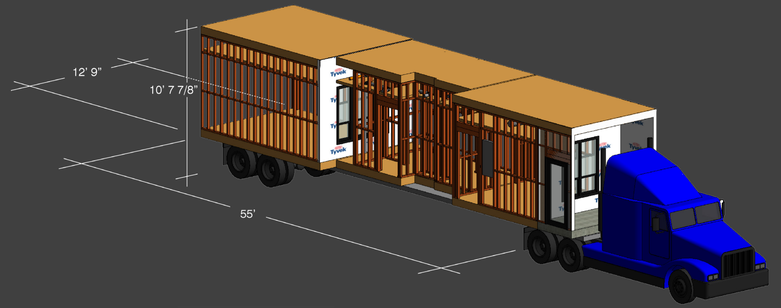
- **Lifting Capacity**
  - Tower crane capacity - 14,770 lbs @ 210’
  - Module estimated weight - 9,930 lbs
- **Stable Foundation**
  - 22’ x 22’ x 3.5’
  - Top & bottom mats - #9’s @ 12”

- STUDIO & SINGLE BEDROOM UNITS
  4 Modules per unit
- DOUBLE BEDROOM UNITS
  6 Modules per unit
- 800 TOTAL MODULES



Hauling Permit Load Compliance			
Estimated Max. Dimensions		**Compliance Requirements**	
Width	**12' 9"**	**12-13 Feet**	Wide Load Signs Required
			Beltway Hours - Travel restrictions apply where applicable
Height	**10' 7 7/8"**	**< 13' 6"**	Legal Limit - No special conditions apply
Length	**17' 0"**	**< 55 Feet**	No Special Notes or Conditions

- **RESTRICTIONS**
  - **Transportation Compliance**
  - **Module construction - 1.5 modules per day = 15 months of total construction**
  - **Transporting & setting modules - 11 per day (3 trucks) = 3 months**

Image Courtesy of Clark Builders Group

Estimated Man Hours of Fall Exposure (Wood Framers)

Day	Month (2013)					
	Jan	Feb	Mar	Apr	May	Total
1		4	34	44	9	
2		0	34	45	9	
3				45	9	
4		6	34	44	9	
5		0	34	43		
6		17	34	21	9	
7		17	34		9	
8		7	34	45	9	
9		17	34	45	9	
10				49	9	
11		16	34	38	9	
12		17	34	5		
13		34	34	40	9	
14		33	34		9	
15		33	34	40	9	
16		33	34	45	9	
17				45	9	
18		34	44	45	9	
19		35	44	45		
20		47	44	45	9	
21		49	44		9	
22		47	44	45	9	
23		10	44	45	9	
24				45	9	
25		56	44	45	9	
26		51	44	45		
27		51	44	45	9	
28		52	44		9	
29			44	45	9	
30	3		44	45	9	
31	4			45	9	
Total Man Days	7	672	1,004	1,134	243	3,060
Total Man Hours	56	5,376	8,032	9,072	1,944	24,480
Estimated Man Hours of Fall Exposure (44% of Total Man hours)						10,771

RESTRICTIONS

- Transportation Compliance
- Module construction - 1.5 modules per day = 15 months of total construction
- Transporting & setting modules - 11 per day (3 trucks) = 3 months

OPPORTUNITIES

- Movements to Jobsite
  6254 Reduction
- Reduction in Fall Exposure
  10, 771 man hours

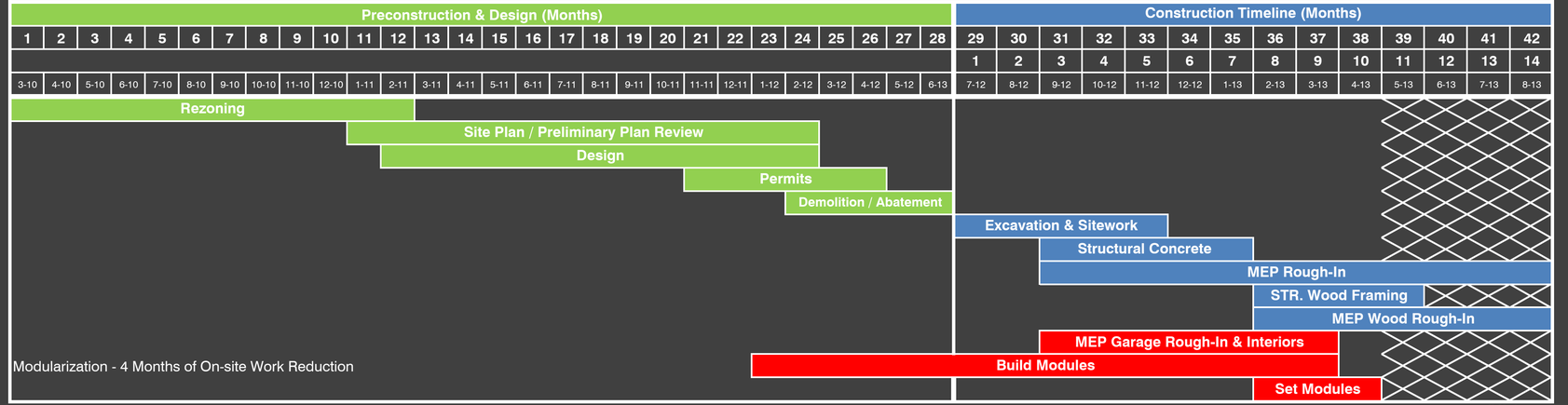
- **ERECTION SEQUENCE**
  - Work out of the southwest corner (minimal site access)
  - Trucks access only on the east side of the site along Georgia Avenue
  - Stepped or benched sequence of erection
  - Mason will follow suquence out of the southwest corner

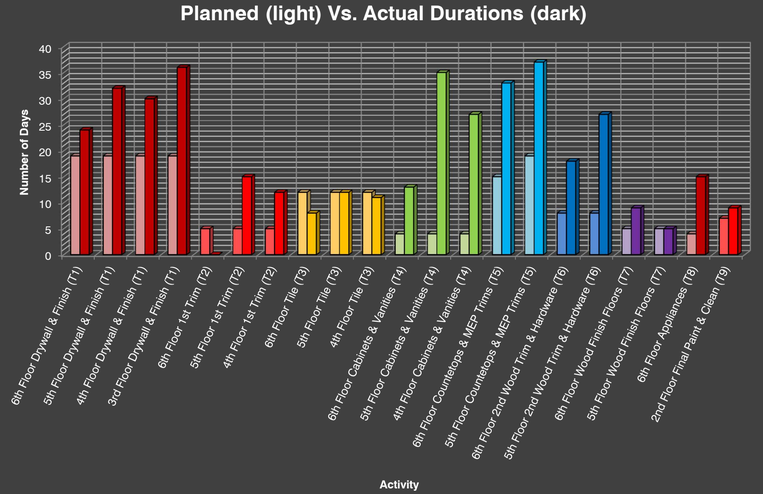
Modularization Cost Analysis		
Description	**Cost Increase**	**Cost Reduction**
Warehouse Cost	**$87,285.00**	
Off-site General Conditions (6 months) Assume $33,000/month	**$200,000.00**	
Mobile Crane for Warehouse ($120/hour) $120/hour * 8 hours/ day = $960/day $960/day * 21 days/month = $20,160/month $20,160/month * 3 months = $60,480	**$60,480.00**	
Transportation Cost $68.21/hour/truck * 2 trucks * 8 hrs/day = $1091.36/day $1091.36/day * 21 days/month * 3 months = $68,755.68	**$68,755.68**	
Material Increase (Structural Bracing) Total Framing Contract = $2,340,000 Less 30% Markup = $1,638,000 Material Cost (60%) = $928,800 Structural Increase (5%) = $46,440	**$46,440.00**	
Reduced Crane Fees (1 month)		**$15,000.00**
Labor Productivity Increases Assume 15% for Off-site Fabrication		**$461,503.00**
On-site General Conditions (2 months)		**$162,020.00**
Total Cost Increases	**$462,960.68**	
Total Cost Decreases		**$638,523.00**
Total Cost Implication	**-$175,562.32**	

RESULTS AND CONCLUSION

- **Cost Impact**
  Savings = $175,000
- **Schedule Impact**
  4 month on-site work reduction
  Fast-tracked design
- **Higher quality of work**
- **Safer work environment**

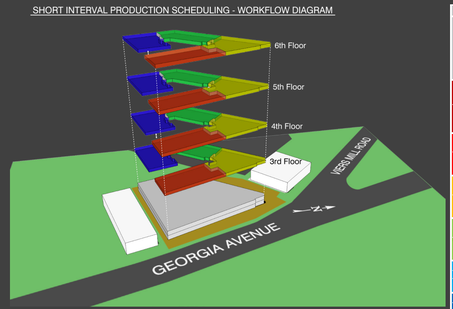
OVERALL PROJECT SCHEDULE





- **PROBLEM IDENTIFICATION**
  - **Consistent schedule overruns**
  - **CPM Scheduling = Unreliable**

SHORT INTERVAL PRODUCTION SCHEDULING - WORKFLOW DIAGRAM



SIPS Duration Calcuation

Activity		Actual Duration (Days/Floor)	Average Manpower (workers)	Actual Production (wk hrs/floor)	SIPS Production (wk hrs/section)	SIPS Duration (Days /Section)	SIPS Manpower Required (workers)
		Data from Project Superintendent Daily Reports & CPM Schedule			Actual Duration * Avg.Manpower * 8 hrs/day	Average Actual Production/ 4 sections	SIPS Production / (SIPS Duration * 8)
T1 - Drywall & Finish	6th Floor	24	12	2304	732	5	18
	5th Floor	32	12	3072			
	4th Floor	30	12	2880			
	3rd Floor	36	12	3456			
	Average			2928			
T2 - 1st Trim	6th Floor	N/A	N/A	N/A	108	5	3
	5th Floor	15	4	480			
	4th Floor	12	4	384			
	Average			432			
T3 - Tile	6th Floor	8	2	128	41	5	1
	5th Floor	12	2	192			
	4th Floor	11	2	176			
	Average			165			
T4 - Cabinets & Vanities	6th Floor	13	4	416	200	5	5
	5th Floor	35	4	1120			
	4th Floor	27	4	864			
	Average			800			
T5 - Countetops & MEP Trims	6th Floor	33	12	3168	840	5	21
	5th Floor	37	12	3552			
	Average			3360			
T6 - 2nd Wood Trim & Hardware	6th Floor	18	6	864	270	5	7
	5th Floor	27	6	1296			
	Average			1080			
T7 - Wood Finish Floors	6th Floor	9	2	144	28	5	1
	5th Floor	5	2	80			
	Average			112			
T8 - Appliances	6th Floor	15	3	360	90	5	2
	Average			360			
T9 - Final Paint & Clean	2nd Floor	9	8	576	144	5	4
	Average			576			
T10 - CBG Punchlist & Correction	Average	-	-	-	-	5	-
T11 - Owner Punchlist & Corrections	Average	-	-	-	-	5	-

- **SHORT INTERVAL PRODUCTION SCHEDULING (SIPS) PROCESS**
  - Determine the sequence of activities
  - Calculate actual production rates using schedules and daily reports
  - Determine SIPs duration (5 days/trade/section)
  - Calculate required manpower per trade to meet SIPs duration
  - Organize matrix schedule demonstrating flow of work

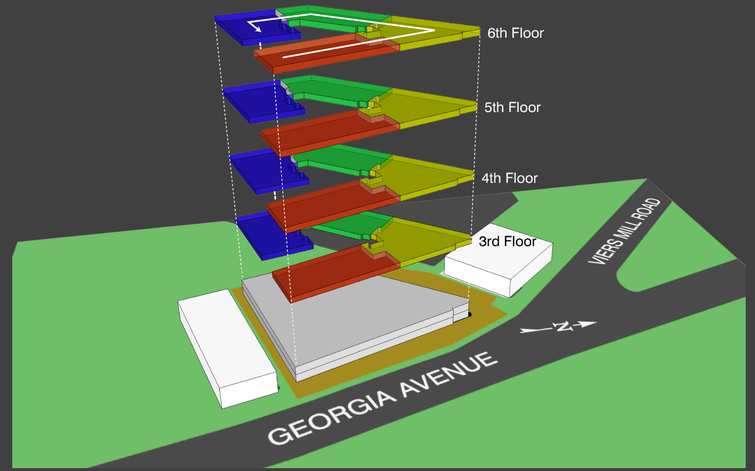
SIPS Schedule (3rd-6th Floor Units)

Section		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24	W25	W26
Floor 6	Area 1	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11															
	Area 2		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11														
	Area 3			T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11													
	Area 4				T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11												
Floor 5	Area 1					T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11											
	Area 2						T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11										
	Area 3							T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11									
	Area 4								T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11								
Floor 4	Area 1									T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11							
	Area 2										T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11						
	Area 3											T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11					
	Area 4												T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11				
Floor 3	Area 1													T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11			
	Area 2														T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11		
	Area 3															T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	
	Area 4																T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11

		# of Contractors	Contractors
T1	Drywall & Finish	1	Charly Drywall
T2	1st Trim	1	Kelly Trim
T3	Tile	1	CB Flooring
T4	Cabinets & Vanities	1	Crown America International (CAI)
T5	Countertops & MEP Trims	5	Ellis, Power Design, Breeden Mechanical, Mid-Atlantic Air, Castle Sprinkler
T6	2nd Wood Trim & Hardware	2	Kelly Trim, Contract Hardawre
T7	Wood Finish Floors	1	CB Flooring
T8	Appliances	1	Apollo
T9	Final Paint & Clean	2	Charly Drywall & Fresco Cleaning
T10	CBG Punchlist & Correction		
T11	Owner Punchlist & Correctior		

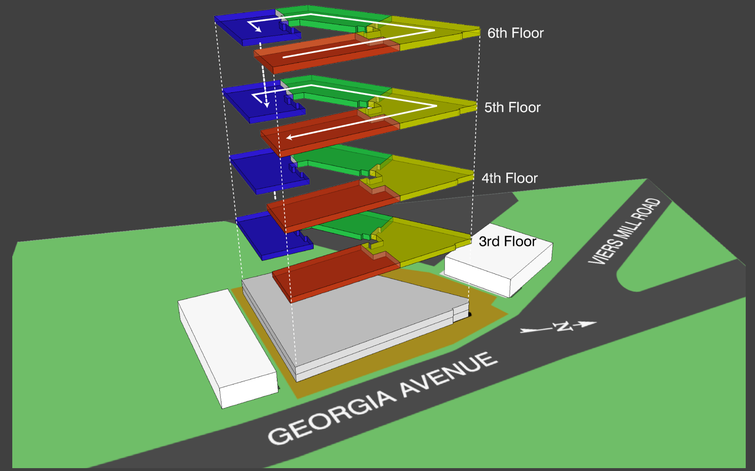
- **SHORT INTERVAL PRODUCTION SCHEDULING (SIPS) PROCESS**
  - Determine the sequence of activities
  - Calculate actual production rates using schedules and daily reports
  - Determine SIPs duration (5 days/trade/section)
  - Calculate required manpower per trade to meet SIPs duration
  - Organize matrix schedule demonstrating flow of work
- **CONCERNS**
  - Specialty contractor buy-in and commitment to durations
  - Manpower capabilities
  - Domino effect of missing a deadline

SHORT INTERVAL PRODUCTION SCHEDULING - WORKFLOW DIAGRAM



- **WORKFLOW**
  - **Top-down (6th - 3rd floor)**
    - **Minimizes tracking through finished floors**
    - **Minimizes damage due to settlement of wood structure**
  - **U-shape - Alternating counterclockwise and clockwise flow**
    - **Minimizes movement of material and equipment**

SHORT INTERVAL PRODUCTION SCHEDULING - WORKFLOW DIAGRAM



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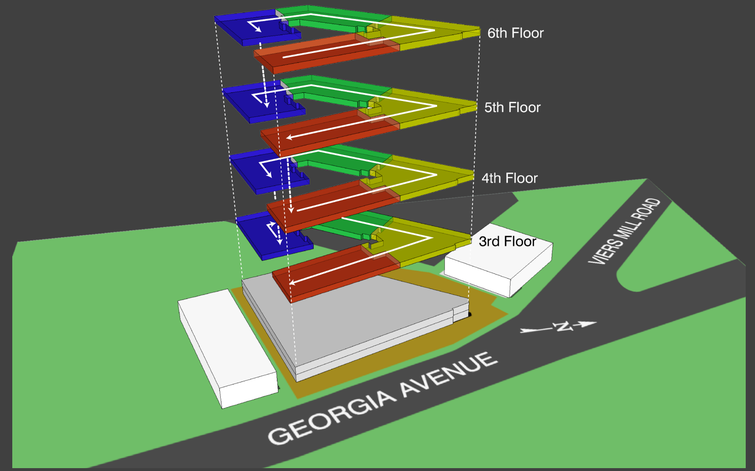
SHORT INTERVAL PRODUCTION SCHEDULING - WORKFLOW DIAGRAM



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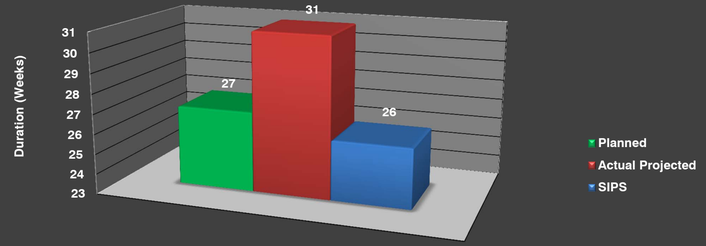
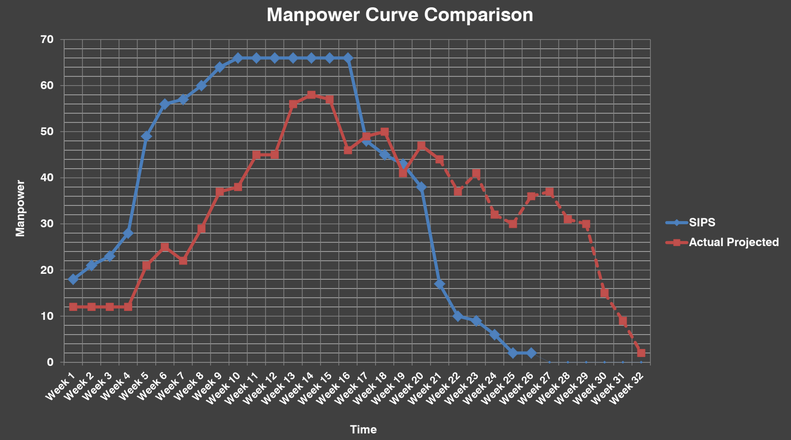
Interior Finishes Schedule Comparison



	Total Weeks
Planned	27
Actual Projected	31
SIPS	26

RESULTS - SHORT INTERVAL PRODUCTION SCHEDULING

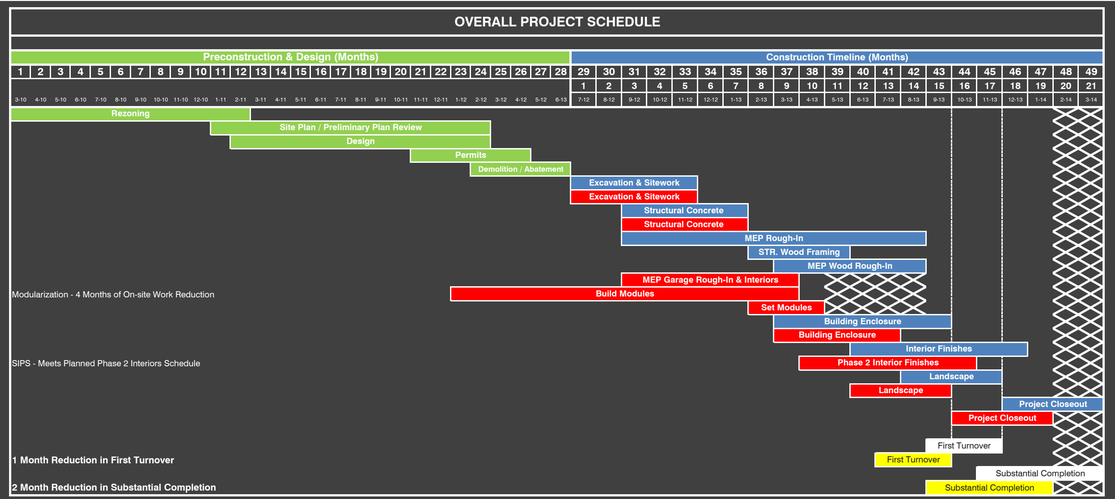
- 5 week reduction in actual schedule
- Estimated $118,000.00 general conditions savings
  Average weekly cost = $23,706.00
- 1 week reduction in planned schedule



- **RESULTS - SHORT INTERVAL PRODUCTION SCHEDULING**
  - 5 week reduction in actual schedule
  - Estimated $118,000.00 general conditions savings
    Average monthly cost = $23,706.00
  - 1 week reduction in planned schedule
  - Consistent crew size (single mobilization)

SCHEDULE ACCELERATION CONCLUSION

OVERALL PROJECT SCHEDULE



SCHEDULE ACCELERATION SUMMARY

- **Modularization**
  - 4 month on-site schedule reduction
  - 2 month schedule reduction
  - $175,000 cost savings
- **Short Interval Production Scheduling**
  - 5 week reduction from actual duration
  - 1 week reduction from planned duration
  - $118,000 in general conditions cost savings
- **Overall Results**
  - 9 week schedule reduction
  - $293,000 cost savings
- **Increased Rental Fees (2 Months)**

Studio Apt. - $1,000/month * 27 * 2 months = $54,000	
Single Apt. - $1,200/month * 147 * 2 months = $352,800	
Double Apt. - $2,000/month * 58 * 2 months = $232,200	
Total Rental Fees Increased (2 months)	**$638,800.00**

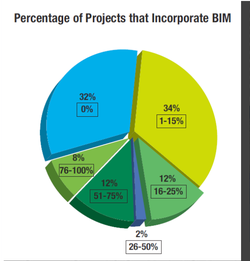
Clark Builders Group Project Team
- Dave Tapparo
- Tommy Rumley
- John Aldridge
- Charlie Liesfeld
- Mark Metzler
- Will Thomas

The Washington Property Company

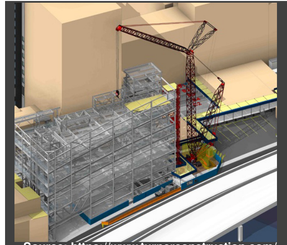
Dr. Rob Leicht
Professor Jerry Pisarcik
AE Faculty
Friends & Family

Gonzalo Lay - Spanish Translator

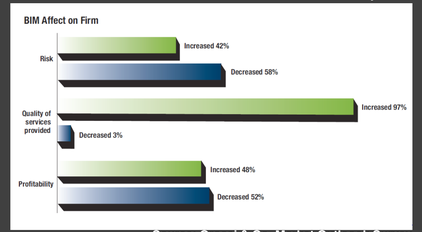
Image Courtesy of The Preston Partnership



Source: Grossi & Co. Market Outlook Survey



Source: https://www.turnerconstruction.com/news/item/2dc5/New-York-City-Department-of-Buildings-Approves-First-Three-Dimensional-BIM-Site-Safety-Plans



Source: Grossi & Co. Market Outloook Survey

Safety Topic Applicability

OSHA Section	Topic	Solaire Wheaton Project	BIM Orientation Capability	Generic Safety Orientation Video
Subpart A	General			
	Safety Statistics (# of fatalities, etc.)			
Subpart B	General Inrepretations			
Subpart C	General Safety & Health Provisions			
	Means of Egress (Fire Egress Plan)			
Subpart D	Occupational Health and Environmental Controls			
	Hospital Directions			
Subpart E	Personal Protective Equipment			
Subpart F	Fire Protection (Fire Extinguisher Locations)			
Subpart G	Signs, Signals, Barricades			
Subpart H	Materials Handling, Storage, Use, and Disposal			
Subpart I	Tools - Hand and Power (Extension Chords)			
Subpart J	Welding and Cutting			
Subpart K	Electrical			
Subpart L	Scaffolding			
	Pump Jack Scaffolding			
	Aerial Lifts			
Subpart M	Fall Protection Safety			
Subpart N	Cranes, Derricks, Hoists, Elevators			
Subpart O	Vehicles & Equipment (Proximity to Overhead Power Lines)			
Subpart P	Excavation and Safety Trenching			
Subpart Q	Concrete & Masonry			
Subpart R	Steel Erections			
Subpart S	Tunnels and Shafts, Caissons, Cofferdams, and Compressed Air			
Subpart T	Demolition			
Subpart U	Blasting and Use of Explosives			
Subpart V	Power Transmission and Distribution			
Subpart W	Rollover Protective Structures; Overhead Protection			
Subpart X	Falls from Ladders			
Subpart Y	Commercial Diving Operations			
Subpart Z	Toxic and Hazardous Substances			

Source: NYC Building Department

MODIFIED 6TH FLOOR LAYOUT PLAN

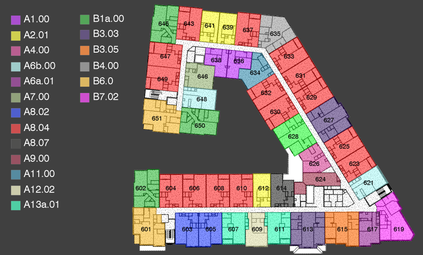


Image Courtesy of The Preston Partnership

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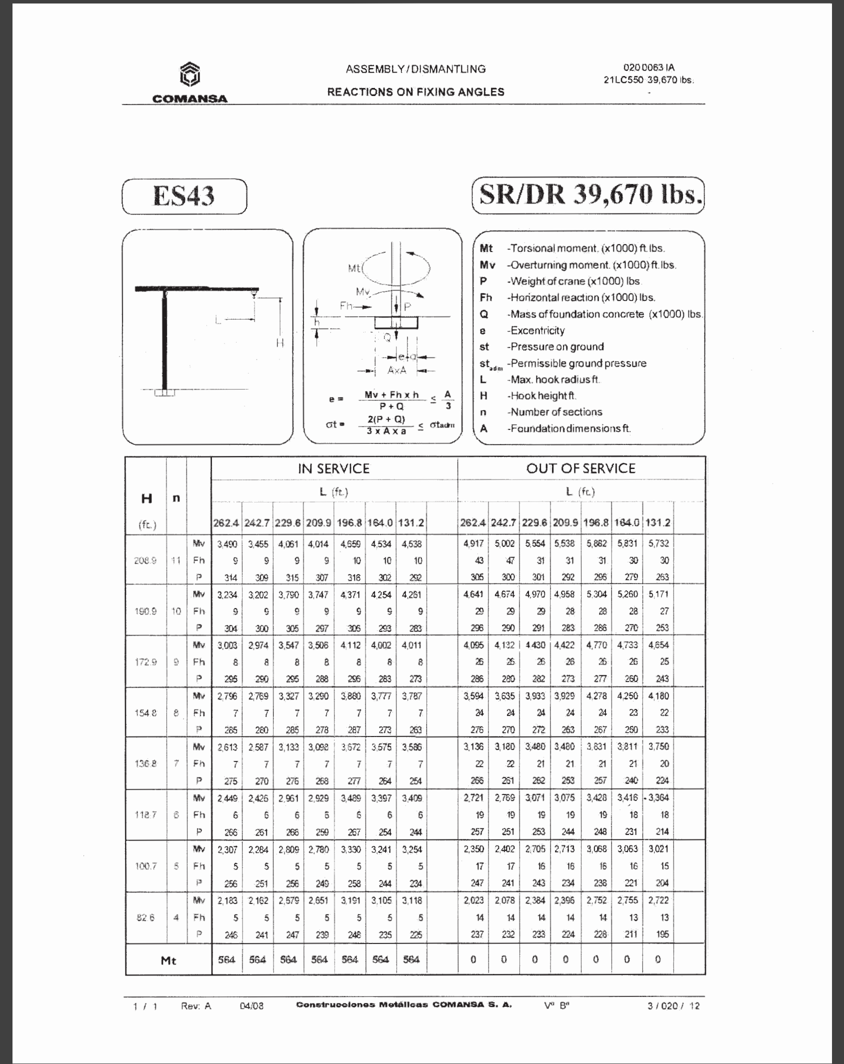


Source: Linden Comansa

TOWER CRANE MAT DESIGN:

CRANE CONFIGURATION:
Model: LINDEN COMANSA 21 LC 550
Hook Height: 126 ft — Crane Mast Base Plan Dimension, Bc = 6.5 ft
Jib Reach: 210 ft

BASE FORCES AT TOP OF MAT:

	M	H	V	Md
In Operation	3098 ft-kips	7 kips	268 kips	564 ft-kips
Out of Operation	3480 ft-kips	21 kips	253 kips	- ft-kips
GOVERNING LOAD CONDITION:	3480 ft-kips	21 kips	268 kips	564 ft-kips

ALLOWABLE SOIL BEARING CAPACITY= 6000 psf — **SOIL TYPE:** Clayey Sand

MAT MATERIALS:
f'c= 3500 psi — **Fy=** 60 ksi — ASTM A615 Grade 60
Min. Cover 3.5 in

MAT SIZE ASSUMPTIONS:
Plan Size B x L — **B=** 22 ft — **L=** 22 ft
Thickness — **D=** 3.5 ft
Mat Dead Load — **Wm=** 254 kips (150 pcf x L x B x D)
Overturning Moment — **Mot=** M+(HxDf) = 3480(21*3.5)
Mot= 3554 ft-kips
Loading Eccentricity — **e=** Mot/(V+Wm)>B/6 = 2779/(268+254)>22/6
e= 7 ft >B/6 3.67 => OK
Max Soil Stress — **fbr max=** (2x(V+Wm)/(3xLx(B/2-e))) = (2*(268+254)/(3*22*(22/2-7))
fbr max= 3772 psf < Allowable Soil Bearing Capacity =>OK

COMPUTE SOIL STRESS @ FACE OF MAST
Edge Distance
Ed= .5(B-Bc) = .5(22-6.5) — **Lfbr =** 3(B/2-e) = 3(22/2-7)
Ed= 7.75 ft — **Lfbr =** 12.58 ft
L2 Ed/2 = 7.75/2 — **L1=** 2/3(B/2 - Bc/2) = 2/3(22/2 - 6.5/2)
L2 3.88 — **L1=** 5.17 ft

fbrmast= fbrmax(Lfbr-B/2+Bc/2)/Lfbr = 3772(12.58-22/2+6.5/2)/12.58
fbrmast= 1448.70 psf

RESISTANCE TO OVERTURNING
Resisting Moments — Mr= (Wm+V)B/2 = (254+268)22/2
Mr= 5743.1 ft-kips

Factor of Safety for Overturing (FSot)= Mr/Mot >= 1.5 = 5743.1/3554
FSot= 1.62

FSot= 1.62 => OK for Overturning

DESIGN REINFORCEMENT FOR TOWER CRANE MAT:

COMPUTE BENDING MOMENT FOR BOTTOM REBAR:
V1u= (fbrmax-fbrmast)(Ed/2)1.6 x L — V2u= (fbrmast) x Ed x 1.6 x L
V1u= ((2926-1163)(7.75/2)1.6*22)/1000 — V2u= (1163*7.75*1.6*22)/1000
V1u= 316.97 kips — V2u= 395.2 kips
M1u= V1u x L1 = 316.97*5.17 — M2u= V2u x L2 = 395.2*3.88
M1u= 1637.66 ft-kips — M2u= 1531.42 ft-kips

Total Mu= M1u + M2u = 1637.66 + 1531.42
Total Mu= 3169.0761 ft-kips

TRY	See Rebar Calculations			
	No. 11's Spaced at	12 in. oc	As= 31.2 in.^2	d= 37.80 in.
	No. 10's Spaced at	12 in. oc	As= 25.4 in.^2	d= 37.87 in.
	No. 9's Spaced at	12 in. oc	As= 20.0 in.^2	d= 37.94 in.
	No. 8's Spaced at	12 in. oc	As= 15.8 in.^2	d= 38.00 in.
	No. 7's Spaced at	12 in. oc	As= 12.0 in.^2	d= 38.06 in.
TRIAL SECTION	No. 8	12 in. oc	As= 20.0 in.^2	d= 37.94 in.

ΦMn= 0.9(AsFy(d-AsFy/(1.7f'cB)))>=Increased Mu
ΦMn= (0.9(20.0*60*(37.94-(20.0*60/(1.7*3500/1000*22*12))))/12)>=Increased Mu
ΦMn= 3345.8452 ft-kips => OK
Total Mu= 3169.0761 ft-kips
USE: #9's @12" O.C. IN BOTTOM MAT

COMPUTE BENDING MOMENT FOR TOP REBAR:
Vu= D*0.150kcf*Ed*L*1.6 = 3.5*0.150kcf*7.75*22*1.6
Vu= 143.22 kips
Mu= Vu*Ed/2 = 143.22*7.75/2
Mu= 554.98 ft-kips

TRY				
	No. 9's Spaced at	12 in. oc	As= 20.0 in.^2	d= 37.94 in.
	No. 8's Spaced at	12 in. oc	As= 15.8 in.^2	d= 38.00 in.
	No. 7's Spaced at	12 in. oc	As= 12.0 in.^2	d= 38.06 in.
TRIAL SECTION	No. 7	12 in. oc	As= 20.0 in.^2	d= 37.94 in.

ΦMn= 0.9(AsFy(d-AsFy/(1.7f'cB)))>=Increased Mu
ΦMn= (0.9(20.0*60*(37.94-(20.0*60/(1.7*3500/1000*22*12))))/12)>=Increased Mu
ΦMn= 3345.8452 ft-kips => OK
Total Mu= 554.98 ft-kips
USE: #9's @12" O.C. IN TOP MAT

COMPUTE MINIMUM TEMPERATURE & SHRINKAGE REINFORCEMENT
Asmin= 0.0018 x B x D = 0.0018*22*12*3.5*12
Asmin= 19.9584 in.^2

As (top) + As (bot)= 40.0 in.^2 >Asmin => OK

CHECK RESISTANCE TO SLEWING MOMENT:

Resisting force is assumed to be a triangular force distribution on all four sides as developed by passive soils

Soil Unit Weight: γ= 125 pcf
Friction Angle Φ= 35 degrees
Kp= tan^2(45+Φ/2)
Kp= tan^2(45+35/2)
Kp= 3.69

Max. Allow. Resisting Pressure
Qr= 0.5 x Kp x γ x Df^2
Qr= (0.5*3.69*125*3.5^2)/1000
Qr= 2.83 kips/LF

Resistance Along B Side of Footing
Mrb= Qr(B/2) — Moment Arm — Br= B/3
Mrb= 2.83(22/2) — Br= 22/3
Mrb= 31.08 kips — Br= 7.33 ft

Resistance Along L Side of Footing
Mrl= Qr(L/2) — Moment Arm — Lr= L/3
Mrl= 2.83(22/2) — Lr= 22/3
Mrl= 31.08 kips — Lr= 7.33 ft

Resisting Moments
ΣMr= 2((Mrb x Br) + (Mrl x Lr))
ΣMr= 2((31.08*7.33) + (31.08*7.33))
ΣMr= 911.58 kips

FSsm= ΣMr/Md >=1.5
FSsm= 911.58/564

FSsm= 1.62 => OK for Slewing Moment

CHECK SHEAR IN THE MAT SLAB:

CHECK ONE WAY SHEAR IN THE MAT:
Shear Area
Av= L x (D-6)
Av= 22*12*((3.5*12)-6)
Av= 9504 in^2

Vu= V1u + V2u
Vu= 316.97 + 395.2
Vu= 712.17 kips

fvu= Vu/Av
fvu= 712.17/9504*1000
fvu= 74.93 psi

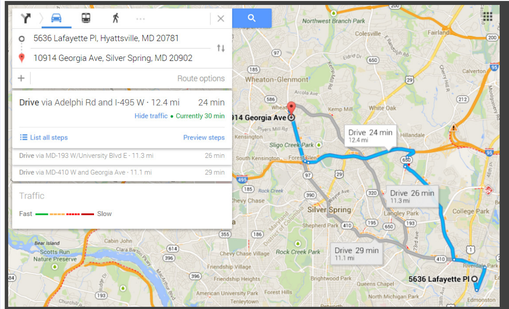
ΦVu= 0.85(2)(f'c^0.5)
ΦVu= 0.85*2*(3500^0.5)
ΦVu= 100.57 psi >fvu => OK in Shear

CHECK PUNCHING SHEAR AT ERECTION:
f'c= 2000 psi MINIMUM
Critical Section — Bo= 4 sides (Bc + d) — Punching shear control for this temporary condition
Bo= 4 sides (6.5 + 37.94)
Bo= 463.76 in.

Vu= 1.6V
Vu= 1.6*268
Vu= 428.8 kips

ΦVc= 0.85(4)(f'c^0.5)(Bo)(d)
ΦVc= (0.85*4*(3500^0.5)*463.76*37.94)/1000
ΦVc= 3539 kips >Vu => OK for Punching Shear at Erection

Calculation Source: Clark Concrete



Source: http://continuingeducation.construction.com/article_print.php?L=5&C=943

Wood Framing Worker Fall Exposure Percentage

Tasks	Task Duration (% of Total)	Fall Exposure During Task	Total Fall Exposure (% of Total)
Frame Exterior Walls	20%	30%	6%
Frame Interior Walls	35%	0%	0%
Set Floor Trusses	25%	90%	23%
Install Floor Deck	5%	40%	2%
Sheath Exterior Wall	10%	90%	9%
Install Tyvek Building Wrap	5%	90%	5%
Total	**100%**		**44%**

Estimated Number of Jobsite Movements Avoided

Contractor	Average Wkrs/Day	Duration (Months)	Working Days/Month	Total Working Days	Total Workers to Jobsite
				Duration*Working Days/Month	Wkrs/Day*Total Working Days
Wood Framing	30	3.66	21	77	2306
Mechanical	8	5.5	21	116	924
Plumbing	10	5.5	21	116	1155
Electrical	15	5.5	21	116	1733
CM	1	6.5	21	137	137
Estimated Movements to Jobsite Avoided:					**6254**
Car Movements Avoided (Assume 3 workers/ Car):					2085

Increased Labor Productivity Cost Savings

Contractor	Contract Cost	% Area of Building	Cost (Wood Structure % Area)	Labor Costs (40%)	Increased Productivity Savings (Assume 15%)
Wood Framing	$2,340,000.00	100%	$2,340,000.00	$936,000.00	$140,400.00
Mechanical Rough-in	$1,813,000.00	63%	$1,133,125.00	$453,250.00	$67,987.50
Electrical Rough-in	$2,122,974.00	63%	$1,326,858.75	$530,743.50	$79,611.53
Plumbing rough-in	$1,635,910.00	63%	$1,022,443.75	$408,977.50	$61,346.63
Fire Protection Rough-in	$689,675.00	63%	$431,046.88	$172,418.75	$25,862.81
Window Installation	$1,732,826.00	83%	$1,438,245.58	$575,298.23	$86,294.73
Total					**$461,503.20**

MODULE CONSTRUCTION SCHEDULE CALCULATIONS

$$1.5\frac{Modules}{Day} \times 6\frac{Days}{Week} = \sim 9\frac{Modules}{Week}$$

$$200\frac{Modules}{Floor} \div 9\frac{Modules}{Week} = \sim 22.2\frac{Weeks}{Floor}$$

$$22.2\frac{Weeks}{Floor} \times 4\ Floors = 88\ Weeks = 1\ Year\ 3\ Months$$

MODULE TRANSPORTATION AND SETTING

$$1.38\frac{Modules}{Hour} \times 8\frac{Hours}{Day} = \sim 11\frac{Modules}{Day}$$

$$11\frac{Modules}{Day} \times 6\frac{Days}{Week} = \sim 67\frac{Modules}{Week}$$

$$200\frac{Modules}{Floor} \div 67\frac{Modules}{Week} = \sim 3\frac{Weeks}{Floor}$$

$$3\frac{Weeks}{Floor} \times 4\ Floors = 12\ Weeks = 3\ Months$$

OVERALL ON-SITE SCHEDULE EFFECTS

$$\frac{6.5\ Months\ (Stick-Built) - 3\ Months\ (Modular)}{6.5\ Months\ (Stick-Built)} = 52\%\ Reduction\ in\ Schedule$$

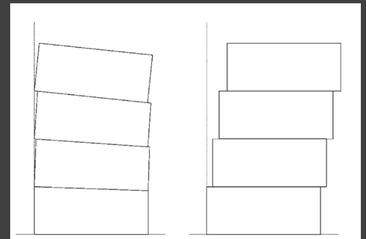


Figure 16.3 Out-of-verticality effects of manufacturing and installation tolerances in modular construction.

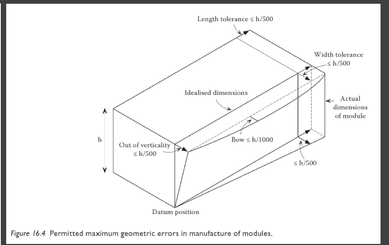
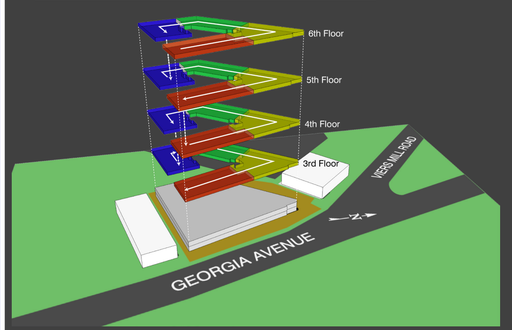


Figure 16.4 Permitted maximum geometric errors in manufacture of modules.

SHORT INTERVAL PRODUCTION SCHEDULING - WORKFLOW DIAGRAM



SIPS Schedule (3rd-6th Floor Units)

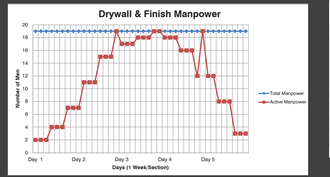
Section		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24	W25	W26
Floor 6	Area 1	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11															
	Area 2		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11														
	Area 3			T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11													
	Area 4				T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11												
Floor 5	Area 1					T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11											
	Area 2						T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11										
	Area 3							T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11									
	Area 4								T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11								
Floor 4	Area 1									T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11							
	Area 2										T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11						
	Area 3											T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11					
	Area 4												T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11				
Floor 3	Area 1													T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11			
	Area 2														T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11		
	Area 3															T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	
	Area 4																T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11

		# of Contractors	Contractors
T1	Drywall & Finish	1	Charly Drywall
T2	1st Trim	1	Kelly Trim
T3	Tile	1	CB Flooring
T4	Cabinets & Vanities	1	Crown America International (CAI)
T5	Countertops & MEP Trims	5	Ellis, Power Design, Breeden Mechanical, Mid-Atlantic Air, Castle Sprinkler
T6	2nd Wood Trim & Hardware	2	Kelly Trim, Contract Hardawre
T7	Wood Finish Floors	1	CB Flooring
T8	Appliances	1	Apollo
T9	Final Paint & Clean	2	Charly Drywall & Fresco Cleaning
T10	CBG Punchlist & Correction		
T11	Owner Punchlist & Correction		

DETAILED DRYWALL SIPS BREAKDOWN

Estimated Production Rates

Activity	Crew	Unit	Daily Output	Labor Hours
Drywall (5/8" thick on walls - no finish)	2 carp	SF	2000	0.008
Drywall (5/8" thick on walls - taped and finished)	2 carp	SF	965	0.017
Drywall (5/8" thick on walls - skim coat finish)	2 carp	SF	775	0.021
Drywall (5/8" thick on ceilings - no finish)	2 carp	SF	1600	0.01
Drywall (5/8" thick on ceilings - taped and finished)	2 carp	SF	680	0.024
Drywall (5/8" thick on ceilings - skim coat finish)	2 carp	SF	545	0.029
Finish & Sand	2 carp	SF	5000	-
Resilient Channel (ceiling - 12" O.C.)	1 carp	CLF	25	-
Paint (walls - sprayer primer plus one finish coat)	1 Pord	SF	9000	-



Calculated Durations (Units 601 & 602)

Task	Unit	Takeoff	Men/Crew	Daily Crew Production	# of Crews	Total Manpower	Hourly Production	Duration (hour)
						men/crew * # of crews	daily production/8 hr	Takeoff/ (# of crews * hourly production
Exterior Wall Drywall	SF	567	2	2000	1	2	250	2.3
Ceiling Resilient Channel	CLF	7.2	2	25	1	2	3.125	2.3
Ceiling Drywall	SF	1,047	2	1600	2	4	200	2.6
Interior Wall Drywall	SF	1,710	2	2500	2	4	312.5	2.7
Finish & Sand	SF	3,324	2	5000	2	4	625	2.7
Prime & One Coat	SF	3,324	2	9000	1	2	1125	3.0
Total						18		

Calculated Durations (Remaining Units)

Task	Unit	Takeoff	Men/Crew	Daily Crew Production	# of Crews	Total Manpower	Hourly Production	Duration (hour)
						men/crew * # of crews	daily production/8 hr	Takeoff/ (# of crews * hourly production
Exterior Wall Drywall	SF	251	1	1000	1	1	125	2.0
Ceiling Resilient Channel	CLF	6.3	2	25	1	2	3.125	2.0
Ceiling Drywall	SF	719	2	1600	2	4	200	1.8
Interior Wall Drywall	SF	1,356	2	2500	2	4	312.5	2.2
Finish & Sand	SF	3,657	2	5000	2.5	5	625	2.3
Prime & One-Coat	SF	3,657	2	9000	1.5	3	1125	2.2
Total						19		

T1 - Dyrwall and Finish

Tasks	Day 1								Day 2								Day 3								Day 4								Day 5							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Exterior Drywall (2 layers 5/8" type X)	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1																		
Ceiling Resilient Channel				2	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2		2	2	2														
Ceiling Drywall (1 layer 5/8" type X)					4	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4		4	4	4	4	4	4											
Interior Drywall (1 layer 5/8" type X)									4	4	4	4	4	4	4		4	4	4	4	4	4	4		4	4	4	4	4	4	1		4	4							
Finish & Sand												4	4	4			4	4	4	4	5	5	5		5	5	5	5	5	5	5		5	5	5	5	5	5			
Prime & One Finish Coat																	2	2	2	2	2	2	3		3	3	3	3	3	3	3		3	3	3	3	3	3	3	3	
Total Manpower	2	2	2	4	4	4	7	7	7	11	11	11	15	15	15	19	17	17	17	18	18	18	19	19	18	18	18	16	16	16	12	19	12	12	8	8	8	8	3	3

RECOMMENDED WEATHER CLAUSE

"The contractor will be entitled to a time extension if the weather conditions at the jobsite are adverse and he can prove that the adverse weather conditions delayed activities on the critical path. Prior to the notice to proceed, **the owner and contractor will agree on the amount of reasonably anticipated weather days that shall be built into the contractors schedule.** Time extensions will only be considered for individual months. Total anticipated and total adverse weather days will not be considered when determining time extensions due to weather. Weather data shall be obtained from the nearest weather station to the project site.

Adverse weather conditions are defined as the occurrence of the following conditions:

(1) Weather conditions that exceed the standard baseline of reasonably anticipated weather days, and one or more of the following conditions as established by NOAA:

1. precipitation (rain, snow, or ice) in excess of one-tenth inch (0.10") liquid measure.
2. temperatures that do not rise above that required for the day's construction activity, if such temperature requirement is specified as standard industry practice.
3. sustained wind in excess of twenty-five (25) m.p.h.

(2)Adverse Weather may include, if appropriate, "dry-out" or "mud" days:

1. resulting from precipitation days that occur beyond the standard baseline;
2. only if there is a hindrance to site access or sitework and Contractor has taken all reasonable accommodations to avoid such hindrance; and,
3. at a rate no greater than 1 make-up day for each day or consecutive days of precipitation beyond the standard baseline that total 1.0 inch or more, liquid measure, unless specifically recommended otherwise by the Designer.

All claims for extension of the Time(s) of Completion shall comply with the procedures and notice requirements set forth in the Contract Documents."

Source: Tennessee Weather Clause Provision

WEATHER DELAY CLAIM PROCESS

WRITTEN NOTICE - 10 DAYS
Contractor shall, within ten (10) days after the commencement of any such delay, give written notice to Owner of the cause of any such delay and identify effected critical path activities

↓

PERFORM ANALYSIS
Perform an analysis using NOAA to determine weather a claim is possible

↓

OPTION 1: EXCEED MONTHLY AVERAGES
Weather conditions exceed monthly averages as established by NOAA

↓

DEMONSTRATE WEATHER DELAYS
Demonstrate adverse weather days by comparing planned and actual schedules, as well as using superintendent daily reports.

OPTION 2: EXCEED DAILY CONDITIONS
Daily weather conditions exceed precipitation, temperature, or wind predetermined conditions as established by NOAA

↓

EXCEED STANDARD BASELINE
Number of adverse weather days in a month exceeds the predetermined number of reasonably anticipated adverse weather days

↓

SHOW EFFECT ON CRITICAL PATH
Show that the weather delay affected critical path activities

↓

WRITTEN TIME EXTENSION REQUEST -20 DAYS
Within twenty (20) days after the conclusion of any such delay, Contractor shall request in writing a time extension for such delay demonstrating that the claimed delay arises

Month	Anticipated Weather Days
Janury	12
February	11
March	8
April	7
May	7
June	6
July	7
August	5
September	4
October	5
November	6
December	11

Precipitation (in.)
Station: Silver Spring 0.9 N, MD US
24 hour amounts ending at observation time

Day	Jul. 2012	Aug. 2012	Sep. 2012	Oct. 2012	Nov. 2012	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Apr. 2013	May 2013	Jun. 2013	Jul. 2013	Aug. 2013	Sep. 2013	Oct. 2013	Nov. 2013	Dec. 2013
1	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.30	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.16	0.00	0.00	0.00
3	0.00	0.00	0.11	0.00	0.00	0.01	0.00	0.84	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
4	0.10	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
7	0.00	0.00	0.11	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	1.75	0.00	0.03	0.00	0.00	0.00	1.14
8	0.00	0.00	0.00	0.14	0.00	0.01	0.00	0.12	0.00	0.00	0.87	0.82	0.19	0.12	0.00	1.28	0.00	0.00
9	0.26	0.00	0.08	0.07	0.00	0.14	0.00	0.03	0.00	0.00	0.05	0.01	0.05	0.05	0.00	0.00	0.00	1.10
10	0.05	0.66	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.04	0.53	0.00	0.24	0.00	0.40	0.00	0.22
11	0.27	0.19	0.00	0.00	0.00	0.09	0.00	0.39	0.00	0.00	0.50	1.33	0.00	0.01	0.00	1.47	0.00	0.08
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.74	0.01	0.00	0.00	0.00	2.59	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.00
14	0.00	0.10	0.00	0.00	0.08	0.00	0.00	0.28	0.00	0.00	0.00	0.33	0.00	0.46	0.00	0.02	0.00	0.00
15	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.28	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.07	0.00	0.00
19	0.00	0.00	0	0.77	0.00	0.00	0.00	0.38	0.00	0.02	0.11	0.00	0.04	0.00	0.00	0.00	0.00	0.00
20	0.00	0.38	0	0.66	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.49	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
23	0.00	0.02	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.57	0.00	0.11	0.00	0.00	0.00	0.00
25	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.02	0	0.00	0.00	0.00	0.05	0.00	0.21	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00
27	0.01	0.43	0	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	2.28	0.00
28	0.00	0.05	0	0.00	0.08	0.00	0.03	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.07	0.00
29	0.00	0.01	0	0.63	0.00	0.00	0.09	-	0.00	0.09	0.00	0.31	0.00	0.35	0.00	0.00	0.00	0.00
30	0.00	0.00	0	4.94	0.00	0.00	0.00	-	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	0.00	-	0.27	-	0.00	1.65	-	0.00	-	0.00	-	0.00	0.00	-	0.00	-	0.00
Total Days	3	9	4	7	1	1	1	5	3	1	3	9	4	5	1	5	1	3
Anticipated Days	7	5	4	5	6	11	12	11	8	7	7	6	7	5	4	5	6	11
Potential Time Extension		4		2								3						