SENIOR THESIS FINAL REPORT

The Pennsylvania State AE Senior Thesis

Duval County Unified Courthouse Facility

Jacksonville, Florida

Darre'll Alston

Construction Management

Advisor: Rob Leicht

The Duval County Unified Courthouse Facility

Jacksonville, Florida

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Construction Management

CPEP Website: http://www.engr.psu.edu/ae/thesis/portfolios/2011/dma5056/index.html

Project Analysis Overview

The Design Team:

- Owner: City of Jacksonville
- Architect: KBJ Architecture, INC.
- General Contractor: Turner Construction Company
- MEP Engineer: TLC Engineering for Architecture
- Structural: McVeigh & Mangum Engineering INC.
- Civil Engineer: Civil Services, INC
- Landscape Architect: FLAGG Design Studio, LLC

General Project Information:

- Construction Dates: May 2009 – May 2012
- Building Area: 798,000 square feet
- Cost: $224 Million
- Story Levels: 7 total
- Project Delivery Method: Design-Build

Architecture

Greek influence:

- White concrete façade
- Doric columns
- Temple representations

Primary building material is concrete:

- Matches existing architecture in surrounding area
- Locally manufactured and supports efficiency
- Limestone precast concrete panels at 5000psi

Secondary building material is glass:

- Maximum day-lighting
- Spandrel, storefront vision , and curtain wall glazing

The functionality of spaces grows with hierarchy:

- Level one: Maintenance and public office supports
- Level two-five : Courtrooms and justice proceedings
- Level six: Attorney and court official offices
- Level seven: Judicial and chief justice offices

Construction

- Work sequence is broken up into four phases that generally includes a center section, colonnade section, west section, and east section respectively. Project sequencing follows a flow of starting on the inner portions of the building and working towards the outer portions and then reversing order to maximize work productivity. This effort best represents a dependent task schedule.

Structural

- **Foundation:** Auger and Lateral Piles serve as soil bearing work. Concrete footings, pile caps at 42" to 75" in depth, slabs, and beam aid in support.
- **Superstructure:** Mainly composed of 8x29, 19x29, 27x29, 36x29 beams and joists. Masonry wall units at 3000 psi. Shear-wall system at 4000 psi. Column composition is steel at 50 ksi and concrete at 3000 psi.
- **Two Roof System:** Steep roof system supported by aluminum metal seam and frame. Flat roof system supported by limestone aggregate concrete.

Electrical/Lighting

- **Primary Source:** Utility Transformer at 2500kVA
- **Back-Up Generator:** 277/480V, 3 phase at 1875kVA

*Services provided by J.E.A. Utility Company

- **Interior Lighting:** Florescent (T5, T8 & Compact)
- **Exterior Lighting:** Metal Halide
- **Controls:** Timed Switches and Motion Sensors

Mechanical/Plumbing

- **Mechanical system:** Variable Air Volume system at 3300-50000 CFM.
- **Recovery system:** 3 Make-Up air handling units at 40000 CFM.
- **Pump System:** Chilled water, CRU, and MAU.
- **Boilers:** Two low emission rated with input/output levels of 16330/13390 CFM respectively.

*All plumbing is conducted with gravity and pressure flow rates from a Triplex System Booster Pump.

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ACKNOWLEDGEMENTS

ACADEMIC ACKNOWLEDGEMENTS:

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MS. MARGARET SIMONE

MR. ROBERT MAC

MY FAMILY AND FRIENDS

EXECUTIVE SUMMARY

***T*he senior thesis final report** is to present the findings, conclusions, and recommendations of the four analyses that were executed for the Duval County Unified Courthouse Facility (DCUCF). This project is a new built 798,000 SF building that is dominated with the construction of 51 large scale courtroom rooms and in-house parking. The focal point of each analysis is to promote value engineering bot in the office and on the field through means of – prefabrication, schedule efficiency, financial development, and risk allocation.

ANALYSIS NUMBER 1: Critical Industry Issue

Prefabrication is a beneficial tactic already used for the concrete paneling exterior enclosure of the DCUCF. Using this wide spread innovation on the development of a floor system would promote the same benefits. Two systems were observed – Double Tees and Hollow Core Planks using a typical bay method. The double tees didn't prove to fit the project due to size and composition. The hollow core planks, though in a large quantity, took 50 days to implement and ended up saving the project by almost 10 times the original work. It also permitted roughly $14.5 million savings by using a manufacturing source. Through this introduction of process, the results shared in favor of using an all prefabricated project.

ANALYSIS NUMBER 2: Introduction of a Short Interval Production Schedule (SIPS)

The current project duration is targeted at May 2009 - May 2012. Through multiple debates and research, the project cost and schedule have been issues before the project was initiated on paper. The main concern was that the courtroom construction was taking too long due to constructability detail primarily focusing on the millwork. Using a SIPS schedule to strengthen the interior finishes displayed a minimal but still economic benefit. The schedule to accelerate all of the required trades resulted with a 48 week work period that gave a $21,250 saving cost to reorganize sequencing issues.

ANALYSIS NUMBER 3: Financial Analysis Awareness

The Duval County Unified Courthouse Facility exhibited financial obstacles prior to May 2009 for construction due to material price inflation for design. The efforts here were to see what strategies could have been used to highlight the original construction time back in 2004. Financial strategies are suggested and should be monitored for a company's success. Once evaluated, the Auchter Company should have used a joint venture to minimize and spread the risk.

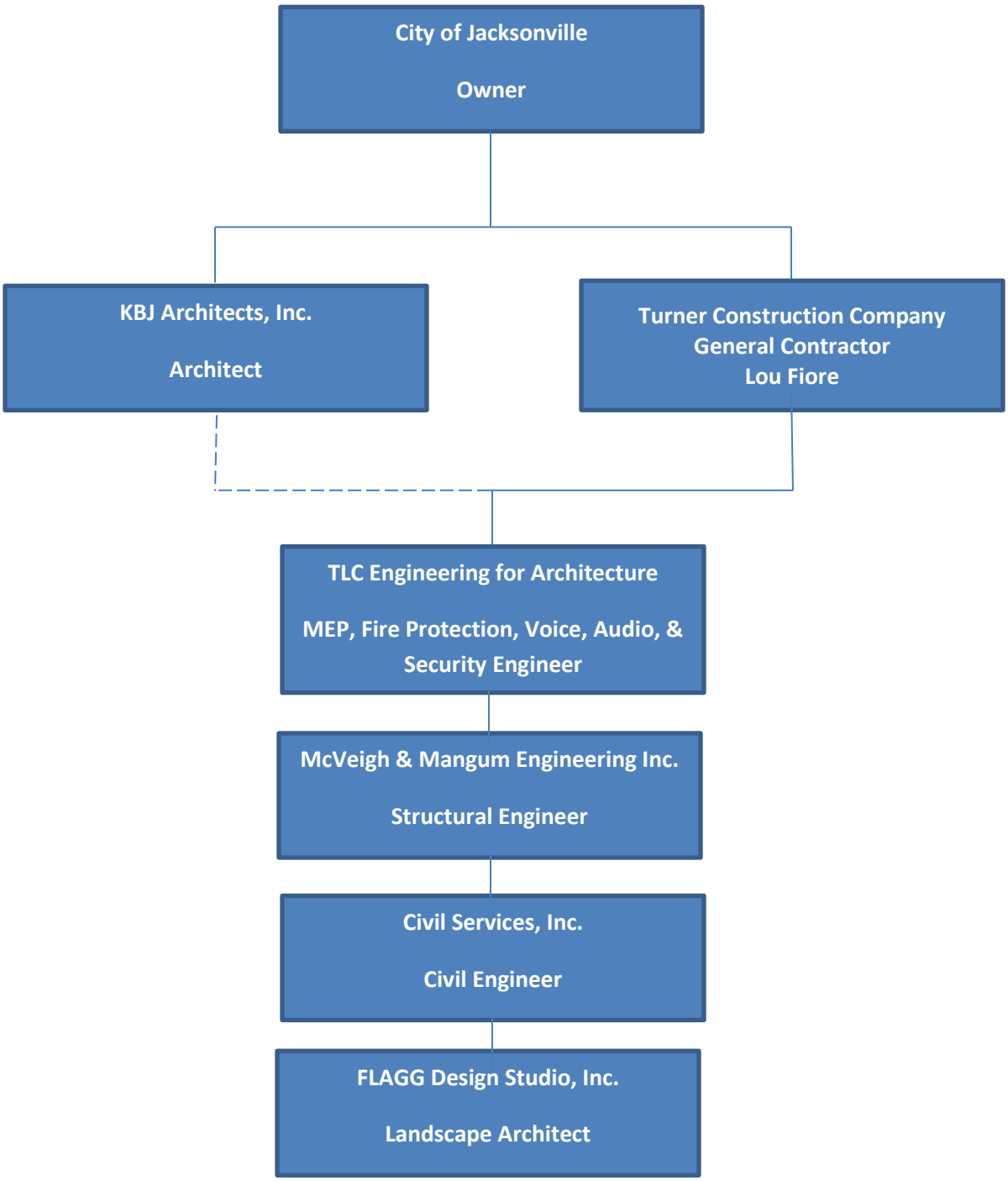
CLIENT INFORMATION

Sponsored development and the idea of the Duval County Unified Courthouse Facility are credited to its owner-the City of Jacksonville. The City of Jacksonville saw its previous 1958 courthouse facility in disarray and disrepair and seized the opportunity to unify the building itself and the community that revolved around it. This plan was utilized and dubbed the Better Jacksonville Plan (BJP) under Mayor John Delaney and approved by the city voters. Budget analysis seemed to be prevailing in the economy and looked promising for construction but unforeseen influences shifted winds. Building materials skyrocketed due to China's building boom, oil price increase, and asphalt price increase causing construction efforts to be put on hold until a better commission was pursued. Once a plan was generated, the new Mayor Peyton approved it and the project could then be resumed.

Once the project definition could commence, the owner displayed expectations dealing with cost, quality, schedule, and safety. Cost was expected to be reasonable within the basis of the new economic path that was presented since it needed approval. Along with project cost, construction material and equipment was another concern. The City of Jacksonville was awarded the Florida Consumer's Certificate of Exemption for sales tax by the Florida Department of Revenue. This exemption allowed the Duval County Unified Courthouse Facility construction to be exempt from Florida's sales tax from making purchases for materials and equipment directly from its suppliers. Quality of work was expected to reflect its original design and cost provided for budget. Project to be completed on time was a guiding factor for work progression. Safety expectations were oversaw with a safety plan and orientation developed by Turner Construction Company. This plan involved an OSHA 30 Hour required competent person holding pre-construction and weekly safety meetings and frequent and regular inspections. The owner had no sequencing issue because that discretion of work was assigned to the design team to deal with. Dual occupancies were utilized within this project because of the structure being a Unified Courts Facility that contains Civil, Criminal, and Family Judiciary components. Turner Construction Company had many key factors in completing the project to the owner's satisfaction consisting of- city requirements, local participants, security, and the end result users. These factors are currently driving to project success from which the owner had expected in short term and long term goals of this facility and its outreach to the community

PROJECT DELIVERY METHOD

Figure 1. Design-Build Project Delivery Method



The City of Jacksonville declared the Duval County Unified Courthouse Facility project to be a design-build project delivery method as illustrated in Figure 1. This system is defined by an agreement to perform both design and construction under one contract between an owner and a design-build contractor. Benefits of an incorporated GMP, quicker project process, minimize owner's risk and minimal conflicts were sought out for this project. The owner especially chose this project delivery method because of the control of project "destiny" throughout the development of its growth through a reputable company. A critical factor of cost control with no outside agendas played a secondary role for this decision. Overall, this system permits freedom to have input applied with a structure control by the owner.

PROJECT STAFFING PLAN

***See APPENDIX A for Staffing Plan Organizational Chart**

The organizational chart within the Turner Construction Company for the Duval County Unified Courthouse Facility follows a strong communication and coordination relationship. The main component of the structure is led by a vice president, principal in charge, and senior project executive. Project operations and are overseen by the senior project manager who coordinates with a staff of fellow senior project manager, Jacksonville Small and Emerging Business (JSEB) coordinator, and general superintendent. Administrative responsibilities for the project are given to the JSEB coordinator and this division has interaction with the second organizational structure division with the senior project manager through these tasks. The senior project manager takes on tasks of leading field engineering work and has correlation through MEP implementation with the general superintendent. Field superintendent aspects of structural, interior and MEP are supervised by the general superintendent for project success. Safety operations are relayed by all units of field work to the safety director to ensure jobsite safety. .This unique organizational structure spotlights effective technical communication between divisions to properly organize work responsibilities and team collaboration skills. With these factors being followed project error can be better avoided and project quality, safety, and cost can be efficiently employed.

EXISTING CONDITIONS SITE PLAN SUMMARY

***See APPENDIX B for the Existing Conditions Site Plan**

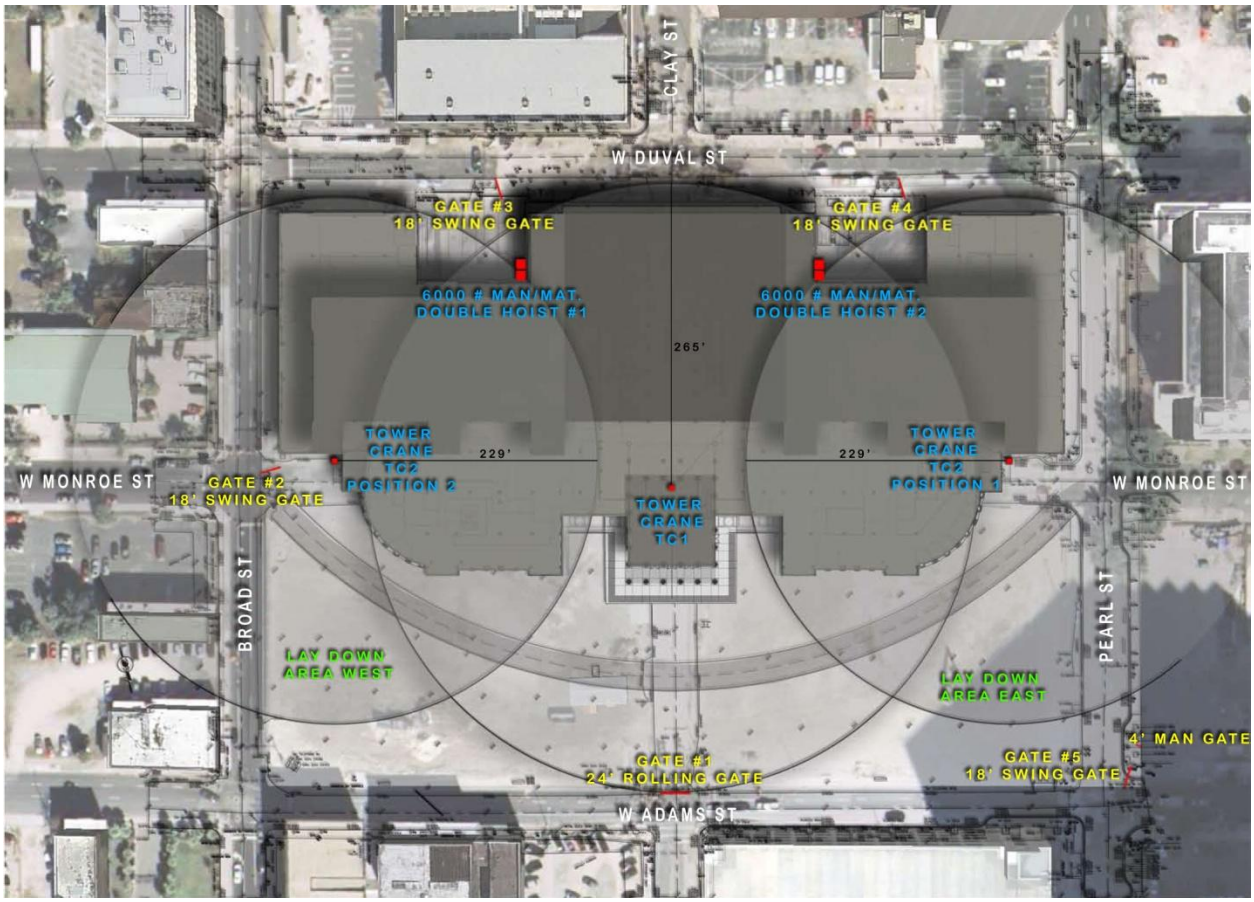


Figure 2. Site Logistics Plan

The Duval County Unified Courthouse Facility's site is featured on the intersection of Monroe Street and Clay Street. Routine procedure to ease vehicular traffic congestion through alternative road detours was implemented. This procedure allowed for the project team to move and transport around the entire site and surrounding exterior environment with five monitored gate access routes. Crane locations were placed strategically to apply site efficiency within picks and laydown areas. Even though crane locations are within reach of the community environment, the lifts were maintained in the project boundary. As seen in Figure 2, the project building is able to function off of existing utilities because of its location due North of the site. Locate APPENDIX B to see the relationship of the project building and existing utilities.

LOCAL CONDITIONS

The Duval County Unified Courthouse Facility is dignified in its rating of LEED Certification and it owes some gratification to its means of recycling. Currently jobsite materials of steel and cardboard are being urged to be recycled to increase a "greener" job productivity. Wood was stated to being recycled but actions were ceased due to the business loss of the recycling company. Recycling centers were scouted out but no local suppliers within a 500 mile radius were encountered. Internal practices of recycling aluminum and plastic products are still in action within the construction trailers of the site. Along with these recycling habits, green cleaning products are being executed to cut back on jobsite contaminants. All recycling efforts brought on by Turner Construction Company are helping to promote a brighter, leaner, and greener jobsite to future Jacksonville area projects.

Under investigation of a CPTu test of the subsurface, groundwater was discovered in depths ranging from one to seven feet below the ground surface. This varying in groundwater was anticipated from factors of seasonal climatic changes, rainfall variations, construction activity, surface water runoff, and other site-specific factors. Soil compaction must support this moisture content due to soil expansion. All specifications and drawings are expected to reflect this variance due to its observed characteristics for future references. With this said, Turner Construction Company accommodated for groundwater levels to be decreased to one foot below the bottom of any excavation during construction and two feet below surface for vibratory compactions procedures. Several soil classifications were discovered during a lateral pile capacity test. During a depth analysis, the following data was recorded:

WPC6208.00063 Lateral Pile Capacity Design Parameters

Depth (ft)	Soil Type	Submerged γ' (pcf)	Ø (degrees)	c (psf)	Unconfined Compressive Strength, (psf)	k (pci)	ε_{50}
0 to 12	Sands, Silty Sands	48	30	--		90	--
12 to 20	Sands, Silty Sands	53	34	--		120	
20 to 24	Sands, Silty Sands	48	30	--		60	
24 to 30	Silty Clay	38	0	250	500	10	0.01
30 to 45	Limestone	73	0	20,000	40,000	--	--
45 -	Marl	53	0	4,000	8,000	50	0.005

BUILDING SYSTEMS SUMMARY

DEMOLITION:

There is an order for the removal of all existing water meter and box assemblies, that are typical at all occurrences of abandoned water service lines. Remaining service lines must have plugged ends. The contractor is responsible for the removal of the fencing on the property lines. The intersection of Monroe Street and Clay Street is to be demolished for site preparation.

STRUCTURAL STEEL FRAME:

The structural framing system consists of lateral bracing and chevron bracing that support the upper roof system from ultimate tension and shear forces. Reference Figure 1 for a chevron bracing roofing example that is frequently used throughout the building. The beam channel is held together by moment connections that are done both on the field and before jobsite delivery. The floor system is made up of composite slab which is consistent on each floor. Crane locations for steel lifting can be referenced in the site logistics plan in relation to west, east, and center section picks.

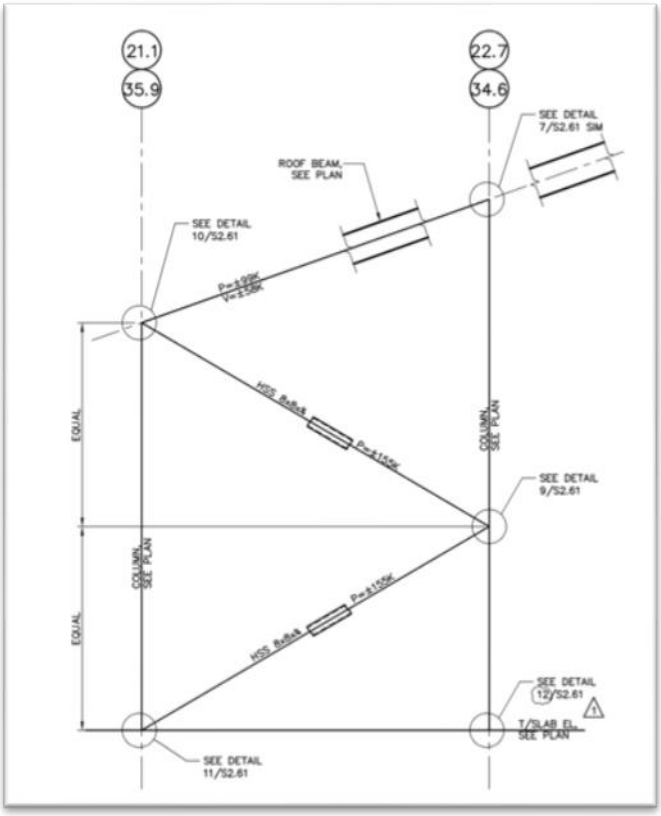


Figure 3. Chevron Bracing System

CAST-IN-PLACE CONCRETE:

Cast-in-place concrete consists of footings at 3,000 psi, floor slabs for composite decking at 3,000 psi, and interior columns at 5,000 psi.

PRECAST CONCRETE:

Precast parapet framing is added to support North face column connection on the eastside of the building. The precast concrete paneling on the façade is connected by a wing grit framing connection to transfer loads to exterior wall columns. These panels are also supported by panel to panel connections to resist horizontal loading. Lower roof slabs have been designed to temperature support one story of precast. Exterior columns have been designed to resist horizontal wind loads with embedded connections manufacturer. Crane locations for these lifts can be referenced in the photo site logistics plan in relation to west, east, and center section picks. Sixteen shear wall systems exist within the structure and is designed for 4,000 psi.

MECHANICAL SYSTEM

The main mechanical rooms – fire pump, domestic water boost pump, boiler, and compressor- are located on the first floor. A separate additional shed houses two chiller pumps from outside the building. Floors first through sixth contain a separate secondary room to maintain maintenance for that specific section. The primary system is represented by twenty-five Variable Air Volume Systems ranging from 3, 300-50,000 CFM. Three Make-Up Air Handling Units at 40,000 CFM represent the recovery system for the building. Eleven pump systems and two boilers also contribute to the mechanical layout.

Fire suppression comes in the form of smoke and fire dampers divided into three to five zones per floor. Each zone covers approximately 30,000-50,000 square feet. Quick response sprinkler types include – semi-recessed pendants, upright, recessed, concealed, correctional, sidewall, dry pendant, and deluge. These sprinklers are based on requirements of occupancy space dependent on theme of space. Dry pipe, wet pipe, and stand pipe support water flow to this fire protection system. Each floor is equipped with fire shutters to aid in emergency control. The fire suppression frame is backed up by a fire pump and jockey pump. Fire ratings for project components are as followed – structural frame (3hr /2hr), interior and exterior bearing walls (4hr/3hr), interior and exterior bearing walls (0hr), floor construction (3hr/2hr), and roof construction (1 ½ hr /1hr).

ELECTRICAL SYSTEM:

Main room located on first floor near North-West corner. Transformers valuing at 2,500 kVA are on the exterior wall adjacent to electrical room for proper feeding. A secondary electrical room can be found on North-East corner. All seven floors maintain a separate electrical room

for routing and maintenance control of the electrical layout. A back-up source generator valuing at 277/480V with 1,875 kVA is located in the main electrical room.

MASONRY:

Load bearing walls shall be constructed with Type II hollow concrete masonry units with ASTM C270, Type "S" mortar. This wall system is composed of masonry control joints, two vertical wall joint reinforcements, dowels, and masonry bond beams. All cells are filled with vertical reinforcing solid. Concrete masonry wall connection to precast concrete beam shall use a bolt connection on a steel plate with one-inch clearing to deck above.

CURTAIN WALL:

The curtain wall system utilizes spandrel and curtain wall vision. A three-coat high-performance organic finish of inhibitive primer fluoropolymer and clear fluoropolymer topcoat shall be applied. This unit is fabricated, assembled, and sealed in the factory until delivered on site for erection. The wall make-up consists of alloy and temper extrusions, vertical mullions, and exterior elastometric glazing. A 120 degree Fahrenheit temperature range shall be met by all provisions and material components. Reference Figure 4 for curtain wall system description.

Figure 4. Curtain Wall System Description	
Feature	Requirement
Air Infiltration	Not exceed 0.06 cfm/SF at 6.24 psf differntial air pressure.
Water Resistance (static)	No leakage at static air pressure of 12 psf.
Water Resistance (dynamic)	No leakage at differential air pressure of 12 psf.
Uniform Load	No deflection in excess of L/175 of framing member span.
Thermal Transmittance (U-value)	U-value shall not be more than 0.74 for captured system.
Condensation Resistance Factor	Value shall not be less than 59 for captured system.
Seismic	Meets design displacement of 0.010 x story height.
Sound Transmission Loss	Value shall not be less than 32.
Incidental Water Management Option	Head member capable of directing condensation.

SUPPORT EXCAVATION:

Temporary support systems consisting of filter fences and block and gravel inlet sediment filter will be used during excavation activities. The filter fence involves wire mesh covered with cloth tied to a fence to catch sediment and create a protective shield. The block and gravel curb inlet sediment filter system prevents excessive ponding. The contractor is responsible for the removal of these temporary systems at the end of their duration. For excavations less than three feet deep, the excavation can temporarily stand with vertical cut slopes from the cohesion of soil moisture. Excavations of greater than three feet need temporary side slopes in sandy soils of 1 ½: 1 (H:V) or flatter should be maintained or braced support. Encountered groundwater involves temporary excavation slopes of 2:1 (H:V) or flatter should be maintained for deeper than about four feet.

LEED VERIFICATIONS:

The City of Jacksonville wanted to achieve a new sustainable site that would be beneficial to the surrounding community. For this achievement to be met, the project would be advised by two complementary plans – Construction IAQ Management Plan and Construction Waste Management Plan. These procedures aid in the contractor's responsibilities for both onsite and offsite operations, to lead to a "Going Green" project. Figure 2 shows the LEED expectations of the project owner for the duration of the project phases.

***See APPENDIX C for LEED Owner Goals and LEED Contractor Achievements.**

SITE LAYOUT PLANNING SUMMARY

***See APPENDIX D for the Site Layout Plans**

SUPERSTRUCTURE SITE PLAN

The superstructure phase poses the most susceptible factors for site congestion. Within this layout, steel, masonry, and precast concrete panels are delivered on site and correlate with temporary facilities along with construction equipment. Careful site utilization must be noted during construction operation due to safety concerns that could arise. The most notable section of the layout is the two crane involvement system. Crane one is a stationary unit located at the center exterior of the colonnade portion of the structure with a larger reach of 265 feet. This crane is then removed for the colonnade phase to be constructed due to its materials not needing a lift support. A secondary mobile crane is present on the East side of the structure and then moves to the West side with a reach of 229 feet. Each crane location has a respective laydown material area for work outside of the given structure parameters. Reference Figure 5 for a snapshot of crane locations for a lift involving an exterior component being added to the superstructure. Effective communication is required for these lifts in the laydown areas because their reaches can interfere with one another and could result with unforeseen consequences.

Figure 5. Aerial view of crane locations during s lift.

INTERIOR SERVICES/MEP SITE PLAN

Once the operation of the superstructure ceases, the interior services/MEP work can start. Site congestion and activities are at a lower rate due to the cranes and their laydown areas being removed. The only exterior storage for this portion of the construction phase is allotted by a storage shed near the personnel area on the West side of the site. This procedure gives way for exterior transportation on site among the many trades that must come onto the project. The new material storage area is within the structure and is only permitted for materials that are currently being worked with. Restrictions on materials inside the structure promote a clean project and dissipate any source of interior congestion. A side observation can be noted that worker conflict is depleted by not favoring a certain trade by granting more storage time on site with this restriction. Work flow for this site plan starts with the center section where access routes are implemented at the center South side of the structure. For West and East sections, access routes are mapped on South facing side of each respective section. Two additional sources of admittance are located on the North boundary of the structure and require regulated entry granted from the general contractor to the subcontractors.

DETAILED PROJECT SCHEDULE

***See APPENDIX E for the Detailed Project Schedule**

While working in Duval County division of the Jacksonville area, high volume pedestrian and vehicular traffic must be taken into account in order to sustain proper scheduling procedures. Turner Construction Company implemented a four phase construction procedure for the building of the foundation, structural, and finishing systems of the project. These phases were broken up into sections of center, east, west, and colonnade. For the construction of the foundation, a three phase process was only required due to the colonnade sitting on the center section foundation. The center section started first and was followed by the east and west section respectively within a two to three day gap. By starting with the center section, an allowance for future work on the colonnade would be provided.

Within the construction phase of the Duval County Unified Courthouse Facility, Turner Construction Company utilized a pour, in-slab electrical conduit, and steel girt framing sequential order for each floor per section of work flow. This method allows for an efficiently erected superstructure to support interior power service connections that will be provided later in the construction schedule. The steel girt framing system is constructed with the floor pouring and in-slab electrical conduit sequence of the floor above to aid in laterally supported structural influences. This structural component permits for a faster schedule productivity rate by pertaining to working with multiple floors at a given sequence.

With the exception to the steel girt framing system, the DCUCF follows a standard commercial project schedule. This standard consists of work sequencing of foundation, superstructure, building enclosure and finishes. By maintaining a project environment similar to the construction industry and incorporating a bracing system at the same time as slab layouts, the Duval County Unified Courthouse Facility is projected to be completed in May 2012. With this target completion date, building operation can start before traffic congestion and high usage of the facility is predicted at the beginning of the summer session.

DETAILED STRUCTURAL ESTIMATE

***See APPENDIX F for the Detailed Structural Estimate**

The Duval County Unified Courthouse Facility's superstructure is primarily composed of cast-in-place concrete along with steel for the upper-roof portions. This project measures in at approximately 798,000 square feet which gives many explorations for structure components to be analyzed. In order to produce an accurate estimate, R.S.Means Costworks Software and R.S.Means 2010 Building Construction Cost Data book were used. Table 1 and Figure 6. display a physical summary of the structural breakdown of the superstructure, calculated from both the book and software sources. Values were averaged from a national standpoint of the construction industry in order to obtain the material, labor, and equipment unit costs. Actual structural estimates from this project are currently not accessible for comparison to the national average.

Component	Unit	Unit Cost	Quantity	Total Cost
Concrete Formwork	SFCA	$2.11	6304	$13,301.44
Concrete Reinforcing	TONS	$2,440.00	223.84	$546,169.60
Cast-In-Place Concrete	CY	$153.45	488957.32	$77,059,352.36
Steel Trusses	LF	$370.54	972	$360,164.88
Pan Joist Decking	SF	$50.98	800000	$40,784,000.00
			Total	$118,762,988.28

Table 1. Structural Summary

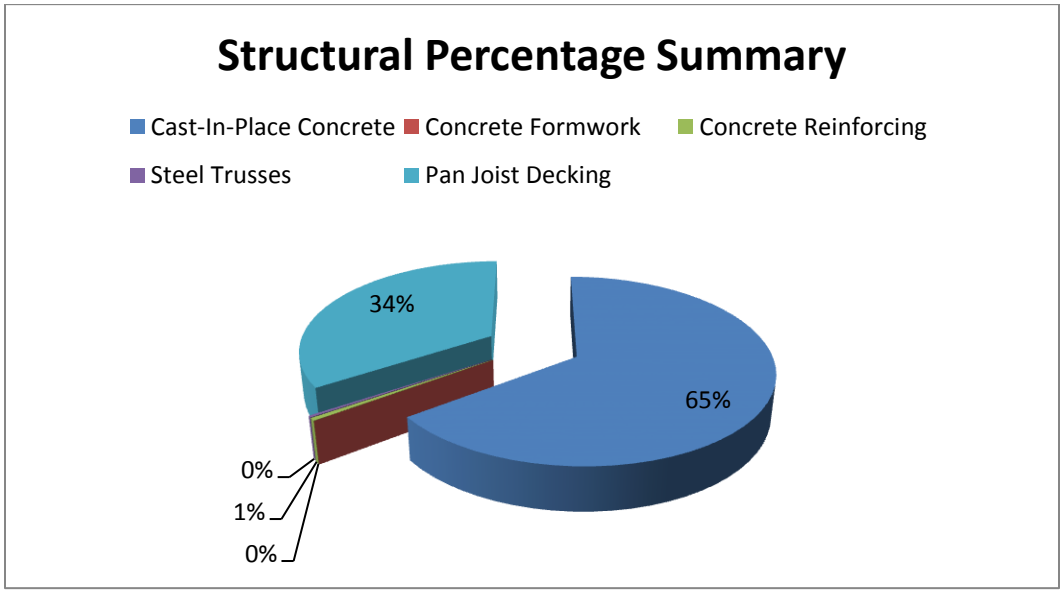


Figure 6. Structural Percentage Summary

After investigating the structure of the DCUCF, an indifferent pan joist system at 4,000 psi and seven inches was observed for the guidelines of the structural system. For construction of pan joists, a reusable one cost steel decking is used. Evaluating this system gives a layout of one floor while being able to construct another floor at the same time of construction. A typical bay method was used to acquire the structural analysis for this concrete beam and joist system. Six typical bays at twenty-four feet were taken and spanned across the entire building's footprint for each floor. Each bay consisted of (4) 8x29 secondary concrete joists and a 19x29, 27x29, and 27x32 primary concrete joist. Very precise symmetrical floor plans were assumed for these calculations which would offset the final result to be over the actual beam estimate. Figure 3shows a sectional cut of a pan joist.

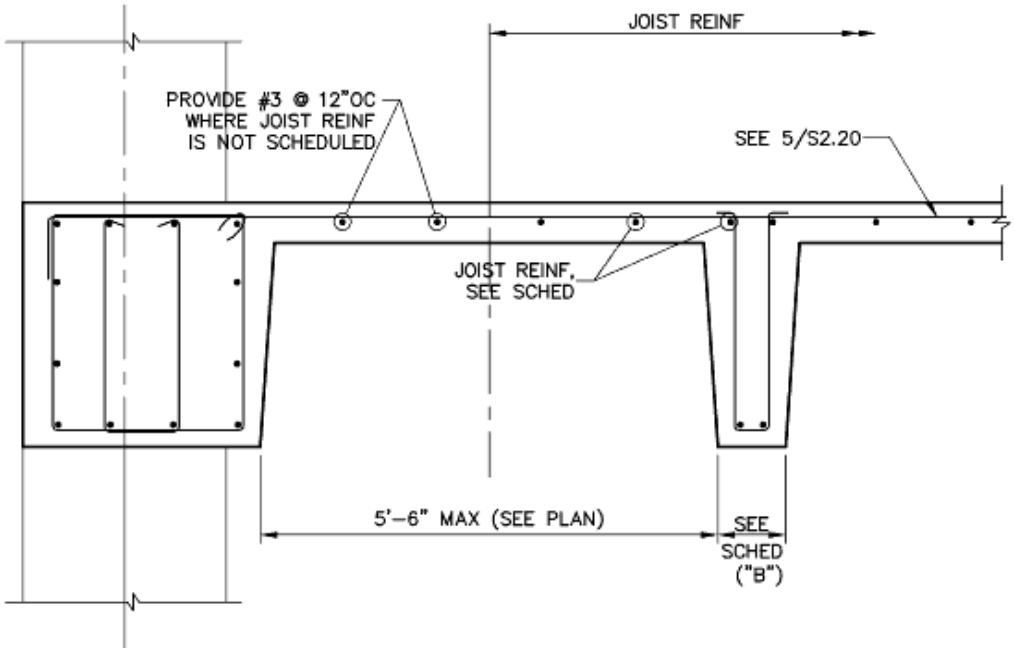


Figure 7. Sectional cut of a standard pan joist.

Concrete columns for this project contained only vertical reinforcing with support of tie offsets. Two specific columns- 16"x24"and 24"x24"- were most represented for construction due to their high capacity endurance and span. Specialty concrete pile caps were also represented; the most distinguished was the Type 3 at a quantity of seventy-one. The Type 3 pile cap was composed of 3-#10 3 WAYS reinforcing formatting with a special designed shape which allows them to withstand the most building transfer loading. See Figure 8 for the Type 3 pile cap.

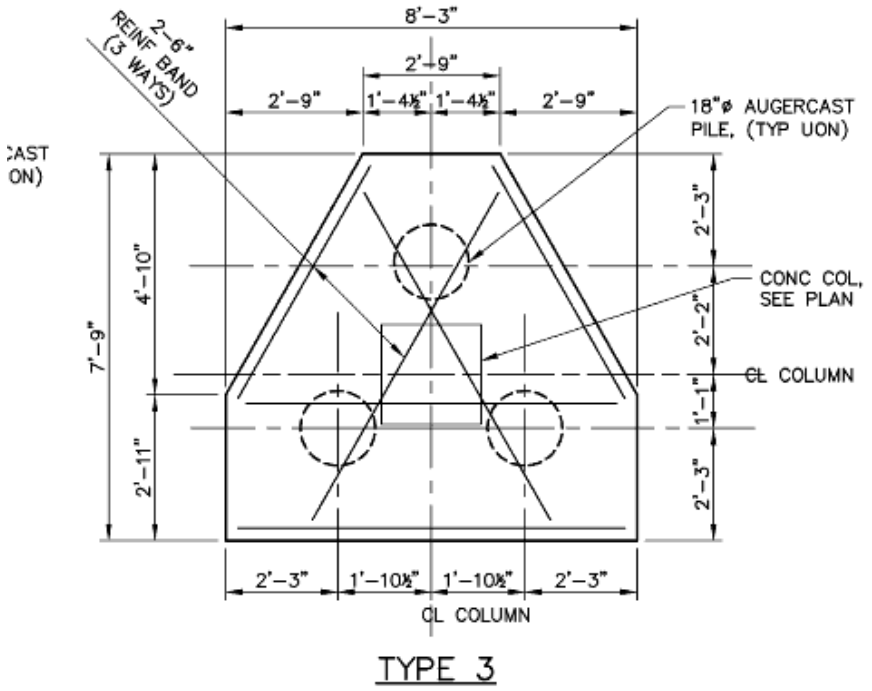


Figure 8. Type 3 pile cap

Steel is constructed in the upper-roof area of the Duval County Courthouse Facility. Beams sizes of W24x104 and W12x40 are used more frequently in chevron bracing to accommodate for roof lateral loads. The W24x104 and W24x131 didn't have unit pricing in the R.S.Means resources so an average value between two similar steel beams was used.

GENERAL CONDITIONS ESTIMATE SUMMARY

***See APPENDIX G for the General Conditions Estimate**

A brief overview of the general conditions estimate for the Duval County Unified Courthouse Facility (DCUCF) can be observed in Figure 9. These values were gathered from the R.S.Means 2010 Edition and in no shape or form reflect the actual obtained contract values gathered from the estimating division of Turner Construction Company. Allocation of assigned tasks and numbers were presented as an assumed efficient construction project modeled from the research project of the DCUCF. This estimate was consolidated into five classifications: personnel, documents/services, project facilities, project equipment, and temporary utilities. The personnel aspect includes suggested staffing members that were referenced off of the actual Turner Construction Company staffing organization consisting of field engineers, superintendents, clerks, and project managers. The documents/services portion includes contractual agreements on bonds, insurance, inspections, scheduling, waste-management, and expenses. The project facilities entail the contractor trailers and storage trailers which help in housing functions and activities within the project. Project equipment such as signage, fencing, and barricades regulates site efficiency and distinguishes public and private sectors. Power, lighting, water/sanitary supply, and portable toilets make up the temporary utilities for the constructed general conditions of the site.

Line Item	Units	Unit Rate($)	Quantity	Cost ($)
Personnel	WEEK	16415	135	2216025
Documents/Services	WEEK	44012.91	135	10,217,235.96
Temporary Facilities	WEEK	471.81	135	63695
Project Equipment	WEEK	432.39	135	58,372.12
Temporary Utilities	WEEK	1249.42	135	168672.16
	Total	62581.53	135	12,724,000.25

Figure 9. General Conditions Estimate Breakdown

Figure 10 indicates that that documents/services along with temporary utilities make up majority of the general conditions estimate. When analyzing the results of the data, this estimate concludes a cost of approximately $12 million that averages 6% of the total cost of the entire project.

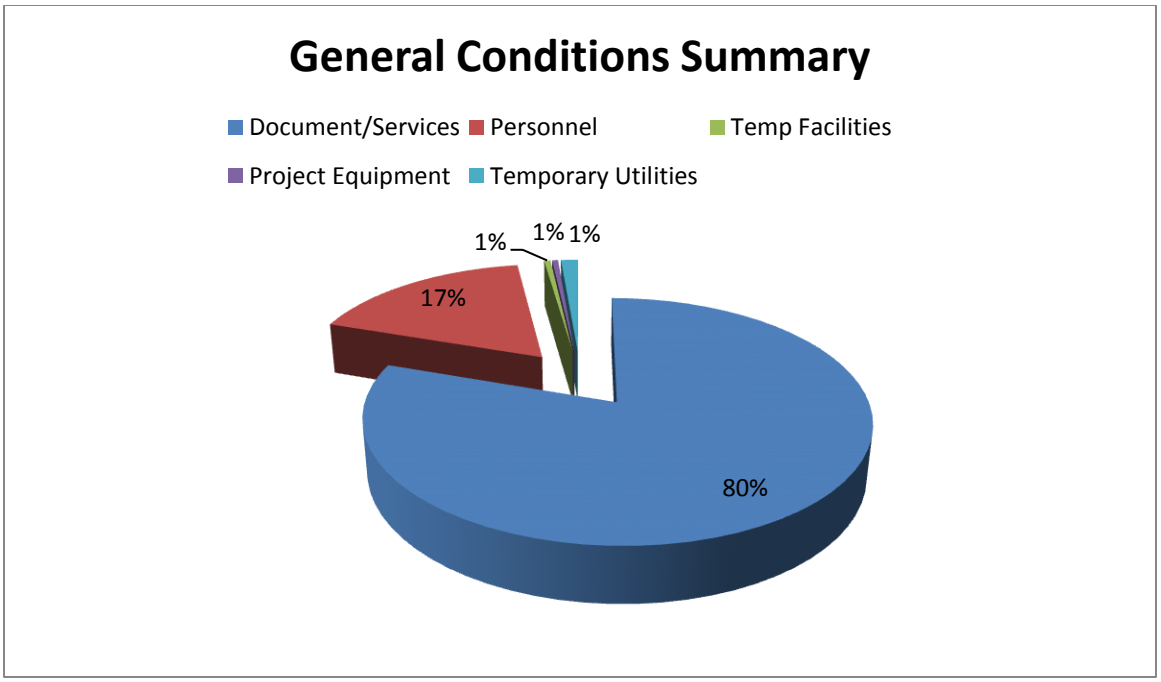


Figure 10. General Conditions Summary

ANALYSIS NUMBER ONE: Uniform Prefabrication Engineering

REVISION IDENTIFICATION

Prefabrication is a newly used innovation service used to accelerate the schedule while promoting cost efficiency for the Duval County Unified Courthouse Facility. Since this project was of great size capacity, work processes were expected to fall out of range for the requirement of time and money established by the Duval County officials. To keep this project on "the drawing table" during a downfall economy for Jacksonville, Florida's budget, prefabricated concrete panels were manufactured for the exterior enclosure. Taking this same procedure and applying it to prefabricated concrete floor planks is predicted to seek out the same benefits. From this investigation, special considerations will be noted for flooring construction methods for a quicker and proper turn-over.

RESEARCH GOAL

The goal of this analysis is to perform detailed design aspects for the structuring of the prefabrication of concrete floor planks to fit an average of a 30'x28' bay spans for an earlier and equipped substantial completion.

METHODOLOGY

- Research typical span requirements for prefabricated concrete units
- Reference/calculate additional systems to support floor planks
- Note later installation objectives needed for floor placement
- Contact manufacturer to see if units can support special cut-outs for placement
- Research transportation requirements of units
- Calculate manpower of crews for assemblies
- Evaluate schedule for trade coordination for new "dual" activity relationships
- Perform estimates of new savings for restructuring

RESOURCE AND TOOL APPLICATIONS

- Turner Construction Project Team
- Prefab Manufacturing Company
- Professional Documentations and Readings
- Structural Engineer
- AE Faculty
- Industry Professionals
- PACE Seminar Contacts

EXPECTED OUTCOMES

From detailed research and design experiments, the prefabricated floor planks are expected to bring the schedule ahead of the previously stated schedule. Trades are predicted to be contributing work at the same time as floor planks are constructed since the floor layouts will be accessible to work on. This comes from the lack of waiting for the current cast-in-place concrete to cure. Cost estimates are foreshadowed to be lower since a constant rate for manufacturing is expected and the usage of the same crew from the exterior enclosure. Structurally, the building should support additional components to connect the concrete floor planks but are expected to add more loading transformation.

CURRENT CONCRETE SLAB-ON-DECK SYSTEM

The Duval County Unified Courthouse Facility is currently composed of 2" normal weight concrete slabs with metal decking at 24" deep. This system is implemented the first floor all the way up to the seventh floor. The cast-in-place concrete was poured in the work production of center, west, and east respectively. The pours would start from the first floor going from center heads west then finishes up on the east end. This same process would then occur upwards to the second, third, fourth, fifth, sixth, and seventh floors. Refer to Figure 11 for the pour durations of the slabs.

Location	Start Date	Finish Date	Duration
West Slabs	9/25/2009	1/30/2010	132
Center Slabs	9/2/2009	5/4/2010	266
East Slabs	2/16/2010	5/28/2010	117
		Total	515

Figure 11. Slab Pour Durations

Figure #12 displays a detailed cost estimate that was performed to reflect the price per floor of elevate slab.

Location	Deck	Material	Rebar	Form	Total
2nd Floor	$2,191,020.00	$1,492,550.00	$688,654.00	$476,079.00	$4,848,303.00
3rd Floor	$1,091,610.00	$772,069.00	$343,101.00	$476,079.00	$2,682,859.00
4th Floor	$1,091,610.00	$756,330.00	$343,101.00	$476,079.00	$2,667,120.00
5th Floor	$1,091,610.00	$756,330.00	$343,101.00	$476,079.00	$2,667,120.00
6th Floor	$1,224,776.00	$814,038.00	$384,956.00	$476,079.00	$2,899,849.00
7th Floor	$1,237,288.00	$843,767.00	$388,889.00	$476,079.00	$2,946,023.00
Total	$7,927,914.00	$5,435,084.00	$2,491,802.00	$2,856,474.00	$18,711,274.00

Figure 12. Elevated Slab Estimate

STRUCTURAL BREADTH STUDY

PREFABRICATED CONCRETE SLABS

When consulting with the Nitterhouse Concrete Products Company, two possible options for the prefabrication of concrete floor planks were possible – double tee concrete panels and hollow core planks. The first investigation dealt with a double tee analysis. The double tee units are primarily used in junction with parking garages for ease of construction and material installation. When researching this product, results showed that its span length exceeded the bays of the Duval County Unified Courthouse Facility. This would evoke reconfiguring the structure and lose design features and cost constraints required for other analyses based upon this report. A major downfall of the double tee is that the interest of the owner and architect for pleasing aesthetics would be loss. One basis of the design of the DCUCF was for uniformity of the public as a whole to come together while reflecting modern and historical unity.

The second investigation dealt with the hollow core planks and their possibility to fit such a large scale project such that of the DCUCF. Some advantages of the hollow core planks are - less concrete usage and easier MEP under-slab coordination. Some disadvantages to the hollow core planks were deemed unnecessary because of:

1. A clustered job site
2. Storage cost to hold excess planks not in use
3. Frequent daily trips from manufacturer to jobsite
4. The cost of LOTS of planks
5. Detailed attention to MEP under-slab coordination
6. Limited to 4’ width

Despite these predicted obstacles, a detailed investigation of an all concrete prefabricated construction project was to be conducted. This procedure seemed most appealing since the industry is recently promoting the benefits of prefabrication. With approval from the advisor, a detailed procedure assuming a typical bay was determined. Refer to Appendix H for the typical bay design. Though this bay was not consistently carried throughout the DCUCF structure, a structural breadth will be carried out for constructability.

***See APPENDIX H for the Detailed Calculations/Product Detail**

System and material values were established using The Nitterhouse Concrete Company. To first analyze this system the live loads, dead loads, and deflections need to be determined using the following equations: W_D & $W_{ll} = \tau_w w_l$; $\Delta_{ll} = (5w_{ll}l_n^4)/(384EI)$. Once these values are analyzed, the deflections are checked to fit within the span. In the case of the Duval County Unified Courthouse Facility, the spans fit with a 6”x4’ hollow core plank with 2” topping and 7-1/2 φ stirrups which is modeled in Figure 13. For this system to work a girder

must be implemented to support each frame hollow core plank. Then values finding force and moment factors are calculated for beam loading. Finally using the deflection equation values are plugged in to establish I_{min} characteristics from which a girder is chosen from the structural tables and compared to the forces and moments that were established earlier.

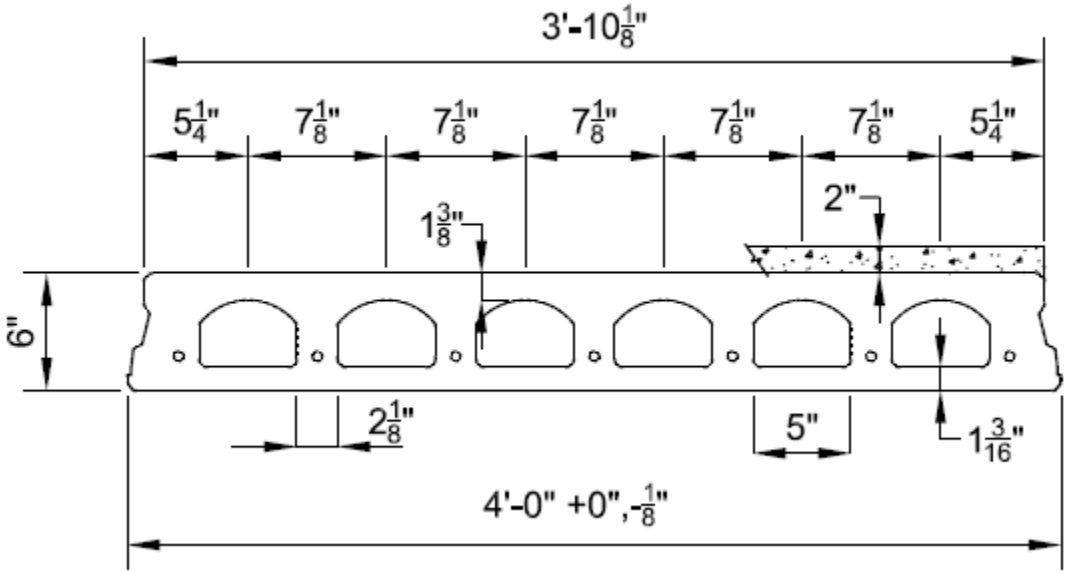


Figure 13. Hollow Core Plank

SCHEDULE ANALYSIS

When talking to Mr. Mark Taylor from The Nitterhouse Concrete Company, he discussed the maximum constraints for distribution of the hollow core concrete planks. This prefabrication can be erected every 6,000 SF per day. Figure 14 shows the breakdown of prefabricated hollow core planks by floor and section. Installation of these units is quite fast with an average of 3 days per bulk of set-up. Material laydown areas will not be of an issue (as predicted before) due to time efficiency. The prefabricated units can be picked up on arrival and at the end of the day the new materials can be properly secured for next day installation. The grouting services of this trade are equipped at 12,000 SF. At a glance this kind of resembles a "mini" Short Interval Production Schedule. Here, possibilities of anchoring the planks to the girder with steel ties. Another option could be suited to fit the still cast-in-place for beam and column pours with base plates offsets to link to the planks. The second option would benefit the production rate especially if free float is available for accurate connections from off the girder. The hollow core planks are valued at a schedule period of 50 work days; In comparison to the current schedule of cast-in-place concrete valuing roughly at 488 work days.

Location	Members	Duration	Start Date	Finish Date
Center				
2nd Floor	394	5	9/2/2009	9/7/2009
3rd Floor	388	5	9/7/2009	9/12/2009
4th Floor	136	2	9/12/2009	9/14/2009
5th Floor	136	2	9/14/2009	9/16/2009
6th Floor	136	2	9/16/2009	9/18/2009
7th Floor	138	2	9/18/2009	9/20/2009
West				
2nd Floor	311	4	9/20/2009	9/24/2009
3rd Floor	306	4	9/24/2009	9/28/2009
4th Floor	87	2	9/28/2009	9/30/2009
5th Floor	87	2	9/30/2009	10/2/2009
6th Floor	111	2	10/2/2009	10/4/2009
7th Floor	112	2	10/4/2009	10/6/2009
East				
2nd Floor	311	4	10/6/2009	10/10/2009
3rd Floor	306	4	10/10/2009	10/14/2009
4th Floor	87	2	10/14/2009	10/16/2009
5th Floor	87	2	10/16/2009	10/18/2009
6th Floor	111	2	10/18/2009	10/20/2009
7th Floor	112	2	10/20/2009	10/22/2009

Figure 14. Prefabricated Hollow Core Floor Planks by Division

COST ANALYSIS

Ideally thoughts that using prefabrication were that it would be more expensive since cutting out the possibility of cheaper crew utilization. In contrast to belief, by using the RSMeans Costs Book, the hollow core planks costs turned out to be cheaper. Even though a transportation factor unit cost from a manufacturing company was not applied and would increase the price of the prefabricated units. A viable option for the lower turn-out could have been from a result of eliminating a higher source of manual labor or from shear simplicity of the size and production of the planks. Figure 15 shows the estimated price that the prefabricated hollow core planks would be. The price comparison of the cast-in-place is estimated at $15,637,066 which shows a relationship that yields a positive net growth for hollow core planks with cost savings of $14,516,090.

Location	Area (SF)	Material Unit Cost	Labor Unit Cost	Material Cost	Labor Cost	Total
2nd Floor Slabs	$ 170,700.00	$ 6.65	$ 1.19	$ 1,135,155.00	$ 203,133.00	$ 1,338,288.00
3rd Floor Slabs	$ 88,300.00	$ 6.65	$ 1.19	$ 587,195.00	$ 105,077.00	$ 692,272.00
4th Floor Slabs	$ 86,500.00	$ 6.65	$ 1.19	$ 575,225.00	$ 102,935.00	$ 678,160.00
5th Floor Slabs	$ 86,500.00	$ 6.65	$ 1.19	$ 575,225.00	$ 102,935.00	$ 678,160.00
6th Floor Slabs	$ 93,100.00	$ 6.65	$ 1.19	$ 619,115.00	$ 110,789.00	$ 729,904.00
7th Floor Slabs	$ 96,500.00	$ 6.65	$ 1.19	$ 641,725.00	$ 114,835.00	$ 756,560.00
					Total	$ 4,195,184.00

Figure 15. Elevated Slab Estimate

CONCLUSION AND RECOMMENDATIONS

After analyzing the prefabrication of hollow core planks with false hopes of a good recovery, the turnout was surprising. The DCUCF has already utilized precast panels for the building enclosure which saved project time. With the calculated results it proved to show that using prefabricated floor planks can also reduce schedule time and could be beneficial on large complex projects similar to this one. Tasks like this on the critical path that occur in large increments can have helpful influence on duration deliverance. A note should be made that the method used for the evaluation was a similar bay assembly which wasn't as consistent to the actual project. Also girder sizing was assumed to stay similar to support the column, beam, joist, and building enclosure loads that still existed. So in theory this analysis could save schedule but is still dependent on cost in relation to manufacturing, inflation, and the sizing sequencing of systems.

ANALYSIS NUMBER TWO: Introduction of Short Interval Production Schedule (SIPS) Efficiency

REVISION IDENTIFICATION

Project scheduling of the DCUCF was put under tight restrictions to be completed with proper cost establishments made by city officials of the Jacksonville, Florida area. Since the layout of the project displays consistent uniformity, a SIPS schedule seems like a possibility as a revision. Using this schedule will also require a cost effective analysis in order to outweigh the construction process of the large-scale complexity.

RESEARCH GOAL

The goal of this analysis is to implement a Short Interval Production Schedule to help improve project scheduling and sequencing efficiency.

METHODOLOGY

- Inquire about trades that could be beneficial to a SIPS schedule
- Research the key players affected
- Establish an order and structure for the project
- Test the process for a division of the building
- Produce a schedule
- Evaluate cost of new schedule
- Analyze cost comparisons between old and new schedule

RESOURCE AND TOOL APPLICATIONS

- Professor Dr. Hanagan
- Professor Dr. Leicht
- Professor Swagata Banerjee
- Turner Construction Project Team
- Structural Engineer
- AE SIPS Software
- Professional Documentation/Readings
- Industry Professionals

EXPECTED OUTCOMES

Performing extensive research, the newly imposed Short Interval Production Schedule is expected to produce an earlier project completion date. Work productivity of trades is foreshadowed to increase, since same work processes will be constructed periodically within the divisions. It is believed that the AE SIPS software will help provide the most economical loading simulation for scheduling and representation.

OVERVIEW OF A SHORT INTERVAL PRODUCTION SCHEDULE

A Short Interval Production Schedule (SIPS) is a project scheduling method that is implemented to investigate possible strategies to reduce construction building time. A perspective is developed in an analysis basis of either days or weeks to pinpoint activity progression. This technique is best suited on projects where construction practices are conceived on repetition, such as hotels and office buildings. The construction practices are generalized by separation of a wing or a floor. Once a wing or floor is designated, zones are established to appoint trade production and permit efficiency of movement. Each trade starts with its respective activity in the first zone and will move throughout each indicated zone with that same activity. Working under these circumstances demotes the idea of "trade-stacking" and promotes an "assembly-line" of subcontractors.

PROJECT CONSTRAINTS

The major constraint for the project is that it is completed on its estimated time of May 2012. This factor is based off of the owner, the City of Jacksonville, due to previous set-backs that caused the project to cease construction before its award to Turner Construction Company. An in-depth report of this constraint can be viewed within Analysis One: Financial Analysis Awareness.

SHORT INTERVAL PRODUCTION SCHEDULE APPLICATION

Step 1:

The Duval County Unified Courthouse Facility was first broken-down by each floor due to constructability constraints of the structural system. These constraints were judged from the design of west to center to east construction. Then zones were delegated to regulate proper flow throughout the building to maximize production. Figure 16 displays a typical zone assignment for each wing of the floor. Each zone represents an individual courtroom that resembles a lecture hall environment of various seating areas, tables, podiums, and ornamental designs. Each room is roughly 1,705 square feet giving a total of 86,989 square feet for investigation.

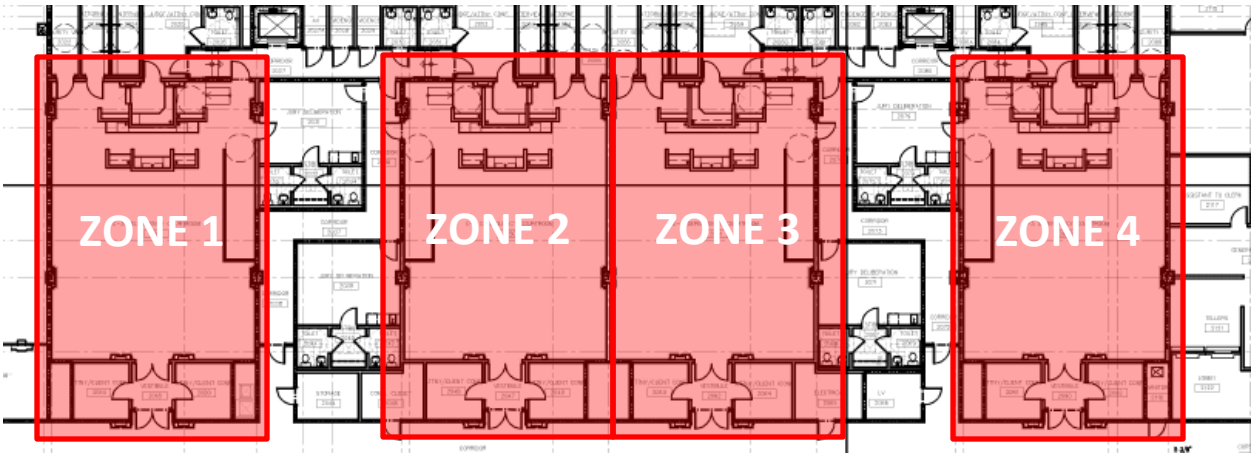


Figure 16. Zone Layout

Step 2:

After completing a zone appointment strategy, activities that are important to the critical path must be determined. These tasks are crucial due to their direct relationship to the construction timeline and relevancy to adequately fluctuate with implemented constraints. Once the tasks are obtained, quantity take-offs must be calculated. FIGURE 17 offers the quantity take-offs.

Line Number	Item	Actual Duration (Days)	Quantity	Units	Unit Cost	Cost	Daily Output	Matrix Duration	Legend Color
9260	Hang Gypsum/Tape & Finish	310	120,207	SF	17.66	2,122,855.62	472	5	
9910	Prime Paint, Caulk, Paint First Coat	182	25,755	GSF	3.06	78,810.30	1150	3	
6440	Millwork & Trim	922	94,452	GSF	19.32	1,824,812.64	260	8	
10630	Acoustical Wall Panels	141	51,383	SF	52.00	2,671,916.00	152	7	
11486	Audience Courtroom Pew Seating	226	21,420	SF	5.92	126,806.40	210.00	2	
9910	Final Paint	627	25,755	GSF	3.06	78,810.30	1150	3	
9500	Acoustical Ceiling Tile Install	160	86,989	SF	4.46	387,970.94	625	3	
9658	VCT Flooring & Base	186	86,989	SF	0.66	57,412.74	500	4	
9680	Carpet & Base	204	86,989	SF	2.59	225,301.51	500	4	
8710	Doors & Hardware	258	306	EA	3.23	988.38	9.00	1	

Figure 17. Line Item Breakdown

The criteria for procedure for the DCUCF are as followed:

1. Hang Gypsum/Tape & Finish
2. Prime Paint, Caulk & Paint First Coat
3. Millwork & Trim
4. Acoustical Wall Panels
5. Audience Courtroom Seating and Furnishings
6. Final Paint
7. Acoustical Ceiling Tile
8. Flooring Base
9. Flooring Carpet
10. Doors & Hardware

Each selected task must be put in order of its suggested sequencing feasibility to follow the traditional "start-to-finish" process. By placing each take-off in order, the Short Interval Production Schedule can be put into effect for efficient time allotment.

Step 3:

Finally, duration balancing must be achieved for the process to be maximized. To accomplish this, crew sizes must be increased or reduced. By assorting values to the crews, a principle of zone regulation is followed by restricting the number of workers in a given zone. An organized structure of production is acquired – therefore reducing site chaos and "time-waste" of trade miscommunication. The DCUCF utilized a six-day/ten-hour work week due to project complexity. To eliminate "trade-stacking" as much as possible, the millwork & trim trades were given an increase in crew size to offset its already "over-the-schedule" time frame. To try and balance this offset, some crews were kept the same due to their low crew impact size (i.e. paint, furnishings, etc…); and others were added to (i.e. acoustical wall panels and flooring carpet).

PROJECT SCHEDULE AND COST RESULTS

***See APPENDIX I for SIPS Schedule**

By assessing the Short Interval Production Schedule, the interior finishes of the 51 courtroom facility yielded a 48 week completion time. In comparison to the original project schedule modeled in APPENDIX I**,** a SIPS schedule savings centered on the millwork & trim resulted with a three working day savings. Saving this amount of schedule completion would permit a savings value of $21,250 from the general conditions estimate.

ARCHITECTURAL BREADTH STUDY

***See APPENDIX J for Calculations**

***See APPENDIX K for Product Detail**

Among the attention of increasing the production and speed of one of the critical path tasks – courtroom millwork - a change in quantity and characteristics can also aid in project recovery. The courtroom millwork led the most schedule increase due to delay, though the Short Interval Production Schedule proved to aid in production time – other options could help alleviate the obstacle. Architecturally the millwork is the focus within the courtroom facilities. It dominates in detail design and quantity to aid in aesthetically pleasing dimensions to the occupants.

The project manager of the Duval County Unified Courthouse Facility stated that within the parameters of the courtrooms is still a problematic error of sound and noise travel to maintain a balance of room purpose. An action that is currently manifesting is – HVAC noise which forecasts a possibility of communication and speech error. The architectural millwork is made up of many trimmings and veneer compositions which can be witnessed in Figure 18 This frame is

support by plywood, vertical framing and fiberglass. All of these factors add in detail production, cost, and most importantly sound transmittance from which some overlook.

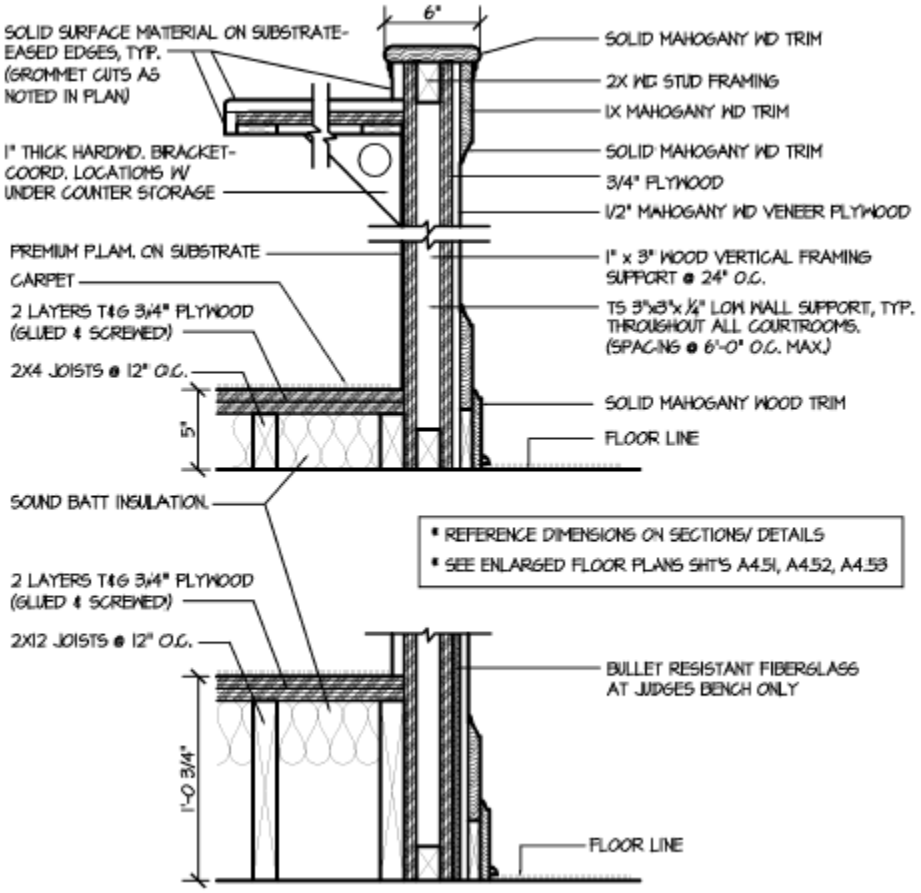


Figure 18. Section Cut of Courtroom Millwork

But first the basic function of sound must be understood in order to develop strategies to help in project success. Sound is a result of a force that acts in pressure to excite particles in the form of moving energy. Sound is measured at frequency levels that it takes to complete its movement of cycle. This movement travels through the air and is affected by the surrounding environment.

Due to its uniformity and characteristics, the millwork is one contributing factor to the HVAC noise and potential speech malfunction. It is a stiff source from which sound will bounce off of and travel in multiple distances. This process can be analyzed by the definition of time reverberation (T_{60}). Time reverberation refers to the part of sound that is still moving once the original sound is ceased. An easier way to comprehend this is to visualize someone talking in front of a class and once that person stops, whatever you hear over that time (identified in seconds) is the reverberation process. This relationship is established by the equation:

$$T_{60} = 0.161V/ (S_t\acute{\alpha})$$

Where V = volume of room, S_t = total room surface area, and ά = the sum of sound coefficients. The sum coefficients are measured from frequencies of 125, 250, 500, 1000, 2000, and 4000 hz. Under a rule of thumb a range of 0.8 – 1.1 is optimum, with other factors outside of this range being fair and poor. These values alone are not the only concern but so are various room factors. For a courtroom, a need for speech prolongation is good but can be controversial if all the surfaces are stiff materials (i.e. solid wood, concrete blocks, etc…) because the sound will constantly bounce off of materials producing uncomfortable multiple hearings that could produce echoes.

The architectural millwork of the DCUCF exhibits properties of stiff materials and is the main focus of design in the building, resulting with figures outside of the optimum range of sound absorbency. Acoustical panels were installed but only contribute to a marginal value of the total room absorbency due to its solid configuration which is modeled in grey in Figure 19.

Figure 19. Courtroom Acoustical Panels

A consideration of a more absorbent material like felt, carpet, and cloth was analyzed. The website fabricmatestore.com sells products such as carpet wall panels that are very useful in sound absorbency. The emerald green material would be best suitable to take the place of the intrinsic detail of the trim of the millwork. This is to also say that it would keep up with the same design features by matching the carpet color and quality. The carpet panel would be located below the acoustical panels all the way around the room. This would save even more time for the millwork to be accomplished. The time reverberation of the newly added system evokes a more proportional time (1.13 seconds) more suitable within the optimal range for speech in a

courtroom setting and objectives. In contrast the original layout permits a reasonable reverberation time of 1.34 seconds but still could result with divert transmissions. The carpet panel would roughly cost $22,893 and would approximately take a five minute installation process due to its nail attach to the dry wall. This material would cut out $40,021 worth of millwork.

CONCLUSIONS AND RECOMMENDATIONS

Though very nominal savings were observed with the Short Interval Production Schedule, benefits were still gained. Through emphasizing an average mean of repetition and complexity, the construction team was able to accelerate a very pivotal role that had a long lead time. By accomplishing this task, the City of Jacksonville's expectations are still on target for meeting its project's turnover key for occupancy.

Also relating to schedule efficiency, the three specific additional working days could be put to use in other ways. The working days attributed to the SIPS schedule are referred to free float days. These float days could be more applicable in relation to preventing any "time-lapses" and unexpected delays/damages caused by other trades that could result from on and off of the critical path features.

The $21,250 contribution could be used as an incentive rate at the beginning of the contract phase when dealing with this kind of schedule. A ratio of owner/contractor values could interpolate other substantial gains to turn over better value engineering techniques. Making use of this benefit could possibly make an even quicker turnover from team motivation.

Finally, a distinct organization for trade sequencing is better understood from using a SIPS schedule. The construction team can better analyze what work needs to be accomplished and when it needs to be completed. This eases any chance of trade confusion and site congestion that could come-about from "trade-stacking".

ANALYSIS NUMBER THREE: Financial Analysis Awareness

REVISION IDENTICATION

Financial turmoil struck the DCUCF before the current project could be constructed. Before it could receive the "Go" approval, a plan was devised to compensate for the condition of the construction economy. This plan was to offset new materials, since inflation hit the market for the desired material usage for the project. Recyclable and regional materials were sought which in turn help to aid in LEED Certification.

RESEARCH GOALS

The goal of this analysis is to obtain a financial procedure that could achieve maximum cash flow analyses through different project components for the owner and project team.

METHODOLOGY

- Investigate current financial arrangements of bonds, securities, and strategies
- Research other project financial plans that have been successful for construction
- Research and develop new financial plans
- Interview with the project financial staff
- Interview with PSU SMEAL College
- Research financial institutions
- Perform life cycle costs of plans to the DCUCF

RESOURCE AND TOOL APPLICATIONS

- SMEAL College Faculty and Staff
- AE Faculty
- Professional Documents/Readings
- Florida Financial Institutions
- Industry Professionals

EXPECTED OUTCOMES

The expected outcome of this analysis is to achieve an appropriate financial plan that could aid in financial risks that were encountered by the project team and owner. Other means of project efficiencies (other than material utilization) are expected to be obtained through research. A newly proposed financial plan is sought.

DCUCF HISTORY

Before the project became the Duval County Unified Courthouse Facility, it had several identities. Its first premiere was in the 1840s to be the first courthouse erected in the Duval

County. With a wooden structure being a very popular building material, it became a target during the Civil War and was burnt down to the ground. Its second run came about in 1886 when the basis of building projects was out of brick. It stood ground until the Great Fire of 1901 consumed the downtown Jacksonville area. The DCUCF was then constructed in 1902 with a stone exterior façade and started to grow in population that was centering around a "modern" style. It was then demolished leaving the 1914 annex to be created in its spot.

FINANCIAL BACKGROUND

In 2000, the Duval County area grew at a rapid rate just shy of a million residences and it didn't seem like it was going to stop. To meet these demands of the consumers and the public, the city officials developed a financial inquiry and had the public vote on it. This program was called the Better Jacksonville Plan (BJP) which allotted approximately $2.25 billion for growth management missions to help promote a new of the society through new developments and facilities. The BJP program was funded by a sales tax of a half-cent which the voters approved of. The City of Jacksonville set out for a new courthouse and they first found that in 2000 with Skanska being awarded the $190 M bid as the acting construction manager. The company broke ground but during an economic downfall, the city felt as though Skanska couldn't meet the feasibility of the construction in relation to the increasing construction material costs so construction stopped. $64.3 million dollars was already invested into the project and would remain as part of the budget for future bid packages. In 2004 a new bid went out and Perry-McCall Construction was awarded the contract. This company had a joint venture with The Auchter Company but The Auchter Company was hit hard with finance problems and had to withdraw from the contract. The City of Jacksonville was excited for the project to happen so they awarded it to the second runner-up – Turner Construction Company for $263.5 million in 2006. Turner teamed up with Technical Construction Services Group and KBJ Architects to establish a contract type which was accepted later in 2007. The Jacksonville City Council developed and approved a plan to finance a $350 million budget for the project due to economic research to accommodate for any unforeseen damages.

FINANCIAL STRATEGIES

The City of Jacksonville was really eager to unite its ever-so increasing community as a whole. Due to economic breakdowns and foreign market, the project's construction was delayed over a four year gap. Starting from the Aucther Company failure, several solutions could have been developed to help the progress of the DCUCF. Some of the possible strategies:

1. Track and manage cash-flow within the company
2. Use a Construction by Force Account method
3. Research small and disadvantage enterprises
4. Use a Limited Partnership before bid
5. Use a Joint Venture strategy

MANAGING CASH-FLOW

Cash-flow is defined as the relationship between the contractor's income versus the expenditure of the company. A positive cash-flow dictates that money coming in outweighs when is being spent – in contrast negative cash-flow is the reverse. Every company should asses their financial status to make sure that business failure doesn't occur. Construction is the second highest industry to have failures due to not checking the financial records. The most common companies to fail are those that are small and lack complexity experience. Other factors that contribute to cash-flow business failure are:

1. Incompetence
2. Missing experience in financing and business transaction demands
3. Management skills are low
4. Minimum experience in work
5. Competitive weakness
6. Slow payments
7. Job delays
8. Fraud, disaster & neglect

Specific to the DCUCF while assuming that the Auchter Company knew of their status, they could have sought out financial help. Before the bidding process started, Auchter Company could have analyzed an expected profit margin. This method uses an equation of:

$$\text{Expected profit} = p(h-t)$$

Where p is the probability of getting the bid, h is the amount of the bid, and t is the actual cost of work. P is measured from 0-1 from 1 being the highest and zero is the lowest. By using this method, the company could have determined the pros and cons of wanting to bid for the DCUCF. If they were at a mutual ground, they could have predicted the profit from above and used it to stay in business before filing for failure.

Financial ratios should also be considered before placing a bid. Possible ratios for consideration are: liquidity – company's ability to meet financial standards, activity – level of investment turnover, profitability – relates profit to assets, and leverage – compares debt to total assets or net worth. Theses values along with others can be determined using an income statement and a balance sheet. Figure 20 depicts the ratios.

Ratio	Forumla
Quick Ratio	Quick Asset/Current Liabilites
Current Ratio	Current Assets/Current Liabilites
Total Liability to Net Worth	Total Liabilites/Net Worth
Project income to Net Working	Project Income/Net Working
Project Income to Net Worth	Project Income/Net Worth
Fixed Assests to Net Worth	Fixed Asset/Net Worth
%Project Income to Project Income	Net Project Income*100/Project Income
% Net Project Income to Net Worth	Net Project Income*100/Net Worth
% Net Project Income to Total Assets	Net Project Income*100/Net Worth

Figure 20. Ratio Development

A quick ratio displays the cash that is readily available to put towards debt. Note: that this ratio doesn't include inventory. When the ratio is assigned the value of 1 or higher, then the company is adequate for functioning. The current ratio helps identify short term financing. This is to ask if the company can afford its expected business? If the value is above 1, then the company can afford all of its short term expenditures. The total liabilities to net worth shows the amount that creditors and owners have put into the company. The construction industry emphasizes acceptable values of 1 to 2. Project income to net working and net worth measures the capital turnover on how it's contributing to business. If values are down then profit suffers. Fixed assets to net worth is different in aspect because a higher value means that funded debt is incurred and is over the working capital of the company. Percent net income to project income reveals a company's profit margin on the process of doing work. Percent project income to net worth measures efficiency is measured from the capital that is invested. Lastly, percent project income to total assets relates to how much profit is available compared to assets. All of these ratios are very crucial and help to individual companies monitor and control cash-flow.

CONSTRUCTION BY FORCE ACCOUNT

This method could be implemented by the owner to have control and take over construction by using their own resources. They could operate with supervision of an acting manager. Using force by account allows for day-by-day labor so the owner can track feasibility. Also subcontracts can be lent out by owner discretion to get specialty help while assuming sole responsibility. Force by account is more expensive (but is outweighed by expertise of contractor selection) than all other delivery methods but can assure that the owner gets what he or she wants. Time and cost is usually lost within this method, along with trust.

SMALL AND DISADVANTAGE BUSNIESS ENTERPRISE

The Small and Disadvantage Business Enterprise is a federal act that helps mandate business control to disadvantage and small businesses. A percent of all public contracted bids are given to this program and then is dispersed to companies that fall within this program. This agency could

have helped Auchter Company by setting up sessions to help the company monitor its cash-flow. Along with this program, the agency can finance loans if the company can be assisted before failure is filed.

LIMITED PARTNERSHIP

A limited partnership is defined as a firm or surety that contributes cash or property with another company and assumes the same profit and losses but has no management say. Under this contract duties and obligations are drawn up and dispersed to be followed. The Auchter Company could have reached out to another firm or bank to help them maintain business. A surety bond could have been proposed to ensure that a performance would be provided on a contractual agreement. If the company of the surety bonds fails to provide services then the firm would have to assume those risks associated with the owner of the project. To avoid this setback, the surety usually entails a long investigation or past records and present commitments of the company or contractor. The surety will investigate matters from character, reputation, owner satisfaction, personal habits and more.

JOINT VENTURE

A joint venture is defined as the spreading and utilizing of resources of two or more contracting firms together. This is very useful on big projects that not one company can handle on its own. This contract must be presented to the owner before any work can be awarded. The contract states what responsibilities each partner will have such as leadership roles, limitations of liability against one another, supervision, and administration. But for a joint venture to be legal four factors must be met: a contract, purpose, common interest, and equal right of control. Auchter Company did end up signing a joint venture with Perry Construction once the company fell under. But due to them bidding separately before the bid and not obtaining a license to commit this operation, they reject to stay on with their bid due to unfair bidding.

CONCLUSIONS AND RECOMMENDATIONS

The Duval County Unified Courthouse Facility could have been constructed at its original timeframe if some of these strategies would have been followed. Tracking finances and learning what opportunities there are in society will help a company grow. If Auchter Company could have implemented a financial strategy earlier in the process (before the bidding phase), a joint venture could have been the best option to pursue and could have helped the company maintain business life instead of having to file for failure. Allowing construction to start at its original set date, the DCUCF could have benefited from the following:

1. The construction price would have been lowered and not have to take on more of the government funding. As time went on construction materials increased due to inflation of an economic boom for steel and concrete in China. From the ENR sources, inflation

for construction prices grew marginally about 3-5% each year which results with a $100 million over-bid.

2. The use of the facility would have been in effect earlier. The population was growing and needed this building for its services.
3. Government time could have been focused on other matters. Since this financial situation occurred over a four year gap, it drew the attention of government officials to solve the problem. This means that time and money was taken away from other ticketed items

RESOURCES

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Fiore, Louis. Turner Construction Company. Phone Interview. August 2010.

Lenze, David. The Pennsylvania State University Smeal College of Busniess.Interview 2011.

R.S.Means Engineering Department. *RS Means Building Construction Costs Data 2011*. RS Means Company 2010.

APPENDIX A – STAFFING PLAN CHART

Scott Skidelsky
VP/General Manager

David Reaves
VP/OM/Principal in Charge

Mark Alles
Sr. Project Executive

Lou Fiore
Sr. Project Manager

Tony DeMarco
Senior Business Unit
Safety Director

Margaret Simone
Sr. Project Manager - ENG

Dave Freeman
General Superintendent

Deborah Thompson
JSEB Coordinator
JSEB Coordinator

Linda Brinkley
Project Administrator
Office Manager, Accounting
(Pay App & Invoices), CCIP

Jean Reddick
Administrative Assistant
Asst. JSEB Coordinator

Stephanie Harjung
Administrative Assistant
Receptionist, phones, DCRs,
Security "Cleared" List

Kim Fichte
Administrative Assistant
Receptionist, phones, DCRs,
Security "Cleared" List

David Glotfelty
Engineer
Budget, Monthly Report, Turner
Reporting, ODPs, BIM

Prashant Bhakta
Field Engineer
ODPs, OAC, MEP and BIM
Meeting Minutes, Sub Change Orders

Michael Sprauge
Intern
Submittals, RFIs

DL Bouldrick
Engineer
Submittals, RFIs

Ivis Swan
Asst. Engineer
Document Control, RFIs
ODPs, LEED

Shane Tarno
Field Engineer
Submittals, RFIs, LEED
Benchmark Reporting

Clanzel Brown
Field Engineer - MEP
MEP Submittals and RFIs
MEP Field Corrdination

Paul Boree
Safety Manager
Site Safety

Will Duagan
Safety Engineer
Site Safety

Jody Jones
Strucutral Superintendent
Foundations, Structure, Envelope -
Precast, Glass, Roofing

Kayla Timulak
Superintendent
Envelope - Precast, Glass
Structual Punchlist

Lacey Goeckner
Field Engineer
Structure, Envelope - Precast,
Glass

Jonathan Head
Field Engineer
Envelope - Precast, Glass

Rudy Chisholm
Interiors Superintendent
Detention Equipment, Interior
Finishes

Conor Goodson
Field Engineer
Structure Punchlist, Detention
Equipment

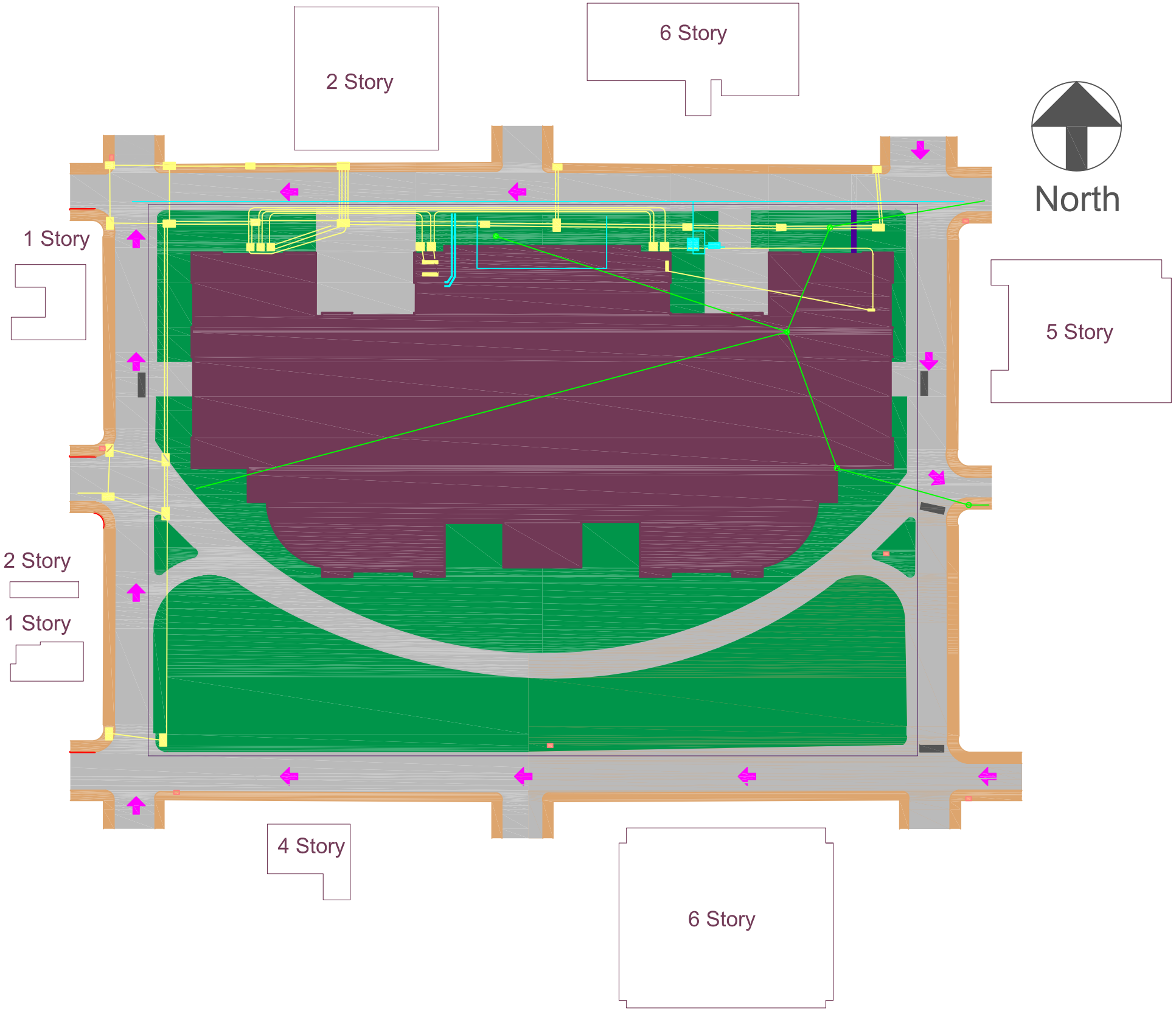
Jorge Argueta
Asst. Superintendent
Doors/Frames/Hardware, Interior
Finishes, Site Security

Rock Feaster
MEP Superintendent
HVAC, Plumbing, Fire Protection,
Electrical

Millard Brewster
MEP Asst. Superintendent
HVAC, Plumbing, Fire Protection,
Electrical, Utilities

Paul Ballowe
Scheduler
Project Schedule

APPENDIX B – EXISTING CONDITION SITE LAYOUT



LEGEND:

Existing Utilities:

- Electric
- Water
- Telecommunication
- Gas

Symbols:

- Road Closed
- Vehicular Traffic
- Construction Fence
- Telecommunications Manhole
- Fire Hydrant
- Transformer
- Electrical Manhole
- Chill Water to Main
- Water Meter
- Switchboard

Duval County Unified Courthouse Facility

Existing Conditions Site Plan

October 9, 2010

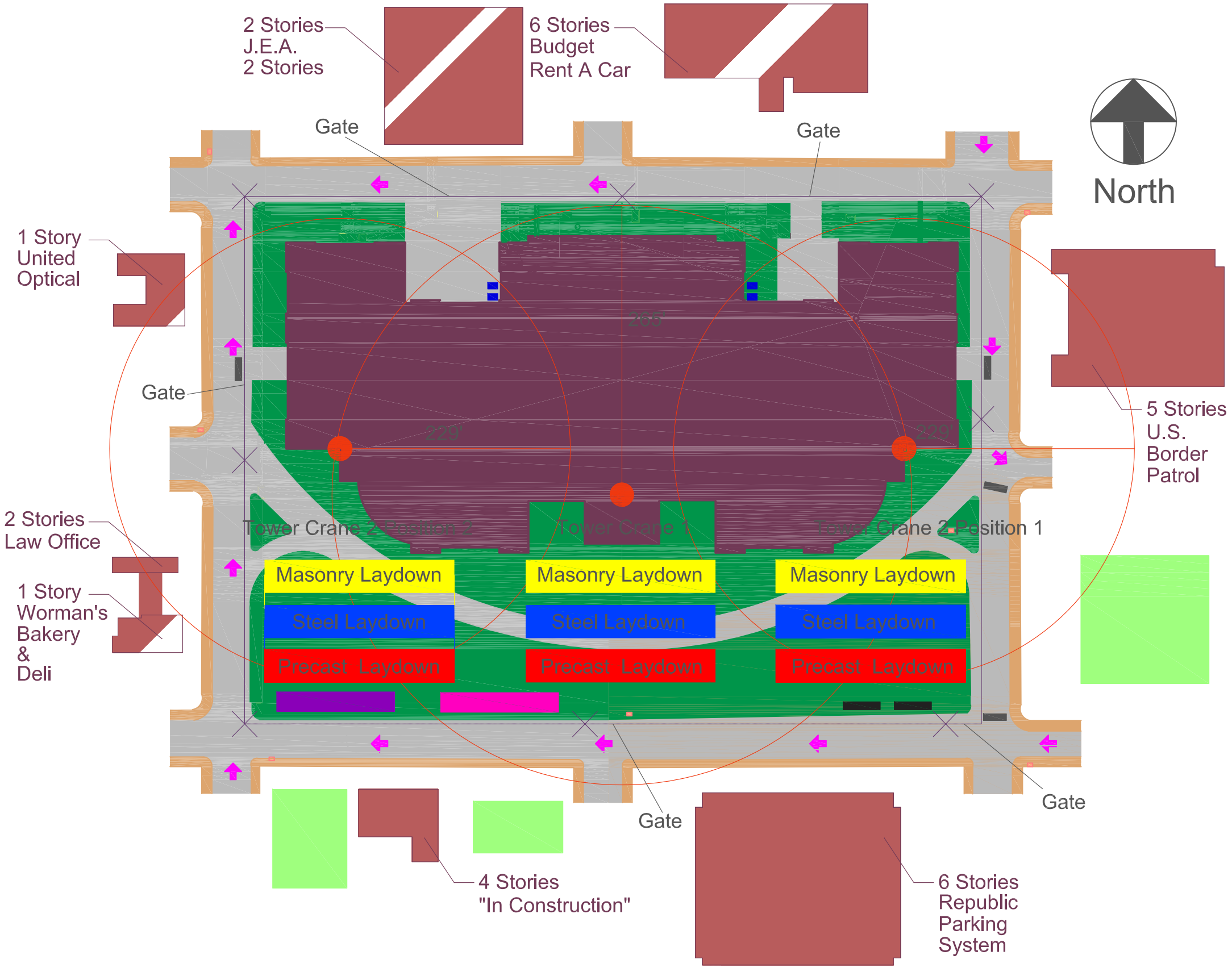
Darre'll Alston

APPENDIX C – LEED CERTIFICATIONS

LEED Goals and Accomplishments		
Owner's Goals	Met	Not Met
Handling Construction Waste	X	
Use of Low Emitting Materials	X	
Use of Locally Manufactured Items	X	
Design and Implementation of Energy Efficient Systems	X	
Use of Materials Having Recycled Content	X	
Indoor Air Quality Requirements	X	
Conservation of Materials During Phases of:	X	
Design, Construction, Commissioning, and Maintenance		

Contractor LEED Achievements	
Category	Points
Site Selection	1
Development Density & Community Connectivity	1
Alternative Transportation (Public Access)	1
Alternative Transportation (Low-Emitting & Fuel Efficient)	1
Site Development (Protect of Restore Habitat)	1
Site Development (Maximize Open Space)	1
Stormwater Design (Quantity Control)	1
Heat Island Effect (Non-Roof)	1
Water Efficient Landscaping (Reduced by 50%)	1
Innovative Wastewater Technologies	1
Water Use Reduction (20% Reduction)	1
Water Use Reduction (30% Reduction)	1
Optimize Energy Performance	2
Construction Waste Management (Divert 50% from Disposal)	1
Construction Waste Management (Divert 75% from Disposal)	1
Recycled Content (10%)	1
Recycled Content (20%)	1
Regional Materials (20% Extracted)	1
Outdoor Air Delivery Monitoring	1
Construction IAQ Management Plan (During Construction)	1
Low-Emitting Materials (Adhesives & Sealants)	1
Low-Emitting Materials (Paints & Coatings)	1
Low-Emitting Materials (Carpet Systems)	1
Low-Emitting Materials (Composite Wood & Agrifiber Products)	1
Indoor Chemical & Pollutant Source Control	1
Thermal Comfort (Design)	1
Thermal Comfort (Verification)	1
Innovative in Design: Sustainable Education	1
Innovative in Design: Low Mercury Lamps (from LEED EB)	1
Innovative in Design: Exemplary Performance WEc3 40% Water R	1
LEED® Accredited Professional	1
Project Total	32
Accompished: LEED CERTIFIED: 26-32 points	

APPENDIX D – SITE LOGISTICS LAYOUT PLANS



LEGEND:

Symbols:

- Masonry Laydown
- Steel Laydown
- Precast Laydown
- Construction Parking
- Double Hoist
- Road Closed
- General Contractor Trailers
- Portable Toilets
- Vehicular Traffic
- Construction Fence
- Fire Hydrant
- Dumpsters

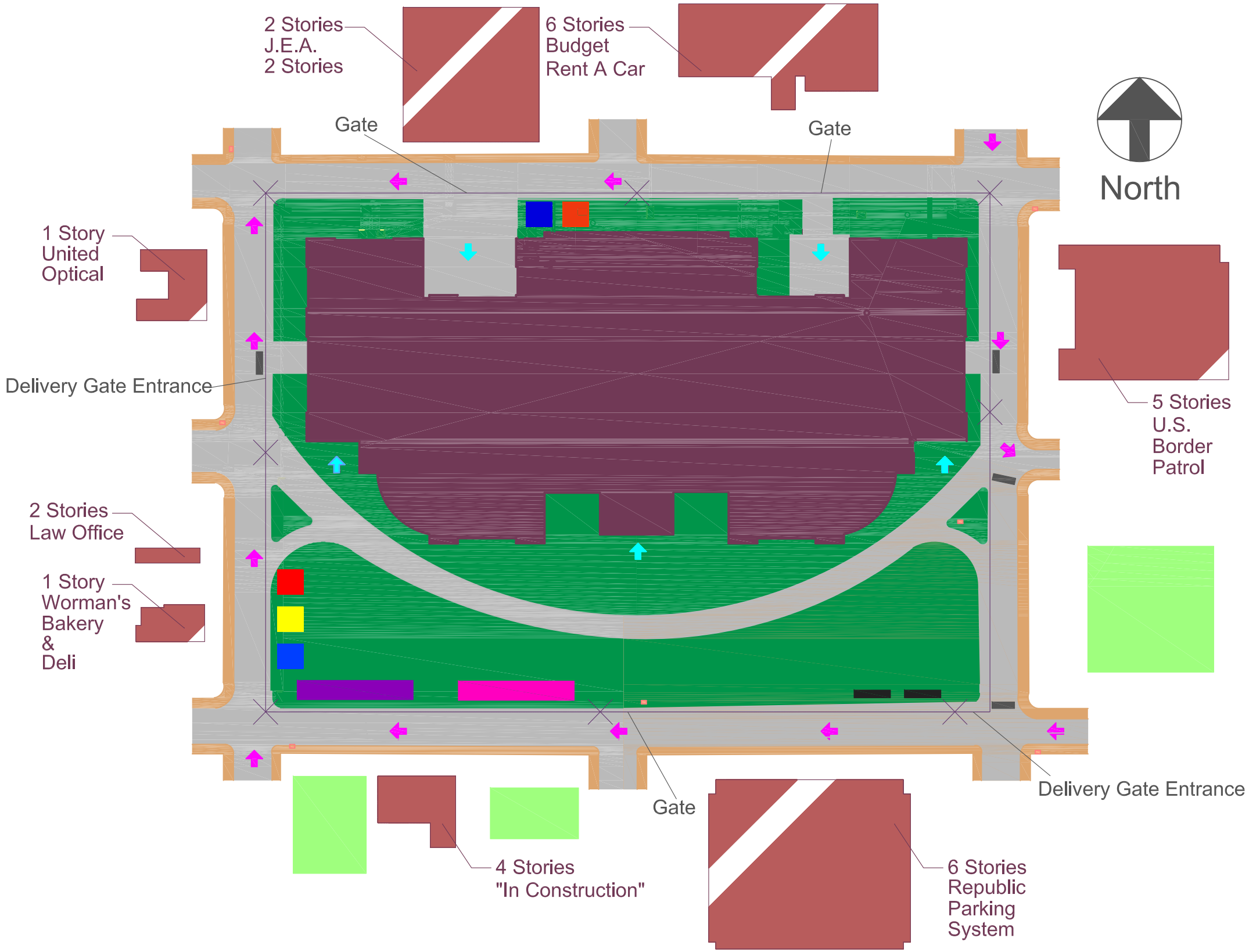
Duval County Unified Courthouse Facility

Superstructure Phase Plan

Scale: 1' = 1/8"

October 27, 2010

Darre'll Alston



LEGEND:

Symbols:

- Material Storage Area
- Electrical Contractor Trailer
- Mechanical Contractor Trailer
- Construction Parking
- Material Access Paths
- Road Closed
- General Contractor Trailers
- Portable Toilets
- Vehicular Traffic
- Construction Fence
- Fire Hydrant
- Dumpsters
- Temporary Water Supply
- Temporary Power Supply

Duval County Unified Courthouse Facility

Interior Services & MEP Site Plan

Scale: 1' = 1/8"

October 27, 2010

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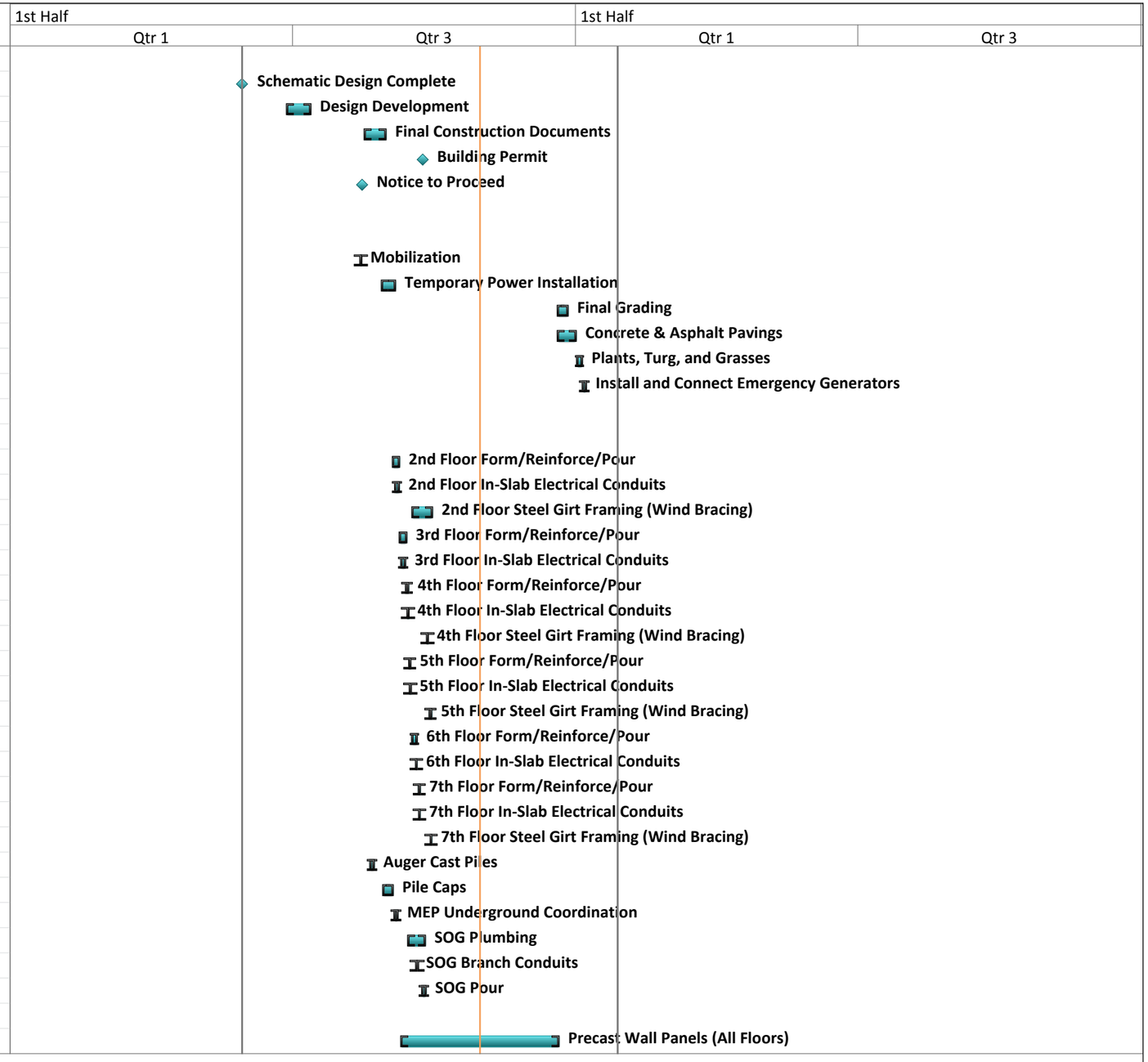
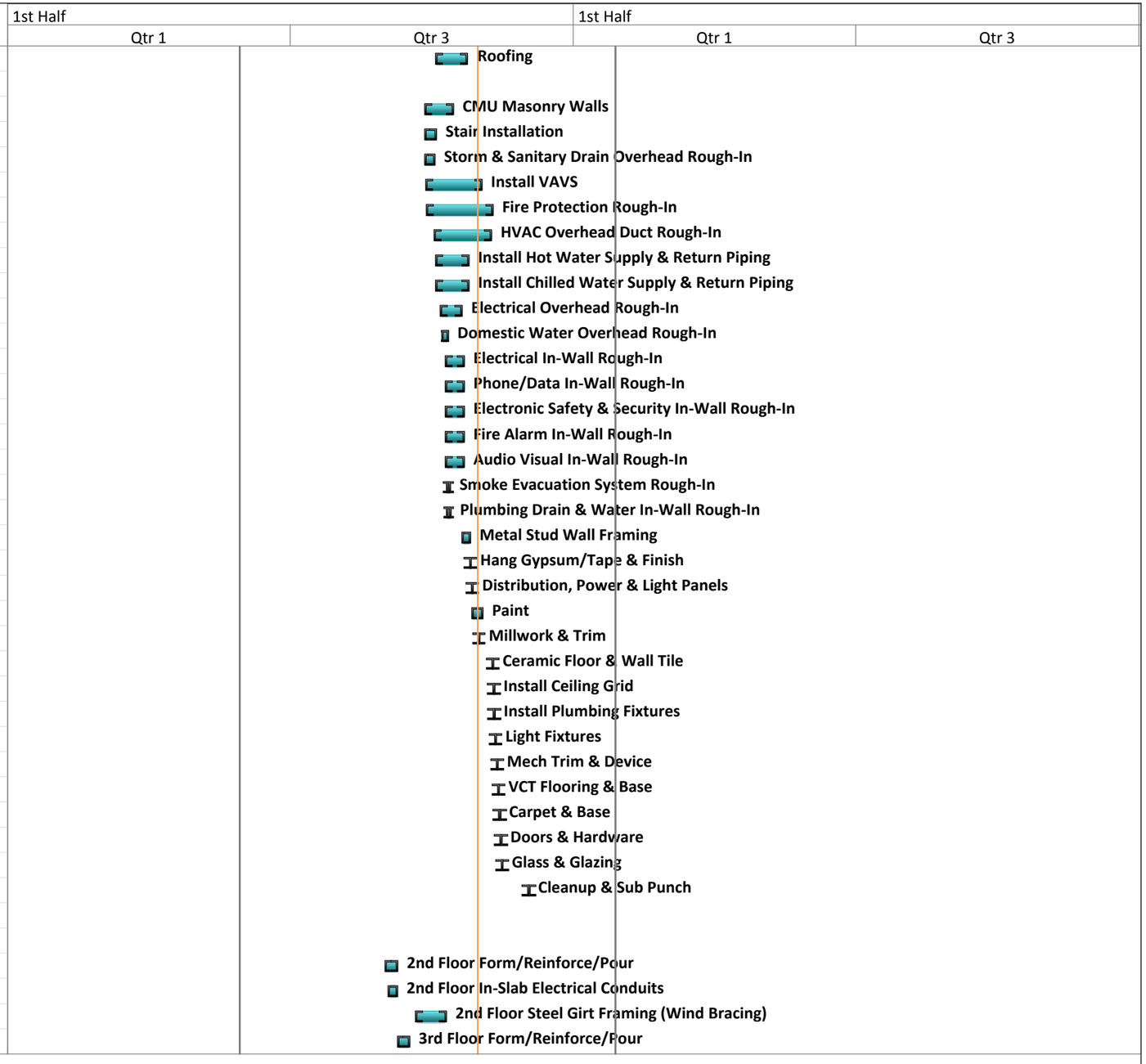
APPENDIX E – PROJECT SCHEDULE

Task Name	Duration	Start	Finish	Predecessors
Preconstruction				
Schematic Design Complete	0 days	Fri 11/16/07	Fri 11/16/07	
Design Development	80 days	Tue 6/3/08	Mon 9/22/08	
Final Construction Documents	73 days	Wed 5/20/09	Fri 8/28/09	
Building Permit	0 days	Wed 2/10/10	Wed 2/10/10	
Notice to Proceed	0 days	Tue 5/12/09	Tue 5/12/09	
Construction				
Sitework				
Mobilization	5 days	Mon 5/4/09	Fri 5/8/09	
Temporary Power Installation	48 days	Thu 8/6/09	Sat 10/10/09	
Final Grading	37 days	Mon 10/10/11	Tue 11/29/11	
Concrete & Asphalt Pavings	64 days	Mon 10/10/11	Thu 1/5/12	
Plants, Turg, and Grasses	20 days	Fri 1/6/12	Thu 2/2/12	
Install and Connect Emergency Generators	15 days	Tue 1/31/12	Mon 2/20/12	
West				
Structural				
2nd Floor Form/Reinforce/Pour	24 days	Fri 9/25/09	Wed 10/28/09	
2nd Floor In-Slab Electrical Conduits	17 days	Mon 10/5/09	Tue 10/27/09	
2nd Floor Steel Girt Framing (Wind Bracing)	69 days	Tue 12/22/09	Fri 3/26/10	
3rd Floor Form/Reinforce/Pour	26 days	Mon 10/26/09	Mon 11/30/09	
3rd Floor In-Slab Electrical Conduits	17 days	Mon 11/2/09	Tue 11/24/09	
4th Floor Form/Reinforce/Pour	12 days	Mon 11/23/09	Tue 12/8/09	
4th Floor In-Slab Electrical Conduits	3 days	Thu 12/3/09	Mon 12/7/09	
4th Floor Steel Girt Framing (Wind Bracing)	5 days	Mon 3/1/10	Fri 3/5/10	
5th Floor Form/Reinforce/Pour	9 days	Tue 12/8/09	Fri 12/18/09	
5th Floor In-Slab Electrical Conduits	4 days	Mon 12/14/09	Thu 12/17/09	
5th Floor Steel Girt Framing (Wind Bracing)	10 days	Wed 3/10/10	Tue 3/23/10	
6th Floor Form/Reinforce/Pour	21 days	Mon 12/21/09	Sat 1/16/10	
6th Floor In-Slab Electrical Conduits	6 days	Fri 1/8/10	Fri 1/15/10	
7th Floor Form/Reinforce/Pour	9 days	Wed 1/20/10	Sat 1/30/10	
7th Floor In-Slab Electrical Conduits	6 days	Fri 1/22/10	Fri 1/29/10	
7th Floor Steel Girt Framing (Wind Bracing)	7 days	Mon 3/15/10	Tue 3/23/10	
Auger Cast Piles	16 days	Mon 6/15/09	Mon 7/6/09	
Pile Caps	35 days	Wed 8/12/09	Tue 9/29/09	
MEP Underground Coordination	14 days	Fri 10/2/09	Wed 10/21/09	
SOG Plumbing	58 days	Thu 12/3/09	Mon 2/22/10	
SOG Branch Conduits	1 day	Fri 1/15/10	Fri 1/15/10	
SOG Pour	16 days	Thu 2/4/10	Thu 2/25/10	
Exterior				
Precast Wall Panels (All Floors)	513 days	Mon 11/2/09	Wed 10/19/11	



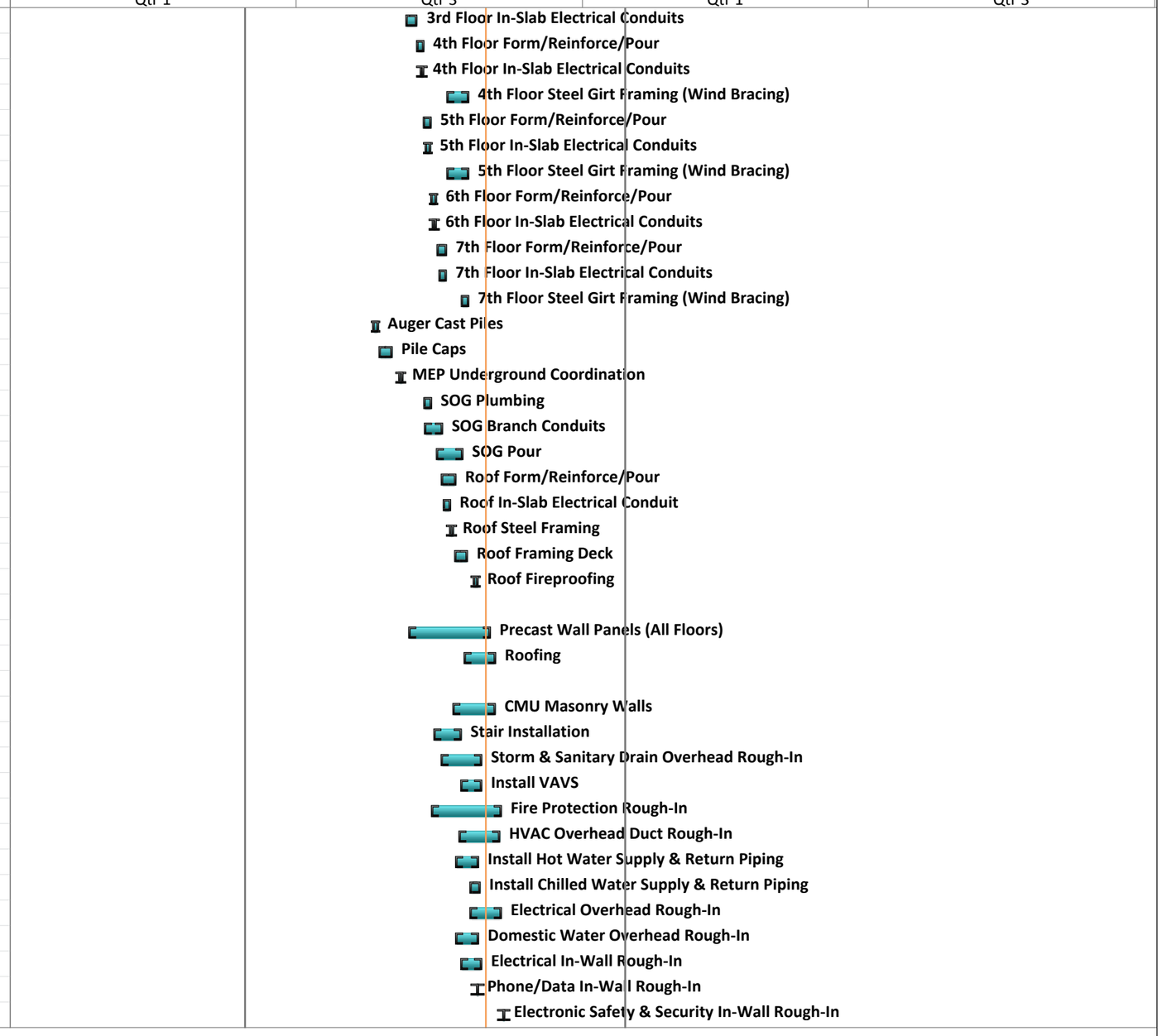
Proje Date:								
Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline				
Split	External Tasks	Inactive Summary	Manual Summary	Progress				
Milestone	External Milestone	Manual Task	Start-only					
Summary	Inactive Task	Duration-only	Finish-only					

Task Name	Duration	Start	Finish	Predecessors
Roofing	105 days	Mon 4/19/10	Fri 9/10/10	
Interior				
CMU Masonry Walls	95 days	Mon 3/1/10	Fri 7/9/10	
Stair Installation	40 days	Mon 3/1/10	Fri 4/23/10	
Storm & Sanitary Drain Overhead Rough-In	35 days	Mon 3/1/10	Fri 4/16/10	
Install VAVS	182 days	Fri 3/5/10	Mon 11/15/10	
Fire Protection Rough-In	217 days	Mon 3/8/10	Tue 1/4/11	
HVAC Overhead Duct Rough-In	187 days	Mon 4/12/10	Tue 12/28/10	
Install Hot Water Supply & Return Piping	110 days	Mon 4/19/10	Fri 9/17/10	
Install Chilled Water Supply & Return Piping	110 days	Mon 4/19/10	Fri 9/17/10	
Electrical Overhead Rough-In	72 days	Mon 5/10/10	Tue 8/17/10	
Domestic Water Overhead Rough-In	23 days	Mon 5/17/10	Wed 6/16/10	
Electrical In-Wall Rough-In	63 days	Wed 6/2/10	Fri 8/27/10	
Phone/Data In-Wall Rough-In	63 days	Wed 6/2/10	Fri 8/27/10	
Electronic Safety & Security In-Wall Rough-In	63 days	Wed 6/2/10	Fri 8/27/10	
Fire Alarm In-Wall Rough-In	63 days	Wed 6/2/10	Fri 8/27/10	
Audio Visual In-Wall Rough-In	63 days	Wed 6/2/10	Fri 8/27/10	
Smoke Evacuation System Rough-In	15 days	Mon 6/7/10	Fri 6/25/10	
Plumbing Drain & Water In-Wall Rough-In	16 days	Mon 6/7/10	Mon 6/28/10	
Metal Stud Wall Framing	30 days	Mon 8/16/10	Fri 9/24/10	
Hang Gypsum/Tape & Finish	5 days	Tue 9/21/10	Mon 9/27/10	
Distribution, Power & Light Panels	7 days	Tue 9/28/10	Wed 10/6/10	
Paint	37 days	Thu 9/30/10	Fri 11/19/10	
Millwork & Trim	8 days	Wed 10/27/10	Fri 11/5/10	
Ceramic Floor & Wall Tile	6 days	Thu 12/30/10	Thu 1/6/11	
Install Ceiling Grid	3 days	Thu 1/6/11	Mon 1/10/11	
Install Plumbing Fixtures	3 days	Fri 1/7/11	Tue 1/11/11	
Light Fixtures	7 days	Tue 1/11/11	Wed 1/19/11	
Mech Trim & Device	5 days	Thu 1/20/11	Wed 1/26/11	
VCT Flooring & Base	6 days	Tue 1/25/11	Tue 2/1/11	
Carpet & Base	3 days	Wed 2/2/11	Fri 2/4/11	
Doors & Hardware	4 days	Mon 2/7/11	Thu 2/10/11	
Glass & Glazing	5 days	Fri 2/11/11	Thu 2/17/11	
Cleanup & Sub Punch	3 days	Tue 6/14/11	Thu 6/16/11	
Center				
Structural				
2nd Floor Form/Reinforce/Pour	43 days	Wed 9/2/09	Fri 10/30/09	
2nd Floor In-Slab Electrical Conduits	32 days	Wed 9/16/09	Thu 10/29/09	
2nd Floor Steel Girt Framing (Wind Bracing)	101 days	Mon 1/18/10	Mon 6/7/10	
3rd Floor Form/Reinforce/Pour	40 days	Thu 10/29/09	Wed 12/23/09	



Proje Date:												
	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline			
	Split		External Tasks		Inactive Summary		Manual Summary		Progress			
	Milestone		External Milestone		Manual Task		Start-only					
	Summary		Inactive Task		Duration-only		Finish-only					

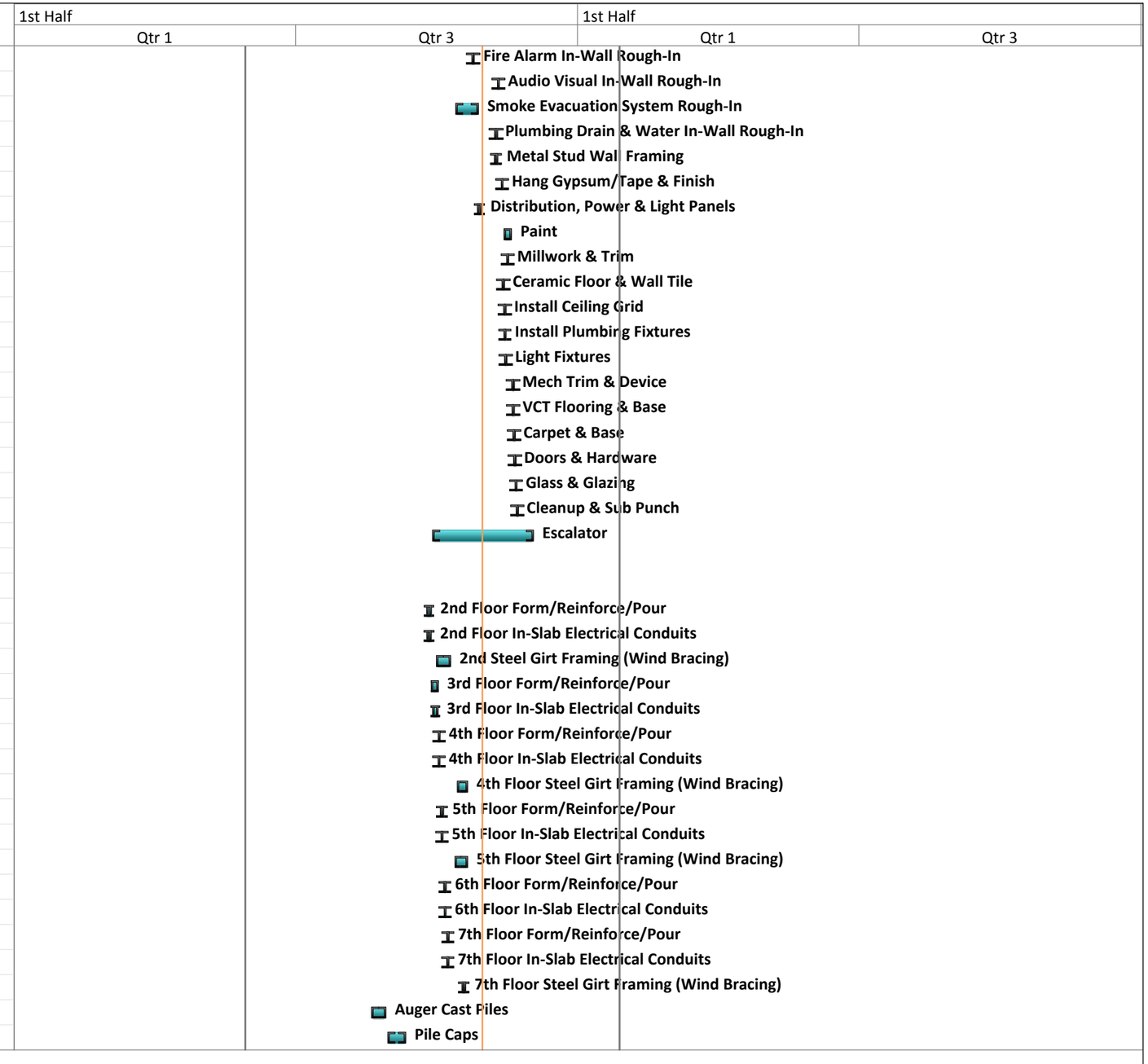
Task Name	Duration	Start	Finish	Predecessors
3rd Floor In-Slab Electrical Conduits	36 days	Tue 11/3/09	Tue 12/22/09	
4th Floor Form/Reinforce/Pour	26 days	Mon 12/21/09	Sat 1/23/10	
4th Floor In-Slab Electrical Conduits	13 days	Wed 1/6/10	Fri 1/22/10	
4th Floor Steel Girt Framing (Wind Bracing)	71 days	Wed 5/5/10	Wed 8/11/10	
5th Floor Form/Reinforce/Pour	26 days	Wed 1/20/10	Wed 2/24/10	
5th Floor In-Slab Electrical Conduits	18 days	Thu 1/28/10	Mon 2/22/10	
5th Floor Steel Girt Framing (Wind Bracing)	71 days	Wed 5/5/10	Wed 8/11/10	
6th Floor Form/Reinforce/Pour	21 days	Mon 2/22/10	Sat 3/20/10	
6th Floor In-Slab Electrical Conduits	15 days	Mon 3/1/10	Fri 3/19/10	
7th Floor Form/Reinforce/Pour	32 days	Mon 3/22/10	Tue 5/4/10	
7th Floor In-Slab Electrical Conduits	24 days	Wed 3/31/10	Mon 5/3/10	
7th Floor Steel Girt Framing (Wind Bracing)	25 days	Thu 7/8/10	Wed 8/11/10	
Auger Cast Piles	21 days	Mon 6/8/09	Sat 7/4/09	
Pile Caps	44 days	Mon 7/6/09	Thu 9/3/09	
MEP Underground Coordination	14 days	Fri 10/2/09	Wed 10/21/09	
SOG Plumbing	26 days	Fri 1/22/10	Fri 2/26/10	
SOG Branch Conduits	60 days	Mon 1/25/10	Fri 4/16/10	
SOG Pour	86 days	Fri 3/19/10	Fri 7/16/10	
Roof Form/Reinforce/Pour	48 days	Sat 4/10/10	Tue 6/15/10	
Roof In-Slab Electrical Conduit	26 days	Mon 4/19/10	Sat 5/22/10	
Roof Steel Framing	15 days	Mon 5/17/10	Fri 6/4/10	
Roof Framing Deck	42 days	Wed 6/9/10	Thu 8/5/10	
Roof Fireproofing	17 days	Tue 8/31/10	Wed 9/22/10	
Exterior				
Precast Wall Panels (All Floors)	262 days	Mon 11/16/09	Tue 11/16/10	
Roofing	102 days	Wed 7/21/10	Thu 12/9/10	
Interior				
CMU Masonry Walls	137 days	Tue 6/1/10	Wed 12/8/10	
Stair Installation	90 days	Mon 3/8/10	Fri 7/9/10	
Storm & Sanitary Drain Overhead Rough-In	131 days	Fri 4/9/10	Fri 10/8/10	
Install VAVS	69 days	Tue 7/6/10	Fri 10/8/10	
Fire Protection Rough-In	224 days	Thu 2/25/10	Tue 1/4/11	
HVAC Overhead Duct Rough-In	132 days	Mon 6/28/10	Tue 12/28/10	
Install Hot Water Supply & Return Piping	76 days	Sun 6/13/10	Fri 9/24/10	
Install Chilled Water Supply & Return Piping	35 days	Mon 8/16/10	Fri 10/1/10	
Electrical Overhead Rough-In	102 days	Mon 8/16/10	Tue 1/4/11	
Domestic Water Overhead Rough-In	76 days	Sun 6/13/10	Fri 9/24/10	
Electrical In-Wall Rough-In	69 days	Tue 7/6/10	Fri 10/8/10	
Phone/Data In-Wall Rough-In	4 days	Fri 9/17/10	Wed 9/22/10	
Electronic Safety & Security In-Wall Rough-In	8 days	Mon 1/10/11	Wed 1/19/11	



Proje
Date:

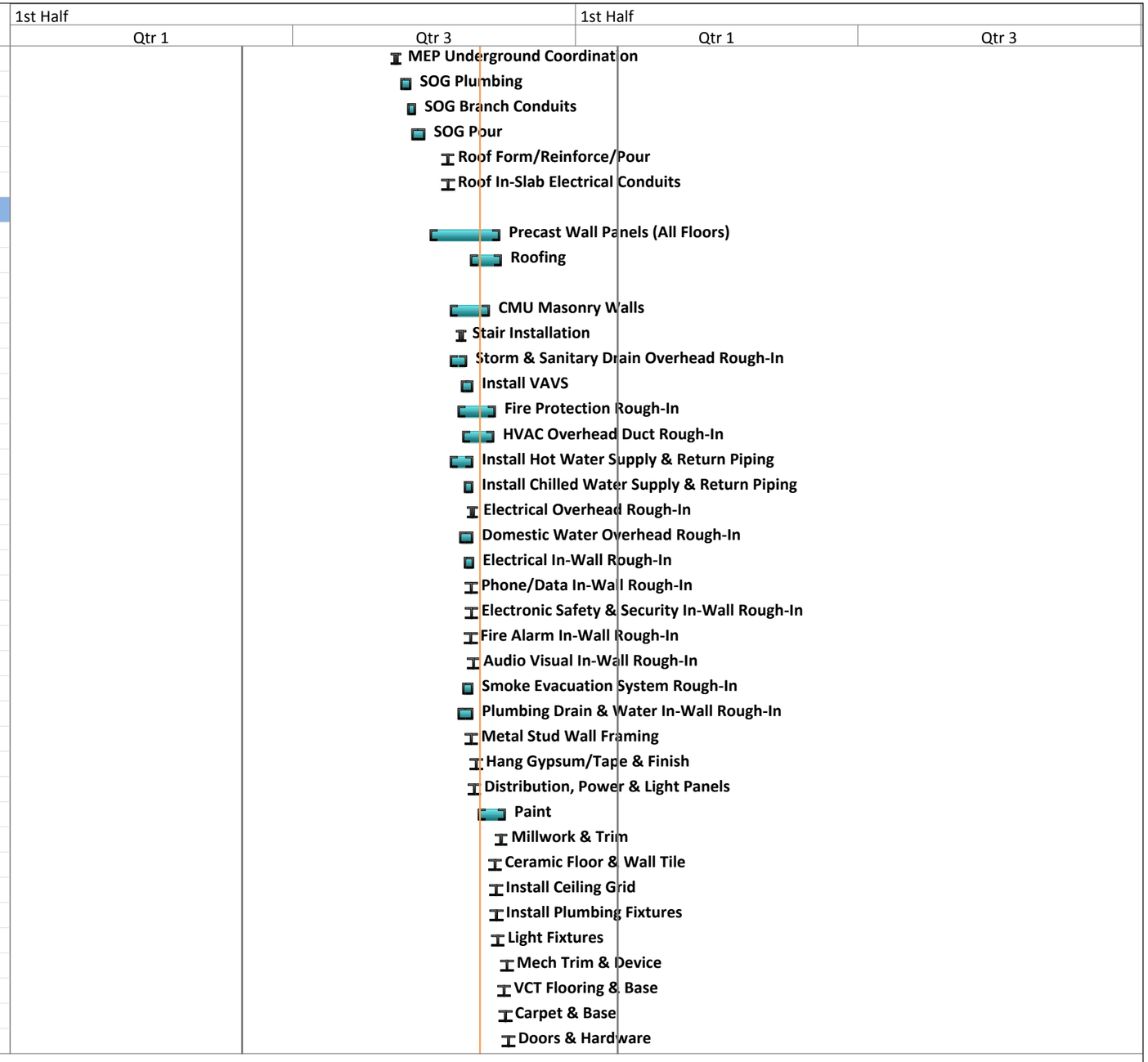
Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline	
Split	External Tasks	Inactive Summary	Manual Summary	Progress	
Milestone	External Milestone	Manual Task	Start-only		
Summary	Inactive Task	Duration-only	Finish-only		

Task Name	Duration	Start	Finish	Predecessors
Fire Alarm In-Wall Rough-In	4 days	Mon 9/13/10	Thu 9/16/10	
Audio Visual In-Wall Rough-In	4 days	Wed 1/5/11	Mon 1/10/11	
Smoke Evacuation System Rough-In	75 days	Mon 6/28/10	Fri 10/8/10	
Plumbing Drain & Water In-Wall Rough-In	1 day	Tue 12/28/10	Tue 12/28/10	
Metal Stud Wall Framing	12 days	Mon 12/20/10	Tue 1/4/11	
Hang Gypsum/Tape & Finish	5 days	Fri 1/21/11	Thu 1/27/11	
Distribution, Power & Light Panels	15 days	Mon 10/4/10	Fri 10/22/10	
Paint	24 days	Wed 2/2/11	Mon 3/7/11	
Millwork & Trim	4 days	Wed 2/16/11	Mon 2/21/11	
Ceramic Floor & Wall Tile	2 days	Fri 1/28/11	Mon 1/31/11	
Install Ceiling Grid	2 days	Fri 2/4/11	Mon 2/7/11	
Install Plumbing Fixtures	8 days	Tue 2/1/11	Thu 2/10/11	
Light Fixtures	4 days	Tue 2/8/11	Fri 2/11/11	
Mech Trim & Device	3 days	Mon 3/14/11	Wed 3/16/11	
VCT Flooring & Base	4 days	Mon 3/14/11	Thu 3/17/11	
Carpet & Base	2 days	Fri 3/18/11	Mon 3/21/11	
Doors & Hardware	3 days	Tue 3/22/11	Thu 3/24/11	
Glass & Glazing	5 days	Fri 3/25/11	Thu 3/31/11	
Cleanup & Sub Punch	3 days	Fri 4/1/11	Tue 4/5/11	
Escalator	328 days	Mon 3/15/10	Wed 6/15/11	
East				
Structural				
2nd Floor Form/Reinforce/Pour	16 days	Tue 2/16/10	Tue 3/9/10	
2nd Floor In-Slab Electrical Conduits	14 days	Wed 2/17/10	Mon 3/8/10	
2nd Steel Girt Framing (Wind Bracing)	47 days	Thu 4/1/10	Fri 6/4/10	
3rd Floor Form/Reinforce/Pour	24 days	Tue 3/9/10	Fri 4/9/10	
3rd Floor In-Slab Electrical Conduits	19 days	Mon 3/15/10	Thu 4/8/10	
4th Floor Form/Reinforce/Pour	7 days	Fri 4/9/10	Sat 4/17/10	
4th Floor In-Slab Electrical Conduits	6 days	Fri 4/9/10	Fri 4/16/10	
4th Floor Steel Girt Framing (Wind Bracing)	35 days	Mon 7/5/10	Fri 8/20/10	
5th Floor Form/Reinforce/Pour	11 days	Mon 4/19/10	Mon 5/3/10	
5th Floor In-Slab Electrical Conduits	7 days	Thu 4/22/10	Fri 4/30/10	
5th Floor Steel Girt Framing (Wind Bracing)	42 days	Thu 6/24/10	Fri 8/20/10	
6th Floor Form/Reinforce/Pour	10 days	Tue 5/4/10	Sat 5/15/10	
6th Floor In-Slab Electrical Conduits	7 days	Thu 5/6/10	Fri 5/14/10	
7th Floor Form/Reinforce/Pour	9 days	Tue 5/18/10	Fri 5/28/10	
7th Floor In-Slab Electrical Conduits	8 days	Tue 5/18/10	Thu 5/27/10	
7th Floor Steel Girt Framing (Wind Bracing)	13 days	Mon 7/26/10	Wed 8/11/10	
Auger Cast Piles	47 days	Thu 6/11/09	Fri 8/14/09	
Pile Caps	59 days	Mon 8/24/09	Thu 11/12/09	



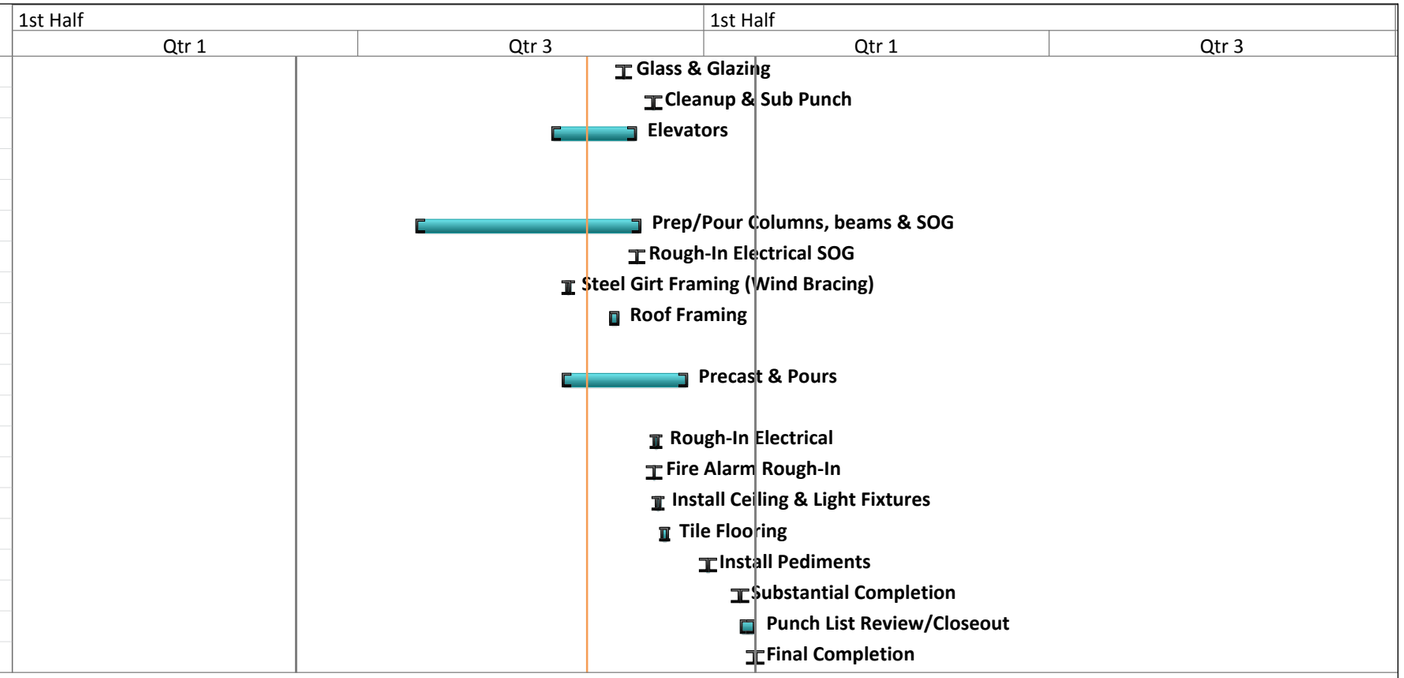
Proje Date:								
Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline				
Split	External Tasks	Inactive Summary	Manual Summary	Progress				
Milestone	External Milestone	Manual Task	Start-only					
Summary	Inactive Task	Duration-only	Finish-only					

Task Name	Duration	Start	Finish	Predecessors
MEP Underground Coordination	14 days	Fri 10/2/09	Wed 10/21/09	
SOG Plumbing	35 days	Mon 11/2/09	Fri 12/18/09	
SOG Branch Conduits	27 days	Thu 12/3/09	Fri 1/8/10	
SOG Pour	44 days	Tue 12/22/09	Fri 2/19/10	
Roof Form/Reinforce/Pour	8 days	Sat 5/29/10	Tue 6/8/10	
Roof In-Slab Electrical Conduits	4 days	Wed 6/2/10	Mon 6/7/10	
Exterior				
Precast Wall Panels (All Floors)	226 days	Mon 3/15/10	Mon 1/24/11	
Roofing	101 days	Mon 9/13/10	Mon 1/31/11	
Interior				
CMU Masonry Walls	128 days	Mon 6/14/10	Wed 12/8/10	
Stair Installation	15 days	Fri 7/23/10	Thu 8/12/10	
Storm & Sanitary Drain Overhead Rough-In	55 days	Mon 6/14/10	Fri 8/27/10	
Install VAVS	39 days	Tue 8/3/10	Fri 9/24/10	
Fire Protection Rough-In	122 days	Mon 7/19/10	Tue 1/4/11	
HVAC Overhead Duct Rough-In	102 days	Mon 8/9/10	Tue 12/28/10	
Install Hot Water Supply & Return Piping	75 days	Mon 6/14/10	Fri 9/24/10	
Install Chilled Water Supply & Return Piping	30 days	Mon 8/16/10	Fri 9/24/10	
Electrical Overhead Rough-In	15 days	Mon 9/13/10	Fri 10/1/10	
Domestic Water Overhead Rough-In	45 days	Mon 7/26/10	Fri 9/24/10	
Electrical In-Wall Rough-In	32 days	Mon 8/16/10	Tue 9/28/10	
Phone/Data In-Wall Rough-In	7 days	Mon 9/13/10	Tue 9/21/10	
Electronic Safety & Security In-Wall Rough-In	7 days	Tue 9/14/10	Wed 9/22/10	
Fire Alarm In-Wall Rough-In	5 days	Mon 9/13/10	Fri 9/17/10	
Audio Visual In-Wall Rough-In	7 days	Thu 9/23/10	Fri 10/1/10	
Smoke Evacuation System Rough-In	35 days	Mon 8/9/10	Fri 9/24/10	
Plumbing Drain & Water In-Wall Rough-In	50 days	Mon 7/19/10	Fri 9/24/10	
Metal Stud Wall Framing	7 days	Mon 9/13/10	Tue 9/21/10	
Hang Gypsum/Tape & Finish	5 days	Thu 10/7/10	Wed 10/13/10	
Distribution, Power & Light Panels	7 days	Mon 9/27/10	Tue 10/5/10	
Paint	90 days	Mon 10/18/10	Fri 2/18/11	
Millwork & Trim	10 days	Mon 1/24/11	Fri 2/4/11	
Ceramic Floor & Wall Tile	6 days	Thu 12/30/10	Thu 1/6/11	
Install Ceiling Grid	3 days	Thu 1/6/11	Mon 1/10/11	
Install Plumbing Fixtures	3 days	Fri 1/7/11	Tue 1/11/11	
Light Fixtures	7 days	Tue 1/11/11	Wed 1/19/11	
Mech Trim & Device	5 days	Wed 2/23/11	Tue 3/1/11	
VCT Flooring & Base	6 days	Wed 2/9/11	Wed 2/16/11	
Carpet & Base	3 days	Thu 2/17/11	Mon 2/21/11	
Doors & Hardware	4 days	Wed 3/2/11	Mon 3/7/11	



Proje Date:								
Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

Task Name	Duration	Start	Finish	Predecessors
Glass & Glazing	5 days	Tue 3/8/11	Mon 3/14/11	
Cleanup & Sub Punch	3 days	Tue 6/28/11	Thu 6/30/11	
Elevators	224 days	Fri 6/18/10	Wed 4/27/11	
Colonnade				
Structural				
Prep/Pour Columns, beams & SOG	596 days	Sun 2/1/09	Fri 5/13/11	
Rough-In Electrical SOG	5 days	Tue 4/26/11	Mon 5/2/11	
Steel Girt Framing (Wind Bracing)	15 days	Mon 8/9/10	Fri 8/27/10	
Roof Framing	25 days	Tue 1/18/11	Mon 2/21/11	
Exterior				
Precast & Pours	332 days	Tue 7/27/10	Wed 11/2/11	
Interior				
Rough-In Electrical	16 days	Tue 6/28/11	Tue 7/19/11	
Fire Alarm Rough-In	6 days	Tue 6/28/11	Tue 7/5/11	
Install Ceiling & Light Fixtures	15 days	Wed 7/6/11	Tue 7/26/11	
Tile Flooring	20 days	Wed 7/27/11	Tue 8/23/11	
Install Pediments	2 days	Mon 1/16/12	Tue 1/17/12	
Substantial Completion	1 day	Mon 5/14/12	Mon 5/14/12	
Punch List Review/Closeout	40 days	Tue 5/15/12	Mon 7/9/12	
Final Completion	1 day	Mon 7/9/12	Mon 7/9/12	



Proje
Date:

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline			
Split	External Tasks	Inactive Summary	Manual Summary	Progress			
Milestone	External Milestone	Manual Task	Start-only				
Summary	Inactive Task	Duration-only	Finish-only				

APPENDIX F – DETAILED STRUCTURAL ESTIMATE

FLOORS

1 Typical Bay Method

Pan-Joists

Size	Units	Quantity	Bay Width (LF)	Length of Building (LF)	Bay Area Covered (SF)	Bay Area Covered Total (SF)	Bay Area Covered Building Total (SF)	Total CY	Member Size	Units	Quantity	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total	No. Bays	Rebar	Length	Weight	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total
27x29	L.F.	30.3	24	620.6	727.2	18804.18	112825.08	65814.63	27x29	CY	73.23	106	34.5	12.95	153.45	7762.38	2526.435	948.3285	11237.14		14-#3	24	0.0631	840	380	0	1220	53.004	23.978	0	76.982
8x29	L.F.	30.3							8x29	CY	21.7	106	34.5	12.95	153.45	2300.2	748.65	281.015	3329.865		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	30.3							8x29	CY	21.7	106	34.5	12.95	153.45	2300.2	748.65	281.015	3329.865		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	30.3							8x29	CY	21.7	106	34.5	12.95	153.45	2300.2	748.65	281.015	3329.865		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	30.3							8x29	CY	21.7	106	34.5	12.95	153.45	2300.2	748.65	281.015	3329.865		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
																		Total	24556.6	x 18 Bays										Total	340.99
																				442018.8										x 18 Bays	6120
Size	Units	Quantity							Member Size	Units	Quantity	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total												
27x32	L.F.	37	24	520.6	888	12494.4	74964	43729	27x32	CY	98.67	106	34.5	12.95	153.45	10459.02	3404.115	1277.7765	15140.91		14-#3	24	0.0631	840	380	0	1220	53.004	23.978	0	76.982
8x29	L.F.	37							8x29	CY	26.49	106	34.5	12.95	153.45	2807.94	913.905	343.0455	4064.891		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	37							8x29	CY	26.49	106	34.5	12.95	153.45	2807.94	913.905	343.0455	4064.891		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	37							8x29	CY	26.49	106	34.5	12.95	153.45	2807.94	913.905	343.0455	4064.891		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	37							8x29	CY	26.49	106	34.5	12.95	153.45	2807.94	913.905	343.0455	4064.891		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
																		Total	31400.47	x 18 Bays										Total	340.99
																				565208.46										x 18 Bays	6120
Size	Units	Quantity							Member Size	Units	Quantity	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total												
27x29	L.F.	32.2	24	620.6	772.8	18804.18	112825.08	65814.63	27x29	CY	77.82	106	34.5	12.95	153.45	8248.92	2684.79	1007.769	11941.48		14-#3	24	0.0631	840	380	0	1220	53.004	23.978	0	76.982
8x29	L.F.	32.2							8x29	CY	23.06	106	34.5	12.95	153.45	2444.36	795.57	298.627	3538.557		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	32.2							8x29	CY	23.06	106	34.5	12.95	153.45	2444.36	795.57	298.627	3538.557		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	32.2							8x29	CY	23.06	106	34.5	12.95	153.45	2444.36	795.57	298.627	3538.557		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	32.2							8x29	CY	23.06	106	34.5	12.95	153.45	2444.36	795.57	298.627	3538.557		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
																		Total	26095.71	x 18 Bays										Total	340.99
																				469722.78										x 18 Bays	6120
Size	Units	Quantity							Member Size	Units	Quantity	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total												
27x29	L.F.	38	24	620.6	912	18804.18	112825.08	65814.63	27x29	CY	91.83	106	34.5	12.95	153.45	197.83	126.33	104.78	428.94		14-#3	24	0.0631	840	380	0	1220	53.004	23.978	0	76.982
8x29	L.F.	38							8x29	CY	27.21	106	34.5	12.95	153.45	133.21	61.71	40.16	235.08		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	38							8x29	CY	27.21	106	34.5	12.95	153.45	133.21	61.71	40.16	235.08		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	38							8x29	CY	27.21	106	34.5	12.95	153.45	133.21	61.71	40.16	235.08		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	38							8x29	CY	27.21	106	34.5	12.95	153.45	133.21	61.71	40.16	235.08		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
																		Total	1369.26	x 18 Bays										Total	340.99
																				24646.68										x 18 Bays	6120
Size	Units	Quantity							Member Size	Units	Quantity	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total												
19x29	L.F.	12.2	24	620.6	292.8	18804.18	112825.08	65814.63	19x29	CY	20.75	106	34.5	12.95	153.45	126.75	715.875	268.7125	1111.338		14-#3	24	0.0631	840	380	0	1220	53.004	23.978	0	76.982
8x29	L.F.	12.2							8x29	CY	8.74	106	34.5	12.95	153.45	114.74	301.53	113.183	529.453		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	12.2							8x29	CY	8.74	106	34.5	12.95	153.45	114.74	301.53	113.183	529.453		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	12.2							8x29	CY	8.74	106	34.5	12.95	153.45	114.74	301.53	113.183	529.453		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	12.2							8x29	CY	8.74	106	34.5	12.95	153.45	114.74	301.53	113.183	529.453		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
																		Total	3229.15	x 18 Bays										Total	340.99
																				58124.7										x 18 Bays	6120
Size	Units	Quantity							Member Size	Units	Quantity	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total												
19x29	L.F.	29.1	24	620.6	698.4	18804.18	112825.08	65814.63	19x29	CY	49.49	106	34.5	12.95	153.45	5245.94	1707.405	640.8955	7594.241		14-#3	24	0.0631	840	380	0	1220	53.004	23.978	0	76.982
8x29	L.F.	29.1							8x29	CY	20.84	106	34.5	12.95	153.45	2209.04	718.98	269.878	3197.898		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	29.1							8x29	CY	20.84	106	34.5	12.95	153.45	2209.04	718.98	269.878	3197.898		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	29.1							8x29	CY	20.84	106	34.5	12.95	153.45	2209.04	718.98	269.878	3197.898		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
8x29	L.F.	29.1							8x29	CY	20.84	106	34.5	12.95	153.45	2209.04	718.98	269.878	3197.898		12-#3	24	0.0541	840	380	0	1220	45.444	20.558	0	66.002
																		Total	20385.83	x 18 Bays										Total	340.99
																				366944.94										x 18 Bays	6120

Concrete Columns

Size	Height (LF)	CY	Quantity	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total	Reinforcement	LF	Rebar Weight, Tons	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total
16x24"	18	21.33	118	106	34.5	12.95	153.45	266795.64	86834.43	32594.373	386224.443	10-#3	180	0.0338	840	380	0	1220	28.392	12.844	0	41.236
18"x24"	18	24	19	106	34.5	12.95	153.45	48336	15732	5905.2	69973.2	10-#3	180	0.0338	840	380	0	1220	28.392	12.844	0	41.236
18"x28"	18	28	1	106	34.5	12.95	153.45	2968	966	362.6	4296.6	16-#7	288	4.71	840	380	0	1220	3956.4	1789.8	0	5746.2
24"x24"	18	32	532	106	34.5	12.95	153.45	1804544	587328	220460.8	2612332.8	9-#9	162	2.48	840	380	0	1220	2083.2	942.4	0	3025.6
26"x26"	18	37.56	3	106	34.5	12.95	153.45	11944.08	3887.46	1459.206	17290.746	20-#7	360	7.36	840	380	0	1220	6182.4	2796.8	0	8979.2
24"x28"	18	37.33	1	106	34.5	12.95	153.45	3956.98	1287.885	483.4235	5728.2885	16-#7	288	4.71	840	380	0	1220	3956.4	1789.8	0	5746.2
										Total	3095846.078										Total	23579.672

Steel Trusses for Upper Roofs

Size	Units	Quantity	No.	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total
W24x104	L.F.	18	19	128	3.77	1.89	133.66	165	40.77	38.89	244.66
W12x40	L.F.	18	21	51	3.01	2.01	56.02	90	42.01	41.01	173.02
W24x131	L.F.	18	2	5.22	4.35	2.24	11.81	25.22	24.35	22.24	71.81
W12x79	L.F.	18	6	91	4.31	3.27	98.58	115	28.31	27.27	170.58
W12x53	L.F.	18	6	65.25	3.13	2.09	70.47	89.25	27.13	26.09	142.47
										Total	802.54

Concrete and Rebar for Pile Caps

Type	Width (LF)	Length (LF)	Area (SF)	Depth (LF)	Concrete Used (CY)	Quantity	Reinforcement		Rebar Weight, Tons	Pile Cap	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total	Rebar	Material	Labor	Equipment	Total	Material	Labor	Equipment	Total
Type 1	3.5	3.5	12.25	3.5	1.588	10	5-#6 Vert.	5-#6 Hor.	0.263	Type 1	106	34.5	12.95	153.45	1683.24	547.85	205.64	2436.73		840	380	0	1220	0.263	99.94	0	100.203
Type 2	8.25	6	49.5	3.5	6.417	18	5-#10 Vert.	8-#4 Hor.	1.56	Type 2	106	34.5	12.95	153.45	12243	3984.75	1495.73	17723.48		840	380	0	1220	1.56	592.8	0	594.36
Type 3	8.25	7.75	33.92	3.5	4.397	71	3-#10 3 WAYS		11.11	Type 3	106	34.5	12.95	153.45	33092.10	10770.54	4042.86	47905.50		840	380	0	1220	11.11	4221.8	0	4232.91
Type 4	8.25	8.25	68.06	3.75	9.453	18	9-#10 Vert.	9-#10 Hor.	5.75	Type 4	106	34.5	12.95	153.45	18035.90	5870.18	2203.44	26109.52		840	380	0	1220	5.75	2185	0	2190.75
Type 5	9.83	9.83	96.69	3.75	13.43	16	11-#10 Vert.	11-#10 Hor.	7.44	Type 5	106	34.5	12.95	153.45	22775.87	7412.90	2782.52	32971.29		840	380	0	1220	7.44	2827.2	0	2834.64
Type 6	8.25	12	99	4.5	16.5	8	10-#11 Vert.	13-#10 Hor.	4.4	Type 6	106	34.5	12.95	153.45	13992.00	4554.00	1709.40	20255.40		840	380	0	1220	4.4	1672	0	1676.4
Type 7	11	12	132	4.9	23.96	4	12-#10 Vert.	13-#10 Hor.	2.47	Type 7	106	34.5	12.95	153.45	10157.16	3305.87	1240.90	14703.92		840	380	0	1220	2.47	938.6	0	941.07
Type 8	11	12	132	4.3	21.02	14	15-#11 Vert.	13-#11 Hor.	12.01	Type 8	106	34.5	12.95	153.45	31196.98	10153.73	3811.33	45162.04		840	380	0	1220	12.01	4563.8	0	4575.81
Type 8A	8.25	15.75	129.94	5.3	25.51	2	14-#11 Vert.	16-#10 Hor.	1.74	Type 8A	106	34.5	12.95	153.45	5407.43	1759.97	660.62	7828.02		840	380	0	1220	1.74	661.2	0	662.94
Type 9	12	12	144	5	26.67	19	14-#11 Vert.	14-#11 Hor.	17	Type 9	106	34.5	12.95	153.45	53706.67	17480.00	6561.33	77748.00		840	380	0	1220	17	6460	0	6477
Type 10	11	15.75	173.25	5	32.08	8	15-#11 Vert.	16-#10 Hor.	8.05	Type 10	106	34.5	12.95	153.45	27206.67	8855.00	3323.83	39385.50		840	380	0	1220	8.05	3059	0	3067.05
Type 11	11	15.75	173.25	5.5	35.29	5	18-#11 Vert.	18-#10 Hor.	5.9	Type 11	106	34.5	12.95	153.45	18704.58	6087.81	2285.14	27077.53		840	380	0	1220	5.9	2242	0	2247.9
Type 12	12	15.75	189	5.6	39.2	2	19-#11 Vert.	17-#11 Hor.	2.67	Type 12	106	34.5	12.95	153.45	8310.40	2704.80	1015.28	12030.48		840	380	0	1220	2.67	1014.6	0	1017.27
Type 13	12	17.5	210	6.25	48.61	4	21-#11 vert.	18-#11 Hor.	6.2	Type 13	106	34.5	12.95	153.45	20611.11	6708.33	2518.06	29837.50		840	380	0	1220	6.2	2356	0	2362.2
																	Total	401174.90								Total	32980.5

Concrete Footings and Slabs

Description	Area (SF)	Depth (LF)	Volume (CY)	Material ($/unit)	Labor($/unit)	Equipment ($/unit)	Total ($)	Material($)	Labor ($)	Equipment ($)	Total ($)
Footings	169.92	1	169.92	106	34.5	12.95	153.45	18011.52	5862.24	2200.464	26074.224
2nd Floor Deck Slab	170700	0.58333	99574.431	106	34.5	12.95	153.45	10554889.7	3435317.87	1289488.881	15279696.44
3rd Floor Deck Slab	88300	0.58333	51508.039	106	34.5	12.95	153.45	5459852.13	1777027.346	667029.1051	7903908.585
4th Floor Deck Slab	86500	0.58333	50458.045	106	34.5	12.95	153.45	5348552.77	1740802.553	653431.6828	7742787.005
5th Floor Deck Slab	86500	0.58333	50458.045	106	34.5	12.95	153.45	5348552.77	1740802.553	653431.6828	7742787.005
6th Floor Deck Slab	93100	0.58333	54308.023	106	34.5	12.95	153.45	5756650.44	1873626.794	703288.8979	8333566.129
7th Floor Deck Slab	96500	0.58333	56291.345	106	34.5	12.95	153.45	5966882.57	1942051.403	728972.9178	8637906.89
Slab on Grade	178400	0.58333	104066.072	106	34.5	12.95	153.45	11031003.6	3590279.484	1347655.632	15968938.75
										Total	71635665.02

Rebar for Concrete Footings and Slabs

Typical Bay																
Floor	Rebar	Bay Dimension (LFxLF)	Area (SF)	Units (LF)	Total (LF)	Quantity (Floors)	Total (LF)	Weight, Tons	Material ($/unit)	Labor ($/unit)	Equipment ($/unit)	Total ($/unit)	Material ($)	Labor ($)	Equipment ($)	Total ($)
Typical Floor	4-#3 Vertical	24'x34'	178400	816	29342.44	2	58684.88	11.03	840	380	0	1220	9265.2	4191.4	0	13456.6
					14671.22	5	73356.1	13.79	840	380	0	1220	11583.6	5240.2	0	16823.8
															Total	30280.4

Pan Joist Metal Decking

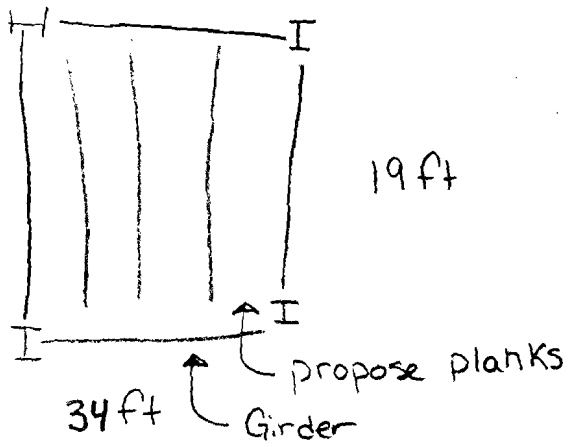
Item	Units	Quantity	Material	Labor	Equipment	Total
Metal Decking up to 40 tons	SF	800000	47.5	2.26	1.22	40784000

APPENDIX G – DETAILED GENERAL CONDITIONS ESTIMATE

General Conditions Estimate

Division	Description	Unit	Quantity	Mt'l Unit Cost($/unit)	Mt'l Cost($)	Labor Unit Cost($/unit)	Labor Cost ($)	Equip Unit Cost($/unit)	Equip Cost($)	Total Cost Units($)	Total Cost($)
Permits 01 41 26.50											
20	Rule of Thumb, most cities, minimum	project								0.50%	1,124,180
Field Personnel 01 31 13.20											
120	Field Engineers (avg)	week	135			1,215				1875	164,025
120	Field Engineers (avg)	week	135			1,215				1875	164,025
120	Field Engineers (avg)	week	135			1,215				1875	164,025
120	Field Engineers (avg)	week	135			1,215				1875	164,025
120	Field Engineers (avg)	week	135			1,215				1875	164,025
260	Superintendents	week	135			1850				2850	249,750
260	Superintendents	week	135			1850				2850	249,750
260	Superintendents	week	135			1850				2850	249,750
200	Project Managers	week	135			2,000				3,075	270,000
200	Project Managers	week	135			2,000				3,075	270,000
20	Clerks	week	135			395				605	53,325
20	Clerks	week	135			395				605	53,325
Inspections and Testing Services 01 45 26.50											
100	For concrete building costing, $10 million minimum	project								33,100	33,100
Scheduling 01 32 13.50											
600	Rule of Thumb, CPM scheduling, large job ($50 million)	job								0.03%	67,451
Temporary Facilities 01 52 13.20											
20	Field Trailers 20' x 8' buy	Ea	1	8,550	8,550	680	680			9,230	9,230
20	Field Trailers 20' x 8' buy	Ea	1	8,550	8,550	680	680			9,230	9,230
20	Field Trailers 20' x 8' buy	Ea	1	8,550	8,550	680	680			9,230	9,230
1000	Toilet,Portable	Month	36	150	5400					150	5400
1000	Toilet,Portable	Month	36	150	5400					150	5400
1000	Toilet,Portable	Month	36	150	5400					150	5400
1000	Toilet,Portable	Month	36	150	5400					150	5400
1000	Toilet,Portable	Month	36	150	5400					150	5400
1000	Toilet,Portable	Month	36	150	5400					150	5400
1200	Storage Trailers/Shed 20' x 8' Buy	Ea	1	3,225		380				3,605	3605
Temporary Utilities 01 51 13.80											
100	Heat incl. fuel and operation, per week, 12 hrs. per day	CSF Flr	1784	27	48168	3.41	6083.44			30.41	54251.44
350	Lighting, incl service lamps, wiring & outlets, minimum	CSF Flr	1784	2.63	4691.92	11.55	20605.2			14.18	25297.12
430	Power for temp lighting only, per month, average/month 11.8 KWH	CSF Flr	1784	1.65	2943.6					1.65	2943.60
600	Power for job duration incli elevator, etc, minimum	CSF Flr	1784	47	83848					47	83848.00
700	Temp construction water bill per mo. Average	month	36	62	2232					62	2332.00
Field Office Expenses 01 52 13.20											
100	Equipment Rental	month	36	155	5580					155	5580
120	Office Supplies	month	36	85	3060					85	3060
160	Lights & HVAC	month	36	150	5400					150	5400
140	Telephone bill avg. bill/month incl long distance	month	36	80	2880					80	2880
Roadways and Sidewalks 01 55 23.50											
50	Roads, gravel fill, no surfacingg, 4" gravel depth	SY	180.72	4	722.88	2.34	422.8848	0.47	84.9384	6.81	1230.70
Temporary Fencing 01 56 26.50											
550	4" x 4" wire meshposts 8' high	L.F.	2439.68	14.75	35985.28	8.3	20249.344			23.05	56234.624
Signs 01 58 13.50											
20	High Intensity Reflective	SF	15	26.5	397.5					26.5	397.5
Cleaning and Waste Management 01 74 13.20											
40	Job Completion Maximum	job								1%	2246360
Construction Management Fees 01 11 31.20											
300	$50,000,000 minimum	project								2.50%	5620900
Insurance 01 31 13.30											
20	Builder's Risk Minimum	job								0.24%	539606.4
50	All-risk type	job								0.25%	562090
Performance Bond 01 31 13.90											
20	For buildings	job								0.60%	1349016
Temporary Protective Walkways 01 56 29.50											
2300	Sidewalks 2" x 12" planks, 2 uses 1/2" thick	SF	3659.52	0.21	768.4992	0.44	1610.1888			0.65	2378.69
Demolition 02 41 13.17											
5010	Pavement removal, bituminous roads, 3" thick	S.Y.	782.22			2.15	1681.773	1.71	1337.5962	3.86	3019.37
Temp Barricades 01 56 23.10											
300	Stock units 6' high, 8' wide, buy	EA	1	435						435	435
300	Stock units 6' high, 8' wide, buy	EA	1	435						435	435
300	Stock units 6' high, 8' wide, buy	EA	1	435						435	435
300	Stock units 6' high, 8' wide, buy	EA	1	435						435	435
										Total General Conditions Cost	12,724,000.25

APPENDIX H – STRUCTURAL CALCS & PRODUCT DETAIL



* Information Supplied by
Nitterhouse Concrete Company

note : LL = 100psf Florida Designation
DL = 20 Given

$w_{LL} = \gamma_w (w_t) = 100(4ft) = 0.4\ klf$

$E = 57\sqrt{6000} = 4415 \qquad f'_c = 6000$

$\Delta_{LL} = \frac{5 w_L l_n^4}{384 E I} = \frac{5(.4)(19)^4(1728)}{384(1519)(4415)} = 0.174 \rightarrow \frac{l}{360} = \frac{(19)(12)}{360} = 0.633 \quad \therefore OK \checkmark$

$w_D = \gamma_w (psf) = 4(20 + 48.75) = 275 = 0.275\ klf$

$\Delta_D = \frac{5 w_D l_n^4}{384 E I} = \frac{5(0.275)(19)^4(1728)}{384(1519)(4415)} = 0.295 \rightarrow \frac{l}{240} = \frac{19(12)}{240} = 0.95 \quad \therefore OK \checkmark$

Girder Design:

$DL = 78.75\ psf\ (19ft) = 1.50\ klf$
$LL = 100\ psf\ (19) = 1.90\ klf$
$w_u = 1.2(1.5) + 1.6(1.9) = 4.84\ klf$

$V_u = \frac{w_L l_n}{2} = \frac{4.84(34)}{2} = 82.28\ K \qquad m_u = \frac{w_L l_n^2}{8} = \frac{4.84(34)^2}{8} = 699.38\ K\text{-}ft$

$\frac{(34\ ft)(12)}{360} = \frac{5(1.9\ klf)(34\ ft)^4(1728)}{384(29000\ ksi)\, I_{min}} \rightarrow I_{min} = 1738.18\ in^4$

$\rightarrow 168.75 \times 19\ ft$

$\frac{(34\ ft)(12)}{240} = \frac{5(3.2)(34ft)^4(1728)}{384(29000\ ksi)\, I_{min}} \rightarrow I_{min} = 1951.65\ in^4$

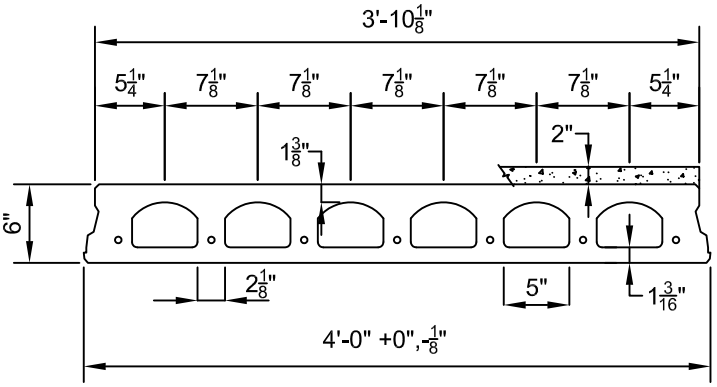
* use 6"-4' hollow Core Plank w/ 2" topping & 7-½ ø stirrups
* use W 24 x 76 Girder → $\phi m = 750\ K\text{-}ft > 699.38\ K\text{-}ft$
$I = 2100\ in^4 > 1951.65\ in^4$

Prestressed Concrete
6"x4'-0" Hollow Core Plank

2 Hour Fire Resistance Rating With 2" Topping

PHYSICAL PROPERTIES Composite Section	
A_c = 253 in.^{2}	Precast b_w = 16.13 in.
I_c = 1519 in.^{4}	Precast S_{bcp} = 370 in.^{3}
Y_{bcp} = 4.10 in.	Topping S_{tct} = 551 in.^{3}
Y_{tcp} = 1.90 in.	Precast S_{tcp} = 799 in.^{3}
Y_{tct} = 3.90 in.	Precast Wt. = 195 PLF
	Precast Wt. = 48.75 PSF

DESIGN DATA



1. Precast Strength @ 28 days = 6000 PSI
2. Precast Strength @ release = 3500 PSI
3. Precast Density = 150 PCF
4. Strand = 1/2"Ø 270K Lo-Relaxation.
5. Strand Height = 1.75 in.
6. Ultimate moment capacity (when fully developed)...
   - 4-1/2"Ø, 270K = 67.4 k-ft at 60% jacking force
   - 6-1/2"Ø, 270K = 92.6 k-ft at 60% jacking force
   - 7-1/2"Ø, 270K = 95.3 k-ft at 60% jacking force
7. Maximum bottom tensile stress is $10\sqrt{f'c}$ = 775 PSI
8. All superimposed load is treated as live load in the strength analysis of flexure and shear.
9. Flexural strength capacity is based on stress/strain strand relationships.
10. Deflection limits were not considered when determining allowable loads in this table.
11. Topping Strength @ 28 days = 3000 PSI. Topping Weight = 25 PSF.
12. These tables are based upon the topping having a uniform 2" thickness over the entire span. A lesser thickness might occur if camber is not taken into account during design, thus reducing the load capacity.
13. Load values to the left of the solid line are controlled by ultimate shear strength.
14. Load values to the right are controlled by ultimate flexural strength or fire endurance limits.
15. Load values may be different for IBC 2000 & ACI 318-99. Load tables are available upon request.
16. Camber is inherent in all prestressed hollow core slabs and is a function of the amount of eccentric prestressing force needed to carry the superimposed design loads along with a number of other variables. Because prediction of camber is based on empirical formulas it is at best an estimate, with the actual camber usually higher than calculated values.

SAFE SUPERIMPOSED SERVICE LOADS — IBC 2006 & ACI 318-05 (1.2 D + 1.6 L)

Strand Pattern		SPAN (FEET)																		
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
4 - 1/2"ø	LOAD (PSF)	349	317	290	258	227	197	174	149	127	108	92	78	66	55					
6- 1/2"ø	LOAD (PSF)	524	478	437	377	334	292	269	237	215	188	165	142	122	104	88	73	61	49	39
7 - 1/2"ø	LOAD (PSF)	541	492	451	416	364	331	293	274	242	214	190	167	144	124	107	91	77	64	53

NITTERHOUSE CONCRETE PRODUCTS

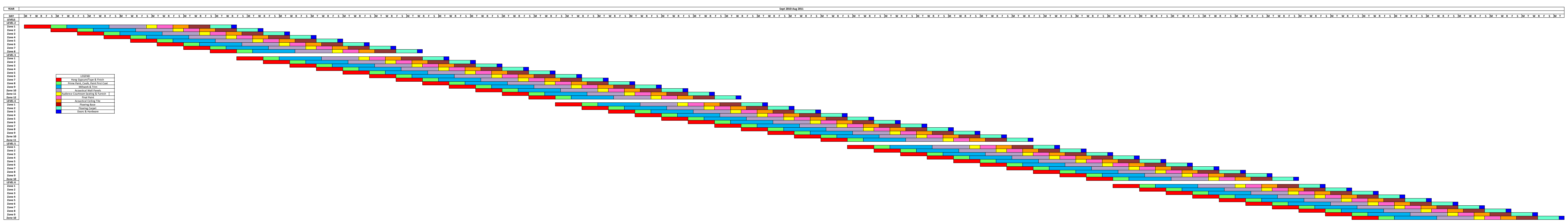
2655 Molly Pitcher Hwy. South, Box N
Chambersburg, PA 17202-9203
717-267-4505 Fax 717-267-4518

This table is for simple spans and uniform loads. Design data for any of these span-load conditions is available on request. Individual designs may be furnished to satisfy unusual conditions of heavy loads, concentrated loads, cantilevers, flange or stem openings and narrow widths. The allowable loads shown in this table reflect a 2 Hour & 0 Minute fire resistance rating.

11/03/08

6F2.0T

APPENDIX I – SHORT INTERVAL PRODUCTION SCHEDULE


YEAR
Sept 2010-Aug 2011
DAY
M T W R F S
LEVELS
LEVEL 2
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
LEVEL 3
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Zone 9
Zone 10
Zone 11
Zone 12
LEVEL 4
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Zone 9
Zone 10
Zone 11
LEVEL 5
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Zone 9
Zone 10
LEVEL 6
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Zone 9
Zone 10
LEGEND
Hang Gypsum/Tape & Finish
Prime Paint, Caulk, Paint First Coat
Millwork & Trim
Acoustical Wall Panels
Audience Courtroom Seating & Furnish
Final Paint
Acoustical Ceiling Tile
Flooring Base
Flooring Carpet
Doors & Hardware

APPENDIX J – ACOUSTICAL CALCS & PRODUCT DETAIL

Frequency Level = 125			Proposed Time Reverb	Actual Reverb
Sabine Absorptivity α			2.53	2.61
GWP w/ Studs	0.3			
African Mahogany Wood Veneer	0.3			
Carpet Panel	0.37			
Carpet Flooring	0.02			
Acoustical Ceiling Tile	0.4			
Acoustical Wall Panel	0.1			
Frequency Level = 250				
Sabine Absorptivity α			2.18	2.31
GWP w/ Studs	0.1			
African Mahogany Wood Veneer	0.25			
Carpet Panel	0.41			
Carpet Flooring	0.06			
Acoustical Ceiling Tile	0.5			
Acoustical Wall Panel	0.25			
Frequency Level = 500				
Sabine Absorptivity α			1.59	1.8
GWP w/ Studs	0.05			
African Mahogany Wood Veneer	0.2			
Carpet Panel	0.63			
Carpet Flooring	0.14			
Acoustical Ceiling Tile	0.6			
Acoustical Wall Panel	0.55			
Frequency Level = 1000				
Sabine Absorptivity α			1.23	1.39
GWP w/ Studs	0.04			
African Mahogany Wood Veneer	0.17			
Carpet Paneling	0.85			
Carpet Flooring	0.35			
Acoustical Ceiling Tile	0.75			
Acoustical Wall Panel	0.65			
Frequency Level = 2000				
Sabine Absorptivity α			1.2	1.25
GWP w/ Studs	0.07			
African Mahogany Wood Veneer	0.15			
Carpet Paneling	0.96			
Carpet Flooring	0.6			
Acoustical Ceiling Tile	0.7			
Acoustical Wall Panel	0.65			
Frequency Level = 4000				
Sabine Absorptivity α			1.13	1.34
GWP w/ Studs	0.09			
African Mahogany Wood Veneer	0.1			
Carpet Paneling	0.92			
Carpet Flooring	0.65			
Acoustical Ceiling Tile	0.6			
Acoustical Wall Panel	0.6			

Proposed System	Areas (ft)Proposed	Actual System	Area (ft) Actual
GWP w/ Studs	505	GWP w/ Studs	505
Mahogany	1179	Mahogany	1852
Carpet Panel	673	Carpet Flooring	1705
Carpet Flooring	1705	Acoustical Tile	1705
Acoustical Tile	1705	Acoustical Wall	1007
Acoustical Wall	1007		

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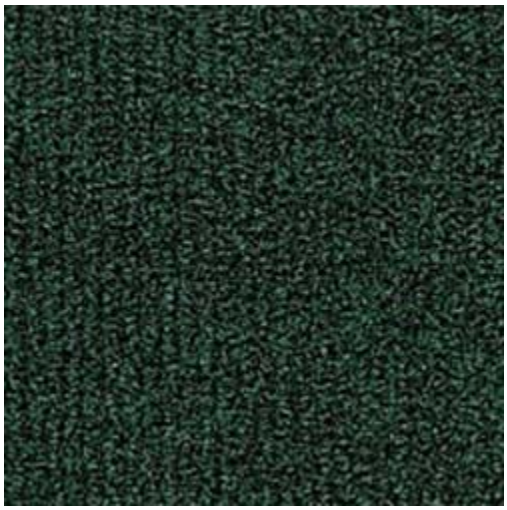
Application

Support

HytexRib® Wall Carpeting



The virtual fabric color image shown is representative of the finished color to be supplie is made to match this color to a master sample, some variation may occur due to your c that you order or specify from this image and cannot be responsible for variations Examination of an actual fabric sample is recommended. Cut fabric (any qu

Overview

HytexRib® is a dimensional fabric that offers moderate acoustical properties Class A flammability rating. With the aesthetic appearance of wallcarpet, it is as conventional direct applied coverings. HytexRib® is moisture resistant allergenic. Great for wall protection ap

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