Tech 2

Towson Tiger Arena

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Construction Management

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Executive Summary

Tech II focuses on an investigation and analysis of Towson Tiger Arena's cost and schedule. The Tiger Arena is located on the campus of Towson University in Towson Maryland. This Tech report will involve investigation into the structural model, general conditions, and project schedule.

The report includes a detailed schedule and sequence analysis for Tiger Arena. The arena began construction on April 11, 2011 and substantial completion is scheduled for March 2013, a 469 day construction schedule. This report demonstrates a fast paced environment complimented by a strict schedule in order to meet the owner's request and allow for the beneficial occupancy of the arena in March.

A detailed structural estimate allows for cost awareness and analysis of the structure for potential future alternative structural systems. Through the use of the structural model and RS Means Cost Data, a value within 20 percent of the original project cost was calculated. This estimated value of $6,725,757, giving a total cost of $57.98 per square foot.

In addition to the structural estimate, a detailed general conditions (GC) estimate was calculated to total $3,296,051, with a monthly cost of $156,955. This value will enable future analysis regarding impacts on GC cost from a schedule change.

Building Information Modeling (BIM) will be implemented on Tiger Arena through four main ways; Design Authoring, Design Reviews, 3D Coordination, and Construction System Design. Led by Gilbane and HCM, Towson University will receive the benefits of implementing BIM in these ways without requiring it through the RFP. 3D Coordination will play a large role in the schedule durations and decreasing potential for costly change orders.

Through the completion of this report, a better understanding of the project schedule and sequencing can be realized and used in future analysis of schedule impacts. In addition to this, the detailed structural estimates can play into future discussions of changing systems to potential decrease the cost and increase productivity. The knowledge gained from this report will be used and built on as Tech III evolves and my understanding of Towson Arena grows.

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Detailed Project Schedule

Tiger Arena Schedule Summary			
Phase	Duration	Start	Finish
Design	653 Days	10/1/08	4/1/11
Preconstruction	458 Days	7/1/09	4/1/11
Owner NTP	0 Days	4/11/11	4/11/11
Construction	469 days	4/11/11	1/24/13
Sitework	357 Days	6/17/11	10/29/12
Structure	181 Days	9/19/11	5/28/12
Façade	168 Days	1/26/12	9/17/13
MEPF Systems	196 Days	2/16/12	11/15/12
Interior Finishes	236 Days	3/1/12	1/24/13
Closeout	103 Days	10/9/12	3/1/13
Substantial Completion	0 Days	3/1/13	

Table 1: Summary Schedule Durations, created by Derek Stoecklein

Overview

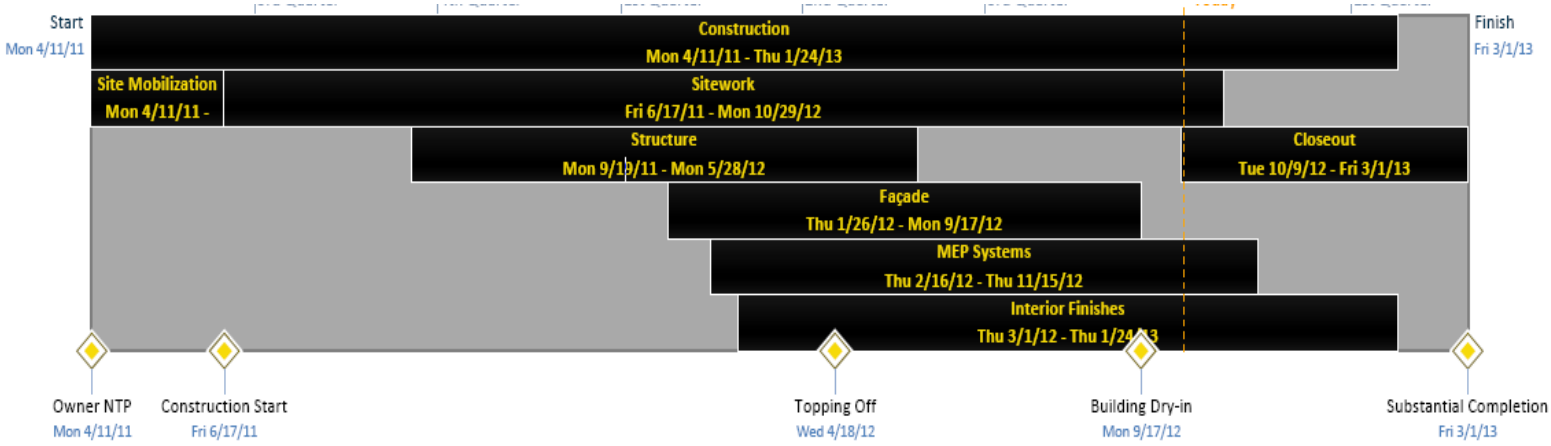
The project was initiated by Towson University and was especially driven by planned events that the University requested the arena for, such as commencement services for the 2013 graduating class. Liquid damages were built into Gilbane's contract, charging $10,000 a day that they did not turn over the building. With this in mind, Gilbane knew they needed to create a well-designed and manageable schedule to insure the important deadlines were met. During preconstruction, all the subcontractors were brought in to perform a "card trick." Essentially, the "card trick" is a white board with all critical scheduled dates. Each contractor is assigned their own color sticky note that they will create their schedule with. Through much collaboration and discussion between Gilbane, Towson, and the contractors, the final schedule was created. This schedule had a construction start date of 06/07/2011 and a substantial completion on 03/01/2013, establishing an overall construction duration of 469 days.

**A complete Building Schedule can be found in APPENDIX A*

Sequencing and Milestones

The Owner NTP on 04/11/2011 allowed Gilbane to mobilize the site and begin to locate and redirect existing utilities, as well as tie in temporary utilities. Construction started almost two months later with site clearing and E&R control. Following this was the excavation of the building foundation from west to east. The foundation and structure will begin to be constructed following the foundation excavation. The structure will be constructed from west-south-east-north-roof. This sequence was chosen due to the complexity and size of the CIP foundation walls along the north and south side. The building top of milestone is set for April, 18 2012. The façade of the building begins as the north structure is underway, starting on the west again. The façade is sequenced slightly differently than the structure with the east following the west, then moving to the north and finishing on the south side. This sequence was driven by the façade material and location on the building. In order the avoid congestion on one side or another of the building, the contractors stared in different locations. To give an example, the zinc panel contractor has a large amount of panels on the east and south of the building, so they were called in early to begin on the east prior to the next contractor, being the glazing crew, finishing on the west and moving over to the east. Another very important reason why this sequence was chosen was due to access to the building, which I will discuss in more detail within the "Constructability Challenge Section." The building Dry-in date is set for September 17, 2012.

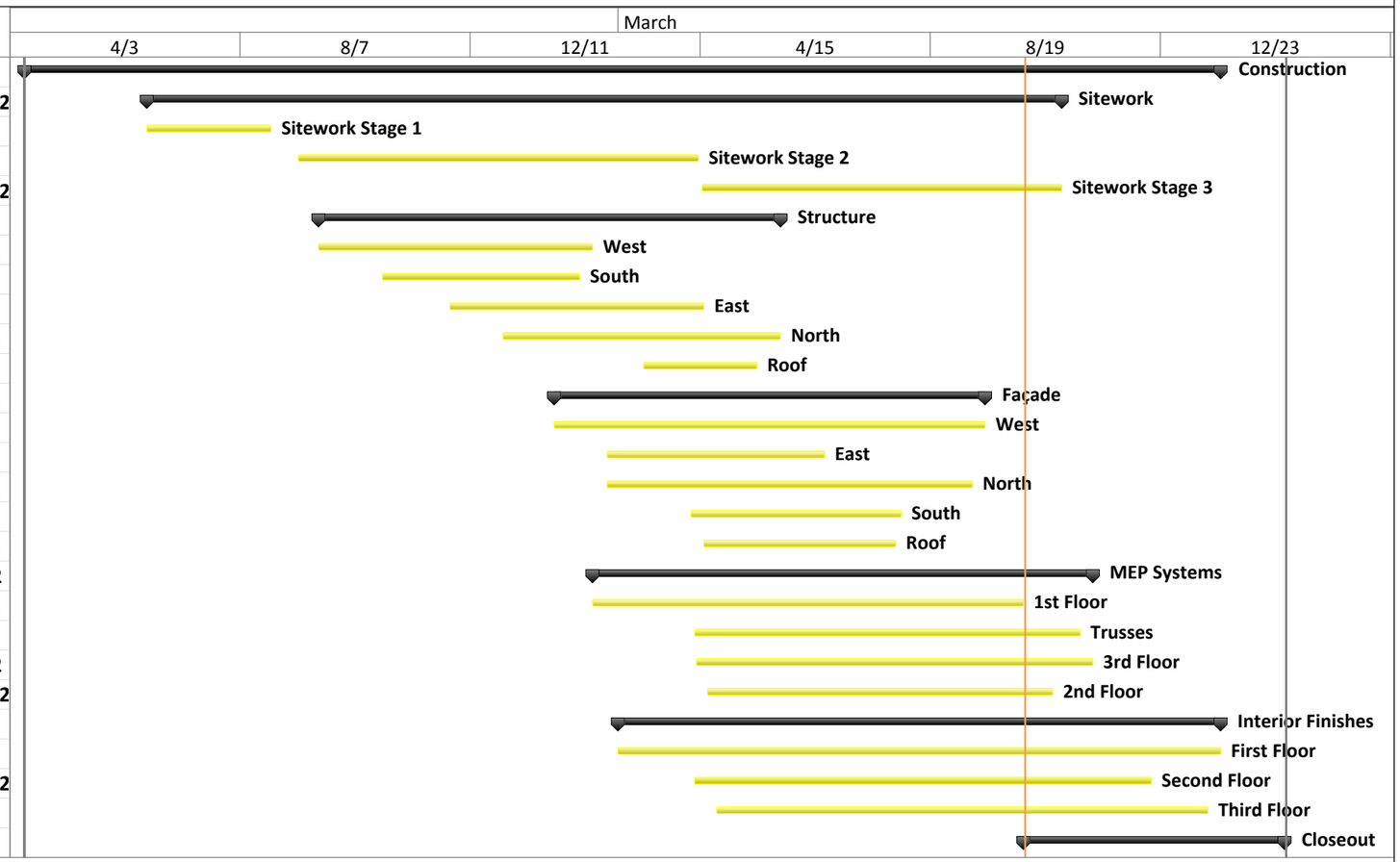
The buildings MEPF systems began on the first floor and moved to the truss level where they would finish from top down. This was do the large amount of rough-in and equipment that needed to be ran through the trusses, prior to them getting painted and finished. Interior finishes were sequenced bottom-up, and followed along with the completion of MEPF rough-in work on each floor. Closeout will begin on October 9, 2012, with RCL/Punch list and system commissioning from October to the end of January 2013. The substantial project completion date is March 1, 2013.



Timeline of Towson Tiger Arena Phases, created by Derek Stoecklein

Towson Tiger Arena Summary Schedule
Created by Derek Stoecklein

ID	Task Name	Duration	Start	Finish
1	**Construction**	**469 days**	**Mon 4/11/11**	**Thu 1/24/13**
5	**Sitework**	**357 days**	**Fri 6/17/11**	**Mon 10/29/12**
6	**Sitework Stage 1**	**48 days**	**Fri 6/17/11**	**Tue 8/23/11**
10	**Sitework Stage 2**	**157 days**	**Thu 9/8/11**	**Fri 4/13/12**
23	**Sitework Stage 3**	**141 days**	**Mon 4/16/12**	**Mon 10/29/12**
35	**Structure**	**181 days**	**Mon 9/19/11**	**Mon 5/28/12**
36	**West**	**108 days**	**Mon 9/19/11**	**Wed 2/15/12**
55	**South**	**78 days**	**Mon 10/24/11**	**Wed 2/8/12**
70	**East**	**99 days**	**Wed 11/30/11**	**Mon 4/16/12**
82	**North**	**108 days**	**Thu 12/29/11**	**Mon 5/28/12**
100	**Roof**	**44 days**	**Thu 3/15/12**	**Tue 5/15/12**
107	**Façade**	**168 days**	**Thu 1/26/12**	**Mon 9/17/12**
108	**West**	**168 days**	**Thu 1/26/12**	**Mon 9/17/12**
121	**East**	**85 days**	**Fri 2/24/12**	**Thu 6/21/12**
132	**North**	**142 days**	**Fri 2/24/12**	**Mon 9/10/12**
143	**South**	**83 days**	**Tue 4/10/12**	**Thu 8/2/12**
152	**Roof**	**75 days**	**Tue 4/17/12**	**Mon 7/30/12**
158	**MEP Systems**	**196 days**	**Thu 2/16/12**	**Thu 11/15/12**
159	**1st Floor**	**168 days**	**Thu 2/16/12**	**Mon 10/8/12**
173	**Trusses**	**151 days**	**Thu 4/12/12**	**Thu 11/8/12**
180	**3rd Floor**	**155 days**	**Fri 4/13/12**	**Thu 11/15/12**
190	**2nd Floor**	**135 days**	**Thu 4/19/12**	**Wed 10/24/12**
200	**Interior Finishes**	**236 days**	**Thu 3/1/12**	**Thu 1/24/13**
201	**First Floor**	**236 days**	**Thu 3/1/12**	**Thu 1/24/13**
210	**Second Floor**	**178 days**	**Thu 4/12/12**	**Mon 12/17/12**
218	**Third Floor**	**193 days**	**Tue 4/24/12**	**Thu 1/17/13**
227	**Closeout**	**103 days**	**Tue 10/9/12**	**Fri 3/1/13**



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			

Detailed Structural Systems Estimate

Tiger Arena has a unique structural layout, with no true "typical bay." As seen in *Figure 1*, the arena is essentially designed as two offset boxes. To illustrate as close as possible to a "typical bay," I decided to select a 20' truss bay and assume that the structure duplicates this from east to west. This bay can be seen as a 3D section in *Figure 2 and 3*. Tiger Arena's structural system is comprised of concrete footings, grade beams, foundation walls, columns, beams, slab on grade, slab on deck, one way elevated slab, steel columns, beams, bracing, and galv. decking. To manage the large scale of steel and concrete through 20' sections, I utilized the structural model created by Faisant (Structural Engineer) to do takeoffs. These take offs were exported to Excel and can be found in *APPENDIX B*. Using these takeoffs and RS Means 2012, I was able to create a detailed structural estimate for the selected bay.

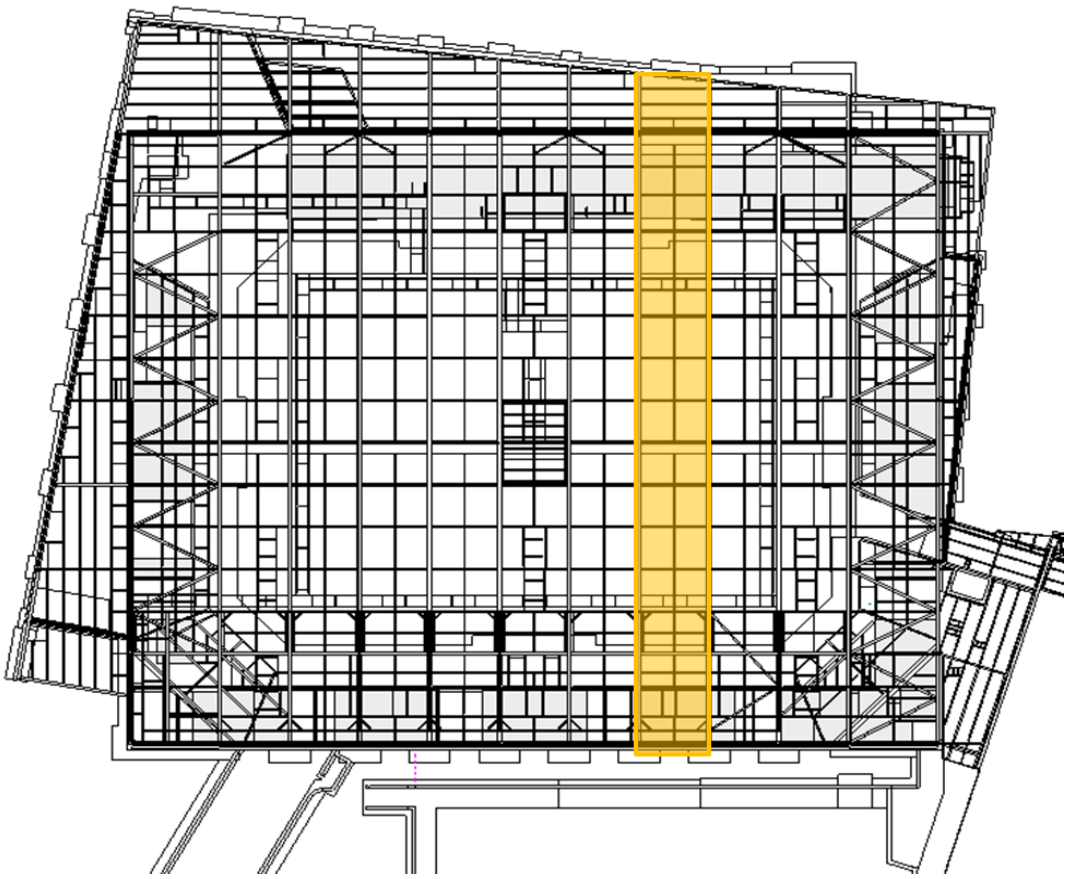


Figure 1: 20" Bay used for Structural Estimate, courtesy of HCM

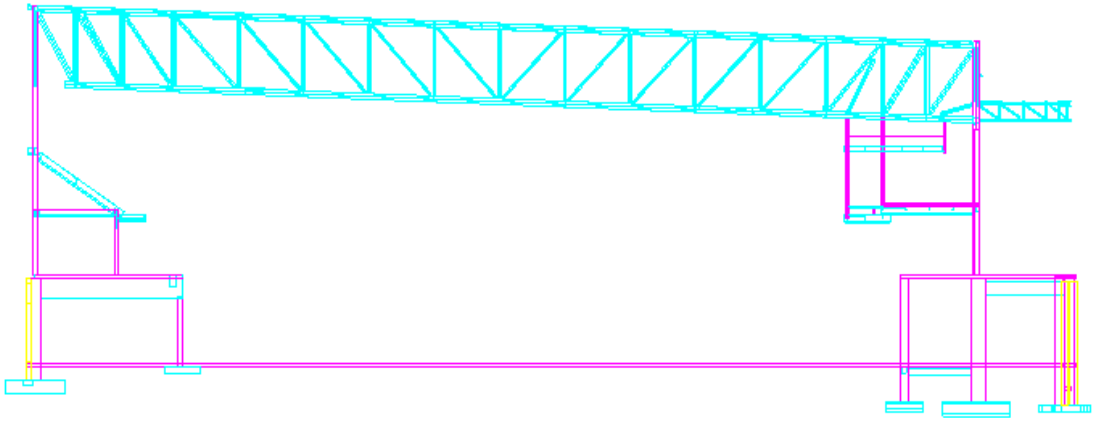


Figure 2: Section of Truss Bay Structure, courtesy of Faisant

The values were calculated based on Division 5 Metals, and Division 3 Concrete. The estimated concrete value was **$232,406** and the metals value was **$416,928**. In order to compare these to the actual construction costs, I had to assume this bay to be typical and repeat 10 times from east to west. The value 10 was used, because there are 10 truss bays in Tiger Arena. Once I multiplied my estimated values by 10, I resulted in number values that I could use to compare to the actual costs of Tiger Arenas structure. These values can be seen in *Table 2* below.

Structural Estimate Evaluated		
	20' Section	Total Building (10)
Concrete	$ 232,406.29	$ 2,556,469.23
Structural Steel	$ 416,928.83	$ 4,169,288.30
Total	$ 649,335.12	$ 6,725,757.53

Table 2: Structural Estimate Evaluated, created by Derek Stoecklein

When I compared my overall structural value to the GMP values, I was off by **($1,758,987) or 20 percent,** *Table 3.* The large majority of this error comes from the concrete value, which was roughly $1.5MM lower than the actual cost. I believe this is due the large variance in the structural system from bay-to-bay, and the large foundation wall along the north that is not captured well by this estimate. With the offset shape of the structure frame, the foundation changes from one side of the building to the other. I believe the value of the SOG in the bowl is missed by this estimate due to the quality assurance that must take place to meet NCAA regulations. The pouring of this slab and finishes had to done in a very precise manor that is not typical to normal concrete placement. The structural steel value may be changed due to the connection types and some miscellaneous metals that were not estimated. I also believe that the steel values include the crane used the base of the cost of equipment per unit found in RS Means. For the construction of the structure, the steel contractor was responsible for their own crane(s) as well as the concrete crew. Most of the concrete was bucketed in, with small situations were a pump truck was used and the bowl slab was direct chute poured.

Structural Estimate Compared			
	Estimated	Actual	Difference
Concrete	$ 2,556,469.23	$ 4,016,745.00	$ (1,460,275.77)
Structural Steel	$ 4,169,288.30	$ 4,468,000.00	$ (298,711.70)
Total	**$ 6,725,757.53**	**$ 8,484,745.00**	**$ (1,758,987.47)**

Table 3: Structural Estimate Compared, created by Derek Stoecklein

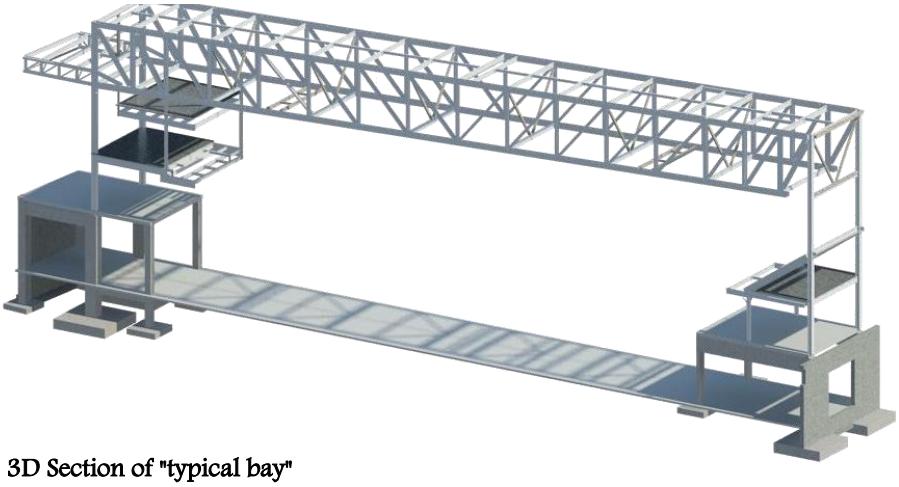


Figure 3: 3D Section of "typical bay"

General Conditions Estimate

Tiger Arena has an overall General Condition cost of **$3,332,255,** broken down into non-personnel items and on-site staff. The non-personnel items include; temporary utilities, fencing, trailers, office supplies, bonding, insurance, and several other basic general conditions. The on-site staff consists of all Gilbane personnel assigned to the job site. Using *RS Means 2012*, I assembled my own GC estimate based of these known GC items. Looking at my final GC cost of **$3,296,051**, I was of the original cost by **-1 percent** or **($36,204).** When I compared my numbers individually to Gilbane's, I noticed I was off by roughly $350,000 (+/-) in each category. My on-site staffing cost was **28 percent** lower than that of the GMP and my non-personnel cost is **16 percent** higher. These values can be seen in *Table 4*. I believe the reason behind my on-site staff value coming in so low, is that I did not include a project executive number or another assistant superintendent. The additional superintendent is staffed onsite and responsible for the renovation work, which I have left out of my thesis and all budgeting/scheduling values. Adding another super to my number would add roughly $200,000 and the addition of a part-time or full-time PX would increase my number even more. The PX was not included in my value, because I was not sure how his time worked would be charged to the job site by Gilbane. As far as the non-personnel items, I can only assume to be high, due to the percentages used for bonding and insurance items. Decreasing these percentages could lower my number closer to that of the actual project.

•Detailed GC Estimate in APPENDIX C

General Conditions Estimate Compared			
	Estimated	Actual	Difference
Non-Personnel Items	$ 2,365,451.00	$ 2,029,300.00	$ 336,151.00
On-Site Staff	$ 930,600.00	$ 1,302,955.00	$ (372,355.00)
Total	**$ 3,296,051.00**	**$ 3,332,255.00**	**$ (36,204.00)**

Table 4: General Conditions Estimate Compared, created by Derek Stoecklein

Building Information Modeling Use Evaluation

Towson Arena did not require any BIM uses within the RFP from Towson University. Through experience, Gilbane has seen the benefits that some BIM uses can provide the owner and themselves. Knowing that the Architect, Hord Caplan Mach (HCM) and the structural engineer, Faisant utilized 3D modeling during their design, Gilbane planned to implement some BIM into the contracts of the mechanical, electrical, plumbing and fire protection (MEPF) contractors. This would be used for 3D coordination and design reviews as specified in their scope of work.

Table 5 highlights the BIM uses implemented on Tiger Arena by Gilbane and the design team. Clearly defined in this table, is the use of BIM on Tiger Arena is limited. Design Authoring and Reviews with the contractors, Towson University (TU), and the end users, as well as 3D coordination and construction system design. Towson University does not have an advanced facilities management team and the use of a record model is of no value to them. Gilbane plans to turn over all existing models to TU upon completion, but no additional maintenance or product data will be installed into the model.

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING	x	DESIGN AUTHORING		SITE UTILIZATION PLANNING		BUILDING MAINTENANCE SCHEDULING
	SITE ANALYSIS	X	DESIGN REVIEWS	x	CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
		X	3D COORDINATION	x	3D COORDINATION		ASSET MANAGEMENT
			STRUCTURAL ANALYSIS		DIGITAL FABRICATION		SPACE MANAGEMENT / TRACKING
			LIGHTING ANALYSIS		3D CONTROL AND PLANNING		DISASTER PLANNING
			ENERGY ANALYSIS		RECORD MODELING		RECORD MODELING
			MECHANICAL ANALYSIS				
			OTHER ENG. ANALYSIS				
			SUSTAINABLITY (LEED) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

Table 5. BIM Uses, Completed by Derek Stoecklein

Design Authoring

"A process in which 3D software is used to develop a Building Information Model (BIM) based on criteria that are important to the translation of the building's design. Authoring tools create models while audit and analysis tools study or add to the richness of information in a model. Most of audit and analysis tools can be used for Design Review and Engineering Analysis BIM Uses. Design authoring tools are a first step towards BIM and the key is connecting the 3D model with a powerful database of properties, quantities, means and methods, costs and schedules."

Value: **High**

Through Design Authoring, Towson will be able to better understand the design of the building. The greater understanding will lead to collaboration between the BIM team and Towson. Additionally, this process allows for improved quality control of the design, cost and schedule.

Design Reviews

"A process in which stakeholders view a 3D model and provide their feedbacks to validate multiple design aspects. These aspects include evaluating meeting the program, previewing space aesthetics and layout in a virtual environment, and setting criteria such as layout, sightlines, lighting, security, ergonomics, acoustics, textures and colors, etc. This BIM use can be done by using computer software only or with special virtual mock-up facilities, such as CAVE (Computer Assisted Virtual Environment) and immersive lab. Virtual mock-ups can be performed at various levels of detail depending on project needs. An example of this is to create a highly detailed model of a small portion of the building, such as a facade to quickly analyze design alternatives and solve design and constructability issues."

Value: **High**

Through Design Reviews, Towson visualizes the building and proved input on design features. Different design options can be easily presented and changed in real-time based on Towson's feedback. Creates shorter and more effective design reviews. Easily communicate with the design team, Gilbane, and Towson through visualization. Lastly, using BIM for design reviews can help to create better and more involved discussion for design.

3D Coordination

"A process in which Clash Detection software is used during the coordination process to determine field conflicts by comparing 3D models of building systems. The goal of clash detection is to eliminate the major system conflicts prior to installation."

Value: **High**

3D Coordination was utilized by Gilbane and the project teams to help eliminate potential field issues earlier on. Gilbane organized bi-weekly coordination meetings for MEP trades were they discussed and reviewed areas of conflict to resolve clashes. Through these coordination meetings, thousands of dollars have been saved for Towson and countless hours of rework and demolition of improperly installed or conflicting materials.

Construction System Design

"A process in which 3D System Design Software is used to design and analyze the construction of a complex building system (e.g. form work, glazing, tie-backs, etc.) in order to increase planning."

Value: **High**

The use of Construction System Design was implemented in the design and submittal of several façade items and unique interior features. Through this process, Towson has been given the ability to easily visualize and provide feedback on given systems prior to completing a design. Additionally, this has helped save money for Towson University and saved time and cost to the overall project by eliminating improperly design elements of the building.

Constructability Challenges

Tiger Arena is a unique and challenge building in many ways. One is the fact that it is attached to an existing and occupied facility, construction logistics in a college campus such as large deliveries and hours on construction, offset shape of the building, and the large variety of exterior finish materials. All of these prove to be challenging and unique construction issues, but these issues maybe more common than the three I have decided to describe in more detail. These being, steel erection sequencing, congestion of contractors in the "bowl" and the limited accessibility to the NW corner.

Steel Truss Erection Sequencing

Tiger Arena is constructed with 10 Pratt trusses, weighing roughly 90,000 pounds. Each truss spans 200' north to south, and shipped to site in sections of three. During the erection of the trusses, two of the most northern sections are assembled on the ground and picked together by a crane located in the bowl. The larger crane on the south side of the building will then pick that remaining section of the truss and final connections are made in place, *Figure 4*.

Figure 4: Truss erection image, taken by Ryan Simmons of Gilbane

Due to the extra crane inside of the arena, a 45' section of the south side must be left open for the crane to back out, *Figure 5*. With this section of the building left out, 1/3 of truss three and four must be left out and the erected 2/3 will be supported by shoring towers, *Figure 6*. After the second crane has been removed from site, the concrete contractor begins to form and pour the remaining wall sections, SOG and elevated slab. Once the concrete has cured the steel contractor begins to erect the truss supports and precast seating riser support steel, followed by the final two truss sections and the removal of the shoring towers.

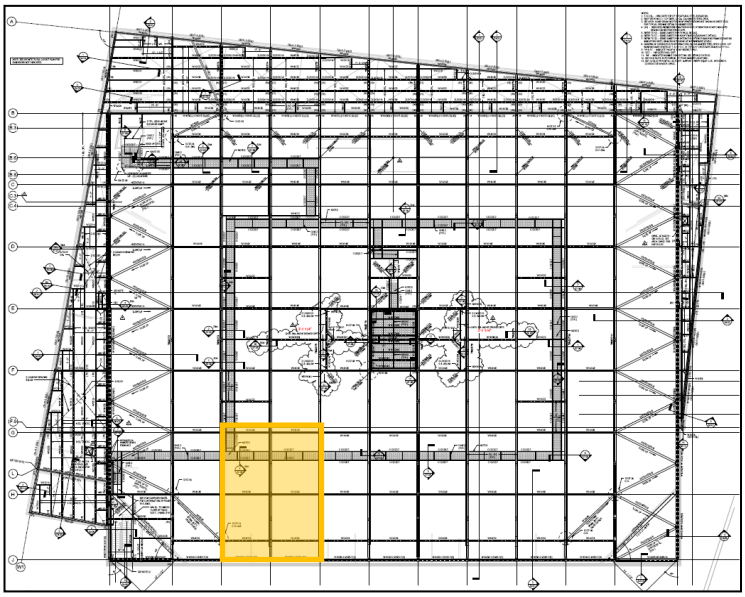


Figure 5: Section of building left open, S1.10

Figure 6: Shoring Towers, taken by Derek Stoecklein

Figure 7: Final truss section erection, taken by Derek Stoecklein

Congestion in the "Bowl"

This construction issue was very challenging and was never properly handled, causing the electrician to work a second shift to catch up. The "bowl" is what Gilbane referred to when referencing the center of Tiger Arena. During MEP installation, the bowl turned into the spaghetti bowl with over 15 man lifts and several Lulls inside at any given time, *Figure 8*. Once the building began to get roof decking and the building began to close in, the trades hit the trusses hard. Everything from roof drains, electrical previsions, large HVAC duct, catwalk steel, and other mechanical piping was being installed simultaneously. Due to this confusion and congestion, the contractors began to get delayed and working Saturdays was a common occurrence in order to maintain the schedule. Another reason for the confusion within the bowl was the staging of extra material that was not needed immediately. In order to correct this, a pull approach could have been utilized. Pulling material from the suppliers as needed and according to the progress they were making. The over ordering of materials that were not needed that day or even that week, added to the problem of maintaining proper work flow around the bowl. In conclusion, I believe Gilbane handled this issue as well as they could have in the time frame given. Through a little overtime and extra shifts, the problem was solved and the project remains on schedule.

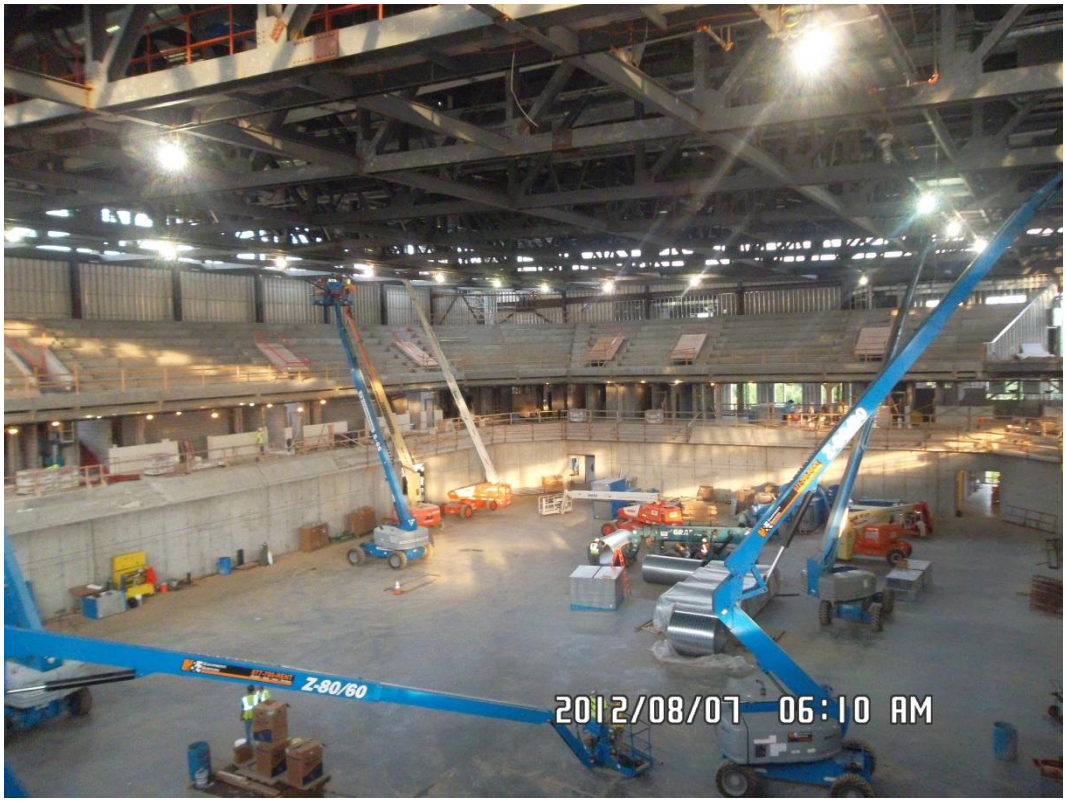


Figure 8: Man lifts inside the Bowl, taken by Derek Stoecklein

NW Corner Accessibility

The northwest corner of the façade has created an unexpected issue or challenge due to accessability. The northwest corner of Tiger Arena is the highest point above grade on the building, roughly 90', *Figure 9*. Due to Maryland Department of the Environment (MDE) regulations, two large retention pond must be maintained along the north side of the building, as *Figure 10*. With the retention pond located directly under the highest point of the building, this will limit the access from a boom lift. In addition to the sedimant pond, along the west side of the building is a sloped access road. With the safety restrictions of the lifts, extending the boom out past a certain point on a given slope, it restricts the machine from over extending and tipping. As seen in *Figure 11,* an Ultra Boom (135') lift is being used to place decrative channel on the west side. Even with the reach of an Ultra Boom, the contractors can not reach the heigher points of the NW corner. Considering this issue impacts the Zinc, Glazing, and Framing contractors, Gilbane planned to have a swing stage shared between them. The swing stage will be rented originally by the framing contractor, then transferred to the glazing contractor and finally the zinc contractor will own the rental. This is all managed within each of the companies and no addition charges will be incountered by the owner.

Figure 9: NW Corner, taken by Derek Stoecklein

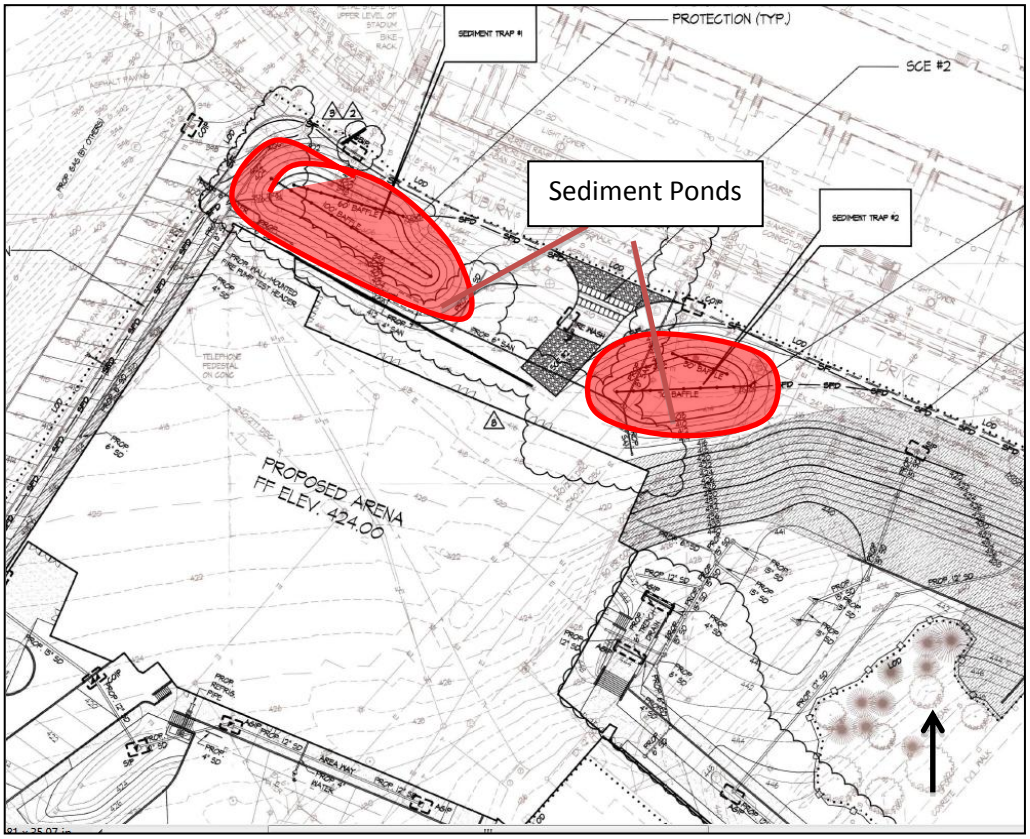


Figure 10: Sedimant Traps along North, ESC1.02

Figure 9: Ultra Boom on West side, taken by Derek Stoecklein

References

http://bim.psu.edu/Project/resources/download_thank_you.aspx

http://bim.psu.edu/Uses/default.aspx

RS Means 2012, Building Construction Data

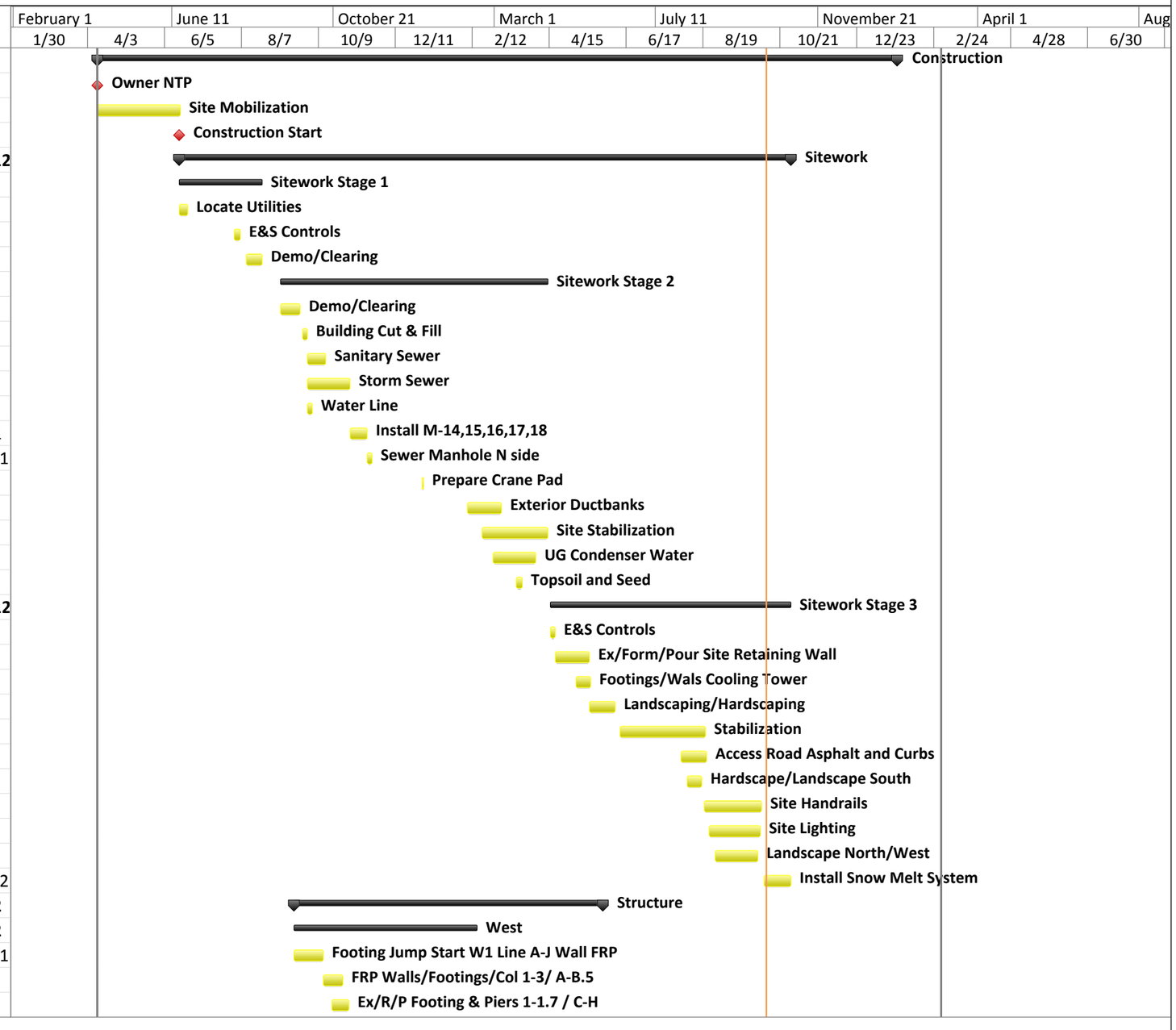
Faisant Structural Model

APPENDIX A

Project Schedule

Towson Tiger Arena Schedule
Created by Derek Stoecklein

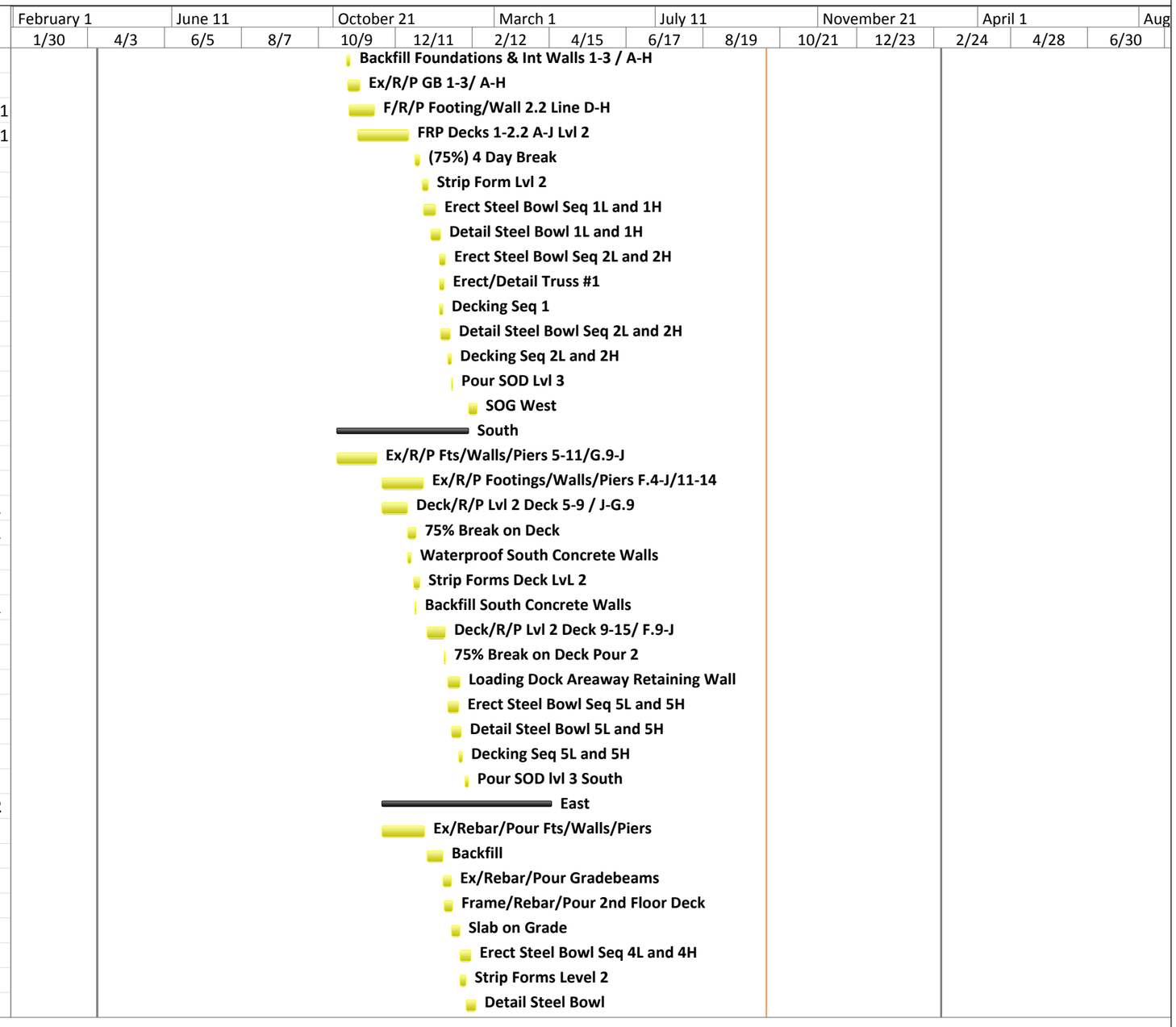
ID	Task Name	Duration	Start	Finish
1	**Construction**	**469 days**	**Mon 4/11/11**	**Thu 1/24/13**
2	Owner NTP	0 days	Mon 4/11/11	Mon 4/11/11
3	Site Mobilization	50 days	Mon 4/11/11	Fri 6/17/11
4	Construction Start	0 days	Fri 6/17/11	Fri 6/17/11
5	**Sitework**	**357 days**	**Fri 6/17/11**	**Mon 10/29/12**
6	**Sitework Stage 1**	**48 days**	**Fri 6/17/11**	**Tue 8/23/11**
7	Locate Utilities	5 days	Fri 6/17/11	Thu 6/23/11
8	E&S Controls	5 days	Mon 8/1/11	Fri 8/5/11
9	Demo/Clearing	9 days	Thu 8/11/11	Tue 8/23/11
10	**Sitework Stage 2**	**157 days**	**Thu 9/8/11**	**Fri 4/13/12**
11	Demo/Clearing	12 days	Thu 9/8/11	Fri 9/23/11
12	Building Cut & Fill	4 days	Mon 9/26/11	Thu 9/29/11
13	Sanitary Sewer	11 days	Fri 9/30/11	Fri 10/14/11
14	Storm Sewer	25 days	Fri 9/30/11	Thu 11/3/11
15	Water Line	2 days	Fri 9/30/11	Mon 10/3/11
16	Install M-14,15,16,17,18	10 days	Fri 11/4/11	Thu 11/17/11
17	Sewer Manhole N side	2 days	Fri 11/18/11	Mon 11/21/11
18	Prepare Crane Pad	1 day	Mon 1/2/12	Mon 1/2/12
19	Exterior Ductbanks	20 days	Wed 2/8/12	Tue 3/6/12
20	Site Stabilization	40 days	Mon 2/20/12	Fri 4/13/12
21	UG Condenser Water	25 days	Wed 2/29/12	Tue 4/3/12
22	Topsoil and Seed	5 days	Mon 3/19/12	Fri 3/23/12
23	**Sitework Stage 3**	**141 days**	**Mon 4/16/12**	**Mon 10/29/12**
24	E&S Controls	4 days	Mon 4/16/12	Thu 4/19/12
25	Ex/Form/Pour Site Retaining Wall	20 days	Fri 4/20/12	Thu 5/17/12
26	Footings/Wals Cooling Tower	10 days	Mon 5/7/12	Fri 5/18/12
27	Landscaping/Hardscaping	15 days	Fri 5/18/12	Thu 6/7/12
28	Stabilization	50 days	Tue 6/12/12	Mon 8/20/12
29	Access Road Asphalt and Curbs	15 days	Wed 8/1/12	Tue 8/21/12
30	Hardscape/Landscape South	10 days	Mon 8/6/12	Fri 8/17/12
31	Site Handrails	35 days	Mon 8/20/12	Fri 10/5/12
32	Site Lighting	30 days	Fri 8/24/12	Thu 10/4/12
33	Landscape North/West	25 days	Wed 8/29/12	Tue 10/2/12
34	Install Snow Melt System	16 days	Mon 10/8/12	Mon 10/29/12
35	**Structure**	**181 days**	**Mon 9/19/11**	**Mon 5/28/12**
36	**West**	**108 days**	**Mon 9/19/11**	**Wed 2/15/12**
37	Footing Jump Start W1 Line A-J Wall FRP	18 days	Mon 9/19/11	Wed 10/12/11
38	FRP Walls/Footings/Col 1-3/ A-B.5	12 days	Thu 10/13/11	Fri 10/28/11
39	Ex/R/P Footing & Piers 1-1.7 / C-H	10 days	Thu 10/20/11	Wed 11/2/11



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	

Towson Tiger Arena Schedule
Created by Derek Stoecklein

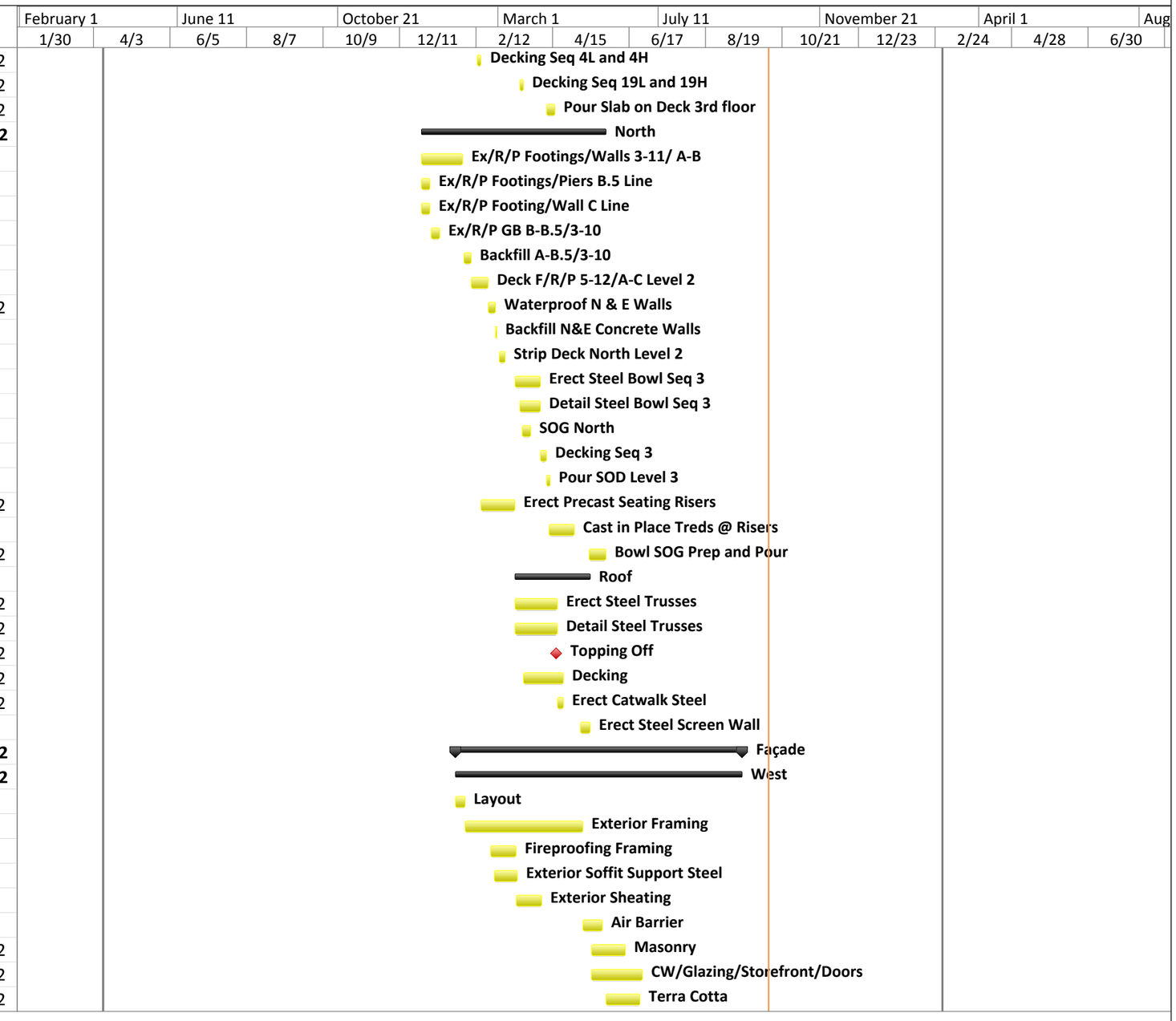
ID	Task Name	Duration	Start	Finish
40	Backfill Foundations & Int Walls 1-3 / A-H	3 days	Tue 11/1/11	Thu 11/3/11
41	Ex/R/P GB 1-3/ A-H	8 days	Wed 11/2/11	Fri 11/11/11
42	F/R/P Footing/Wall 2.2 Line D-H	15 days	Thu 11/3/11	Wed 11/23/11
43	FRP Decks 1-2.2 A-J Lvl 2	30 days	Thu 11/10/11	Wed 12/21/11
44	(75%) 4 Day Break	4 days	Tue 12/27/11	Fri 12/30/11
45	Strip Form Lvl 2	5 days	Mon 1/2/12	Fri 1/6/12
46	Erect Steel Bowl Seq 1L and 1H	8 days	Tue 1/3/12	Thu 1/12/12
47	Detail Steel Bowl 1L and 1H	6 days	Mon 1/9/12	Mon 1/16/12
48	Erect Steel Bowl Seq 2L and 2H	5 days	Mon 1/16/12	Fri 1/20/12
49	Erect/Detail Truss #1	4 days	Mon 1/16/12	Thu 1/19/12
50	Decking Seq 1	3 days	Mon 1/16/12	Wed 1/18/12
51	Detail Steel Bowl Seq 2L and 2H	6 days	Tue 1/17/12	Tue 1/24/12
52	Decking Seq 2L and 2H	3 days	Mon 1/23/12	Wed 1/25/12
53	Pour SOD Lvl 3	1 day	Thu 1/26/12	Thu 1/26/12
54	SOG West	5 days	Thu 2/9/12	Wed 2/15/12
55	**South**	**78 days**	**Mon 10/24/11**	**Wed 2/8/12**
56	Ex/R/P Fts/Walls/Piers 5-11/G.9-J	25 days	Mon 10/24/11	Fri 11/25/11
57	Ex/R/P Footings/Walls/Piers F.4-J/11-14	24 days	Wed 11/30/11	Mon 1/2/12
58	Deck/R/P Lvl 2 Deck 5-9 / J-G.9	15 days	Wed 11/30/11	Tue 12/20/11
59	75% Break on Deck	5 days	Wed 12/21/11	Tue 12/27/11
60	Waterproof South Concrete Walls	3 days	Wed 12/21/11	Fri 12/23/11
61	Strip Forms Deck LvL 2	5 days	Mon 12/26/11	Fri 12/30/11
62	Backfill South Concrete Walls	1 day	Tue 12/27/11	Tue 12/27/11
63	Deck/R/P Lvl 2 Deck 9-15/ F.9-J	11 days	Fri 1/6/12	Fri 1/20/12
64	75% Break on Deck Pour 2	1 day	Fri 1/20/12	Fri 1/20/12
65	Loading Dock Areaway Retaining Wall	8 days	Mon 1/23/12	Wed 2/1/12
66	Erect Steel Bowl Seq 5L and 5H	7 days	Mon 1/23/12	Tue 1/31/12
67	Detail Steel Bowl 5L and 5H	6 days	Thu 1/26/12	Thu 2/2/12
68	Decking Seq 5L and 5H	3 days	Wed 2/1/12	Fri 2/3/12
69	Pour SOD lvl 3 South	3 days	Mon 2/6/12	Wed 2/8/12
70	**East**	**99 days**	**Wed 11/30/11**	**Mon 4/16/12**
71	Ex/Rebar/Pour Fts/Walls/Piers	25 days	Wed 11/30/11	Tue 1/3/12
72	Backfill	9 days	Fri 1/6/12	Wed 1/18/12
73	Ex/Rebar/Pour Gradebeams	5 days	Thu 1/19/12	Wed 1/25/12
74	Frame/Rebar/Pour 2nd Floor Deck	5 days	Fri 1/20/12	Thu 1/26/12
75	Slab on Grade	5 days	Thu 1/26/12	Wed 2/1/12
76	Erect Steel Bowl Seq 4L and 4H	7 days	Thu 2/2/12	Fri 2/10/12
77	Strip Forms Level 2	3 days	Thu 2/2/12	Mon 2/6/12
78	Detail Steel Bowl	6 days	Tue 2/7/12	Tue 2/14/12



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

Towson Tiger Arena Schedule
Created by Derek Stoecklein

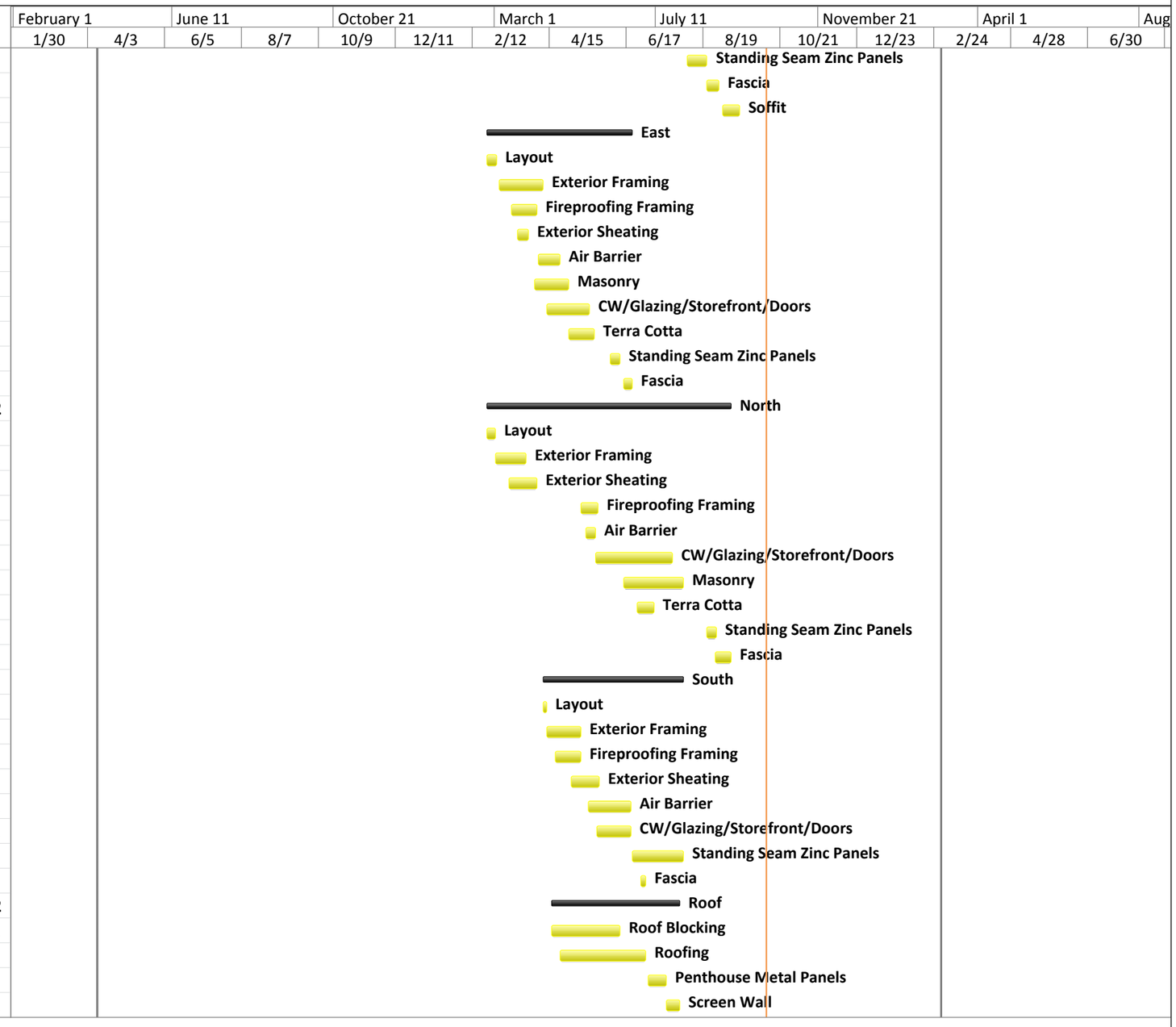
ID	Task Name	Duration	Start	Finish
79	Decking Seq 4L and 4H	3 days	Mon 2/13/12	Wed 2/15/12
80	Decking Seq 19L and 19H	3 days	Mon 3/19/12	Wed 3/21/12
81	Pour Slab on Deck 3rd floor	5 days	Tue 4/10/12	Mon 4/16/12
82	**North**	**108 days**	**Thu 12/29/11**	**Mon 5/28/12**
83	Ex/R/P Footings/Walls 3-11/ A-B	24 days	Thu 12/29/11	Tue 1/31/12
84	Ex/R/P Footings/Piers B.5 Line	5 days	Thu 12/29/11	Wed 1/4/12
85	Ex/R/P Footing/Wall C Line	5 days	Thu 12/29/11	Wed 1/4/12
86	Ex/R/P GB B-B.5/3-10	5 days	Fri 1/6/12	Thu 1/12/12
87	Backfill A-B.5/3-10	4 days	Thu 2/2/12	Tue 2/7/12
88	Deck F/R/P 5-12/A-C Level 2	10 days	Wed 2/8/12	Tue 2/21/12
89	Waterproof N & E Walls	4 days	Wed 2/22/12	Mon 2/27/12
90	Backfill N&E Concrete Walls	1 day	Tue 2/28/12	Tue 2/28/12
91	Strip Deck North Level 2	3 days	Fri 3/2/12	Tue 3/6/12
92	Erect Steel Bowl Seq 3	15 days	Thu 3/15/12	Wed 4/4/12
93	Detail Steel Bowl Seq 3	13 days	Mon 3/19/12	Wed 4/4/12
94	SOG North	5 days	Wed 3/21/12	Tue 3/27/12
95	Decking Seq 3	3 days	Thu 4/5/12	Mon 4/9/12
96	Pour SOD Level 3	3 days	Tue 4/10/12	Thu 4/12/12
97	Erect Precast Seating Risers	20 days	Thu 2/16/12	Wed 3/14/12
98	Cast in Place Treds @ Risers	15 days	Thu 4/12/12	Wed 5/2/12
99	Bowl SOG Prep and Pour	10 days	Tue 5/15/12	Mon 5/28/12
100	**Roof**	**44 days**	**Thu 3/15/12**	**Tue 5/15/12**
101	Erect Steel Trusses	25 days	Thu 3/15/12	Wed 4/18/12
102	Detail Steel Trusses	25 days	Thu 3/15/12	Wed 4/18/12
103	Topping Off	0 days	Wed 4/18/12	Wed 4/18/12
104	Decking	23 days	Thu 3/22/12	Mon 4/23/12
105	Erect Catwalk Steel	3 days	Thu 4/19/12	Mon 4/23/12
106	Erect Steel Screen Wall	6 days	Tue 5/8/12	Tue 5/15/12
107	**Façade**	**168 days**	**Thu 1/26/12**	**Mon 9/17/12**
108	**West**	**168 days**	**Thu 1/26/12**	**Mon 9/17/12**
109	Layout	6 days	Thu 1/26/12	Thu 2/2/12
110	Exterior Framing	69 days	Fri 2/3/12	Wed 5/9/12
111	Fireproofing Framing	15 days	Fri 2/24/12	Thu 3/15/12
112	Exterior Soffit Support Steel	15 days	Mon 2/27/12	Fri 3/16/12
113	Exterior Sheating	15 days	Fri 3/16/12	Thu 4/5/12
114	Air Barrier	12 days	Thu 5/10/12	Fri 5/25/12
115	Masonry	20 days	Thu 5/17/12	Wed 6/13/12
116	CW/Glazing/Storefront/Doors	30 days	Thu 5/17/12	Wed 6/27/12
117	Terra Cotta	20 days	Tue 5/29/12	Mon 6/25/12



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				

Towson Tiger Arena Schedule
Created by Derek Stoecklein

ID	Task Name	Duration	Start	Finish
118	Standing Seam Zinc Panels	12 days	Mon 8/6/12	Tue 8/21/12
119	Fascia	8 days	Wed 8/22/12	Fri 8/31/12
120	Soffit	10 days	Tue 9/4/12	Mon 9/17/12
121	**East**	**85 days**	**Fri 2/24/12**	**Thu 6/21/12**
122	Layout	6 days	Fri 2/24/12	Fri 3/2/12
123	Exterior Framing	26 days	Mon 3/5/12	Mon 4/9/12
124	Fireproofing Framing	15 days	Thu 3/15/12	Wed 4/4/12
125	Exterior Sheating	7 days	Tue 3/20/12	Wed 3/28/12
126	Air Barrier	12 days	Fri 4/6/12	Mon 4/23/12
127	Masonry	20 days	Tue 4/3/12	Mon 4/30/12
128	CW/Glazing/Storefront/Doors	25 days	Fri 4/13/12	Thu 5/17/12
129	Terra Cotta	15 days	Tue 5/1/12	Mon 5/21/12
130	Standing Seam Zinc Panels	6 days	Mon 6/4/12	Mon 6/11/12
131	Fascia	5 days	Fri 6/15/12	Thu 6/21/12
132	**North**	**142 days**	**Fri 2/24/12**	**Mon 9/10/12**
133	Layout	5 days	Fri 2/24/12	Thu 3/1/12
134	Exterior Framing	17 days	Fri 3/2/12	Mon 3/26/12
135	Exterior Sheating	17 days	Tue 3/13/12	Wed 4/4/12
136	Fireproofing Framing	10 days	Fri 5/11/12	Thu 5/24/12
137	Air Barrier	6 days	Tue 5/15/12	Tue 5/22/12
138	CW/Glazing/Storefront/Doors	45 days	Wed 5/23/12	Tue 7/24/12
139	Masonry	35 days	Fri 6/15/12	Thu 8/2/12
140	Terra Cotta	10 days	Tue 6/26/12	Mon 7/9/12
141	Standing Seam Zinc Panels	6 days	Wed 8/22/12	Wed 8/29/12
142	Fascia	9 days	Wed 8/29/12	Mon 9/10/12
143	**South**	**83 days**	**Tue 4/10/12**	**Thu 8/2/12**
144	Layout	3 days	Tue 4/10/12	Thu 4/12/12
145	Exterior Framing	20 days	Fri 4/13/12	Thu 5/10/12
146	Fireproofing Framing	15 days	Fri 4/20/12	Thu 5/10/12
147	Exterior Sheating	17 days	Thu 5/3/12	Fri 5/25/12
148	Air Barrier	25 days	Thu 5/17/12	Wed 6/20/12
149	CW/Glazing/Storefront/Doors	20 days	Thu 5/24/12	Wed 6/20/12
150	Standing Seam Zinc Panels	30 days	Fri 6/22/12	Thu 8/2/12
151	Fascia	2 days	Fri 6/29/12	Mon 7/2/12
152	**Roof**	**75 days**	**Tue 4/17/12**	**Mon 7/30/12**
153	Roof Blocking	40 days	Tue 4/17/12	Mon 6/11/12
154	Roofing	50 days	Tue 4/24/12	Mon 7/2/12
155	Penthouse Metal Panels	11 days	Thu 7/5/12	Thu 7/19/12
156	Screen Wall	7 days	Fri 7/20/12	Mon 7/30/12



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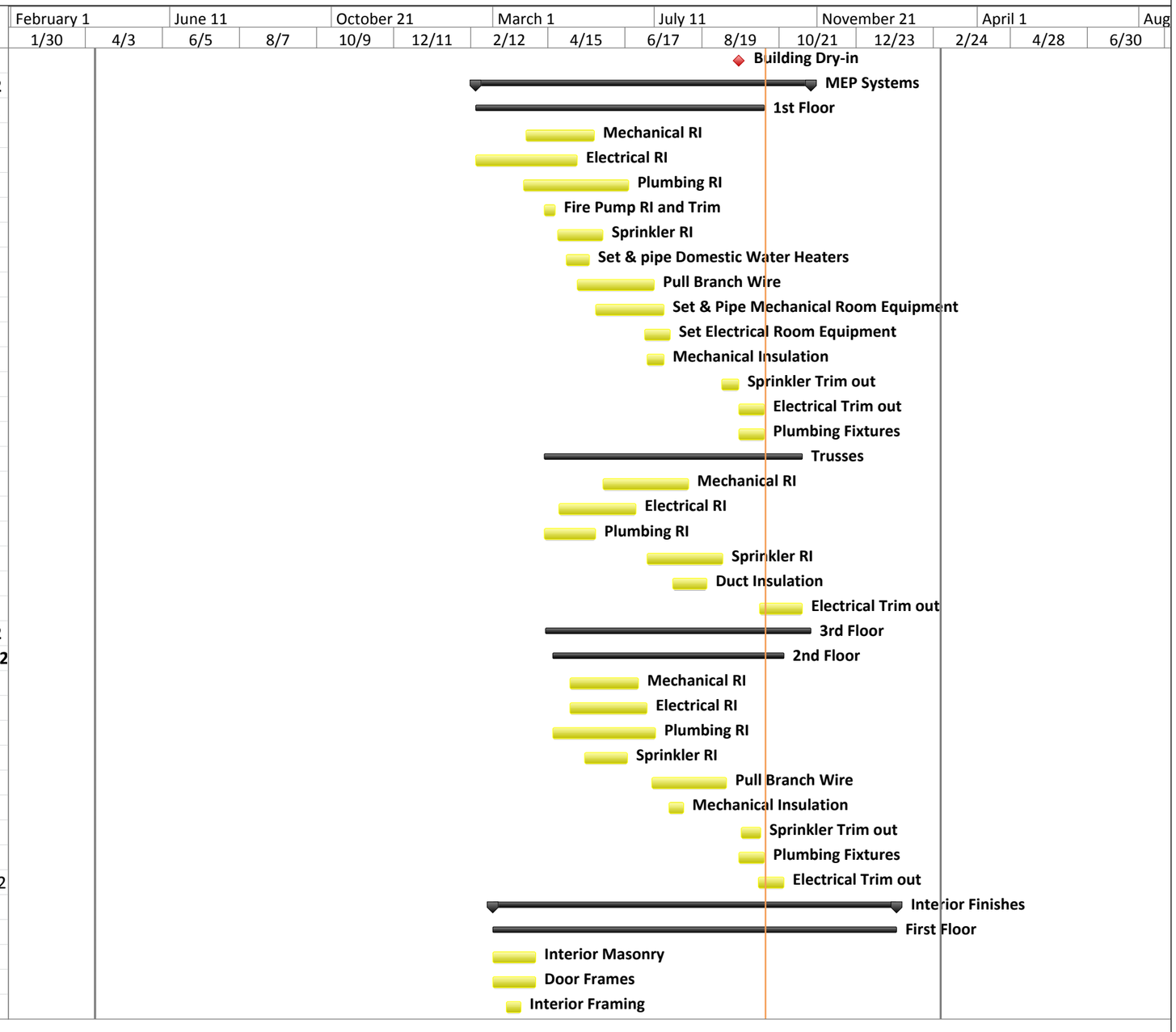
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Deadline
Progress

Towson Tiger Arena Schedule
Created by Derek Stoecklein

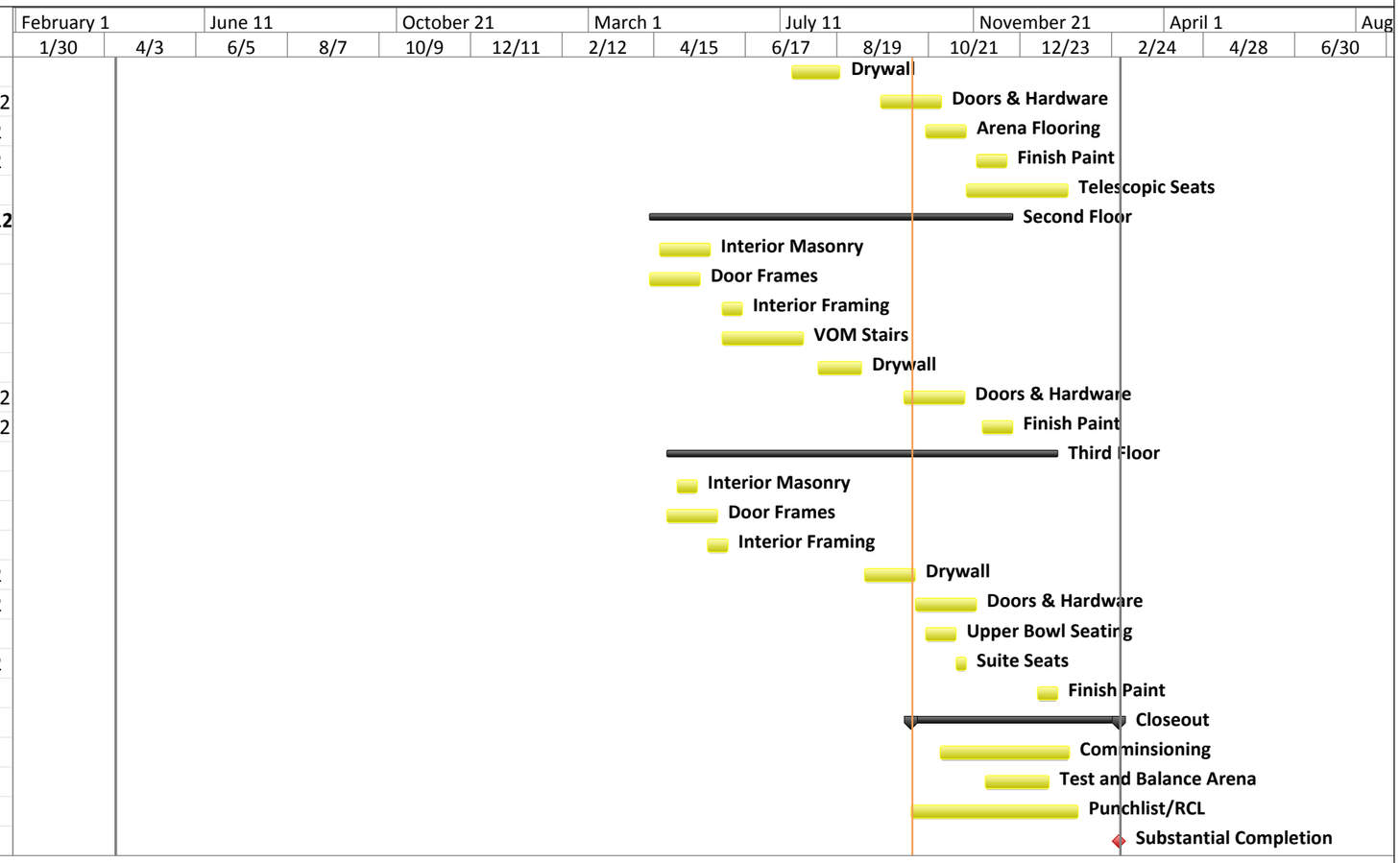
ID	Task Name	Duration	Start	Finish
157	Building Dry-in	0 days	Mon 9/17/12	Mon 9/17/12
158	**MEP Systems**	**196 days**	**Thu 2/16/12**	**Thu 11/15/12**
159	**1st Floor**	**168 days**	**Thu 2/16/12**	**Mon 10/8/12**
160	Mechanical RI	40 days	Wed 3/28/12	Tue 5/22/12
161	Electrical RI	59 days	Thu 2/16/12	Tue 5/8/12
162	Plumbing RI	62 days	Mon 3/26/12	Tue 6/19/12
163	Fire Pump RI and Trim	7 days	Thu 4/12/12	Fri 4/20/12
164	Sprinkler RI	27 days	Mon 4/23/12	Tue 5/29/12
165	Set & pipe Domestic Water Heaters	15 days	Mon 4/30/12	Fri 5/18/12
166	Pull Branch Wire	45 days	Wed 5/9/12	Tue 7/10/12
167	Set & Pipe Mechanical Room Equipment	40 days	Thu 5/24/12	Wed 7/18/12
168	Set Electrical Room Equipment	15 days	Tue 7/3/12	Mon 7/23/12
169	Mechanical Insulation	10 days	Thu 7/5/12	Wed 7/18/12
170	Sprinkler Trim out	10 days	Tue 9/4/12	Mon 9/17/12
171	Electrical Trim out	15 days	Tue 9/18/12	Mon 10/8/12
172	Plumbing Fixtures	15 days	Tue 9/18/12	Mon 10/8/12
173	**Trusses**	**151 days**	**Thu 4/12/12**	**Thu 11/8/12**
174	Mechanical RI	50 days	Wed 5/30/12	Tue 8/7/12
175	Electrical RI	45 days	Tue 4/24/12	Mon 6/25/12
176	Plumbing RI	30 days	Thu 4/12/12	Wed 5/23/12
177	Sprinkler RI	44 days	Thu 7/5/12	Tue 9/4/12
178	Duct Insulation	20 days	Thu 7/26/12	Wed 8/22/12
179	Electrical Trim out	25 days	Fri 10/5/12	Thu 11/8/12
180	**3rd Floor**	**155 days**	**Fri 4/13/12**	**Thu 11/15/12**
190	**2nd Floor**	**135 days**	**Thu 4/19/12**	**Wed 10/24/12**
191	Mechanical RI	40 days	Thu 5/3/12	Wed 6/27/12
192	Electrical RI	45 days	Thu 5/3/12	Wed 7/4/12
193	Plumbing RI	60 days	Thu 4/19/12	Wed 7/11/12
194	Sprinkler RI	25 days	Tue 5/15/12	Mon 6/18/12
195	Pull Branch Wire	45 days	Mon 7/9/12	Fri 9/7/12
196	Mechanical Insulation	10 days	Mon 7/23/12	Fri 8/3/12
197	Sprinkler Trim out	12 days	Thu 9/20/12	Fri 10/5/12
198	Plumbing Fixtures	15 days	Tue 9/18/12	Mon 10/8/12
199	Electrical Trim out	15 days	Thu 10/4/12	Wed 10/24/12
200	**Interior Finishes**	**236 days**	**Thu 3/1/12**	**Thu 1/24/13**
201	**First Floor**	**236 days**	**Thu 3/1/12**	**Thu 1/24/13**
202	Interior Masonry	25 days	Thu 3/1/12	Wed 4/4/12
203	Door Frames	25 days	Thu 3/1/12	Wed 4/4/12
204	Interior Framing	10 days	Mon 3/12/12	Fri 3/23/12



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	

Towson Tiger Arena Schedule
Created by Derek Stoecklein

ID	Task Name	Duration	Start	Finish
205	Drywall	23 days	Thu 7/19/12	Mon 8/20/12
206	Doors & Hardware	30 days	Tue 9/18/12	Mon 10/29/12
207	Arena Flooring	20 days	Fri 10/19/12	Thu 11/15/12
208	Finish Paint	15 days	Fri 11/23/12	Thu 12/13/12
209	Telescopic Seats	50 days	Fri 11/16/12	Thu 1/24/13
210	**Second Floor**	**178 days**	**Thu 4/12/12**	**Mon 12/17/12**
211	Interior Masonry	25 days	Thu 4/19/12	Wed 5/23/12
212	Door Frames	25 days	Thu 4/12/12	Wed 5/16/12
213	Interior Framing	10 days	Fri 6/1/12	Thu 6/14/12
214	VOM Stairs	40 days	Fri 6/1/12	Thu 7/26/12
215	Drywall	22 days	Mon 8/6/12	Tue 9/4/12
216	Doors & Hardware	30 days	Thu 10/4/12	Wed 11/14/12
217	Finish Paint	15 days	Tue 11/27/12	Mon 12/17/12
218	**Third Floor**	**193 days**	**Tue 4/24/12**	**Thu 1/17/13**
219	Interior Masonry	10 days	Tue 5/1/12	Mon 5/14/12
220	Door Frames	25 days	Tue 4/24/12	Mon 5/28/12
221	Interior Framing	10 days	Tue 5/22/12	Mon 6/4/12
222	Drywall	25 days	Fri 9/7/12	Thu 10/11/12
223	Doors & Hardware	30 days	Fri 10/12/12	Thu 11/22/12
224	Upper Bowl Seating	15 days	Fri 10/19/12	Thu 11/8/12
225	Suite Seats	5 days	Fri 11/9/12	Thu 11/15/12
226	Finish Paint	10 days	Fri 1/4/13	Thu 1/17/13
227	**Closeout**	**103 days**	**Tue 10/9/12**	**Fri 3/1/13**
228	Comminsioning	65 days	Mon 10/29/12	Fri 1/25/13
229	Test and Balance Arena	32 days	Thu 11/29/12	Fri 1/11/13
230	Punchlist/RCL	83 days	Tue 10/9/12	Thu 1/31/13
231	Substantial Completion	0 days	Fri 3/1/13	Fri 3/1/13



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 B

Structural Estimate

Division 3 Concrete									
Spec	Item	Count	Units	Material	Labor	Equipment	Total	Total Incl O&P	Cost
03 11 13	Elevated Slab Forms in place	232	SFCA	5.35	4.97	-	10	14	$ 3,248.00
03 11 13	Footing Forms in place	900	SFCA	1.9	4.39	-	6	9.3	$ 8,370.00
03 11 13	Foundation Walls Forms in place	1000	SFCA	1.02	5.95	-	7	10.98	$ 10,980.00
03 11 13	Slab Edge Forms in place, 6" High	250	SFCA	0.29	2.23	-	3	3.98	$ 995.00
03 22 05	WWF (Average)	650	C.S.F	21.5	25.5	-	47	66	$ 42,900.00
03 30 53	6" Slab on Grade	104	CY	114	41.5	0.3	156	194	$ 20,176.00
03 30 53	5.25" LW Concrete on Deck	11	CY	103	15.1	4.82	123	143	$ 1,573.00
03 30 53	11" One-Way Slab	60	CY	239	239	19.3	497	675	$ 40,500.00
03 30 53	18" CIP Foundation Wall Concrete	2	CY	147	96.5	8.2	252	330	$ 660.00
03 30 53	13" CIP Foundation Wall Concrete	1	CY	147	96.5	8.2	252	330	$ 330.00
03 30 53	Rectangular Footings Concrete	89	CY	177	63	0.36	240	298	$ 26,522.00
03 30 53	Concrete Columns (4000 psi)	45	CY	415	500	42	957	1325	$ 59,625.00
03 30 53	Concrete Beams (4000 psi)	15	CY	305	565	47.5	918	1325	$ 19,875.00
								Total	$ 235,754.00
								Loc Adj (Baltimore) .93	$ 219,251.22
								Tax 6%	$ 13,155.07
								Total Cost	$ 232,406.29

Division 5 Metals									
Spec	Item	Count	Unit	Material	Labor	Equipment	Total	Total Incl O&P	Cost
05 15 44	1 1/2" Galv. Steel Deck	1600	SF	1.25	0.31	0.02	1.58	1.89	$ 3,024.00
05 15 44	Glav. Roof Deck	4800	SF	2.05	0.41	0.03	2.49	3.05	$ 14,640.00
05 15 23	HSS4X4X1/2	4	EA	200	46.5	26	272.5	330	$ 1,320.00
05 15 23	HSS6X4X5/16	1	EA	315	50	27.5	392.5	465	$ 465.00
05 15 23	HSS6X6X5/16	15	EA	340	50	27.5	417.5	490	$ 7,350.00
05 15 23	HSS7X7X5/16	1	EA	730	54	30	814	935	$ 935.00
05 15 23	HSS10X8X5/16	1	EA	730	54	30	814	935	$ 935.00
05 15 23	W8X35	40	LF	42.5	2.5	1.39	46.39	53	$ 2,120.00
05 15 23	W8X10	248	LF	12.4	4.5	2.49	19.39	24.5	$ 6,076.00
05 15 23	W8X15	12	LF	13.75	4.5	2.49	20.74	26	$ 312.00
05 15 23	W10X12	20	LF	30.5	4.5	2.49	37.49	44.5	$ 890.00
05 15 23	W10X15	70	LF	30.5	4.5	2.49	37.49	44.5	$ 3,115.00
05 15 23	W10X45	27	LF	62	2.62	1.45	66.07	74.5	$ 2,011.50
05 15 23	W12X14	240	LF	22	3.07	1.7	26.77	31.5	$ 7,560.00
05 15 23	W12X16	22	LF	22	3.07	1.7	26.77	31.5	$ 693.00
05 15 23	W12X19	159	LF	30.5	3.07	1.7	35.27	41	$ 6,519.00
05 15 23	W12X26	367	LF	36	3.07	1.7	40.77	47	$ 17,249.00
05 15 23	W12X30	160	LF	36	3.07	1.7	40.77	47	$ 7,520.00
05 15 23	W12X35	108	LF	36	3.07	1.7	40.77	47	$ 5,076.00
05 15 23	W12X40	238	LF	50	3.07	1.7	54.77	47	$ 11,186.00
05 15 23	W12X45	53	LF	50	3.07	1.7	54.77	47	$ 2,491.00
05 15 23	W12X50	20	LF	69	2.62	1.45	73.07	82	$ 1,640.00
05 15 23	W12X53	84	LF	69	2.62	1.45	73.07	82	$ 6,888.00
05 15 23	W12X58	102	LF	69	2.62	1.45	73.07	82	$ 8,364.00
05 15 23	W12X65	116	LF	99	4.22	2.34	105.56	119	$ 13,804.00
05 15 23	W14X90	111	LF	100	2.24	1.85	104.09	119	$ 13,209.00
05 15 23	W14X120	300	LF	165	2.82	1.56	169.38	189	$ 56,700.00
05 15 23	W14X22	394	LF	36	2.73	1.51	40.24	46	$ 18,124.00
05 15 23	W14X26	22	LF	36	2.73	1.51	40.24	46	$ 1,012.00
05 15 23	W14X30	155	LF	41.5	3	1.66	46.16	52.5	$ 8,137.50
05 15 23	W14X34	67	LF	47	3.34	1.85	52.19	59.5	$ 3,986.50
05 15 23	W14X43	3	LF	47	3.34	1.85	52.19	59.5	$ 178.50
05 15 23	W14X48	145	LF	47	3.34	1.85	52.19	59.5	$ 8,627.50
05 15 23	W14X109	203	LF	165	3.75	2.08	170.83	191	$ 38,773.00
05 15 23	W14X120	203	LF	165	3.75	2.08	170.83	191	$ 38,773.00
05 15 23	W14X132	203	LF	165	3.75	2.08	170.83	191	$ 38,773.00
05 15 23	W14X145	203	LF	165	3.75	2.08	170.83	191	$ 38,773.00
05 15 23	W16X26	44	LF	36	2.7	1.5	40.2	46	$ 2,024.00
05 15 23	W16X31	42	LF	42.5	3	1.66	47.16	54	$ 2,268.00
05 15 23	W16X36	102	LF	55	3.38	1.87	60.25	68.5	$ 6,987.00
05 15 23	W16X45	44	LF	55	3.38	1.87	60.25	68	$ 2,992.00
05 15 23	W21X62	23	LF	85.5	3.77	1.56	90.83	103	$ 2,369.00
05 15 23	W21X68	53	LF	93.5	3.77	1.56	98.83	112	$ 5,936.00
05 15 23	W24X68	28	LF	93.5	3.25	1.46	98.21	111	$ 3,108.00
								Total	$ 422,934.50
								Loc Adj (Baltimore) .93	$ 393,329.09
								Tax 6%	$ 23,599.75
								Total Cost	$ 416,928.83

APPENDIX C

General Conditions Estimate

General Conditions Estimate									
Spec	Item	Unit	Material	Labor	Equipment	Total	Total Incl O&P	Quantity	Project Total
Division 1 - General Requirements									
Non-Personnel Items									
01 31 13	Builders Risk Insurance	Job	-	-	-	-	0.005	BCC	$ 250,000.00
01 31 13	General Liability Insurance	Job	-	-	-	-	0.01	BCC	$ 500,000.00
01 31 13	Performance Bonds	Job	-	-	-	-	0.01	BCC	$ 500,000.00
01 32 13	Scheduling	Job	-	-	-	-	0.005	BCC	$ 250,000.00
01 41 26	Permits	Job	-	-	-	-	0.005	BCC	$ 250,000.00
01 45 23	Testing and Inspections	Job	-	-	-	35000	35000	1	$ 35,000.00
01 51 13	Temp Electric	CSF Flr	-	-	-	80	83	1160	$ 96,280.00
01 51 13	Temp Water	CSF Flr	63	-	-	63	69.5	1160	$ 80,620.00
01 51 33	Temp Toilets	Month	100	50	-	150	165	21	$ 3,465.00
01 52 13	Trailer/Month Rental (3)	EA	400	-	-	400	445	21	$ 28,035.00
01 52 13	Storage Box	Month	72	-	-	72	79	21	$ 1,659.00
01 52 13	Office Equipment Rental	Month	275	-	-	275	300	21	$ 6,300.00
01 52 13	Phone Bill	Month	81	-	-	81	89	21	$ 1,869.00
01 56 26	Temp Fencing	L.F.	5.3	1.87	-	7.17	8.75	2500	$ 21,875.00
01 74 13	Cleaning	M.S.F	1.75	26.5	2.2	30.45	45	1160	$ 52,200.00
01 91 13	Building Commissioning	%	-	-	-	-	0.005	BCC	$ 250,000.00
01 74 13	Waste Management	Week	-	-	-	525	578	66	$ 38,148.00
								Total	**$ 2,365,451.00**
On-Site Staff Reimdurseables									
01 31 13	Field Personnel - Project Intern	Week	-	995	-	995	1550	66	$ 102,300.00
01 31 13	Field Personnel - Project Engineer	Week	-	1475	-	1475	2275	66	$ 150,150.00
01 31 13	Field Personnel - Sr. Project Manager	Week	-	2425	-	2425	3750	66	$ 247,500.00
01 31 13	Field Personnel - Assistant Superintendent	Week	-	1975	-	1975	3050	66	$ 201,300.00
01 31 13	Field Personnel - General Superintendent	Week	-	2250	-	2250	3475	66	$ 229,350.00
								Total	**$ 930,600.00**

APPENDIX D

BIM Use Level 1 Chart

Towson Tiger Arena

Level 1 Process Map