Tech 1

Towson Tiger Arena

Derek R Stoecklein

Construction Management

Advisor: Ray Sowers

9/21/2012

August 21, 2012

Raymond Sowers
Thesis Advisor
106 Fox Hollow Building
(814) 863-2571

RE: Tech 1

Dear Mr. Sowers,

Enclosed, please find my response to Tech 1. I am excited to submit to you the information I have generated and gathered regarding Towson Tiger Arena, located in Towson, MD. Tech 1 has challenged me to create a project summary schedule, project cost evaluation, and several site layout plans for Tiger Arena. In addition to this you will find a building system summary, existing site plan, local conditions, client information, project delivery analysis and a staffing plan.

I hope that you find this report to be both interesting and informative. If you have any questions or concerns regarding my Tech 1, please contact me at any time.

Sincerely,

Derek Stoecklein
drs5233@psu.edu
(412) 335-5967

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Schedule Considerations

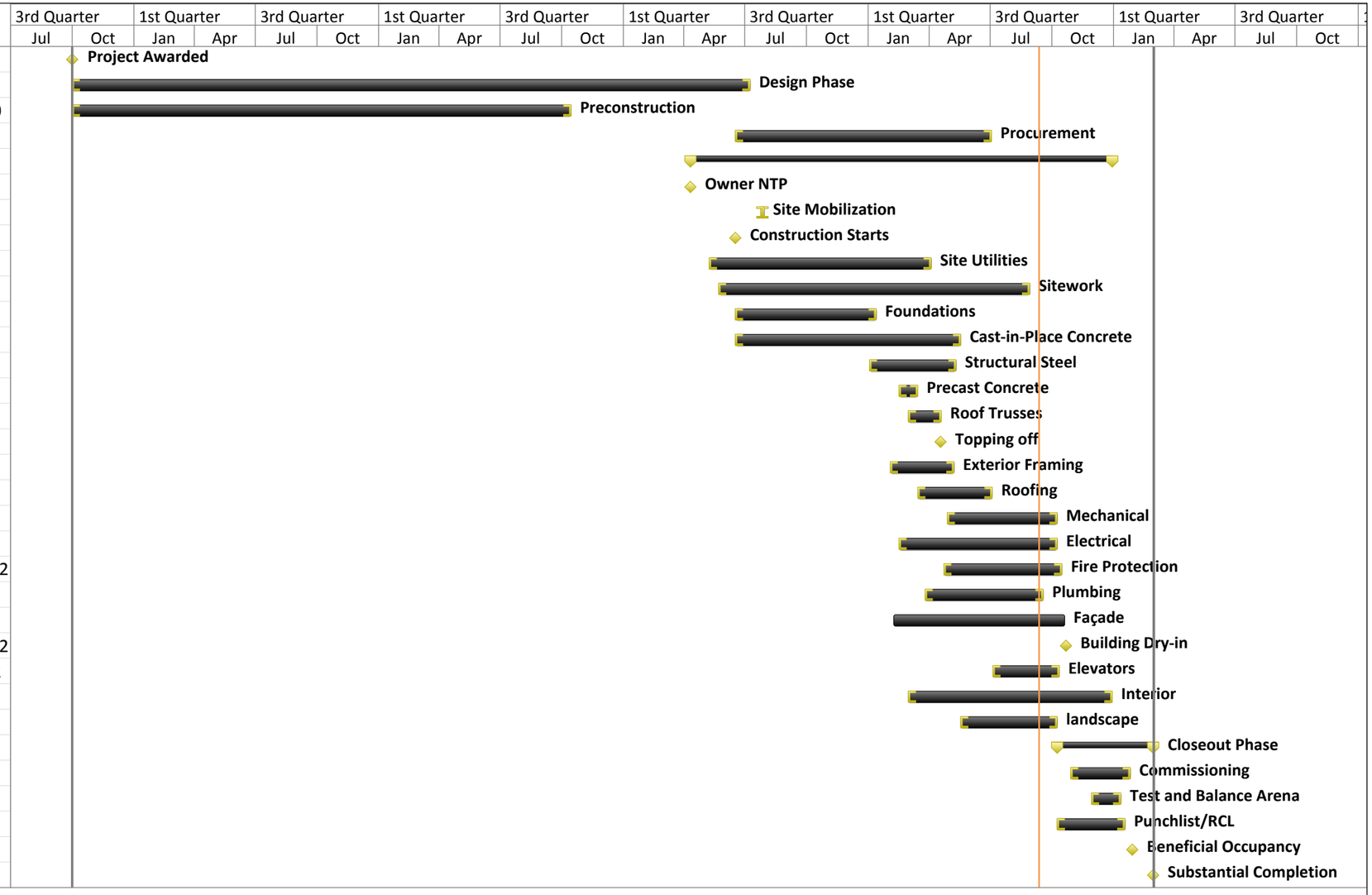
The design phase of Tiger Arena was unique. As you can see from the schedule, the project was awarded to Gilbane in October, 2008. This may draw a flag considering construction start date was not until June 17, 2011. The reason for this "long delay" was due to the complete redesign of the arena. The contract was originally won as a renovation to the existing Tiger Center at a price tag of roughly $40M. With the collaborative approach used by Gilbane they suggested a completely new arena as an "addition" to the existing center. Gilbane presented the opportunities of the new arena verse a renovation to TU. This move towards a new building would cost the University $15M more but fit well with their future plans within TU athletics and the University. This decision was made easily after review by TU and UMB and understanding the benefits to the community and University. HCM was issued the go ahead for design of a new building and through the next 2 years, Gilbane and Towson worked closely on finalizing a design and moving into preconstruction and procurement.

Other notable schedule impacts are the logistics of steel erection. Each truss in the arena weights 30,000lbs and triple wide spans. Starting from East to West, two 999 Manitowoc crawler cranes pick the trusses. The crane located in the bowl will pick 2 sections that are pre-assembled on the ground while second crane located on the west side will pick the third section. With the large trusses, a section of the building will have to be left out for the central crane to back out of the bowl as it picks the west most section, Truss line 1. After this crane is removed from site, trusses three and four are 2/3 erected and placed on soring towers until the building section is filled in. Next the concrete crew will come in to fill the section and pour the remaining slabs followed by the steel risers and truss supports. Lastly, the remaining two trusses sections will be picked and placed.

Figure 1 – First Truss Erected, 3/1/12, *Courtesy of Gilbane*

**Please note that the schedule seen in APPENDIX A is based on an early Gilbane baseline schedule. This does not reflex any challenges or delays that may have occurred during construction.*

ID	Task Name	Duration	Start	Finish
1	Project Awarded	0 days	Wed 10/1/08	Wed 10/1/08
2	Design Phase	723 days	Wed 10/1/08	Fri 7/8/11
3	Preconstruction	532 days	Wed 10/1/08	Thu 10/14/10
4	Procurement	272 days	Fri 6/17/11	Mon 7/2/12
5	**Construction**	**450 days**	**Mon 4/11/11**	**Sat 12/29/12**
6	Owner NTP	0 days	Mon 4/11/11	Mon 4/11/11
7	Site Mobilization	5 days	Mon 7/25/11	Fri 7/29/11
8	Construction Starts	0 days	Fri 6/17/11	Fri 6/17/11
9	Site Utilities	237 days	Mon 5/9/11	Tue 4/3/12
10	Sitework	332 days	Mon 5/23/11	Tue 8/28/12
11	Foundations	150 days	Fri 6/17/11	Thu 1/12/12
12	Cast-in-Place Concrete	240 days	Fri 6/17/11	Thu 5/17/12
13	Structural Steel	93 days	Tue 1/3/12	Thu 5/10/12
14	Precast Concrete	20 days	Thu 2/16/12	Wed 3/14/12
15	Roof Trusses	35 days	Thu 3/1/12	Wed 4/18/12
16	Topping off	0 days	Wed 4/18/12	Wed 4/18/12
17	Exterior Framing	67 days	Fri 2/3/12	Mon 5/7/12
18	Roofing	79 days	Thu 3/15/12	Tue 7/3/12
19	Mechanical	117 days	Sat 4/28/12	Mon 10/8/12
20	Electrical	168 days	Thu 2/16/12	Mon 10/8/12
21	Fire Protection	126 days	Mon 4/23/12	Mon 10/15/12
22	Plumbing	126 days	Mon 3/26/12	Mon 9/17/12
23	Façade	183 days	Wed 2/8/12	Fri 10/19/12
24	Building Dry-in	0 days	Mon 10/22/12	Mon 10/22/12
25	Elevators	71 days	Thu 7/5/12	Thu 10/11/12
26	Interior	218 days	Thu 3/1/12	Sat 12/29/12
27	landscape	102 days	Fri 5/18/12	Mon 10/8/12
28	**Closeout Phase**	**103 days**	**Tue 10/9/12**	**Fri 3/1/13**
29	Commissioning	65 days	Mon 10/29/12	Fri 1/25/13
30	Test and Balance Arena	32 days	Thu 11/29/12	Fri 1/11/13
31	Punchlist/RCL	73 days	Tue 10/9/12	Thu 1/17/13
32	Beneficial Occupancy	0 days	Tue 1/29/13	Tue 1/29/13
33	Substantial Completion	0 days	Fri 3/1/13	Fri 3/1/13



Project: Tiger Arena
Date: 9/12/12

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				

Building Systems

Building Systems Summary		
Yes	No	Work Scope
	x	Demolition
x		Structural Steel Frame
x		CIP Concrete
x		Precast Concrete
x		Mechanical Systems
x		Electrical Systems
x		Masonry
x		Curtain Wall
	x	Support of Excavation

Table 1 – Building Systems Matrix – Created by Derek Stoecklein

Site Work and Site Improvements

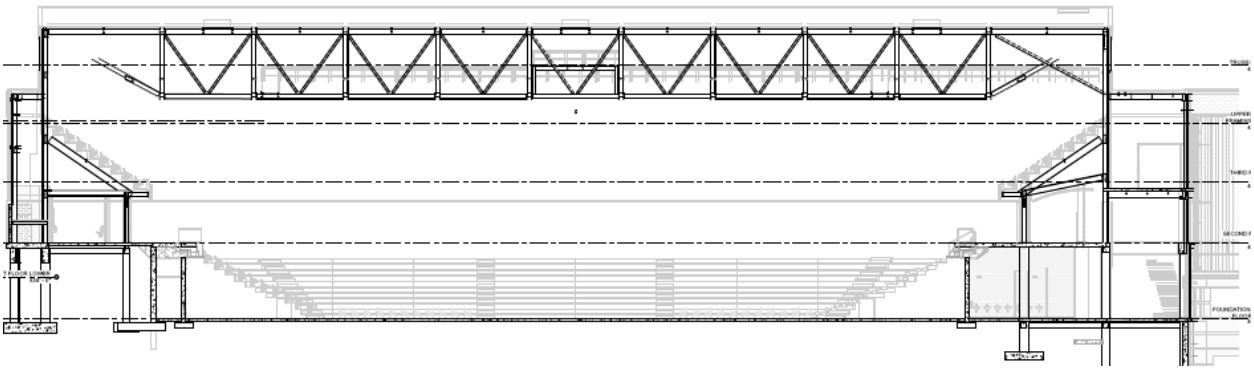
Site work began with rerouting existing utilities including electric and communications. This was run through a duct bank and several man holes to allow the 13.2kv line that supplied power to the building to be moved for the hookup of construction trailers and safe construction and demolition. Silt fence was set up due to the digging associated with the placement of the manholes and duct bank near the sports fields and parking lot. Demolition work will be required for removing several parking lots and walk ways in the area that the new arena will be constructed. The terrain in this area has a slope and because of this, several retaining walls will be constructed and excavation will be required in these areas.

Structure

Starting from the ground up, Tiger Arena is built on foundation systems consisting of retaining walls, spread and continuous footings, and grade beams. The retaining walls are located along the entire north and east exterior. This is due to the large change in elevation from the NW corner to the SE. Grade beams are found interior, between the exterior footings and interior footings for the bowl. The grade beams will support interior concrete columns and the one way slab above. CIP concrete walls, columns and beams, will be resting on theses foundations systems and support the above slabs and structural steel. All CIP concrete will be 4000psi normal weight concrete with grade 60 r-bar. A Steel braced frame

Building Image – Taken by Ryan Simmons, Gilbane

system will tie into the CIP concrete columns at the second floor. All building steel will be ASTM A992, grade 50, with bolted connections. Precast Concrete Seat riser sections will be support by steel risers and beams from below. To complete the structure is a Pratt truss system consisting of 11, three piece trusses.



Building Sections – S2.01

Masonry

The building masonry is light weight, 1500psi concrete blocks, with type S mortar, and 3000psi grout. The interior masonry consists of 6" and 8" CMU inclosing the mechanical and electrical spaces, VOM shaft walls, and bathroom enclosures. Also seen on the interior is white ground face CMU, lining the entire concourse level. The exterior will have ground face and split face CMU on all sides. The ground face is used as accents strip every five courses. Lastly, bluestone caps will be placed along all the side walls and along the main promenade.

Exterior Masonry on Mock-up – Taken by Derek Stoecklein

Moisture Protection

South Vapor Barrier – Taken by Derek Stoecklein

Moisture protection on the roof will be completed with SBS modified bituminous membrane. This membrane slopes north towards two sets of drains to provide adequate drainage. Moisture protection below grade in the addition section of the building will be Bituminous Damp proofing on foundation walls, Self-Adhering Sheet Waterproofing on foundation will be used on walls with proximity to an occupied space, and cold fluid applied plaza deck water proofing is to be applied under concourse pavers. In the elevator pits, Modified Cement Waterproofing is to be completed. The exterior has a liquid applied water proofing coving all glass rock.

Façade

Towson Arena is made of several unique façade systems that are used to visually link the adjacent Unitas stadium and the existing Tiger Center to it. These systems include Terracotta, Zinc panels (Standing Seam and Flat Lock), 12" and 6" C-Channel, Split Face CMU, Ground Face CMU, Curtain Wall, Glazing, and a Clear Story. The structure of the façade is made up of cast-in-place concrete and 6", 16 GA. structural stud framing. Wrapping the structural studs is a 5/8" layer of moisture and mold resistive Glasrock. A layer of liquid applied air barrier is sprayed over the glasrock and all exterior cast-in-place concrete. The North, Unitas facing, façade is a used to draw the spectators into the Arena with a long promenade

West Facade – Taken by Derek Stoecklein

walkway from Auburn drive and large span glazing to allow for a view into the beyond space. Covering the promenade is a canopy roof with zinc soffit that is returns from the façade above seamlessly. Also along this north façade is a large Splitface and Groundface wall, terracotta panels, and a clear story above the canopy that wraps the entire building.

Elevators

The Towson Arena addition is furnished with two elevators. Elevator one is to be rated for 4000lbs and have four landings. This elevator will be located in the North West corner of the Arena and is meant to service all of the floors in the Addition and has a total travel of 50'-2". Elevator two has two doors on the car and requires four landings; it is rated for 4500lbs. The total travel of this elevator is 26'-0" and will be located in the south east side of the Arena Addition. There is an existing elevator in the Towson Center that is rated for 2500lbs and has three landings. The total travel for this elevator is 24'-0" and is located on the north wall of the Existing Arena to service the offices and areas around the Arena.

Mechanical Systems

Heating for this building will be provided by two 400hp, four pass, fire tube boiler/burner set ups. These boilers will be set up to run parallel or independently from each other. Unlike the boilers they are replacing, these units are both natural gas and oil fired, because of this BGE will be required to run natural gas lines to the facility. Two centrifugal Chillers rated at 450 tons each will provide chilled water for the building and two cooling towers rated at 450 tons each will provide cooling water for the chillers, each cooling tower will be rated for 1125 GPM and 450 tons of cooling. Chilled and heating water will be circulated through the building to various air handlers for temperature and humidity control within the arena. Two custom air handling units made by Air Enterprises, rated at 47,000 CFM each will be used in the main portions of the arena for climate control and will be located on the roof. In addition to these

Roof top AHU with curbs - Taken by Derek Stoecklein

custom units, eight smaller air handling units will supply conditioned air to offices and suites throughout the building. An ERU or energy recovery unit will be located on the roof of the arena to allow some of the air to be diverted through the building. This ERU will be rated for 11,000 CFM.

Electrical Systems, Power Distribution and Lighting

Power to the existing center arena is supplied by 15kV underground feeders; these lines ran from the utility company to transformers located next to the arena, which have been moved for construction. The feeder is now run through a duct bank that supplies power to the construction trailers and also the building via a different underground run. Moving this utility was required due to the new stadium location. Switch gear for these 15kV lines will be provided with the new construction and transformers will be used to step down to 480/277V 3 Phase. From there, the building electric is fed to transformers located in mechanical and electrical rooms to step the power down to 208/120V. Equipment and motors throughout the facility will use 480v or 277v electric unless otherwise noted in specs and drawings. Three 150kW generators will be installed for emergency power and will be located near the boiler room outside the existing Towson Center. Air handling units, pumps, fans and other specialties will be furnished with variable frequency drives for motor control where specified.

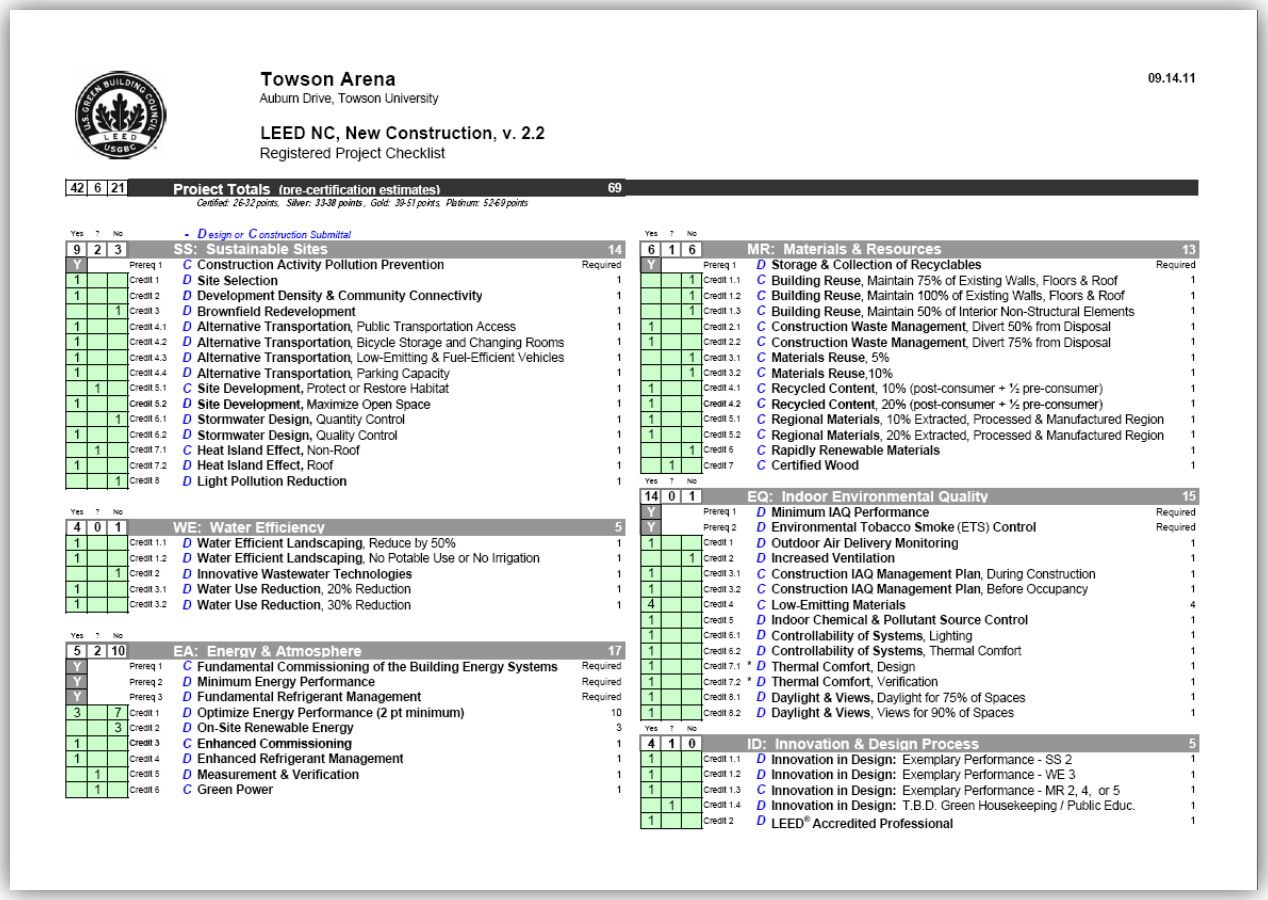
Roofing

The roofing system is a Two Ply Styrene-butadiene-styrene (SBS), touch applied, White granular membrane with an Aluminum roof edge set in multi-purpose MB flashing cement. Below the SBS cap sheet is a tapered, 4" min, ISO 95+ Insulation, covered with ¼" Densdeck and sealed with a base sheet to create a water, vapor and air barrier. At the perimeter of the roof there is wood blocking to support a perlite cant strip and several layers of flashing to allow for proper water from and drainage around the edges. To top the roof of, walk pads will be installed to allow for access to the Air handling units and ERU's.

Roof base sheet - Taken by Derek Stoecklein

Sustainable Features

Towson Tiger Arena's LEED Gold design encompasses many sustainable features including low VOC content for all interior products, all wood material meets FSC and all waste will be recycled according. In addition to these features, Towson will utilized Energy Recovery units (ERU's) to capture energy from the exhausted air as well as a large clear story around the entire truss level to introduce day lighting into the "bowl" of the arena. To improve the indoor air quality within the arena, two centrifugal chillers will be installed to supply chilled water to several Air Handling Units (AHU) throughout the building.



Towson Arena 09.14.11
Auburn Drive, Towson University

LEED NC, New Construction, v. 2.2
Registered Project Checklist

42	6	21	**Project Totals** (pre-certification estimates)	69

Certified: 26-32 points, Silver: 33-38 points, Gold: 39-51 points, Platinum: 52-69 points

Yes	?	No				
					D Design or C Construction Submittal	
9	2	3			**SS: Sustainable Sites**	14
Y			Prereq 1	C	**Construction Activity Pollution Prevention**	Required
1			Credit 1	D	**Site Selection**	1
1			Credit 2	D	**Development Density & Community Connectivity**	1
		1	Credit 3	D	**Brownfield Redevelopment**	1
1			Credit 4.1	D	**Alternative Transportation**, Public Transportation Access	1
1			Credit 4.2	D	**Alternative Transportation**, Bicycle Storage and Changing Rooms	1
1			Credit 4.3	D	**Alternative Transportation**, Low-Emitting & Fuel-Efficient Vehicles	1
1			Credit 4.4	D	**Alternative Transportation**, Parking Capacity	1
	1		Credit 5.1	C	**Site Development,** Protect or Restore Habitat	1
1			Credit 5.2	D	**Site Development,** Maximize Open Space	1
		1	Credit 6.1	D	**Stormwater Design,** Quantity Control	1
1			Credit 6.2	D	**Stormwater Design,** Quality Control	1
	1		Credit 7.1	C	**Heat Island Effect,** Non-Roof	1
1			Credit 7.2	D	**Heat Island Effect,** Roof	1
		1	Credit 8	D	**Light Pollution Reduction**	1

Yes	?	No				
4	0	1			**WE: Water Efficiency**	5
1			Credit 1.1	D	**Water Efficient Landscaping**, Reduce by 50%	1
1			Credit 1.2	D	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		1	Credit 2	D	**Innovative Wastewater Technologies**	1
1			Credit 3.1	D	**Water Use Reduction**, 20% Reduction	1
1			Credit 3.2	D	**Water Use Reduction**, 30% Reduction	1

Yes	?	No				
5	2	10			**EA: Energy & Atmosphere**	17
Y			Prereq 1	C	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	D	**Minimum Energy Performance**	Required
Y			Prereq 3	D	**Fundamental Refrigerant Management**	Required
3		7	Credit 1	D	**Optimize Energy Performance (2 pt minimum)**	10
		3	Credit 2	D	**On-Site Renewable Energy**	3
1			Credit 3	C	**Enhanced Commissioning**	1
1			Credit 4	D	**Enhanced Refrigerant Management**	1
	1		Credit 5	D	**Measurement & Verification**	1
	1		Credit 6	C	**Green Power**	1

Yes	?	No				
6	1	6			**MR: Materials & Resources**	13
Y			Prereq 1	D	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	C	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	C	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	C	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	C	**Construction Waste Management**, Divert 50% from Disposal	1
1			Credit 2.2	C	**Construction Waste Management**, Divert 75% from Disposal	1
		1	Credit 3.1	C	**Materials Reuse**, 5%	1
		1	Credit 3.2	C	**Materials Reuse**,10%	1
1			Credit 4.1	C	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
1			Credit 4.2	C	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	C	**Regional Materials**, 10% Extracted, Processed & Manufactured Region	1
1			Credit 5.2	C	**Regional Materials**, 20% Extracted, Processed & Manufactured Region	1
		1	Credit 6	C	**Rapidly Renewable Materials**	1
	1		Credit 7	C	**Certified Wood**	1

Yes	?	No				
14	0	1			**EQ: Indoor Environmental Quality**	15
Y			Prereq 1	D	**Minimum IAQ Performance**	Required
Y			Prereq 2	D	**Environmental Tobacco Smoke** (ETS) **Control**	Required
1			Credit 1	D	**Outdoor Air Delivery Monitoring**	1
		1	Credit 2	D	**Increased Ventilation**	1
1			Credit 3.1	C	**Construction IAQ Management Plan**, During Construction	1
1			Credit 3.2	C	**Construction IAQ Management Plan**, Before Occupancy	1
4			Credit 4	C	**Low-Emitting Materials**	4
1			Credit 5	D	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	D	**Controllability of Systems**, Lighting	1
1			Credit 6.2	D	**Controllability of Systems**, Thermal Comfort	1
1			Credit 7.1	* D	**Thermal Comfort**, Design	1
1			Credit 7.2	* D	**Thermal Comfort**, Verification	1
1			Credit 8.1	D	**Daylight & Views,** Daylight for 75% of Spaces	1
1			Credit 8.2	D	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No				
4	1	0			**ID: Innovation & Design Process**	5
1			Credit 1.1	D	**Innovation in Design:** Exemplary Performance - SS 2	1
1			Credit 1.2	D	**Innovation in Design:** Exemplary Performance - WE 3	1
1			Credit 1.3	C	**Innovation in Design:** Exemplary Performance - MR 2, 4, or 5	1
	1		Credit 1.4	D	**Innovation in Design:** T.B.D. Green Housekeeping / Public Educ.	1
1			Credit 2	D	**LEED® Accredited Professional**	1

Towson LEED Checklist – Courtesy of Gilbane

Project Cost Evaluation

Tiger Arena Cost Evaluation		
	Total	SF Cost
Building Construction Cost	$ 50,334,248.00	$ 419.45
Total Project Cost	$ 54,889,905.00	$ 457.42
R.S. Means SF Cost	$ 15,510,000.00	$ 129.25
R.S. Means Assemblies Cost		
	Actual	RS Means
HVAC	$ 11,086,400.00	$ 2,851,200.00
Plumbing		$ 280,960.00
Electrical	$ 6,997,000.00	$ 2,755,184.00

Table 2 –Building Cost breakdown - Created by Derek Stoecklein

R.S. Means SF Cost Break Down

Building Type Used: Gymnasium

Exterior Wall Construction: Metal Sandwich Panels

Structure: Rigid Steel Frame

S.F Area: 120,000 S.F

L.F. Perimeter: 1020 L.F

Location Adjustment: .93 (Baltimore)

Total per SF = $129.25

Building Cost = $15,510,000

** Estimate was created using RS Means SF Cost 2012*

** Reference material found in APPENDIX C*

R.S. Means Assemblies Estimate

	Mat	Inst.	Total	Cost
HVAC				
Terminal Unit Heaters	1.72	2.12	3.84	$ 460,800.00
Cooling Tower Systems	6.8	6.5	13.3	$ 1,596,000.00
AHU	3.45	3.17	6.62	$ 794,400.00
			Total	**$ 2,851,200.00**
Plumbing				
Water Closet System	1650	680	2330	$ 139,800.00
Urinal	590	765	1355	$ 16,260.00
Sinks	870	750	1620	$ 40,500.00
Domestic Water Heaters	39200	3000	42200	$ 84,400.00
			Total	**$ 280,960.00**
Electrical				
Lighting	2.56	5.35	7.91	$ 949,200.00
HID Lighting	3.45	5.45	8.9	$ 1,068,000.00
Switchgear	28300	15500	43800	$ 43,800.00
Switches & Recpt	0.25	0.92	1.17	$ 140,400.00
Transformers	355	51	406	$ 553,784.00
			Total	**$ 2,755,184.00**

Table 3 – Assemblies estimate- Created by Derek Stoecklein

**R.S. Means Assemblies 2011 was used to create this data*

Estimate Summary

Tiger Arena is an M/E/P intensive building when it comes to overall cost. Thirty six percent of the building total construction cost is M/E/P. Looking at the R.S. Means SF cost data, I knew there would be a large bust in final price due to this and the high levels of interior and exterior finish work. In addition to this, the closest related building type found was a gymnasium. With this in mind, I was expecting a much lower number when calculating the SF estimate. My final number of **$129.25** is $290.20 less than the actual Building Cost. Like said before, this is due to Tiger Arenas specialized A/V package, unique finishes and specialized building systems. When I looked into an assemblies estimate for the M/E/P systems, I was concentrating on the large equipment and systems that supply the building. As you see, the numbers are significantly different. I believe this is because the building systems are custom to Tiger Arena and are not typical. I believe to accurately depict the cost of these systems; a detailed estimate would need to be done with vendor quotes. Tiger Arena may not have elaborate systems but they are unique to this building type and RS Means does not reflect sporting arenas in its cost data.

Existing Conditions

Tiger Arena is built on an existing parking lot and grass field on the Far Southwest end of Towson University, adjacent to Tiger Center and Unitas Stadium, *Figure1.* With Tiger Arena being so close to the existing Unitas Stadium and Tiger Center, the utilities will be easily tied into. During phase one, Ross contracting will be redirecting all the building utilities from auburn drive to locations under the new arena.

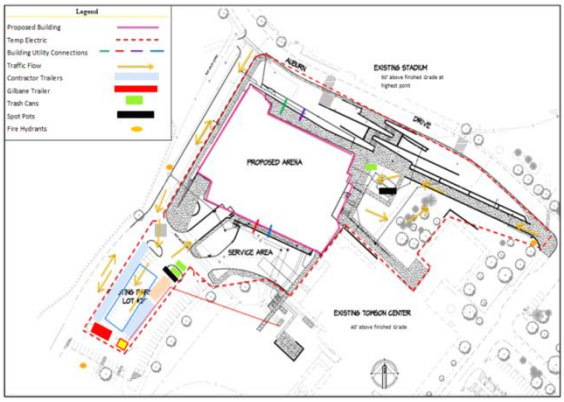


Figure 1– Existing Site Plan – created by Derek Stoecklein

Figure 2 – Existing Tiger Center from proposed site

As seen in *figure 1,* the sanitary and storm drain line will extend from the main down Auburn drive to the North side of the building below grade. Electric will be run from the existing 15kV line at the South end of the Tiger Center. Also on the south side will be the new chilled water lines and domestic water. Gilbane has chosen to organize there site as shown below. The layout was design by the Sr. Superintendent to optimize the site as well as maintain proper pedestrian flow around Unitas, Tiger Center and the maintenance building located south the Gilbane trailer. Pedestrian flow will be impeded in one location due to the site restraints, this being on the building side of Auburn drive. The fence here will overtake the sidewalk which will be demoed at an early stage for excavation and utility purpose. Other things to note on the existing site plan are the use of temporary electric. The existing 15kV transformer for Towson Center is located on the south side, allowing the electrical contractor to run temporary electric to the trailer locations through a temporary ductbank.

Figure 3 – Corner of Auburn Drive and service road

*All Existing Conditions References can be found in Appendix B

Construction Site Layout

Phase One

- Site Utility
- Site Electric

This was done by two contractors; MBR, handling all site electrical and Ross, responsible for storm, water and sanitary lines. During phase one, site mobilization will also begin and temporary fencing will be installed.

**Reference Sitework Site Plan, APPENDIX B*

Phase Two

- Sitework
- Concrete
- Structural steel
- Misc. Steel
- Precast

Phase two started with the demolition of existing curd and cutters, sidewalks and asphalt were needed. Also in the early stage of phase two, the erosion and sediment plan began to eliminate run off during excavation and other site activities that will begin to start. Along Auburn drive are two storm drains that will have asphalt curbs installed to direct water to them and away from the site. Wheel wash stations are also installed at both gates to eliminate tracking mud onto the streets. Sitework is done in four phases, starting with the excavation of the loading dock from the existing Towson center and grading along the service road. This work is done first to allow to necessary flow of future work and current Towson employees. As mentioned before, the maintenance building is located behind the proposed site and the only access is a single lane service road. This road will be expanded to a two way road to allow for deliveries during construction. The next phase of sitework involves the installation of wheel wash stations and excavation of the building footprint. During the next phase, foundations will be excavated and installed followed by furnishing a crane pad inside the building footprint. Also done during phase three is the excavation of the North and East side of the building and installation of a temporary access road to the north side of the site, of Auburn drive. Lastly will be the excavation of the south side of the building.

**Reference Sitework Plan & Structure Site Plan, APPENDIX B*

Phase Three

- M/E/P rough-in and completion
- Exterior Framing
- Roofing
- Facade
- Interior Finishes (Framing, Drywall, Flooring, Painting)
- Masonry
- Site Grading

Phase three involves the most coordination and planning to allow for proper flow and use of the site. During this phase there will be an average of 200 workers on site, deliveries daily, and a large assortment of motorized equipment. Safety will also be critical when laying out the site plan for this phase due to the large increase in trades and equipment.

** Reference Finish Site Plan, APPENDIX B*

Phase Four

- Scoreboard
- Ribbon board
- Food Service Equipment
- Retractable Seating
- Casework
- Landscaping

The final phase of construction of Tiger Arena will consist of equipment install and commissioning of systems. This means the cranes and larger equipment will be off site and all final grading will be complete.

**All Site plans can be seen in APENDIX B*

Local Conditions

The community of Towson has had a large impact on the construction and location of Tiger Arena. From the very beginning the community has been supportive and informative of what they would like to get out of the arena and during construction. Work hours are regulated from 7:00 AM – 5:30 PM, in order to respect the surrounding residences. In addition to these work regulations, parking will also be regulated. The site is very small and only allows enough space for foreman and Gilbane employee parking. This means that the contractors must park in LOT 14, located on the north side of Unitas Stadium. This has proven to be a problem due to the fact its pay-to-park and many employees disregard that and receive tickets. Parking permits are available to purchase and are prorated through a given period. If a permit is not purchased, daily passes can be bought at a kiosk in the lot.

Towson University is governed under University of Maryland, Baltimore (UMB). This means that all process from change orders to purchasing must be approved by TU and UMB prior to Gilbane receiving the go ahead. This creates some challenges and coordination requirements to maintain a good chain of communication up and down the parties.

Recycling & Tipping Fees

All building waste will be recycled by metals, drywall, concrete, paper, plastic, etc. by Waste Management. Please see APPENDIX C for tipping fees. With Tiger Arena striving for LEED Gold, 50-75% of the buildings waste must be diverted from landfill.

Soils Classifications

The existing site is underlain by a thin surface layer of a man-made fill. The top of the residual soil was encountered directly below this fill, and these residual soils extend to the top of bedrock surface, which is located 6 to 38 feet below the ground surface. The lower portions of the residual soils are defined as disintegrated rock, and consist of very dense soils with rock-like properties,

**Information found in geotech report done by D. W. Kozera, INC.*

Client Information

"*Towson University, founded in 1866, is known as one of the nation's best regional public universities. TU offers more than 100 bachelors, masters and doctoral degree programs in the liberal arts and sciences, and applied professional fields.*"
- Towson.edu/aboutme

Towson Image- Courtesy of Bing

TU has over 21,000 students and is among the largest universities in Maryland. Towson is located eight miles north of Baltimore and sits on 328-acres.

TU has a strategic plan, *TU2016*, which evaluates the growth of the university and what they want to build on. Within *TU2016,* Towson has new 22 goals. Included in these goals is the addition of a new sports complex; *Tiger Arena.*

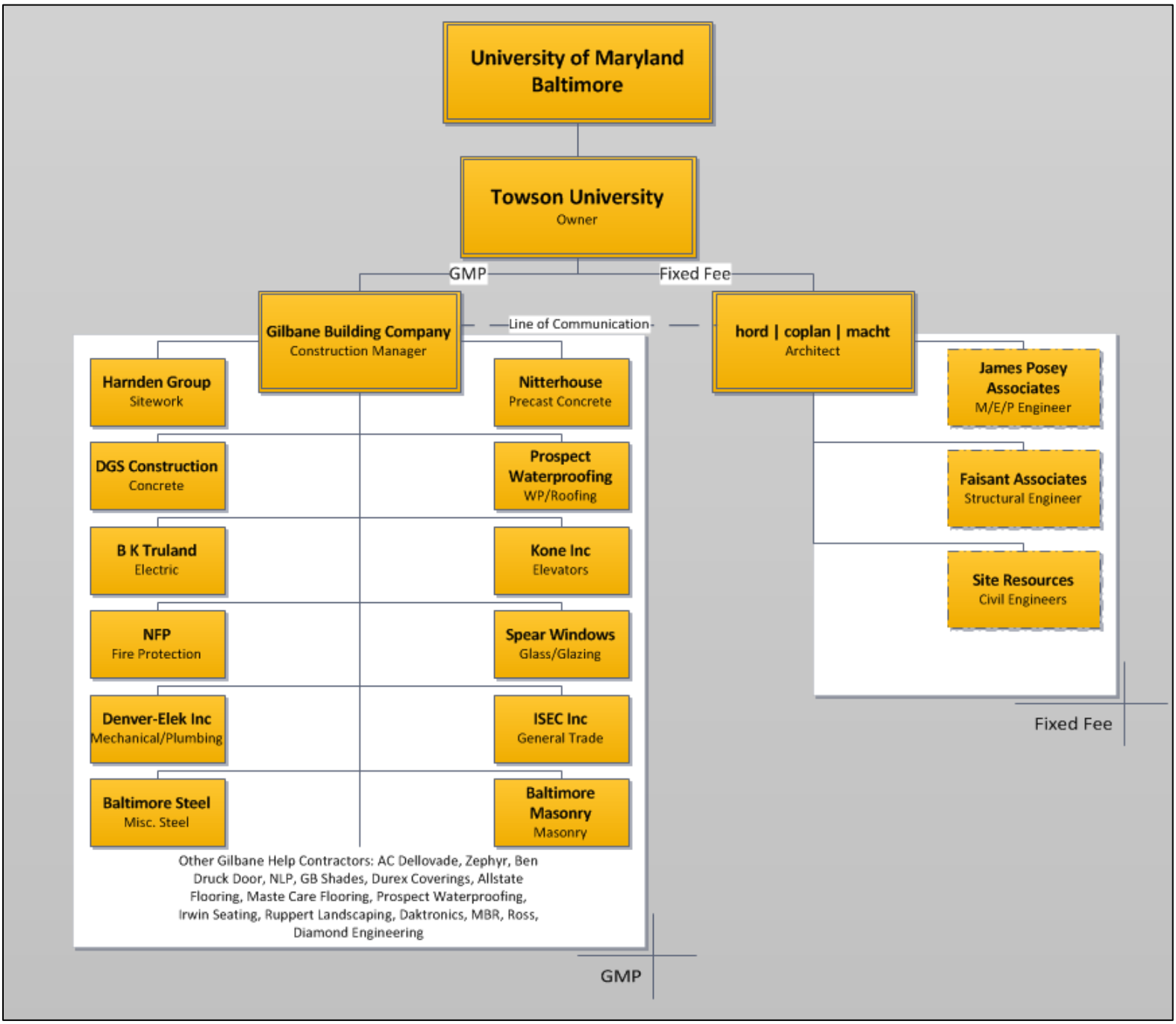
Tiger Arena provides a large opportunity for the university to expand their athletic programs, attract performers, and connect with the community. When looking at the value added by the new arena, we quickly see why this is built into *TU2016*. The construction of Tiger Arena will play a role in the future recruitment of students and excitement of current students.

Quality, schedule, and safety are very important to TU and the University of Baltimore, UMB. With the facility being built on an active college campuses and eventually being used by NCAA sports programs, quality, schedule and safety play are significantly important. NCAA has very strict regulation for court sizing and slopes, lighting and broadcasting standards. In addition to this, the arena must be completed by the 2013 home opener. Safety of college students will be watched closely by TU and managed even closer by Gilbane to protect the university and the students from any unforeseen incidents.

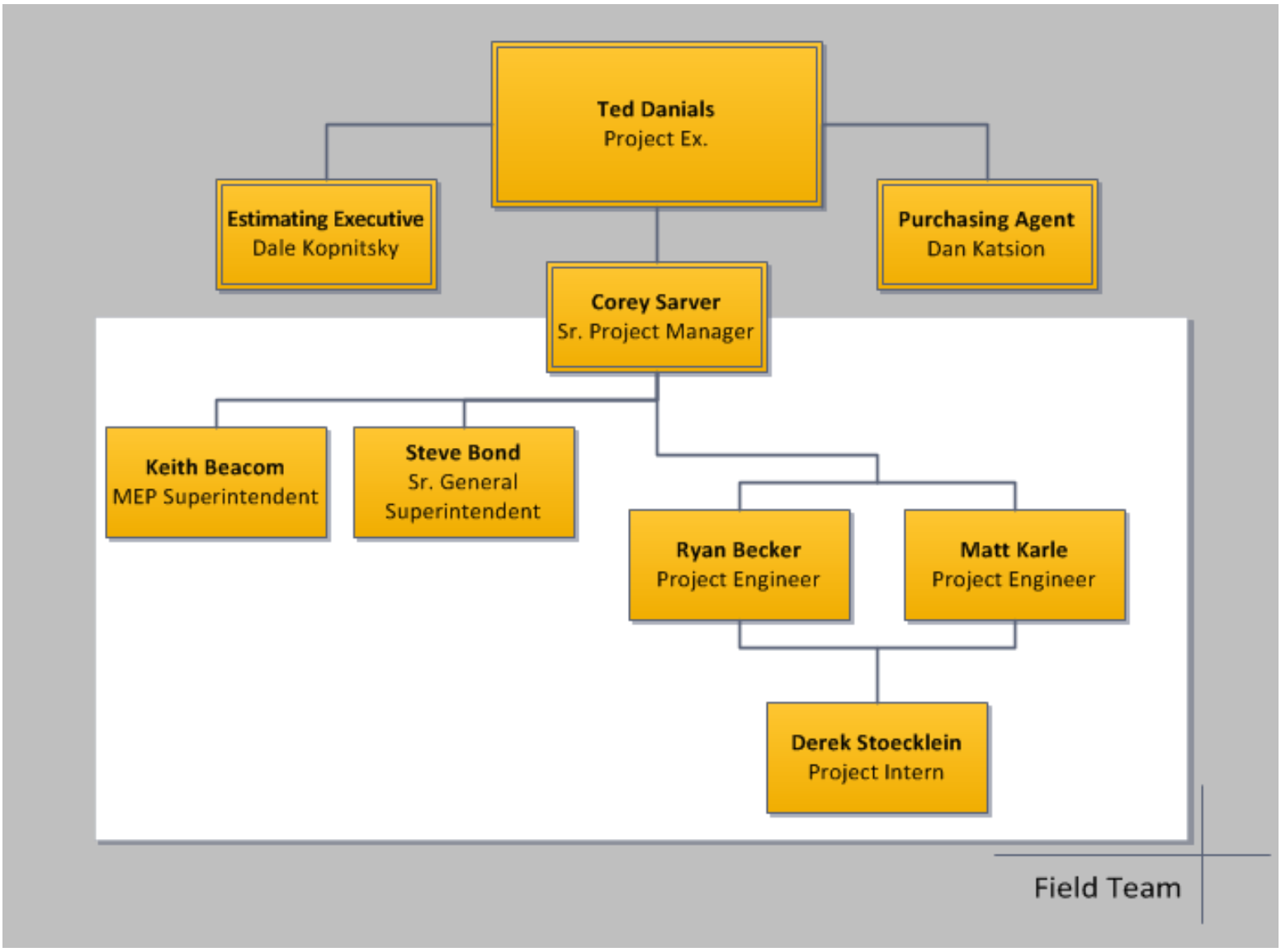
Towson University Logo - Courtest of TU

**Campus Map in APPENDIX D*

Tiger Arena Organizational Chart



Gilbane Staffing Chart for Tiger Arena



End of Tech 1

APPENDIX

APPENDIX A: Project Cost

COMMERCIAL/INDUSTRIAL/INSTITUTIONAL | **M.310** | **Gymnasium**

Costs per square foot of floor area

Exterior Wall	S.F. Area	12000	16000	20000	25000	30000	35000	40000	45000	50000
	L.F. Perimeter	440	520	600	700	708	780	841	910	979
Reinforced Concrete Block	Lam. Wood Arches	163.80	159.30	156.60	154.40	150.40	149.05	147.80	147.00	146.30
	Rigid Steel Frame	166.80	162.30	159.50	157.35	153.35	152.00	150.80	149.95	149.25
Face Brick with Concrete Block Back-up	Lam. Wood Arches	190.10	182.65	178.10	174.45	167.30	165.05	162.85	161.50	160.40
	Rigid Steel Frame	193.25	185.75	181.20	177.60	170.45	168.15	166.00	164.60	163.50
Metal Sandwich Panels	Lam. Wood Arches	176.40	170.45	166.80	164.00	158.50	156.65	155.00	153.95	153.00
	Rigid Steel Frame	179.50	173.55	169.95	167.05	161.60	159.80	158.10	157.05	156.15
Perimeter Adj., Add or Deduct	Per 100 L.F.	6.95	5.20	4.15	3.30	2.80	2.35	2.05	1.85	1.65
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	1.00	0.85	0.75	0.70	0.65	0.60	0.55	0.55	0.55

Basement—Not Applicable

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $77.60 to $231.55 per S.F.

Common additives

Description	Unit	$ Cost
Bleachers, Telescoping, manual		
To 15 tier	Seat	129 - 179
16-20 tier	Seat	265 - 325
21-30 tier	Seat	281 - 340
For power operation, add	Seat	51.50 - 81
Gym Divider Curtain, Mesh top		
Manual roll-up	S.F.	13.15
Gym Mats		
2" naugahyde covered	S.F.	4.19
2" nylon	S.F.	7.20
1-1/2" wall pads	S.F.	9.75
1" wrestling mats	S.F.	6.15
Scoreboard		
Basketball, one side	Each	3400 - 9350
Basketball Backstop		
Wall mtd., 6' extended, fixed	Each	2375 - 3075
Swing up, wall mtd.	Each	2600 - 7700

Description	Unit	$ Cost
Lockers, Steel, single tier, 60" or 72"	Opening	202 - 340
2 tier, 60" or 72" total	Opening	108 - 153
5 tier, box lockers	Opening	68 - 81
Locker bench, lam. maple top only	L.F.	23.50
Pedestals, steel pipe	Each	70.50
Sound System		
Amplifier, 250 watts	Each	1975
Speaker, ceiling or wall	Each	203
Trumpet	Each	290
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	290
Nickel cadmium	Each	770

Model costs calculated for a 1 story building with 25′ story height and 20,000 square feet of floor area

Gymnasium

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings		S.F. Ground	1.73	1.73	
1020	Special Foundations	N/A		–	–	–	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	5.11	5.11	8.1%
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing		S.F. Ground	.18	.18	
2020	Basement Walls	4' foundation wall		L.F. Wall	72	2.51	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	N/A		–	–	–	15.2 %
1020	Roof Construction	Wood deck on laminated wood arches		S.F. Roof	17.79	17.79	
	B20 Exterior Enclosure						
2010	Exterior Walls	Reinforced concrete block (end walls included)	90% of wall	S.F. Wall	13.04	8.80	
2020	Exterior Windows	Metal horizontal pivoted	10% of wall	Each	521	3.91	11.4%
2030	Exterior Doors	Aluminum and glass, hollow metal, steel overhead		Each	1984	.59	
	B30 Roofing						
3010	Roof Coverings	EPDM, 60 mils, fully adhered; polyisocyanurate insulation		S.F. Roof	5.01	5.01	4.3%
3020	Roof Openings	N/A		–	–	–	
C. INTERIORS							
1010	Partitions	Concrete block	50 S.F. Floor/L.F. Partition	S.F. Partition	9	1.80	
1020	Interior Doors	Single leaf hollow metal	500 S.F. Floor/Door	Each	1194	2.39	
1030	Fittings	Toilet partitions		S.F. Floor	.26	.26	
2010	Stair Construction	N/A		–	–	–	20.5%
3010	Wall Finishes	50% paint, 50% ceramic tile		S.F. Surface	9.53	3.81	
3020	Floor Finishes	90% hardwood, 10% ceramic tile		S.F. Floor	14.73	14.73	
3030	Ceiling Finishes	Mineral fiber tile on concealed zee bars	1.5% of area	S.F. Ceiling	6.86	1.03	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	N/A		–	–	–	0.0 %
1020	Escalators & Moving Walks	N/A		–	–	–	
	D20 Plumbing						
2010	Plumbing Fixtures	Toilet and service fixtures, supply and drainage	1 Fixture/51.5 S.F. Floor	Each	4228	8.21	
2020	Domestic Water Distribution	Electric water heater		S.F. Floor	4.02	4.02	10.4%
2040	Rain Water Drainage	N/A		–	–	–	
	D30 HVAC						
3010	Energy Supply	N/A		–	–	–	
3020	Heat Generating Systems	Included in D3050		–	–	–	
3030	Cooling Generating Systems	N/A		–	–	–	9.2 %
3050	Terminal & Package Units	Single zone rooftop unit, gas heating, electric cooling		S.F. Floor	10.75	10.75	
3090	Other HVAC Sys. & Equipment	N/A		–	–	–	
	D40 Fire Protection						
4010	Sprinklers	Wet pipe sprinkler system		S.F. Floor	3.64	3.64	3.9%
4020	Standpipes	Standpipe		S.F. Floor	.95	.95	
	D50 Electrical						
5010	Electrical Service/Distribution	400 ampere service, panel board and feeders		S.F. Floor	1.07	1.07	
5020	Lighting & Branch Wiring	High efficiency fluorescent fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	9.34	9.34	11.5%
5030	Communications & Security	Addressable alarm systems, sound system and emergency lighting		S.F. Floor	2.83	2.83	
5090	Other Electrical Systems	Emergency generator, 7.5 kW		S.F. Floor	.22	.22	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		–	–	–	
1020	Institutional Equipment	N/A		–	–	–	3.3 %
1030	Vehicular Equipment	N/A		–	–	–	
1090	Other Equipment	Bleachers, lockers, weight room		S.F. Floor	6.38	6.38	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		–	–	–	0.0 %
1040	Special Facilities	N/A		–	–	–	
G. BUILDING SITEWORK		N/A					

Arch Fee = 7%
Contractor Fee (GR, W% Overhead 5% Profit 10%) = 25%

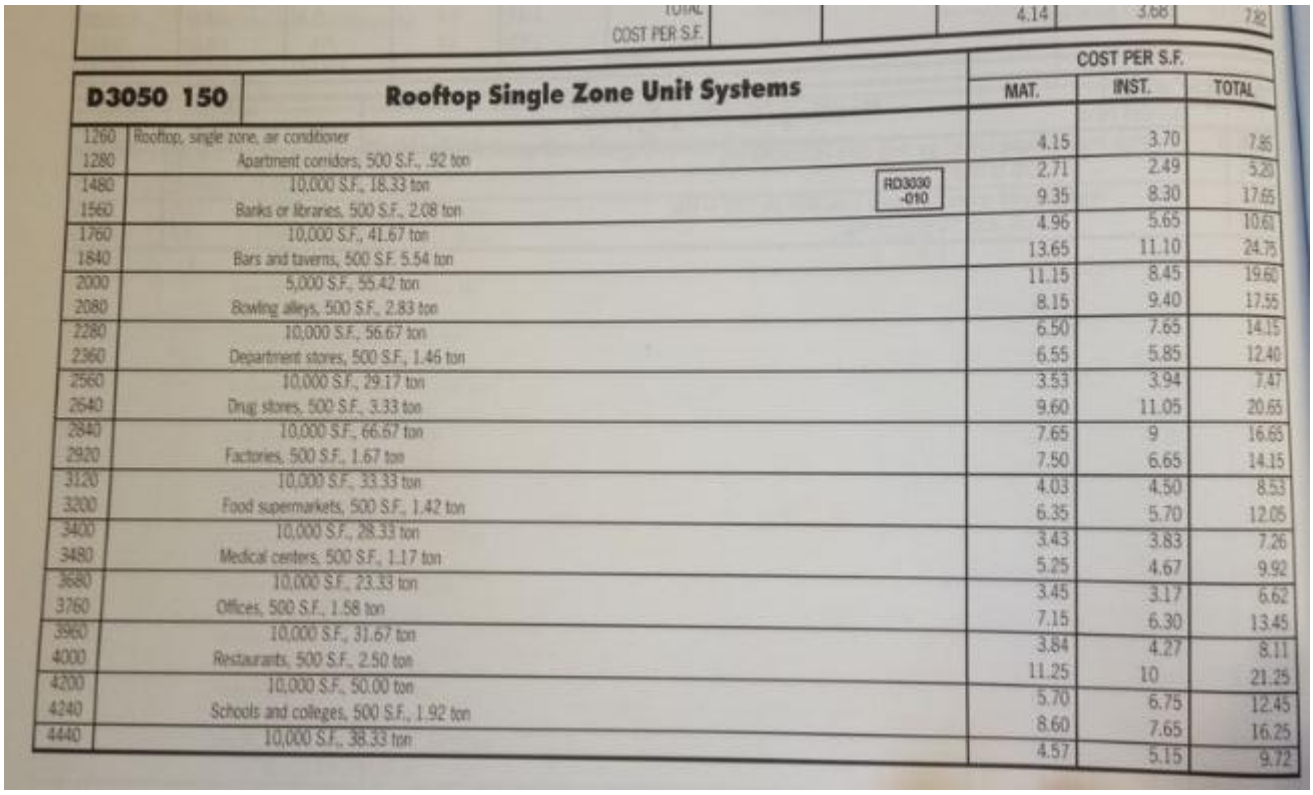
Sub-Total

System Components	QUANTITY	UNIT	COST EACH MAT.	INST.	TOTAL
SYSTEM D3010 530 1880					
HEATING SYSTEM, TERMINAL UNIT HEATERS, FORCED HOT WATER					
1,000 S.F. BLDG., ONE FLOOR					
Boiler oil fired, CI, burner/ctrls/insul/breech/pipe/ftngs/valves, 109 MBH	1.000	Ea.	3,937.50	3,587.50	7,525
Expansion tank, painted steel, ASME 18 Gal capacity	1.000	Ea.	2,450	97	2,547
Storage tank, steel, above ground, 550 Gal capacity w/supports	1.000	Ea.	3,100	430	3,530
Circulating pump, CI, flanged, 1/8 HP	1.000	Ea.	590	192	782
Pipe, steel, black, schedule 40, threaded, cplg & hngr 10' OC 1-1/2" diam	260.000	L.F.	2,496	3,744	6,240
Pipe covering, calcium silicate w/cover, 1" wall, 1-1/2" diam	260.000	L.F.	819	1,651	2,470
Unit heater, 1 speed propeller, horizontal, 200° EWT, 26.9 MBH	2.000	Ea.	1,110	290	1,400
Unit heater piping hookup with controls	2.000	Set	1,370	2,750	4,120
TOTAL			15,872.50	12,741.50	28,614
COST PER S.F.			15.87	12.74	28.61

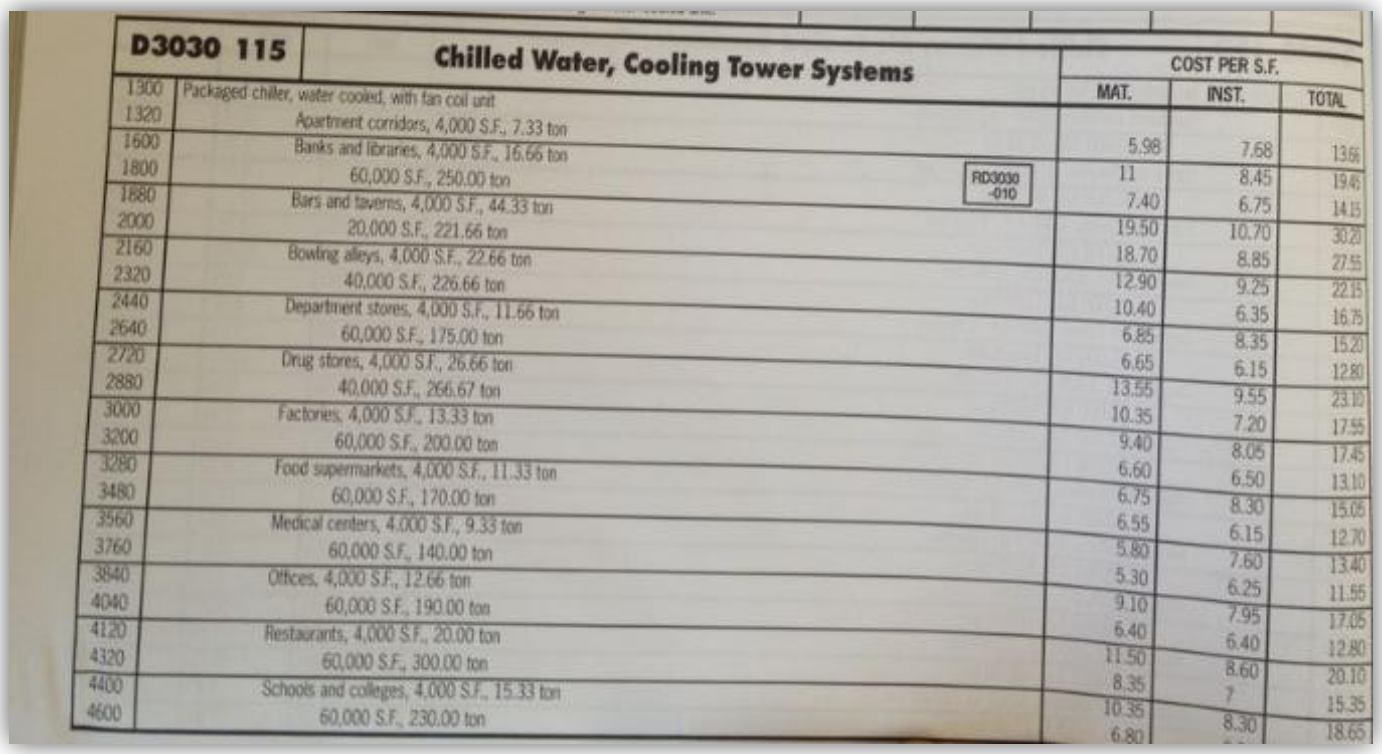
D3010 530	Commercial Bldg. Heating - Terminal Unit Heaters		COST PER S.F. MAT.	INST.	TOTAL
1860	Heating systems, terminal unit heaters, forced hot water				
1880	1,000 S.F. bldg., one floor		15.90	12.70	28.60
1920	10,000 S.F. bldg., 100,000 C.F. total two floors	RD3020 -010	4	4.37	8.37
1960	100,000 S.F. bldg., 1,000,000 C.F. total three floors		1.72	2.12	3.84
2000	1,000,000 S.F. bldg., 10,000,000 C.F. total five floors	RD3020 -020	1.13	1.37	2.50
2010					

Wrought copper 90° elbow for solder joints 3/4" diam.	34.000	L.F.	222.70	283.90	506.60
Wrought copper Tee for solder joints, 3/4" diam.	5.000	Ea.	23.05	167.50	190.55
Wrought copper union for soldered joints, 3/4" diam	2.000	Ea.	17.60	107	124.60
Valve, bronze, 125 lb, NRS, soldered 3/4" diam.	2.000	Ea.	64	71	135
Relief valve, bronze, press & temp, self-close, 3/4" IPS	2.000	Ea.	89	64	153
Wrought copper adapter, copper tubing to male, 3/4" IPS	1.000	Ea.	146	23	169
Copper tubing, type L, solder joint, hanger 10' OC, 3/8" diam.	1.000	Ea.	7.85	37.50	45.35
Wrought copper 90° elbow for solder joints 3/8" diam	10.000	L.F.	40.20	76	116.20
Valve, globe, fusible, 3/8" IPS	2.000	Ea.	13.40	58	71.40
TOTAL	1.000	Ea.	14.40	27	41.40
			17,038.20	1,456.60	18,494.80

D2020 260	Oil Fired Water Heaters - Commercial Systems		COST EACH MAT.	INST.	TOTAL
1800	Oil fired water heater, commercial, 100°F rise				
1820	140 gal., 140 MBH input, 134 GPH		17,000	1,450	18,450
1900	140 gal., 255 MBH input, 247 GPH	RD2020 -100	18,600	1,825	20,425
1940	140 gal., 270 MBH input, 259 GPH		22,700	2,075	24,775
1980	140 gal., 400 MBH input, 384 GPH		23,700	2,400	26,100
2060	140 gal., 720 MBH input, 691 GPH		25,100	2,500	27,600
2100	221 gal., 300 MBH input, 288 GPH		33,400	2,750	36,150
2140	221 gal., 600 MBH input, 576 GPH		37,000	2,800	39,800
2180	221 gal., 800 MBH input, 768 GPH		37,600	2,900	40,500
2220	201 gal., 1000 MBH input, 960 GPH		38,400	2,925	41,325
2260	201 gal., 1250 MBH input, 1200 GPH		39,200	3,000	42,200
2300	201 gal., 1500 MBH input, 1441 GPH		42,400	3,075	45,475
2340	411 gal., 600 MBH input, 576 GPH		42,800	3,125	45,925
2380	411 gal., 800 MBH input, 768 GPH		43,100	3,200	46,300
2420	411 gal., 1000 MBH input, 960 GPH		47,100	3,725	50,825
2460	411 gal., 1250 MBH input, 1200 GPH		48,100	3,825	51,925
2500	397 gal., 1500 MBH input, 1441 GPH		48,500	3,950	52,45
2540	397 gal., 1750 MBH input, 1681 GPH		52,000	4,075	56,0



			COST PER S.F.		
D3050 150	Rooftop Single Zone Unit Systems		MAT.	INST.	TOTAL
1260	Rooftop, single zone, air conditioner				
1280	Apartment corridors, 500 S.F., .92 ton		4.15	3.70	7.85
1480	10,000 S.F., 18.33 ton	RD3030 -010	2.71	2.49	5.20
1560	Banks or libraries, 500 S.F., 2.08 ton		9.35	8.30	17.65
1760	10,000 S.F., 41.67 ton		4.96	5.65	10.61
1840	Bars and taverns, 500 S.F. 5.54 ton		13.65	11.10	24.75
2000	5,000 S.F., 55.42 ton		11.15	8.45	19.60
2080	Bowling alleys, 500 S.F., 2.83 ton		8.15	9.40	17.55
2280	10,000 S.F., 56.67 ton		6.50	7.65	14.15
2360	Department stores, 500 S.F., 1.46 ton		6.55	5.85	12.40
2560	10,000 S.F., 29.17 ton		3.53	3.94	7.47
2640	Drug stores, 500 S.F., 3.33 ton		9.60	11.05	20.65
2840	10,000 S.F., 66.67 ton		7.65	9	16.65
2920	Factories, 500 S.F., 1.67 ton		7.50	6.65	14.15
3120	10,000 S.F., 33.33 ton		4.03	4.50	8.53
3200	Food supermarkets, 500 S.F., 1.42 ton		6.35	5.70	12.05
3400	10,000 S.F., 28.33 ton		3.43	3.83	7.26
3480	Medical centers, 500 S.F., 1.17 ton		5.25	4.67	9.92
3680	10,000 S.F., 23.33 ton		3.45	3.17	6.62
3760	Offices, 500 S.F., 1.58 ton		7.15	6.30	13.45
3960	10,000 S.F., 31.67 ton		3.84	4.27	8.11
4000	Restaurants, 500 S.F., 2.50 ton		11.25	10	21.25
4200	10,000 S.F., 50.00 ton		5.70	6.75	12.45
4240	Schools and colleges, 500 S.F., 1.92 ton		8.60	7.65	16.25
4440	10,000 S.F., 38.33 ton		4.57	5.15	9.72



			COST PER S.F.		
D3030 115	Chilled Water, Cooling Tower Systems		MAT.	INST.	TOTAL
1300	Packaged chiller, water cooled, with fan coil unit				
1320	Apartment corridors, 4,000 S.F., 7.33 ton		5.98	7.68	13.66
1600	Banks and libraries, 4,000 S.F., 16.66 ton		11	8.45	19.45
1800	60,000 S.F., 250.00 ton	RD3030 -010	7.40	6.75	14.15
1880	Bars and taverns, 4,000 S.F., 44.33 ton		19.50	10.70	30.20
2000	20,000 S.F., 221.66 ton		18.70	8.85	27.55
2160	Bowling alleys, 4,000 S.F., 22.66 ton		12.90	9.25	22.15
2320	40,000 S.F., 226.66 ton		10.40	6.35	16.75
2440	Department stores, 4,000 S.F., 11.66 ton		6.85	8.35	15.20
2640	60,000 S.F., 175.00 ton		6.65	6.15	12.80
2720	Drug stores, 4,000 S.F., 26.66 ton		13.55	9.55	23.10
2880	40,000 S.F., 266.67 ton		10.35	7.20	17.55
3000	Factories, 4,000 S.F., 13.33 ton		9.40	8.05	17.45
3200	60,000 S.F., 200.00 ton		6.60	6.50	13.10
3280	Food supermarkets, 4,000 S.F., 11.33 ton		6.75	8.30	15.05
3480	60,000 S.F., 170.00 ton		6.55	6.15	12.70
3560	Medical centers, 4,000 S.F., 9.33 ton		5.80	7.60	13.40
3760	60,000 S.F., 140.00 ton		5.30	6.25	11.55
3840	Offices, 4,000 S.F., 12.66 ton		9.10	7.95	17.05
4040	60,000 S.F., 190.00 ton		6.40	6.40	12.80
4120	Restaurants, 4,000 S.F., 20.00 ton		11.50	8.60	20.10
4320	60,000 S.F., 300.00 ton		8.35	7	15.35
4400	Schools and colleges, 4,000 S.F., 15.33 ton		10.35	8.30	18.65
4600	60,000 S.F., 230.00 ton		6.80		

D2010 210	Urinal Systems	COST EACH		
		MAT.	INST.	TOTAL
2000	Urinal, vitreous china, wall hung	590	765	1,355
2040	Stall type	1,225	910	2,135

D2010 310	Lavatory Systems	COST EACH		
		MAT.	INST.	TOTAL
1560	Lavatory w/trim, vanity top, PE on CI, 20" x 18", Vanity top by others	680	680	1,36
1600	19" x 16" oval	530	680	1,21
1640	18" round	605	680	1,28
1680	Cultured marble, 19" x 17" RD2010 -400	585	680	1,26
1720	25" x 19"	620	680	1,30
1760	Stainless, self-rimming, 25" x 22"	750	680	1,43
1800	17" x 22"	740	680	1,42
1840	Steel enameled, 20" x 17"	560	700	1,26
1880	19" round	530	700	1,23
1920	Vitreous china, 20" x 16"	640	715	1,35
1960	19" x 16"	640	715	1,35
2000	22" x 13"	645	715	1,36
2040	Wall hung, PE on CI, 18" x 15"	870	750	1,62
2080	19" x 17"	870	750	1,62
2120	20" x 18"	840	750	1,59
2160	Vitreous china, 18" x 15"	715	770	1,48
2200	19" x 17"	660	770	1,43
2240	24" x 20"	935	770	1,70
2300	20" x 27", handicap	970		1,80

System Components	QUANTITY	UNIT	COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
SYSTEM D5010 240 0240					
SWITCHGEAR INSTALLATION, INCL SWBD, PANELS & CIRC BREAKERS, 600 A					
Panelboard, NQOD 225A 4W 120/208V main CB, w/20A bkrs 42 circ	1.000	Ea.	2,475	2,125	
Switchboard, alum. bus bars, 120/208V, 4 wire, 600V	1.000	Ea.	4,425	1,200	
Distribution sect., alum. bus bar, 120/208 or 277/480 V, 4 wire, 600A	1.000	Ea.	2,525	1,200	
Feeder section circuit breakers, KA frame, 70 to 225 A	3.000	Ea.	4,200	558	
TOTAL			13,625	5,083	

D5010 240	Switchgear		COST EACH MAT.	COST EACH INST.	COST EACH TOTAL
0200	Switchgear inst., incl. swbd., panels & circ bkr, 400 A, 120/208volt				
0240	600 A		4,500	3,750	
0280	800 A		13,600	5,075	
0320	1200 A	RD5010 -110	17,400	7,200	
0360	1600 A		20,900	11,000	
0400	2000 A		28,300	15,500	
0410	Add 20% for 277/480 volt		35,800	19,700	

TOTAL			1,163.33	259.47	

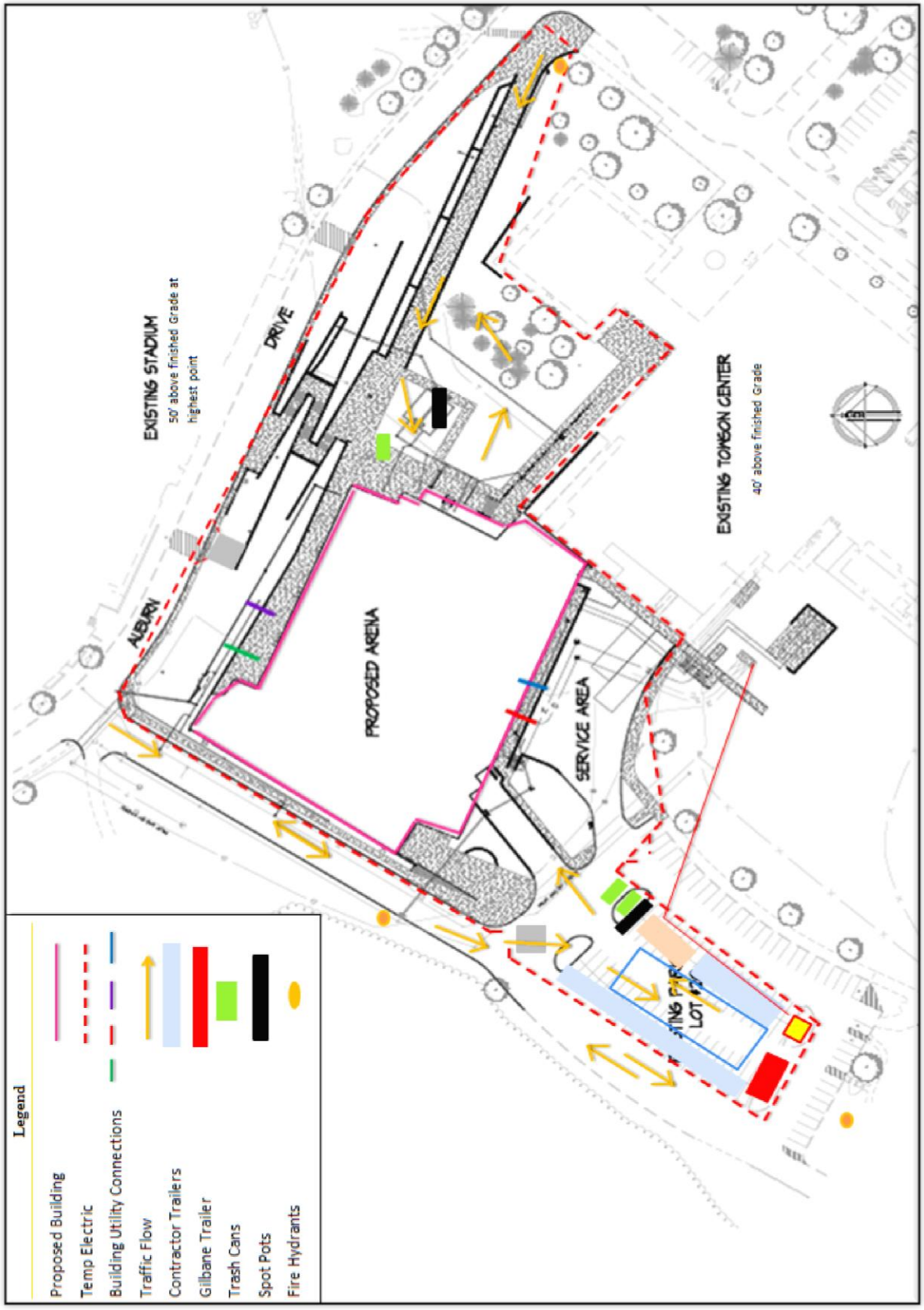
D5090 210	Generators (by kW)		COST PER kW MAT.	COST PER kW INST.	COST PER kW TOTAL
0190	Generator sets, include battery, charger, muffler & transfer switch				
0200	Gas/gasoline operated, 3 phase, 4 wire, 277/480 volt, 7.5 kW		1,175	260	
0240	11.5 kW	RD5010 -110	1,075	197	
0280	20 kW		730	129	
0320	35 kW		495	84	
0360	80 kW		355	51	
0400	100 kW		310	49.50	
0440	125 kW		510	46	
0480	185 kW		455	35	
0560	Diesel engine with fuel tank, 30 kW		770	97.50	
0600	50 kW		550	77.50	
0720	125 kW		335	45	
0760	150 kW		320	41.50	
0800	175 kW		297	36.50	
0840	200 kW		268	34	
0880	250 kW		252	28	
0920	300 kW		228	24.50	
0960	350 kW		220	23	
1000	400 kW		239	21.50	
1040	500 kW		240	18	
1200	750 kW		263	11.30	
1400	1000 kW				

D5020 130	Wall Switch by Sq. Ft.	COST PER S.F. MAT.	INST.	TOTAL
0200	Wall switches, 1.0 per 1000 S.F.	.06	.21	
0240	1.2 per 1000 S.F.	.06	.25	
0280	2.0 per 1000 S.F.	.10	.34	
0320	2.5 per 1000 S.F.	.11	.43	
0360	5.0 per 1000 S.F.	.25	.92	
0400	10.0 per 1000 S.F.	.52	1.86	

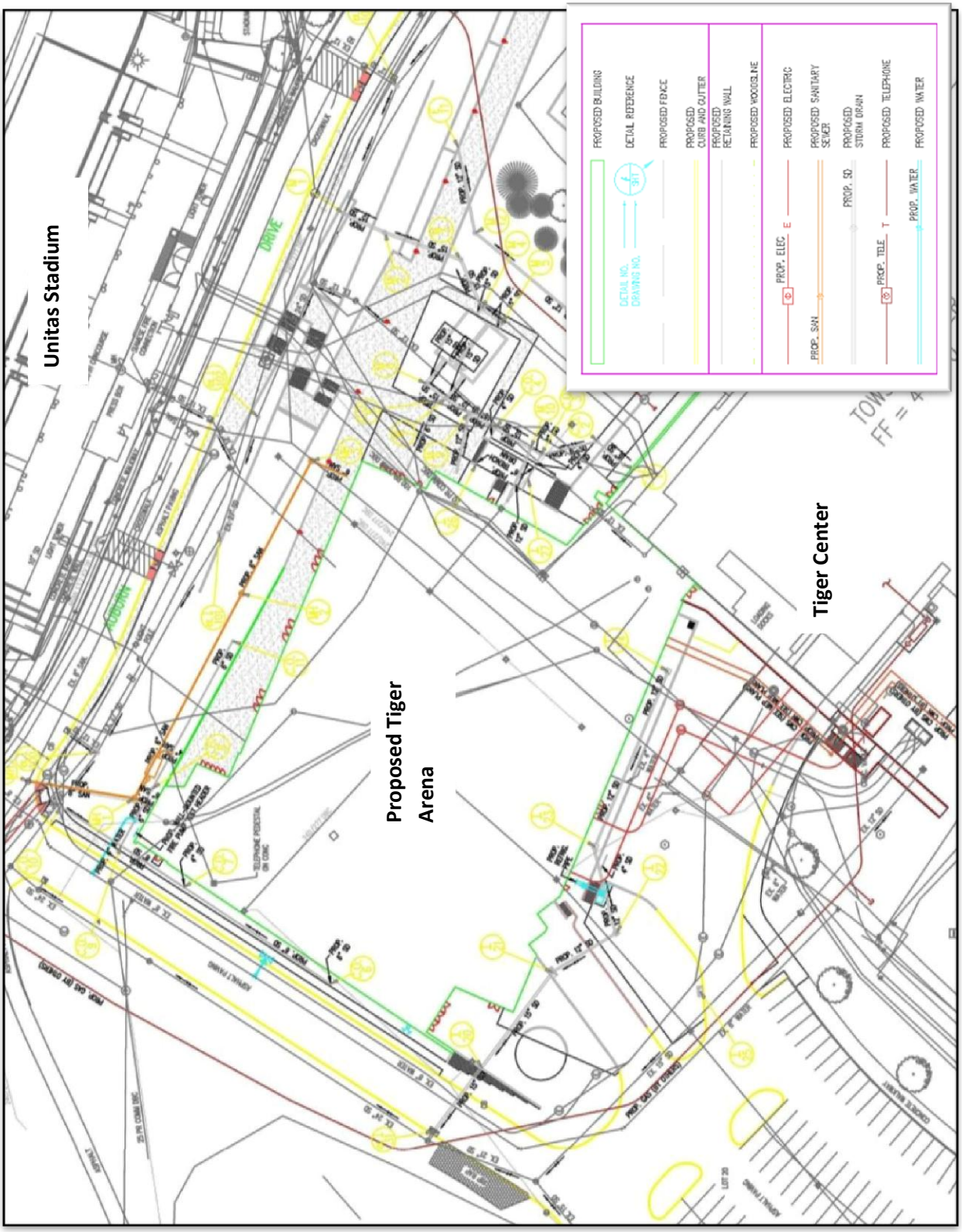
D5020 208	Fluorescent Fixtures (by Type)		COST PER S.F. MAT.	INST.	TOTAL
0520	Fluorescent fixtures, type A, 8 fixtures per 400 S.F.		2.71	5.50	
0560	11 fixtures per 600 S.F.		2.56	5.35	
0600	17 fixtures per 1000 S.F.	RD5020 -200	2.47	5.25	
0640	23 fixtures per 1600 S.F.		2.25	4.97	
0680	28 fixtures per 2000 S.F.		2.25	4.97	
0720	41 fixtures per 3000 S.F.		2.18	4.97	
0800	53 fixtures per 4000 S.F.		2.15	4.85	
0840	64 fixtures per 5000 S.F.		2.15	4.85	
0880	Type B, 11 fixtures per 400 S.F.		4.90	8.05	
0920	15 fixtures per 600 S.F.		4.54	7.70	
0960	24 fixtures per 1000 S.F.		4.45	7.70	
1000	35 fixtures per 1600 S.F.		4.16	7.30	
1040	42 fixtures per 2000 S.F.		4.08	7.35	
1080	61 fixtures per 3000 S.F.		4.09	7.10	
1160	80 fixtures per 4000 S.F.		3.97	7.25	
1200	98 fixtures per 5000 S.F.		3.96	7.20	
1240	Type C, 11 fixtures per 400 S.F.		4.06	8.50	
1280	14 fixtures per 600 S.F.		3.63	7.95	
1320	23 fixtures per 1000 S.F.		3.61	7.90	
1360	34 fixtures per 1600 S.F.		3.48	7.80	
1400	43 fixtures per 2000 S.F.		3.51	7.70	
1440	63 fixtures per 3000 S.F.		3.42	7.60	
1520	81 fixtures per 4000 S.F.		3.35	7.50	
1560	101 fixtures per 5000 S.F.		3.35	7.50	
1600	Type D, 8 fixtures per 400 S.F.		3.66	6.50	
1640	12 fixtures per 600 S.F.		3.66	6.55	
1680	19 fixtures per 1000 S.F.		3.52	6.40	
1720	27 fixtures per 1600 S.F.		3.30	6.25	
1760	34 fixtures per 2000 S.F.		3.28	6.15	
1800	48 fixtures per 3000 S.F.		3.15	6	
1880	64 fixtures per 4000 S.F.		3.15	6	
1920	79 fixtures per 5000 S.F.				

D5020 232	H.I.D. Fixture, High Bay, 30' (by Type)		COST PER S.F. MAT.	INST.	TOTAL
1210	High intensity discharge fixture, 30' above work plane, 100 FC				
1280	Type F, 4 fixtures per 900 S.F.		3.94	5.85	9.79
1280	6 fixtures per 1800 S.F.	RD5020 -200	3.34	5.60	8.94
1320	8 fixtures per 3000 S.F.		3.34	5.60	8.94
1360	9 fixtures per 4000 S.F.	RD5020 -240	2.75	5.30	8.05
1400	10 fixtures per 5000 S.F.		2.75	5.30	8.05
1440	17 fixtures per 8000 S.F.		2.75	5.30	8.05
1480	18 fixtures per 10,000 S.F.		2.62	4.89	7.51
1520	27 fixtures per 16,000 S.F.		2.62	4.89	7.51
1560	52 fixtures per 32000 S.F.		2.60	4.83	7.43
1600	Type G, 4 fixtures per 900 S.F.		4.26	6.20	10.46
1640	6 fixtures per 1800 S.F.		3.51	5.65	9.16
1680	9 fixtures per 3000 S.F.		3.45	5.45	8.90
1720	11 fixtures per 4000 S.F.		3.40	5.30	8.70
1760	13 fixtures per 5000 S.F.		3.40	5.30	8.70
1800	21 fixtures per 8000 S.F.		3.40	5.30	8.70
1840	23 fixtures per 10,000 S.F.		2.96	5.60	8.56
1880	36 fixtures per 16,000 S.F.		2.96	5.60	8.56
1920	70 fixtures per 32,000 S.F.		2.96	5.60	8.56

APPENDIX B: Site Planning



Tiger Arena Existing Site Map

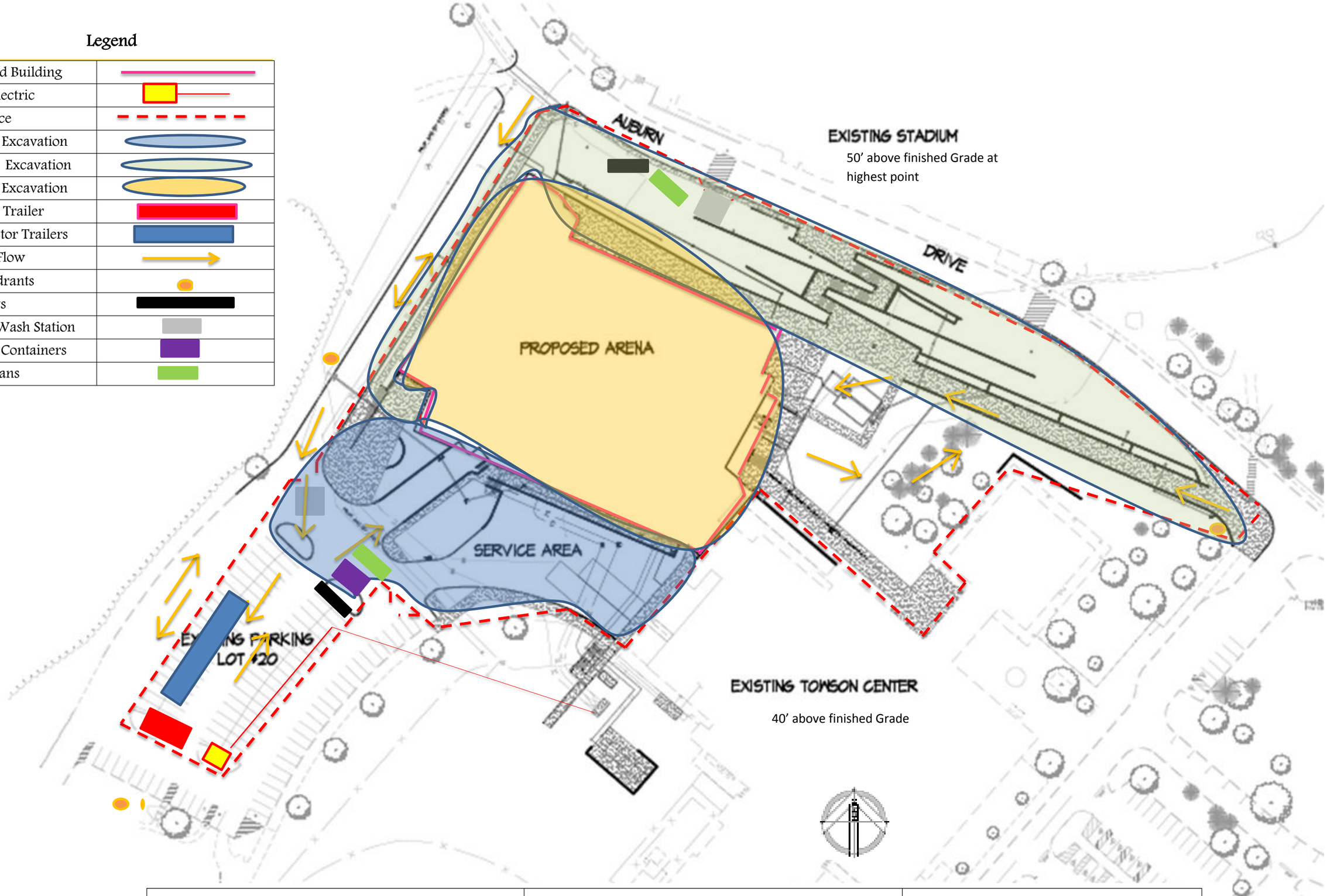


Existing and Proposed (colored) Utilities

Existing Site photo – courtesy of Google Maps

Legend

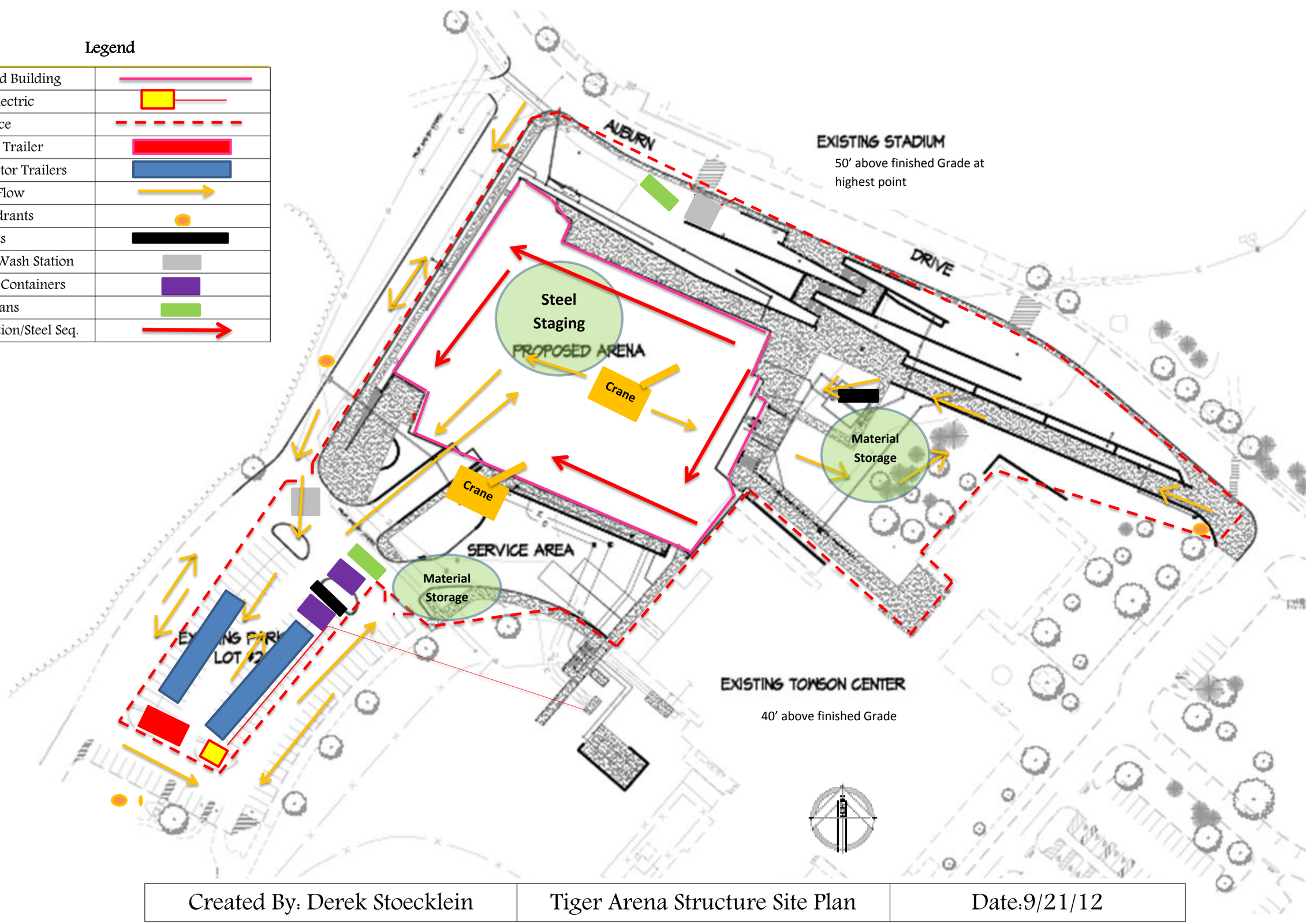
Proposed Building	
Temp Electric	
Site Fence	
Phase 1 Excavation	
Phase 2 Excavation	
Phase 3 Excavation	
Gilbane Trailer	
Contractor Trailers	
Traffic Flow	
Fire Hydrants	
Spot Pots	
Wheel Wash Station	
Storage Containers	
Trash Cans	



Created By: Derek Stoecklein	Tiger Arena Excavation Site Plan	Date:9/21/12

Legend

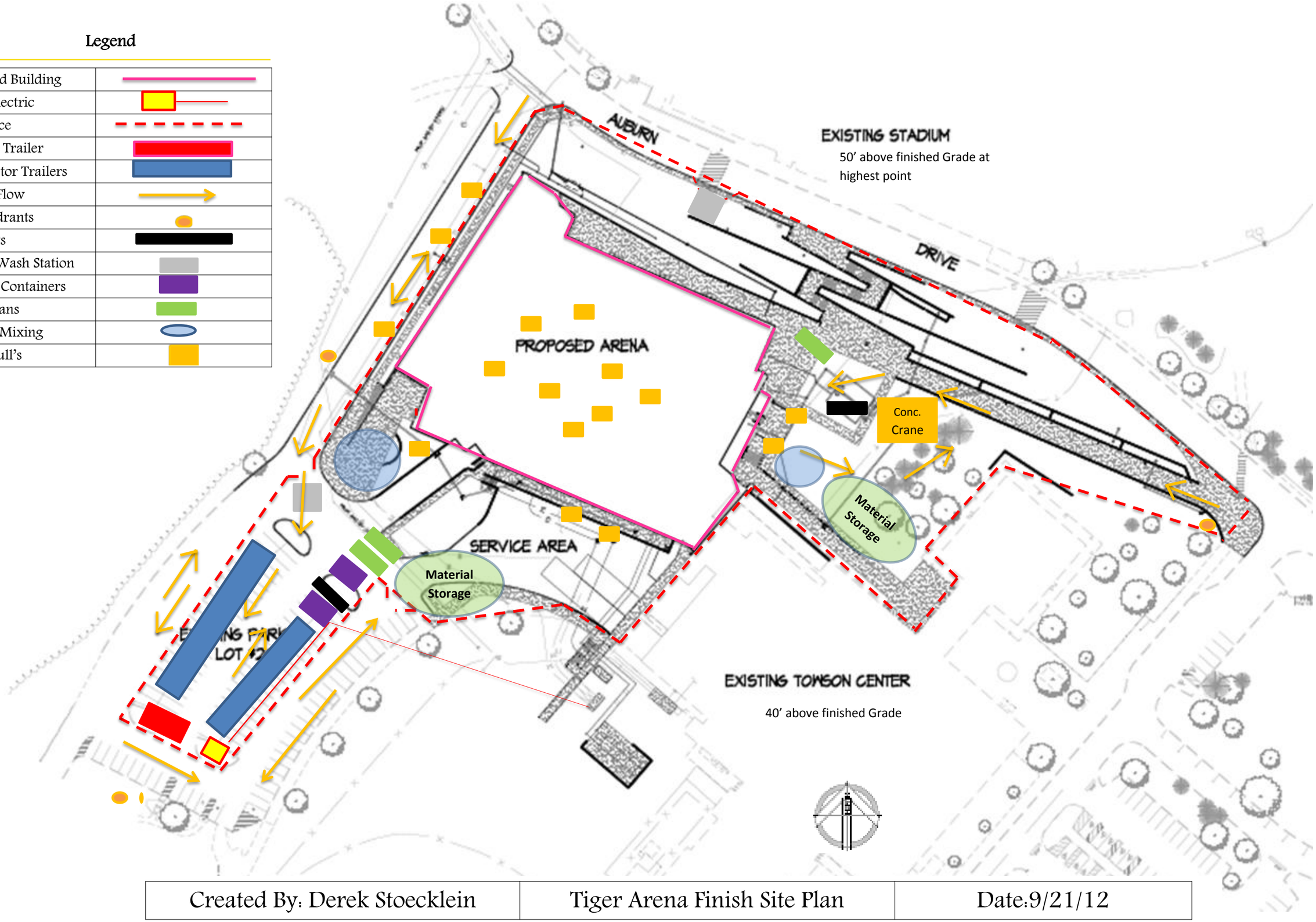
Proposed Building	
Temp Electric	
Site Fence	
Gilbane Trailer	
Contractor Trailers	
Traffic Flow	
Fire Hydrants	
Spot Pots	
Wheel Wash Station	
Storage Containers	
Trash Cans	
Foundation/Steel Seq.	



Created By: Derek Stoecklein	Tiger Arena Structure Site Plan	Date:9/21/12

Legend

Proposed Building	
Temp Electric	
Site Fence	
Gilbane Trailer	
Contractor Trailers	
Traffic Flow	
Fire Hydrants	
Spot Pots	
Wheel Wash Station	
Storage Containers	
Trash Cans	
Mortar Mixing	
JLG & Lull's	



Created By: Derek Stoecklein	Tiger Arena Finish Site Plan	Date:9/21/12

APPENDIX C: Local Conditions

Parking Permits – Are Available for Purchase at the Auxiliary Services Business Office in the Union for lot 14.

1. Fill out Parking Permit Request form Attached to this Packet. Under Group check off "Other" and indicate Construction Worker.
2. Bring completed application with license plate information to the Parking Office in the Union Garage
3. Once your account is created in the system, take the application to the Auxiliary Services Business Office in the Union, across from the Book Store. Permits are available as outlined below:

    a. Weekly Permit - $25.00

    b. Monthly Permit - $50.00

    c. Annual permit valid through August 31, 2012 - $121 (fee is prorated down each Monday)

3. The Union Parking Garage and Lot 14 can be found on the attached Map.

4. Display Parking Permit in Vehicle at all Times

5. Construction company employees are prohibited from parking in lots 19 & 21 near the Arena.

Daily permits may also be purchased from the pay station in lot 13 for $6.00 per day. The daily permit is only valid in lot 13 or 14 for construction workers.

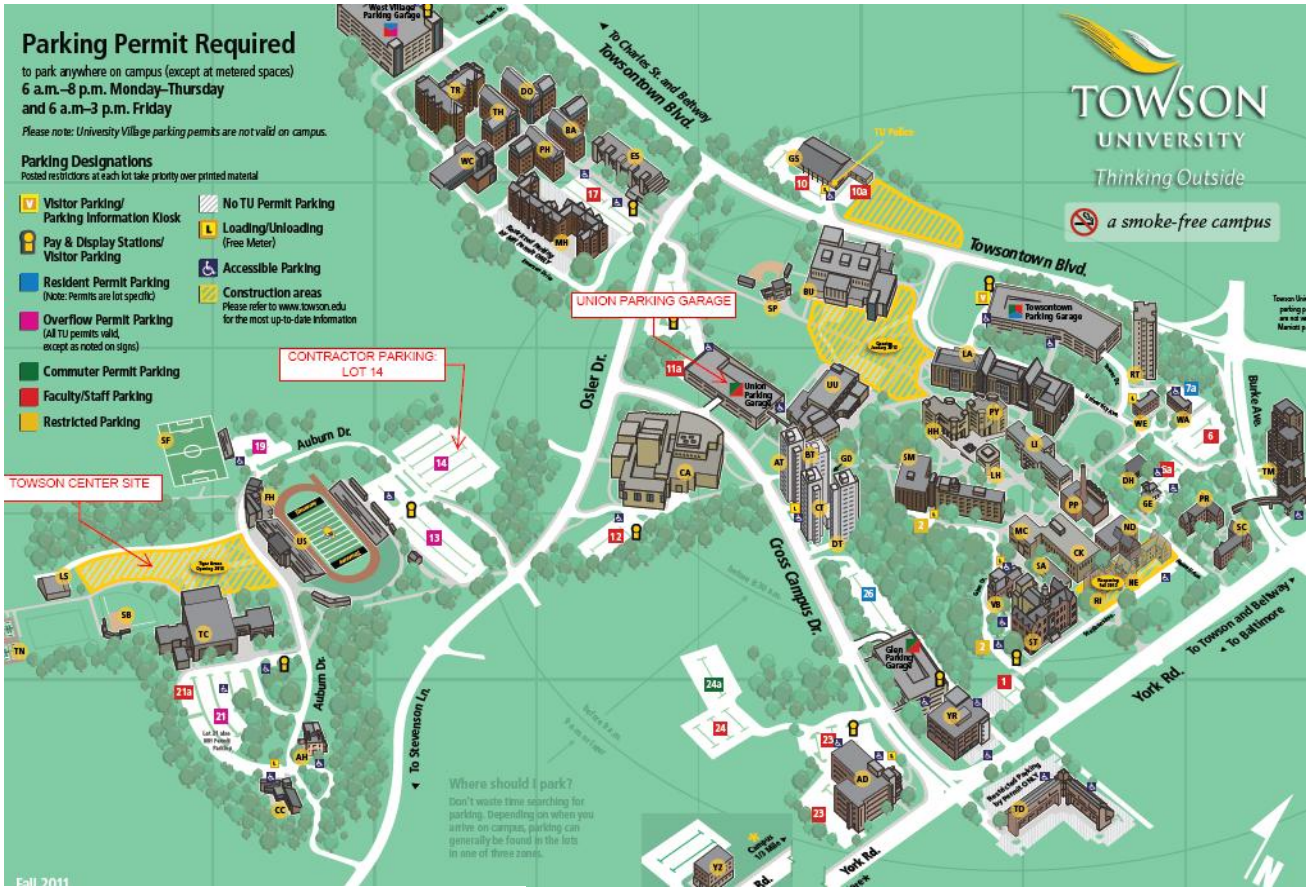
Towson Parking Permit Info, *Courtesy of Towson*

Description	Unit Cost
• Pull with 5 Ton Limit	$ 300.00
• Price/Ton over 5 Tons	$56.00

Description	Unit Cost
• 1-9 units at 1 cleaning per week	$72.75
• 1-9 units at 2 cleanings per week	$82.75
• 10-15 units at 1 cleaning per week	$72.75
• 10-15 units at 2 cleanings per week	$82.75
• 15+ units at 1 cleaning per week	$72.75
• 15+ units at 2 cleanings per week	$82.75
• 250 gallon waste holding tank (Monthly rate includes installation and 1 cleaning per week)	$224.31

Waste and Spot pot removal fees – Courtesy of Gilbane

APPENDIX D: Client Info



Towson University Map - Courtesy of TU