STEM Building

Science **T**echnology **E**ngineering **M**athematics

Hagerstown Community College

Hagerstown, MD

Technical Assignment 1

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Executive Summary

This report will define the parameters of the Science, Technology, Engineering and Mathematics (STEM) Building of Hagerstown Community Community College located in Hagerstown, Maryland. The STEM Building is a five story, 62,000 square foot academic building that will serve as the home for such disciplines.

In depth analyses will be given in areas for schedule, building systems, cost estimate and site planning. The schedule has be produced for the project using Microsoft Project and outlines the major phases of construction: sitework, substructure, superstructure, enclosure etc. The building systems section goes further in depth to descripe such systems as structural steel frame, cast in place concrete, mechanical and electrical. Two programs were used in the justification of the project cost: Means Cost Works and D4 Estimating. In this section, the actual cost will be compared to the costs generated by these programs. Discrepencies will also be discussed as to why such estimates may be different. An analyses was performed of the existing site conditions as well. In this section will be images provided to help visualize the site, locations of roads, utilities, neighboring building, traffic patterns and more.

Information about the client/owner and general contractor will be relayed as well. Defined will be the reasons for constructing the STEM building as well as expectations of the owner relating to quality, safety, schedule and cost. The delivery method chosen by the owner and general contractor will be justified and an organizational chart has been developed to visualize the major players of the project. To finish the report, a staffing plan will show the structure of the general contractor's management team and how they are assigned to the job.

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Project Summary Schedule

(See Appendix A for Project Summary Schedule)

The schedule for the HCC STEM Building was derived from the schedule provided by the general contractor, HESS Construction + Engineering Services. I have taken the schedule provided and outlined the major systems of the building, as well as a few milestones.

The design phase of the STEM Building started in September of 2008 and lasted approximately 17 months. Following the design phase, the project was sent out to bid. The general contractor selected to lead this project was HESS Construction + Engineering Services. With the notice to proceed being given, HESS went to work. Initial planning and scheduling took part for the most of June. During this time, limits of disturbance were outlined, permits were acquired and many meetings were held. Meetings were held to discuss sedimentary and erosion control, pre-communication with the architect and owner, scheduling etc. HESS began mobilization of the site on the 25th of June.

Construction of the STEM Building began on July 7, 2010. Initial site work took place for three months and will end on October 8, 2010 (I am switching from past tense to future tense in the middle of this sentence because this activity is being completed now). Activities being completed during this time period were power relocation at the new building pad, sediment and erosion control, new utilities at egress between existing buildings, new waterline and gas line, walkway patching and building pad excavation.

Following the completion of site work begins the construction of the substructure. The substructure of the STEM Building will be completed in a little over four months, 10/11/10-2/21/11. Construction of the superstructure will begin while the substructure of level three is being completed. This is three weeks before the completion of the substructure. The steel for levels two and three will be set first. Following the completion of levels two and three steel, the steel for the west side of the building for levels three to roof will start next with the steel for the east side of the building for levels three to roof starting two weeks later. Both activities will take four weeks each to complete. The superstructure will take a little over two months to complete.

Slab on deck placements will be the next major activity on the schedule. The placement of decks will commence midway through setting the steel superstructure. The decks will be placed with a typical bottom-up construction method with concrete placement following. This activity will take two months.

Enclosing the building and installing the mechanical and electrical rooms will begin while concrete slabs on the upper levels dry and strengthen. This enclosure process will take place over three months and the mechanical and electrical rooms will be installed in four months. Two months after the start of enclosure and mech./elec. room installation, site finishes will begin and take five months to complete. The interior rough-ins and finishes also follow closely behind the placement of slab on deck. Each level takes approximately seven months to rough-in and finish. Each level begins approximately two weeks after the previous, going from level one to level five. After completing the rough-ins and finishes for level 5, the STEM Building will receive substantial completion. The close-out period will last for five months and start midway through the completion of level 5 rough-in and finishing. At the end of this period, the STEM Building will reach final completion. See Appendix A for Project Summary Schedule.

Building Systems Summary

Building Systems Checklist

Work Scope	Yes	No
Demolition Required	x	
Structural Steel Frame	x	
Cast in Place Concrete	x	
Precast Concrete		x
Mechanical System	x	
Electrical System	x	
Masonry	x	
Curtain Wall	x	
Support of Excavation	x	

Demolition

The largest portion of demolition required for the STEM Building is the removal of two existing asphalt parking lots and several asphalt sidewalks. Additional demo includes the removal of a small portion of curbing and paving of another parking lot in order to install a silt fence. The last of the demolition is the removal of eight trees, four light poles, and a fire hydrant.

Structural Steel Frame

The structural steel system of the STEM Building is comprised of shear connections and three concrete towers/stair shafts used for lateral bracing. This system rests on cast in place concrete footings ranging from 4'-0" x 4'-0" x 15" with 6 #5 EW BOT reinforcing up to 10'-0" x 10'-0" x 33" with 10 #10 EW BOT reinforcing. In general, the columns span from the first floor to the third, and then from the third floor to the roof. There is a large range in sizes of columns but most are W12s, which support majority of the building, or HSS 12.75s, which support the overhang covering the exterior stairs on the southwest side of the building. Typical beam sizes are W18x35 and W18x40. All steel will be set using one 150 ton crawler crane. The flooring system is to be 3 ¼" light weight concrete over 2"x20/20 gauge composite lock floor cellular galvanized deck with WWF 6x6 W2.1xW2.1. Total slab thickness to be 5 ¼".

Cast in Place Concrete

Cast in place concrete for this project is used for footings, foundation walls, slabs-on-grade, elevated slabs and lean concrete backfill. The concrete will be placed via pump truck.

There is no specific type of formwork to be implemented on this project but the specifications do state certain criteria. See below.

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

c. Structural 1, B-B or better; mill oiled and edge sealed.

d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

The concrete compressive strengths are shown in the table below.

Application	Compressive Strength
All concrete components unless otherwise noted	f'c=4,000 psi
Grout for CMU walls	f'c=3,000 psi
Concrete over composite metal deck shall be lightweight	f'c=4,000 psi
Lean concrete	f'c=2,000 psi

Mechanical System

There is one main mechanical room on the second floor that services the STEM Building. The building is heated with the use of cabinet unit heaters and propeller unit heaters. Chilled water is used for cooling. There is one custom air handling unit (AHU) that services the entire building. The entire building is serviced using a variable air volume (VAV) system. The AHU provides a maximum of 37,000 CFMs of outdoor and a minimum of 23,000.

Electrical System

The STEM Building is powered by a 1000 KVA pad mount transformer outside the building. The main transformer feeds into the fire pump controller and circuit breaker before connecting into a 250 KVA, 277/480 V 3 phase generator. The generator then feeds an additional five transformers. One of which feeds the mechanical room, one for the server room, and three for the electrical room.

Masonry

All brick masonry used on the STEM Building is veneer. The brick veneer is used partially on all sides of the building.

Curtain Wall

A large amount of the STEM Building consists of a glazed aluminum curtain wall system but mostly seen on the south wall. The curtain wall components will be fabricated for assembly using a shear-block system provided by Kawneer North America, 1600, System 1 or 2.

Support of Excavation

Excavation will be supported by trench boxes in most cases during construction. This is due to the large amounts of limestone beneath top soil. When possible, a 1:1 layback ratio will be used. There will be a dewatering system implemented during the excavation of this project for foundation draining and it will be permanent.

Project Cost Evaluation

RS Means
(See Appendix B for RS Means Square Foot Cost Report)

The square foot estimate for the STEM Building was generated with the use of R.S. Means' online software, Means Cost Works. The most similar building type was a college laboratory and a wall/framing system of face brick with concrete brick back-up/steel frame. The problem with selecting this type of building is that there can one be one story. To remedy this problem, I took the building perimeter and multiplied it by the number of floors, five. By doing this, Means Cost Works had the correct linear footage and square footage of the building helping to generate a more accurate estimate.

Perimeter (LF)	Number of Floors	Average Floor Area (SF)
620	5	3100

Estimate Name: **HCC**

Building Type:	**College, Laboratory with Face Brick with Concrete Brick Back-up / Bearing Walls**
Location:	**National Average**
Stories:	**1**
Story Height (L.F.):	**14.5**
Floor Area (S.F.):	**62840**
Labor Type:	**Union**
Basement Included:	**No**
Data Release:	**Year 2010 Quarter 3**
Cost Per Square Foot:	**$194.19**
Building Cost:	**$12,202,500**

Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.

Discrepancies between the $12M RS Means square foot estimate and the actual building estimate are due largely to the curtain wall. The actual building has extensive amounts of curtain wall that the Means Cost Works software did not take into account. Another factor includes the use of blasting for excavation. Blasting is much more costly than traditional excavation. Both of these factors would increase the RS Means estimate to more accurately relate to the actual building estimate of $15.7M.

D4
(See Appendix C for D4 Square Foot Cost Report)

A parametric estimate was generated with the use of the D4 cost estimating software. The project selected to compare to the STEM Building was the Vermeer Science Center. The Vermeer Science Center is located in Pella, Iowa and finished construction in August 2003. The buildings are comparable in size in terms of square footage, approximately 9,000 sq. ft. difference. The uses for each building are very similar. Both are to house disciplines in biology, physics, chemistry, mathematics, engineering, and computer science. These buildings will each provide high tech facilities with extensive mechanical systems. They each provide offices for faculty, computer labs, and study rooms. The biggest difference is Vermeer Science Center is three floors and has a 100-seat auditorium. The STEM Building is five floors and lacks an auditorium.

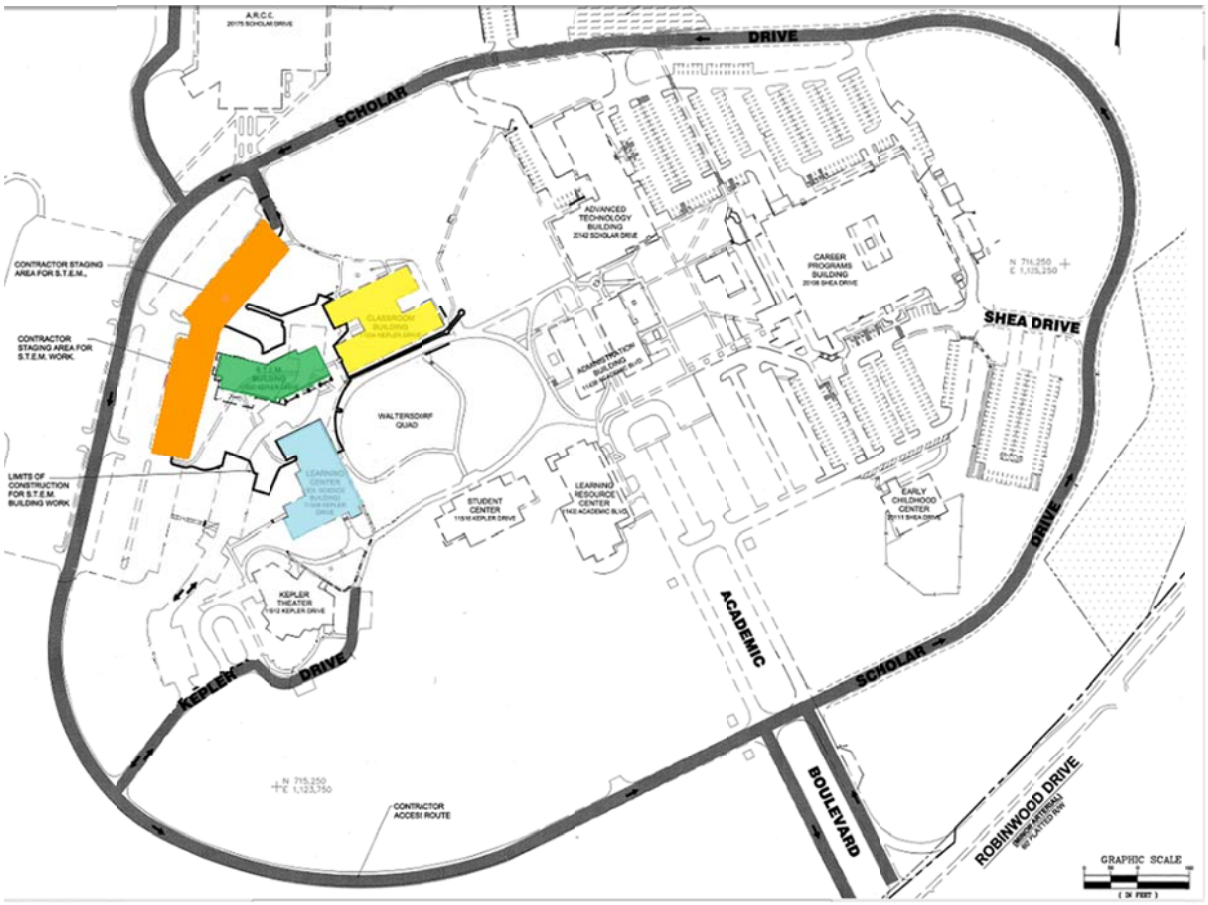
Div. #	Division	%	Cost per Sq. Ft.	Projected Cost
1	General Requirements	13.44	33.00	$ 2,073,502
3	Concrete	10.72	26.32	$ 1,653,755
4	Masonry	2.95	7.25	$ 455,508
5	Metals	5.30	13.01	$ 817,679
6	Wood & Plastics	3.52	8.64	$ 543,049
7	Thermal & Moisture Protection	1.63	4.00	$ 251,672
8	Doors and Windows	9.95	24.42	$ 1,534,368
9	Finishes	9.82	24.10	$ 1,514,727
10	Specialties	0.67	1.63	$ 102,738
11	Equipment	4.37	10.73	$ 674,365
12	Furnishing	0.09	0.23	$ 14,501
13	Special Construction	2.03	4.98	$ 313,206
14	Conveying Systems	0.31	0.08	$ 47,487
15	Mechanical	22.67	55.65	$ 3,496,990
16	Electrical	12.53	30.76	$ 1,933,039
	Total Building Cost	100.00	245.49	$ 15,426,584
2	Site Work	100.00	6.32	$ 826,099
	Total Non-Building Cost	100.00	6.32	$ 826,099
	Total Project Costs			$ 16,252,683

Actual Cost

Div. #	Division	Cost per Sq. Ft.	Projected Cost
1	General Conditions	$ 12.20	$ 766,434
3	Concrete	$ 20.63	$ 1,296,163
4	Masonry	$ 9.82	$ 617,075
5	Metals	$ 19.60	$ 1,231,914
6	Wood, Plastics & Composites	$ 3.57	$ 224,072
7	Thermal and Moisture Protection	$ 13.68	$ 859,737
8	Doors and Windows, Hardware, Openings	$ 12.95	$ 814,030
9	Finishes	$ 16.63	$ 1,044,867
10	Specialties	$ 1.32	$ 82,851
11	Equipment	$ 0.23	$ 14,346
12	Furnishings	$ 11.84	$ 744,052
14	Conveying Systems	$ 1.78	$ 111,826
21	Fire Suppression	$ 2.30	$ 144,357
22	Plumbing	$ 19.99	$ 1,256,007
23	Heating Ventilation & Air Conditioning	$ 42.13	$ 2,647,223
26	Electrical	$ 27.18	$ 1,707,820
31	Earthwork	$ 8.60	$ 540,556
32	Exterior Improvements	$ 8.81	$ 553,880
	Construction Cost Subtotal	$ 233.25	$ 14,657,209
	Project Cost	$ 249.18	$ 15,658,449

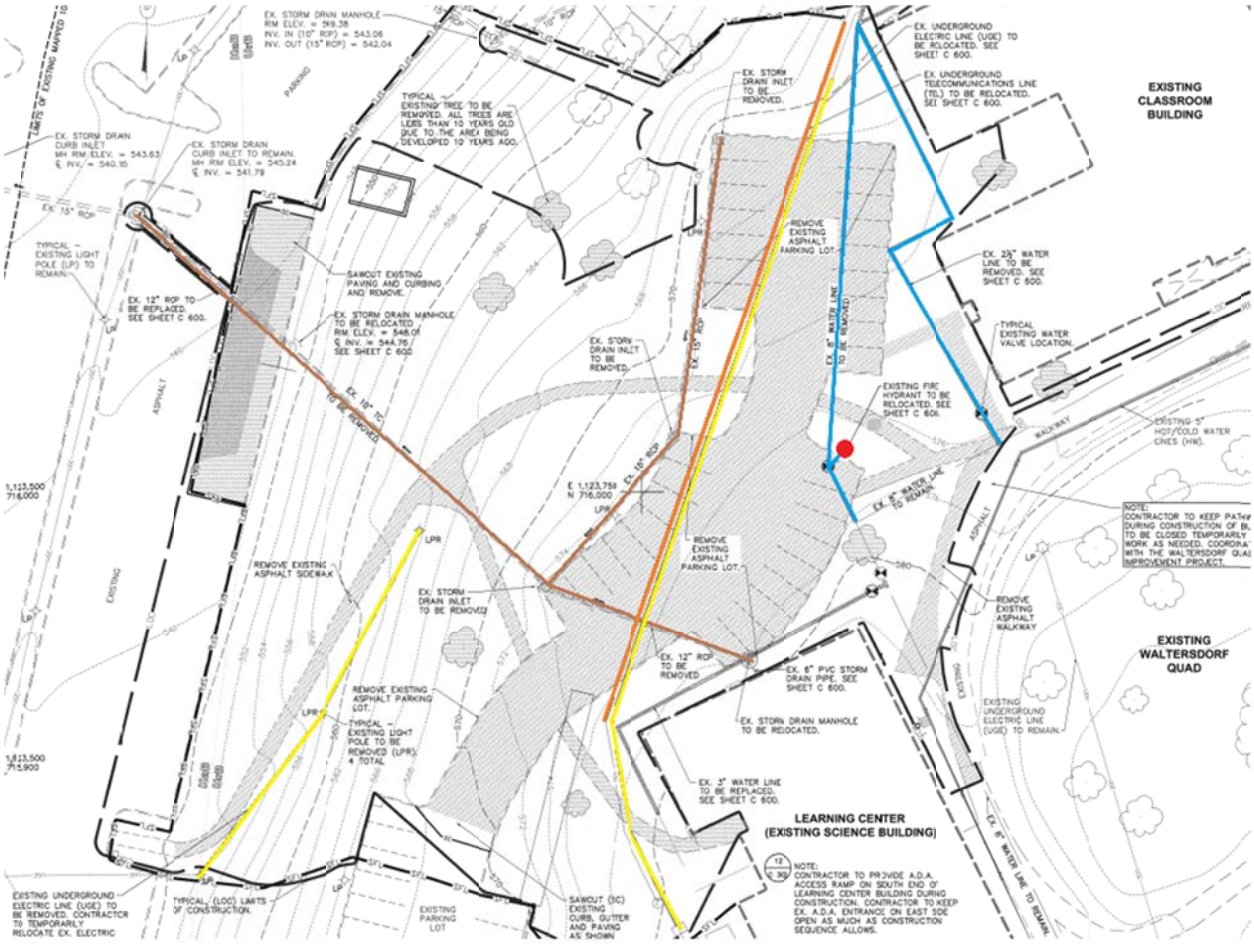
Site Plan of Existing Conditions

The STEM Building, accented in green below, is located in the northwest quadrant of the Hagerstown Community College campus. It will be constructed to the west of the Classroom Building and to the north of the Learning Center, accented in yellow and blue, respectively. The primary entrance for HCC is located at the south end of campus off of Robinwood Drive, circled in purple. From Robinwood Drive, individuals will turn onto Academic Boulevard and then onto Scholar Drive. Scholar drive makes a large loop through campus, allowing access to the campus to be simple and easy. Construction vehicles accessing the site are to turn right on Scholar Drive to keep all construction traffic moving in the same direction, counterclockwise. Parking for construction is located east of the STEM Building in two lots that run north and south. These parking lots will also be used for trailers and material staging.



Pedestrian traffic through the HCC Campus is mainly coming from the parking lots once student and faculty park. There is also significant pedestrian traffic to and from the Athletic, Recreation and Community Center (ARCC). This is the location of the basketball courts, indoor running track, exercise facilities and locker rooms. (See Appendix D for Existing Circulation Plan)

See below for a plan of the existing utilities. Existing utilities that run through the site are two underground electrical line (yellow), multiple storm lines that are all interconnected (brown), telecommunication line (orange) and two water lines (blue). Two parking lots, several sidewalks, and eight trees will also need to be removed from the site before construction can begin.

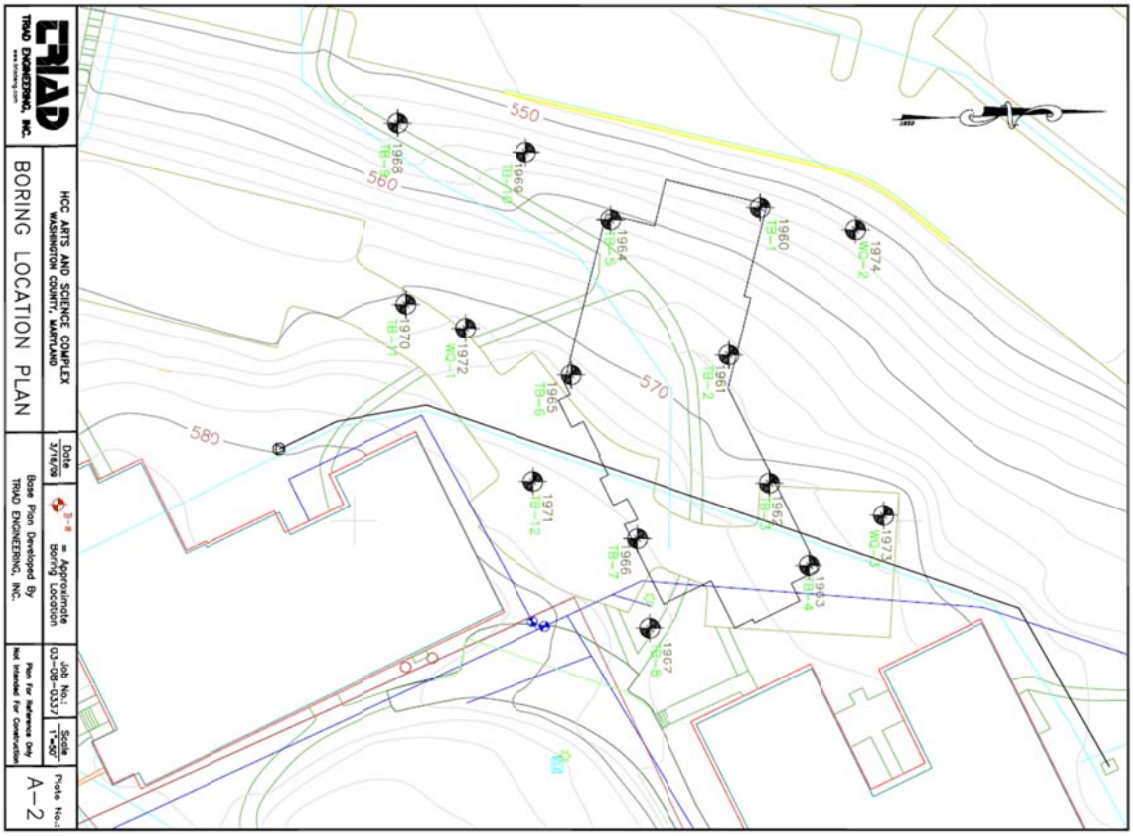


Provided in Appendix E is an aerial view of the campus. This view labels roads, buildings, and athletic fields to help visualize the campus. The location of the STEM Building is also shown in red.

Local Conditions

In Hagerstown, MD, there are not any preferred construction methods other than that for excavation. All of Washington County, where HCC resides, sits on a landmass composed primarily of Conococheague Limestone. This limestone is described as dark blue, laminated, oolitic, argillaceous and siliceous limestone, algal limestone, and flat-pebble conglomerate. This hard rock makes it virtually impossible to excavate with the use of excavators and backhoes. Rock breakers can be used but with such large amounts of rock to be excavated, the schedule would suffer immensely. Therefore the easiest and quickest way to excavate the limestone is with the use of explosives and blasting.

In Washington County, it is commonly knows that the subsurface is limestone, but a geotechnical investigation was still performed to verify. In summary, the field exploration included drilling eleven structure test borings and three storm water management test borings. Locations are shown below. The test borings included Standard Penetration Testing (SPT) and split barrel sampling (ASTM D 1586) at select intervals to depths of auger refusal on hard rock. Auger refusal on hard rock was encountered in all test borings at depths ranging from 2.0 to 6.5 feet below existing grades. Groundwater levels were checked during and upon completion of drilling operations. A static groundwater level was not detected in any of the borings during the investigation. However, it is important to note that fluctuations in groundwater levels may occur due to variations in environmental conditions, surface drainage and other factors which may not have been evident at the time measurements were made and reported.



In terms of recycling, most of the rock that has been excavated will be taken offsite and broken to be utilized as a structural backfill. Also, the construction waste will be recycled throughout the project. HESS has hired a Waste Management Company that provides the recycling services.

Client Information

The owner of the STEM Building is the Hagerstown Community College. HCC is Maryland's first community college and was founded in 1946. There are over 100 programs offered at the college, which is also accredited by the Middle States Association of Colleges and Schools. HCC employs approximately 720 personnel each year. Enrollment at the college is at an all-time high with more than 5,000 credit students and 9,000 non-credit students annually. With the increase in student population, HCC seeks to expand their campus and provide facilities of the highest quality to their students and faculty. The construction of the STEM Building will give HCC a leap in the right direction. The new building will be comprised of labs for many areas of study:

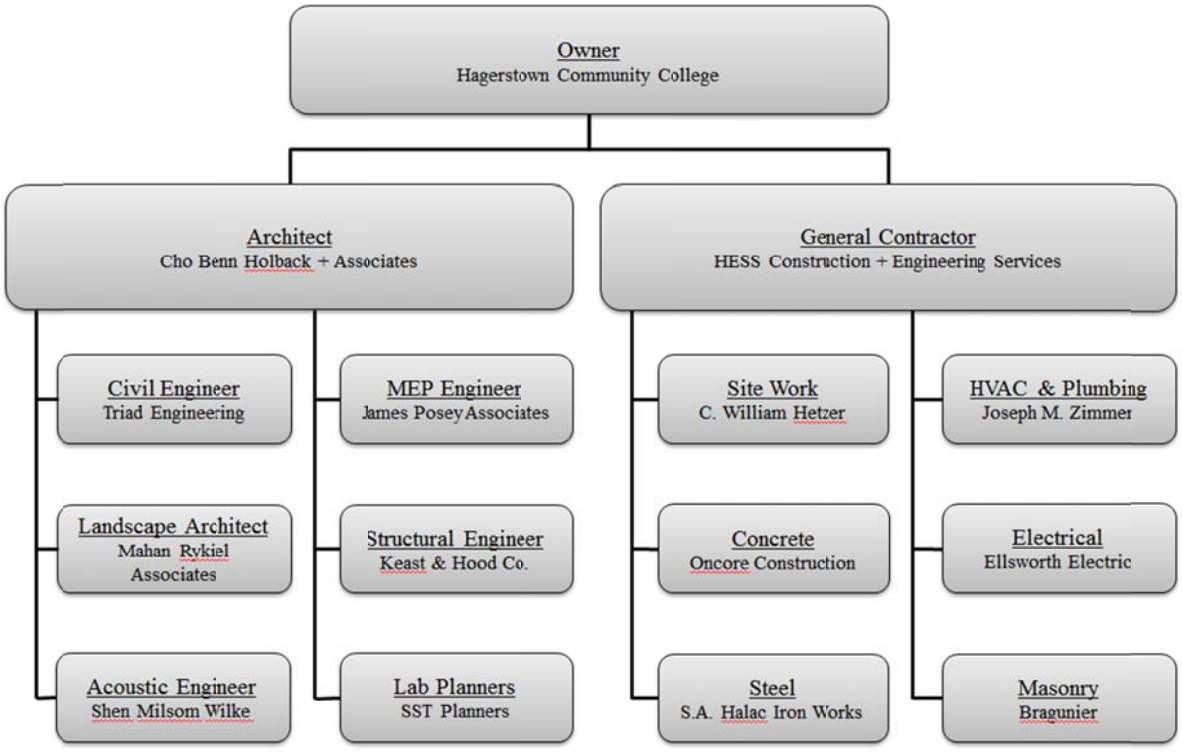
- Physics
- Engineering
- Energy Technology
- Instrumentation and Controls
- Biology
- Microbiology
- Biotechnology
- Anatomy and Physiology
- Chemistry
- Organic Chemistry

Like all owners, HCC want the STEM Building to be completed with the highest quality with a fair and reasonable cost. Schedule and safety are among the top priorities. The schedule must be kept on time as to not interrupt classes. Delaying the start of classes due to an incomplete building is not an option. Activities such as blasting must be coordinated and sequenced appropriately as to not disrupt classes. With the constant flow of pedestrian traffic, HESS Construction + Engineering Services must take all the necessary precautions to ensure the safety of those on site. Construction fences, warning/pedestrian traffic signage, barriers around excavations and overhead protection are all items that will help guarantee safety.

Project Delivery System

The project delivery method being implemented on the STEM Building is design-bid-build. Design-bid-build, the most commonly used project delivery method, was selected because there were no driving factors to cause otherwise. There was substantial time for the design phase of the building which caused HCC to steer away from a design-build project delivery method. All the parties involved in the project are familiar with design-build-build, making it the best pick.

The project will be constructed under a single prime contract, under which HCC contracts with one primary contractor, HESS, which manages bids, contracts and work of each subcontractor. HCC will also be contracted with one architect, Cho Benn Holback + Associates, which will hold the contracts with the engineers. Shown below is an organizational chart displaying thhese contracts.

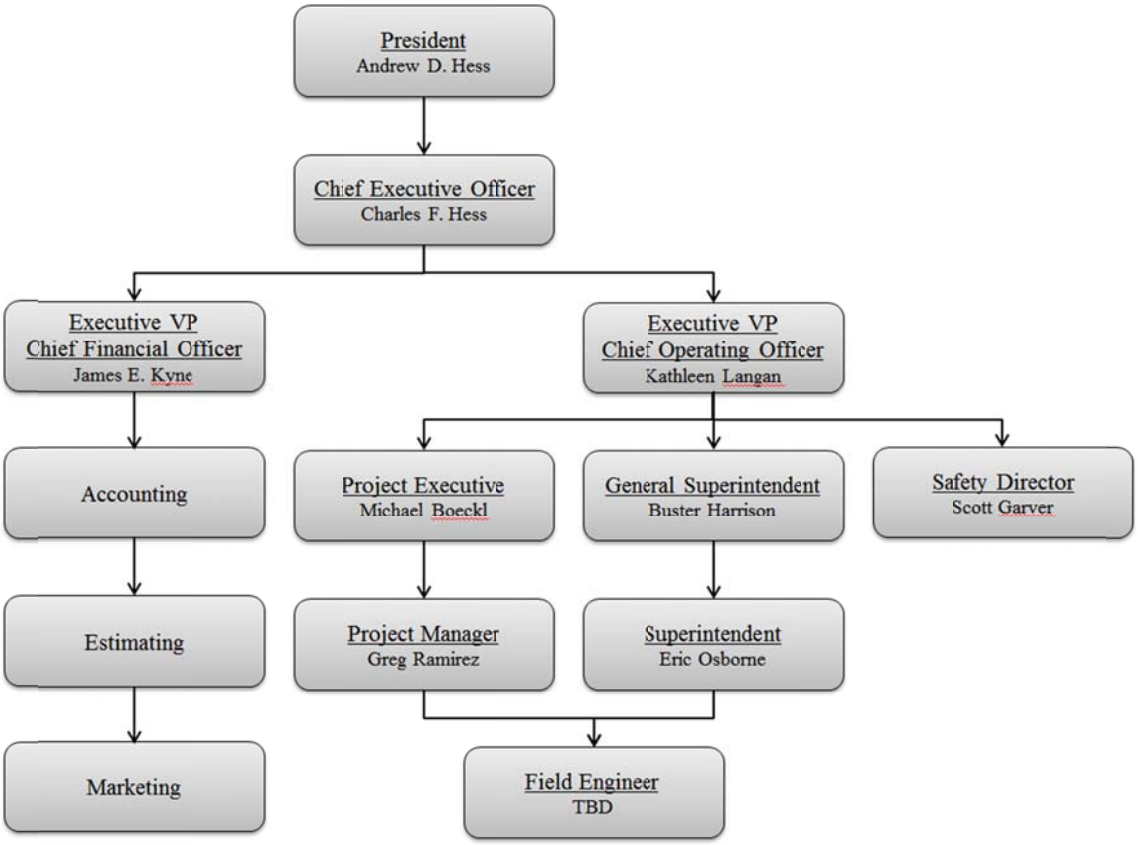


Staffing Plan

HESS Construction + Engineering Services was hired as the General Contractor for this project and is assuming all construction risk for the project. They will assist with preconstruction services and will see the project through closeout. During the construction phase, the project is staffed by operations on site.

The site team consists of the Project Manager, Superintendent and a Field Engineer. As is typical in the industry, the Project Manager is responsible the financials, approvals of documents, communication, and reporting. The Superintendent supervises field activity, updates the schedule, and is generally responsible for the means and methods of constructing the project. A Field Engineer will support the activities of the Project Manager and Superintendent. In this entry position, there is a focus on learning the responsibilities and participate in all the activities of a project All site personnel are responsible for safety but the Superintendent runs the daily program due to his presence in the field. A Safety Director also performs weekly audits with the Superintendent and/or Field Engineer. The Project Executive and General Superintendent act as supervisors to the Project Manager and Superintendent. They generally support the activities of the site as required. They are responsible for a group of projects and generally are not involved on a daily basis.

Departments in the office such as Accounting, Marketing, and Estimating assist activities on site. They are utilized as needed but generally focus on procurement of new work.



Appendix A

Project Summary Schedule

	Task Name	Duration	Start	Finish
1	Design Phase	375 days	Mon 9/1/08	Fri 2/5/10
2	Procurement of GC	80 days	Mon 2/8/10	Fri 5/28/10
3	Notice to Proceed	0 days	Fri 6/4/10	Fri 6/4/10
4	Initial Site Meetings/Permits/GC Mobilization	23 days	Fri 6/4/10	Tue 7/6/10
5	Initial Sitework	68 days	Wed 7/7/10	Fri 10/8/10
6	**Substructure**	**96 days**	**Mon 10/11/10**	**Mon 2/21/11**
7	Level 1 Substructure	54 days	Mon 10/11/10	Thu 12/23/10
8	Wall Bracing/Backfill Foundation Walls	17 days	Thu 11/18/10	Fri 12/10/10
9	Level 1 SOG	13 days	Tue 12/7/10	Thu 12/23/10
10	Level 3 Substructure	30 days	Mon 12/13/10	Fri 1/21/11
11	Level 2 SOG	14 days	Mon 1/17/11	Thu 2/3/11
12	Level 3 SOG	26 days	Mon 1/17/11	Mon 2/21/11
13	**Superstructure Steel**	**50 days**	**Fri 1/14/11**	**Thu 3/24/11**
14	Steel Level 2 and 3	6 days	Fri 1/14/11	Fri 1/21/11
15	Steel West Side Level 3 to Roof	23 days	Fri 2/4/11	Tue 3/8/11
16	Steel East Side Level 3 to Roof	23 days	Tue 2/22/11	Thu 3/24/11
17	**Slab on Deck Placements**	**42 days**	**Fri 2/4/11**	**Mon 4/4/11**
18	Level 2 and 3	12 days	Fri 2/4/11	Mon 2/21/11
19	West Level 4 and 5	16 days	Mon 2/28/11	Mon 3/21/11
20	East Level 4 and 5	15 days	Tue 3/15/11	Mon 4/4/11
21	Enclosures	66 days	Fri 3/18/11	Fri 6/17/11
22	Main Mechanical and Electrical Rooms	87 days	Fri 3/18/11	Mon 7/18/11
23	Site Finishes	112 days	Thu 5/19/11	Fri 10/21/11
24	**Interior Rough-Ins and Finishes**	**202 days**	**Tue 2/22/11**	**Wed 11/30/11**
25	Level 1	149 days	Tue 2/22/11	Fri 9/16/11
26	Level 2	152 days	Thu 3/3/11	Fri 9/30/11
27	Level 3	162 days	Mon 3/14/11	Tue 10/25/11
28	Level 4	164 days	Mon 3/28/11	Thu 11/10/11
29	Level 5	163 days	Mon 4/18/11	Wed 11/30/11
30	Substantial Completion	1 day	Wed 11/30/11	Wed 11/30/11
31	Final Close-Out	110 days	Thu 8/11/11	Wed 1/11/12
32	Final Completion			Wed 1/11/12

Appendix B

RS Means Square Foot Cost Report

Square Foot Cost Estimate Report

Estimate Name: HCC

Building Type:	**College, Laboratory with Face Brick with Concrete Brick Back-up / Bearing Walls**
Location:	National Average
Stories Count (L.F.):	**1.00**
Stories Height	**14.50**
Floor Area (S.F.):	**62,840.00**
LaborType	**Union**
Basement Included:	No
Data Release:	**Year 2010 Quarter 3**
Cost Per Square Foot	**$194.19**
Total Building Cost	**$12,202,500**

Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.

		% of Total	Cost Per SF	Cost
A Substructure		**16.9%**	**26.47**	**$1,663,500**
A1010	**Standard Foundations**		**7.02**	**$441,000**
	Strip footing, concrete, reinforced, load 5.1 KLF, soil bearing capacity 3 KSF, 12" deep x 24" wide			
A1030	**Slab on Grade**		**4.77**	**$300,000**
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	**Basement Excavation**		**0.18**	**$11,500**
	Excavate and fill, 30,000 SF, 4' deep, sand, gravel, or common earth, on site storage			
A2020	**Basement Walls**		**14.50**	**$911,000**
	Foundation wall, CIP, 4' wall height, direct chute, .099 CY/LF, 4.8 PLF, 8" thick			
	Foundation wall, CIP, 4' wall height, direct chute, .148 CY/LF, 7.2 PLF, 12" thick			
B Shell		**23.6%**	**36.86**	**$2,316,000**
B1010	**Floor Construction**		**1.69**	**$106,000**
	Floor, concrete, slab form, open web bar joist @ 2' OC, or bearing wall, 35' span, 20" deep, 125 PSF superimposed			
B1020	**Roof Construction**		**3.58**	**$225,000**
	Roof, steel joists, 1.5" 22 ga metal deck, on bearing walls, 35' bay, 25.5" deep, 40 PSF superimposed load, 60 PSF t			
B2010	**Exterior Walls**		**16.26**	**$1,021,500**
	Brick wall, composite double wythe, standard face/CMU back-up, 8" thick, perlite core fill			
B2020	**Exterior Windows**		**6.60**	**$415,000**
	Aluminum flush tube frame, for 1/4"glass, 1-3/4"x4", 5'x6' opening, no intermediate horizontals			
	Glazing panel, plate glass, 1/4" thick, clear			
B2030	**Exterior Doors**		**2.01**	**$126,500**
	Door, aluminum & glass, with transom, narrow stile, double door, hardware, 6'-0" x 10'-0" opening			
	Door, aluminum & glass, with transom, non-standard, hardware, 3'-0" x 10'-0" opening			
B3010	**Roof Coverings**		**6.48**	**$407,500**
	Roofing, asphalt flood coat, gravel, base sheet, 3 plies 15# asphalt felt, mopped			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Roof edges, aluminum, duranodic .050" thick, 6" face			
	Flashing, aluminum, no backing sides, .019"			

1

		% of Total	Cost Per SF	Cost
	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick			
B3020	**Roof Openings**		0.23	$14,500
	Skylight, plastic domes, insulated curbs, 30 SF to 65 SF, single glazing			
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", galvanized steel, 165 lbs			
	Smoke hatch, unlabeled, galvanized, 2'-6" x 3', not incl hand winch operator			
C Interiors		19.7%	30.82	$1,937,000
C1010	**Partitions**		11.08	$696,000
	Concrete block (CMU) partition, light weight, hollow, 6" thick, no finish			
	Concrete block (CMU) partition, light weight, hollow, 8" thick, no finish			
	8" concrete block partition			
C1020	**Interior Doors**		1.22	$76,500
	Door, single leaf, kd steel frame, kalamein fire, commercial quality, 3'-0" x 7'-0" x 1-3/4"			
C1030	**Fittings**		0.05	$3,000
	Lockers, steel, single tier, 5' to 6' high, per opening, minimum			
C3010	**Wall Finishes**		6.48	$407,500
	2 coats paint on masonry with block filler			
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			
	Wall coatings, epoxy coatings, maximum			
C3020	**Floor Finishes**		5.49	$345,000
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 35 oz			
	Composition flooring, epoxy, minimum			
	Vinyl, composition tile, maximum			
C3030	**Ceiling Finishes**		6.51	$409,000
	Acoustic ceilings, 3/4"mineral fiber, 12" x 12" tile, concealed 2" bar & channel grid suspended support			
D Services		38.8%	60.72	$3,815,500
D2010	**Plumbing Fixtures**		21.27	$1,336,500
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Urinal, vitreous china, wall hung			
	Lavatory w/trim, wall hung, PE on CI, 18" x 15"			
	Lab sink w/trim, polyethylene, single bowl, double drainboard, 54" x 24" OD			
	Service sink w/trim, vitreous china wall hung 22" x 20"			
	Shower, stall, fiberglass 1 piece, three walls, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		1.73	$109,000
	Gas fired water heater, commercial, 100< F rise, 600 MBH input, 576 GPH			
D2040	**Rain Water Drainage**		0.60	$37,500
	Roof drain, CI, soil, single hub, 6" diam, 10' high			
	Roof drain, CI, soil, single hub, 6" diam, for each additional foot add			
D3050	**Terminal & Package Units**		18.40	$1,156,500
	Rooftop, multizone, air conditioner, schools and colleges, 25,000 SF, 95.83 ton			
D4010	**Sprinklers**		2.78	$174,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 50,000 SF			
D4020	**Standpipes**		0.26	$16,500
	Wet standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor			
D5010	**Electrical Service/Distribution**		1.42	$89,500
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 1000 A			
	Feeder installation 600 V, including RGS conduit and XHHW wire, 1000 A			
	Switchgear installation, incl switchboard, panels & circuit breaker, 1200 A			
D5020	**Lighting and Branch Wiring**		10.46	$657,500
	Receptacles incl plate, box, conduit, wire, 8 per 1000 SF, 9 W per SF, with transformer			

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		% of Total	Cost Per SF	Cost
	Wall switches, 2.0 per 1000 SF			
	Miscellaneous power, 1 watt			
	Central air conditioning power, 3 watts			
	Fluorescent fixtures recess mounted in ceiling, 1.6 watt per SF, 40 FC, 10 fixtures @32watt per 1000 SF			
D5030	**Communications and Security**		3.61	$227,000
	Communication and alarm systems, fire detection, addressable, 50 detectors, includes outlets, boxes, conduit and w			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
	Internet wiring, 8 data/voice outlets per 1000 S.F.			
D5090	**Other Electrical Systems**		0.18	$11,000
	Generator sets, w/battery, charger, muffler and transfer switch, gas/gasoline operated, 3 phase, 4 wire, 277/480 V, 1			
	Uninterruptible power supply with standard battery pack, 15 kVA/12.75 kW			
E Equipment & Furnishings		1.0%	1.48	$93,000
E1020	**Institutional Equipment**		1.48	$93,000
	Architectural equipment, laboratory equipment glassware washer, distilled water, deluxe			
	Architectural equipment, laboratory equipment glove box, fiberglass, radio isotope			
	Architectural equipment, laboratory equipment, cabinets, wall, open			
	Architectural equipment, laboratory equipment, cabinets, base, drawer units			
	Architectural equipment, laboratory equipment fume hoods, not including HVAC, deluxe including fixtures			
E1090	**Other Equipment**		0.00	$0
F Special Construction		0.0%	0.00	$0
G Building Sitework		0.0%	0.00	$0
Sub Total		100%	$156.35	$9,825,000
Contractor's Overhead & Profit		8.0%	$12.51	$786,000
Architectural Fees		15.0%	$25.33	$1,591,500
User Fees		0.0%	$0.00	$0
Total Building Cost			**$194.19**	**$12,202,500**

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Appendix C

D4 Square Foot Cost Report

Monday, October 4, 2010

STEM Building

STEM Building - Jan 2012 - MD - Hagerstown

Prepared By:		Prepared For:	
	Fax:		Fax:
Building Sq. Size:	62840	Site Sq. Size:	130680
Bid Date:	3/26/2010	Building use:	Educational
No. of floors:	5	Foundation:	CAS
No. of buildings:	1	Exterior Walls:	CUR
Project Height:	45.2	Interior Walls:	MSD
1st Floor Height:	14.5	Roof Type:	SBS
1st Floor Size:	12568	Floor Type:	COM
		Project Type:	NEW

Division		Percent	Sq. Cost	Amount
01	**General Requirements**	**13.44**	**33.00**	**2,073,502**
	General Requirements	8.07	19.82	1,245,250
	TAB & Commissioning	1.84	4.52	284,179
	FF&E	2.08	5.11	321,210
	Misc (Central College)	1.44	3.55	222,862
03	**Concrete**	**10.72**	**26.32**	**1,653,755**
	Concrete	10.72	26.32	1,653,755
04	**Masonry**	**2.95**	**7.25**	**455,508**
	Masonry	2.95	7.25	455,508
05	**Metals**	**5.30**	**13.01**	**817,679**
	Metals	5.30	13.01	817,679
06	**Wood & Plastics**	**3.52**	**8.64**	**543,049**
	Wood & Plastics	3.52	8.64	543,049
07	**Thermal & Moisture Protection**	**1.63**	**4.00**	**251,672**
	Thermal & Moisture Protection	1.63	4.00	251,672
08	**Doors & Windows**	**9.95**	**24.42**	**1,534,368**
	Doors & Windows	9.95	24.42	1,534,368
09	**Finishes**	**9.82**	**24.10**	**1,514,727**
	Finishes	9.82	24.10	1,514,727
10	**Specialties**	**0.67**	**1.63**	**102,738**
	Specialties	0.67	1.63	102,738
11	**Equipment**	**4.37**	**10.73**	**674,365**
	Laboratory Casework & Furniture	4.37	10.73	674,365
12	**Furnishings**	**0.09**	**0.23**	**14,501**
	Furnishings	0.09	0.23	14,501
13	**Special Construction**	**2.03**	**4.98**	**313,206**
	Special Construction	2.03	4.98	313,206
14	**Conveying Systems**	**0.31**	**0.76**	**47,487**
	Elevator	0.31	0.76	47,487
15	**Mechanical**	**22.67**	**55.65**	**3,496,990**
	Mechanical	16.38	40.21	2,527,099
	Chiller Plant	6.29	15.43	969,892
16	**Electrical**	**12.53**	**30.76**	**1,933,039**
	Electrical	7.85	19.26	1,210,217
	Controls	4.69	11.50	722,823
Total Building Costs		**100.00**	**245.49**	**15,426,584**

02	**Site Work**	**100.00**	**6.32**	**826,099**
	Site Work	100.00	6.32	826,099
Total Non-Building Costs		**100.00**	**6.32**	**826,099**
Total Project Costs		**--**	**--**	**16,252,683**

Appendix D

Existing Circulation Plan

Exhibit 3: Existing Circulation & Parking

Hagerstown Community College

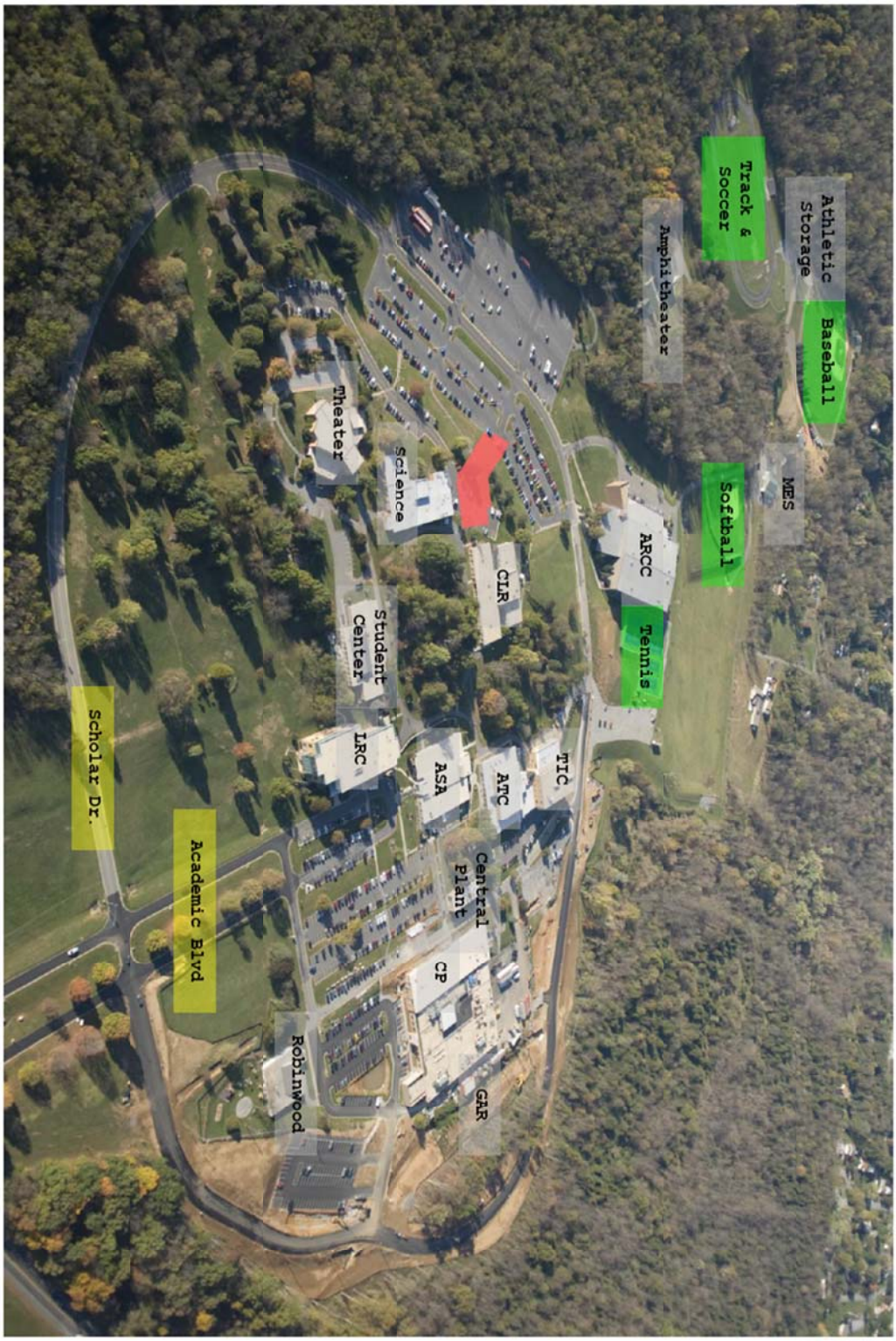
CAMPUS DEVELOPMENT PLAN

June 15, 2010

MAHAN RYKIEL ASSOCIATES
TRIAD ENGINEERING, INC.

Appendix E

Site Aerial View


Athletic Storage
Baseball
Track & Soccer
Amphitheater
MES
Softball
Theater
Science
ARCC
Tennis
CLR
Student Center
TIC
LRC
ASA
ATC
Central Plant
CP
GAR
Robinwood
Scholar Dr.
Academic Blvd