

GREEN URBAN DESIGN MODEL

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Architectural Engineering
Construction Management Option
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Harrisburg University Academic Center
Harrisburg, Pennsylvania



PROJECT TEAM

OWNER: HARRISBURG UNIVERSITY OF SCIENCE AND TECHNOLOGY
CONSTRUCTION MANAGER: REYNOLDS CONSTRUCTION MANAGEMENT
ARCHITECT & M. P. ENGINEER: BURT, HILL
STRUCTURAL ENGINEER: BARBER & HOFFMAN
CIVIL/ELECTRICAL ENGINEER: BENATEC ASSOCIATES
ELECTRICAL ENGINEER (LIGHTING): INTEGRATED ENGINEERING SOLUTIONS, INC.
PARKING CONSULTANT: TIMOTHY HAAHS & ASSOCIATES
CONSTRUCTION DATES: JANUARY 2007– WINTER 2008

PROJECT FEATURES

BUILDING LOCATION: HARRISBURG, PENNSYLVANIA AT THE INTERSECTION OF MARKET AND NORTH FORTH STREETS
BUILDING OCCUPANTS: HARRISBURG UNIVERSITY OF SCIENCE AND TECHNOLOGY
BUILDING FUNCTION: UNIVERSITY WITH CLASSROOMS, TEACHING LABS, SEMINAR ROOMS, LIBRARY, AUDITORIUM SPACE, OFFICE SPACE, AND PARKING FACILITY
SIZE: 370,000 SQUARE FEET
HEIGHT: 16 STORIES
PROJECT COSTS: \$73 MILLION (TOTAL WITH CONSTRUCTION COSTS >\$100 MILLION)
PROJECT DELIVERY METHOD: CM AT RISK

MECHANICAL, ELECTRICAL, PLUMBING

MECHANICAL: ONE CHILLER AND BOILER SYSTEM LOCATED ON 16TH FLOOR SERVICING BUILDING VIA 96x36 DUCTS
ELECTRICAL: MAIN SERVICE TO SWITCH GEAR 3-PHASE 480/277V, 4-WIRE WITH MAIN CIRCUIT BREAKER 1600A
PLUMBING: CITY WATER PRESSURE FOR PLUMBING AND FIRE WATER WITH BOOSTER PUMP FOR FIRE SUPPRESSION SYSTEM

STRUCTURAL, ARCHITECTURAL

FOUNDATION: 70 CAISSONS AVERAGING 5 FEET IN DIAMETER AND 24" GRADE BEAM
CORE STRUCTURE: PRECAST CONCRETE AND STRUCTURAL STEEL WIDE-FLANGE BEAMS AND GIRDERS CONNECTING TO W18x480 COLUMNS
SHELL: NONLOAD-BARING CURTAIN WALL AND ALUMINUM WINDOW GLAZING SYSTEM
ROOF: EPDM RUBBER ELASTOMER

LAUREL HEATHER WARNER ✎ CONSTRUCTION MANAGEMENT OPTION
The Pennsylvania State University ✎ Department of Architectural Engineering
<http://www.arche.psu.edu/thesis/eportfolio/2008/portfolios/LHW106>

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Executive Summary

The following report reflects on one year of intensive study and analysis on the Harrisburg University of Science and Technology Academic Center. The students, faculty, and staff of the University have been eagerly awaiting this facility as they have been renting office spaces in the down town area on Market Street in Harrisburg since the University has opened its doors a few years ago. With the new academic center, Harrisburg University of Science and Technology will be able for the first time to have everyone working or attending the school in one location. Their hopes are to expand interest in science and technology within the region and one day include additional learning facilities to the University.

The first area of study performed for the construction project of the Academic Center included research of current LEED Certified buildings in the United States. Twenty-two buildings were chosen with similar aspects of the Harrisburg University Academic Center. These aspects are urban environment, size, occupancy, intended use, and LEED Rating System version. A Green Urban Design Model was created so that those considering similar types of projects can also become LEED Certified or take into account design aspects of green and environmentally friendly building.

Breadth studies were also performed and involved a lighting analysis of daylighting a space and a structural analysis of a green roof implementation. The daylighting analysis involved research on the subject and used a typical classroom floor for a glazing factor calculation. The addition of a green roof took into account additional loading for the structural analysis and research of a specific system for the building project. With both designs considered, the Harrisburg University Academic Center has potential to qualify for LEED Rating points or simply add green features to the existing design.



Project Background

The Harrisburg University of Science and Technology is currently using spaces within local offices that are not currently in use in the down town Harrisburg area. Currently under construction is the new Academic Center on the corners of Market and North 4th Streets. This newly developed design prominently set itself apart from its surrounding buildings with extensive use of glass on two of its facades. Some of the main features that have been analyzed and researched on the Harrisburg University of Science and Technology's Academic Center are: construction schedule and budget; construction site plans; local conditions; client standpoint; project delivery methods; and project staffing relative to the construction of the project.

The contractual relationships are based on a CM at risk and joint venture delivery method. The project is also fast tracked so that construction can begin as soon as possible. Time and budget constraints in funding are the only concerns for the owner at this time. The schedule for construction indicates a start date of the beginning of January 2007 and completion date is set for November 25, 2008. Key milestone dates are also noted on the schedule as well. Early delays due to weather and improper placement of the tower crane have caused the schedule to vary, however the work is underway and on time.

Various estimates for the project have been assembled and have been thoroughly reviewed and analyzed to determine whether the Harrisburg University Academic Center is within budget. It was found that the estimates from D4 Cost 2002 estimating software and R.S. Means that the actual budget for the project is realistic and fits well to the project constraints and requirements set forth by the owner. The actual building budget and estimates are listed as followed: \$73M Actual Building Cost; \$68.8M D4 Estimate Building Cost; and \$60.5M R.S. Means Building Cost.

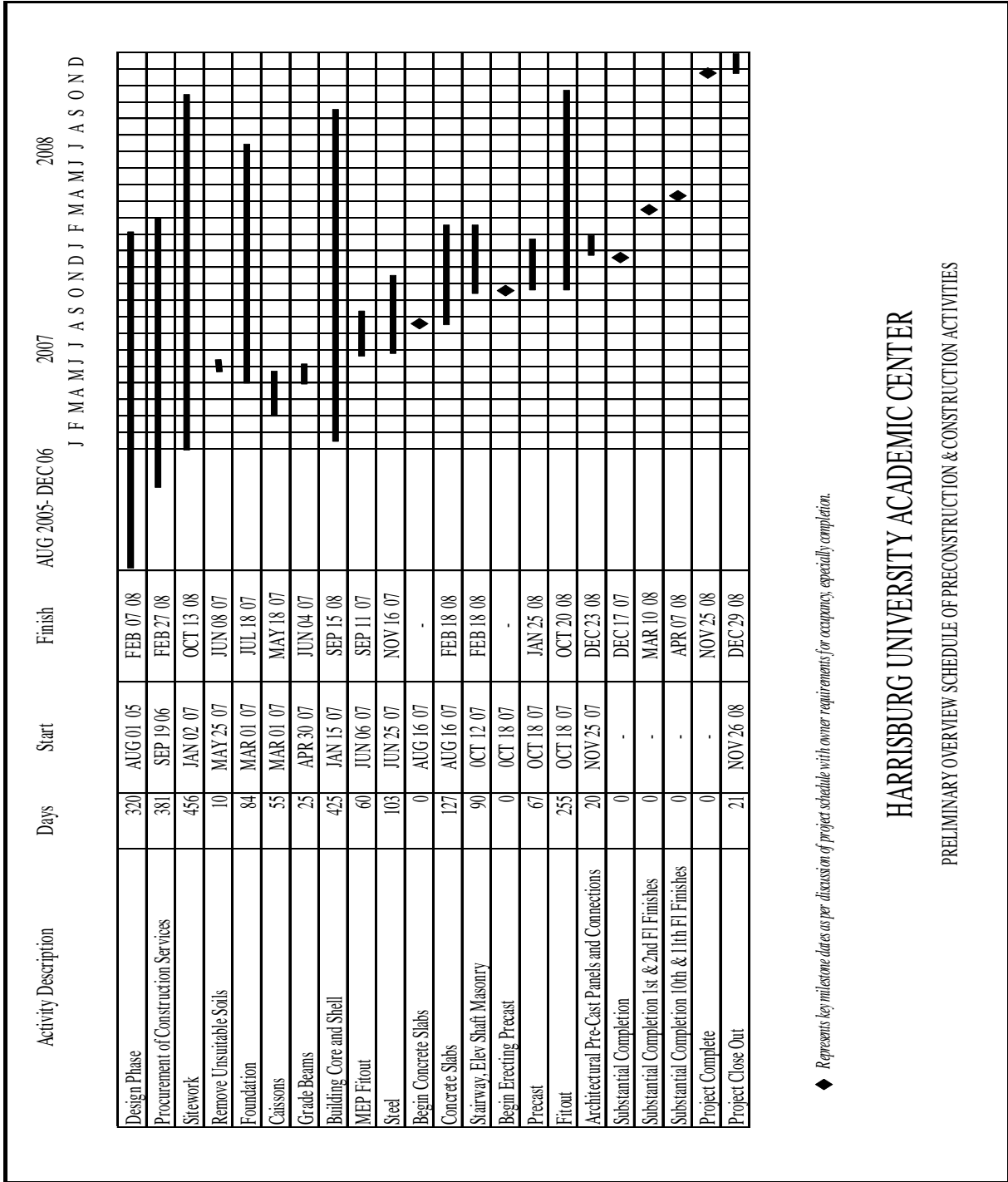
A. Project Schedule Summary

The Harrisburg University of Science and Technology had begun design work for their first building in August of 2005, not yet two years after the University opened its doors for students. It has been using office buildings within three blocks of the construction site of their Academic Center and will be occupying them until the winter semester of 2009, when the new Academic Center will open its doors for the first time. The project completion date is set for November 25, 2008. Reference schedule on following page.

The foundation of the Harrisburg University Academic Center consists of nearly 70 caissons. The caissons range in diameter from just under two feet to nearly five feet; most are on the larger side of approximately 4.5 feet in diameter. Overtop of the caissons is a grade beam of 24 inches. This slab and foundation system was chosen due to the height and load requirements of the building to resist wind lateral forces of the area.

The Academic Center has a structural system that consists of steel girders, beams, and columns; precast concrete wall panels; and composite slab on metal deck. The steel will be erected two bays at a time and the steel deck will be placed before the next set of bays will be erected. The concrete slabs for the floors will be poured after required reinforcement is placed on the decking at a rate of five every eight weeks. Two months after the beginning of slab placement on the decks, the precast slabs will be erected. The shaft for the elevator shares part of the tower crane's foundation and at the point in time when the crane is removed from the site, the elevator shaft will be installed. A material lift is to be in place and functionally at the beginning of January 2008.

Finish sequence milestones begin at the end of the first quarter in 2008-the middle of March with the first two floors clean-out scheduled. The next five floors (3-9) will be for a parking garage and therefore finishing of these levels will come near project completion. Floors 10 and 11 have a finish date of the beginning of April and finishes for the last (16th) floor where the HVAC system will be housed is scheduled for late October 2008.



◆ Represents key milestone dates as per discussion of project schedule with owner requirements for occupancy, especially completion.

HARRISBURG UNIVERSITY ACADEMIC CENTER

PRELIMINARY OVERVIEW SCHEDULE OF PRECONSTRUCTION & CONSTRUCTION ACTIVITIES

B. Building Systems Summary

Yes	No	Work Scope
<input checked="" type="checkbox"/>		Demolition Required
<input checked="" type="checkbox"/>		Structural Steel Frame
<input checked="" type="checkbox"/>		Cast in Place Concrete
<input checked="" type="checkbox"/>		Precast Concrete
<input checked="" type="checkbox"/>		Mechanical System
<input checked="" type="checkbox"/>		Electrical System
<input checked="" type="checkbox"/>		Masonry
<input checked="" type="checkbox"/>		Curtain Wall
<input checked="" type="checkbox"/>		Support of Excavation

Demolition: Soils had to be tested according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548. The existing storm sewer piping at Fourth Street, parking lot, sidewalks and curbs had to be demolished.

Structural Steel: Composite slab on metal deck for floors 2-16, hat and core frame bracing using moment connections on exterior wall for wind resistance exists in the building. Members will confirm will ASTM A992, Grade 50 steel.

Cast in Place Concrete: All floors have composite slab on metal deck, utilizing cast-in-place concrete. Stay-in-place and timber formwork is used, along with truck and buggy placement for the concrete.

Pre-cast Concrete: Casting will take place from Fourth Street site entrance. The use of pre-cast concrete exists on the façade, parking structure, and classroom partition walls. Connections will be made using pins; crane used is same for steel erection—225' tower crane with 80' horizontal jib.

Mechanical & Electrical Systems: There are rooftop HVAC units with (3) AHU on 16th floor servicing building via 96x36 ducts. Variable air volume boxes supply air to the university classroom buildings as well as the first two floors of office/retail space. Existing air conditioning units range from 1,200 CFM to 16,000 CFM; three split system heat pump units exist as well. Fire water with booster pump exists for the fire suppression system. From the main service to switch gear, a 3-phase 480/277V, 4-wire with main circuit breaker 2000A exists.

Masonry: Interior masonry will be for some of the partitioning walls inside the building along with the framing of stair and elevator shafts. Concrete masonry units will be used.

Curtain Wall: Non-load bearing curtain wall exists on the exterior walls. Aluminum window glazing system and pre-cast concrete make up the south and east facades. The north and west facades are simply pre-cast concrete.

Support of Excavation: A free draining sheeting system, consisting of H beams, wood lagging and bracing, was used for support against the existing Strawberry Square building on the west façade.

C. Project Cost Evaluation

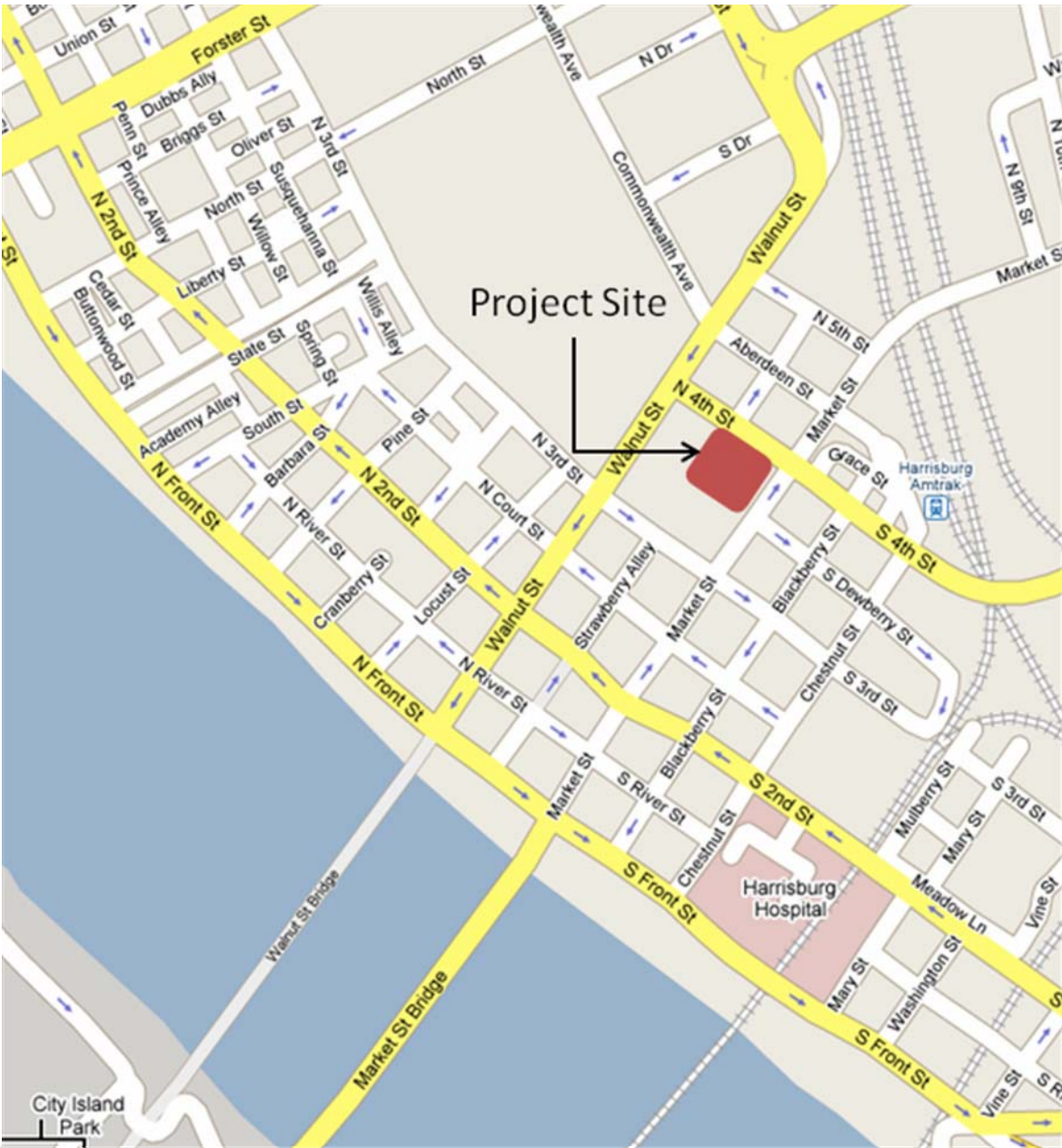
Actual Building Costs: \$73,000,000
SF Costs: \$197.30
Total Project Costs (to date): \$100,000,000
SF Project Costs: \$270.27
Parking Garage: \$13,475,531
SF Parking Garage: \$36.42
General Conditions: \$2,499,844
SF General Conditions: \$6.76
Concrete: \$4,099,488
SF Concrete: \$11.08
Steel: \$8,770,250
SF Steel: \$23.70
Aluminum Glass and Glazing: \$3,240,764
SF Aluminum Glass and Glazing: \$8.76
Electrical: \$6,986,981
SF Electrical: \$18.83
HVAC: \$4,800,000
SF HVAC: \$12.97
Plumbing: \$2,600,000
SF Plumbing: \$7.03
Technology Equipment and Furniture: \$4,275,000
SF Technology Equipment and Furniture: \$11.55

The actual costs for construction of the Harrisburg University Academic Center are only current values as the total package has not yet been out to bid. Costs are expected to be in excess of \$100M. D4 Cost 2002 ran a comparison of building the university but comparisons were not as close as needed. The final cost of \$68.8M was for a university in Pennsylvania with the same number of square feet. The parking garage and technology facilities were not able to be run in the estimate, allowing the numbers to be lower than the actual costs. The total added costs of different facilities comparable to the Academic Center totaled \$60.5M, quite lower than the actual costs. This was due to the fact that the parking garage and offices in the building are state-of-the-art and have precast panels and aluminum glazing. In summary, the Harrisburg University Academic Center is a complex facility and costs are added for the buildings use as a technology center. See following sheets and numbers with a golden star.

D4 Cost 2002					
Project Name:	Harrisburg University Academic Center		Project Height:	16 floors	
Project Location:	Harrisburg, Pennsylvania		Projec Size	370,000	SF
Year:	2007		Facility:	University	
	Percent		Sq. Cost		Amount
Bidding Requirements	4.08		7.59		2808300
General Requirements	6.37		11.85		4384500
Site Requirements	8.13		15.12		5594400
Site Work	34.47		64.14		23731800
Concrete	0.52		0.96		355200
Metals	3.06		5.7		2109000
Woods and Plastics	0.56		1.05		388500
Thermal and Moistur	1.87		3.48		1287600
Doors and Windows	11.09		20.64		7636800
Finishes	5.71		10.62		3929400
Specialties	0.27		0.51		188700
Equipment	0.11		0.21		77700
Furnishings	0.29		0.54		199800
Conveying Systems	4.52		8.4		3108000
Mechanical	11.79		21.93		8114100
Electrical	7.15		13.32		4928400
Building Costs	100		186.06		68842200

D. Site Plan of Existing Conditions

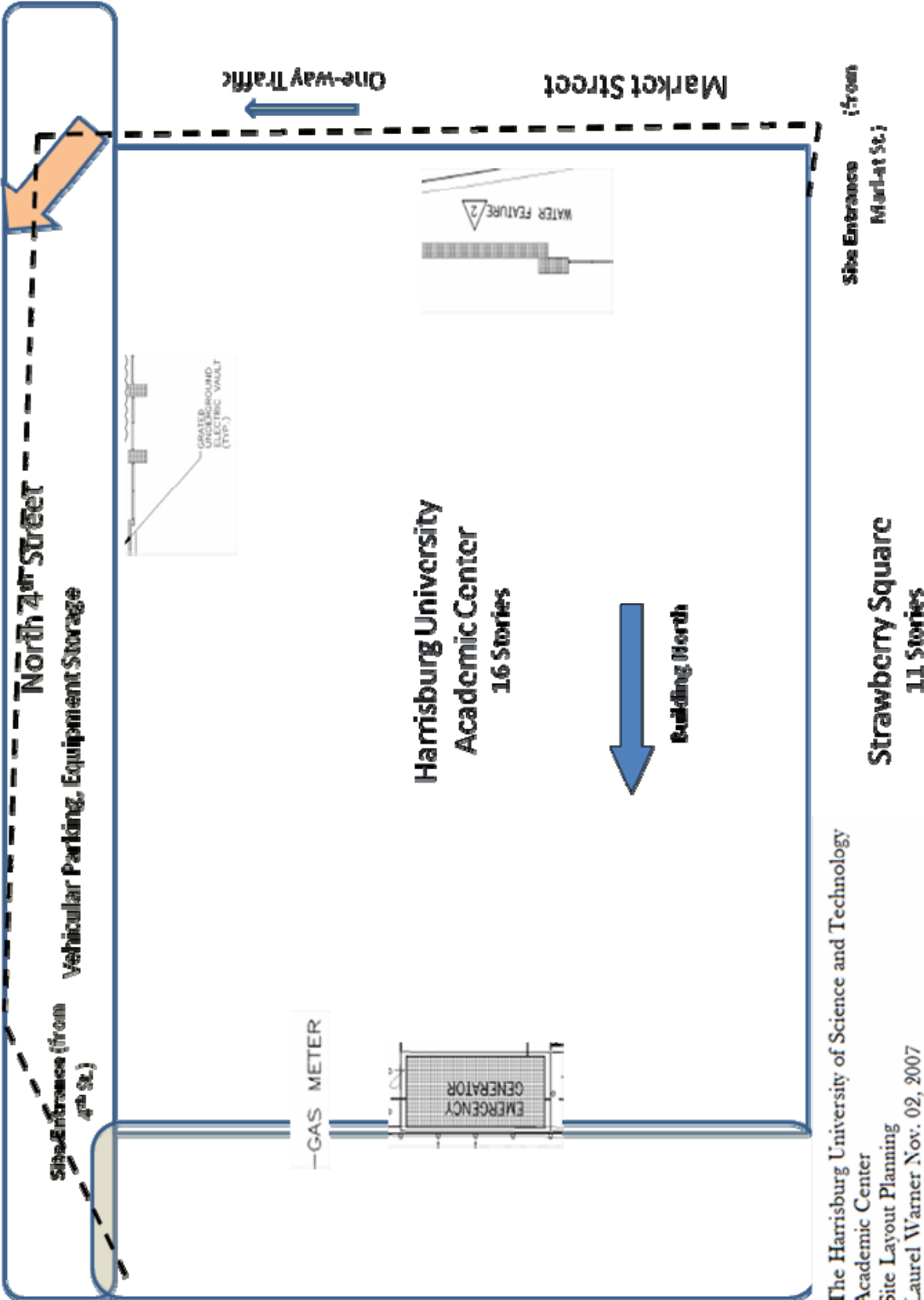
The site for the Harrisburg University Academic Center is located in the heart of downtown. For a year and a half, Market Street from 3rd to 4th Street is one lane and North 4th Street from Walnut to Market will be closed. Prior to demolition, the site existed as a parking lot for Strawberry Square, and indoor shopping mall. The site, due to its location is congested and storage is limited to the south and east locations of the site. Site offices are located on the southeast corner of the site and will move to inside the first floor of the building at substantial completion of the first two floors.



City Map of Harrisburg, PA

Site Prior to Demolition





The Harrisburg University of Science and Technology
Academic Center
Site Layout Planning
Laurel Warner Nov. 02, 2007

E. Local Conditions

In the downtown area of Harrisburg, one sees many tower cranes amongst the rooftops of the skyline. The general area is booming with construction as the city is returning to its splendor many decades ago. In the city, construction projects have little site room as city streets are always congested and changing traffic patterns and closing roads becomes quite a hassle. Limited space for staging, working, and parking are general conditions in the area.

More recently, owners are using construction managers for their building projects and companies are expanding for in-house estimating, scheduling, and constructability reviewing as the needs are changing for owners. However, there is still a large demand for general contracting depending on the type of project. Schools are the ideal candidate owners for using construction management in their construction project.

As the construction industry moves toward a green type of design and construction approach, it becomes more desirable to have waste removal and recycling of materials for a project. There are no new fees for recycling in the area but the \$2 recycling fee was reauthorized within the last decade. This has reduced construction costs by millions over the years.

The city of Harrisburg is divided into two regions by the Susquehanna River by the locals: the East Shore and the West Shore. Since most of the area is surrounded by a body of water, this impacts the soil conditions as construction buildings are concerned. Because of the moisture in the soil, the work for the construction site is affected. Foundations are designed as per the limited strength of the soil within the bounds of the perimeter of the buildings footprint.

As per the specs of the project, damage caused by the settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations is the responsibility of the general contractor during construction of the structure, utilities, sidewalks, and other facilities. Preparation of subgrade for earthwork operations is necessary and includes removal of debris, obstructions, and toxic materials from ground surface. It is also essential to prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the project site and surrounding area. Protection of the subgrades from softening, undermining, washout, and damage by rain or water accumulation is essential also for the area. This was done by rerouting surface water runoff away from excavated areas, not allowing water to accumulate in excavations, and not using excavated trenches as temporary drainage ditches.

F. Client Information

The Harrisburg University of Science and Technology is an infant as far as Pennsylvania higher education is concern. The University became incorporated in the Commonwealth in 2001 and opened its doors for its charter class in 2005. The University is the first of its kind in the Harrisburg region and only plans on expanding by opening the doors of the Academic Center in January 2009. It will be the first building the University owns, in part to very early public and private sector investments.

In order to continue its funding, the University has a need to expand as soon as possible. Due to its location, limited space of former office buildings are now used as laboratories and classrooms. By building the Academic Center, the University hopes to bring in new talent interested in the sciences and eager to learn in a new state-of-the-art facility right downtown. For now, it focuses on bringing in local high school graduates and those wanting to further their education. Great attempts have not been made for advertising because of the size of the current temporary facilities.

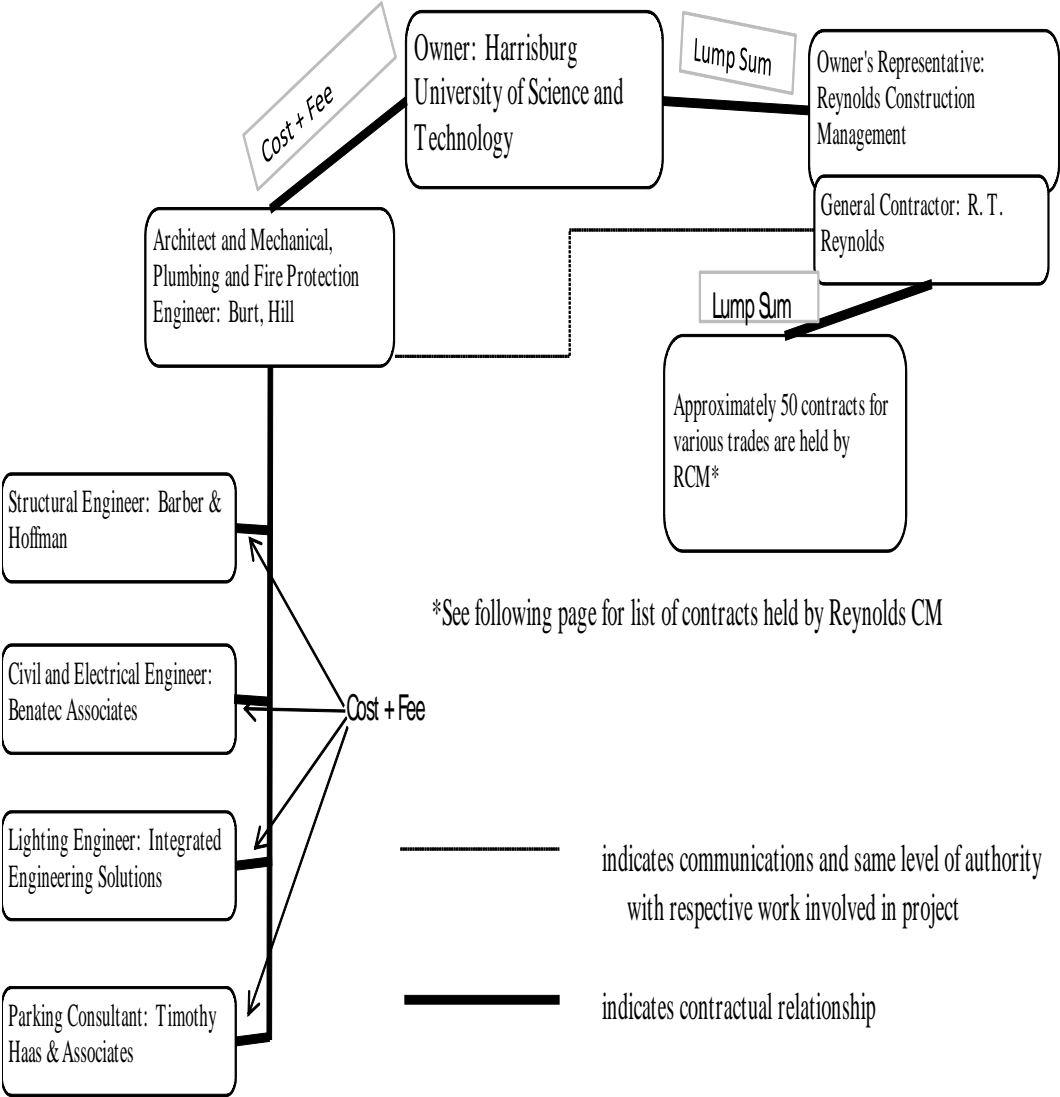
The owner representative of Reynolds Construction Management stated that the Harrisburg University Academic Center is a risky project but everything seems to be going accordingly. He hopes that the University will expand and direct new talent into the area and revive the city.

The Academic Center will be where the University's offices, classrooms, library, auditoriums, laboratories, and parking garage are located. The design stage was extensive due to the University's funding and anticipates costs just over \$70 million.

The faculty, staff, and students are awaiting their new technology facility to open with hopes to spread out in the Academic Center for spring 2009 semester. Currently, they are the only occupants of the project. Their anticipation can be noted on the University's website as they are documenting the construction progress with live video feeds and milestone pictures.

G. Project Delivery System

The project delivery system for the Harrisburg University of Science and Technology's Academic Center is that of a joint venture (non-contractual) CM at Risk. Reynolds Construction Management R.T. Reynolds is acting as the general contractor on the project, holding all of the contracts from the various trades on the project.



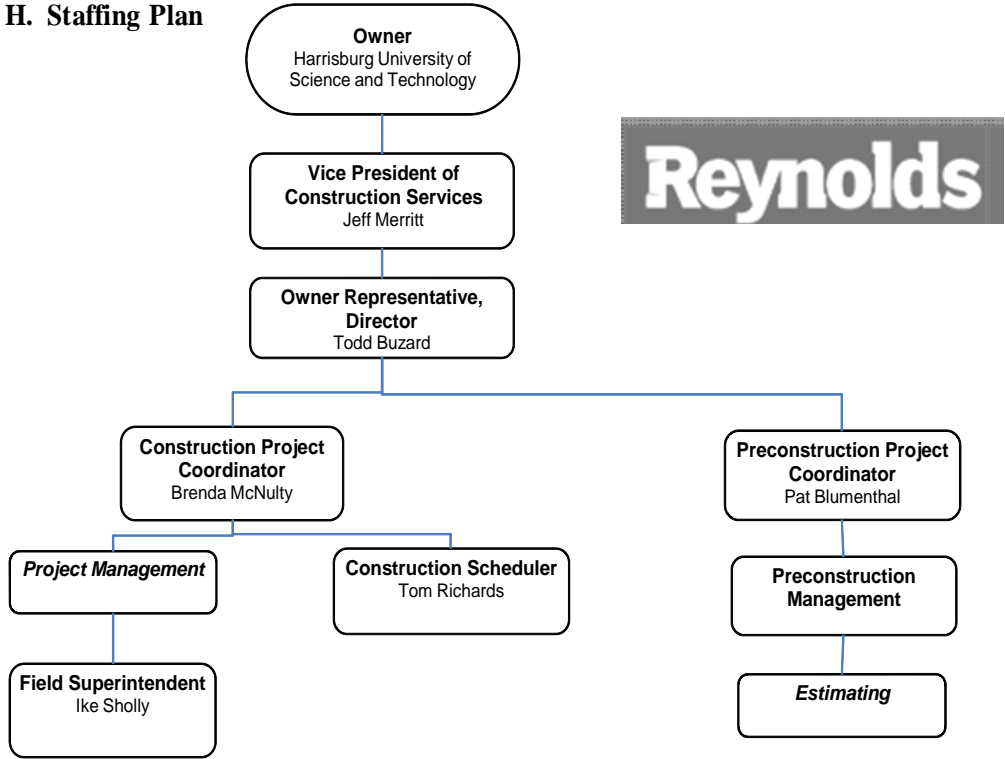
Project Delivery System: Organizational Chart

Harrisburg University of Science and Technology
Harrisburg Academic Center
Contract Values

<u>Contract Number</u>	<u>Description</u>	<u>Subcontractor</u>	<u>Amount</u>
1	General Conditions	RTR	\$2,500,000.00
2	Vibration Monitoring Allowance	ALLOWANCE	\$20,000.00
3	Additional Street Barricades	PSI	\$43,137.00
4	Temp Winter Protection for Fireproofing	RTR	\$25,000.00
5	Scaffolding for Aluminum Panels, Louvers, Soffit	RTR	\$250,000.00
6	Additional Temporary Fencing	Washington & Dowling	\$12,987.00
7	Sitework	Markcrete	\$593,870.00
8	Excavation & Backfill for Cassions	ALLOWANCE	\$6,000.00
9	Cassions	Brayman	\$616,600.00
10	Cassons Bad Earth Conditions	ALLOWANCE	\$48,000.00
11	60" Corrigated Casing	ALLOWANCE	\$6,000.00
12	Concrete	Macri	\$4,099,488.00
13	Ornamental Gate, Foundation, Pier	ALLOWANCE	\$20,000.00
14	Architectural Precast	Architectural Precast	\$1,992,905.00
15	Masonry	Advance	\$2,012,300.00
16	Precast Connection Allowance	ALLOWANCE	\$250,000.00
17	Structural Steel	Strait Steel	\$8,770,250.00
18	Tower Crane/Operator	Dickinson	\$750,000.00
19	Miscellaneous Metals	McGregor	\$1,550,000.00
20	Metal Pan Stairs	Ebingers	\$541,303.00
21	Carpentry	Acri	\$1,700,000.00
22	Fixed Radiused Desk @ Lecture Hall	ALLOWANCE	\$85,000.00
23	Waterproof Elevator Pits	Houck	\$8,680.00
24	Courtyard Water Feature Liner		\$10,000.00
25	Traffic Coating	Houck	\$93,890.00
26	Spray-on Insulation	Novingers	\$100,000.00
27	Temp Damp Coating at Caisson Areas	Houck	\$5,000.00
28	Fireproofing	A1	\$550,000.00
29	Intumescent Fireproofing	Novingers	\$100,000.00
30	Roofing/Sheet Metal	Allied	\$887,822.00
31	Caulking & Sealants	Thesen	\$250,000.00
32	Electronic Door Hardware		\$40,000.00
33	Coiling Doors & Grills	Builders Specialties	\$120,000.00
34	Aluminum/Glass & Glazing	Hershocks	\$3,240,764.00
35	Drywall, Metal Studs & Insulation	Novingers	\$3,568,000.00

36	Upgrade Existing Facade Allowance	ALLOWANCE	\$30,000.00
37	Ceramic & Glazed Tile	Interstate	\$325,000.00
38	Acoustical Ceilings	Novingers	\$936,600.00
39	Acoustical Wall Panel Allowance	ALLOWANCE	\$100,000.00
40	Flooring	DeGol	\$297,073.00
41	Painting	Art I Do	\$400,000.00
42	Access Flooring	Bettinger West	\$9,000.00
43	Folding Partition		\$13,275.00
44	Pay-on-Foot Stations (2) Each - Allowance	ALLOWANCE	\$100,000.00
45	Proximity Reader & Exit Loop for GRG Door	ALLOWANCE	\$5,000.00
46	Lab Casework & Equipment	Northeast	\$264,500.00
47	Roof Anchors	Pro-Bel	\$39,050.00
48	Window Blinds & Shades	Kay	\$55,650.00
49	Technology & Furniture Allowance	ALLOWANCE	\$2,965,000.00
50	Pumping & Filtration - 2 water features	ALLOWANCE	\$40,000.00
51	Elevators	Otis	\$1,755,160.00
52	Elevator Call Station Kiosk Allowance	ALLOWANCE	\$10,000.00
53	Elevator Color Touch Screen Terminals	ALLOWANCE	\$10,000.00
54	Fire Protection	Tomko	\$994,000.00
55	Plumbing	Tomko	\$1,606,000.00
56	HVAC	GR Sponaugle	\$4,800,000.00
57	Electrical	GR Sponaugle	\$6,986,981.00
58	Telecommunications Systems Allowance	ALLOWANCE	\$769,000.00
	Harrisburg Merchantile Tax	RTR	\$69,700.00
	Performance Bond	RTR	\$385,275.00
	Subguard	RTR	\$640,000.00
	Insurances	RTR	\$408,000.00
	Contingency		\$1,775,000.00
	Subtotal		\$60,656,260.00
	RTR CM Fee (3%)		\$1,819,688.00
Revised GMP Construction Total			\$62,475,948.00

H. Staffing Plan



- Owner Representative: Asks as voice of owner
- VP of CS: Consultant of company, reports to director
- Precon Proj Coordinator: Writes contracts, in charge of bidding
- Precon Management: oversees estimating, attends owner meetings
- Estimating: does architectural and MEP estimating
- Construction Scheduler: schedules project duration
- Project Management: work in office and field (communications)
- Const. Proj. Coordinator: documents submittals, RFIs
- Field Superintendent: oversees construction process

Green Urban Design Model

Research: Green Urban Design Model

Construction Industry Issue

The environmental impact of the building design, construction and operation industry is significant. Buildings annually consume more than 30% of the total energy and more than 60% of the electricity used in the U.S. Each day five billion gallons of potable water is used solely to flush toilets. A typical North American commercial construction project generates up to 2.5 pounds of solid waste per square foot of completed floor space [29]. Development shifts land usage away from natural, biologically-diverse habitats to landscape that is impervious and devoid of biodiversity. The far reaching influence of the built environment necessitates action to reduce its impact. Green building practices can substantially reduce or eliminate negative environmental impacts and improve existing unsustainable design, construction and operational practices [24]. As an added benefit, green design measures reduce operating costs, enhance building marketability, increase worker productivity, and reduce potential liability resulting from indoor air quality problems [17]. In other words, green design has environmental, economic and social elements that benefit all building stakeholders, including owners, occupants and the general public.

Following the formation of the U.S. Green Building Council in 1993, the membership quickly realized that a priority for the sustainable building industry was to have a system to define and measure “green buildings.” The USGBC began to research existing green building metrics and rating systems. Less than a year after formation, the membership followed up on the initial findings with the establishment of a committee to focus solely on this topic. The diverse initial composition of the committee included architects, realtors, a building owner, a lawyer, and environmentalist and industry representatives. This cross section of people and professions added a richness and depth both to the process and to the ultimate product. The LEED Green Building Rating System is a voluntary, consensus-based, market-driven building rating system based on existing proven technology. It evaluates environmental performance from a whole building perspective over a building’s life cycle, providing a definitive standard for what constitutes a “green building.” The rating system is organized into five environmental categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, and Indoor Environmental Quality. An additional category, Innovation & Design Process addresses sustainable building expertise as well as design measures not covered under the five environmental categories [30]. LEED is a measurement system designed for rating new and existing commercial, institutional and residential buildings. It is based on accepted energy and environmental principles and strikes a balance between known established practices and emerging concepts.

Research Goals

Over the last decade, green design has become more of trend in the construction industry than just a want of the architecture or perhaps building owner. Recognition for having a building that is environmentally friendly is now coveted. The goals for the critical industry research are to bring together design concepts from current LEED Certified buildings that are similar to the Harrisburg University Academic Center. With the model, research is compiled for future use in the design industry, with the intention that professionals would not have a blind eye to green building and design concepts.

*A letter and copy of this report will be sent to the Harrisburg University of Science and Technology.

Modeling Process

Research was compiled existing of various building design trends and a current list of buildings LEED certified by the U. S. Green Building Council for their outstanding design, construction, and performance systems [30]. Thousands of buildings were reviewed for their criteria to be similar in aspects to the Harrisburg University Academic Center. Among the aspects were building site selection in an urban setting, square footage between 275,000 to 500,000 square feet, use during daylight hours, information for design and construction being non-classified, and being LEED certified with versions 2.0 for New Construction or later. See Figure 1 for the list of the 22 buildings that were chosen for the analysis. Figure 2 illustrates the amount of each level of certification is represented in the analysis, with the average building being at a LEED Silver Certification.

Using the LEED Project Checklist, Figure 3.1 and 3.2, information was gathered about each building to attain design aspects that were incorporated into each project. A spreadsheet compiled the data from project profiles, LEED journal articles, and building owners, architects, and engineers. Please reference Appendix for each building's checklist. Next, the totals for each of the six categories of design were found, see Figure 4a.

To create the Green Urban Design Model, the most frequently used aspects of design for each category were noted into one chart. Theses aspects represent current trends featured in the design, construction, and performance of building projects most like the Harrisburg University's Academic Center currently under construction. Please reference design model and example features of design.

Project Name	City	State	Version	Project Type	Owner Type	Occupant Type	Gross Square Feet	Registration Date
OUC Administration Building	Orlando	FL	2.2	Commercial Office	Profit Org	Mixed Occupancy	278,000	Aug 7 2006
Manulife US Headquarters	Boston	MA	2.2	Commercial Office	Federal Government	Federal Government	526,020	Jan 19 2007
Social Security Annex Building	Baltimore	MD	2.0	Commercial Office	Federal Government	Federal Government	406,069	Dec 10 2001
Liberty Mutual Office Building	Dover	NH	2.1	Commercial Office	Profit Org	Profit Org	350,000	Jun 16 2005
Molasky Corporate Center	Las Vegas	NV	2.1	Commercial Office	Profit Org	Mixed Occupancy	265,000	May 2 2005
The Plaza At PPL Center	Allentown	PA	2.0	Commercial Office	Other	Profit Org	280,000	Nov 8 2001
Bp Commercial and Trading Office	Houston	TX	2.2	Commercial Office	Profit Org	Profit Org	390,000	Sept 15 2006
Vocation Technology Center, City College	San Diego	CA	2.1	Higher Education	State Government	State Government	336,100	Nov 20 2006
Management Building	Atlanta	GA	2.0	Higher Education	State Government	State Government	248,059	Jan 31 2001
Center for Interdisciplinary Engineering	Durham	NC	2.1	Higher Education	Profit Org	Profit Org	323,000	July 23 2002
Whitehead Biomedical Research Building	Atlanta	GA	2.0	Laboratory	Profit Org	Profit Org	325,000	July 19 2000
San Diego New Main Library	San Diego	CA	2.1	Library	Local Government	Local Government	360,858	May 4 2004
California Academy of Sciences	San Francisco	CA	2.1	Multi-Use	Non-Profit Org	Non-Profit Org	390,000	Mar 19 2003
David Skaggs Research Center	Boulder	CO	2.2	Multi-Use	Federal Government	Federal Government	400,000	Dec 02 2006
Univ of North Florida - Osprey Fountains	Jacksonville	FL	2.2	Multi-Use	State Government	State Government	375,000	Mar 19 2007
Simmons College of Mana	Boston	MA	2.1	Multi-Use	Non-Profit Org	Non-Profit Org	309,660	Dec 9 2005
Moziac Development	Minneapolis	MN	2.2	Multi-Use	Individual	Mixed Occupancy	350,000	Oct 12 2006
Jefferson Arms	S Louis	MO	2.2	Multi-Use	Profit Org	Mixed Occupancy	509,855	Dec 22 2006
Duke Univ French Family Science Center	Durham	NC	2.1	Multi-Use	Profit Org	Profit Org	273,872	Sep 22 2004
4275 Dean Martin Drive	Las Vegas	NV	2.1	Multi-Use	Profit Org	Profit Org	400,000	Jan 7 2006
1700 Building	Portland	OR	2.2	Multi-Use	Profit Org	Mixed Occupancy	371,000	Aug 20 2001
Two Potomac Yard	Arlington	VA	2.1	Multi-Use	Profit Org	Federal Government	309,270	Jan 31 2005

Average SF 353,489

Figure 1: Selected Projects for Analysis

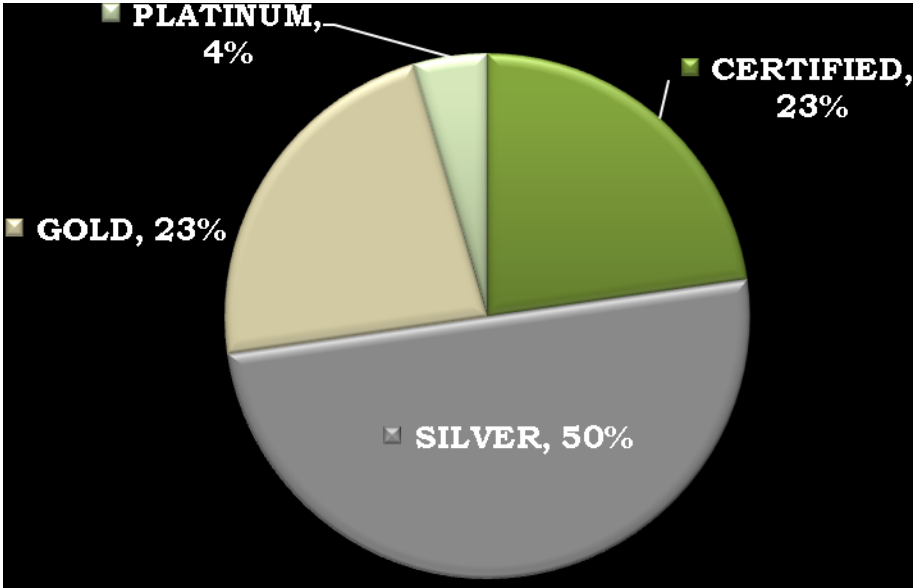


Figure 2: Percentage of Level of Certification of Buildings Used in Urban Design Model



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

<< PROJECT NAME >>
 << CITY, STATE >>

Yes ? No

Sustainable Sites 14 Points

Y	Prereq 1	Construction Activity Pollution Prevention	Required
	Credit 1	Site Selection	1
	Credit 2	Development Density & Community Connectivity	1
	Credit 3	Brownfield Redevelopment	1
	Credit 4.1	Alternative Transportation, Public Transportation Access	1
	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
	Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
	Credit 4.4	Alternative Transportation, Parking Capacity	1
	Credit 5.1	Site Development, Protect or Restore Habitat	1
	Credit 5.2	Site Development, Maximize Open Space	1
	Credit 6.1	Stormwater Design, Quantity Control	1
	Credit 6.2	Stormwater Design, Quality Control	1
	Credit 7.1	Heat Island Effect, Non-Roof	1
	Credit 7.2	Heat Island Effect, Roof	1
	Credit 8	Light Pollution Reduction	1

Yes ? No

Water Efficiency 5 Points

	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
	Credit 2	Innovative Wastewater Technologies	1
	Credit 3.1	Water Use Reduction, 20% Reduction	1
	Credit 3.2	Water Use Reduction, 30% Reduction	1

Yes ? No

Energy & Atmosphere 17 Points

Y	Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2	Minimum Energy Performance	Required
Y	Prereq 3	Fundamental Refrigerant Management	Required
	Credit 1	Optimize Energy Performance	1 to 10
	Credit 2	On-Site Renewable Energy	1 to 3
	Credit 3	Enhanced Commissioning	1
	Credit 4	Enhanced Refrigerant Management	1
	Credit 5	Measurement & Verification	1
	Credit 6	Green Power	1

Figure 3.1: Registered Project Checklist

Yes ? No

Materials & Resources 13 Points

Y	Prereq 1	Storage & Collection of Recyclables	Required
	Credit 1.1	Building Reuse , Maintain 75% of Existing Walls, Floors & Roof	1
	Credit 1.2	Building Reuse , Maintain 100% of Existing Walls, Floors & Roof	1
	Credit 1.3	Building Reuse , Maintain 50% of Interior Non-Structural Elements	1
	Credit 2.1	Construction Waste Management , Divert 50% from Disposal	1
	Credit 2.2	Construction Waste Management , Divert 75% from Disposal	1
	Credit 3.1	Materials Reuse , 5%	1
	Credit 3.2	Materials Reuse , 10%	1
	Credit 4.1	Recycled Content , 10% (post-consumer + ½ pre-consumer)	1
	Credit 4.2	Recycled Content , 20% (post-consumer + ½ pre-consumer)	1
	Credit 5.1	Regional Materials , 10% Extracted, Processed & Manufactured Regionally	1
	Credit 5.2	Regional Materials , 20% Extracted, Processed & Manufactured Regionally	1
	Credit 6	Rapidly Renewable Materials	1
	Credit 7	Certified Wood	1

Yes ? No

Indoor Environmental Quality 15 Points

Y	Prereq 1	Minimum IAQ Performance	Required
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
	Credit 1	Outdoor Air Delivery Monitoring	1
	Credit 2	Increased Ventilation	1
	Credit 3.1	Construction IAQ Management Plan , During Construction	1
	Credit 3.2	Construction IAQ Management Plan , Before Occupancy	1
	Credit 4.1	Low-Emitting Materials , Adhesives & Sealants	1
	Credit 4.2	Low-Emitting Materials , Paints & Coatings	1
	Credit 4.3	Low-Emitting Materials , Carpet Systems	1
	Credit 4.4	Low-Emitting Materials , Composite Wood & Agrifiber Products	1
	Credit 5	Indoor Chemical & Pollutant Source Control	1
	Credit 6.1	Controllability of Systems , Lighting	1
	Credit 6.2	Controllability of Systems , Thermal Comfort	1
	Credit 7.1	Thermal Comfort , Design	1
	Credit 7.2	Thermal Comfort , Verification	1
	Credit 8.1	Daylight & Views , Daylight 75% of Spaces	1
	Credit 8.2	Daylight & Views , Views for 90% of Spaces	1

Yes ? No

Innovation & Design Process 5 Points

	Credit 1.1	Innovation in Design : Provide Specific Title	1
	Credit 1.2	Innovation in Design : Provide Specific Title	1
	Credit 1.3	Innovation in Design : Provide Specific Title	1
	Credit 1.4	Innovation in Design : Provide Specific Title	1
	Credit 2	LEED® Accredited Professional	1

Yes ? No

Project Totals (pre-certification estimates) 69 Points

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

Figure 3.2: Registered Project Checklist

#	Sustainable Sites	Water Efficiency	Energy and Atmosphere	Materials and Resources	Indoor Environmental Quality	Innovation and Design	Total LEED Points
1	7	2	14	7	10	2	42
2	12	3	8	6	4	1	34
3	10	2	8	4	8	2	34
4	4	3	5	6	9	2	29
5	6	5	9	8	9	3	40
6	10	3	11	6	10	1	41
7	6	2	9	6	8	2	33
8	6	3	11	9	6	3	38
9	6	1	7	6	11	3	34
10	6	4	4	8	6	2	30
11	7	3	10	6	10	3	39
12	7	3	7	7	11	2	37
13	10	5	14	11	11	4	55
14	9	3	4	5	9	3	33
15	8	2	8	8	12	2	40
16	9	4	4	6	9	2	34
17	10	3	6	8	11	3	41
18	7	2	6	8	6	2	31
19	11	2	2	8	6	2	31
20	7	2	11	6	4	2	32
21	9	3	6	6	11	3	38
22	9	2	7	8	12	3	41
Category Average							37
	8	3	8	7	9	2	

Figure 4a: Totals for Each Project in 6 Categories

Design Model

Green Urban Design Model		
Sustainable Sites		8 / 14 Points
Prereq 1	Construction Activity Pollution Prevention	Required
Credit 1	Site Selection	1
Credit 2	Development Density & Community Connectivity	1
Credit 4.1	Alternative Transportation , Public Transportation Access	1
Credit 4.2	Alternative Transportation , Bicycle Storage & Changing Rooms	1
Credit 4.4	Alternative Transportation , Parking Capacity	1
Credit 5.1	Site Development , Protect or Restore Habitat	1
Credit 6.1	Stormwater Design , Quantity Control	1
Credit 6.2	Stormwater Design , Quality Control	1
Water Efficiency		3 / 5 Points
Credit 1.1	Water Efficient Landscaping , Reduce by 50%	1
Credit 1.2	Water Efficient Landscaping , No Potable Use or No Irrigation	1
Credit 3.1	Water Use Reduction , 20% Reduction	1
Energy & Atmosphere		8 / 17 Points
Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
Prereq 2	Minimum Energy Performance	Required
Prereq 3	Fundamental Refrigerant Management	Required
Credit 1	Optimize Energy Performance	5
Credit 2	On-Site Renewable Energy	1
Credit 5	Measurement & Verification	1
Credit 6	Green Power	1
Materials & Resources		7 / 13 Points
Prereq 1	Storage & Collection of Recyclables	Required
Credit 2.1	Construction Waste Management , Divert 50% from Disposal	1
Credit 3.1	Materials Reuse , 5%	1
Credit 3.2	Materials Reuse , 10%	1
Credit 4.1	Recycled Content , 10% (post-consumer + ½ pre-consumer)	1
Credit 5.1	Regional Materials , 10% Extracted, Processed & Manufactured Regionally	1
Credit 5.2	Regional Materials , 20% Extracted, Processed & Manufactured Regionally	1
Credit 6	Rapidly Renewable Materials	1
Indoor Environmental Quality		9 / 15 Points
Prereq 1	Minimum IAQ Performance	Required
Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
Credit 1	Outdoor Air Delivery Monitoring	1
Credit 4.1	Low-Emitting Materials , Adhesives & Sealants	1
Credit 4.2	Low-Emitting Materials , Paints & Coatings	1
Credit 6.1	Controllability of Systems , Lighting	1
Credit 6.2	Controllability of Systems , Thermal Comfort	1
Credit 7.1	Thermal Comfort , Design	1
Credit 7.2	Thermal Comfort , Verification	1
Credit 8.1	Daylight & Views , Daylight 75% of Spaces	1
Credit 8.2	Daylight & Views , Views for 90% of Spaces	1
Innovation & Design Process		2 / 5 Points
Credit 1.1	Innovation in Design : Provide Specific Title	1
Credit 2	LEED® Accredited Professional	1
Project Totals (pre-certification estimates)		37 / 69 Points

After compiling each building projects LEED Criteria check sheets, trends were found showing the most often used design or construction aspect of each category of sustainable sites, water efficiency, energy & atmosphere, materials & resources, indoor environmental quality and innovation and design process. The following are examples of each criteria that the design model uses [2].

SS	Credit 1	Create erosion and sediment control plan during design phase of project
	Credit 2	Give pedestrians access to a variety of services
	Credit 4.1	Project site within 1/4 mile of bus/transit stop
	Credit 4.2	Add bicycle racks, shower and locker rooms
	Credit 4.4	Provide preferred parking for carpools, share parking lot space with other facilities
	Credit 5.1	Maintain same area of greenfield as before construction by adding grasses and plants
	Credit 6.1	Use vegetative roofs or pervious paving to minimize impervious surfaces
	Credit 6.2	Employ constructed wetlands and open channels to treat stormwater runoff
WE	Credit 1.1	Use stormwater, greywater, or condensate for water irrigation
	Credit 1.2	Same as previous
	Credit 3.1	Chose fixtures to reduce water usage, i.e. toilets
EA	Credit 1	Minimum energy savings of 24.5% of baseline building performance
	Credit 2	Use solar, wind, geothermal energy to provide 2.5% of building energy use
	Credit 5	Evaluate energy efficiency by comparing actual to baseline performance
	Credit 6	Use solar, wind, geothermal, biomass, or low-impact hydro energy sources
MR	Credit 2.1	Divert 50% of construction, demolition, and land-clearing debris from disposal
	Credit 3.1	Use 10% salvaged beams, flooring, paneling, doors, etc.
	Credit 3.2	Same as previous but 20%
	Credit 4.1	Incorporate 10% recycled material into building products
	Credit 5.1	Use 10% project materials extracted from 500 mile radius
	Credit 5.2	Same as previous but 20%
	Credit 6	Use materials such as bamboo, cotton insulation, linoleum and cork
EQ	Credit 1	Install carbon dioxide and airflow measurement equipment on HVAC system
	Credit 4.1	Reduce quantities of indoor air contaminants with these materials
	Credit 4.2	Reduce quantities of indoor air contaminants with these materials
	Credit 6.1	Provide individual lighting controls for 90% of building occupants
	Credit 6.2	Provide individual comfort controls for 50% of buildings occupants
	Credit 7.1	Evaluate air temperature, radiant temperature, air speed, humidity for comfort
	Credit 7.2	Supply assessment for previous
	Credit 8.1	Provide daylight to 75% of regularly occupied spaces
	Credit 8.2	Provide daylighted views to 90% of regularly occupied spaces
ID	Credit 1.1	Go beyond minimum requirements for a certain credit
	Credit 2	Hire a LEED Accredited Professional

Conclusions

The Green Urban Design Model shows trends in green design that are being recognized by the U. S. Green Building Council's LEED Rating System for New Construction. It also shows those trends that are significant to Harrisburg University's Academic Center's relative size, urban location, intended use, among other factors. Many design models can be created, but this one shows how environmentally friendly design can be considered into higher education and office buildings in the major cities in the United States.

To have a building project registered as LEED Certified, many man hours go into submitting documentation about the design and construction process as well as additional calculations to provide evidence that a certain criteria has been met. If the Harrisburg University of Science and Technology incorporated the registration process at the beginning of the project conception phase in August 2005, the doors of the University would not have opened for another semester due to vigorous performance checks and document submittals. Please reference Appendix for beginning of construction schedule. Many buildings have been denied registration because of improper documentation.

In summary, the Green Urban Design Model represents a skyscrapers capacity to become environmentally friendly. The use of it is during daylit hours, when most are at work or in a classroom setting. The model building's location lends itself to automatically qualifying for LEED points in Sustainable Site while other factors to be discussed in this report show how designers can lean towards a greener approach. In the following sections about daylighting and feasibility of a green roof, the Harrisburg University of Science and Technology's Academic Center has potential to meet over a quarter of the LEED points for regular certification. The points are sustainable site 6.1-2 and 7.2; water efficiency 1.1; energy and atmosphere 1; materials and resources 4.1 and 5.1; indoor environmental quality 8.1-2; and innovation and design 1.1 and 2. Multiple points can be earned if the design meets criteria exceeding requirements.

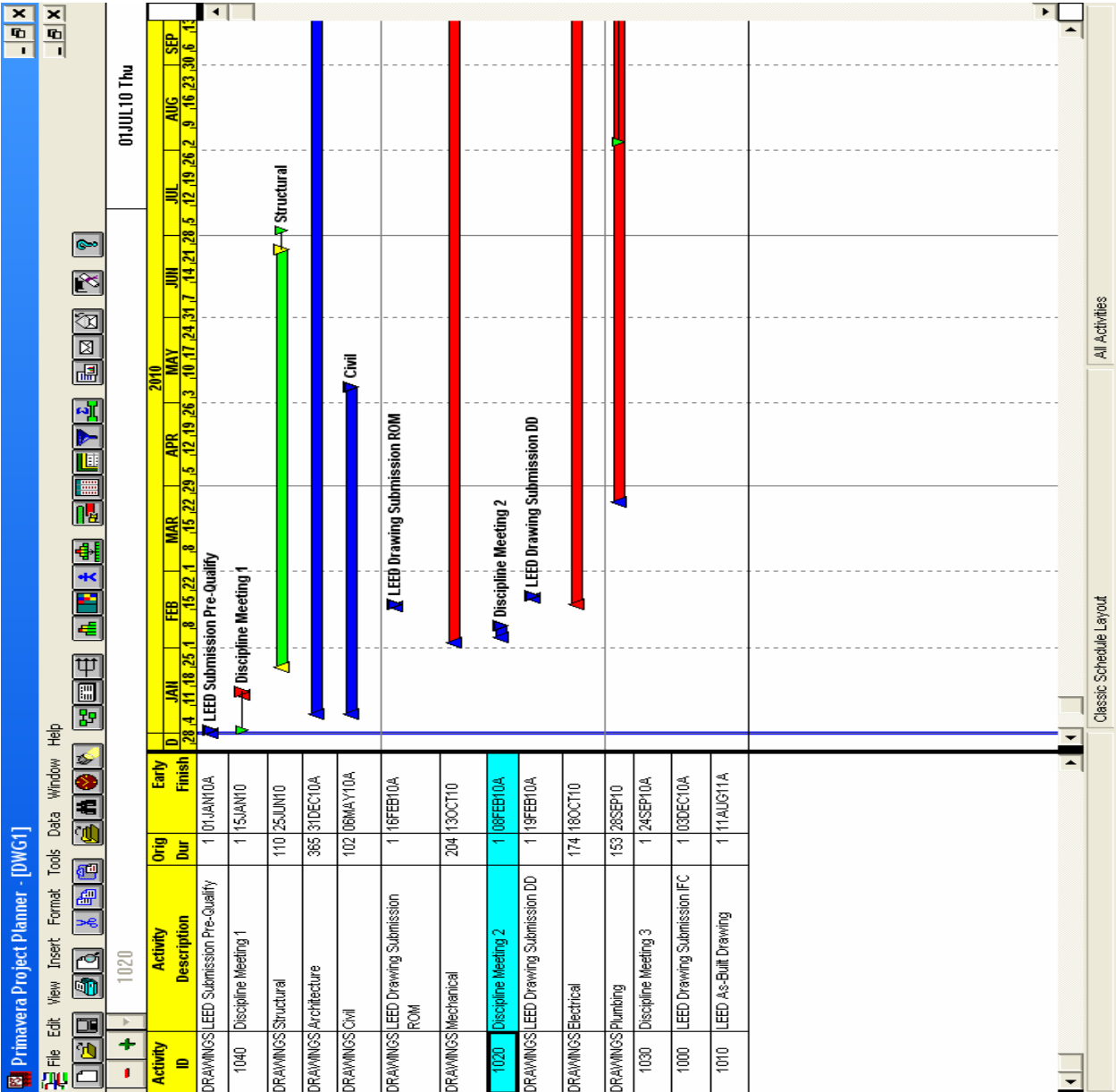


Figure 4b: Example of Basic Drawing Schedule with LEED Submissions

Daylighting a Typical Interior Space

Analysis I: Daylighting a Typical Interior Space

Daylighting a Space

Daylighting is the controlled admission of natural light into a space through glazing with the intent of reducing or eliminating electric lighting. By utilizing solar light, daylighting creates a stimulating and productive environment for building occupants (See Appendix). With the reduction of electric lighting is the decreased energy use. A well-designed daylit building is estimated to reduce lighting energy use by 50% to 80% [34]. This conserves natural resources and reduces air pollution and impacts due to energy production and consumption. Daylighting design involves a careful balance of heat gain and loss, glare control, visual quality and variations in daylight availability. Shading devices, light shelves, courtyards, atriums and window glazing are all strategies employed in daylighting design. Important considerations include the selected building’s orientation, window size and spacing, glass selection, reflectance of interior finishes and locations of interior walls. Daylit spaces also increase occupant productivity and reduce absenteeism and illness [17].

Daylighting Analysis

Through straightforward calculations by a LEED AP, designing a space for daylighting criteria based off of the LEED EQ point 8.1, daylighting for 75% of the spaces with a glazing factor of 2%. In certified projects, strategies have included building orientation, shallow floor plates, increased building perimeter, exterior and interior permanent shading devices, high performance glazing and automatic photocell-based controls [15]. See Figure 5 for glazing factor calculation.

Compliance for the EQ 8.1 Credit may be determined by either the glazing factor calculation methodology or daylighting simulation software to determine point-by-point illumination levels. Daylighting models are performed by lighting designers or electrical engineers using programs developed for use while the design of the building project is underway [30]. The remaining portion of the analysis will follow the Glazing Factor methodology.

$$\text{Glazing Factor} = \frac{\text{Window Area [SF]}}{\text{Floor Area [SF]}} \times \text{Window Geometry Factor} \times \frac{\text{Actual } T_{vis}}{\text{Minimum } T_{vis}} \times \text{Window Height Factor}$$

Figure 5: Glazing Factor Equation Used in Calculations

Areas of the building under consideration for daylighting calculations are all regularly occupied spaces such as office spaces, meeting areas, and cafeterias. For analysis for the Harrisburg University Academic Center, the twelfth floor will be studied. Rooms that will have sample

calculations are located on the East side, Southeast corner, and center part of the floor. Areas that are not generally taken into consideration are support areas for copying, storage, mechanical equipment, laundry and restrooms.

The Glazing Factor calculation method is designed to identify daylighting conditions based on room and window geometry and visible transmittance based on meeting the performance criteria for overcast sky conditions. Currently this calculation method doesn't take into account light shelves, partitions, significant exterior obstructions or exterior reflective surfaces [27]. The following is a summary of the Glazing Factor method outlined in the LEED Version 2.2 Reference Guide. It will be implemented for daylighting analysis of the Harrisburg University Academic Center of rooms 1201, 1205, 1206, 1210, 1212, and 1219, all currently devoted to office spaces on the latest construction documents (Figure 6).

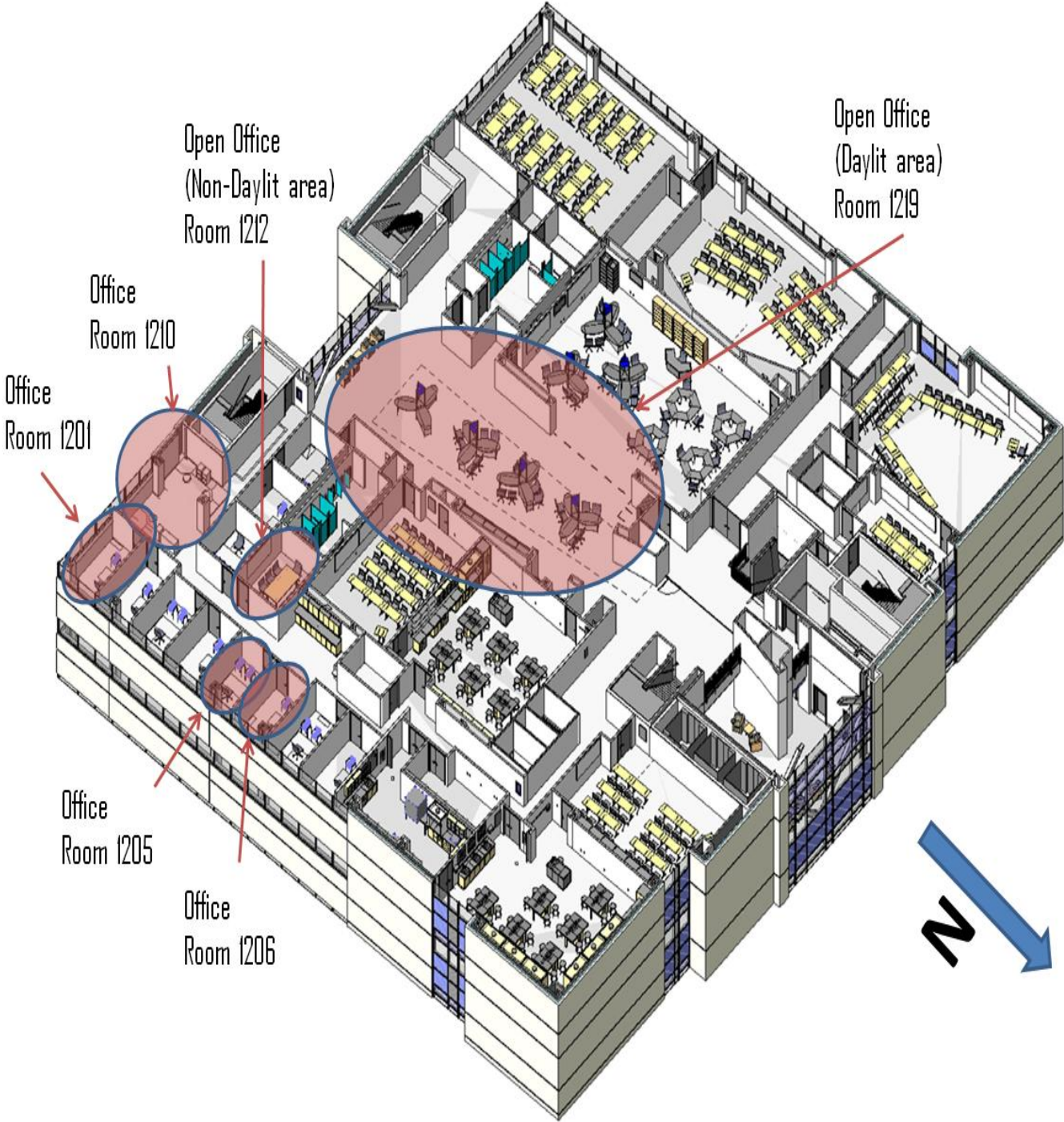


Figure 6: 12th Floor Axonometric Plan Showing Rooms in Calculation

Procedure for Glazing Factor Method

1. Create a spreadsheet and identify all regularly occupied rooms/areas. Determine the floor area of each applicable room using construction documents.
2. For each room/area identified, calculate the window area and indicate the acceptable window types, noting that window areas above 7'-6" are considered to be daylight glazing. Glazing at this height is the most effective at distributing daylight deep into the interior space. Window areas from 2'-6" to 7'-6" are considered to be vision glazing. These window areas are primarily used for viewing and lighting interior spaces close to the building perimeter. Window areas below 2'-6" do not contribute to daylighting of interior spaces and are to be excluded from the calculations.
3. For each window type, insert the appropriate geometry and height factors (Figure 7). The geometry factor indicates the effectiveness of a particular aperture to distribute daylight relative to window location. The height factor accounts for where light is introduced to the space.
4. For each window type, indicate the visible transmittance (T_{vis}), a variable number that differs for each product. Minimum T_{vis} is the recommended level of transmittance for selected glazing.
5. Calculate the Glazing Factor for each window type using the GF equation. For rooms/areas with more than one window type, sum all window types to obtain a total Glazing Factor for the room/area.
6. If the total Glazing Factor for a room/area is 2% or greater, then the square footage of the room/area is applicable to the credit.
7. Sum the square footage of all applicable rooms/areas and divide by the total square footage of all regularly occupied spaces. If this percentage is equal to or greater than 75%, then the project qualifies for this point [30].

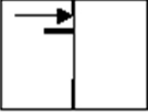
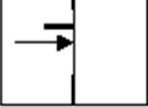
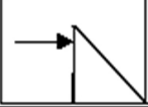

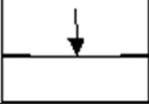
Window Type		Geometry Factor	Minimum T_{vis}	Height Factor	Best Practice Glare Control Methods
Sidelight, daylight glazing		0.1	0.7	1.4	Adjustable blinds Interior light shelves Fixed translucent exterior shading devices
Sidelight, vision glazing		0.1	0.4	0.8	Adjustable blinds Exterior shading devices
Top lighting, vertical monitor		0.2	0.4	1.0	Adjustable exterior blinds
Top lighting, saw tooth monitor		0.33	0.4	1.0	Exterior louvers
Top lighting, horizontal skylights		0.5	0.4	1.0	Interior fins Exterior fins Louvers

Figure 7: Daylighting Design Criteria [30]

Results

Using the GF procedure and actual T_{vis} of 0.5 from the design specs book, the twelfth floor of the Harrisburg University Academic Center was analyzed and the percentage of regularly occupied spaces with a 2% glazing factor meet the minimum of 75% of the spaces. Due to the excessive percentage of 95%, the daylighting of the space may meet design and performance criteria to meet another credit that will be discussed in a following section. Please reference the Appendix for the glazing factor tabulation and Figure 8 for the tabulation totals.

Total Regularly Occupied Space Area (SF)	Total Regularly Occupied Space Area with a Minimum 2% Glazing Factor	Percentage of Regularly Occupied Space with a 2% Glazing Factor
4,104	3,889	95%

Figure 8a: Glazing Factor Tabulation Totals



Figure 8b: View from Walkway Looking Onto 12th Floor

Conclusions

As noted in the Glazing Factor method analysis, the example rooms on the twelfth floor of the Harrisburg University Academic Center meet the design criteria to obtain a rating point within the LEED EQ 8.1 section. This credit may be eligible for exemplary performance under the Innovation & Design section because the project example achieves 95% daylighting based on the requirements and guidelines of this credit [2]. For this credit, it is necessary to document in writing and in calculations during the design submittal process during pre-construction phases of the project.

Specialized glazing can increase initial costs for a project and can lead to excessive heat gain if not designed properly. Glazing provides less insulating effects compared to standard walls, resulting in higher energy use and requiring additional maintenance. However, offices with sufficient natural daylight have proven to increase occupant productivity and comfort. In most cases, occupant salaries significantly outweigh first costs of incorporating daylighting measures into a building design.

Studies of schools and stores have shown that daylighting can improve student performance and retail sales. Daylighting can significantly reduce artificial lighting requirements and energy costs in many commercial and industrial buildings, as well as schools, libraries and hospitals [4]. Daylighting combined with energy-efficient lighting and electronic ballasts can reduce the lighting power density in some office buildings by up to 30% [17]. In summary, where one must pay increased prices in proper heating and cooling of a space, they make up for in reduced costs for lighting and worker productivity.

Green Roof Implementation

Analysis II: Green Roof Implementation

Vegetation on a Roof

Specialized roofs with regional plants and grasses are known as green, garden, or planted roofs. They are comprised of layers that support the vegetation: root resistance, drainage, filter membrane, growing medium, and vegetation (Figure 9). This type of roof is becoming more popular with local and state governments promoting them for tax purposes. Another advantage of adding green roofs are for their ability to substantially reduce heat flux from the top of a building, preventing what is known as the heat island effect in urban environments [22]. This phenomenon is when the temperature of a city is compared to a surrounding suburban environment, the former having warmer temperatures. Higher temperatures have negative impacts on the society because of the increase in energy consumption, air pollution levels and heat-related illnesses [24]. In this way, the green roof technology has a potential to add value to a building due to its positive health and productivity impacts of the tenants and surrounding citizens of the area. Currently, the real estate market is in favor of green buildings with similar features.

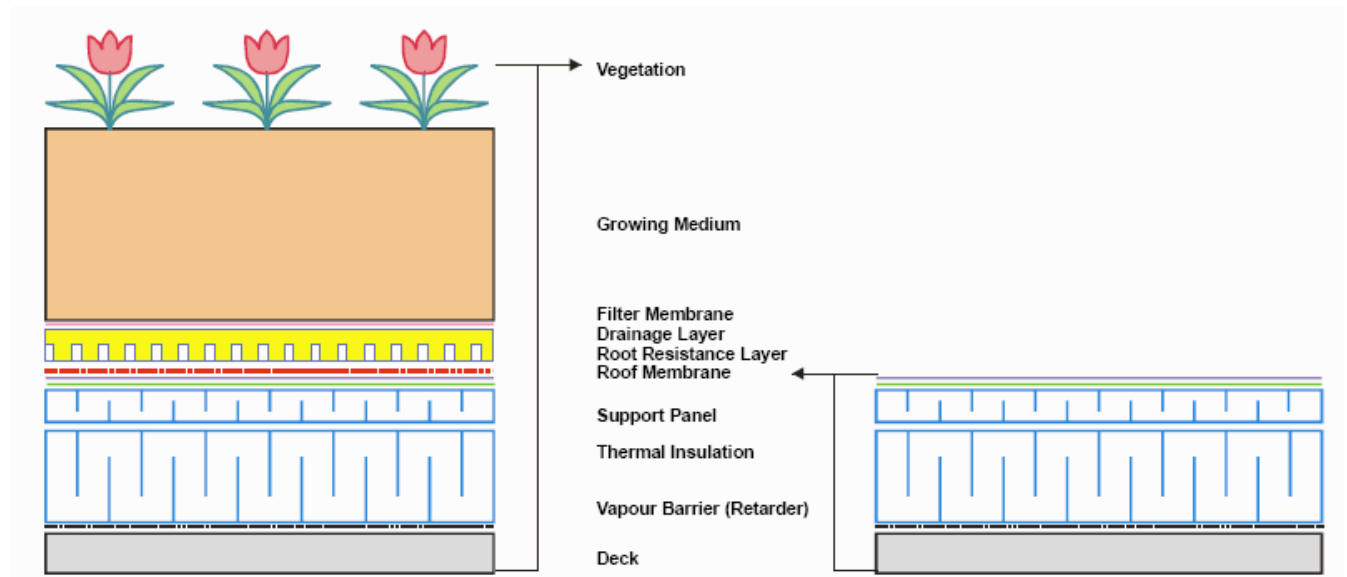


Figure 9: Principle components of a green roof system installed on a conventional roofing system [33].

Structural Analysis

The current roof design where the green roof implementation will be analyzed uses steel beams sized for the current loading conditions with a W24x76. See Figure 15 for specific beam placement, sizing and chosen beam for calculations and Figure 16 for placement of green areas. Assumptions for the analysis include uniform loading, simply supported beams with shear connections, the depths of the beams are not critical to the 16th floor which houses the mechanical equipment for the building. Conservative figures were used in the calculations which are located in the Appendix. Also used in the analysis was information from the AISC Steel Construction Manual and Vulcraft Steel Decking Catalog.

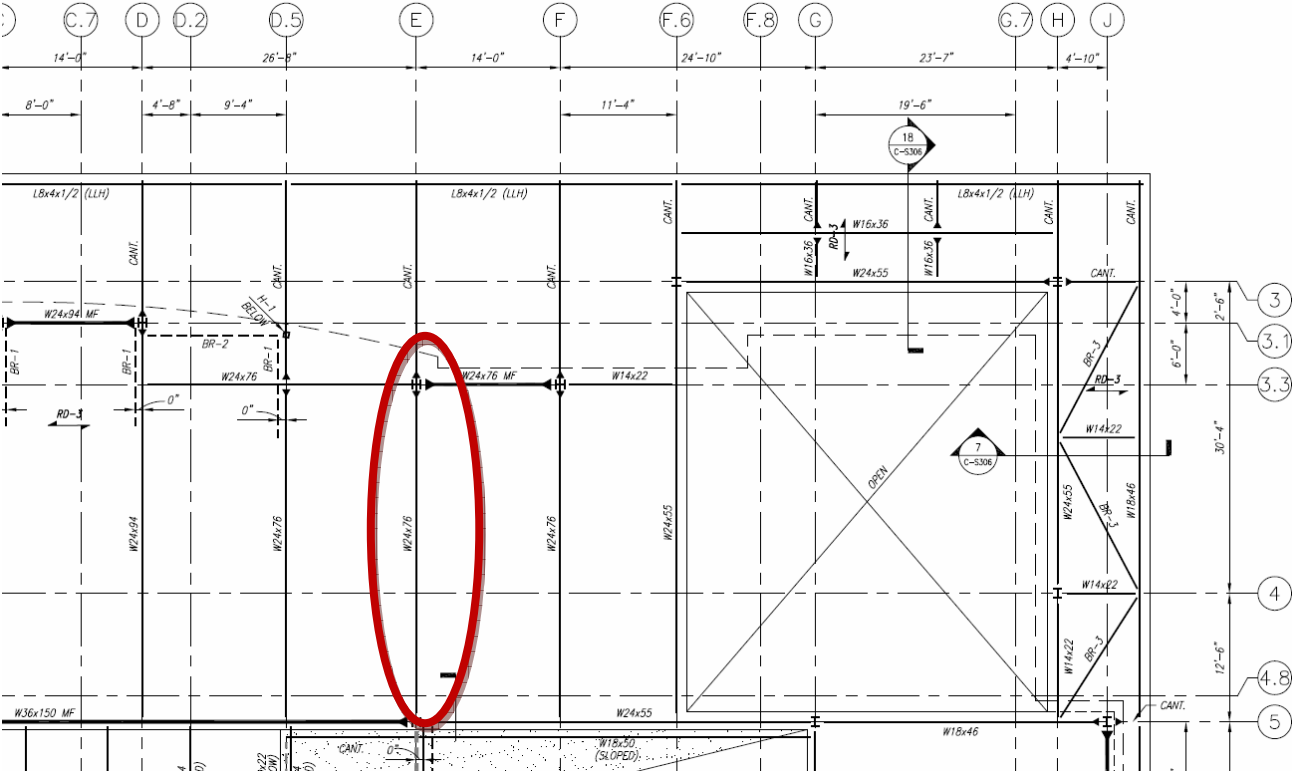


Figure 10: Beam Used in Calculations for New Loading

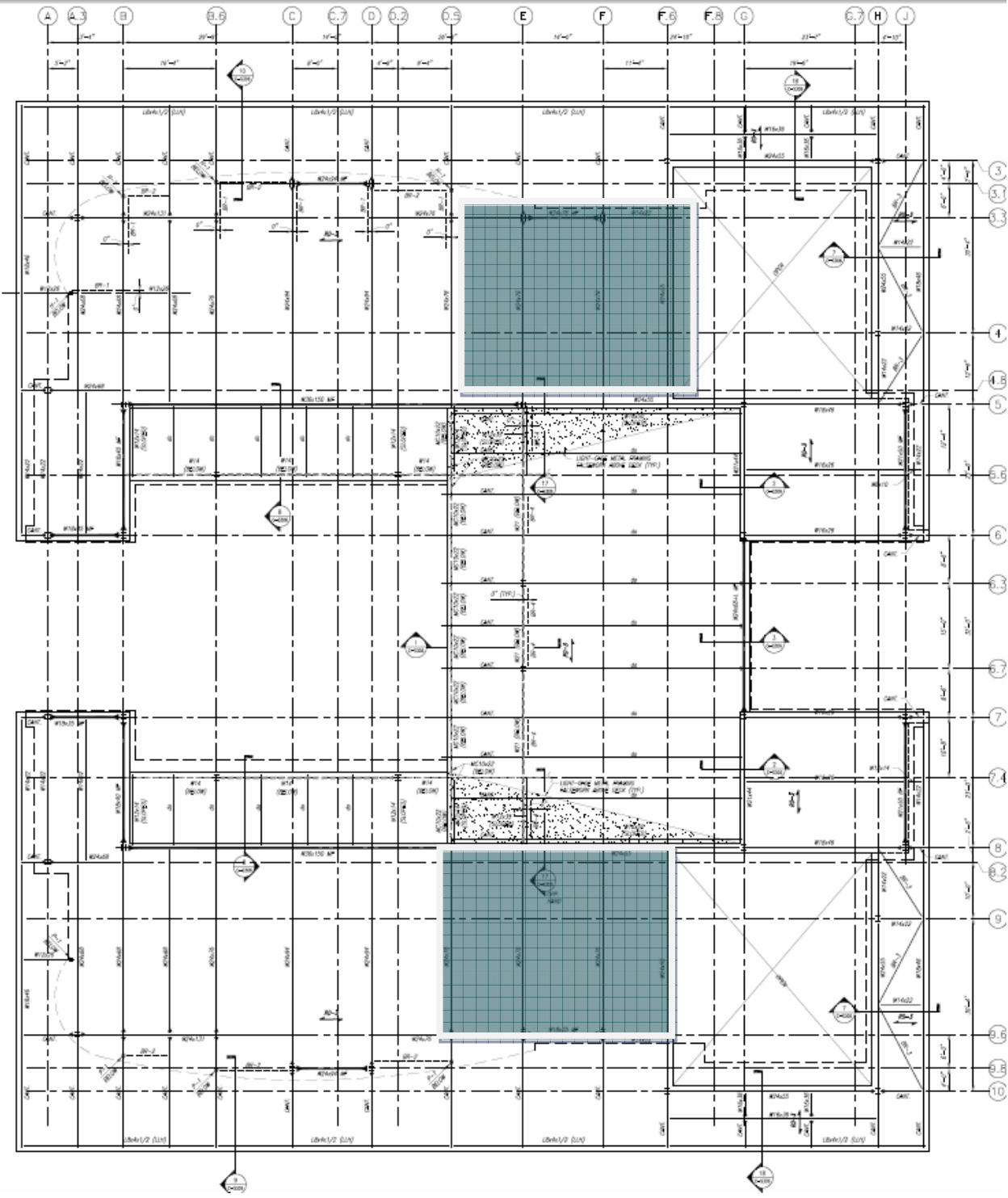


Figure 11: Areas of Green Roof Placement

The Extensive 4" GreenGrid was the green garden of choice for its design features that include relatively no maintenance, lighter weight added to structure, and ability to reduce storm water runoff. The added benefit of modular sections for easy installation and repair make it the fore-runner in the competition. In the weight of the added plants to the roof, water from rainfall was included. An added 22psf dead load was used for the GreenGrid roof, an average figure for this type of system. Please see Appendix for more about the GreenGrid system and LEED Certification.



Figure 12: Extensive Green Roof System [5].

Outcome

Through structural analysis of an added GreenGrid Extensive Assembly, it is not economically possible to add a green roof to the structure. The changes to the structure would include replacing the original 3N20 to a lower gauge 3N16 and using a heavier beam with greater moment capacity. See calculations in appendix.

Loads used: (Dead) 62psf + (Live) 55psf

Tonnage added to building: 38.3 tons

Costs added to roofing and sheet metal package: \$71,280

**The costs will usually include:*

- Consultant fees: Structural analysis, designers, landscapers, and contractors fees
- Structural analysis recommendations: Safety and repairs needed before installation of green roof.
- Irrigation system: Drip system (permanently installed) or sprinkler and drainage costs
- Garden materials: Growing medium, plants, fertilizers, substrate containers (extensive green roofs), and pavers (to prevent spread of fire and allow accessibility).
- Plants: Typically, Production costs of cultivating plants are higher in the United States than in Europe because green roof technology is relatively new in the U.S.
- Maintenance: Initial (*extensive green roofs*) and sometimes long-term (*intensive green roofs*) maintenance costs depending on the size and type of green roof installed. For example, extensive green roofs regular maintenance is only needed for 6-12 months (after plants are established) after which watering a weeding once a season is sufficient.
- Transportation of materials and services: Based on the location and types of materials (I.e. some roofing membranes need to be imported from Europe and some substrate materials come from concrete manufacturing companies far away) needed.
- Professional assistance and permits: The zoning and building codes are different in every city [23b].

Green Roof Costs: An Example of the Typical Extensive Green Roof

#	Component	Costs	Cost Factors
1	Design & Specifications	5 - 10 % (of total roofing cost)	The size/complexity of the project and the number/type of consultants needed.
2	Project Administration & Site Review	2.5 - 5 % of total roofing cost	The size/complexity of the project and the number/type of consultants needed.
3	Re-roofing with root-repelling membrane	\$ 10.00 - \$15.00 / ft ²	The type of existing roof, type of new roof system, and roof accessibility.
4	Green Roof System (drainage, filtering, paving, growing medium)	\$ 5.00 - \$10.00 / ft ²	Growing medium (type and depth), pavers (size and type), and square footage of the green roof (project size).
5	Plants	\$ 1.00 - \$3.00 / ft ²	Season of installation, type of plants, and size of seeds being planted.
6	Installation and Labor	\$ 3.00 - \$8.00 / ft ²	Equipment necessary to move materials on to the roof (E.g. crane, if rented is: \$ 4,000.00 /day), project size, design, and planting methods.
7	Maintenance	\$ 1.25 - \$2.00 / ft ² (only for the first two years)	Project size, installation schedule, irrigation system, and plants (type and size) used.
8	Irrigation System	\$ 2.00 - \$4.00 / ft ²	Since extensive roofs require little irrigation (E.g. sprinkler system or drip system), this component is optional.

Conclusions

With the new loads of added weight to the structure, the current beam system in place could not with stand the green roof structure. With a closer look at other factors affecting implementation of the green roof, it would not be economical either. Figure 13a shows energy calculations for the current roof. Data was taken from the drawing specs. With the 3,500 square feet of added of green space, the average R-value of the roof increased from 17 to 18.7. The GreenGrid Extensive Assembly would save \$0.02/SF per year to both heat and cool the structure. Figure 13b depicts a cost vs. savings calculation over 36 years after the roof has been in place. Notice that the cost of the green roof with maintenance (red line) is increasing at a more rapid pace than the annual energy savings (blue line). At this rate, it would not be possible to payback the initial cost of the green roof and maintain it for years to come.

My Proposed Roof:

R-value (HIGH=20; AVG=10; LOW=5) [h·ft²·°F/Btu]

Solar reflectance, SR (HIGH=80; AVG=50; LOW=10) [%]

Infrared emittance, IE (HIGH=90; AVG=60; LOW=10) [%]

My Energy Costs and Equipment Efficiencies:

Summertime cost of electricity (HIGH=0.20; AVG=0.10; LOW=0.05) [\$/kWh]

Air conditioner efficiency (COP) over cooling season (HIGH=2.5; AVG=2.0; LOW=1.5)

Energy source for heating (choose one) Electricity Fuel

If electricity, wintertime cost (HIGH=0.20; AVG=0.10; LOW=0.05) [\$/kWh]

If fuel, cost (Natural gas: HIGH=1.00; AVG=0.70; LOW=0.50) [\$/Therm]

(Fuel oil: 2002 East coast=0.85; 2002 Midwest=0.70) [\$/Therm]

Heating system efficiency (Furnace or boiler: HIGH=0.8; AVG=0.7; LOW=0.5)

(Electric heat pump: HIGH=2.0; AVG=1.5) (Electric resistance: 1.0)

My Electricity Demand Charges and Duration:

Demand charge during cooling season (HIGH=15.00; AVG=10.00; LOW=5.00) [\$/kW]

Months charged for peak demand (Typical = 6) [-]

Total Annual Energy + Demand Savings (relative to a black roof) [\$/ft² per year]

Cooling energy savings [\$/ft² per year]

Heating energy savings (heating penalty if negative) [\$/ft² per year]

Cooling season demand savings [\$/ft² per year]

Insulation in Black Roof for Same Total Annual Energy Savings
 (ignores demand savings):
 Upgrade from R- to R- [h·ft²·°F/Btu]

Details of Energy and Demand Savings:

Heating degree days for location chosen [Annual °F-day]

Cooling degree days for location chosen [Annual °F-day]

Solar load for location chosen [Annual average Btu/ft² per day]

Cooling load for black roof (SR=5%; IE=90%) [Btu/ft² per year]

Heating load for black roof (SR=5%; IE=90%) [Btu/ft² per year]

Cooling load for proposed roof [Btu/ft² per year]

Heating load for proposed roof [Btu/ft² per year]

Average heat load reduction during cooling season [Btu/ft² each month]

Maximum heat load reduction during cooling season [Btu/ft²]

Figure 13a: Department of Energy Cool Roof Calculator

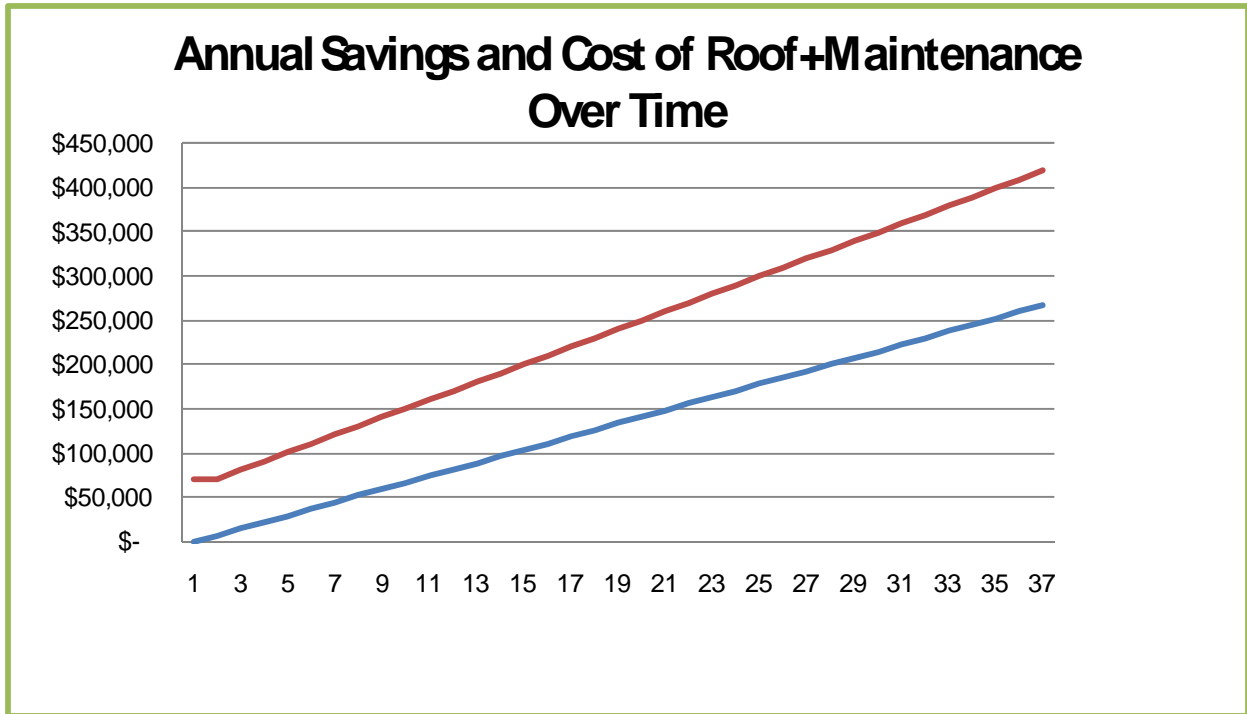


Figure 13b: Annual Energy Savings vs. Roof Cost+Maintenance Over 36 Years. (Red depicts initial green roof and maintenance while blue shows energy savings each year.)

As per the project schedule and the time it takes to install a green roof structure as proposed, it would not affect the current completion date. When the building is fully enclosed and roof structure complete, a crew can place the green space while other activities are occurring for the project fit-out. Replacement activities are as follows: instead of EPDM roofing on 06Mar-12Mar, laying deck, vapor barrier, thermal insulation, support panels, and roof membrane; during the final cleaning scheduled currently for 12Jun-18Jun, now activities placing root resistance layer, drainage layer, filter membrane, growing medium and vegetation will take place. Please reference Figure 14a. This would allow for the crew to work simultaneously while other activities take place. Please reference project schedule in Appendix as well. The material/man-lift's limited use and time needed to place all materials involved in setting of the modular GreenGrid System would be feasible. At this time in the project's schedule, the tower crane will not be in place (refer to Figure 14b). Re-erection of the tower crane or having it idle on site would be too costly for the project. Due to limited storage space of the site and the capacity for the beams located on the roof to their maximum, having the soils, plants, etc. for the roof on site prior to their installation would also not be recommended. Therefore, adding a green roof structure as proposed would be the best choice for the Harrisburg University Academic Center, however, cost savings and economics of building design prevent this from being the recommended choice.

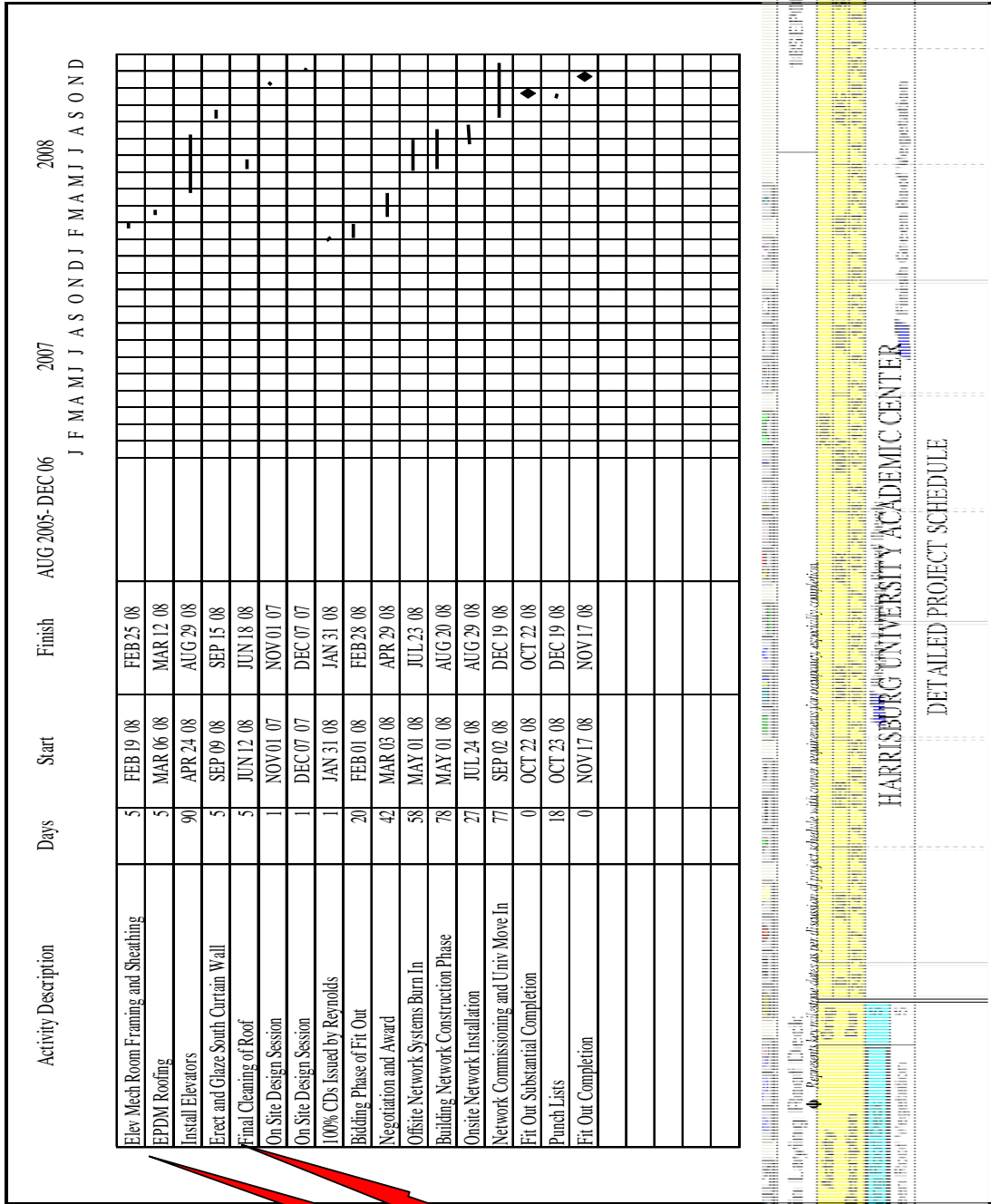


Figure 14a: Roof Activities Replacement Schedule

DESCRIPTION	DAYS	START	FINISH	FLOAT	2007			2008			2009														
					JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC			
FD024 Switchgear	60	AUG 15 07	NOV 07 07	3d																					
FD026 Emergency Generator	75	AUG 15 07	DEC 03 07	0																					
FD022 Elevators	130	AUG 15 07	FEB 20 08	24d																					
FD028 Wood Veneer Wall Covering	60	APR 10 08	JUL 03 08	45d																					
FD029 Wood Casework	60	APR 10 08	JUL 03 08	22d																					
SITE WORK																									
SW005 Demo Storm Sewer Piping at 4th Street	1	JUL 25 07	JUL 25 07	181d																					
SW022 Install Oil/Water Separator	5	AUG 22 07	AUG 28 07	5d																					
SW053 Site Fire Line	1	AUG 29 07	AUG 29 07	83d																					
SW054 Site Domestic Water	1	AUG 29 07	AUG 29 07	21d																					
SW018 Install 15" Storm Water Line UG to 4th St Sewer	5	AUG 29 07	SEP 05 07	157d																					
SW023 Emergency Generator Pad and Underground	5	AUG 29 07	SEP 05 07	44d																					
SW025 Install 15" Sanitary Line to Market Street Sewer	5	AUG 29 07	SEP 05 07	5d																					
SW017 Install Gas Supply Underground	1	SEP 06 07	SEP 06 07	5d																					
SW019 Install 8" CWS/CWR	5	SEP 07 07	SEP 13 07	5d																					
SW020 Install CATV Underground	2	SEP 12 07	SEP 13 07	5d																					
SW021 Install Telephone Underground	2	SEP 13 07	SEP 14 07	5d																					
SW024 Install Emergency Generator	2	SEP 13 07	SEP 14 07	44d																					
TOWER CRANE AND MAN/MATERIAL LIFT																									
SW051 Tower Crane in Place	178*	JUN 11 07 A	FEB 24 08	0																					
SW014 Install North 4th Street PPL Vault	5	JUL 25 07	JUL 31 07	68d																					
SW043 Excavate for Man/Material Lift Foundation	1	AUG 08 07	AUG 08 07	52d																					
SW044 Form Man/Material Lift Foundation	1	AUG 09 07	AUG 09 07	52d																					
SW045 Rebar Man/Material Lift Foundation	1	AUG 10 07	AUG 10 07	52d																					
SW046 Set Man/Material Lift Base	1	AUG 13 07	AUG 13 07	52d																					
SW047 Pour Man/Material Lift Base	1	AUG 14 07	AUG 14 07	52d																					
SW048 Cure Man/Material Lift Foundation Concrete	15	AUG 15 07	AUG 29 07	74d																					
SW052 Erect Man/Material Lift	3	SEP 12 07	SEP 14 07	43d																					
SW050 Man/Material Lift in Place	251*	SEP 12 07	SEP 08 08	-1d																					
SW012 Finish Erecting Material/Man Lift	2	DEC 28 07	DEC 31 07	253d																					
SW008 Pull Tower Crane	2	FEB 23 08	FEB 24 08	0*																					
SW013 Build Infill at Crane Bay	15	FEB 25 08	MAR 14 08	25d																					

Figure 14b: Detailed Schedule for Site Work- Tower Crane and Man/Material Lift

Closing Remarks

For future building projects that the Harrisburg University of Science and Technology may wish to endeavor upon, green design is a step in the right direction. With the setting of the University in an urban environment, it is easy to meet most requirements of each of the LEED Criteria points. For instance, a project is awarded points for being in close proximity to many services for its occupants, such as restaurants, grocery stores, pharmacies, banks, and post offices [2]. Having public transportation systems already within the city adds to the benefits of the urban setting. Specifically for the University, it gives faculty and students different modes of transportation options; taking the city bus reduces CO₂ pollutance [5]. This criteria falls under Sustainable Site Credit 2 for development density and community connectivity.

If the best interest of the students is in mind, having a productive place to grow, learn, and work would only benefit the University. Providing for the building's occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas will add to the sense of well-being and let minds develop and flourish. Occupant well-being can be improved by providing views to the exterior and by providing daylighting, in this case, students and faculty of the University. The joint efforts of the owner, building design team, contractors, subcontractors and suppliers are integral to providing a quality indoor environment [34].

The cost savings for the vegetative roof when the price of natural gas and electricity are on a steady increase adds value to the building. If the idea for the new roof design came in the design phase of the project, the implementation would have been easy. Scheduling the installation of the extensive assembly system would have taken roughly 2 days if using the modular system in the analysis. Due to the current construction conditions and limited energy savings, implementation of the green roof would not be recommended unless the owner or developer would have other reasons for its addition.

The green design field is growing and changing daily. New technologies and products are coming into the marketplace and innovative designs are proving their effectiveness. This summary report is preceded by a year of analysis and research into the pre-construction and construction phases of the Harrisburg University Academic Center. The calculations provided generate an example of LEED criteria points that could be obtained due to the nature of the existing design.

Appendix



LEED-NC Version 2.2 Registered Project Checklist
 OUC Administration Building
 Orlando, FL

Yes		
7	Sustainable Sites	14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
1	Credit 1 Site Selection	1
1	Credit 2 Development Density & Community Connectivity	1
1	Credit 3 Brownfield Redevelopment	1
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation, Parking Capacity	1
1	Credit 5.1 Site Development, Protect or Restore Habitat	1
1	Credit 5.2 Site Development, Maximize Open Space	1
1	Credit 6.1 Stormwater Design, Quantity Control	1
1	Credit 6.2 Stormwater Design, Quality Control	1
1	Credit 7.1 Heat Island Effect, Non-Roof	1
1	Credit 7.2 Heat Island Effect, Roof	1
1	Credit 8 Light Pollution Reduction	1
Yes		
2	Water Efficiency	5 Points
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction, 20% Reduction	1
1	Credit 3.2 Water Use Reduction, 30% Reduction	1
Yes		
14	Energy & Atmosphere	17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
8	Credit 1 Optimize Energy Performance	1 to 10
3	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
1	Credit 5 Measurement & Verification	1
1	Credit 6 Green Power	1
Yes		
7	Materials & Resources	13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse, 5%	1
1	Credit 3.2 Materials Reuse, 10%	1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1
1	Credit 6 Rapidly Renewable Materials	1
1	Credit 7 Certified Wood	1
Yes		
10	Indoor Environmental Quality	15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
1	Credit 1 Outdoor Air Delivery Monitoring	1
1	Credit 2 Increased Ventilation	1
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5 Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1 Controllability of Systems, Lighting	1
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1
1	Credit 7.1 Thermal Comfort, Design	1
1	Credit 7.2 Thermal Comfort, Verification	1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1
Yes		
2	Innovation & Design Process	5 Points
1	Credit 1.1 Innovation in Design: Provide Specific Title	1
1	Credit 1.2 Innovation in Design: Provide Specific Title	1
1	Credit 1.3 Innovation in Design: Provide Specific Title	1
1	Credit 1.4 Innovation in Design: Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
42	Project Totals (pre-certification estimates)	69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points		



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

Manulife
 Boston, MA

12 Sustainable Sites 14 Points		
Y	Prereq 1	Construction Activity Pollution Prevention Required
1	Credit 1	Site Selection 1
1	Credit 2	Development Density & Community Connectivity 1
1	Credit 3	Brownfield Redevelopment 1
1	Credit 4.1	Alternative Transportation, Public Transportation Access 1
1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms 1
1	Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles 1
1	Credit 4.4	Alternative Transportation, Parking Capacity 1
1	Credit 5.1	Site Development, Protect or Restore Habitat 1
1	Credit 5.2	Site Development, Maximize Open Space 1
1	Credit 6.1	Stormwater Design, Quantity Control 1
1	Credit 6.2	Stormwater Design, Quality Control 1
1	Credit 7.1	Heat Island Effect, Non-Roof 1
1	Credit 7.2	Heat Island Effect, Roof 1
1	Credit 8	Light Pollution Reduction 1
Yes		
3 Water Efficiency 5 Points		
1	Credit 1.1	Water Efficient Landscaping, Reduce by 50% 1
1	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation 1
1	Credit 2	Innovative Wastewater Technologies 1
1	Credit 3.1	Water Use Reduction, 20% Reduction 1
1	Credit 3.2	Water Use Reduction, 30% Reduction 1
Yes		
8 Energy & Atmosphere 17 Points		
Y	Prereq 1	Fundamental Commissioning of the Building Energy Systems Required
Y	Prereq 2	Minimum Energy Performance Required
Y	Prereq 3	Fundamental Refrigerant Management Required
4	Credit 1	Optimize Energy Performance 1 to 10
1	Credit 2	On-Site Renewable Energy 1 to 3
1	Credit 3	Enhanced Commissioning 1
1	Credit 4	Enhanced Refrigerant Management 1
1	Credit 5	Measurement & Verification 1
1	Credit 6	Green Power 1
Yes		
6 Materials & Resources 13 Points		
Y	Prereq 1	Storage & Collection of Recyclables Required
1	Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors & Roof 1
1	Credit 1.2	Building Reuse, Maintain 100% of Existing Walls, Floors & Roof 1
1	Credit 1.3	Building Reuse, Maintain 50% of Interior Non-Structural Elements 1
1	Credit 2.1	Construction Waste Management, Divert 50% from Disposal 1
1	Credit 2.2	Construction Waste Management, Divert 75% from Disposal 1
1	Credit 3.1	Materials Reuse, 5% 1
1	Credit 3.2	Materials Reuse, 10% 1
1	Credit 4.1	Recycled Content, 10% (post-consumer + 1/2 pre-consumer) 1
1	Credit 4.2	Recycled Content, 20% (post-consumer + 1/2 pre-consumer) 1
1	Credit 5.1	Regional Materials, 10% Extracted, Processed & Manufactured Region 1
1	Credit 5.2	Regional Materials, 20% Extracted, Processed & Manufactured Region 1
1	Credit 6	Rapidly Renewable Materials 1
1	Credit 7	Certified Wood 1
Yes		
4 Indoor Environmental Quality 15 Points		
Y	Prereq 1	Minimum IAQ Performance Required
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control Required
1	Credit 1	Outdoor Air Delivery Monitoring 1
1	Credit 2	Increased Ventilation 1
1	Credit 3.1	Construction IAQ Management Plan, During Construction 1
1	Credit 3.2	Construction IAQ Management Plan, Before Occupancy 1
1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants 1
1	Credit 4.2	Low-Emitting Materials, Paints & Coatings 1
1	Credit 4.3	Low-Emitting Materials, Carpet Systems 1
1	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products 1
1	Credit 5	Indoor Chemical & Pollutant Source Control 1
1	Credit 6.1	Controllability of Systems, Lighting 1
1	Credit 6.2	Controllability of Systems, Thermal Comfort 1
1	Credit 7.1	Thermal Comfort, Design 1
1	Credit 7.2	Thermal Comfort, Verification 1
1	Credit 8.1	Daylight & Views, Daylight 75% of Spaces 1
1	Credit 8.2	Daylight & Views, Views for 90% of Spaces 1
Yes		
1 Innovation & Design Process 5 Points		
1	Credit 1.1	Innovation in Design: Provide Specific Title 1
1	Credit 1.2	Innovation in Design: Provide Specific Title 1
1	Credit 1.3	Innovation in Design: Provide Specific Title 1
1	Credit 1.4	Innovation in Design: Provide Specific Title 1
1	Credit 2	LEED® Accredited Professional 1
Yes		
34 Project Totals (pre-certification estimates) 69 Points		

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



LEED-NC Version 2.2 Registered Project Checklist
 Social Security Annex Building
 Baltimore, MD

Yes			
10	Sustainable Sites	14 Points	
Y	Prereq 1 Construction Activity Pollution Prevention	Required	
1	Credit 1 Site Selection		1
1	Credit 2 Development Density & Community Connectivity		1
1	Credit 3 Brownfield Redevelopment		1
1	Credit 4.1 Alternative Transportation, Public Transportation Access		1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms		1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles		1
1	Credit 4.4 Alternative Transportation, Parking Capacity		1
1	Credit 5.1 Site Development, Protect or Restore Habitat		1
1	Credit 5.2 Site Development, Maximize Open Space		1
1	Credit 6.1 Stormwater Design, Quantity Control		1
1	Credit 6.2 Stormwater Design, Quality Control		1
1	Credit 7.1 Heat Island Effect, Non-Roof		1
1	Credit 7.2 Heat Island Effect, Roof		1
1	Credit 8 Light Pollution Reduction		1
Yes			
2	Water Efficiency	5 Points	
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%		1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation		1
1	Credit 2 Innovative Wastewater Technologies		1
1	Credit 3.1 Water Use Reduction, 20% Reduction		1
1	Credit 3.2 Water Use Reduction, 30% Reduction		1
Yes			
8	Energy & Atmosphere	17 Points	
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required	
Y	Prereq 2 Minimum Energy Performance	Required	
Y	Prereq 3 Fundamental Refrigerant Management	Required	
6	Credit 1 Optimize Energy Performance		1 to 10
1	Credit 2 On-Site Renewable Energy		1 to 3
1	Credit 3 Enhanced Commissioning		1
1	Credit 4 Enhanced Refrigerant Management		1
1	Credit 5 Measurement & Verification		1
1	Credit 6 Green Power		1
Yes			
4	Materials & Resources	13 Points	
Y	Prereq 1 Storage & Collection of Recyclables	Required	
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof		1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof		1
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements		1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal		1
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal		1
1	Credit 3.1 Materials Reuse, 5%		1
1	Credit 3.2 Materials Reuse, 10%		1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)		1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)		1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region		1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region		1
1	Credit 6 Rapidly Renewable Materials		1
1	Credit 7 Certified Wood		1
Yes			
8	Indoor Environmental Quality	15 Points	
Y	Prereq 1 Minimum IAQ Performance	Required	
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required	
1	Credit 1 Outdoor Air Delivery Monitoring		1
1	Credit 2 Increased Ventilation		1
1	Credit 3.1 Construction IAQ Management Plan, During Construction		1
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy		1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants		1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings		1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems		1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products		1
1	Credit 5 Indoor Chemical & Pollutant Source Control		1
1	Credit 6.1 Controllability of Systems, Lighting		1
1	Credit 6.2 Controllability of Systems, Thermal Comfort		1
1	Credit 7.1 Thermal Comfort, Design		1
1	Credit 7.2 Thermal Comfort, Verification		1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces		1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces		1
Yes			
2	Innovation & Design Process	5 Points	
1	Credit 1.1 Innovation in Design: Provide Specific Title		1
1	Credit 1.2 Innovation in Design: Provide Specific Title		1
1	Credit 1.3 Innovation in Design: Provide Specific Title		1
1	Credit 1.4 Innovation in Design: Provide Specific Title		1
1	Credit 2 LEED® Accredited Professional		1
Yes			
34	Project Totals (pre-certification estimates)	69 Points	
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

Liberty Mutual
 Dover, NH

4 Sustainable Sites		14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
Y	Credit 1 Site Selection	1
Y	Credit 2 Development Density & Community Connectivity	1
Y	Credit 3 Brownfield Redevelopment	1
Y	Credit 4.1 Alternative Transportation, Public Transportation Access	1
Y	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
Y	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation, Parking Capacity	1
1	Credit 5.1 Site Development, Protect or Restore Habitat	1
Y	Credit 5.2 Site Development, Maximize Open Space	1
1	Credit 6.1 Stormwater Design, Quantity Control	1
1	Credit 6.2 Stormwater Design, Quality Control	1
Y	Credit 7.1 Heat Island Effect, Non-Roof	1
Y	Credit 7.2 Heat Island Effect, Roof	1
Y	Credit 8 Light Pollution Reduction	1
Yes		
3 Water Efficiency		5 Points
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
Y	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction, 20% Reduction	1
Y	Credit 3.2 Water Use Reduction, 30% Reduction	1
Yes		
5 Energy & Atmosphere		17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
3	Credit 1 Optimize Energy Performance	1 to 10
Y	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
Y	Credit 5 Measurement & Verification	1
Y	Credit 6 Green Power	1
Yes		
6 Materials & Resources		13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
Y	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
Y	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
Y	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1
Y	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse, 5%	1
Y	Credit 3.2 Materials Reuse, 10%	1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1
Y	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1
1	Credit 6 Rapidly Renewable Materials	1
Y	Credit 7 Certified Wood	1
Yes		
9 Indoor Environmental Quality		15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
Y	Credit 1 Outdoor Air Delivery Monitoring	1
Y	Credit 2 Increased Ventilation	1
Y	Credit 3.1 Construction IAQ Management Plan, During Construction	1
Y	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5 Indoor Chemical & Pollutant Source Control	1
Y	Credit 6.1 Controllability of Systems, Lighting	1
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1
1	Credit 7.1 Thermal Comfort, Design	1
Y	Credit 7.2 Thermal Comfort, Verification	1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1
Yes		
2 Innovation & Design Process		5 Points
1	Credit 1.1 Innovation in Design: Provide Specific Title	1
Y	Credit 1.2 Innovation in Design: Provide Specific Title	1
Y	Credit 1.3 Innovation in Design: Provide Specific Title	1
Y	Credit 1.4 Innovation in Design: Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
29 Project Totals (pre-certification estimates)		69 Points

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



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

Molasky
 Las Vegas, NV

6 Sustainable Sites		14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
1	Credit 1 Site Selection	1
1	Credit 2 Development Density & Community Connectivity	1
1	Credit 3 Brownfield Redevelopment	1
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation, Parking Capacity	1
	Credit 5.1 Site Development, Protect or Restore Habitat	1
	Credit 5.2 Site Development, Maximize Open Space	1
	Credit 6.1 Stormwater Design, Quantity Control	1
	Credit 6.2 Stormwater Design, Quality Control	1
	Credit 7.1 Heat Island Effect, Non-Roof	1
	Credit 7.2 Heat Island Effect, Roof	1
	Credit 8 Light Pollution Reduction	1
Yes		
5 Water Efficiency		5 Points
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction, 20% Reduction	1
1	Credit 3.2 Water Use Reduction, 30% Reduction	1
Yes		
9 Energy & Atmosphere		17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
7	Credit 1 Optimize Energy Performance	1 to 10
	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
	Credit 5 Measurement & Verification	1
	Credit 6 Green Power	1
Yes		
8 Materials & Resources		13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1
	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse, 5%	1
1	Credit 3.2 Materials Reuse, 10%	1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1
	Credit 6 Rapidly Renewable Materials	1
1	Credit 7 Certified Wood	1
Yes		
9 Indoor Environmental Quality		15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
	Credit 1 Outdoor Air Delivery Monitoring	1
	Credit 2 Increased Ventilation	1
	Credit 3.1 Construction IAQ Management Plan, During Construction	1
	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1
	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5 Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1 Controllability of Systems, Lighting	1
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1
1	Credit 7.1 Thermal Comfort, Design	1
	Credit 7.2 Thermal Comfort, Verification	1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1
Yes		
3 Innovation & Design Process		5 Points
1	Credit 1.1 Innovation in Design: Provide Specific Title	1
1	Credit 1.2 Innovation in Design: Provide Specific Title	1
	Credit 1.3 Innovation in Design: Provide Specific Title	1
	Credit 1.4 Innovation in Design: Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
40 Project Totals (pre-certification estimates)		69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points		



LEED-NC Version 2.2 Registered Project Checklist
 The Plaza
 Allentown, PA

Yes		
10	Sustainable Sites	14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
1	Credit 1 Site Selection	1
1	Credit 2 Development Density & Community Connectivity	1
1	Credit 3 Brownfield Redevelopment	1
1	Credit 4.1 Alternative Transportation , Public Transportation Access	1
1	Credit 4.2 Alternative Transportation , Bicycle Storage & Changing Rooms	1
1	Credit 4.3 Alternative Transportation , Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation , Parking Capacity	1
1	Credit 5.1 Site Development , Protect or Restore Habitat	1
1	Credit 5.2 Site Development , Maximize Open Space	1
1	Credit 6.1 Stormwater Design , Quantity Control	1
1	Credit 6.2 Stormwater Design , Quality Control	1
1	Credit 7.1 Heat Island Effect , Non-Roof	1
1	Credit 7.2 Heat Island Effect , Roof	1
1	Credit 8 Light Pollution Reduction	1
Yes		
3	Water Efficiency	5 Points
1	Credit 1.1 Water Efficient Landscaping , Reduce by 50%	1
1	Credit 1.2 Water Efficient Landscaping , No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction , 20% Reduction	1
1	Credit 3.2 Water Use Reduction , 30% Reduction	1
Yes		
11	Energy & Atmosphere	17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
8	Credit 1 Optimize Energy Performance	1 to 10
1	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
1	Credit 5 Measurement & Verification	1
1	Credit 6 Green Power	1
Yes		
6	Materials & Resources	13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
1	Credit 1.1 Building Reuse , Maintain 75% of Existing Walls, Floors & Roof	1
1	Credit 1.2 Building Reuse , Maintain 100% of Existing Walls, Floors & Roof	1
1	Credit 1.3 Building Reuse , Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1 Construction Waste Management , Divert 50% from Disposal	1
1	Credit 2.2 Construction Waste Management , Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse , 5%	1
1	Credit 3.2 Materials Reuse , 10%	1
1	Credit 4.1 Recycled Content , 10% (post-consumer + ½ pre-consumer)	1
1	Credit 4.2 Recycled Content , 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials , 10% Extracted, Processed & Manufactured Region	1
1	Credit 5.2 Regional Materials , 20% Extracted, Processed & Manufactured Region	1
1	Credit 6 Rapidly Renewable Materials	1
1	Credit 7 Certified Wood	1
Yes		
10	Indoor Environmental Quality	15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
1	Credit 1 Outdoor Air Delivery Monitoring	1
1	Credit 2 Increased Ventilation	1
1	Credit 3.1 Construction IAQ Management Plan , During Construction	1
1	Credit 3.2 Construction IAQ Management Plan , Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials , Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials , Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials , Carpet Systems	1
1	Credit 4.4 Low-Emitting Materials , Composite Wood & Agrifiber Products	1
1	Credit 5 Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1 Controllability of Systems , Lighting	1
1	Credit 6.2 Controllability of Systems , Thermal Comfort	1
1	Credit 7.1 Thermal Comfort , Design	1
1	Credit 7.2 Thermal Comfort , Verification	1
1	Credit 8.1 Daylight & Views , Daylight 75% of Spaces	1
1	Credit 8.2 Daylight & Views , Views for 90% of Spaces	1
Yes		
2	Innovation & Design Process	5 Points
1	Credit 1.1 Innovation in Design : Provide Specific Title	1
1	Credit 1.2 Innovation in Design : Provide Specific Title	1
1	Credit 1.3 Innovation in Design : Provide Specific Title	1
1	Credit 1.4 Innovation in Design : Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
42	Project Totals (pre-certification estimates)	69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points		



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

BP
 Houston, TX

6 Sustainable Sites		14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
1	Credit 1 Site Selection	1
1	Credit 2 Development Density & Community Connectivity	1
1	Credit 3 Brownfield Redevelopment	1
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1
	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation, Parking Capacity	1
	Credit 5.1 Site Development, Protect or Restore Habitat	1
1	Credit 5.2 Site Development, Maximize Open Space	1
	Credit 6.1 Stormwater Design, Quantity Control	1
	Credit 6.2 Stormwater Design, Quality Control	1
	Credit 7.1 Heat Island Effect, Non-Roof	1
	Credit 7.2 Heat Island Effect, Roof	1
	Credit 8 Light Pollution Reduction	1
Yes		
2 Water Efficiency		5 Points
	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction, 20% Reduction	1
	Credit 3.2 Water Use Reduction, 30% Reduction	1
Yes		
9 Energy & Atmosphere		17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
5	Credit 1 Optimize Energy Performance	1 to 10
	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
1	Credit 5 Measurement & Verification	1
1	Credit 6 Green Power	1
Yes		
6 Materials & Resources		13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1
	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse, 5%	1
1	Credit 3.2 Materials Reuse, 10%	1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1
	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1
1	Credit 6 Rapidly Renewable Materials	1
	Credit 7 Certified Wood	1
Yes		
8 Indoor Environmental Quality		15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
1	Credit 1 Outdoor Air Delivery Monitoring	1
1	Credit 2 Increased Ventilation	1
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1
	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1
	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1
	Credit 5 Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1 Controllability of Systems, Lighting	1
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1
	Credit 7.1 Thermal Comfort, Design	1
	Credit 7.2 Thermal Comfort, Verification	1
	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1
	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1
Yes		
2 Innovation & Design Process		5 Points
1	Credit 1.1 Innovation in Design: Provide Specific Title	1
	Credit 1.2 Innovation in Design: Provide Specific Title	1
	Credit 1.3 Innovation in Design: Provide Specific Title	1
	Credit 1.4 Innovation in Design: Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
33 Project Totals (pre-certification estimates)		69 Points

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



LEED-NC Version 2.2 Registered Project Checklist
 Vocation Tech Center
 San Diego, CA

Yes			
6	Sustainable Sites	14 Points	
Y	Prereq 1 Construction Activity Pollution Prevention	Required	
	Credit 1 Site Selection	1	
1	Credit 2 Development Density & Community Connectivity	1	
	Credit 3 Brownfield Redevelopment	1	
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1	
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1	
	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1	
1	Credit 4.4 Alternative Transportation, Parking Capacity	1	
1	Credit 5.1 Site Development, Protect or Restore Habitat	1	
	Credit 5.2 Site Development, Maximize Open Space	1	
	Credit 6.1 Stormwater Design, Quantity Control	1	
	Credit 6.2 Stormwater Design, Quality Control	1	
	Credit 7.1 Heat Island Effect, Non-Roof	1	
	Credit 7.2 Heat Island Effect, Roof	1	
1	Credit 8 Light Pollution Reduction	1	
Yes			
3	Water Efficiency	5 Points	
	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1	
	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1	
1	Credit 2 Innovative Wastewater Technologies	1	
1	Credit 3.1 Water Use Reduction, 20% Reduction	1	
1	Credit 3.2 Water Use Reduction, 30% Reduction	1	
Yes			
11	Energy & Atmosphere	17 Points	
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required	
Y	Prereq 2 Minimum Energy Performance	Required	
Y	Prereq 3 Fundamental Refrigerant Management	Required	
6	Credit 1 Optimize Energy Performance	1 to 10	
3	Credit 2 On-Site Renewable Energy	1 to 3	
	Credit 3 Enhanced Commissioning	1	
	Credit 4 Enhanced Refrigerant Management	1	
1	Credit 5 Measurement & Verification	1	
1	Credit 6 Green Power	1	
Yes			
9	Materials & Resources	13 Points	
Y	Prereq 1 Storage & Collection of Recyclables	Required	
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1	
	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1	
	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1	
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1	
	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1	
1	Credit 3.1 Materials Reuse, 5%	1	
1	Credit 3.2 Materials Reuse, 10%	1	
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1	
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1	
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1	
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1	
1	Credit 6 Rapidly Renewable Materials	1	
	Credit 7 Certified Wood	1	
Yes			
6	Indoor Environmental Quality	15 Points	
Y	Prereq 1 Minimum IAQ Performance	Required	
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required	
	Credit 1 Outdoor Air Delivery Monitoring	1	
1	Credit 2 Increased Ventilation	1	
	Credit 3.1 Construction IAQ Management Plan, During Construction	1	
	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1	
	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1	
	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1	
	Credit 4.3 Low-Emitting Materials, Carpet Systems	1	
	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1	
1	Credit 5 Indoor Chemical & Pollutant Source Control	1	
1	Credit 6.1 Controllability of Systems, Lighting	1	
	Credit 6.2 Controllability of Systems, Thermal Comfort	1	
1	Credit 7.1 Thermal Comfort, Design	1	
	Credit 7.2 Thermal Comfort, Verification	1	
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1	
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1	
Yes			
3	Innovation & Design Process	5 Points	
1	Credit 1.1 Innovation in Design: Provide Specific Title	1	
1	Credit 1.2 Innovation in Design: Provide Specific Title	1	
	Credit 1.3 Innovation in Design: Provide Specific Title	1	
	Credit 1.4 Innovation in Design: Provide Specific Title	1	
1	Credit 2 LEED® Accredited Professional	1	
Yes			
38	Project Totals (pre-certification estimates)	69 Points	
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			



LEED-NC Version 2.2 Registered Project Checklist
 Management Building
 Atlanta, GA

Yes			
6	Sustainable Sites	14 Points	
Y	Prereq 1 Construction Activity Pollution Prevention	Required	
1	Credit 1 Site Selection	1	
1	Credit 2 Development Density & Community Connectivity	1	
1	Credit 3 Brownfield Redevelopment	1	
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1	
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1	
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1	
1	Credit 4.4 Alternative Transportation, Parking Capacity	1	
1	Credit 5.1 Site Development, Protect or Restore Habitat	1	
1	Credit 5.2 Site Development, Maximize Open Space	1	
1	Credit 6.1 Stormwater Design, Quantity Control	1	
1	Credit 6.2 Stormwater Design, Quality Control	1	
1	Credit 7.1 Heat Island Effect, Non-Roof	1	
1	Credit 7.2 Heat Island Effect, Roof	1	
1	Credit 8 Light Pollution Reduction	1	
Yes			
1	Water Efficiency	5 Points	
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1	
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1	
1	Credit 2 Innovative Wastewater Technologies	1	
1	Credit 3.1 Water Use Reduction, 20% Reduction	1	
1	Credit 3.2 Water Use Reduction, 30% Reduction	1	
Yes			
7	Energy & Atmosphere	17 Points	
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required	
Y	Prereq 2 Minimum Energy Performance	Required	
Y	Prereq 3 Fundamental Refrigerant Management	Required	
4	Credit 1 Optimize Energy Performance	1 to 10	
2	Credit 2 On-Site Renewable Energy	1 to 3	
1	Credit 3 Enhanced Commissioning	1	
1	Credit 4 Enhanced Refrigerant Management	1	
1	Credit 5 Measurement & Verification	1	
1	Credit 6 Green Power	1	
Yes			
6	Materials & Resources	13 Points	
Y	Prereq 1 Storage & Collection of Recyclables	Required	
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1	
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1	
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1	
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1	
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1	
1	Credit 3.1 Materials Reuse, 5%	1	
1	Credit 3.2 Materials Reuse, 10%	1	
1	Credit 4.1 Recycled Content, 10% (post-consumer + 1/2 pre-consumer)	1	
1	Credit 4.2 Recycled Content, 20% (post-consumer + 1/2 pre-consumer)	1	
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1	
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1	
1	Credit 6 Rapidly Renewable Materials	1	
1	Credit 7 Certified Wood	1	
Yes			
11	Indoor Environmental Quality	15 Points	
Y	Prereq 1 Minimum IAQ Performance	Required	
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required	
1	Credit 1 Outdoor Air Delivery Monitoring	1	
1	Credit 2 Increased Ventilation	1	
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1	
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1	
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1	
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1	
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1	
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1	
1	Credit 5 Indoor Chemical & Pollutant Source Control	1	
1	Credit 6.1 Controllability of Systems, Lighting	1	
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1	
1	Credit 7.1 Thermal Comfort, Design	1	
1	Credit 7.2 Thermal Comfort, Verification	1	
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1	
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1	
Yes			
3	Innovation & Design Process	5 Points	
1	Credit 1.1 Innovation in Design: Provide Specific Title	1	
1	Credit 1.2 Innovation in Design: Provide Specific Title	1	
1	Credit 1.3 Innovation in Design: Provide Specific Title	1	
1	Credit 1.4 Innovation in Design: Provide Specific Title	1	
1	Credit 2 LEED® Accredited Professional	1	
Yes			
34	Project Totals (pre-certification estimates)	69 Points	
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist
 Center for Interdisciplinary Engineering
 Durham, GA

Yes	
6	Sustainable Sites 14 Points
Y	Prereq 1 Construction Activity Pollution Prevention Required
	Credit 1 Site Selection 1
	Credit 2 Development Density & Community Connectivity 1
	Credit 3 Brownfield Redevelopment 1
1	Credit 4.1 Alternative Transportation , Public Transportation Access 1
1	Credit 4.2 Alternative Transportation , Bicycle Storage & Changing Rooms 1
	Credit 4.3 Alternative Transportation , Low-Emitting and Fuel-Efficient Vehicles 1
	Credit 4.4 Alternative Transportation , Parking Capacity 1
1	Credit 5.1 Site Development , Protect or Restore Habitat 1
	Credit 5.2 Site Development , Maximize Open Space 1
1	Credit 6.1 Stormwater Design , Quantity Control 1
	Credit 6.2 Stormwater Design , Quality Control 1
1	Credit 7.1 Heat Island Effect , Non-Roof 1
1	Credit 7.2 Heat Island Effect , Roof 1
	Credit 8 Light Pollution Reduction 1
Yes	
4	Water Efficiency 5 Points
1	Credit 1.1 Water Efficient Landscaping , Reduce by 50% 1
1	Credit 1.2 Water Efficient Landscaping , No Potable Use or No Irrigation 1
	Credit 2 Innovative Wastewater Technologies 1
1	Credit 3.1 Water Use Reduction , 20% Reduction 1
1	Credit 3.2 Water Use Reduction , 30% Reduction 1
Yes	
4	Energy & Atmosphere 17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems Required
Y	Prereq 2 Minimum Energy Performance Required
Y	Prereq 3 Fundamental Refrigerant Management Required
2	Credit 1 Optimize Energy Performance 1 to 10
	Credit 2 On-Site Renewable Energy 1 to 3
1	Credit 3 Enhanced Commissioning 1
	Credit 4 Enhanced Refrigerant Management 1
1	Credit 5 Measurement & Verification 1
	Credit 6 Green Power 1
Yes	
8	Materials & Resources 13 Points
Y	Prereq 1 Storage & Collection of Recyclables Required
	Credit 1.1 Building Reuse , Maintain 75% of Existing Walls, Floors & Roof 1
	Credit 1.2 Building Reuse , Maintain 100% of Existing Walls, Floors & Roof 1
	Credit 1.3 Building Reuse , Maintain 50% of Interior Non-Structural Elements 1
1	Credit 2.1 Construction Waste Management , Divert 50% from Disposal 1
1	Credit 2.2 Construction Waste Management , Divert 75% from Disposal 1
1	Credit 3.1 Materials Reuse , 5% 1
1	Credit 3.2 Materials Reuse , 10% 1
1	Credit 4.1 Recycled Content , 10% (post-consumer + ½ pre-consumer) 1
1	Credit 4.2 Recycled Content , 20% (post-consumer + ½ pre-consumer) 1
1	Credit 5.1 Regional Materials , 10% Extracted, Processed & Manufactured Region 1
	Credit 5.2 Regional Materials , 20% Extracted, Processed & Manufactured Region 1
	Credit 6 Rapidly Renewable Materials 1
1	Credit 7 Certified Wood 1
Yes	
6	Indoor Environmental Quality 15 Points
Y	Prereq 1 Minimum IAQ Performance Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control Required
	Credit 1 Outdoor Air Delivery Monitoring 1
	Credit 2 Increased Ventilation 1
	Credit 3.1 Construction IAQ Management Plan , During Construction 1
	Credit 3.2 Construction IAQ Management Plan , Before Occupancy 1
1	Credit 4.1 Low-Emitting Materials , Adhesives & Sealants 1
1	Credit 4.2 Low-Emitting Materials , Paints & Coatings 1
1	Credit 4.3 Low-Emitting Materials , Carpet Systems 1
	Credit 4.4 Low-Emitting Materials , Composite Wood & Agrifiber Products 1
1	Credit 5 Indoor Chemical & Pollutant Source Control 1
	Credit 6.1 Controllability of Systems , Lighting 1
	Credit 6.2 Controllability of Systems , Thermal Comfort 1
1	Credit 7.1 Thermal Comfort , Design 1
1	Credit 7.2 Thermal Comfort , Verification 1
	Credit 8.1 Daylight & Views , Daylight 75% of Spaces 1
	Credit 8.2 Daylight & Views , Views for 90% of Spaces 1
Yes	
2	Innovation & Design Process 5 Points
1	Credit 1.1 Innovation in Design : Provide Specific Title 1
	Credit 1.2 Innovation in Design : Provide Specific Title 1
	Credit 1.3 Innovation in Design : Provide Specific Title 1
	Credit 1.4 Innovation in Design : Provide Specific Title 1
1	Credit 2 LEED® Accredited Professional 1
Yes	
30	Project Totals (pre-certification estimates) 69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points	



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist
 Whitehead Building
 Atlanta, GA

Yes			
7	Sustainable Sites	14 Points	
Y	Prereq 1 Construction Activity Pollution Prevention	Required	
1	Credit 1 Site Selection	1	
1	Credit 2 Development Density & Community Connectivity	1	
1	Credit 3 Brownfield Redevelopment	1	
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1	
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1	
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1	
1	Credit 4.4 Alternative Transportation, Parking Capacity	1	
1	Credit 5.1 Site Development, Protect or Restore Habitat	1	
1	Credit 5.2 Site Development, Maximize Open Space	1	
1	Credit 6.1 Stormwater Design, Quantity Control	1	
1	Credit 6.2 Stormwater Design, Quality Control	1	
1	Credit 7.1 Heat Island Effect, Non-Roof	1	
1	Credit 7.2 Heat Island Effect, Roof	1	
1	Credit 8 Light Pollution Reduction	1	
Yes			
3	Water Efficiency	5 Points	
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1	
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1	
1	Credit 2 Innovative Wastewater Technologies	1	
1	Credit 3.1 Water Use Reduction, 20% Reduction	1	
1	Credit 3.2 Water Use Reduction, 30% Reduction	1	
Yes			
10	Energy & Atmosphere	17 Points	
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required	
Y	Prereq 2 Minimum Energy Performance	Required	
Y	Prereq 3 Fundamental Refrigerant Management	Required	
6	Credit 1 Optimize Energy Performance	1 to 10	
2	Credit 2 On-Site Renewable Energy	1 to 3	
1	Credit 3 Enhanced Commissioning	1	
1	Credit 4 Enhanced Refrigerant Management	1	
1	Credit 5 Measurement & Verification	1	
1	Credit 6 Green Power	1	
Yes			
6	Materials & Resources	13 Points	
Y	Prereq 1 Storage & Collection of Recyclables	Required	
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1	
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1	
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1	
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1	
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1	
1	Credit 3.1 Materials Reuse, 5%	1	
1	Credit 3.2 Materials Reuse, 10%	1	
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1	
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1	
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1	
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1	
1	Credit 6 Rapidly Renewable Materials	1	
1	Credit 7 Certified Wood	1	
Yes			
10	Indoor Environmental Quality	15 Points	
Y	Prereq 1 Minimum IAQ Performance	Required	
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required	
1	Credit 1 Outdoor Air Delivery Monitoring	1	
1	Credit 2 Increased Ventilation	1	
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1	
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1	
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1	
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1	
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1	
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1	
1	Credit 5 Indoor Chemical & Pollutant Source Control	1	
1	Credit 6.1 Controllability of Systems, Lighting	1	
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1	
1	Credit 7.1 Thermal Comfort, Design	1	
1	Credit 7.2 Thermal Comfort, Verification	1	
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1	
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1	
Yes			
3	Innovation & Design Process	5 Points	
1	Credit 1.1 Innovation in Design: Provide Specific Title	1	
1	Credit 1.2 Innovation in Design: Provide Specific Title	1	
1	Credit 1.3 Innovation in Design: Provide Specific Title	1	
1	Credit 1.4 Innovation in Design: Provide Specific Title	1	
1	Credit 2 LEED® Accredited Professional	1	
Yes			
39	Project Totals (pre-certification estimates)	69 Points	
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			



LEED:NC

LEED-NC Version 2.2 Registered Project Checklist
 San Diego New Main Library
 San Diego, CA

7 Sustainable Sites		14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
1	Credit 1 Site Selection	1
1	Credit 2 Development Density & Community Connectivity	1
1	Credit 3 Brownfield Redevelopment	1
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation, Parking Capacity	1
1	Credit 5.1 Site Development, Protect or Restore Habitat	1
1	Credit 5.2 Site Development, Maximize Open Space	1
1	Credit 6.1 Stormwater Design, Quantity Control	1
1	Credit 6.2 Stormwater Design, Quality Control	1
1	Credit 7.1 Heat Island Effect, Non-Roof	1
1	Credit 7.2 Heat Island Effect, Roof	1
1	Credit 8 Light Pollution Reduction	1
Yes		
3 Water Efficiency		5 Points
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction, 20% Reduction	1
1	Credit 3.2 Water Use Reduction, 30% Reduction	1
Yes		
7 Energy & Atmosphere		17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
4	Credit 1 Optimize Energy Performance	1 to 10
1	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
1	Credit 5 Measurement & Verification	1
1	Credit 6 Green Power	1
Yes		
7 Materials & Resources		13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse, 5%	1
1	Credit 3.2 Materials Reuse, 10%	1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1
1	Credit 6 Rapidly Renewable Materials	1
1	Credit 7 Certified Wood	1
Yes		
11 Indoor Environmental Quality		15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
1	Credit 1 Outdoor Air Delivery Monitoring	1
1	Credit 2 Increased Ventilation	1
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5 Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1 Controllability of Systems, Lighting	1
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1
1	Credit 7.1 Thermal Comfort, Design	1
1	Credit 7.2 Thermal Comfort, Verification	1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1
Yes		
2 Innovation & Design Process		5 Points
1	Credit 1.1 Innovation in Design: Provide Specific Title	1
1	Credit 1.2 Innovation in Design: Provide Specific Title	1
1	Credit 1.3 Innovation in Design: Provide Specific Title	1
1	Credit 1.4 Innovation in Design: Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
37 Project Totals (pre-certification estimates)		69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points		



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist
 California Academy of Arts and Sciences
 San Francisco, CA

Yes		
10	Sustainable Sites	14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
1	Credit 1 Site Selection	1
1	Credit 2 Development Density & Community Connectivity	1
1	Credit 3 Brownfield Redevelopment	1
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation, Parking Capacity	1
1	Credit 5.1 Site Development, Protect or Restore Habitat	1
1	Credit 5.2 Site Development, Maximize Open Space	1
1	Credit 6.1 Stormwater Design, Quantity Control	1
1	Credit 6.2 Stormwater Design, Quality Control	1
1	Credit 7.1 Heat Island Effect, Non-Roof	1
1	Credit 7.2 Heat Island Effect, Roof	1
1	Credit 8 Light Pollution Reduction	1
Yes		
5	Water Efficiency	5 Points
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction, 20% Reduction	1
1	Credit 3.2 Water Use Reduction, 30% Reduction	1
Yes		
14	Energy & Atmosphere	17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
8	Credit 1 Optimize Energy Performance	1 to 10
2	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
1	Credit 5 Measurement & Verification	1
1	Credit 6 Green Power	1
Yes		
11	Materials & Resources	13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse, 5%	1
1	Credit 3.2 Materials Reuse, 10%	1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1
1	Credit 6 Rapidly Renewable Materials	1
1	Credit 7 Certified Wood	1
Yes		
11	Indoor Environmental Quality	15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
1	Credit 1 Outdoor Air Delivery Monitoring	1
1	Credit 2 Increased Ventilation	1
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5 Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1 Controllability of Systems, Lighting	1
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1
1	Credit 7.1 Thermal Comfort, Design	1
1	Credit 7.2 Thermal Comfort, Verification	1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1
Yes		
4	Innovation & Design Process	5 Points
1	Credit 1.1 Innovation in Design: Provide Specific Title	1
1	Credit 1.2 Innovation in Design: Provide Specific Title	1
1	Credit 1.3 Innovation in Design: Provide Specific Title	1
1	Credit 1.4 Innovation in Design: Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
55	Project Totals (pre-certification estimates)	69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points		



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

David Skaggs
 Boulder, CO

Yes			
9	Sustainable Sites	14 Points	
Y	Prereq 1 Construction Activity Pollution Prevention	Required	
1	Credit 1 Site Selection		1
1	Credit 2 Development Density & Community Connectivity		1
1	Credit 3 Brownfield Redevelopment		1
1	Credit 4.1 Alternative Transportation, Public Transportation Access		1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms		1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles		1
1	Credit 4.4 Alternative Transportation, Parking Capacity		1
1	Credit 5.1 Site Development, Protect or Restore Habitat		1
1	Credit 5.2 Site Development, Maximize Open Space		1
1	Credit 6.1 Stormwater Design, Quantity Control		1
1	Credit 6.2 Stormwater Design, Quality Control		1
1	Credit 7.1 Heat Island Effect, Non-Roof		1
1	Credit 7.2 Heat Island Effect, Roof		1
1	Credit 8 Light Pollution Reduction		1
Yes			
3	Water Efficiency	5 Points	
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%		1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation		1
1	Credit 2 Innovative Wastewater Technologies		1
1	Credit 3.1 Water Use Reduction, 20% Reduction		1
1	Credit 3.2 Water Use Reduction, 30% Reduction		1
Yes			
4	Energy & Atmosphere	17 Points	
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required	
Y	Prereq 2 Minimum Energy Performance	Required	
Y	Prereq 3 Fundamental Refrigerant Management	Required	
2	Credit 1 Optimize Energy Performance		1 to 10
1	Credit 2 On-Site Renewable Energy		1 to 3
1	Credit 3 Enhanced Commissioning		1
1	Credit 4 Enhanced Refrigerant Management		1
1	Credit 5 Measurement & Verification		1
1	Credit 6 Green Power		1
Yes			
5	Materials & Resources	13 Points	
Y	Prereq 1 Storage & Collection of Recyclables	Required	
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof		1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof		1
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements		1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal		1
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal		1
1	Credit 3.1 Materials Reuse, 5%		1
1	Credit 3.2 Materials Reuse, 10%		1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)		1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)		1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region		1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region		1
1	Credit 6 Rapidly Renewable Materials		1
1	Credit 7 Certified Wood		1
Yes			
9	Indoor Environmental Quality	15 Points	
Y	Prereq 1 Minimum IAQ Performance	Required	
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required	
1	Credit 1 Outdoor Air Delivery Monitoring		1
1	Credit 2 Increased Ventilation		1
1	Credit 3.1 Construction IAQ Management Plan, During Construction		1
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy		1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants		1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings		1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems		1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products		1
1	Credit 5 Indoor Chemical & Pollutant Source Control		1
1	Credit 6.1 Controllability of Systems, Lighting		1
1	Credit 6.2 Controllability of Systems, Thermal Comfort		1
1	Credit 7.1 Thermal Comfort, Design		1
1	Credit 7.2 Thermal Comfort, Verification		1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces		1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces		1
Yes			
3	Innovation & Design Process	5 Points	
1	Credit 1.1 Innovation in Design: Provide Specific Title		1
1	Credit 1.2 Innovation in Design: Provide Specific Title		1
1	Credit 1.3 Innovation in Design: Provide Specific Title		1
1	Credit 1.4 Innovation in Design: Provide Specific Title		1
1	Credit 2 LEED® Accredited Professional		1
Yes			
33	Project Totals (pre-certification estimates)	69 Points	
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			



LEED-NC Version 2.2 Registered Project Checklist
 University of N. Florida - Osprey
 Jacksonville, FL

Yes			
8	Sustainable Sites	14 Points	
Y	Prereq 1 Construction Activity Pollution Prevention	Required	
1	Credit 1 Site Selection	1	
1	Credit 2 Development Density & Community Connectivity	1	
1	Credit 3 Brownfield Redevelopment	1	
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1	
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1	
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1	
1	Credit 4.4 Alternative Transportation, Parking Capacity	1	
1	Credit 5.1 Site Development, Protect or Restore Habitat	1	
1	Credit 5.2 Site Development, Maximize Open Space	1	
1	Credit 6.1 Stormwater Design, Quantity Control	1	
1	Credit 6.2 Stormwater Design, Quality Control	1	
1	Credit 7.1 Heat Island Effect, Non-Roof	1	
1	Credit 7.2 Heat Island Effect, Roof	1	
1	Credit 8 Light Pollution Reduction	1	
Yes			
2	Water Efficiency	5 Points	
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1	
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1	
1	Credit 2 Innovative Wastewater Technologies	1	
1	Credit 3.1 Water Use Reduction, 20% Reduction	1	
1	Credit 3.2 Water Use Reduction, 30% Reduction	1	
Yes			
8	Energy & Atmosphere	17 Points	
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required	
Y	Prereq 2 Minimum Energy Performance	Required	
Y	Prereq 3 Fundamental Refrigerant Management	Required	
6	Credit 1 Optimize Energy Performance	1 to 10	
1	Credit 2 On-Site Renewable Energy	1 to 3	
1	Credit 3 Enhanced Commissioning	1	
1	Credit 4 Enhanced Refrigerant Management	1	
1	Credit 5 Measurement & Verification	1	
1	Credit 6 Green Power	1	
Yes			
8	Materials & Resources	13 Points	
Y	Prereq 1 Storage & Collection of Recyclables	Required	
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1	
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1	
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1	
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1	
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1	
1	Credit 3.1 Materials Reuse, 5%	1	
1	Credit 3.2 Materials Reuse, 10%	1	
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1	
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1	
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1	
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1	
1	Credit 6 Rapidly Renewable Materials	1	
1	Credit 7 Certified Wood	1	
Yes			
12	Indoor Environmental Quality	15 Points	
Y	Prereq 1 Minimum IAQ Performance	Required	
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required	
1	Credit 1 Outdoor Air Delivery Monitoring	1	
1	Credit 2 Increased Ventilation	1	
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1	
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1	
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1	
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1	
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1	
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1	
1	Credit 5 Indoor Chemical & Pollutant Source Control	1	
1	Credit 6.1 Controllability of Systems, Lighting	1	
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1	
1	Credit 7.1 Thermal Comfort, Design	1	
1	Credit 7.2 Thermal Comfort, Verification	1	
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1	
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1	
Yes			
2	Innovation & Design Process	5 Points	
1	Credit 1.1 Innovation in Design: Provide Specific Title	1	
1	Credit 1.2 Innovation in Design: Provide Specific Title	1	
1	Credit 1.3 Innovation in Design: Provide Specific Title	1	
1	Credit 1.4 Innovation in Design: Provide Specific Title	1	
1	Credit 2 LEED® Accredited Professional	1	
Yes			
40	Project Totals (pre-certification estimates)	69 Points	
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

Simmons
 Boston, MA

Yes				
9	Sustainable Sites			14 Points
Y	Prereq 1	Construction Activity Pollution Prevention		Required
1	Credit 1	Site Selection		1
1	Credit 2	Development Density & Community Connectivity		1
1	Credit 3	Brownfield Redevelopment		1
1	Credit 4.1	Alternative Transportation, Public Transportation Access		1
1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms		1
1	Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles		1
1	Credit 4.4	Alternative Transportation, Parking Capacity		1
1	Credit 5.1	Site Development, Protect or Restore Habitat		1
1	Credit 5.2	Site Development, Maximize Open Space		1
1	Credit 6.1	Stormwater Design, Quantity Control		1
1	Credit 6.2	Stormwater Design, Quality Control		1
1	Credit 7.1	Heat Island Effect, Non-Roof		1
1	Credit 7.2	Heat Island Effect, Roof		1
1	Credit 8	Light Pollution Reduction		1
Yes				
4	Water Efficiency			5 Points
1	Credit 1.1	Water Efficient Landscaping, Reduce by 50%		1
1	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation		1
1	Credit 2	Innovative Wastewater Technologies		1
1	Credit 3.1	Water Use Reduction, 20% Reduction		1
1	Credit 3.2	Water Use Reduction, 30% Reduction		1
Yes				
4	Energy & Atmosphere			17 Points
Y	Prereq 1	Fundamental Commissioning of the Building Energy Systems		Required
Y	Prereq 2	Minimum Energy Performance		Required
Y	Prereq 3	Fundamental Refrigerant Management		Required
2	Credit 1	Optimize Energy Performance		1 to 10
1	Credit 2	On-Site Renewable Energy		1 to 3
1	Credit 3	Enhanced Commissioning		1
1	Credit 4	Enhanced Refrigerant Management		1
1	Credit 5	Measurement & Verification		1
1	Credit 6	Green Power		1
Yes				
6	Materials & Resources			13 Points
Y	Prereq 1	Storage & Collection of Recyclables		Required
1	Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors & Roof		1
1	Credit 1.2	Building Reuse, Maintain 100% of Existing Walls, Floors & Roof		1
1	Credit 1.3	Building Reuse, Maintain 50% of Interior Non-Structural Elements		1
1	Credit 2.1	Construction Waste Management, Divert 50% from Disposal		1
1	Credit 2.2	Construction Waste Management, Divert 75% from Disposal		1
1	Credit 3.1	Materials Reuse, 5%		1
1	Credit 3.2	Materials Reuse, 10%		1
1	Credit 4.1	Recycled Content, 10% (post-consumer + ½ pre-consumer)		1
1	Credit 4.2	Recycled Content, 20% (post-consumer + ½ pre-consumer)		1
1	Credit 5.1	Regional Materials, 10% Extracted, Processed & Manufactured Region		1
1	Credit 5.2	Regional Materials, 20% Extracted, Processed & Manufactured Region		1
1	Credit 6	Rapidly Renewable Materials		1
1	Credit 7	Certified Wood		1
Yes				
9	Indoor Environmental Quality			15 Points
Y	Prereq 1	Minimum IAQ Performance		Required
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control		Required
1	Credit 1	Outdoor Air Delivery Monitoring		1
1	Credit 2	Increased Ventilation		1
1	Credit 3.1	Construction IAQ Management Plan, During Construction		1
1	Credit 3.2	Construction IAQ Management Plan, Before Occupancy		1
1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants		1
1	Credit 4.2	Low-Emitting Materials, Paints & Coatings		1
1	Credit 4.3	Low-Emitting Materials, Carpet Systems		1
1	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products		1
1	Credit 5	Indoor Chemical & Pollutant Source Control		1
1	Credit 6.1	Controllability of Systems, Lighting		1
1	Credit 6.2	Controllability of Systems, Thermal Comfort		1
1	Credit 7.1	Thermal Comfort, Design		1
1	Credit 7.2	Thermal Comfort, Verification		1
1	Credit 8.1	Daylight & Views, Daylight 75% of Spaces		1
1	Credit 8.2	Daylight & Views, Views for 90% of Spaces		1
Yes				
2	Innovation & Design Process			5 Points
1	Credit 1.1	Innovation in Design: Provide Specific Title		1
1	Credit 1.2	Innovation in Design: Provide Specific Title		1
1	Credit 1.3	Innovation in Design: Provide Specific Title		1
1	Credit 1.4	Innovation in Design: Provide Specific Title		1
1	Credit 2	LEED® Accredited Professional		1
Yes				
34	Project Totals (pre-certification estimates)			69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points				



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

Mosaic
 Minnaeapolis, MN

Yes			
10	Sustainable Sites	14	Points
Y	Prereq 1 Construction Activity Pollution Prevention		Required
1	Credit 1 Site Selection		1
1	Credit 2 Development Density & Community Connectivity		1
	Credit 3 Brownfield Redevelopment		1
1	Credit 4.1 Alternative Transportation, Public Transportation Access		1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms		1
	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles		1
1	Credit 4.4 Alternative Transportation, Parking Capacity		1
1	Credit 5.1 Site Development, Protect or Restore Habitat		1
1	Credit 5.2 Site Development, Maximize Open Space		1
1	Credit 6.1 Stormwater Design, Quantity Control		1
	Credit 6.2 Stormwater Design, Quality Control		1
1	Credit 7.1 Heat Island Effect, Non-Roof		1
	Credit 7.2 Heat Island Effect, Roof		1
1	Credit 8 Light Pollution Reduction		1
Yes			
3	Water Efficiency	5	Points
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%		1
	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation		1
1	Credit 2 Innovative Wastewater Technologies		1
1	Credit 3.1 Water Use Reduction, 20% Reduction		1
	Credit 3.2 Water Use Reduction, 30% Reduction		1
Yes			
6	Energy & Atmosphere	17	Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems		Required
Y	Prereq 2 Minimum Energy Performance		Required
Y	Prereq 3 Fundamental Refrigerant Management		Required
3	Credit 1 Optimize Energy Performance		1 to 10
	Credit 2 On-Site Renewable Energy		1 to 3
1	Credit 3 Enhanced Commissioning		1
	Credit 4 Enhanced Refrigerant Management		1
1	Credit 5 Measurement & Verification		1
1	Credit 6 Green Power		1
Yes			
8	Materials & Resources	13	Points
Y	Prereq 1 Storage & Collection of Recyclables		Required
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof		1
	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof		1
	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements		1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal		1
	Credit 2.2 Construction Waste Management, Divert 75% from Disposal		1
1	Credit 3.1 Materials Reuse, 5%		1
	Credit 3.2 Materials Reuse, 10%		1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)		1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)		1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region		1
	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region		1
1	Credit 6 Rapidly Renewable Materials		1
1	Credit 7 Certified Wood		1
Yes			
11	Indoor Environmental Quality	15	Points
Y	Prereq 1 Minimum IAQ Performance		Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control		Required
1	Credit 1 Outdoor Air Delivery Monitoring		1
1	Credit 2 Increased Ventilation		1
	Credit 3.1 Construction IAQ Management Plan, During Construction		1
	Credit 3.2 Construction IAQ Management Plan, Before Occupancy		1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants		1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings		1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems		1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products		1
1	Credit 5 Indoor Chemical & Pollutant Source Control		1
1	Credit 6.1 Controllability of Systems, Lighting		1
1	Credit 6.2 Controllability of Systems, Thermal Comfort		1
1	Credit 7.1 Thermal Comfort, Design		1
	Credit 7.2 Thermal Comfort, Verification		1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces		1
	Credit 8.2 Daylight & Views, Views for 90% of Spaces		1
Yes			
3	Innovation & Design Process	5	Points
1	Credit 1.1 Innovation in Design: Provide Specific Title		1
1	Credit 1.2 Innovation in Design: Provide Specific Title		1
	Credit 1.3 Innovation in Design: Provide Specific Title		1
	Credit 1.4 Innovation in Design: Provide Specific Title		1
1	Credit 2 LEED® Accredited Professional		1
Yes			
41	Project Totals (pre-certification estimates)	69	Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

Jefferson Arms
 St Louis, MO

Yes		
7	Sustainable Sites	14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
1	Credit 1 Site Selection	1
1	Credit 2 Development Density & Community Connectivity	1
1	Credit 3 Brownfield Redevelopment	1
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation, Parking Capacity	1
1	Credit 5.1 Site Development, Protect or Restore Habitat	1
1	Credit 5.2 Site Development, Maximize Open Space	1
1	Credit 6.1 Stormwater Design, Quantity Control	1
1	Credit 6.2 Stormwater Design, Quality Control	1
1	Credit 7.1 Heat Island Effect, Non-Roof	1
1	Credit 7.2 Heat Island Effect, Roof	1
1	Credit 8 Light Pollution Reduction	1
Yes		
2	Water Efficiency	5 Points
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction, 20% Reduction	1
1	Credit 3.2 Water Use Reduction, 30% Reduction	1
Yes		
6	Energy & Atmosphere	17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
4	Credit 1 Optimize Energy Performance	1 to 10
1	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
1	Credit 5 Measurement & Verification	1
1	Credit 6 Green Power	1
Yes		
8	Materials & Resources	13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse, 5%	1
1	Credit 3.2 Materials Reuse, 10%	1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1
1	Credit 6 Rapidly Renewable Materials	1
1	Credit 7 Certified Wood	1
Yes		
6	Indoor Environmental Quality	15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
1	Credit 1 Outdoor Air Delivery Monitoring	1
1	Credit 2 Increased Ventilation	1
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5 Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1 Controllability of Systems, Lighting	1
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1
1	Credit 7.1 Thermal Comfort, Design	1
1	Credit 7.2 Thermal Comfort, Verification	1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1
Yes		
2	Innovation & Design Process	5 Points
1	Credit 1.1 Innovation in Design: Provide Specific Title	1
1	Credit 1.2 Innovation in Design: Provide Specific Title	1
1	Credit 1.3 Innovation in Design: Provide Specific Title	1
1	Credit 1.4 Innovation in Design: Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
31	Project Totals (pre-certification estimates)	69 Points

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



LEED-NC Version 2.2 Registered Project Checklist
 Duke French Family Sciences
 Durham, NC

Yes		
11	Sustainable Sites	14 Points
Y	Prereq 1 Construction Activity Pollution Prevention	Required
1	Credit 1 Site Selection	1
1	Credit 2 Development Density & Community Connectivity	1
1	Credit 3 Brownfield Redevelopment	1
1	Credit 4.1 Alternative Transportation, Public Transportation Access	1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4 Alternative Transportation, Parking Capacity	1
1	Credit 5.1 Site Development, Protect or Restore Habitat	1
1	Credit 5.2 Site Development, Maximize Open Space	1
1	Credit 6.1 Stormwater Design, Quantity Control	1
1	Credit 6.2 Stormwater Design, Quality Control	1
1	Credit 7.1 Heat Island Effect, Non-Roof	1
1	Credit 7.2 Heat Island Effect, Roof	1
1	Credit 8 Light Pollution Reduction	1
Yes		
2	Water Efficiency	5 Points
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2 Innovative Wastewater Technologies	1
1	Credit 3.1 Water Use Reduction, 20% Reduction	1
1	Credit 3.2 Water Use Reduction, 30% Reduction	1
Yes		
2	Energy & Atmosphere	17 Points
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2 Minimum Energy Performance	Required
Y	Prereq 3 Fundamental Refrigerant Management	Required
1	Credit 1 Optimize Energy Performance	1 to 10
1	Credit 2 On-Site Renewable Energy	1 to 3
1	Credit 3 Enhanced Commissioning	1
1	Credit 4 Enhanced Refrigerant Management	1
1	Credit 5 Measurement & Verification	1
1	Credit 6 Green Power	1
Yes		
8	Materials & Resources	13 Points
Y	Prereq 1 Storage & Collection of Recyclables	Required
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal	1
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1 Materials Reuse, 5%	1
1	Credit 3.2 Materials Reuse, 10%	1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region	1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region	1
1	Credit 6 Rapidly Renewable Materials	1
1	Credit 7 Certified Wood	1
Yes		
6	Indoor Environmental Quality	15 Points
Y	Prereq 1 Minimum IAQ Performance	Required
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required
1	Credit 1 Outdoor Air Delivery Monitoring	1
1	Credit 2 Increased Ventilation	1
1	Credit 3.1 Construction IAQ Management Plan, During Construction	1
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems	1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5 Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1 Controllability of Systems, Lighting	1
1	Credit 6.2 Controllability of Systems, Thermal Comfort	1
1	Credit 7.1 Thermal Comfort, Design	1
1	Credit 7.2 Thermal Comfort, Verification	1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces	1
Yes		
2	Innovation & Design Process	5 Points
1	Credit 1.1 Innovation in Design: Provide Specific Title	1
1	Credit 1.2 Innovation in Design: Provide Specific Title	1
1	Credit 1.3 Innovation in Design: Provide Specific Title	1
1	Credit 1.4 Innovation in Design: Provide Specific Title	1
1	Credit 2 LEED® Accredited Professional	1
Yes		
31	Project Totals (pre-certification estimates)	69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points		



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LEED-NC Version 2.2 Registered Project Checklist

4275 Dean Martin
 Las Vegas, NV

Yes
7 Sustainable Sites 14 Points

Y	Prereq 1	Construction Activity Pollution Prevention	Required
1	Credit 1	Site Selection	1
1	Credit 2	Development Density & Community Connectivity	1
1	Credit 3	Brownfield Redevelopment	1
1	Credit 4.1	Alternative Transportation, Public Transportation Access	1
1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4	Alternative Transportation, Parking Capacity	1
	Credit 5.1	Site Development, Protect or Restore Habitat	1
	Credit 5.2	Site Development, Maximize Open Space	1
	Credit 6.1	Stormwater Design, Quantity Control	1
	Credit 6.2	Stormwater Design, Quality Control	1
	Credit 7.1	Heat Island Effect, Non-Roof	1
	Credit 7.2	Heat Island Effect, Roof	1
1	Credit 8	Light Pollution Reduction	1

Yes
2 Water Efficiency 5 Points

	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
	Credit 2	Innovative Wastewater Technologies	1
1	Credit 3.1	Water Use Reduction, 20% Reduction	1
	Credit 3.2	Water Use Reduction, 30% Reduction	1

Yes
11 Energy & Atmosphere 17 Points

Y	Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2	Minimum Energy Performance	Required
Y	Prereq 3	Fundamental Refrigerant Management	Required
6	Credit 1	Optimize Energy Performance	1 to 10
2	Credit 2	On-Site Renewable Energy	1 to 3
1	Credit 3	Enhanced Commissioning	1
	Credit 4	Enhanced Refrigerant Management	1
1	Credit 5	Measurement & Verification	1
1	Credit 6	Green Power	1

Yes
6 Materials & Resources 13 Points

Y	Prereq 1	Storage & Collection of Recyclables	Required
	Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
	Credit 1.2	Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
	Credit 1.3	Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1	Construction Waste Management, Divert 50% from Disposal	1
	Credit 2.2	Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1	Materials Reuse, 5%	1
	Credit 3.2	Materials Reuse, 10%	1
1	Credit 4.1	Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
	Credit 4.2	Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1	Regional Materials, 10% Extracted, Processed & Manufactured Regiona	1
1	Credit 5.2	Regional Materials, 20% Extracted, Processed & Manufactured Regiona	1
1	Credit 6	Rapidly Renewable Materials	1
	Credit 7	Certified Wood	1

Yes
4 Indoor Environmental Quality 15 Points

Y	Prereq 1	Minimum IAQ Performance	Required
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
	Credit 1	Outdoor Air Delivery Monitoring	1
	Credit 2	Increased Ventilation	1
	Credit 3.1	Construction IAQ Management Plan, During Construction	1
	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
	Credit 4.2	Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3	Low-Emitting Materials, Carpet Systems	1
	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1
	Credit 5	Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1	Controllability of Systems, Lighting	1
	Credit 6.2	Controllability of Systems, Thermal Comfort	1
	Credit 7.1	Thermal Comfort, Design	1
	Credit 7.2	Thermal Comfort, Verification	1
	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

Yes
2 Innovation & Design Process 5 Points

1	Credit 1.1	Innovation in Design: Provide Specific Title	1
	Credit 1.2	Innovation in Design: Provide Specific Title	1
	Credit 1.3	Innovation in Design: Provide Specific Title	1
	Credit 1.4	Innovation in Design: Provide Specific Title	1
1	Credit 2	LEED® Accredited Professional	1

Yes
32 Project Totals (pre-certification estimates) 69 Points

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



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

1700 Building
 Portland, Or

Yes			
9	Sustainable Sites		14 Points
Y	Prereq 1	Construction Activity Pollution Prevention	Required
1	Credit 1	Site Selection	1
1	Credit 2	Development Density & Community Connectivity	1
	Credit 3	Brownfield Redevelopment	1
1	Credit 4.1	Alternative Transportation, Public Transportation Access	1
1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
	Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1
1	Credit 4.4	Alternative Transportation, Parking Capacity	1
1	Credit 5.1	Site Development, Protect or Restore Habitat	1
	Credit 5.2	Site Development, Maximize Open Space	1
1	Credit 6.1	Stormwater Design, Quantity Control	1
1	Credit 6.2	Stormwater Design, Quality Control	1
	Credit 7.1	Heat Island Effect, Non-Roof	1
	Credit 7.2	Heat Island Effect, Roof	1
1	Credit 8	Light Pollution Reduction	1
Yes			
3	Water Efficiency		5 Points
1	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
	Credit 2	Innovative Wastewater Technologies	1
1	Credit 3.1	Water Use Reduction, 20% Reduction	1
	Credit 3.2	Water Use Reduction, 30% Reduction	1
Yes			
6	Energy & Atmosphere		17 Points
Y	Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
Y	Prereq 2	Minimum Energy Performance	Required
Y	Prereq 3	Fundamental Refrigerant Management	Required
4	Credit 1	Optimize Energy Performance	1 to 10
	Credit 2	On-Site Renewable Energy	1 to 3
1	Credit 3	Enhanced Commissioning	1
	Credit 4	Enhanced Refrigerant Management	1
1	Credit 5	Measurement & Verification	1
	Credit 6	Green Power	1
Yes			
6	Materials & Resources		13 Points
Y	Prereq 1	Storage & Collection of Recyclables	Required
	Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors & Roof	1
	Credit 1.2	Building Reuse, Maintain 100% of Existing Walls, Floors & Roof	1
	Credit 1.3	Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1	Credit 2.1	Construction Waste Management, Divert 50% from Disposal	1
	Credit 2.2	Construction Waste Management, Divert 75% from Disposal	1
1	Credit 3.1	Materials Reuse, 5%	1
	Credit 3.2	Materials Reuse, 10%	1
1	Credit 4.1	Recycled Content, 10% (post-consumer + ½ pre-consumer)	1
	Credit 4.2	Recycled Content, 20% (post-consumer + ½ pre-consumer)	1
1	Credit 5.1	Regional Materials, 10% Extracted, Processed & Manufactured Region	1
	Credit 5.2	Regional Materials, 20% Extracted, Processed & Manufactured Region	1
1	Credit 6	Rapidly Renewable Materials	1
1	Credit 7	Certified Wood	1
Yes			
31	Indoor Environmental Quality		15 Points
Y	Prereq 1	Minimum IAQ Performance	Required
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
	Credit 1	Outdoor Air Delivery Monitoring	1
	Credit 2	Increased Ventilation	1
	Credit 3.1	Construction IAQ Management Plan, During Construction	1
1	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
11	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2	Low-Emitting Materials, Paints & Coatings	1
1	Credit 4.3	Low-Emitting Materials, Carpet Systems	1
1	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5	Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1	Controllability of Systems, Lighting	1
1	Credit 6.2	Controllability of Systems, Thermal Comfort	1
1	Credit 7.1	Thermal Comfort, Design	1
1	Credit 7.2	Thermal Comfort, Verification	1
	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
11	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1
Yes			
3	Innovation & Design Process		5 Points
1	Credit 1.1	Innovation in Design: Provide Specific Title	1
1	Credit 1.2	Innovation in Design: Provide Specific Title	1
	Credit 1.3	Innovation in Design: Provide Specific Title	1
	Credit 1.4	Innovation in Design: Provide Specific Title	1
1	Credit 2	LEED® Accredited Professional	1
Yes			
58	Project Totals (pre-certification estimates)		69 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			



LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

Two Potomac Yard
 Arlington, VA

Yes			
9	Sustainable Sites	14 Points	
Y	Prereq 1 Construction Activity Pollution Prevention	Required	
1	Credit 1 Site Selection		1
1	Credit 2 Development Density & Community Connectivity		1
1	Credit 3 Brownfield Redevelopment		1
1	Credit 4.1 Alternative Transportation, Public Transportation Access		1
1	Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms		1
1	Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles		1
1	Credit 4.4 Alternative Transportation, Parking Capacity		1
1	Credit 5.1 Site Development, Protect or Restore Habitat		1
1	Credit 5.2 Site Development, Maximize Open Space		1
1	Credit 6.1 Stormwater Design, Quantity Control		1
1	Credit 6.2 Stormwater Design, Quality Control		1
1	Credit 7.1 Heat Island Effect, Non-Roof		1
1	Credit 7.2 Heat Island Effect, Roof		1
1	Credit 8 Light Pollution Reduction		1
Yes			
2	Water Efficiency	5 Points	
1	Credit 1.1 Water Efficient Landscaping, Reduce by 50%		1
1	Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation		1
1	Credit 2 Innovative Wastewater Technologies		1
1	Credit 3.1 Water Use Reduction, 20% Reduction		1
1	Credit 3.2 Water Use Reduction, 30% Reduction		1
Yes			
7	Energy & Atmosphere	17 Points	
Y	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required	
Y	Prereq 2 Minimum Energy Performance	Required	
Y	Prereq 3 Fundamental Refrigerant Management	Required	
5	Credit 1 Optimize Energy Performance		1 to 10
1	Credit 2 On-Site Renewable Energy		1 to 3
1	Credit 3 Enhanced Commissioning		1
1	Credit 4 Enhanced Refrigerant Management		1
1	Credit 5 Measurement & Verification		1
1	Credit 6 Green Power		1
Yes			
8	Materials & Resources	13 Points	
Y	Prereq 1 Storage & Collection of Recyclables	Required	
1	Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floors & Roof		1
1	Credit 1.2 Building Reuse, Maintain 100% of Existing Walls, Floors & Roof		1
1	Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements		1
1	Credit 2.1 Construction Waste Management, Divert 50% from Disposal		1
1	Credit 2.2 Construction Waste Management, Divert 75% from Disposal		1
1	Credit 3.1 Materials Reuse, 5%		1
1	Credit 3.2 Materials Reuse, 10%		1
1	Credit 4.1 Recycled Content, 10% (post-consumer + ½ pre-consumer)		1
1	Credit 4.2 Recycled Content, 20% (post-consumer + ½ pre-consumer)		1
1	Credit 5.1 Regional Materials, 10% Extracted, Processed & Manufactured Region		1
1	Credit 5.2 Regional Materials, 20% Extracted, Processed & Manufactured Region		1
1	Credit 6 Rapidly Renewable Materials		1
1	Credit 7 Certified Wood		1
Yes			
12	Indoor Environmental Quality	15 Points	
Y	Prereq 1 Minimum IAQ Performance	Required	
Y	Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required	
1	Credit 1 Outdoor Air Delivery Monitoring		1
1	Credit 2 Increased Ventilation		1
1	Credit 3.1 Construction IAQ Management Plan, During Construction		1
1	Credit 3.2 Construction IAQ Management Plan, Before Occupancy		1
1	Credit 4.1 Low-Emitting Materials, Adhesives & Sealants		1
1	Credit 4.2 Low-Emitting Materials, Paints & Coatings		1
1	Credit 4.3 Low-Emitting Materials, Carpet Systems		1
1	Credit 4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products		1
1	Credit 5 Indoor Chemical & Pollutant Source Control		1
1	Credit 6.1 Controllability of Systems, Lighting		1
1	Credit 6.2 Controllability of Systems, Thermal Comfort		1
1	Credit 7.1 Thermal Comfort, Design		1
1	Credit 7.2 Thermal Comfort, Verification		1
1	Credit 8.1 Daylight & Views, Daylight 75% of Spaces		1
1	Credit 8.2 Daylight & Views, Views for 90% of Spaces		1
Yes			
3	Innovation & Design Process	5 Points	
1	Credit 1.1 Innovation in Design: Provide Specific Title		1
1	Credit 1.2 Innovation in Design: Provide Specific Title		1
1	Credit 1.3 Innovation in Design: Provide Specific Title		1
1	Credit 1.4 Innovation in Design: Provide Specific Title		1
1	Credit 2 LEED® Accredited Professional		1
Yes			
41	Project Totals (pre-certification estimates)	69 Points	
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			

Detailed Project Schedule Summary

The Harrisburg University of Science and Technology had begun design work for their first building in August of 2005, not yet two years after the University opened its doors for students. It has been using office buildings within three blocks of the construction site of their Academic Center and will be occupying them until the winter semester of 2009. The project completion date is set for November 25, 2008.

Finish sequence milestones begin at the end of the first quarter in 2008-the middle of March with the first two floors clean-out scheduled. The next five floors (3-9) will be for a parking garage and therefore finishing of these levels will come near project completion. Floors 10 and 11 have a finish date of the beginning of April and finishes for the last (16th) floor where the HVAC system will be housed is scheduled for late October 2008.

For the core-shell package, interior work is completed in a sequence that allows for phased finishing by floor. Each crew works each floor start to finish and then moves on to the floor above to repeat the process. This sequencing method allows for the substantial completion of the building, the project to be fast-tracked, and have separate core-shell and fit-out packages with more than 60 contracts. The phased completion of each floor is in approximate two week increments, with some slight differences in the parking garage levels.

The following pages consist of the construction schedule, first of which is the preliminary overview schedule, continued by a detailed schedule with highlights of each floor. Due to the events of construction and the complexity of the project, many items were left out but the milestone dates and general durations are noted.

Activity Description Days Start Finish AUG 2005- DEC 06 2007 2008
 J F M A M J J A S O N D J F M A M J J A S O N D

Activity Description	Days	Start	Finish	AUG 2005- DEC 06	2007	2008
Curatin Wall Shop Drawings	15	JUL 11 07	JUL 31 07			
Fit Out General Trades	15	JUL 25 07	AUG 14 07			
Ground Floor Duct Drawings	15	JUL 25 07	AUG 14 07			
Fit Out MEP	60	JUL 25 07	OCT 17 07			
Core and Shell Technology	60	AUG 11 07	NOV 07 07			
Fit Out Technology	60	AUG 11 07	NOV 07 07			
Wood Veneer Wall Covering/ Casework Mockup	15	MAR 20 08	APR 09 08			
Cast-in-Place Plumbing Equipment Fab	10	JUL 25 07	AUG 07 07			
Architectural Precast Panel Connections	55	JUL 25 07	OCT 10 07			
HVAC Pumps and Heat Exchangers Delivery	30	AUG 08 07	SEP 19 07			
Switchgear	60	AUG 15 07	NOV 07 07			
Elevators	130	AUG 15 07	FEB 20 08			
Wood Casework	60	APR 10 08	JUL 03 08			
Demo Storm Swear Piping at 4th street	1	JUL 25 07	JUL 25 07			
Site Fire Line	1	AUG 29 07	AUG 29 07			
Site Domestic Water	1	AUG 29 07	AUG 29 07			
Install 15inch Sanitary to Market Street Sewer	5	SEP 06 07	SEP 13 07			
Install Gas Supply Underground	1	SEP 07 07	SEP 07 07			
Install 8 inch CWS CWR	5	SEP 07 07	SEP 14 07			
Install CAT 5 Underground	2	SEP 13 07	SEP 14 07			
Install Telephone Underground	2	SEP 13 07	SEP 14 07			
Install Emergency Generator	2	SEP 13 07	SEP 14 07			

◆ Represents key milestone dates as per discussion of project schedule with owner requirements for occupancy, especially completion.

HARRISBURG UNIVERSITY ACADEMIC CENTER
 DETAILED PROJECT SCHEDULE

Activity Description	Days	Start	Finish	2008																							
				AUG 2005-DEC 06	2007					2008																	
				J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Erect Floor Detail and Deck	7	AUG 08 07	AUG 16 07																								
Install Pipe and Duct Hangers	10	AUG 08 07	AUG 21 07																								
Set Duct in Chases	5	OCT 03 07	OCT 09 07																								
Erect Floor Columns and 7th Fl Structural	2	NOV 14 07	NOV 15 07																								
Erect Floor Detail and Deck	7	AUG 17 07	AUG 27 07																								
Erect Precast Panels	10	SEP 12 07	SEP 25 07																								
Stairway, Elev Shaft, Vert Chase Masonry	3	NOV 15 07	NOV 19 07																								
Erect Floor Columns and 8th Fl Structural	6	NOV 27 07	DEC 04 07																								
Erect Floor Detail and Deck	7	AUG 08 07	SEP 11 07																								
Install Pipe and Duct Hangers	10	AUG 08 07	OCT 29 07																								
HVAC Piping	5	DEC 06 07	DEC 12 07																								
Gas Piping	5	DEC 07 07	DEC 12 07																								
Erect Floor Columns and 9th Fl Structural	1	SEP 07 07	SEP 07 07																								
Erect Floor Detail and Deck	7	OCT 02 07	OCT 15 07																								
Set Steel Stairways	10	OCT 23 07	OCT 30 07																								
Cable Rails	6	NOV 06 07	NOV 12 07																								
Spray on Fireproofing	5	NOV 15 07	NOV 21 07																								
Erect Floor Detail and Deck	5	SEP 18 07	OCT 01 07																								
Erect Floor Columns and 10th Fl Structural	10	SEP 19 07	SEP 26 07																								
Prep and Pour Floor Slab	6	OCT 23 07	OCT 29 07																								
Concrete Column Encasement	10	OCT 30 07	NOV 12 07																								
Temporary Handrails at Floor Openings	2	NOV 01 07	NOV 02 07																								

◆ Represents key milestone dates as per discussion of project schedule with owner requirements for occupancy, especially completion.

HARRISBURG UNIVERSITY ACADEMIC CENTER
 DETAILED PROJECT SCHEDULE

Activity Description	Days	Start	Finish	2008																							
				AUG 2005- DEC 06	2007																						
				J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
10th Floor																											
Erect Floor Columns and 11th Fl Structural	6	SEP 27 07	OCT 04 07																								
Erect Floor Detail and Deck	7	OCT 16 07	OCT 24 07																								
Set Hollow Metal Frames	3	NOV 14 07	NOV 16 07																								
Install Pipe and Duct Hangers	5	NOV 15 07	NOV 21 07																								
Gas Piping	6	DEC 31 07	JAN 08 08																								
Acid Waste Piping	7	JAN 02 08	JAN 10 08																								
Drywall and Insulate Exterior Walls	15	JAN 02 08	JAN 22 08																								
11th Floor																											
Erect Floor Columns and 12th Fl Structural	6	OCT 05 07	OCT 12 07																								
Erect Floor Detail and Deck	7	OCT 05 07	OCT 15 07																								
Electrical Rough Ins	5	OCT 16 07	OCT 22 07																								
Lab Vacuum	5	NOV 15 07	NOV 21 07																								
Electrical Wall Rough Ins and Sleeves	3	JAN 16 08	JAN 18 08																								
12th Floor																											
Erect Floor Columns and 13th Fl Structural	6	OCT 16 07	OCT 23 07																								
Erect Floor Detail and Deck	7	NOV 01 07	NOV 09 07																								
Sprinkler Rough Ins	2	JAN 11 08	JAN 14 08																								
Stormwater Piping	2	JAN 21 08	JAN 22 08																								
Drywall Mechanical Chases	6	JAN 22 08	JAN 29 08																								
13th Floor																											
Erect Floor Columns and 14th Fl Structural	3	OCT 23 07	OCT 30 07																								
Erect Floor Detail and Deck	6	OCT 23 07	OCT 31 07																								
Domestic Water Piping	18	MAR 03 08	MAR 26 08																								
Plumbing Pipe Insulation	12	MAR 11 08	MAR 26 08																								
Plumbing Fixtures	8	APR 25 08	MAY 06 08																								

◆ Represents key milestone dates as per discussion of project schedule with owner requirements for occupancy, especially completion.

HARRISBURG UNIVERSITY ACADEMIC CENTER
 DETAILED PROJECT SCHEDULE

Activity Description		Days	Start	Finish	AUG 2005- DEC 06	2007	2008
					J F M A M J J A S O N D J J F M A M J J A S O N D		
14th Floor	Erect Floor Columns and 15th Fl Structural	5	OCT 31 07	NOV 06 07			
	Erect Floor Detail and Deck	7	DEC 03 07	DEC 11 07			
	Water Feature	5	JAN 29 08	FEB 04 08			
	Waterproofing	2	FEB 05 08	FEB 06 08			
	Stairway, Elev Shaft, Vert Chase Masonry	6	FEB 06 08	FEB 13 08			
	Erect Floor Columns and 16th Fl Structural	5	NOV 07 07	NOV 13 07			
15th Floor	Erect Floor Detail and Deck	7	NOV 19 07	NOV 30 07			
	Weld Nelson Studs	2	DEC 03 07	DEC 04 07			
	Prep and pour Floor Slabs	4	DEC 21 07	DEC 27 07			
	Ductwork	15	FEB 18 08	MAR 07 08			
	HVAC Piping	15	MAR 10 08	MAR 28 08			
	Erect Floor Columns and Roof Structural	3	NOV 14 07	NOV 16 07			
16th Floor	Erect Floor Detail and Deck	7	DEC 03 07	DEC 11 07			
	Infill Steel and Slab Above Chiller	3	JAN 07 08	JAN 09 08			
	Prep and pour Floor Slabs	4	JAN 10 08	JAN 15 08			
	Erect Floor Perimeter Roof Structure	2	FEB 11 08	FEB 12 08			
	Install Pipe and Duct Hangers	5	FEB 19 08	FEB 25 08			
	Acid Vent Piping	5	APR 16 08	APR 22 08			
	Erect Roof Deck	7	DEC 12 07	DEC 20 07			
	Erect and Glaze North Curtain Wall	5	DEC 21 07	DEC 28 07			
	Install Window Washer Tie-Off Anchors	5	DEC 21 07	DEC 28 07			
	Roof Insulation	5	FEB 19 08	FEB 25 08			

◆ Represents key milestone dates as per discussion of project schedule with owner requirements for occupancy, especially completion.

HARRISBURG UNIVERSITY ACADEMIC CENTER
 DETAILED PROJECT SCHEDULE

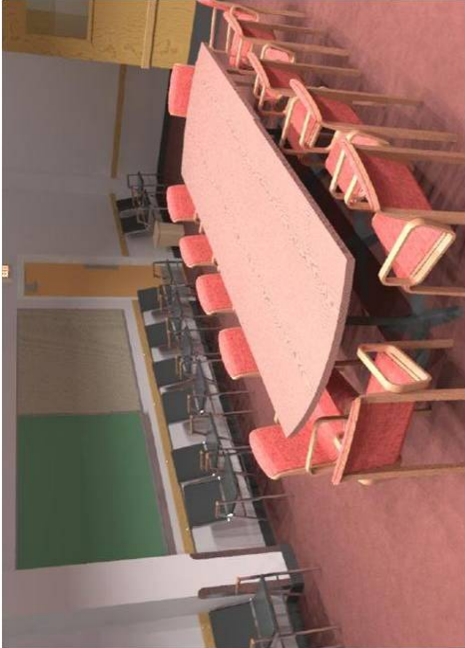
Activity Description	Days	Start	Finish	2008													
				AUG 2005-DEC 06													
				J	F	M	A	M	J	J	A	S	O	N	D		
Elev Mech Room Framing and Sheathing	5	FEB 19 08	FEB 25 08														
EPDM Roofing	5	MAR 06 08	MAR 12 08														
Install Elevators	90	APR 24 08	AUG 29 08														
Erect and Glaze South Curtain Wall	5	SEP 09 08	SEP 15 08														
Final Cleaning of Roof	5	JUN 12 08	JUN 18 08														
On Site Design Session	1	NOV 01 07	NOV 01 07														
On Site Design Session	1	DEC 07 07	DEC 07 07														
100% CDs Issued by Reynolds	1	JAN 31 08	JAN 31 08														
Bidding Phase of Fit Out	20	FEB 01 08	FEB 28 08														
Negotiation and Award	42	MAR 03 08	APR 29 08														
Offsite Network Systems Burn In	58	MAY 01 08	JUL 23 08														
Building Network Construction Phase	78	MAY 01 08	AUG 20 08														
Onsite Network Installation	27	JUL 24 08	AUG 29 08														
Network Commissioning and Univ Move In	77	SEP 02 08	DEC 19 08														
Fit Out Substantial Completion	0	OCT 22 08	OCT 22 08														
Punch Lists	18	OCT 23 08	DEC 19 08														
Fit Out Completion	0	NOV 17 08	NOV 17 08														

◆ Represents key milestone dates as per discussion of project schedule with owner requirements for occupancy, especially completion.

HARRISBURG UNIVERSITY ACADEMIC CENTER
 DETAILED PROJECT SCHEDULE



(a)



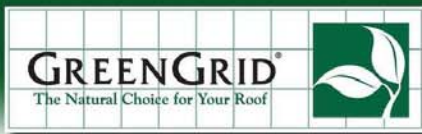
(b)

Comparison of Office Space with traditional Fluorescent lighting (a) and daylighting (b).

Regularly Occupied Space ID	Regularly Occupied Space Name	Regularly Occupied Space Area (SF)	Sidelighting Vision Glazing		Sidelighting Daylight Glazing		Toplighting Sawtooth Monitor		Toplighting Vertical Monitor		Toplighting Horizontal Skylight		Glazing Factor
			Area (SF)	T _{vis}	Area (SF)	T _{vis}	Area (SF)	T _{vis}	Area (SF)	T _{vis}	Area (SF)	T _{vis}	
1201	Office	215	148	0.9	74	0.7	0	N/A	0	N/A	0	N/A	2.7
1205	Office	215	68	0.9	32	0.7	0	N/A	0	N/A	0	N/A	3.9
1206	Office	215	68	0.9	32	0.7	0	N/A	0	N/A	0	N/A	3.9
1210	Open Office (Daylit Area)	566	80	0.9	13	0.7	0	N/A	0	N/A	0	N/A	2.8
1212	Office (Non Daylit Area)	215	0	0.9	0	0.7	0	N/A	0	N/A	0	N/A	0
1219	Open Office	2,678	224	0.9	56	0.7	0	N/A	0	N/A	0	N/A	2.0

Total Regularly Occupied Space Area (SF)	Total Regularly Occupied Space Area with a Minimum 2% Glazing Factor	Percentage of Regularly Occupied Space with a 2% Glazing Factor
4,104	3,889	95%

Glazing Factor Tabulation Spreadsheet



The PREMIER Green Roof System

Fact Sheet

GreenGrid® and LEED® Certification

LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN

Leadership in Energy and Environmental Design (LEED®) is the green building rating system developed by the United States Green Building Council (USGBC). The intent is to provide a standard certification process that registers buildings constructed with environmental performance, efficiency, and occupant health and well-being as primary goals. Buildings receive points towards varying levels of certification based on the set of categories established by the USGBC.

GREENGRID® GREEN ROOF SYSTEM

The GreenGrid® green roof system is an innovative, modular approach to green roof technology. Green roofs have a number of benefits that have been proven for years in Europe and more recently in North America. For example, the National Research Council Canada found that in buildings less than three stories in height, a green roof can reduce average daily energy demands for cooling by 50% or more compared to a typical flat roof. As a result, reductions in the size of mechanical equipment, such as, air conditioning equipment are possible. Additionally, stormwater runoff can be reduced by up to 95% following a 1-inch rain event, lowering the impact of a building on the municipal storm drainage system and the surrounding watershed. The GreenGrid® system's modular design allows for a lighter green roof, faster installation (increasing cost effectiveness), and easier post-installation repairs (or changes) to roofs compared to traditional built-in-place green roof systems. The modules are made from a minimum of 60% post-industrial recycled plastic (HDPE), some edge treatment options are made from recycled metals or plastic and sawdust, and pavers are made from 100% post-industrial recycled rubber.

GREENGRID® AND LEED CERTIFICATION POINTS

A GreenGrid® green roof can help contribute towards a building's LEED certification in a number of different categories. Although any green roof may assist with certification in some areas, specific features of the GreenGrid® system can further enhance the rating in some categories that would not apply to a traditional green roof. The major categories of the USGBC rating system and potential points achievable with a GreenGrid® green roof include the following:



Sustainable Sites

Stormwater Design: Quantity Control – SS Credit 6.1 – A GreenGrid® roof can prevent a post-development stormwater discharge peak rate associated with the building's footprint from exceeding that of pre-development and reduce stormwater discharge by more than 25% (rate and quantity). Green roofs may also be considered as stormwater treatment through their ability to remove suspended solids and other pollutants. **Potential Points: 1 point**

Heat Island Effect: Roof – SS Credit 7.2 – A GreenGrid® roof can reduce roof temperatures from summertime highs of 150°F to less than 80°F. The USGBC specifies green roofs as a way to meet this objective, when the green roof installation covers at least 50% of the roof surface. **Potential Points: 1 point**





The PREMIER Green Roof System

Fact Sheet GreenGrid® and LEED® Certification

Water Efficiency

Water Efficient Landscaping – WE Credit 1.1 – GreenGrid® roofs can be designed so that irrigation is not required. Drought-resistant plants can be selected or greywater systems can be directed onto the roof to irrigate. As an added benefit, runoff from the green roof is filtered by the vegetation and soil media, so this water can be used to irrigate other landscaping features without pretreatment. **Potential Points: 1 to 2 points**

Energy and Atmosphere

Optimize Energy Performance – EA Credit 1 – Green roofs have been documented to reduce energy demand by more than 50% annually in certain types of structures. Reduced demand and increased efficiency may also lead to smaller cooling systems and lower capital costs. **Potential Points: 1 to 8 points**, depending on total energy reduction as a percent versus conventional buildings of the same size.

Materials and Resources

Recycled Content – MR Credit 4.1 – The GreenGrid® modules, pavers, and some edge treatment options are made from recycled materials and can be applied toward the goal of 5% to 10% of the total value of project materials originating from recycled material. **Potential Points: 1 to 2 points**, depending on the overall percent of recycled project materials included in the project.



Regional Materials – MR Credit 5.1 – GreenGrid® systems are assembled and pre-planted prior to installation at local nurseries thus the system can contribute toward having 20% to 50% of a building's materials manufactured within a 500-mile radius. Since plants and media are obtained at local nurseries, the GreenGrid® can contribute to the 50% extracted regionally credit. **Potential Points: 1 to 2 points**

Innovation and Design Process

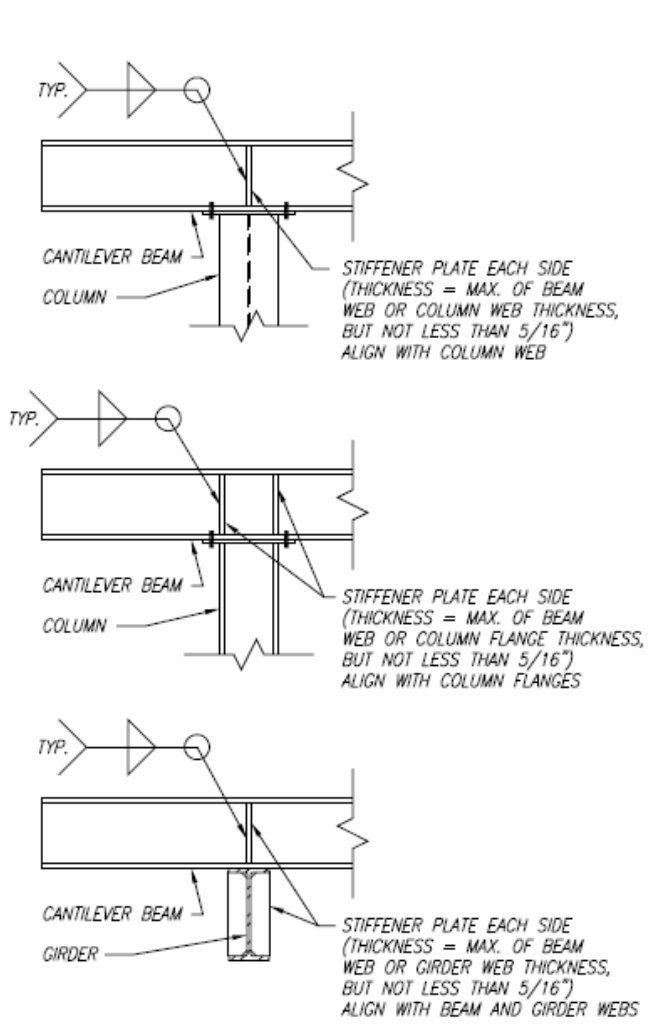
The GreenGrid® system may qualify for innovation and design credits by improving the workplace environment, creating an educational laboratory, or a recreational space. When combined with recycled rubber pavers, decorative edgings, benches, etc., the roof can become a useable space for meetings and relaxation. In addition, green roofs can reduce exterior sound by up to 40%, increasing a building's acoustic performance which is an element not covered by LEED®. **Potential Points: 1 to 2 points**

IN SUMMARY

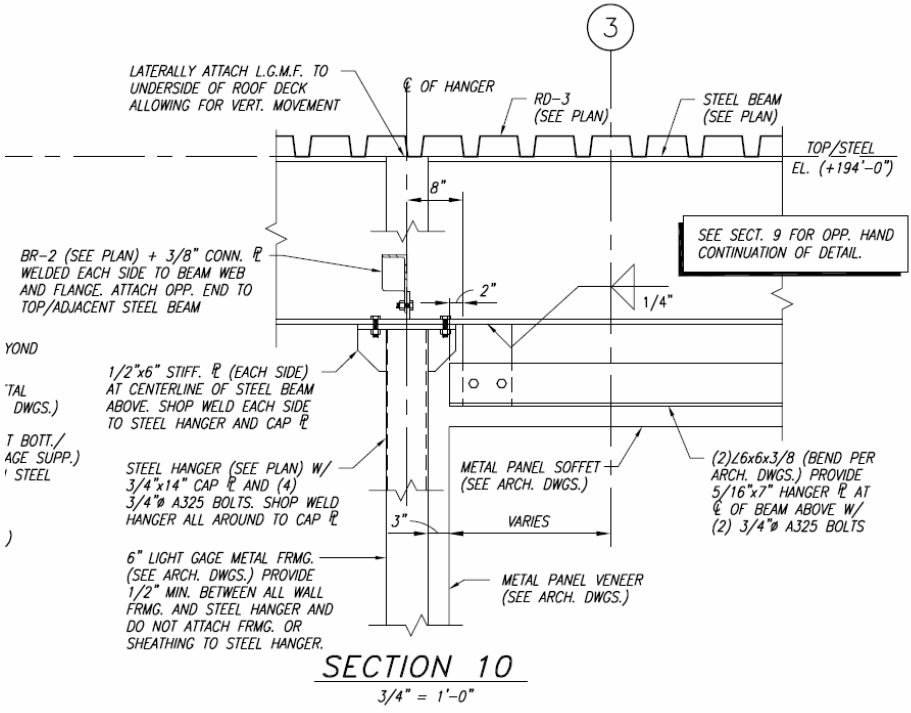
Overall, the GreenGrid® Green Roof system installed on 50% or more of the roof surface virtually guarantees 2 LEED® points and can contribute towards an additional 7+ points towards LEED® certification, almost 25% of the total needed to certify.

For more information on the GreenGrid® green roof system, visit www.GreenGridRoofs.com, send us an email at GreenGridRoofs@WestonSolutions.com, or call us at 847-918-4000.



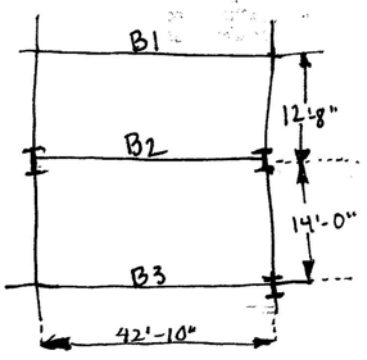


DETAILS AT CANTILEVER BEAMS



① Green Roof Load Calculations

Current roof deck is:
 Vulcraft 3N20 deck galvanized
 w/ beams W24 x 76
 conditions - 2 span, various spacing



Analyzing for
 * B2 *

DEAD LOADS:

- + Deck
 - + Rigid insulation
 - + Built-up roof
 - + Misc.
 - + GREEN WET ROOFING
- } 40 psf
 + 22 psf

LIVE LOAD:
 55 psf (snow, misc)

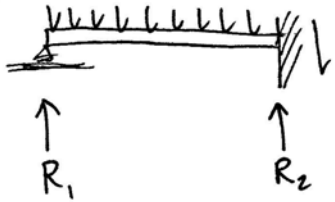
$$\begin{aligned} \text{Total load} &= 1.2D + 1.6L \\ &= 1.2(66) + (55)1.6 = \underline{167.2 \text{ psf}} \\ &\sim 167 \text{ psf w/ Green roof} \end{aligned}$$

* New loading uses Vulcraft 3N16 galv. decking

$$A_w = \frac{(14'-0'' + 12'-8'')}{2} = 13.4 \text{ feet}$$

$$167 \text{ psf} \times 13.4 \text{ ft} = 2,240.48 \text{ plf} \text{ or } \underline{\underline{2.24 \text{ klf}}}$$

2



Uniformly distributed load on beam
 fixed on north end
 pinned on south end

$F_y = 50 \text{ ksi}$
 ࣘ
 adequately braced

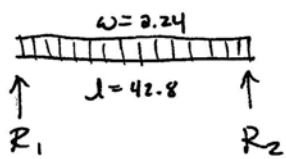
* current loading capacity for W 24x76 = 484 K-ft

$w = 2.24 \text{ klf}$
 $l = 42.8 \text{ feet}$

$\therefore wl = 95.9 \text{ kips}$

$R_1 = R_2 = \frac{95.9 \text{ kips}}{2} = 47.9 \text{ kips}$

$V_u = 47.9 \text{ kips}$

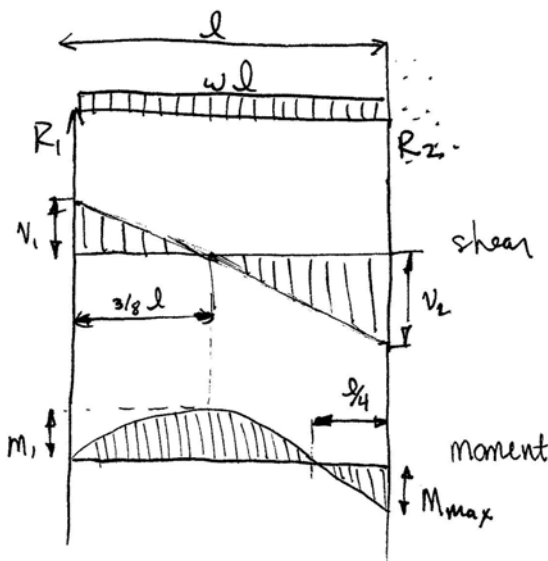


* Fixed-pinned beam, uniformly distributed load

$R_1 = V_1 ; R_2 = V_2 = V_{max}$

$R_1 = \frac{3wl}{8} = 36.0 \text{ k}$

$R_2 = \frac{5wl}{8} = 60.0 \text{ k}$



$M_1 \left(x = \frac{3}{8} l \right) = \frac{9wl^2}{128}$
 $= 288.5 \text{ K-ft}$

$M_{max} = \frac{wl^2}{8} = \frac{400}{8} = 512.9 \text{ K-ft}$

* exceeds beam capacity

③

Using W27x84 or W24x84

economical design (compact)

criteria $\rightarrow M_u \leq \phi M_n$

$V_u \leq \phi V_n$

flexural strength $\rightarrow \phi M_n$

$\phi = 0.9$ $F_y = 50$ ksi for A992 steel

$M_n = M_p = F_y Z_x$
 $= \frac{(50)(224)}{12}$ $\phi M_n = \frac{750}{810.0}$
 840 K-ft

$L_b = \infty \rightarrow$ laterally braced

$M_u \leq \phi_b M_{px} \rightarrow \phi_b M_{px} = 750$ K-ft (for 24x76) orig

$750 \geq 840$ \therefore ^{NOT} economical

$\phi V_n = 1.0 (0.6) F_y A_w \rightarrow \phi V_n = 1.0 (0.6) (50) (0.440) (24.7)$
 $= \underline{326}$ K _{not economical}

With green modular roofing system addition,

deck

would change from 3N20 to 3N16

and beam to W24x84

@ 22 psf "wet weight"

(4)

green roof modular addition would add

$$2(42'-10" \times 40'-8") \rightarrow 2(3,485 \text{ SF})$$

2'x2'x4" Module (wet) 27psf (3,485 SF) = 76,670 lbs
 or 38.3 tons

$$\$10-15 / \text{SF} \text{ for roof} \rightarrow \$34,850 - 52,280$$

for materials

$$\begin{aligned} &\sim \$8,000 - \text{del.} \\ &6,000 - \text{lab.} \\ &5,000 - \text{lift \& GC} \\ \hline &\$71,280 \end{aligned}$$

not including increase in roof deck, beams

- Roof Anchors - \$39,050.00
- Roofing/Sheet Metal - \$887,872.00
- Green Roof - \$71,280.00

Total \$ increase for roof +
 Sheet Metal package
 \$71,280

Total Cost
 \$998,152

% increase $\rightarrow 0.928$
 or
 190

Weight Matrix

Analysis	Research	Value Engineering	Constr. Review	Schedule Reduction	Total
LEED	20	10	5	5	40%
Daylighting	10	15	10	0	35%
Green Roof	5	5	10	5	25%
Total	35%	30%	25%	10%	100%

Bibliography

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