REDLAND TECHNOLOGY CENTER

540 Gaither Road, Rockville, MD

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Construction Management

Technical Assignment #1
September 29, 2008
Dr. Messner

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1.1 Executive Summary

The Redland Technology Center is a 4-building office complex located at 540 Gaither Road, Rockville, MD. It is conveniently located only ½ mile from I-270 and within walking distance of the Shady Grove Metro Station of the Washington D.C. metro system. It is located in a growing mixed-use community area where future tenants will be able to walk to work. Phase 1 was completed in 2004 by the James G. Davis Construction Corporation and included the Building 1 office building and much of the site work and utilities. Phase 2, currently under construction by Clark Construction Group, LLC, includes 2 more office buildings, Buildings 2 and 3, and a 6-story parking garage.

For my technical assignments, I will focus my research on Building 2. Building 2 is a 9-story, 210, 240 SF Class A office building. As the highlighted building of the complex, Building 2 has many features to separate it from the other two office buildings. Tenants of the complex will be able to enjoy a state-of-the-art fitness center with fully equipped locker rooms and on-site dining. The complex is situated on a 24.5 acre site with a 13 acre forest reserve. Many good views of the surrounding communities can be seen from atop Building 2. Clark's original contract was for core and shell office buildings. Core and shell means that Clark is only contracted to construct the structure, the façade, MEP/FP systems, and any other non-tenant space such as bathrooms and the fitness center. Perseus will have the option to contract Clark for the tenant fit out whenever a prospective tenant signs a lease.

Perseus Realty, LLC, the owner of the project, selected design-bid-build as the delivery method for the project. Perseus was founded in 2004 to buy and manage commercial property. The Redland Technology Center is Perseus' first new construction project with more to follow in the near future. Perseus has several employees with long construction experience and has proven to be an excellent partner to work with.

Redland Tech Center is seeking to obtain a LEED Silver certification. Most of the LEED credits that the project team has set as goals come from the design and owner. Perseus has hired an independent LEED consultant, Lorax Partnerships, to assist the project in meeting its LEED goals. Clark had to take the LEED requirements in to account whenever it procured subcontractors for the job. Provisions on how to obtain material resources and indoor air quality credits was detailed in the subs contracts.

This technical assignment details several general construction management topics of Redland Technology Center. It includes summaries of the project schedule and building systems, project cost evaluation, existing conditions, and other construction management issues.

1.2 Project Schedule Summary

DNC Architects did 4 months of preliminary design for the project back in 2004 following the completion of phase 1 of the Redland Tech Center complex. Whenever the project was given the go ahead in early 2007 by Perseus Realty, DNC picked up with the preliminary design and was able to deliver construction documents in 8 months.

Clark was able to sign the steel fabricator under contract because of their early involvement in the preconstruction process. This allowed the steel fabricator to place its order for steel and prepare to fabricate this long lead time item.

Clark was given a notice to proceed in December 2007 and immediately started work on the site. Site excavation and foundations were completed by March 21, 2008. In that time, 15,000 CY of soil was excavated and 46 caissons were drilled. Structural steel erection took almost 5 months to complete by the end of July 2008, erecting 1,300 tons for Building 2. The building is scheduled to be watertight by November 20, 2008, after which the interior finishing trades can commence their work. Final inspections and commissioning will take most of the April and May 2009 with substantial completion expected May 18, 2009.

Please view Appendix A of this technical assignment for the project schedule summary.

1.3 Building Systems Summary

Building Systems Checklist

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

Structural Steel

Redland Tech Center Building 2 is a 9-story structural steel office building with a braced frame to resist lateral loads. The steel fabricator and erector, Strait Steel, Inc. of Greencastle, PA, erected the 1,300 tons of steel in Building 2 in 3 months by a 200-ton crawler crane. Due to the size of crane used and sequencing method, Strait was able to use one pick location and lay down area during the erection of Building 2. The typical column size of the structure ranges from a W14x311 section at the first floor to a W14x43 section at the penthouse level. The typical beam size is a W21x44. Typical bay size is 30' x 30'. Building 2 uses a 3" composite metal deck system for the elevated floor slabs. Building 2 has 3 braced frames in the West-East direction and 2 braced frames in the North-South direction. Each braced frame uses 12" pipe in conjunction with the beams and columns to complete the lateral resisting system.

Cast-in-Place Concrete

The extent of cast-in-place (CIP) concrete work for Building 2 is limited to the caissons, grade beams, slab-on-grade (SOG), and elevated slabs. There are 46 caissons in Building 2 with a diameter ranging from 30" to 78". The caissons used 3,500 psi concrete. Typical caisson depth is approximately 30'. The grade beams also used 3,500 psi concrete and ran only between the outer perimeter of columns. The SOG is a 5" thick normal weight concrete slab. The elevated slabs are a composite metal deck system with 3" thick deck and 3" thick light weight concrete. A pump truck was used to place all concrete.

Precast Concrete

Arban and Carosi, Inc. supplied the architectural precast façade panels for Building 2. There were 292 panels needed to cover the exterior of the building. All the panels were cast in Arban's yard in Woodbridge, VA. The panels were erected by a 50-ton truck crane with a 150' boom and a 50' jib. Arban worked in a clockwise manner around the building and positioned the crane as needed to best erect the panels. Three stories of panels were erected in each pass. The panels use bolted connections to connect to the clips welded to the steel structure.

Mechanical System

Each floor of the building has its own mechanical room with a self-contained air conditioning unit (SCU) to control the environment in the tenant and common spaces. Each SCU flows on average 24,750 CFM. There are 3 water cooling towers on the roof. This system uses forced air through medium pressure ductwork to supply conditioned air to the building. Variable air volume (VAV) units are used throughout each floor to meet the tenant's needs more efficiently. There are separate heat pump systems for the café, fitness center, and elevator machine room.

Electrical System

Two 2,500 amp, 460Y/265V service feeders provide electricity to the building. Each service runs into a common electrical room on the first floor where the power is distributed throughout the building. Two 2,000 amp, 460Y/265V copper bus ducts supply power to the upper floors. There are 3 transformers to step power down to 208Y/120 for tenant use. A 600KW, 480Y/277 diesel generator is located in a separate structure behind the building in a precast enclosure and will provide emergency power should the power grid fail. Lighting fixtures are mostly 277V fixtures manufactured by Lithonia.

Curtain Wall

Building 2, unlike Buildings 1 and 3, has extensive curtain wall on its front façade, along with ribbon windows on the other three faces of the building. Only Building 2 has the curtain wall because it is the feature building of the complex and is meant to stand out from the other two buildings. The system includes prefinished aluminum frames with green tinted glazing. Depending on the location of each piece of glazing, the transparency of the glazing varies. The glazing is less transparent at floor level to block the view of the concrete slabs from the outside of the building. Working from swing stages, the subcontractor installed the curtain wall and ribbon windows from the exterior of the building. Due to the simplicity of the curtain wall for this project, the architect was able to design the system without needing a design-build contractor like some other complex curtain wall projects would need.

1.4 Project Cost Evaluation

Actual Building Construction Cost

Total square footage of the project is 210,240 SF

Construction Cost	$22,409,286
CC/SF	$106.59

Construction costs do not include land costs site work, permitting, etc.

Total Project Cost

Total Project Cost (TC)	$25,025,270
TC/SF	$122.30

Building Systems Costs

Cast-in-Place Concrete (CIPC)	$1,701,700
CIPC/SF	$8.09

Architectural Precast Façade Cost (PFC)	$1,925,000
PFC/SF	$9.16

Structural Steel Cost (SSC)	$2,921,200
SSC/SF	$13.89

Glass and Glazing Cost (GGC)	$3,000,000
GGC/SF	$14.27

Elevator Cost (ELC)	$1,100,000
ELC/SF	$5.23

Mechanical Systems Cost (MC)	$
MC/SF	$

Electrical Systems Cost (EC)	$
EC/SF	$

D4 Cost 2002 Estimate

To estimate the Redland Tech Center Building 2 with D4 Cost 2002, three buildings with similar attributes, such as core and shell projects, were selected as reference projects. The three selected projects are as follows:

Use	Project Name	Size (SF)	Floors	Bldg. Cost
Office	Atwood Professional Center (Shell)	70,884	3	$2,989,670
Office	Knollwood Office Building (Shell)	55,998	3	$3,496,274
Office	Oakbend Office Building (Shell)	18,800	3	$1,556,110

Cost estimate of Building 2 using D4 is as follows:

CSI Code	Division Name	%	Sq. Cost	Projected
01	General Requirements	5.81	$6.58	$1,382,848
02	Existing Conditions	4.22	$4.78	$1,003,911
03	Concrete	7.82	$8.86	$1,863,384
04	Masonry	10.03	$11.36	$2,387,940
05	Metals	12.92	$14.63	$3,075,899
06	Woods, Plastics, and Composites	3.17	$3.59	$754,398
07	Thermal and Moisture Protection	4.06	$4.60	$967,333
08	Openings	3.87	$4.39	$922,547
09	Finishes	7.20	$8.15	$1,713,401
10	Specialties	0.28	$0.31	$65,689
11	Equipment	0.10	$0.12	$24,670
13	Special Construction	2.16	$2.45	$514,909
14	Conveying Systems	1.66	$1.88	$395,863
15	Mechanical	4.30	$4.87	$1,024,464
16	Electrical	6.03	$6.83	$1,436,337
21	Fire Suppression	1.97	$2.23	$468,107
22	Plumbing	2.91	$3.30	$693,472
23	HVAC	4.80	$5.44	$1,143,282
26	Electrical	4.03	$4.56	$959,621
31	Earthwork	8.37	$9.49	$1,994,302
32	Exterior Improvements	2.95	$3.34	$701,657
33	Utilities	1.34	$1.52	$319,328
Total Building Costs		**100.00**	**$113.28**	**$23,813,362**

R.S. Means Square Foot Estimate

An estimate using R.S. Means construction cost database was performed using the information of 5-10 story office buildings, R.S. Means model number M.470. The reference manual used was the 2008 Square Foot R.S. Means.

Office building: 9 stories, 13'-4" floor-to-floor height
Area (SF) = 210,240 SF
Perimeter (LF) = 320 LF
Story Height (LF) = 13'-4"

Exterior Wall	Area (SF)	200,000	250,000	Interpolated Values
	Perimeter (LF)	600	640	608.19
Precast Concrete Panel	Steel Frame	129.30	126.65	128.76
Perimeter Adj.	Per 100 L.F.	2.60	2.15	2.51
Story Hgt. Adj.	Per 1 Ft.	1.20	1.10	1.18

Through interpolation →Unit Cost = $128.76/SF

Adjust for additional perimeter: 288 LF less perimeter
Through interpolation → Deduct $2.51/SF per 100 LF less perimeter
Adjusted Unit Cost = $128.76/SF - 288LF($2.51/SF/100LF) = $121.53/SF

Adjust for story height: 1'-4" additional story height
Through interpolation → Add $1.18/SF per 1' additional story height
Adjusted Unit Cost = $121.35/SF + 1.33'($1.18/SF/1') = $123.10/SF

Adjust for project location: 0.90 for Silver Spring, MD (closest location to project)
Adjusted Unit Cost = $121.35/SF(0.90) = $109.22/SF

Estimated Building Cost w/o additives = $109.22/SF(210,240SF) = $22,958,085

Additives:
(5) 3500# elevators with 9 stops = $165,800 each

R.S. Means Estimated Building Cost = $23,787,085
R.S. Means Estimated Unit Cost = $113.14/SF

Cost Estimate Comparisons

The D4 and R.S. Means cost estimates were very similar to each other but 9% lower than the actual costs for the project. There are several reasons that can explain these price discrepancies between the estimates. First, the quality of materials used for the project is above normal. Use of stone and stainless steel is extensive throughout the building. Second, the buildings used for the comparison in D4 were only 3-story office buildings. D4 did not have enough reference projects to meet all the criteria of the Redland Tech project. The cost/square foot amount in D4 would have likely been higher had there been taller core and shell projects as references. Third, the actual cost estimate includes a preconstruction fee that is not included in the other estimates.

Actual	$25,025,270
D4 Cost 2002 Estimate	$23,813,362
R.S. Means	$23,787,085

1.5 Site Plan of Existing Conditions

The Redland Tech Center is located ½ mile off I-270, exit 8, which allows easier access to the site for construction deliveries and workers. During the height of precast deliveries for the buildings and parking garage, there will be 30 tractor-trailer deliveries per day. This will create congestion on the site that needs to be managed by Clark to not be bothersome to Building 1's occupants and the surrounding community. A review of the site plan show an expansive site, but space will be very limited during peak delivery times.

Whenever Building 1 was constructed in 2004, the contractor on the job installed most of the utilities for the complex at that time. Tie-ins to the existing system will need to be coordinated with Building 1's occupants so as to not interrupt their utility services.

Space between the 3 new buildings is very limited, about 30'. Mobile cranes will be moving between the structures during steel and precast erection. Utility installation and tie-ins will need to be coordinated around times in between the steel and precast erection sequencing.

Please view Appendix B of this technical assignment for the site plan of existing conditions.

1.6 LOCAL CONDITIONS

Construction in the Washington D.C. metro area is predominately CIP concrete with post tensioned elevated slabs. This trend stems from the fact that the District has a height restriction for new buildings. A CIP post tensioned concrete structure is able to have more floors than similarly tall steel structured buildings. Structural steel projects are not common in the area which results in few companies in the area capable of fabricating the steel and erecting it.

Onsite parking is shared with the occupants of Building 1. While there is more parking than at a typical project in downtown D.C., the lot is at maximum capacity almost every day. Construction workers are encouraged to carpool when possible and to park their vehicles on the surrounding neighborhood streets. The onsite lot has ticketed parking, but construction workers can stamp their tickets inside the Clark construction trailer and park for free.

The project site is located in the middle of a residential neighborhood and beside the occupied Building 1 office building. During construction, Clark needs to be sensitive to the community environment around it. There are noise ordinances in effect between 7 pm and 7 am through the weekdays and between 5 pm and 10 am on the weekend. There are many construction material deliveries to the site and Clark needs to ensure that they do not block the flow of traffic through the community and especially through the parking lot shared with Building 1.

Northern Virginia Waste (NOVA) is the provider of dumpster and recycling services for the Redland project. One dumpster is onsite at all times and is pulled as needed. NOVA takes the dumpster back to their facilities and sorts, recycles, and furnishes reports of the materials. The reports can be used to obtain LEED credits in construction waste management. NOVA's reports have the tonnage of each material in the dumpster and how much of the material was recycled. NOVA charges $100 to pull the dumpster and approximately $80/ton to dispose of the material.

Geotechnical reports of the site show existing fill which contains a mixture of silt and clay, with varying amounts of organic debris, which was encountered up to depths of about 13 feet below existing site grades. Much of this material is believed to be part of an old stockpile placed during the site development of an adjacent property. Below the fill or topsoil, the natural soils consist of loose to very dense silt or sandy silt, or very stiff to very hard silty clay. Groundwater was recorded at depths of 23.5 to 49 feet below existing site grades. Variations in the location of the long-term water table may occur as a result of changes in precipitation, evaporation, and surface water runoff.

1.7 Client Information

The owner of the Redland Tech Center project is Perseus Realty, LLC of Washington D.C. Perseus is a relatively new company; it was founded in early 2004 by Perseus president Robert Cohen. Perseus's initial corporate strategy was to buy and manage commercial property. More recently Perseus has expanded their portfolio of capabilities to include office, industrial, retail and residential development. Perseus's first new construction development project is the Redland Tech Center. They now have another mixed-use building in the design phase that will be constructed In the near future. Perseus saw new project development as a way to grow their company and capitalize on the strong office and retail space needs of the Washington D.C. area.

The Redland Tech Center will be above average quality, Class A office space. Many materials have been specified, such as stone and stainless steel, to attract higher end tenants to the complex. Perseus expects a brisk delivery schedule, which is part of the reason Clark was selected as the contractor for the project. Clark was able to build the two buildings and the parking garage simultaneously. Obtaining a LEED Silver rating is the goal of Perseus for the project.

One of Perseus's main concerns with the project is the substantial completion date. Perseus is constantly working with Clark to determine the project's completion date and also the latest date the tenant fit out design could be issued and not delay the finish of the project. As of September 2008, the office space has not been leased out to a future tenant. If a tenant would sign a contract to lease the space before the end of December 2008, Clark will be able to do the interior fit out work without impacting the completion date. It is very important for Perseus to know the accurate completion date so that it can lease the office space out and not have an empty building waiting for the tenant to move in.

1.8 PROJECT DELIVERY SYSTEM

Redland Tech Center was delivered as a design-bid-build (traditional) project. A traditional delivery method was selected by the project team due to the size and type of project and also because of the owner's construction experience. Clark Construction, LLC was the construction manager at risk on the project. Clark was awarded the contract as the CM @ risk in September 2007 after negotiations on the GMP contract price. Clark provided some preconstruction services to the owner and architect during the design process including estimates, scheduling, and constructability reviews. Due to Clark's early involvement with the project team, Clark was able to bring the structural steel and structural precast fabricators (for the precast garage) on board early and start the process of fabricating the materials needed for the project. This was essential to the quick transition from design to construction and will enable the project team to deliver the project to the owner earlier than originally expected. Please view Figure 1 below for the project organization chart.

Clark Construction was selected as the contractor due to three main reasons. First, two other contractors of the Washington D.C. area were considered to build the project. Only Clark was able to build both office buildings and the parking garage of Phase 2 at the same time. This led to the entire project being finished sooner. Second, Clark's contingency and fee was lower than the competitors. Third, while this was Perseus Realty's first construction project that they built, many of the employees and executives of Perseus had experience with Clark at previous companies. This led to the belief that it was in their best interest to select a contractor they were familiar with and that they knew would be able to construct the project successfully.

A GMP contract between Perseus and Clark was the best solution to the fast paced design and construction startup. Clark was able to start procuring the subcontractors and getting ready to build the project while DNC was finalizing details in areas such as finishes, bathrooms, and landscaping. Clark assigned allowances to these details in their GMP contract price that will be settled after the drawings and specifications for the allowances are released and given a true construction value. There is a savings clause to the GMP contract that shares the savings between Perseus and Clark.

Clark awarded its contracts to their subcontractors mostly through a low-bidder process. However, if Clark felt a sub for a trade had a better overall value, they may have awarded the contract to a higher priced sub. Clark has lump sum contracts with all their subcontractors on the project. As the final details are released for construction, Clark will issue a change order to each of the subs affected by the design allowance.

Clark has a general liability insurance policy for the project of $17 million coupled with an excess umbrella liability insurance policy of $25 million. The umbrella policy allows Clark to protect itself further from excessive claims over the $17 million liability coverage of the general policy. Clark has a $2 million automotive policy for all the jobsite vehicles. The liability insurance coverage required by Clark for the subcontractors varies for each sub between $2 and $5 million. Clark has Subguard, a subcontractor surety bond, to manage the risk of subcontractor or supplier default. Clark pays 1% of each subcontractor's contract for the surety bond.

The contract types selected for this project seem to be logical and the best option for the project. Clark's GMP contract allowed them to get work started early and buy long lead items such as steel and granite early to avoid schedule growth and cost escalation. The lump sum low-bid contracts Clark had with their subs kept costs down and enabled them to deliver the project to the owner with the best value possible.

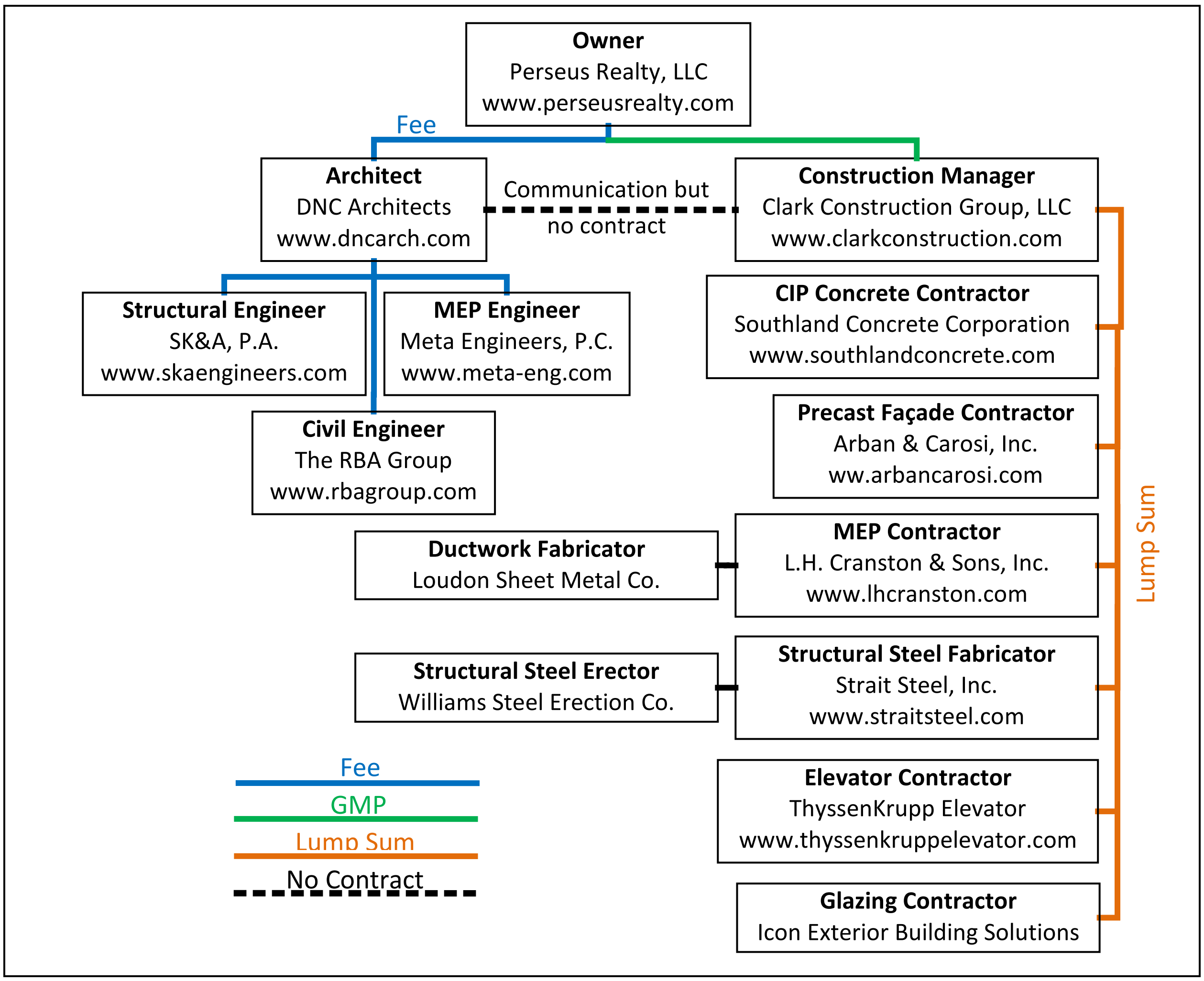


Figure 1 – Project Organization Chart

1.9 STAFFING PLAN

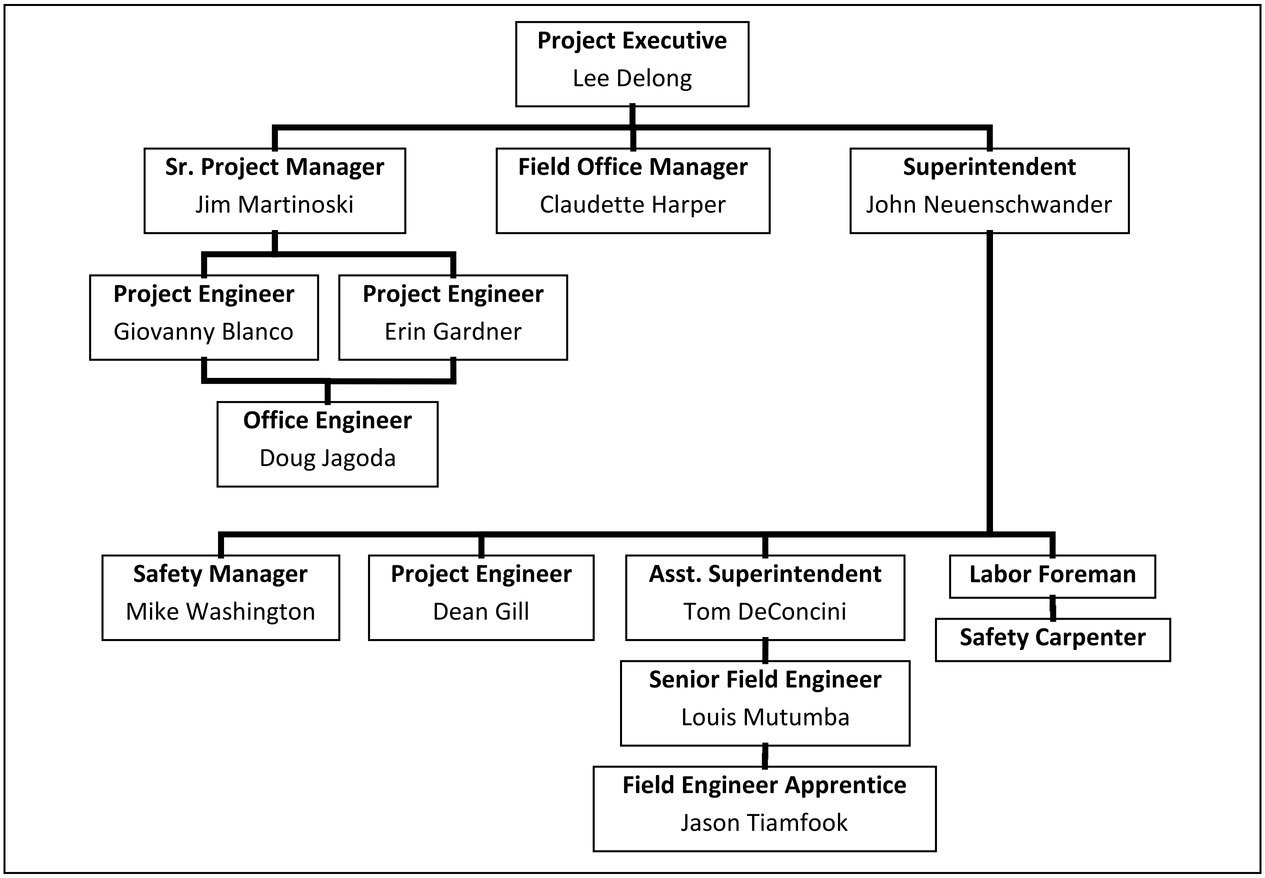


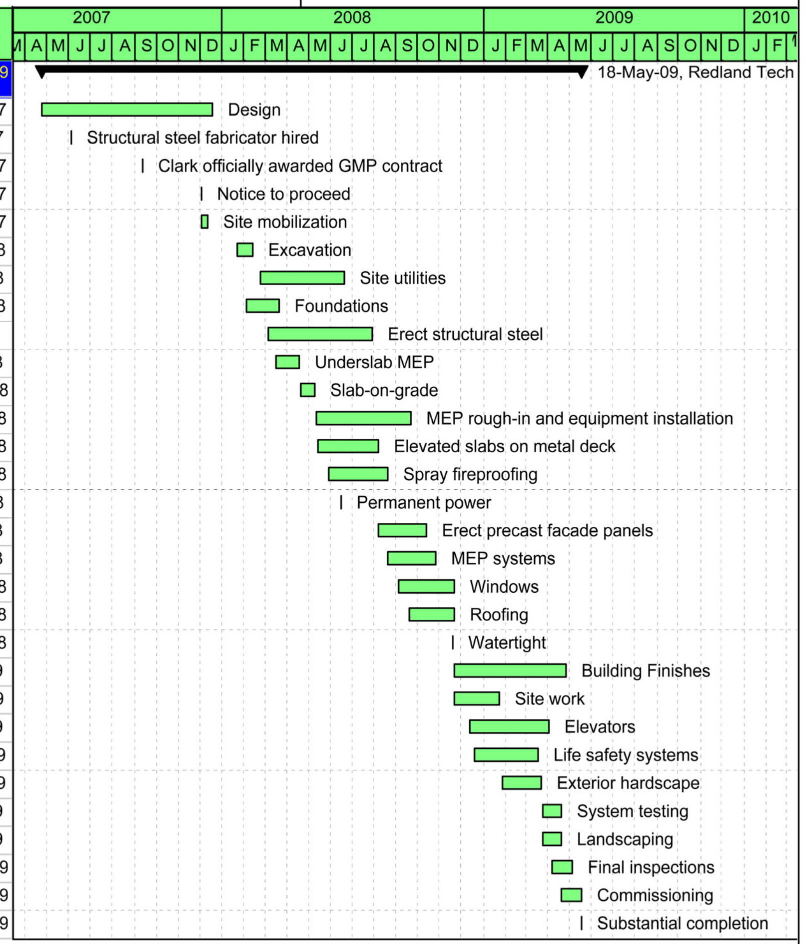
Figure 2 – Staffing Plan Diagram

Figure 2 shows the basic staffing plan that Clark has established to construct the Redland Tech Center project. Lee DeLong, the project executive, is in charge of the overall project and reports directly back to senior management at Clark. Jim Martinoski, the project manager, is in charge of the business side of the construction project. He oversees the project and office engineers. Jim is tasked with client communication, design coordination, subcontract management, quality control, issue and change order negotiation and resolution, project finance, and contract administration. John Neuenschwander, the superintendent, is in charge of the field side of the construction project. He oversees all of Clark's field management staff and also all the work that is being done in the field. John is tasked with site supervision and management, construction coordination, and scheduling for the project.

Appendix A – Project Summary Schedule

Redland Tech Center	Classic WBS Layout	25-Sep-08 02:30

Activity ID	Activity Name	Original Duration	Start	Finish
Redland Tech Center		541	23-Apr-07	18-May-09
A1000	Design	172	23-Apr-07	18-Dec-07
A1010	Structural steel fabricator hired	0	04-Jun-07	04-Jun-07
A1020	Clark officially awarded GMP contract	0	12-Sep-07	12-Sep-07
A1030	Notice to proceed	0	03-Dec-07	03-Dec-07
A1040	Site mobilization	7	03-Dec-07	11-Dec-07
A1050	Excavation	15	23-Jan-08	12-Feb-08
A1060	Site utilities	85	25-Feb-08	20-Jun-08
A1070	Foundations	35	04-Feb-08	21-Mar-08
A1080	Erect structural steel	106	05-Mar-08	30-Jul-08
A1090	Underslab MEP	25	17-Mar-08	18-Apr-08
A1100	Slab-on-grade	15	21-Apr-08	09-May-08
A1110	MEP rough-in and equipment installat...	96	12-May-08	22-Sep-08
A1120	Elevated slabs on metal deck	60	15-May-08	06-Aug-08
A1130	Spray fireproofing	60	29-May-08	20-Aug-08
A1140	Permanent power	0	17-Jun-08	17-Jun-08
A1150	Erect precast facade panels	48	08-Aug-08	14-Oct-08
A1160	MEP systems	50	19-Aug-08	27-Oct-08
A1170	Windows	56	04-Sep-08	20-Nov-08
A1180	Roofing	45	19-Sep-08	20-Nov-08
A1190	Watertight	0	20-Nov-...	20-Nov-08
A1200	Building Finishes	112	21-Nov-...	27-Apr-09
A1210	Site work	45	21-Nov-...	22-Jan-09
A1220	Elevators	80	12-Dec-...	02-Apr-09
A1230	Life safety systems	65	19-Dec-...	19-Mar-09
A1240	Exterior hardscape	40	27-Jan-09*	23-Mar-09
A1250	System testing	20	24-Mar-...	20-Apr-09
A1260	Landscaping	20	24-Mar-...	20-Apr-09
A1270	Final inspections	20	07-Apr-09*	04-May-09
A1280	Commissioning	20	21-Apr-09*	18-May-09
A1290	Substantial completion	0	18-May-...	18-May-09



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

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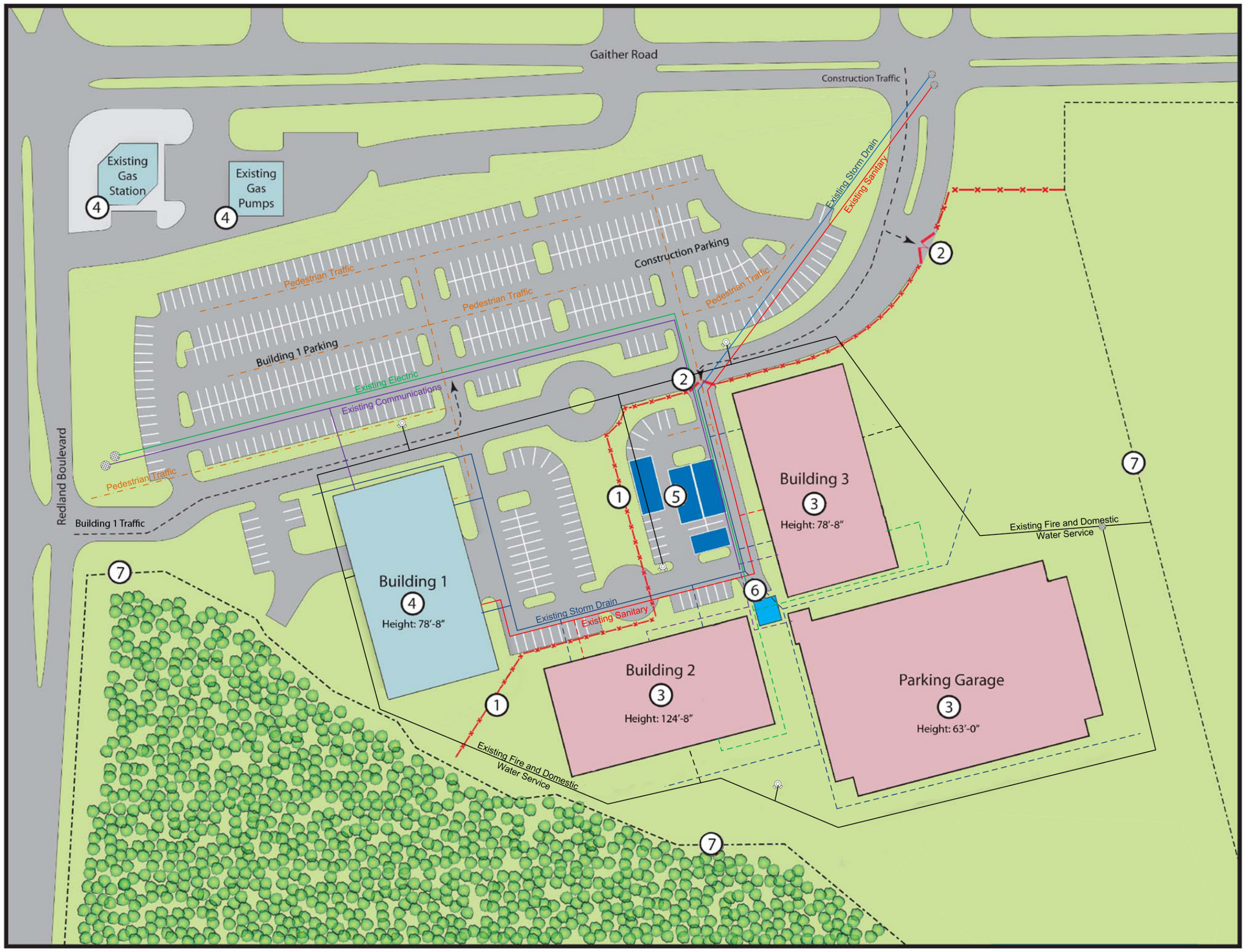

Redland Technology Center

Rockville, MD

Site Plan of Existing Conditions

Legend

1. Construction Fence
2. Construction Entrance & Gate
3. Buildings Under Construction
4. Existing Building
5. Trailer
6. Temporary Power Location
7. Existing Fence Line