



AE 481W : SENIOR THESIS

A faint, light gray silhouette of a globe is positioned on the left side of the page, behind the main title text.

TECHNICAL ASSIGNMENT 1

EXISTING CONSTRUCTION CONDITIONS/ CONSTRUCTION PROJECT MANAGEMENT

Prepared for

Architectural Engineering Department
Construction Management
Penn State University

By

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October 8, 2005

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Executive Summary

First of all, the location of the Benner Pike Shops is well coordinated. It resides right next to other malls consisting of Wal-Mart, Barnes & Nobles, and etc. The shops could be considered as a mall within a mall. Since the shops are located in a non-congested area, the construction could move on not worrying about any site congestion problem. Considering the shops are all one story high, no heavy equipment, such as tower crane, was needed during construction.

One of the interesting features of the construction is that the each shop is considered separate from one another even though the structure of the shops is whole. Basic HVAC and mechanical systems are shared through out the shops while all the interior furniture and lighting systems are supported by each shop separately. Also, opening day for each shop is varied; meaning the shops are not intended to open at the same day, rather one shop opens as soon as its construction is completed. This method of finishing the construction leads to an issue of having construction in some shops while other ones are open. Shops being considered as different constructions, drawings, specifications, estimates, and schedules were created separately.

In this assignment, the research on the Benner Pike Shops should be performed to be acquainted with the relationship of construction schedule and its budget. Also, the research will provide how contractual arrangement and management would affect the schedule and budget.

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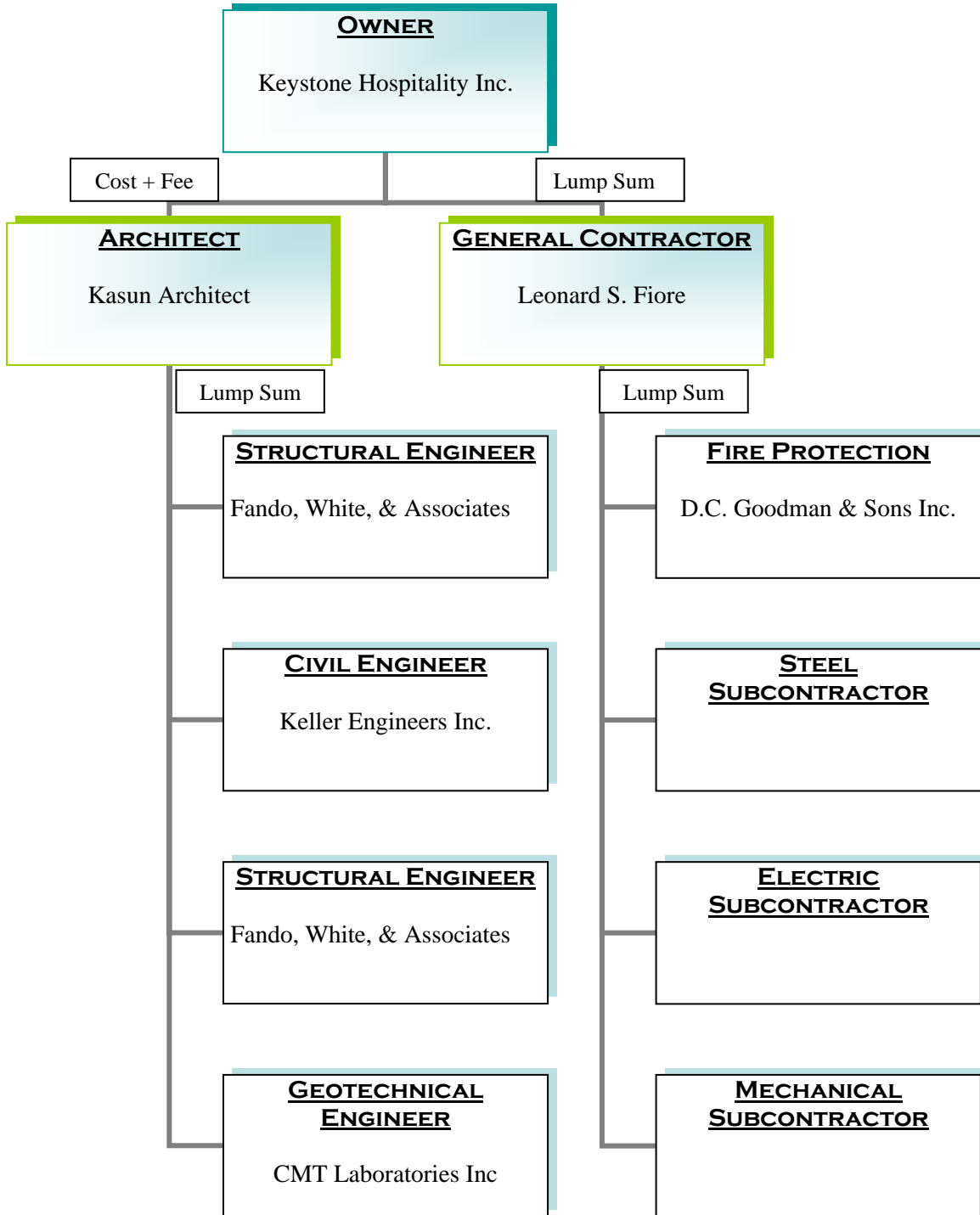
Project Delivery System

The Benner Pike Shops were delivered with traditional design-bid-build system. LS Fiore General Contractors are directly contracted to the owner and the architect is also directly contracted to the owner. However the GC and the architect are not contracted to each other. As LS Fiore being the general contractor of the project, there is no construction manager involved in the job, and the GC was in charge of making sure the job is getting finished before the deadline. Subcontractors were contracted directly to the GC with lump sum pricing.

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Project Delivery System (con'd)

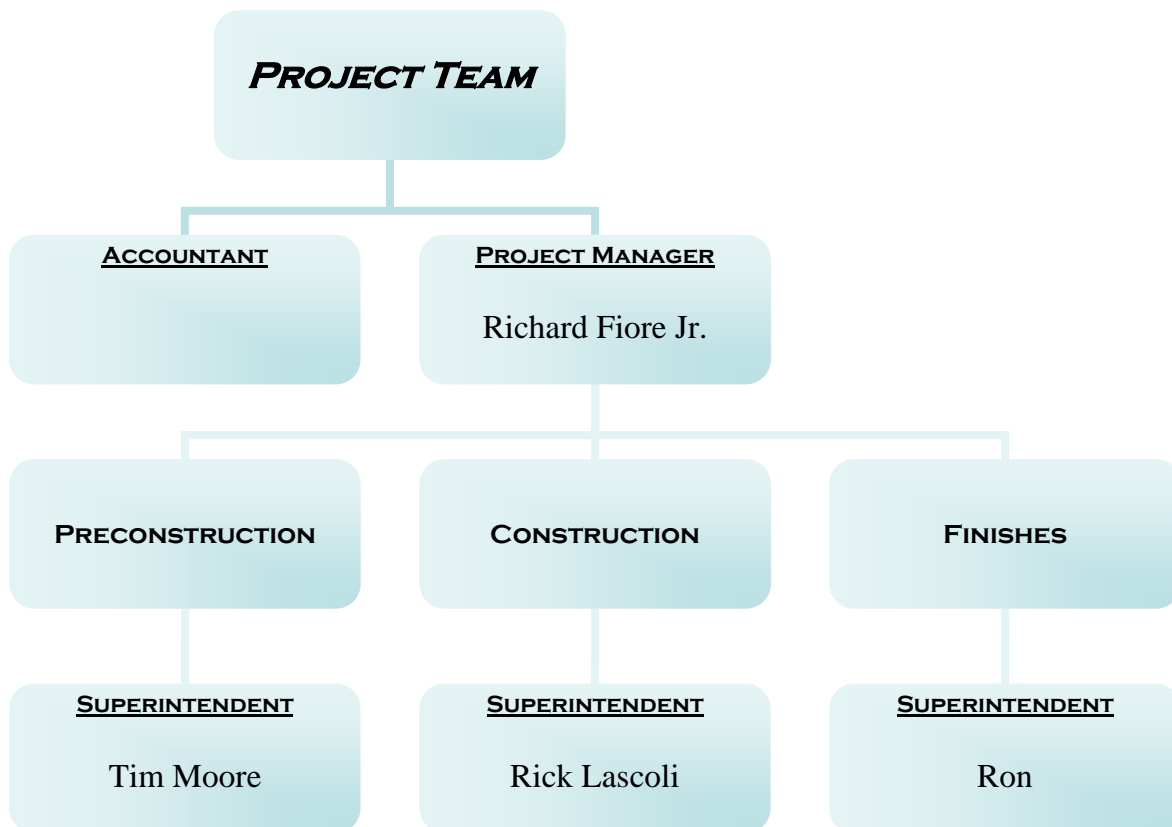


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Staffing Plan

The LSF Contractors were assigned for general contractor for this project and through out the project, three superintendents were placed. For the pre-construction part and layout of the building, Tim Moore was in charge. After the first phase, Rick Lascoli was assigned for the main construction. At the very end of the project, which includes finishes of some small shops, Ron took over to wrap up the whole construction. Although Tim was present during actual construction phase, most of the work was done by Rick. Project manager, Richard Fiore Jr. was assigned from the main office to direct the meetings and conduct overall construction.



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Local Conditions

The site is located in the general commercial zone which covers large radius of area around. There was not any type of structure or building present prior to this project at the location; which means no demolition was required. The condition of the soil in that area was composed of 90% or greater of limestone. Although the excavation had to take more time and consideration than usual, there was no hassle for any de-watering the soil because of its dry condition. Those stones plus any left over stones from the construction were the only materials that were recycled. Since the shops are located in the mall area where no tight neighboring buildings exist, the project had no conflicts on congestion problems such as, access road during construction, material staging area, or damaging adjacent buildings.

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Client Information

The sole purpose of the project started by the client is to lease spaces to tenants. For this project, the tenants focused on this project were different shops because of the location and building type. Joules Patt, the president of Keystone Hospitality Group, is a developer, in which the company concentrates their work on real estate primarily. Since the project is a local job, the company hired LSF Contractor who has done numerous projects around the town and knows well about this region. For the fastest possible lease schedule, construction took place focusing on finishing each shop separately after the basic building structure as a whole. This way, the owner could lease out the finished shops while construction takes place on the other incomplete shops. By finishing the shops on the edge of the mall, the owner minimized the risk factors for safety of customers. Overall, the client was pleased with the schedule and construction cost, especially for the early finish of the project.

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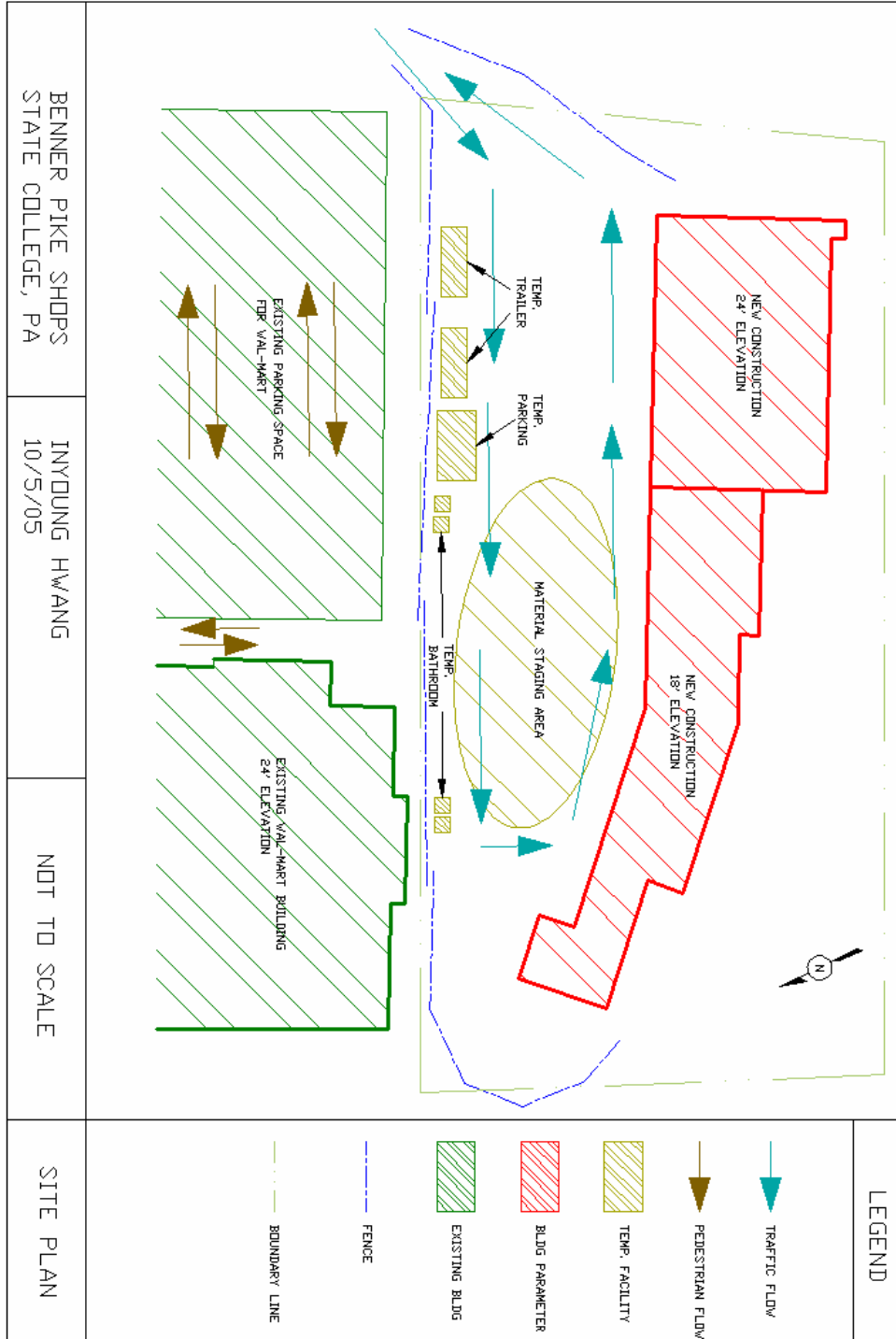
Project Schedule Summary

The following page indicates the schedule of the project solely focused on construction phases. The schedule shows key milestones of events broadly, such as excavation, superstructure, and finish. Based on this schedule, further specified schedules for two major stores (Ross Dress for Less, Bed Bath & Beyond) were generated for the efficiency of the project. The project completion date shown in the schedule is the finish date for the construction part only, meaning each tenant will be able to possess their store for further interior work that needs to be done accordingly.

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Site Plan of Existing Conditions



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Building Systems Summary

Structural Steel Frame

Considering building height no higher than 30', only one 120-ton mobile crane was used for erection of the steel. Based on the concrete wall footings and column footings, TS 10 x 8 steel columns were typically erected for the support. Wide flange beams were then braced to the columns along with numerous steel joists. Typical brace used among a steel column and two joining beams were knee bracing. Two beams joining at the top of the steel column were welded together to the steel column with 3/8" plate stiffeners. In addition, Two Angles 5" x 3 1/2" x 5/16" (one for each beam) were welded to the beam and the column with 3/8" plate gussets. On top of the stiffeners, fill pieces were provided in each brace to support the roof metal deck sitting on top of the beams.

Cast in Place Concrete

For this project, no mass placing of concrete was needed. Since the building is only one story high, concrete was placed in the sub-grade level. Direct pour was adequate in a fact that there is no concrete placing in high elevation. Typically, thick exterior graded plywood was used for the horizontal formwork, and the connection was made with metal junction plates. When the concrete was poured, temporary waterproofing polyethylene sheet was installed.

Mechanical System

The air handling units are located on the rooftop for all the shops. Each shop has its own HVAC units generated from AHU's located on top of each store. Number of AHU's varies between the sizes of shops; in which it varies from 2 to 9. Small – scale mechanical rooms are located on the back of each store for the control purpose. Equipments and ductwork are insulated with rigid fiber glass board and flexible blanket. For the exposed ductwork, aluminum jacket and PVC jacket are used.

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Building Systems Summary (Con'd)

Wet pipe sprinkler system serves the majority portion of the building. Its heads are semi-recessed, chrome plated, so the heads are exposed to the heat for sensitivity and give faster response. For the spaces with ceiling height less than 8 feet, the heads are fully recessed with white covers for aesthetic reason and to allow better interior view.

Electrical System

For the conduit raceways, minimum size of 3/4" EMT was used, and they were concealed except in mechanical rooms and janitor closets. Conductors have voltages of 120/208, 277/480, 120/240 for the ungrounded systems. Panelboards are also 120/208 and 277/480 volts, three - phase with copper bus system. Circuit breaker is 480 volts and has interrupting rating of 64,000 amperes.

Masonry

Exterior CMU's were stacked up among the exterior steel beam. The purpose of the CMU walls was to give the building enclosure, in which the walls are not load bearing. Only about 10 – feet high scaffolding was needed since more than half of the job could be done from the ground.

Support of Excavation

The site before exaction had a slope in which the highest point was about 10 feet off of the ground. Starting from the top of the hill, excavation took place and decent amount of excavated soils were used for fill in the low elevation area. As mentioned in the local conditions, more than 90% of the soil excavated was limestone which led to no work in de-watering the soil. For the excavation support, temporary tieback sheeting system (tiebacks, soldier piles and wood lagging) was integrated which is the most economical method.

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Project Cost Evaluation

Actual Building Cost

Building Construction Cost – \$15,200,000

- Cost per Square Foot – \$139.29 / SF

Total Project Cost is assumed to be 15% more from the construction cost.

(Each shop tenant supplies costs for any interior work)

Total Project Cost – \$17,480,000

- Cost per Square Foot – \$160.19 / SF

Major Building Systems Cost

Mechanical System Cost – \$2,300,000

- Cost per Square Foot – \$21.08 / SF

Plumbing System Cost – \$648,000

- Cost per Square Foot – \$5.94 / SF

Electrical System Cost – \$2,580,000

- Cost per Square Foot – \$23.64 / SF



Project Cost Evaluation (Con'd)

D4 Cost Estimate

Div. #	Division	Base Cost	%	Sq. Cost	Projected
1	General Requirements	\$165,834	13.06	57.68	\$1,672,735
2	Site Work	\$438,101	3.46	15.28	\$443,108
3	Concrete	\$288,212	2.28	10.05	\$291,506
4	Masonry	\$255,224	2.02	8.90	\$258,141
5	Metals	\$720,635	5.69	25.13	\$728,870
6	Wood & Plastics	\$154,361	1.22	5.38	\$156,125
7	Thermal & Moisture Protection	\$403,885	3.19	14.09	\$408,501
8	Doors & Windows	\$668,905	5.28	23.33	\$676,550
9	Finishes	\$596,008	4.71	20.79	\$602,819
10	Specialties	\$69,332	0.55	2.42	\$70,124
11	Equipment	\$280,198	2.21	9.77	\$283,400
12	Furnishings	\$207,647	1.64	7.24	\$210,020
13	Special Construction	\$43,183	0.34	1.51	\$43,677
14	Mechanical	\$5,369,509	42.40	187.27	\$5,430,875
15	Electrical	\$1,513,996	11.96	52.80	\$1,531,299

Total Estimate \$12,807,750

D4 Estimate – \$12,807,750

- Cost per Square Foot – \$117 / SF

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Project Cost Evaluation (Con'd)

Square Foot Estimate

Description	Unit	UNIT COSTS			% OF TOTAL		
		1/4	MEDIAN	3/4	1/4	MEDIAN	3/4
Department Store	S.F.						
Total project costs	C.F.	2.5	3.37	4.74			
Plumbing	S.F.	1.51	1.83	2.77			
HVAC	S.F.	4.22	6.5	9.8	1.82	4.21	5.9
Electrical	S.F.	5.35	7.3	8.6	8.2	9.1	14.8
					9.05	12.15	14.95
Benner Pike Shops							
Total project costs	2618928			\$12,413,718.72			
Plumbing	109122			\$302,267.94			
HVAC	109122			\$1,069,395.60			
Electrical	109122			\$938,449.20			

Square Foot Estimate – \$12,413,718.72

- Cost per Square Foot – \$113.76 / SF

Comparison

As you can see from the comparison, the actual building cost is higher than D4 cost estimate and RS Means estimate. This is because for both D4 and Square Foot Estimate, small department shops were put into consideration and its estimates were based on that. For this project, the actual cost was higher than the other data because it is a mall rather than a store. There are some factors that are not included in either D4 or Square Foot Estimate, which are combining large shops and small shops together, heavy site work, and fast track construction.