Table of Contents

EXISITING CONDITIONS

The Northern Virginia Community College (NVCC) is a diversified project offering many diverse spaces within a common building. The proposed project will support the colleges' expanding medical education department. The building will help to provide "hands on" experience to its students. For this reason the building consists of many laboratory spaces as well as traditional educational facilities. The building will also welcome patients. Individuals in need of healthcare who do not have insurance will be allowed to receive free healthcare at the college. Located within the campus building are a wide array of spaces including a public pharmacy, Barnes & Nobles bookstore, dental and medical laboratories, faculty and administrative offices, patient clinics, and also imaging & EMT related training rooms. The new 121,000 SF project represents the schools seventh campus location. The school looks forward to completing the project May in 2003 to start to operate and holding summer classes.

The project includes a 750 parking space Precast parking garage. The garage is being handled somewhat separately because it is funded through retained parking capital from NVCC and not state funds that are being used for the building.

Design: The building is a three storey design located on five acres of land in the Springfield Industrial Park in Springfield, Virginia. Significant attention has been paid to the planned future expansion over the next 10 years. The façade consists mainly of masonry and cast stone elements, but also includes curtainwall, storefront systems, and metal panels.

PROJECT TEAM

Owner - Northern Virginia Community College

- 3rd largest Community College in the nation with over 60,000 students. – Charlene Connolly (future provost of the medical education department) – Ed Camden , Facilities Director NVCC

Construction Manager - Gilbane Building Company

- One of the nations oldest builders, founded in 1873 Gilbane offers feasibility, planning, financial, and construction management services.

Architects - Hillier & Lukmire Grant Partnership

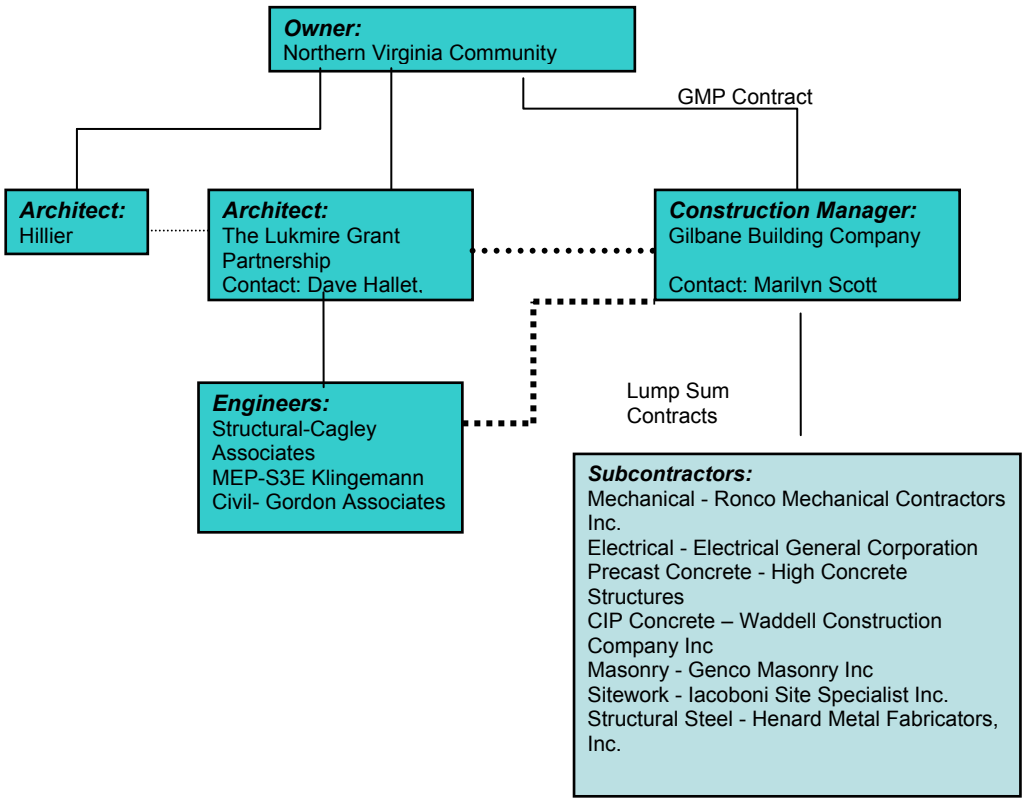
- Joint architecture effort based on each firm's prior experience (Hillier – medical buildings, Lukmire Grant – coordination with the state standards & review agency of BCOM).

As for the design side of the delivery system the owner decided upon two architects each with their own cost plus fee contract. The reasoning to go with the two architecture firms of Hillier and Lukmire Grant, was to combine the strengths. Hillier has an abundance of health care design expertise whereas; Lukmire Grant has much good working experience with the state agency BCOM. Both architects worked closely with the owner, Hillier on the interior design and Lukmire with the BCOM requirements. Lukmire worked with Hillier during the design to adjust the design to meet all the strict requirements of BCOM. Lukmire currently is playing the large role by handling the submittal and RFI procedure as well as being the communication avenue to BCOM

Mechanical Engineer - S3E Klingemann (MEP),

Structural Engineer - Cagley & Associates

Project Delivery Chart



Governing Codes

Major National Model Code: The BOCA, National Building Code – 1996 edition, NFPA**,** Virginia Uniform Statewide Building Code (VUSBC) 1996, Uniform Federal Accessibility Standards (UFAS), Additional Requirements per the Construction and Professional Services Manual (CPSM) 1996

INVESTIGATION AREAS

Existing Conditions: Foundation

Included in the Geo-Technical report by the Inspecting agency, Froehling & Robertson had suggested the building be placed on many clusters of H-piles. A total of 572 piles were driven with a total length 26,717 linear feet. The suggestion was made based on the presence of deep, naturally occurring organic, cohesive soils. Cagley Associates, the structural designer, decided to design to the Froehling & Robertson suggestion. Much of this existing soil was found to be old fill. Based on a collaborative decision to avoid extensive excavation of the old fill on site as well as to avoid dealing with the weak bearing capacities of the soil, the foundation was designed with the deep foundation, H-piles, pile caps, and grade beams with the SOG tying into the grade beams at the perimeter of the building.

The majority of the soil on site is light brown clayey sand with spots of gray sandy striations. The soil was remarked in the report as being "ideal for re-compaction and backfill activities". Therefore much of the excavation soil was stockpiled on site and saved for site work activities.

Existing Conditions: Gilbane Technology Use

Gilbane performs the majority of project controls through the software program Prolog provided by the Meridian Company. Gilbane purchases licenses to adequately staff each job. These licenses are then directly attributed to the corresponding project. This investigation area includes a detailed look at inefficiencies in Gilbane project management software as well as possible solutions.

Existing Conditions: Owner Financing

Currently the new campus building is being financed solely through state appropriations. NVCC, a public institution, currently realized some budget overruns and financial stress do to short term cash flow problems on the project. The investigation area looks at alternative financing available to the college based on recent legislation passed in the state of Virginia.

BUILDING SYSTEMS

Electrical: Incoming power is supplied from Dominion Virginia Power Company at 480/277V, 280 kW, 3 phase from the installed & sized transformer by Virginia Power. The system includes the following.

- Motor Control Center – adjacent to mechanical room
- Switch Gear located in Electrical room which distribute to all circuit panels
- 60 circuit panels located through the building
- Emergency Diesel generator - 480/277V, 280 kW, 3 phase

Lighting: The building lighting system sequence is taken through the power supply to two separate dimmer panels, (277/480V, 3 phase & 120/208V 3 phase) and to an automatic transfer switch, which leads out to the lights. The lighting design covered wide range of areas and needs. There are over 60 types of lighting fixture being used for the project. Light fixtures and lamps range from special dark room lighting to fiber optic accent lighting. All lamps fall under fluorescent, incandescent, or high intensity discharge (HID). The majority of fixtures are 277V and fluorescent.

Mechanical: The Northern Virginia Medical Education Campus has a central plant located between the building itself and the adjoining parking garage. Housed within the central plant are the boilers, chillers, hot water heaters, expansion tanks and 11 pumps. Located on the roof are the 3 Air handlers supplied by a large duct chase that runs from the first floor to the roof. Also located on a roof are the 2 cooling towers.

Mechanical (cont.)

- Central Plant consisting of two 300 ton capacity Centrifugal water chillers
- 3 Roof Top Units (Air Handlers) w/ capacities of 10,000, 13,000, & 19,500 CFM
- 2 Natural Gas, Horizontal Fire tube Boilers
- Air Duct system in overhead plenum that supplies to individual VAV's and diffusers.

Structural: Structural Steel Design, by Cagley Assoc**.** The structural design is a traditional structural steel framing system with composite metal decking/slab. Incorporated on each level of the perimeter were relieving angles for the masonry work.

Fire Protection: The fire suppression system consists of a wet type sprinkler system with automatic pendant, upright, and sidewall mounted heads. Sprinklers are responsive to heat.

Additional components of the fire protection system include:

- Smoke Dampers
- Fire Dampers
- Heat Detectors (In & Out of Ductwork)
- Pull Stations
- Indicating PA system
- Graphic Annunciator panel to inform building security
- Door hold-open devices

Transportation: The main area of transportation will be the transition from the parking garage to the building. This is accommodated by the link area which includes a stairwell and elevator. Also within the building are an architectural glass elevator and 4 stairwells. Faculty and students will be provided with NVCC identification cards which will limit their elevator access, certain cards will only allow for access to certain floors.

- 3 hydraulic elevators
- 4 stairwells

Telecommunications: Telecommunications is supported from a main tele/data closed centrally located in the building**.** The contracted work is for a fully integrated cable system consisting of 100 MHz horizontal copper cable, backbone optical fiber. A CATV/MATV system is also being provided. All standard wall outlets in the building will consist of three Cat 5e outlets and each phone outlet will provide access to one Cat 5e wire. Classroom will consist of CATV/MATV modular poke thru jacks for online and power access.

Special Systems, Medical Gas System: contained in the medical rooms are medical gas systems for patients. This system included the following.

- Medical oxygen manifold and piping distribution
- Medical air compressor
- Medical vacuum pump
- Medical gas valve boxes and alarm system

Area of Rescue System: Contained within the building are designated areas with pull stations for emergency situations. If pull the station is activated it will relay the message to the squad room where security will respond.

COST SUMMARIES

The following tables represent cost summaries by contract (left) and by CSI division (right).

Estimate Summary

CSI Division	Description	Cost
02	**Sitework**	$2,221,640
	The sitework budget includes general clearing, grubbing and grading, as well as the finish sitework, i.e. bollards, road work, sidewalk, & curb). Also included is the driven piles. Site Utilities package - potable water, electric, gas, & telecommunication lines to structure. Two sandfilter designed to accomodate stormwater runoff.	
3	**Concrete**	$4,751,278
	Slab Decking, Concrete Foundations, & Misc. Concrete. Precast Concrete members for parking garage as well as misc. building uses (lintels)	
4	**Masonry**	$1,618,500
	Cast Stone & Brick Masonry work. All through wall flashing and wall system materials	
5	**Steel**	$2,455,697
	The building structural members are made the structural steel members also included is all miscalaneous metals (lintels)	
6	**Millwork/Finish Carpentry**	$1,476,518
	Doors, hardware, rough carpentry, and installation of misc. specialties. Also included is the millwork package which includes plastic laminate and solid surface countertops.	
7	**Thermal & Moisture Protection (Roofing & Waterproofing)**	$711,419
	Included is the 30,000 SF of EPDM roofing, dampproofing on the exterior side of grade beams and pile caps, expansion and control joints, and all elastormeric caulking.	
8	**Glass & Glazing**	$609,000
	Included is all glazing schemes including the aluminm curtainwall and storefront systems.	
9	**Finishes**	$1,836,222
	Included in division is gypsum wallboard, suspended ceiling flooring, and special wall treatments for X-Ray rooms.	
10	**Specialties**	$49,895
	Signage Requirments for parking garage and streets	
11	**Equipment**	$48,000
	Costs include major laboratory equipment and casework.	
12	**Furnishings**	$468,670
13	**Special Construction**	N/A
14	**Conveying Systmes**	$299,600
	Included here are the 3 elevators to be installed in the facility. All are hydraulic elevators serving the 3 floors.	
15	**Mechanical (Plumbing, HVAC, Fire Protection)**	$3,548,113
	Costs include the entire HVAC systems, the three rooftop AHU's, plmbing system, medical gas system, and the entire fire suppression piping system.	
16	**Electrical**	$3,078,161
	Included here are the 3 elevators to be installed in the facility. All are hydraulic elevators serving the 3 floors.	

Estimate Summary

CSI Division	Description	Cost
02	**Sitework**	$2,221,640
	Midlantic Piling Inc.	$641,076
	Iacoboni Site Specialists	$1,553,136
	Green Team Inc	$27,428
3	**Concrete**	$4,751,278
	Waddell Construction Company Inc	$1,603,178
	High Concrete Structures (Precast)	$3,148,100
4	**Masonry**	$1,618,500
	Genco Masonry Inc.	$1,618,500
5	**Steel**	$2,455,697
	Henard Metal Fabricators Inc	$1,765,697
	AIW Inc.	$690,000
6	**Millwork/Finish Carpentry**	$1,476,518
	Worcester Eisenbrant Inc.	$1,198,058
	Jefferson Millwork & Design Inc.	$278,460
7	**Thermal & Moisture Protection (Roofing & Waterproofing)**	$711,419
	Brothers Construction Company Inc. (Roofing)	$301,419
	Metal Sales & Service Inc.	$410,000
8	**Glass & Glazing**	$609,000
	Service Glass Industries Inc.	$602,091
9	**Finishes**	$1,836,222
	Southern Insulation Inc.	$260,100
	Ceilings and Partitions Inc.	$1,235,650
	Majolica Tile LLC	$53,800
	Resource Flooring	$141,672
	NLP Enterprises Inc. (Painting)	$145,000
10	**Specialties**	$49,895
	Signs & Wonders Inc.	$49,895
11	**Equipment**	$48,000
	Lab Equipment (Multiple subcontractors)	$48,000
12	**Furnishings**	$468,670
	Nycom Inc	$353,916
	Krueger International Inc	$114,754
13	**Special Construction**	N/A
14	**Conveying Systmes**	$299,600
	Schindler Elevator Corporation	$299,600
15	**Mechanical (Plumbing, HVAC, Fire Protection)**	$3,548,113
	Ronco Mechanical Contractors Inc	$3,550,488
	Worsham Sprinkler Company Inc	$286,657
16	**Electrical**	$ 3,078,161
	Electrical General Coporation	$ 3,078,161

The chart below outlines costs to the owner associated with use of Gilbane as the construction manager.

CM Soft Cost Incurred	
Design-Regional Labor	**$ 174,012.00**
Estimator, Accouting Department, Safety Department,Project Executive	
Site Support	**$ 18,000.00**
Value Engineering, Regional Travel	
Field Labor	**$ 874,945.00**
Project Manager, Superintendent, MEP Superintendent, Project Engineer, Worker's Compensation	
Regional Labor	**$ 209,746.00**
Office Overhead, Project Executive, Accounting Dept., Purchasing Dept.	
Site Services	**$ 332,530.00**
Office Furniture, Field Office Rental, Team Building, Fire Exstinguishers, Safety Supplies, Telephone, Misc. Blueprinting, Copier & Supplies, Janitorial Services	
Plant & Equipment	**$ 17,280.00**
Project Vehicle, Fuel & Maintenance	
Home Office Support	**$ 34,609.00**
MIS Services	
General & Excess Liability Insurance	**$ 140,105.00**
Bond	
Gilbane Contingency	**$ 720,000.00**
CM Fee	**$ 550,000.00**

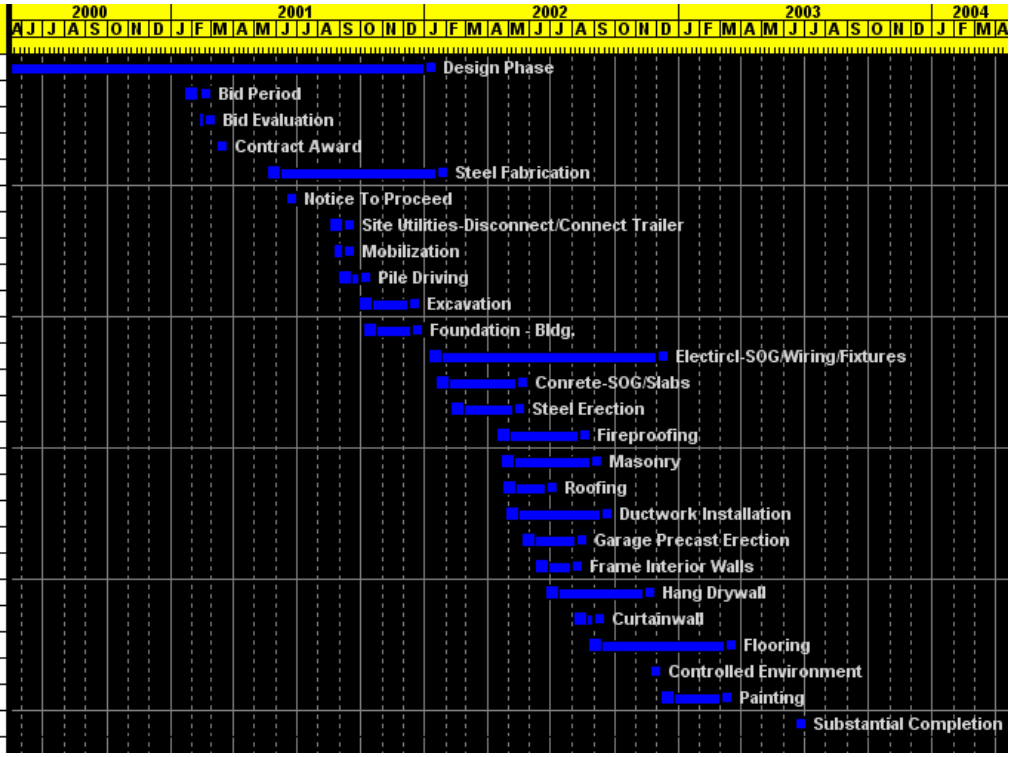
***Summaries do not include all itmes included in costs**

Total Project Cost to Owner - $26,218,614

SUMMARY SCHEULES

The following Primavera schedule represents the major components of the NOVA project.

Activity Description	Orig Dur	Early Start	Early Finish
Design Phase	510	11JAN00A	11JAN02A
Bid Period	15	01FEB01A	21FEB01A
Bid Evaluation	5	22FEB01A	28FEB01A
Contract Award	1	15MAR01A	15MAR01A
Steel Fabrication	105	31MAY01A	28JAN02A
Notice To Proceed	1	25JUN01A	25JUN01A
Site	15	27AUG01A	14SEP01A
Mobilization	10	03SEP01A	14SEP01A
Pile Driving	25	10SEP01A	09OCT01A
Excavation	50	09OCT01A	17DEC01A
Foundation - Bldg.	30	16OCT01A	21DEC01A
Electircl-SOG/Wiring/Fixtures	254	17JAN02A	10DEC02A
Conrete-SOG/Slabs	95	28JAN02A	22MAY02A
Steel Erection	45	18FEB02A	17MAY02A
Fireproofing	82	25APR02A	20AUG02A
Masonry	92	02MAY02A	06SEP02A
Roofing	45	03MAY02A	03JUL02A
Ductwork Installation	96	09MAY02A	20SEP02A
Garage Precast Erection	67	31MAY02A	16AUG02A
Frame Interior Walls	37	20JUN02A	09AUG02A
Hang Drywall	96	05JUL02A	21NOV02A
Curtainwall	20	14AUG02A	10SEP02A
Flooring	138	05SEP02A	17MAR03A
Controlled Environment	101	29NOV02A	29NOV02A
Painting	62	17DEC02A	12MAR03A
Substantial Completion	1	25JUN03A	25JUN03A



The design phase was grouped into one bar. From the onset of the project the design phase was planned to take one year, however due to multiple factors (changes, state review board BCOM) the design took upwards of two years. This is partly to explain why the design overlaps the bid period, contract award, and some initial construction. The project was not a design-build delivery method. The project was bid on documents that were eventually changed. After the contract was awarded to Gilbane a new GMP contract was negotiated with the new documents. The owner and architect raised new issues in which drawings and specifications had to be changed.

The schedule of the NOVA project was not as intense as most. This is due to the fact that the contract did not include liquidated damages, and the scheduled completion did not align with NVCC

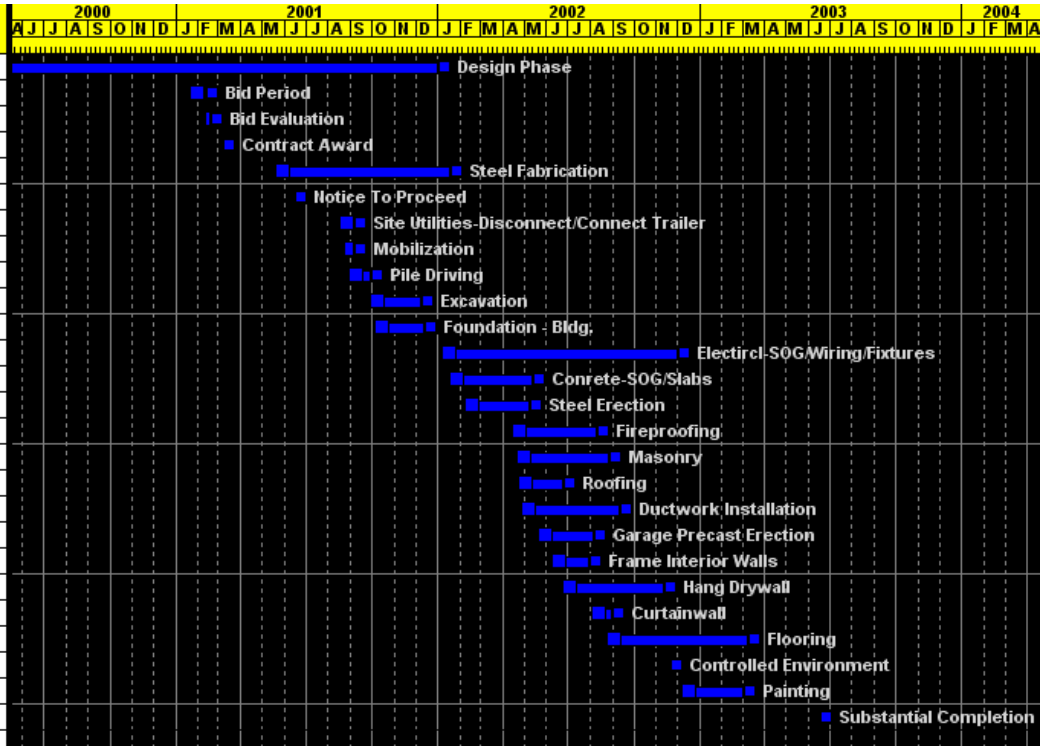
dates for the summer school semester. Also the lack of funding and concern by the owner to not be able to run the building allowed for somewhat lesser concern for schedule.

One component the Gilbane team was pushed for was controlled environment. Many of the specialized finishes depended on a controlled environment. Many of these included specialized laboratory and medical equipment which need to be installed as early as possible to meet milestone dates.

Revised Schedule

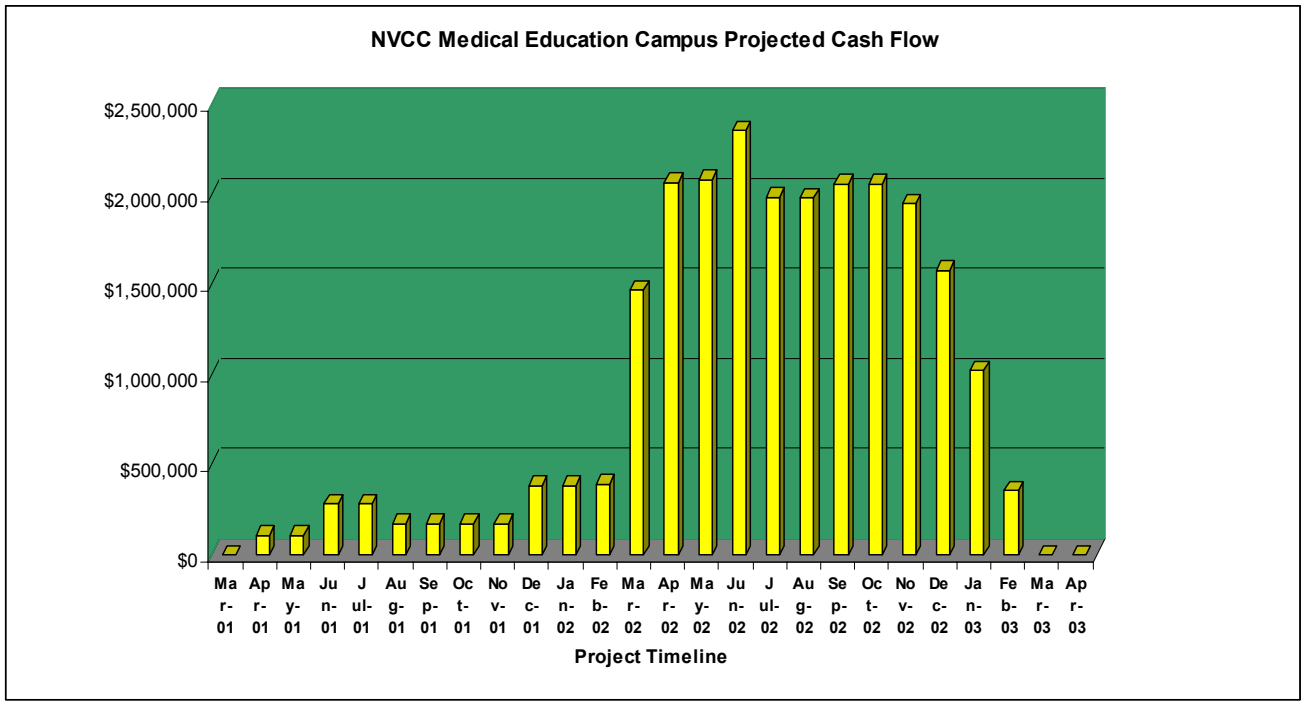
The following revised schedule shows the schedule reduction achieved through SIPS analysis performed in this thesis. This reduction is due to the elimination formwork for the foundation as well as well as scheduling changes.

Activity Description	Orig Dur	Early Start	Early Finish
Design Phase	510	11JAN00A	11JAN02A
Bid Period	15	01FEB01A	21FEB01A
Bid Evaluation	5	22FEB01A	28FEB01A
Contract Award	1	15MAR01A	15MAR01A
Steel Fabrication	105	31MAY01A	28JAN02A
Notice To Proceed	1	25JUN01A	25JUN01A
Site	15	27AUG01A	14SEP01A
Mobilization	10	03SEP01A	14SEP01A
Pile Driving	25	10SEP01A	09OCT01A
Excavation	50	09OCT01A	17DEC01A
Foundation - Bldg.	30	16OCT01A	21DEC01A
Electircl-SOG/Wiring/Fixtures	254	17JAN02A	10DEC02A
Conrete-SOG/Slabs	95	28JAN02A	22MAY02A
Steel Erection	45	18FEB02A	17MAY02A
Fireproofing	82	25APR02A	20AUG02A
Masonry	92	02MAY02A	06SEP02A
Roofing	45	03MAY02A	03JUL02A
Ductwork Installation	96	09MAY02A	20SEP02A
Garage Precast Erection	67	31MAY02A	16AUG02A
Frame Interior Walls	37	20JUN02A	09AUG02A
Hang Drywall	96	05JUL02A	21NOV02A
Curtainwall	20	14AUG02A	10SEP02A
Flooring	138	05SEP02A	17MAR03A
Controlled Environment	101	29NOV02A	29NOV02A
Painting	62	17DEC02A	12MAR03A
Substantial Completion	1	25JUN03A	25JUN03A



PROJECT CASH FLOW CHART

The following chart represents the cash flow corresponding to each month of the project. A schedule of values was completed for each subcontractor and the cost allocated evenly for the duration of their corresponding activities.



FOUNDATION REDESIGN

EXISTING CONDITIONS AND BACKGROUND

Included in the Geo-Technical report by the Inspecting agency, Froehling & Robertson, was the recommendation to place the building on many clusters of steel H-piles. A total of 572, 45 ft. piles were driven with a total length 26,717 linear feet at and average rate of 25 per day. The suggestion was made based on the presence of deep, naturally occurring organic, cohesive soils. Cagley Associates, the structural designer, decided to go with a Froehling & Robertson suggestion on the pursuit of a deep foundation. Much of this existing soil was found to be old fill. Based on a collaborative with the Owner, the decision to avoid the extensive excavation of the old fill and due to the weak bearing capacities the foundation was designed with H-piles pile caps, and grade beams.

Soil: The majority of the soil on site is light brown clayey sand with spots of gray sandy striations. The soil was remarked in the report as being "ideal for re-compaction and backfill activities". Therefore much of the excavation soil was stockpiled on site and saved for site work activities. Groundwater was typical found at 30 ft. below grade.

Site View prior to pouring pile caps

Foundation Schedules

Piling

	Start	Finish
Planned	9/01	10/01
Actual	9-10-01	10-9-01

Excavation

	Start	Finish
Planned	10/01	12/01
Actual	10-9-01	12-17-01

Foundations

	Start	Finish
Planned	10/01	12/01
Actual	10-16-01	12-21-01

Foundation Subcontractor Costs:

- Piling contract: $641,076
- Concrete contract (foundation): $608,450
- Total: $1,249,526

FOUNDATION REDESIGN

Goal:

Based on soil types and the extensive construction needed for this complex foundation system, the intention of the investigation is to redesign with emphasis on ease of construction. My goal is to be able to completely eliminate the Midlantic trade contract as well as the costly steel H-piles. This is hoped to be achieved by designing a shallow foundation consisting of spread footers for each of the columns.

Background:

The choice to pursue deep foundation was jointly made with the owner because of their preference to avoid removing the large amounts of fill already present on the site. This combined with the weak soil bearing capacity lead engineers to design the existing H-pile foundation. Soil Bearing capacities ranged from 500 psf for approx. one-five ft. depth and up too 4000 psf in the range of 15 – 20 ft. depths. (Hansen, Froehling & Robertson)

To avoid the effects of weak soil bearing capacity, the redesigned shallow foundations had to be over excavated and engineered fill be brought in and compacted properly. This operation was competitively price and found to cost in the range of $65 - $75 per C.Y. of fill material. With consideration to labor the estimate climbs to $100 per C.Y. (Elastizell, Gilbane).

Analysis

Loading by all columns was initially calculated according to design data provided on the structural drawings. Live load reduction was also taken into consideration. (See appendix A-1)

Before a shallow foundation could be designed the poor bearing capacity of the soil had to be dealt with. To remedy this, the technique of over-excavation combined with engineered fill to bring back grade to required elevation. Upon the recommendation of PSU

Architectural Instructor, Walt Schneider, excavation needed to be taken to a depth where bearing capacities of 4000 psf were found. According to consultation with John Hansen of the testing agency Froehling & Robertson this bearing capacity did not occur until the depth of 15 ft. To properly accommodate the spread footers an excavation of 15 ft is required and then grade filled back to elevation in 8 in. lifts and compacted.

Spread footings were then designed in accordance with ACI 2002 code. Footer depths were calculated by checking against one-way, or beam shear and two-way or punching shear.

*Analysis – See appendix A-1 for calculations

Once footer design was completed a unit estimate was determined. Estimated unit prices were taken from actual unit prices used on the project acquired via Gilbane. Once the largest load of a typical spread footer was sized, the cost was used for all similar cases. This was used in order to receive the most conservative estimate. All interior columns were able to be estimated under the spreader footer assembly. The total came in slightly over the $2 million mark (See appendix A-1). This has already exceeded the existing foundation budget without taking into consideration the remaining footers for exterior columns. The use of spread footers has been found to be impractical. Based on the extensive excavation required, almost the entire site would need to be excavated to perform the operation. This option is completely unfeasible.

The two typical interior footers sized were sized at 7.5'x7.5'x18" & 5.6'x5.6'x16".

*See appendix A-1 for calculations.

Alternative Options:

Footer over-sizing

Further investigation into the site may allow for a decreased excavation to a lower soil bearing capacity. Since the current site contains old fill it is necessary to, at the very least, excavate past the fill line. In reviewing the twenty-three boring logs taken on site, only two contained fill. However, to correctly pursue this option, boring logs would need to be taken at all columns to properly identify fill levels for excavation. The following analysis sizes a typical loading for the column J-5, which would be similar to other interior columns. Similar to the previous example, the footer would be estimated and the cost applied to the remaining footers. Based from the geotechnical report, fill was found between levels of three to eight ft below grade. Based upon advice from Walt Schneider, excavation was taken below fill to grade where bearing capacities met 2000 psf. Footers were then sized for this bearing capacity. The footer size of for column J-5 increased to 8.8'x8.8'x2' (See appendix A-1 for calculations). Although the footer increased, the real savings will be in the reduced excavation and fill costs. After sizing, a unit estimate was made, because most footings will be of similar sizes this can be computed to receive a low end estimate. Although the price was much more competitive, the final cost came in over the original budget by nearly $600,000. To properly perform this options much more investigation is needed into the site soil conditions concerning fill locations and soil bearing capacities.

Conclusions

It was clearly evident after the first estimation that engineered fill prices would make a shallow foundation unfeasible. As over-excavation increases, engineered fill prices increases exponentially due to the required slope of 2:1 for excavation. Throughout my study it became quite apparent that the leading factor in foundation design is soil bearing capacities. Sites with poor bearing capacities will generally require deep foundations such as piles, caissons, etc.

*See Appendix A-1 for all foundation calculations and estimates.

SHORT INTERVAL PRODUCTION SCHEDULE (SIPS)

Value Engineering, Foundation Suggestions:

The following represents an alternative proposal to the owner concerning the foundation to keep the same value and structural integrity, while reducing the overall cost of the foundation. The goal of using a SIPS analysis in this instance is to be used as a communication tool.

Construction

Short interval production schedules are valuable tools for perfecting and analyzing a highly repetitive activity such as pile cap construction. The building and garage foundation consists of 211 pile caps. Although pile caps differ in size based on the column load and number of piles, each was constructed in the same manner. This analysis, combined with a small constructability change has made the foundation an excellent opportunity for a SIPS analysis.

A SIPS is typically utilized as a planning tool. A precedent can be set for a typical cycle of work and from learning curves, and be approved upon in each cycle. The intended use of the SIPS study is to set a goal for work and overlap different phases in order to minimize construction time.

The first change involves the construction of the pile cap. The structural engineer made the decision to use plywood forms in forming the cap. Based on the fact that the geotechnical report shows that the soil is of an extremely cohesive type, an investigation has been made to see the results in schedule and time to excavate the earth to specified dimensions and use the earth as the form. This small change eliminates additional excavation, carpenter time to install the formwork, stripping the formwork, as well as fill and compaction time. It is highly suggested quality be monitored in this process to ensure pile cap dimensions are met within predetermined tolerances. To avoid eccentric loading, specific attention must be made on placing the rebar cages in order to ensure the quality and integrity of the intended design.

An issue with deleting the formwork is the unavailability to perform the bituminous waterproofing on the exterior of the pile caps and grade beams around the exterior perimeter of the foundation. I have solved this issue by using a bentonite fabric that is to be placed in the sides of the excavated earth prior to concrete placement. (See appendix A-2 for product specifications)

The main goal hoped to be achieved by the SIPS analysis is to improve on the existing construction sequence for the foundation. The negotiated GMP contract for the project was awarded in two phases. The first GMP included some site work, piling, foundations, and some site utilities work. The project team kept the mentality to "start wherever you can". Since the owner had some definite direction early on, Gilbane agreed and started GMP #1 work, without being able to schedule work for the GMP #2 activities. Gilbane attempted to keep a flow of work by not maximizing the efficiency of the work. In this case contractors were scheduled one after another. Work was not sequenced to maximum efficiency in hopes of being able to flow into the other stages of work to be awarded in GMP #2. However, the foundation was finished before work on GMP #2 could begin and the project was forced to slide back many activities almost four weeks.

The intention of the analysis is to identify schedule durations of the SIPS for each pile cap. In this fashion proper analysis of the construction flows of the foundation work and properly schedule the work to maximize efficiency and minimize time. By doing this, Gilbane, and the owner could potentially stage the work much later, saving Gilbane the extensive general conditions costs of improper scheduling and stoppage of work. By using the SIPS analysis as a communication tool hopefully NVCC would agree to allow Gilbane to schedule the work so as they may push back the start of the project to allow for a steady flow of work. By pushing initial activities forward, information could be received by Gilbane from the designer to properly schedule the work.

The following represents the original work sequence vs. the SIP method.

Existing Sequence	**SIPS (Without using formwork)**
1. Pile Driving – Midlantic Piling scheduled to drive piles for entire building. (crews then pulled) 2. Waddell Concrete scheduled. The contractor performed excavation (backhoe & hand) while alternate crew prepared rebar cages. 3. Piling company returned to site and cut all pile caps to elevation and weld pile caps. (This marked the end of Midlantic's work) 4. Once welding was completed the concrete subcontractor was permitted to place chairs and set the rebar cages. 5. This queued the concrete, 4000 psi concrete was poured into the average 1.6 CY. Pile cap. 6. After curing the pile cap was then stripped. 7. Stripping was immediately followed by bituminous waterproofing. 8. Finally fill in 8 in lifts along with compaction took place.	1. Piling stage from south to north. 2. Concrete subcontractor follows the piling with excavation to approved tolerances. 3. Midlantic crew following excavation to perform pile cutting and base plate welding. 4. Rebar cages and bentonite fabric placed. 5. Concrete poured & cured.

Below pictorially shows the sequences used in constructing the foundation.

Sequence 1: Drive Piles

Sequence 2: Excavate (Back Hoe & Hand) – Prefab Rebar concurrently with excavation

Sequence 3: Cut Piles – Weld Bearing Pads

Sequence 4: Form Pile Cap/Place Rebar/Set Anchor Bolts

Sequence 5: Pour Concrete

Sequence 6: Cure/Strip Forms/Bituminous Waterproofing

Sequence 7: Backfill/Compact

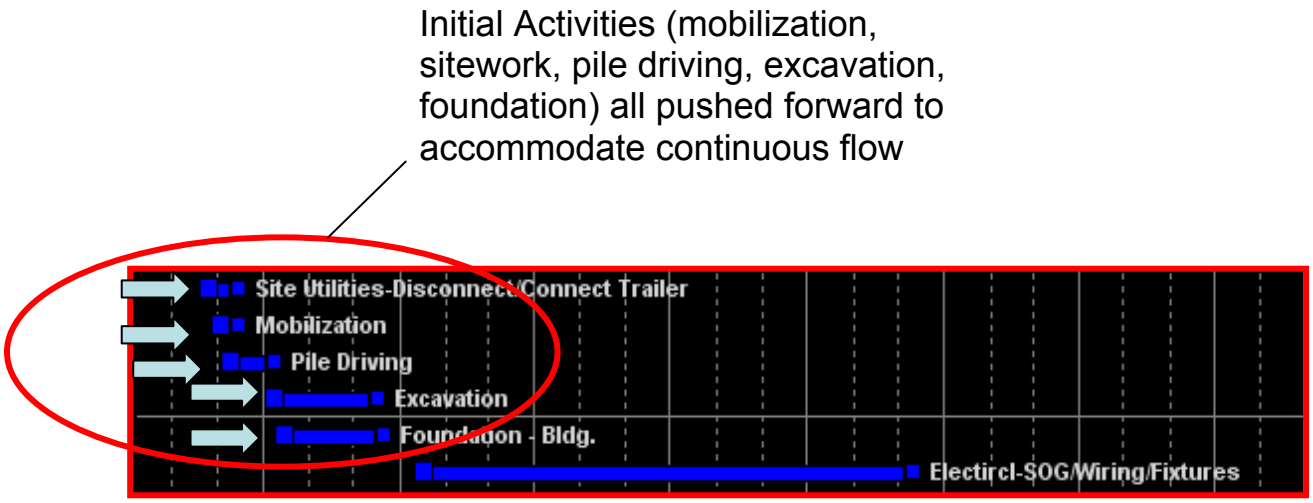
Results from the short interval production schedule resulted in the following. (See Appendix A-2 for calculations). Crew sizes used to estimate and schedule were taken from original crew sizes to complete the foundation

SIPS Results

SIPS were calculated for each of the five pile cap types and grade beams; this data was then analyzed and compiled to receive results. Durations were taken from the superintendent on the project, Harold Adams, unless noted otherwise.

The initial SIPS schedule for the existing construction method of critical path activities came very close to the existing schedule. This was as expected given little consideration was giving to overlapping activities and identical crew sizes were used. In this scenario values were given for each critical activity. Times were totaled as if each activity followed another. Times here can be monitored and improved upon as construction moves along. The superintendent can use the SIPS cycle times as benchmarks used to monitor progress.

Next, durations from the SIPS analysis for work without using formwork were implemented to logically overlap activities. The final revised schedule for the foundations major activities is as seen below. The schedule, by overlapping sequences has been reduced to 12 weeks from 16 weeks. This improvement would significantly save upon overhead costs for the construction manager Gilbane.



The SIPS analysis could be used as a tool to communicate to the owner the value of waiting on starting the site work. The planned durations of the foundation were much longer than the actual. The SIPS process may have identified this error much earlier, and allowed for better scheduling. In this manner the benefits of pushing back the start date and saving costs could be realized.

***See Appendix A-1 for complete results**

Schedule Times for Building Foundation

Original Scheduled Building Foundation	**20 weeks**
Actual Duration	**16 weeks**
SIPS Planned Schedule w/o formwork	**12 weeks.**

***Savings with earth used as formwork of 4 weeks**

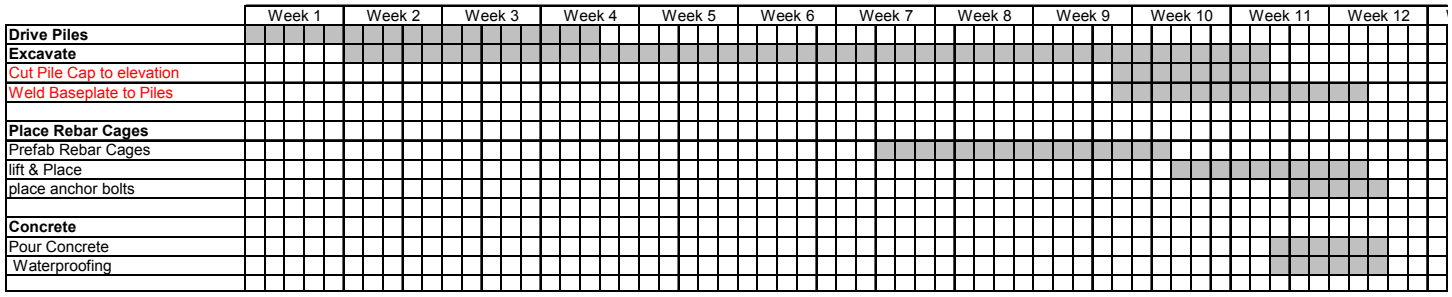
Formwork Savings

Total Savings for elimination of formwork, fill & compaction time total to

$133,294

***See appendix A-1 for estimating spreadsheet**

The following schedule represents the overlapped activities for the foundation construction with earth used as form and the activities durations calculated through the SIPS process.



RECOMMENDATIONS

It is in recommendation to the owner to continue with the deep H-pile foundation. It is also suggested the value engineering recommendation to avoid the formwork for pile caps and use the earth as the pile cap forms with attention paid to quality. I also suggest by using SIPS process, a highly detailed look into the scheduled length of the foundation processes be utilized to stage work properly, as opposed to premature nature it was scheduled. In this scenario work could smoothly flow into the second GMP work. This can eliminate overhead costs, the construction manager's time, and avoid a stop to the project.

TRAILER TECHNOLOGY- A
RESEARCH INTO IMPROVING TECHNOLOGIES IN THE CONSTRUCTION INDUSTRY

INTRODUCTION

A recent poll showed that of contractors, suppliers, service providers and owners: 43% were using the internet, 63% use online plan distribution, 53% were using online collaboration, and 18% were using the internet for pay tracking. Concerning the 28% reporting use of an application service provider (ASP) 27% named primavera as a strategic partner, 21% named Constructware their ASP of choice, 11% reported Meridian's Project Talk, 10% said they customized their own system and the 30% left reported others (Associated General Contractors of America). These numbers clearly show a new direction the construction industry is heading in and that is ease and efficiency of communication between the many parties involved in construction (ENR).

Kenneth Eickman of the Construction Industry Institute was quoted by saying "Information and knowledge management is one of the top priorities for our members (owners, contractors)." Although the desire for the benefits of collaborative software is apparent and real in the industry, the fast paced rate of technology makes it hard for large companies, in this case Gilbane, to stay ahead of the curve and evaluate the technology they should and are willing to invest large amounts of money in. Research was performed on this topic, as the current systems are far from up to date concerning collaboration, compared to their competitors for this project.

Industry Technology

Currently the move for many construction management firms is to a 3rd party for many project control software, a sort of outsourcing of document controls. The advantages to this are many. The main advantage is that online systems allow for an efficient trade of information via the internet. Also, the database can be controlled by an outside company with no liabilities tied to the project. When using online collaborative software users are added for free. All involved people can have as much access to the information as possible.

The industry is moving away from licensing software specific for each job and more to leasing access rights to the software for an extended contract. Turner recently partnered with Meridian to gain rights for there software for a reported multi-year, multi-million dollar deal (www.aeccafe.com).

Current Systems

Gilbane performs the majority of project controls through the software program Prolog, provided by the Meridian Company. Gilbane purchases licenses to adequately staff each job. These licenses are then directly attributed to the corresponding project.

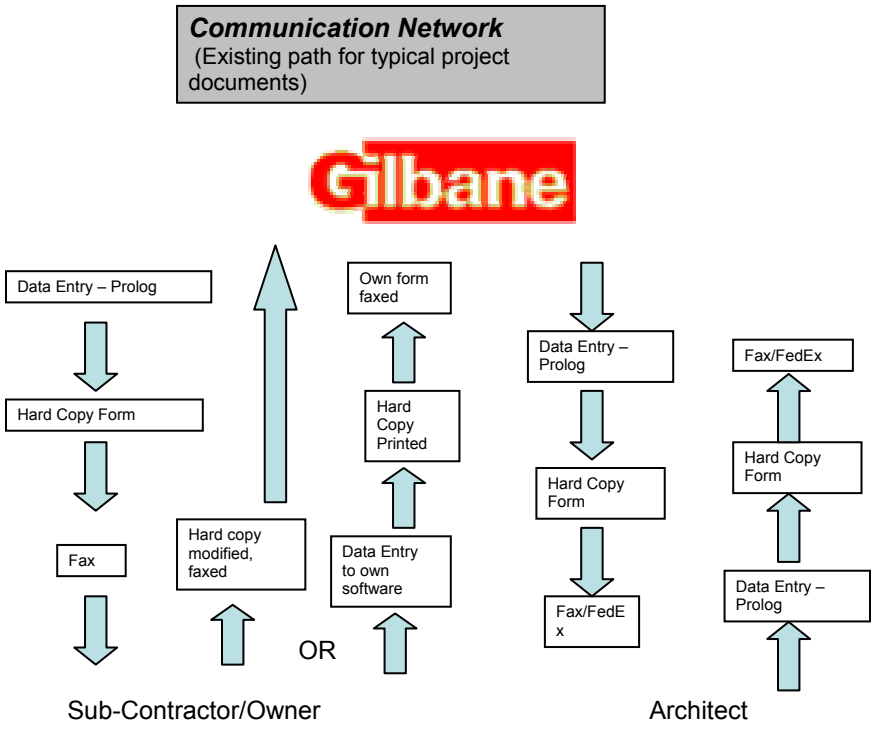
Currently Gilbane uses the Meridian services to train employees, and monitor: RFI's, Submittals, Contacts, Punchlist items, and Meeting Minutes. For the NVCC project two Prolog licenses were allotted to the project. The trailer was staffed with a Project Manager, Asst. Project Manager, Office Engineer, Superintendent, MEP Superintendent, Secretary, and Intern. These seven individuals all had duties related to the use of Prolog. The Prolog services were run from a Local Area Network (LAN) off a server located in the trailer.

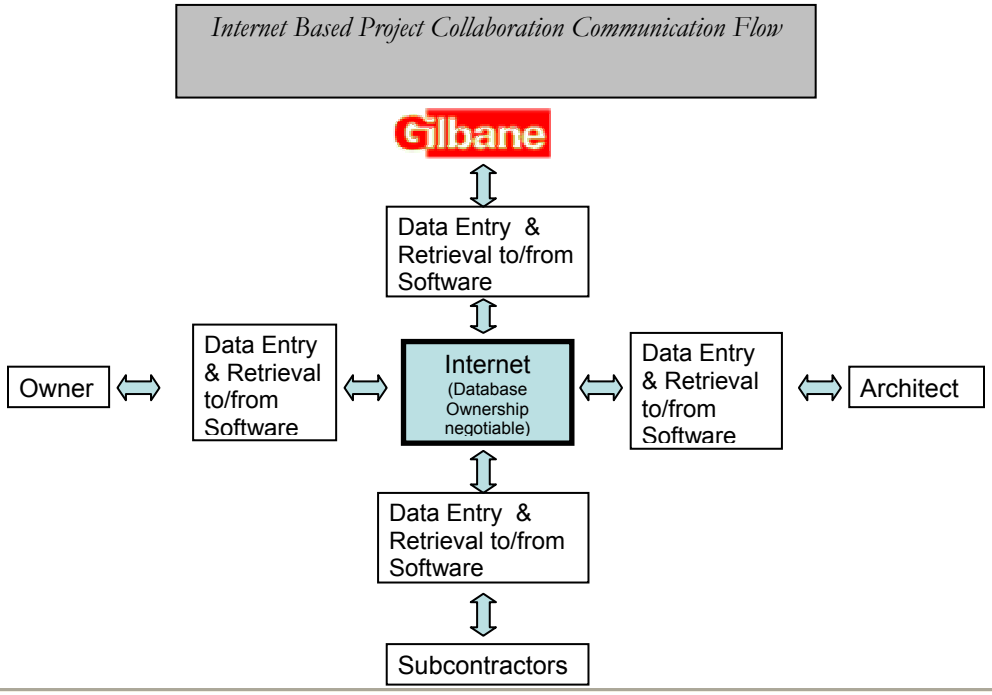
Inefficiencies Identified

The first problem with the system was the internal congestion. Seven employees staffed to the trailer were integral in operating and using the Prolog system, of which only two licenses were available. This means only two people may be accessing the database at one time. The lack of licenses resulted in many headaches and communications problems. For an employee to access the program when the licenses' were already in use the person must walk the trailer to find who is on the system and ask them to log off the system. Current costs of a single license cost $1500 per licenses for Gilbane (Scott).

Although project controls were monitored through the computer systems, communicating the relevant information to all parties was extremely inefficient. This leads into the second inefficiency, the communication network. As the construction manager on the project Gilbane has the main responsibility of coordinating the paths of communication correctly to all parties. Much of the information collected and monitored was relevant to other players on the project. To deliver the information Gilbane reverted to methods of that before technology such as Prolog. Once entered into the system data was printed and collected in hard copy form. Drawings, RFI's, Submittal's, are then copied numerous times and either Fed Ex or Faxed. All hard copies are stored in numerous files. The arduous protocol that Gilbane employees must go through to properly communicate information may negate the productivity that the Prolog system might save. The process has continued the costly use of a copying service as well as the use of a postal service (FedEx).

Below shows the communication flow via documents of the existing system (top) versus a collaborative approach via the internet (bottom).





Measuring Benefits of using Collaborative Software

By increasing costs in technology, managers naturally want to see a return on their investment. Many benefits are hard to track and therefore it is difficult to perform a true cost-benefit analysis. However, there are many identifiable benefits that can be seen, the following table shows intangible benefits as well as tangible benefits with the values associated to site support items than can greatly reduced, if not eliminated by using a truly collaborative system.

Benefits (Intangible)	Savings (Tangible Budgeted Items)
Training Web-based	Postage Services (Fed Ex) – $14,300
Database responsibility allotted to 3rd party	Printing & Copying (Blueboy) - $40,000 (only misc. blueprinting)
Increase in Security	Office Supplies – $6,000
Improved response times	Secretarial Services - $46,800
Decrease in travel time	
Better Interface with Clients	
Human Resource Time	
Timely on hand information available	

The construction industry institute reports that 1-2% of project costs are paperwork costs. By just taking a conservative estimate of a reduction by 50% for site costs directly related to project software, Gilbane would see a savings of $53,550 (www.new-technologies.org).

A recent case study performed for Bovis Lend Lease by Bovis on their Four Season, Miami, Florida project showed real savings. The study attempted to perform a detailed analysis of the savings by using an online 3rd party system. The results of the study showed

for a traditional RFI (system Gilbane is currently using) took an average of 1.05 hrs to complete with an average of $31.50 per RFI. This included writing, faxing, distributing, filing etc. By using the online, digital method of handling of RFI's, Bovis averaged .41 hours and $12.30 to complete a RFI. The total savings for the project landed in the $20,000 range. This demonstrates the need for justification to owners and management as well as the results they can produce if implemented properly (www.mps.com).

There are many different evaluations that have been performed. Accuracy is completely dependent upon the amount of time and depth used in evaluation. Examples of previous attempts include multiple matrices and equations evaluating staff/volume of work ratio of before and after implementation of the technology. However, the largest benefit is the value of timely available information on a project to avoid problems. Although almost immeasurable the value of timely data is recognized as most sought after (Remenyi). The following list benefits applicable to the Gilbane Building Company.

How Does Gilbane/Owners get all players on board?

This question has stifled many attempts for a truly collaborative project, however many great advances are making this possible. With the new technology of XML (extensible markup language) and the internet providers are able to fit systems to each other and properly allocate information to each system. For example Constructware has performed projects with Clark Construction Group and fitted systems to report cost placed into Constructware to be properly place in the accounting software of JDEdwards. This case demonstrates the new flexibility in data transfer from company to company. Before, to achieve a collaborative project all players needed to be using the same software, but now with the emergence of XML parties involved do not necessarily need to switch software. The new code transfers data for each application. Some collaborative software companies offer software packages on a job by job basis. This kind of flexibility allows many more companies able to acquire and use this new technology. Not only is software becoming more and more compatible, but the financial burden of the software is attempting to be

lifted. Currently software providers are encouraging contractors to market the benefits of the software to the owners to allow use of the software to be reimbursable. In the case a CM may not be able to get all parties to collaboratively use the software; it may be given out for free or required by the CM/GC to work on the project. Seeing that many owners prioritize this resource at the top, it may not be too difficult to convince owners to "buy in" to the collaborative approach. Owners want timely informed and accurate data to be able to make crucial decisions as the project progresses. Currently many jobs are being reimbursed by the owner. The main cost to construction companies is that in training employees and implementation of the software in the company.

Implementation of Software

There are many schools of thought on how to properly implement new technology to a large company to receive the greatest benefits. The greatest advantage for Gilbane is that they have already performed much of the implementation work. Although they are far from full employee training on a true online collaboration, their employees have received significant amounts of training on the meridian software. It seems from every party's perspective that these systems need to be fitted to each project, because there are so many unique characteristic to each project. Questions to ask before the system is operational for a project include. (www.constructware.com)

- What data needs to be exchanged?
- What is the workflow for each document?
- What are the milestones for the project?
- What are the security needs of this information?

It is also a common misconception that the implementation of new software is an extensive long process. This can be true, however many companies only need small strategic implementation to the technology. In example, a company many not necessarily transform their entire system, but only perhaps fit software to exchange enough accounting data so that the project accountants can perform their duties. In this way small decisions can be made to

run the company most efficiently and avoid entire overhaul of IT technologies. Many software companies use an internal IT-head/staff to the work within the company and be on hand for any problems that may occur.

Current Industry - Main Competitors

The following lists the leaders in the industry for project management technology in the construction industry along with their competitive edge.

Constructware

- Leader in XML technology and research.

Meridian (Prolog, ProjectTalk) :

- Retains many very large clients

Autodesks' Buzzsaw

- Compatible with AutoCAD and all AutoDesk products.

Primavera (P3e/c)

- Compatible with primavera's scheduling software
- Most widely used.

A Look to the Future

The following documents research and findings to technology on the rise in the industry as well technology on the horizon that will soon be introduced to the industry.

Technology today is changing faster and faster. The construction industry has historically lagged many other industries in keeping up with the newest technologies. This has had its advantages and disadvantages. By waiting on technology many contractors have avoided the "money pit" of forever upgrading to the better and faster available technology (www.constructware.com). The following outlines some new technology that may have a large impact on the industry.

The following list and summaries only list a portion of some of the new and innovative technologies available and soon to be available.

Wireless Communication

Currently in Europe many contractors are starting to experiment with wireless communication in the field. A Swedish based firm has the capability to for companies to be able to download documents and drawings directly to a PDA or a Cell phone. This new technology supports AutoCad's .dwf and Microstation for .svf formats. The current package costs around $52,000 for 50 users (www.enr.com).

The company VISARC boasts the new technology benefits. Claiming the zoom and scalable ease makes for a very efficient and reliable tool in the field. The system has the potential to revolutionize how buildings are built. Foreman and superintendents may only need a palm pilot to check specifications and dimensions in the field of the most revised version of drawings. This could potentially resolve many errors, increase quality, as well as increasing productivity. (ENR, VISIARC)

3D & 4D Technology

The use of 3D and 4D technology has recently been a highly publicized emerging technology in the industry. The benefits are easily seen, the technology allows for better description and visualization of projects and allows for less miscommunication and better judgments. The technology allows a building to be view in three dimension and can be linked to the project schedule to view the project built according to the planned schedule.

Advantages:

- Improved understanding of project to all parties
- Able to identify possible risks and/or constructability issues
- Helpful in planning construction processes
- Easy to communicate to construction illiterate individuals

Disadvantages:

- Added Cost/Time
- Speculative Benefits
- Specially trained human resources (added overhead)

The benefits of 3D greatly outweigh any disadvantages. Communicating design thoroughly and efficiently is paramount in construction relationships.

Code Counselor

A new tool that can be invaluable to a project is called the "Code Counselor". The service is aimed at targeting all codes applicable to a project. The company code lamp uses an interview and evaluation process to filter out all non-applicable requirements. The evaluation process is to develop a report that under a license with the NFPA, lists all applicable requirements for the project. This service can be very helpful in avoiding the possible pitfalls of not meeting a code and having to perform re-work. Superintendents can

review the list and check the building during construction to ensure all work is installed within requirements. (ENR, Codelamp)

Conclusion

The ever changing technology sector has given way to new means of building. Currently the trend is toward implementing the ease and efficiency of the internet as a real time communication device to delivery timely information to all parties involved in a construction project. The benefits can be identified through declining overhead and site costs as well as intangible costs.

Project management software, however is not the only technology that is revolutionizing the way buildings are constructed. There are always new technologies on the way that industry members must be aware of to stay ahead of the competition.

PROJECT FINANCING-
ALTERNATIVE FINANCING OPTIONS FOR PUBLIC OWNERS

INTRODUCTION

Traditionally large public owners have relied upon typical means of financing to fund large construction projects. Typical means for capital necessary for large projects include bond issuance, tuition, grants, gifts, and state and local appropriations. Current trends are moving away from these financing strategies (Eden). More and more is new legislation, political climates, etc. are determining financing strategies.

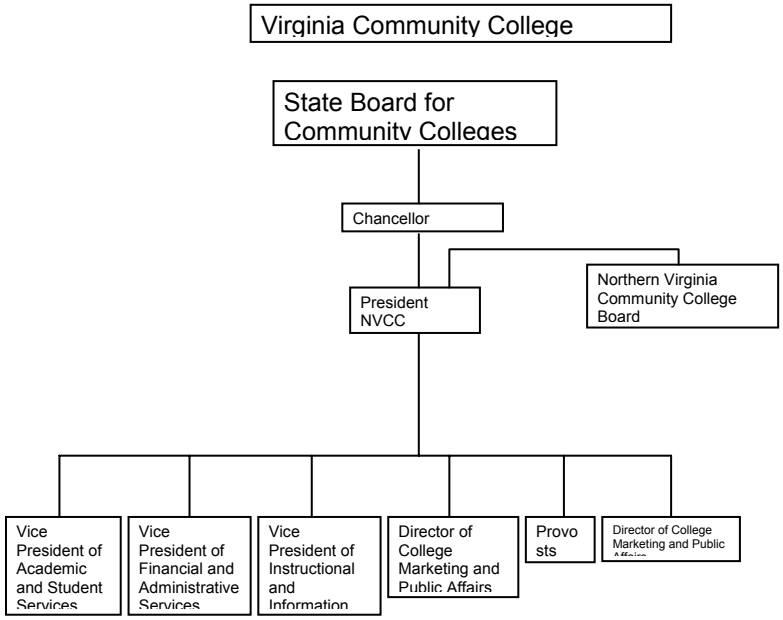
Throughout the project the owner financing had been an issue. Out of good faith the construction manager gave back the contingency prematurely to help with NOVA's cash flow difficulties. The financing problems were not only known by players on the project, but have made public by local news channels. The project was rumored to not be able to be occupied and ran by the college. These budget difficulties presented obstacles to overcome and opportunity to find new ways and more innovative ways to finance a project for a large owner who is certain to expand.

The opportunity now resides in the owner's hands. New legislation in Virginia permits the school many more options in funding projects. The current situation allows the school to use new a more innovative ways to fund projects besides using current appropriations for most long term assets.

Existing Conditions-Why refinancing is a good fit for the owner?

Currently the college is financing the medical education building solely through state appropriations. The college lobbies each year for their funds from the state. This, along with tuitions represents the college's main means of financing for large projects (see the NOVA balance sheet Appendix B). However, the project adjoining parking structure was to be solely financing through existing parking fee capital (Camden).

The current project was the first that was approved for NVCC to use a construction manager. By using state funds for construction the building must be constructed in accordance with state regulations. The following chart shows the hierarchy of the owner and their relationship to the state board.



The community college finds itself in a unique position currently. Due to recent changes in Virginia state legislation (Virginia Public-Private Educational Facilities and Infrastructure Act of 2002) new laws allow for public/private partnerships for capital construction (Camden). Before this legislation the college was limited to only using capital on hand. This capital was limited to state funds and tuitions. This also meant that all

construction was to be performed in adherence with all state regulations as well as procurement laws. State funding also requires that all submittals, not only be reviewed by the architect, but by the state reviewing agency BCOM. Through new financing options this now can be avoided (Eden).

NVCC is a large owner whom expects to be performing many more projects in its near future according to their master plan. Public/Private financing is a growing option for many factors, one of which is the current resistance for voters to approve tax increases. The availability of funds through traditional methods are in jeopardy due to the need for voter referendums to approve funding. This type of financing allows them to not rely solely on the state to fund their projects.

The school must be prepared to face certain questions before entering into public/private financing strategies. These include how much control do we all to give up in design, construction, ownership, finance, and management of facilities, when there are private entities that are just as, if not more capable of providing the afore mentioned control issues.

Virginia Public-Private Educational Facilities and Infrastructure Act of 2002

The goal of the recent legislation is to recognize and capitalize on what each party does best. By allowing public private entities to collaborate on projects the goal is to minimize costs, decrease schedules, which benefit all parties. The legislation welcomes creativity and innovation into the construction, as well as financing of projects. This legislation also bypasses procurement laws as well as review boards. Previous to the legislation subcontracts had to be awarded to the lowest bidder, this is not the case now.

Public entities may now review proposals for the best value to award contracts. The removal of the state review boards represents the removal of a large issue for the current medical education campus. Many delays and even stoppage of work were attributed to the

lack to timely feed back from the review boards on submittals not only during construction, but design as well.

The new legislation covers a wide range of "qualifying projects" that include:

- A school building
- A functionally related and subordinate facility and land to a school building (including stadiums and other facilities for school events)
- Any depreciable property provided for use in a school facility that is operated as part of the public school system

(http://www.administration.state.va.us)

Analysis

As an alternative to the customary manner of funding projects solely through the state, I propose use of public/private finance and development under the new legislation to avoid the current problems faced by the owner. The following represents the three setups in which a public private partnership can take.

Three Basic Types of Public/Private Real Estate Partnerships

Type of Project and Participation Entities	Design	Finance	Develop	Construct	Operate	Ownership
1.Private Partner in conjunction with public entity(s)	Private with little or no Public Input	Private with Marginal Public Capital or Noncapital Investment	Private	Private	Private	Private
2. Traditional Public/Private Partnership	Private with Public Input	Private and Public Entity(s)	Private	Private with Public Oversight	Private or Public	Private and/or Public
3.Public Partner in conjunction with a private developer	Private Contract or in-house Public	Public Entity(s)	Private Developer on a Fee Basis	Private with Public Oversight	Private or Public	Public

Stainback, John. Public/Private Finance and Development

Before determining possible innovative ways to finance the project the following aspects needed to be identified.

Financial aspects of owner to consider

- College is not a for profit organization
- Short term cash flow problems
- New Legislation – Virginia Public-Private Education Facilities and Infrastructure Act of 2002
- Tax exempt clause available for college
- Unable to issue General Obligation Bonds.
- Low Interest Rates

Financing Options: The following methods outline the most common new ways to possible finance large projects for a public entity

Construction Loan – Due to the recent Legislation passed Virginia Public-Private Education Facilities and Infrastructure Act of 2002 loans now can be obtained by the school through typically a commercial bank or an insurance company. This is a viable option for the school, however due to commercial interest rates as well as the availability of construction loans in the current market there are many other, more beneficial options to consider.

Develop Lease-Back

- **Developer Owned – Operating Lease**

In this arrangement NVCC has only the right to use the facility owned by the developer for the duration of the lease term. The typical setup will have the developer finance the project through their own means with commercial interest rates. The operating lease is a

typical lease that builds no equity into the project. Therefore at the end of the term, which can range up to 30 years, the building or equipment ownership is retained by the lessor/developer. The only tax advantage to the developer is through the depreciation of the building.

- **School Owned- Tax-Exempt Lease Purchase**

Tax-exempt leasing provides that title to the equipment or facilities transfers to the university or college at either commencement of the lease term or the end of the term of the contract on payment of a nominal consideration. This option builds principal & interest components into each lease payment, the developer would hold and depreciate the facility so at the end of the lease the asset then transfers to the school for $1.00. With each payment equity is built into the project for an eventual transfer in ownership. Once the college owns 100 percent of the building the campus would be rent free for the remainder of its useful life, life cycle costs can then be determined to show incredible savings.

Tax-exempt leases allow the school to borrow funds without a voter referendum. The lessee essentially owns the leased building as long as they don't default on lease payments, which can be monthly, quarterly, semi-annual, and annual. The setup to tax-exempt funding is very similar to that of a bond; however because of language in the agreement the obligation is not considered long-term debt, but considered as a current expense. This language is what allows the college to perform such and option. One major benefit is that tax-exempt leases do not require a voter referendum as opposed to general obligation bonds, which do.

The benefit for the conduit supplying the funding is that under the law is that interest earned on lease payments is exempt from federal taxes. This can be very enticing for the party issuing the financing. Tax-exempt leases rely on the lessee's credit rating; in this case the college boasts an excellent credit rating backed by the state of AAA.

- **Developer Financed for operation contract**

This option is highly unlikely for the campus building because of its low earning potential. However, the parking garage maybe a candidate for a developer to build in order to operate the structure under a contract term and retain earnings from the parking fees.

- **Bond issuance**

General obligations bonds and not permitted to be issued by NVCC. These bonds must be backed by the state and require a vote of the electorate. Bonds that are approved are backed by the "Faith and Full Credit" of the state and then allocated through the state board of community colleges to each college.

- **Raising Capital**

This technique is standard practice by many higher education intuitions as well as many private schools to fund or partially fund projects. However, this option is more difficult for a community college and not usually explored. NVCC has little experience in raising funds and their alumni association is significantly smaller the many public state schools.

Risk Mitigation

One the most evident benefits to the school of public/private financing are the allocations of risk. Colleges such as NVCC are not in the business of taking risks, whereas developers and contractors are much more accustomed to handle project related risks. Contractual agreements can help alleviate risks felt by the school.

The school is not only affected by project related risks, but must analyze their position and long term risks inherited by taking on long term expenses. By entering into a long-term lease agreement or purchase of a long-term asset there are certain risks that NVCC enters into. These include the variables of student enrollment and technology advances.

Risk 1

-Future student enrollment is very unpredictable; this can be a significant risk to the school. The building may be rendered useless if there are no students to fill it. The college has seven campuses in different locations. To keep this pseudo-satellite campus afloat would take significant capital or liquidation of this long-term asset. To mitigate this risk would be to enter in a lease agreement. A 20 yr. lease is a much less risky investment as opposed to the $26 million upfront costs to purchase the building. In the case that the building is deemed useless to the college, the college has the option to buy-out their lease and walk away.

Risk 2

The advancements in technology can be greatly felt by an educational building, not to mention a medical facility. With the ever changing advances in technology no one is sure what a school might look like in 30 yrs. Also, because the facility is so dependent on technology it has been constructed in that manner (i.e. lead lined walls, dental trenches, medical equipment, medical gas piping, darkrooms) any advances in the medical industry could render these spaces useless or in desperate need of renovation.

Implementation

To properly implement this type of project financing and delivery, much effort from the public partner needs to take place. In the case the school needs to identify, project goals (ownership options), risk associated with the project, amount of control to retain throughout the project, financing strategy, project delivery method, project schedule, and cash flows throughout the life cycle of the building (Stainback).

Once the project has been fully defined by the owner the solicitation of proposals can be made. The owner has the option to issue a series of RFI's, RFQ's, and RFP's as they see fit to ultimately receive the best proposal. Once a RFP is submitted it must be made public

and solicited for 45 days to receive other competitive bids under the new law. However, the lowest bid does not have to be taken.

Recommendations

The college would be wise to mitigate identified risks by not owning the building. A long term lease for the building may be the most valuable option. In this scenario the school could agree to a long term lease with a developer. The developer would be taking the risk of obsolescence of the building; however they are in a much better position to develop/modify building for their own use.

Before the school enters into any long-term obligations cash flows ratios of 1.2 to 1.5 need to be met. This refers to the rule of thumb stating 1.2 to 1.5 times the annual obligation must be met in cash available. This rule of thumb ensures to some degree a stable cash flow through the term of the lease (Eden).

By choosing a public/private partnership with a developer as the private entity many of the problems faced by the project can be remedied. In example a developer will have much more expertise in handling the design phase into construction, whereas the numerous problems faced on this project with design led into a brief stoppage. The current lengthy process dictated by Virginia law for each phase of design/build/finance can be avoided to save as much as three to five years to complete the project (Eden). Public projects have been found to average in length of four to seven years for predevelopment and development, much longer than the private average of three to four years (Stainback). Also, by using a developer, NVCC can get around using the state of Virginia procurement laws this would negate the current setup of using two architects on the project. By choosing a public/private partnership the school can avoid finding current cash to fund the project in a single year and spread the cost of the facility over its useful life. With a lease option the school can properly manage their cash flow at the same time as mitigating the risks previously mentioned.

In summary public/private financing is a growing market for public entities. By allotting each party with the responsibilities they do best reduction in project development costs, time for project development, construction, and cash flows for the public institution can be enhanced to alleviate financial stresses.

From the construction managers' view

AEC companies today are providing more and more services to add value to the owner. Currently many CM's/GC's are offering financing services. This is also true for the Gilbane Building Company. Within Gilbane a subsidiary, Gilbane Properties deals with financing and can help owners with these issues if necessary. The Northern Virginia Community College presents an opportunity for Gilbane to extend the services to help the owner.

Often risk in contractor default is commonly associated with subcontractors. However, research into owner's financial standing is good practice. Before obligating oneself to a project by bid or contract it is necessary to perform investigation into past projects as well as owner integrity and source of financing. Currently many contracts contain verbage as a means of mitigating risk that states owner must provide assurance that suitable financial arrangements have been made in order to finance the project. This excerpt is taken from AIA Document A201 sub paragraph – *The Owner shall, at the request of the Contractor, prior to execution of the Agreement and promptly from time to time thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract.* Although Gilbane entered into contract with an owner with backing by the state of Virginia, owner financing still can become and issue although less likely.