Boll Family YMCA

Detroit, MI

The Pennsylvania State University
Department of Architectural Engineering
Spring 2005 Thesis

The Downtown Family YMCA

General Project Data

- Owner - YMCA of Metropolitan Detroit
- Construction Manager - Barton Malow Co.
- Architects/Engineers - Smithgroup
- Project cost - $29 million
- Occupancy type - II-A, Recreational
- Size: 110,000 Square Feet
- Dates of Construction - January '04-December '05
- Project Delivery Method - Construction Management at Risk

Lighting/Electrical

- The building's main transformer is 1500kVA at 480/277V Y - 3 phase
- The main breaker consists of a 2000AF/2000AT insulated case at 480V, 3HP
- The secondary feeders provide 3000A of current
- The emergency light ballasts are all battery powered
- The entire building generally uses T8 flourescent lighting - With the help of Detroit electrical services, this project was able to acquire its lighting needs from a single company

Mechanical

- 5 rooftop air handling units (AHU)
  - 3 are used for general supply, providing 820 CFH each
  - 1 used for laundry at 450 CFH
  - 1 used for the natatorium at 1140 CFH
- 5 seperate roof exhaust fans at 1000 CFM each
- Natural gas boilers are used for the heating of water
- Central de-ionized/reverse osmosis water system

Architectural Features

- There is a climbing wall in the lobby
- Elevated running track over the gym
- Pool in the basement
- The building contains staggered floors, or 'half-levels'
- Decorative CMU masonry and glass facade
- Site conditions give this building a unique 'stepped' shape
- Performing arts theatre

Structural

- The building rests on drilled caissons at 120+ feet
- The office areas used mainly W18x35 and W18x50 beams
- Lateral bracing was used for the climbing wall in the atrium
- 4000psi lightweight slab on deck with shear studs at 1 per 48" and a 2" metal deck were used for floor construction
- No composite beams were used

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RESEARCH TOPIC

Credits & Acknowledgements

I want to thank the following people for the help and support that they have given me this past year for the development of this thesis.

PENN STATE

- Dr. Michael Horman
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- Prof. Kevin Parfitt

YMCA OF DETROIT

- Lorie Uranga

BARTON MALOW CO.

- Loren Luedeman
- Beth Yorke

SMITHGROUP

- Bruce Comstock
- Jana Hayford
- Robert Quinn

OAKLAND PLUMBING

- Michael Kaufman

HOLDER CONSTRUCTION

- Benjamin Gerald

PERSONAL

- My family and friends who encouraged and gave me inspiration throughout this whole process.

Executive Summary

The purpose of this report is to analyze and investigate the different systems of the Boll Family YMCA in downtown Detroit. There are 3 main topic areas that will be covered, along with an in-depth investigation. These topics are as follows, respectively: foundation analysis, interiors analysis, mechanical room analysis, and thesis research.

Each of the main topics will be covered in the same format. The format will give the reader background information on the current system, information on a proposed system, a cost comparison and a conclusion.

The first topic will analyze a different type of foundation used, the second topic will investigate the handrail system, the third topic will look at the piping in the mechanical room and the thesis research will deal with the topic of integrated design management.

Introduction

This thesis is a culmination of an academic's year worth of research and analysis. The focus of my investigation is on the Boll Family YMCA located in Detroit, Michigan. The notion of making this building my subject of analysis began in July of 2005, during my internship with Barton Malow.

The foundation of this project began with the collection of background information. Everything from who the owner was to how much the project cost. This background information will be the first topic covered in this report.

Following the background information, comes the highlight of my research. The main theme of all my research topics is to find solutions to current problems so that the building operates with a better system while saving money.

The first system analyzed is the foundation. My proposal deals with changing the current strip footings to a mat slab. Cost, schedule, and quality are a big issue regarding this proposal, and through my research I was able to reach a feasible conclusion.

Next, the handrails in the building are evaluated. This topic was suggested to me by the project manager. The central argument surrounding this topic was mainly about aesthetics vs. cost.

The third topic deals with the mechanical room and its layout. A majority of the information for this topic came from talking personally with a mechanical contractor and examining drawings. I found this topic to be most interesting because of the method taken to find an alternate solution.

Lastly, focusing our attention away from the different building systems, I present my research investigation. I learned much about this topic and gained a genuine interest when I had the opportunity to attend a PACE roundtable conference. I collected my information by interviewing the different head entities of the project and I also read different research papers regarding this topic and used information from the best/most relevant two papers.

BUILDING SYSTEMS SUMMARY

Demolition

This project was built over an existing parking lot. When performing the site conditions evaluation, there were remnants of a foundation and pieces of concrete throughout the site. This did not interfere with the process of excavation.

Structural Frame

Only one crane was used due to the space limitations of the site. However, an 80 ton crane was brought in for the heavier members. There are different spans of beams used for the office areas, open gym areas and especially the theatre. Most of the connections are bolted, but in areas such as the elevated track overlooking the basketball court, there were also full penetration welds. Besides this, the atrium/lobby level has a climbing wall that utilizes cross bracing for support. Steel floor framing is being used with shear studs at 1 per 48" on a 4,000 psi Lightweight slab on deck. No composite beams are used.

Building Envelope

The building envelope consists of decorative CMU and glass panels. The CMU areas are cavity walls for load bearing purposes. The glass façade was installed to allow for maximum visibility both inside and out.

Mechanical

Hot water heating generation is used. 2 Firetube boilers at 3200 MBH are installed for this. Med-press, HHW/DX "Intellipak" rooftop air handling units is being used. Both regular and fan-powered VAV boxes with reheat are being used for the circulation of air.

Electrical

The electrical system in this building mainly consists of a medium voltage distribution system along with a secondary distribution. The main transformer of this building is 1500kVA at 480/277V Y - 3Φ. In addition to this, there is a substation at 3-5kV and 1,000kVA transfer (medium dist.) and a MDP 2000 Amp MLO (secondary dist.). In order to provide all the lighting in the building with the appropriate amount of power, (4) 480/277V panels are used along with (9) 208/120V receptacle panels.

Telecommunication

An IP phone system is used, it's a very capable system and very adjustable for any future modifications even though it is already high-tech and up to date. Commscope cables UTP category 5, 350 MHz are used. These cables are used for both data and voice. Besides this, there are SBC-T1 wires for data transfer and 50 pair category 3 cables for voice. There are numerous Sisco wireless points and the system has gigabit transfer capabilities for desktop and Ethernet.

PROJECT COST EVALUATION

Actual total construction cost - $25,795,000

Actual adjusted total cost - $29,000,000

Actual cost per SF - $285.07

D4 total building cost - $18,551,164

D4 adjusted total cost - $22,070,554

(Includes site work)

D4 cost per SF - $216.95

RS Means total project cost per Square Foot (3/4 end) - $178.50/SF

(Includes mechanical and electrical work)

RS Means total project cost – $18,158,805

To my surprise the cost estimate that I generated with the D4 software did not stray far from the actual project costs. The difference was over $5 million, but I expected D4 to go way over or way under (~$10 million). The price difference was not too much of a surprise at second glance. After all, the project that I modeled the estimate after is also in Michigan, it took place 2 years earlier, and it is also a recreation center. Besides this, the design fee, money for furniture and the preconstruction/utilities relocation are some costs that D4, to my knowledge, has not included. Looking closer at the RS Means estimate, I began to wonder if the estimate that I calculated using the RS Means data included the price of the natatorium, elevated track, and the theatre.

(See attached sheets in Appendix A)

LOCAL CONDITIONS

Preferred Methods of Construction

In the Detroit metro area, using concrete for buildings is not as preferred as using steel. The main reason for this preference deals with availability of concrete. There are no close or local concrete companies, which makes production and transportation more expensive. Due to this, there is a steel building preference because steel is so much easier to acquire.

Availability for Construction Parking

If any construction is to take place in downtown Detroit, workers usually have to find parking on their own. They usually park in parking decks. The reason for this being that there is not enough free space in downtown to provide parking for all the employees on any particular site.

Soil/Subsurface Water Condition

The soil conditions encountered at the soil boring locations appeared consistent with the boring previously performed at the project site. The soil profile generally consists of sand and clay fill near the surface, overlying low plasticity soft to hard natural silty clays. Beneath the silty clays, dense silty sandy clay (hardpan) was encountered, to the explored depths of the soil borings. The following gives a generalized summary description of the soils encountered in the current borings performed at the subject site, beginning at the ground surface and proceeding downward:

Stratum 1: Asphaltic and Portland cement concrete and base material. Two to six inches of Asphaltic concrete overlying 5 to 9 inches of crushed slag base material reported at five of the current soil boring locations.

Stratum 2: Various fill materials. At the most recent borings, sand and clay fill with varying amounts of construction debris, was encountered beneath stratum 1 materials, extending to depths of 5.5 to 17 feet. Brick and concrete fill, including possible concrete slabs, were encountered at several of the boring locations.

Stratum 3: Natural silty/sandy clays: 119-121 feet. However, the clays in the upper 20 and 30 feet were hard to stiff. Natural medium dense sands and sandy silts were encountered beneath the fill materials at boring B6, extending to a depth of 16 feet. A single N-value of 29 bpf was obtained in these materials

Stratum 4: Clay hardpan. Dense silty sandy clays (hardpan soils) were encountered beneath the Stratum 3 clays, extending to the explored depths of the soil borings.

Due to wash rotary drilling methods used to advance the deeper soil borings, groundwater levels upon completion of the current borings are not available for the deep soil borings; however, groundwater was encountered at depths of 19.5 to 13 feet during drilling operations, and at a depth of 36 feet below the ground surface upon completion of drilling operations at boring B6. The groundwater levels should be anticipated to fluctuate throughout the year due to variations in precipitation, evaporation, surface runoff and certain construction activities.

CLIENT INFORMATION

Owner's Representative

The client of this project is the metro Detroit YMCA. The client's representative is Mrs. Lorie Uranga. Mrs. Uranga has spent the last 16 years dealing with construction. She has been with the YMCA for the past seven years. This project will be Mrs. Uranga's 3rd new construction building for the YMCA. She completed one in Milford, MI in 2000 and another in Auburn Hills, MI in 2002. She is responsible for all property management.

Why Are They Building This Facility?

The main reason for building a YMCA in downtown Detroit is because there hasn't been one there in almost 90 years, so this is would be a 'revival mission.'

Cost, Quality, Schedule and Safety Expectations

In terms of cost expectations, they do not want the cost of the building to exceed the $29 million budget. However, there are donors and contributors that generously give money, but they want their money going towards something aesthetic and that recognizes the donor/contributor. One good example of this is the fountain that will be placed outside by the main entrance.

One of the big quality/design goals of the YMCA, which can be seen by the design, is to promote high visibility. The want the building to glow at night, that is why there is so much glass used. The use of glass also gives people a chance to see what is going on from the inside out and vice-versa. The concept of the 'half-levels' is also supposed to promote this visibility issue as well as inspiring high energy.

As for schedule expectations both Mrs. Uranga and Mr. Luedeman (project manager with Barton Malow) are collaboratively working hard to reach the goal of the occupancy date (December 2005). There have been processes all over the schedule that have needed to speed up, this usually means that contractors either have to put in longer hours and/or progress on work during the weekend.

Safety expectations are high for both the YMCA and Barton Malow. Safety issues have been especially strict on this site ever since an incident that occurred this past summer. Safety inspectors from MIOSHA came to examine the site and found that there were some people working at dangerous heights without being tied-off. This was the biggest issue that they found on the site, and needless to say, it produced some hefty fines. Besides being concerned with the safety of their workers, the heavy consequences that come with a situation like this is something that the YMCA and Barton Malow cannot afford.

Joint, Dual, or Phased Occupancy Requirements

There are no other tenants in this building. The building is strictly for the YMCA and its members. However, there is a pick-up station for the 'people-mover' on the same site. This station is right outside of the building and it will not be relocated. This station will not be relocated due to the fact that it is a main pick-up point, and also because it will allow members to get dropped off right in front of the Y if they are all the way across town.

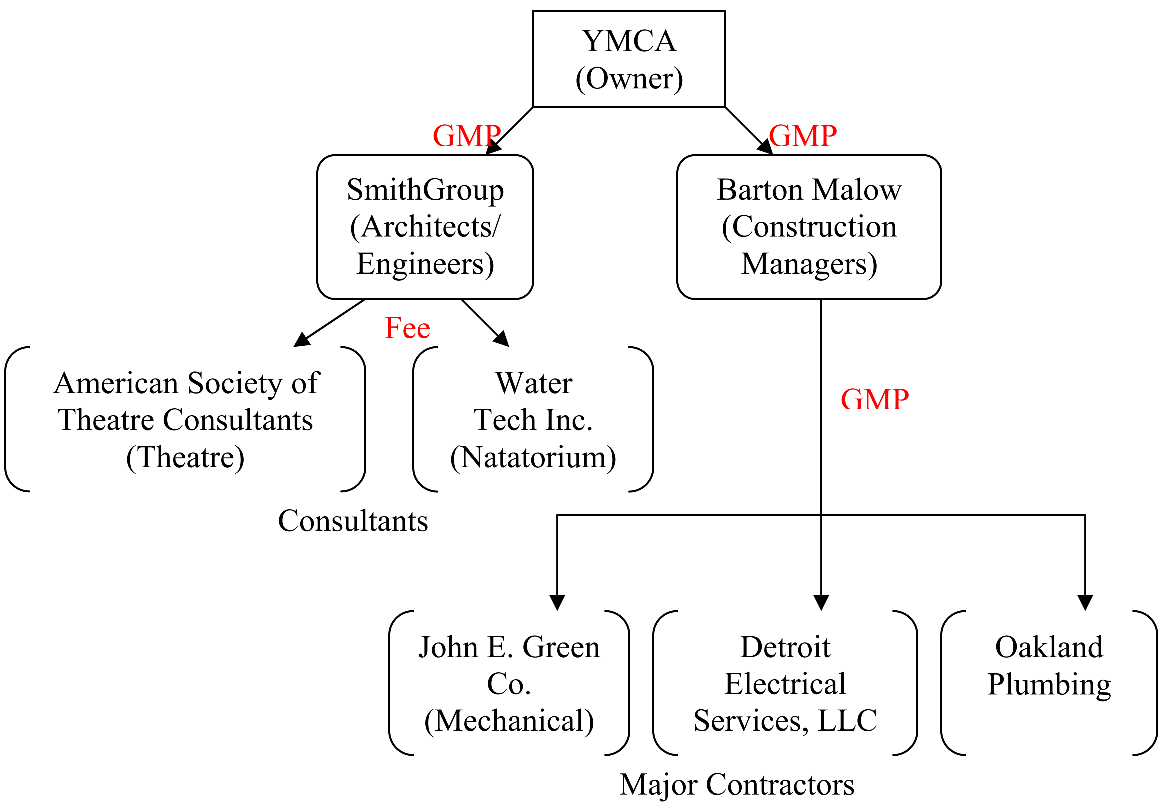
Completing Project to Owner's Satisfaction

The main issue that Mrs. Uranga stated is that the project be completed on time. Schedule was a number 1 priority because the project had to be done in time for the Super Bowl. Cost was hand in hand with schedule, but if rank needed to be assigned; it would get ranked number 2. Quality would be the third priority. Mrs. Uranga stated: "[Placing quality third] may sound bad, but the YMCA has many donors that added to the aesthetics of the building. For example; one family is donating money for a fountain, another is donating money towards the childcare area etc.

PROJECT DELIVERY METHOD

The project started out with Barton Malow Company acting as a construction manager. Once all the subcontracts were awarded, a GMP (Guaranteed Maximum Price) was established and the contract changed to a CM at risk. The CM approach was chosen mainly because of past relationships. Ben Maibach III, President of Barton Malow, is one of the head board members on the YMCA committee and he has been thinking of getting involved with this project for the last 5 years. So, seeing as how Barton Malow already has a direct connection with the YMCA and they are a construction management company, a decision was easily reached.

Organizational Chart of Major Project Players



List of contacts

- YMCA: Lorie Uranga – Luranga@ymcametrodetroit.org (313) 267-5300
- SmithGroup: Kevin Shultis – Kevin.Shultis@smithgroup.com (313) 442-8318
- Barton Malow: Loren Luedeman – Loren.Luedeman@bartonmalow.com (313) 963-4175
- John E. Green Co.: Mark Jones – (313) 868-2400
- Detroit Electrical Services, LLC: Grace Tache – (313) 223-2800
- Oakland Plumbing: Mike Scott – (586) 731-3535

Contractual Agreements

The contracts held with the subs reflected just about all the same requirements that Barton Malow was held to with the owner minus the CM part of things. The subcontract was GC/guaranteed maximum price contract. In essence the contract stated that the sub has to complete their scope of work for the contract price and by the scheduled completion dates. Also, they must complete their work without interfering with the other trades work (make it so that another trade cannot complete their work by the scheduled completion date).

Contractor Selection

In terms of how a contractor is selected; in Detroit, all public jobs require a certain percentage of minority owned companies and women-owned businesses be involved in projects. Since the YMCA wasn't a considered a public job, they didn't have to follow this rule of having a certain percentage, but they did it anyway to demonstrate good deed. After the YMCA confirmed that they wanted a percentage of minority and woman-owned businesses, Barton Malow prepared a bid list and the YMCA went on to approve it.

Bonds and Insurance

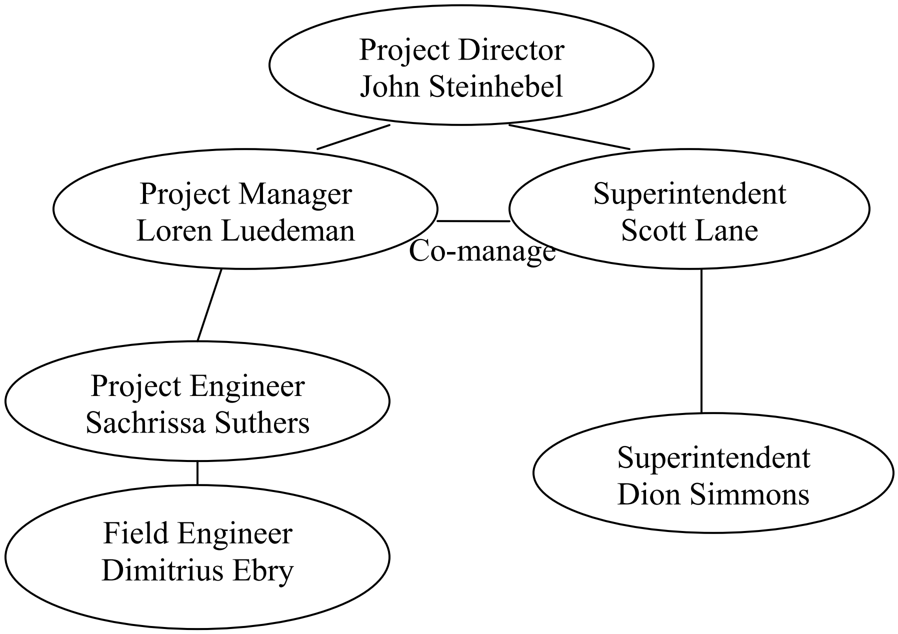
Performance and payment bonds were needed for this job in order for a contractor to commence work. In terms of insurance, each contractor was required to have the following:

- Commercial general liability
- Automotive liability
- Umbrella/excess
- Worker's compensation
- Employer's liability

Contract Types and Delivery System Analysis

I believe that even though there weren't different types of contracts used amongst the major players, keeping it simple was the best way to go. I definitely believe that by limiting the variety, simplicity was maintained. This is especially true since the budget was a very critical issue for this project. In terms of the project delivery method, I thought it was interesting how Barton Malow went from a construction manager to construction manager at risk – after the subcontracts were awarded. I believe that the delivery method is working out well, but I would like to have seen how a Design-Build method would have worked out for this project. I say this mainly because I know that the D-B method provides faster project delivery (to ensure the occupancy date), a fixed cost – lump sum contract (ensuring price predictability), and more competitive prices from the contractors. Besides this, I think it would have been interesting to see what value engineering concepts would have been implemented.

STAFFING PLAN



The Barton Malow staffing structure is traditionally simple. As you can see on the flowchart, Mr. John Steinheble is the Project Director for the YMCA project and everyone else falls under him. Something that is a little less traditional can be seen in the second row: Scott Lane, a superintendent, is co-managing the job with the project manager, Loren Luedeman. Even though Mr. Lane's official title on this job is as a superintendent, he takes on some project manager duties to help Mr. Luedeman with the progress of the job. Dion Simmons is the only person underneath Mr. Lane; while Mr. Luedeman has a project engineer (Mrs. Suthers) and field engineer (Mr. Ebry) that report directly to him.

Research
&
Analyses

ANALYSIS 1 – FOUNDATION

Background Information

This analysis deals with changes to the foundation system. The system that is currently being used is a continuous strip footing with combined drilled and formed piers. The basement is approximately 25,500 square feet, with the perimeter being roughly 765 feet. There are just about 70 drilled piers and 36 formed piers.

Proposed System

I am proposing that a mat foundation be used as an alternate system. I believe that mat foundations would be easier to construct compared to the footings and numerous piers that would have to be formed. While competent structural performance has been achieved, many mat projects have experienced significant cosmetic cracking of floor slabs. This is typically due to volumetric shrinkage of slabs with large lateral dimensions during curing of the concrete. However, the main purpose of this investigation is to see whether the proposed system is to see whether it is economically feasible. Besides this, by looking at the project schedule and using RS Means, I was able to conclude that the time it would take to construct the caissons, spread footings, and installing piers and base plates would take close to 100 days. The latter information was derived from the Barton Malow proposed schedule, which can be found in Appendix F. The RS Means data concluded that it would take close to 70 days to pour the mat.

Cost Comparison

In order to determine which system would be the most feasible, an ICE 2000 estimate was formulated and compared to the cost of the current foundation. This data can be found in appendix B. Before completing the estimate and comparing, I had established some assumptions. These assumptions are as follows; the mat slab system seems like it is easier to construct, however it may cost more due to the price and amount of materials needed. When my ICE 2000 estimate was complete the total cost for the system, including excavation, fill, formwork, etc, came out to be in the $1.4M range. When comparing it to the Barton Malow data, I saw that the cost for the current system was just over $1M. However, when comparing the data, I knew that my estimate wasn't as detailed as the one that Barton Malow provided. Therefore, I would add an extra 10% to my estimate to account for any other items I might have missed. Either way, the cost of the mat slab would not make it the preferred choice.

Conclusion

Besides the cost comparison, there are other factors that I believe may not have made the mat slab the proper choice. First off, I found out from some post-data research that a mat slab may not be appropriate because of the potential for visible cracking in exposed floors. Now, considering that there will be heavy mechanical equipment in the basement, any loading and vibrations will cause any cracking to go from bad to worse. Besides this, I recently found out from the project manager that the mat slab system would not be appropriate due to the fact that the soil is not stable enough. This is especially true since downtown Detroit is close to the Detroit River. Additional information regarding the soil conditions on this site can be found in the geo-technical report in appendix G of this report.

ANALYSIS 2 – HANDRAIL SYSTEM

Pro's & Con's of Current System

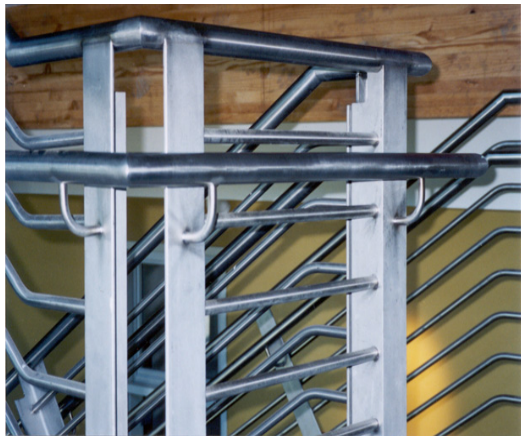
The handrail system at the YMCA is not your conventional stainless steel or aluminum that you would expect in most office buildings, or recreation centers for that matter. There is 1,130 linear feet of railing in the YMCA which consists of approximately 4'-3" high woven wire mesh in-fill panels. These panels can be found lining the running track on the 3rd floor and they can also found in the main stairwell areas. The owner and the architect had a goal of achieving aesthetic consistency throughout the building; this is why the panels are found in areas outside of the running track. The main downside to this system is that the cost per linear foot is expensive and so is the maintenance of the panels.

Proposed Solution

In terms of initial cost and maintenance over a 20 year period, there are other alternatives that can be used that cost less than the woven wire mesh in-fill panels. There was originally a plan to use stainless steel, but the owner felt that this option was out of the price range of the budget. This is why I propose that an aluminum anodized handrail system be incorporated. Aluminum on its own may not be as durable as a stainless steel system, but if the handrails are anodized, it could perform just as well <u>without</u> a heavy price increase. Having the aluminum rails anodized gives them high corrosion, stain, and scratch resistance. Besides this it also gives the aluminum a better cosmetic appearance and increases its durability.

Photographs of current and proposed systems

(Woven wire mesh in-fill panels)



(Anodized aluminum handrails)

Cost Comparison

The data that I have collected is based on records from Barton Malow and from the RS Means catalog. Both sets of data confirm that going with the aluminum handrail option saves a lot of money. However, in the end it is up to the owner to decide which system to go with. I will be comparing cost of material for this section of the report.

Barton Malow records

Item	Linear Feet	Cost (per LF)	Total	Maint. Paint (per LF)	Mnt. 3X per 20 years	Total + Cost of Maintenance
Steel Guard Railing with woven wire mesh in-fill panels	1130	$210.00	$237,300.00	$14.33	$48,578.70	$285,878.70

Barton Malow PM assumption

Item	Linear Feet	Cost (per LF)	Total	Maint. Cleaning (per LF)	Mnt. 3X per 20 years	Total + Cost of Maintenance
Aluminum Handrails	1130	$60.00	$67,800.00	$6.00	$20,340.00	$88,140.00

Like I mentioned above, the data for the panels was extracted from Barton Malow's budget report, which can be found in Appendix C. The data for the aluminum handrails was gathered from provided data and estimates given by the Project Manager. The next set of data was collected directly from RS Means.

RS Means Costs

Item	Crew	Daily Ouput	Labor-hrs	Unit	Mat.	Labor	Eqpt.	Total	Inc. O&P	Project Qty + Labor
Aluminum, 3 rail, 1.5" diam., satin finish, clear anodized	E4	137	0.234	LF	30.5	9.05	0.59	40.14	50.5	$57,065.00
Woven wire partitions, panels, 4' wide, 7' high	2 Carp	65	0.64	LF	109	22		131	154	$174,020.00

RS Means Cleaning/Refinish Costs

Refinish metal stair railing	Crew	Daily Output	Labor-hrs	Unit	Mat.	Labor	Eqpt.	Total	In-house + O&P	Frequency of Maintenance: 3 X per 20 yrs
prepare surface	1 Pord		0.019	SF		0.61		0.61	0.97	
re-finish surface			0.015	SF	0.05	0.49		0.54	0.84	$8,181.20
Paints & protective coating, sprayed in field. Alkyds, primer, gloss topcoat (for wire mesh)	2 Psst	3200	0.005	SF	0.05	0.16		0.21	0.34	$1,632.85
Steam cleaning, 2800-4000 SF/day (for aluminum)	1 Pord	2400	0.003	SF		0.1		0.1	0.15	$678.00

Conclusion

As you can see from the gathered information; both the Barton Malow data and RS Means data prove that the wire mesh panels were not a cost effective option compared to the aluminum anodized system. In the end, the YMCA sided with the architect on this issue and decided to keep the wire mesh panels due to their aesthetic appeal and conformity.

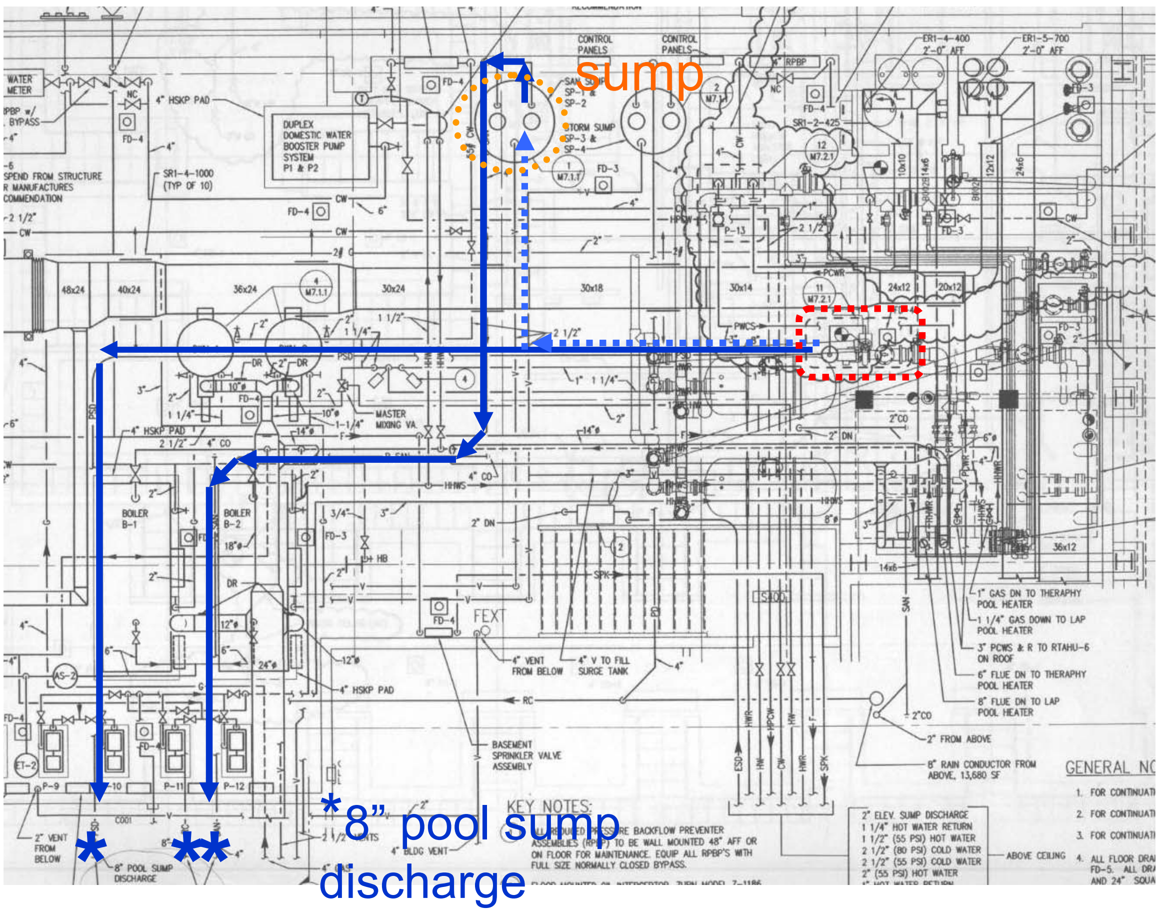
ANALYSIS 3 – MECHANICAL ROOM

Current System Information

The layout of the mechanical room is more complicated than it needs to be. In the middle of the room you will find a 12' tall propylene retention tank with electric switches, infrared beams, and a 1.5 HP (80 gal/min) pump installed. Due to an improper analysis of the mechanical room drawings, this tank had to be installed to regulate the flow of backwash water from the pool. The reason the tank was installed was because the 6" line that carries backwash water away from the pool had a fast flow rate and an improper amount of vertical rise when connecting to the 8" sanitary line. Combining the factors of having an improper amount of vertical rise, the flow rate of the 6" pipe being too fast, and the 8" pipe being a gravity line, problems came up. The resulting problem that occurred was at the air gap connecting the 6" line to the 8" line; because the rate was too fast for the amount of rise given, splashing would occur at the connection and it would cover the mechanical room floor with backwashed pool water. The cost associated with bringing in the tank and installing it came out to about $35K. The pool backwash line (6") pumps out 430 gal/min and is now directly fed to the retention tank, from there it is indirectly tied to the 8" line. This solution is creative, but not cost effective.

Alternate Solution

I believe that a more cost effective solution would have been to run the backwash piping to the sanitary sump. From the sanitary sump, it would already be indirectly ties into an 8" sanitary line and carries away the waste water from the building. The trap line should go into the sanitary sump and have enough vertical rise to prevent any splashing. This process calls for the floor to be broken up to install the line. However, if another line is going to be added to the sump that is bringing in 430 GPM, a need for a new, bigger sump will be necessary (since the current sump can only handle 400 GPM). As a result, this would mean that the current 5HP sump be replaced with a 10HP sump.



EXISTING LINE

PROPOSED LINE

Cost Comparison

The cost of breaking up the floor, removing the old pump, installing the new pump and running the new pipe to it will cost in the neighborhood of $9K. Using charts and data from the RS Means catalog, I was able to estimate the price of tearing open the floor, removing the old sump pump and installing approximately 45 feet of new piping. The data is listed below.

System Description	Crew	Unit	Labor Hrs	Bare Costs				Total In-house	Including O&P
				Mat	Labor	Eqpt.	Total		
Saw cut asphalt	1 B34P	Ea.	2.7	14	85	50	149	175	208
Disconnect current pipe			1.5		64.2		64.2	80	99.5
Remove, wash tank			1		42.5		42.5	53	66.5
Properly dispose of waste/water				17.85			17.85	19.65	22.5
									396.5

B-34P Crew	In House costs Including subs O&P	
	Hr	Daily
1 Pipe fitter	66.95	535.6
1 Truck driver	44.9	359.2
1 Equip. operator	57.95	463.6
1 Flatbed truck		193.8

Description of Activity	Crew	Unit	Mat.	Total Mat.	Labor + O&P		Total Mat. & Labor
					Hr	Daily	
Adding 45' of new 6" pipe line to connect from air gap to new sump pump*	1 Pipe Fitter	LF	38.67	1740.15	66.95	535.6	2275.75

*Data taken from Barton Malow data. See appendix C.

The specifications of the current sump are shown below. The price estimate of the current was provided by a manufacturer to be in the neighborhood of $2,080 and $4,800 for a 10HP sump. The data tables and cost of the sumps can be found in appendix D.

Current Sump(s):

Tag	Service	Location	Type	Fluid	Flow GPM	HP	Volts	Φ	Hz	RPM
SP - 1 & 2	Basement sanitary	Basement Mechanical Rm	Vert.	San.	400 ea.	5 ea.	480	3	60	1750

Conclusion

From the data that I have collected, it seems more reasonable and more cost effective to replace the old sump and to bring in a new line. Bringing in the tank was a creative solution, and yes, it gets the job done, but one must also take into consideration the potential effects of employing a certain solution. In this instance, having an open vessel in the mechanical room could pose a problem to the un-galvanized steel decking above. The tank is holding a massive volume of chlorinated water and over time, the chlorine ions could possibly corrode the metal steel decking. This in turn would mean that the steel decking would have to be replaced, which could cost even more money in the future.

RESEARCH TOPIC – INTEGRATED DESIGN MANAGEMENT

Background

My analysis will focus on the topic of Integrated Design Management. This has been considered a hot topic in the construction industry, raising much discussion and debate. This method of construction involves the incorporation of the Design-Build delivery method and unites the head entities (owner, architect, construction manager etc.) to carefully manage the design of the project before it gets built. By applying this method of synergy, the client can expect better coordination and communication within the entities and trades which can potentially result in schedule reduction, savings in budget and innovative design ideas. Through my research, I came to find that mixed opinions and feelings amongst the different entities regarding this method. Additionally, there is survey data showing that this method is preferably used in certain markets.

Problems

No matter what kind of construction project is being carried out, delays and conflicts are to be expected. Problems can arise as a result trade conflicts, poor understanding or interpretation of plans, etc. There are a number of unforeseen conditions that can arise during the construction process. These problems add headaches, costs, and time, to any project. The best way to eliminate, or at least reduce the impact of these problems is to carefully synchronize the progression of the project. The best possible way to minimize impedances, such as the ones listed previously, is by having the owner, architect and construction manager all collaborate in the planning/design of the project. Besides avoiding potential added time to the schedule and added cost to the budget, a main goal of Integrated Design Management is to produce innovative design ideas to make the building more efficient, without sacrificing design or increasing cost of construction.

Research

The first part of my research involved looking at reports written on the topic of Integrated Design Management and the Design-Build delivery method. One of the reports summarized key aspects of the method as well as getting professional opinions regarding the topic. The other report mainly emphasized on certain interfaces and personalities required to carry out the IDM method successfully. The following are some key points that the reports made.

Proper execution of integrated design management reduces the probability of faults, management of the risk factor, division of activities into a larger number of sub-actions and save a large amount of time. One of the main keys is the proper management of interfaces. On of the roles of the manager is to take care of all the possible interfaces toward the rest of the environment to try to foresee any possible source of fault and human error. The internal interfaces are those that are born and die inside the working group of activities. They can be defined and managed in such a way that the minimization of the project risks and the fluidity of all activities are guaranteed. Among the external interfaces, those that are related to other institutes and companies may be considered the most risky. At any rate all kind of interfaces, internal and external, require dedicated analysis in order to find the best compromise among risk, time needed to manage, amount and type of information to be exchanged and in order to identify the person for the best interface management. A good manager does not relinquish the responsibility for fundamental activities to other organizations without maintaining direct control or almost indirect tracking of such activities, and of those actions that could represent a risk for the project. Any fault can cause a fracture in the work flow process because it affects the natural sensitivity of people that work with enthusiasm. In addition it is not right to point out the problems arising along the way and managed by others as a cause of dissatisfaction. It is always better to show understanding toward any kind of fault arising along the way. In any case, good management has to foresee the problem in advance and as much as possible during the analytical phase, which requires high level expertise and skill. A good manager has to be very optimistic toward his group and very pessimistic about activities conducted outside.

In one of the reports the current chair of AIA's Design-Build Knowledge Community, Dorwin Thomas, states:

"[Owners] are demanding DB because it saves time and money and reduces conflict".

The roles and influence of the architect can vary greatly from team to team, even among those that are structured similarly in terms of who holds the contract with the owner.

Architect Steve Coxhead, senior associate at David Owen Tryba Architects states:

"As long as the contractor is sensitive to the design philosophy and intent, the quality can be just as good in a contractor led project. The quality really has more to do with the relationship between contractor and designer."

Supporters of DB do not suggest that every project must be done according to this method of delivery. Some indicate that DB is most useful when a project is driven by cost and schedule. Others believe that it is best suited to a project whose program is well defined from the start by the client. It is widely accepted that not every architect has the personality to lead a DB project.

The other half of my research involved conducting interviews with an owner, and architect, and an engineer. The owner that I interviewed was Lorie Uranga, who represents the YMCA in the Detroit area. The architect that I interviewed was Jana Hayford, who was one of the designers for the YMCA project. Finally, the engineer that I interviewed was Benjamin Gerald of Holder Construction, who I had a chance to meet at a PACE roundtable discussion. Like I mentioned before, the opinions regarding Integrated Design Management and the Design-Build delivery method varied amongst the three.

Owner

Mrs. Uranga believes that the owner loses control of quality of materials used in the project. In her past experience, when someone other than the architect designs particular systems, you have the most 'cost effective' system applied which always winds up needing more maintenance. She definitely appreciates the cost and time aspect that IDM saves, but despises the maintenance and upgrades that occur as a result of it. She goes on to say that some projects are better suited for the IDM method. For example; an office building would be better suited for this method rather than a multi-system building like the YMCA. The systems of an office building are pretty uniform and repetitive throughout the project, but when you look at the YMCA and see that it has offices, large open spaces like a basketball court, and a pool area, it is obviously more complicated.

Engineer

I had specific questions lined up for Mr. Gerald to answer when it came time to interview him. The questions dealt with topics ranging from performance specifications to opinions on design-build. He started off by stating his opinions on performance specifications. He says that it is always helpful to bring in the expertise of a contractor and that it avoids the effect of a vacuum system. Besides this, it incorporates value engineering early on and captures ideas early in the process. However, the con side to this is that the responsibility of the owner and designer is at a minimum, and everything is on the contractor (in terms of risk). For example: if the specifications fail, the design is flawed and the responsibility is on the contractor. The next topic of discussion was how value engineering can be distinguished from cost cutting. Mr. Gerald said that, in his opinion, it all depends on whether or not the design is complete or not. If it is applied before the design is complete, it can be considered value engineering. But once the design is complete, it is considered cost cutting. He then stated that value engineering is all about adding value to the project at no additional cost to the owner. It doesn't exactly mean that the design meets the program or is the most efficient, but adds most value. When asked about the design-build delivery method, he mentioned that an owner who wants to be more involved in the design process will choose design-build because it produces the overall schedule by incorporating the overlap of phases. Design build is gaining more appreciating industry wide by creating synergy between the aesthetic thinkers and the logical thinkers.

Architect

When I interviewed Mrs. Hayford, the questions that I asked her were along the same lines as the ones that I asked Mr. Gerald. She said that she liked the fact that incorporating IDM establishes an early budget and an up front cost. She also mentioned that the construction process is carried out effectively when there are decisions made cooperatively to use specific systems. However, she adds, communication should be carefully handled because no one wants to be told what to do in this kind of collaboration process. This statement is especially true since it is a challenge to regulate the balance of powers while giving the owner what they want. Mrs. Hayford made an interesting point when she noted that: a project in which IDM is used is typically dependent of the client and the complication level of the building, which is comparable to the comments made by Mrs. Uranga and Mr. Gerald. She believes that IDM would be most effective on a project in which there are multiple (and perhaps similar) buildings. In addition to this, she believes that it is very beneficial to have a contractor ahead of time to help out in the design and coordination of particular building systems. The downside to this, however, is that it is sometimes difficult to have a building designed so that it isn't designed in a cost-cutting mode. Another topic that I covered with Mrs. Hayford was performance specifications, and whether or not they help or hurt the design process. She believes that the specifications should be carefully handled and/or executed because it affects the longevity of the product. This is especially true since the specifications are left up to interpretation. She adds that they are helpful because the architect and the engineer have a single source which can provide specific answers. However, there have been instance where the contractors add money to the design or products because the factor of competition is eliminated; the contractor is already chosen and they are the ones who already understand the specification. When the topic of value engineering came up, she directly confirmed that it is tough to differentiate the two. She went on to say that it is difficult to come up with VE solutions once in construction and over-budget. The best method that Mrs. Hayford offered was the comparison of products. For example: there could be a piece of equipment A being used that has the same specifications and performs just as well as equipment B, but costs less just because they are from a different manufacturer.

Conclusions

In summation of my research, I was able to reach the conclusion that Integrated Design Management depends on a couple of specific factors. One of the main assumptions that I was able to conclude was that in order to have the method carried out properly, the chemistry between the main entities must be a top priority. The owner must specifically know what he/she wants, and the owner must also determine if time and money are the most important factors of the project. Besides this, the project manager must have a strong personality, have high expertise and skill, and must properly manage all of the possible interfaces that could occur. Additionally, the method of integrated design management is sometimes better fitted to be used in some projects over others (See Charts in Appendix E). What I mean by this, can be best referenced to what Mrs. Uranga told me; IDM could be better applied to a project such as an office building with uniform and repetitive systems throughout, compared to a building like the YMCA which has different zone types. Besides this, I picked out certain examples where the IDM method could have helped greatly. The first example is in the mechanical room; there was so much piping in the room that a misinterpretation was likely to happen just by looking at the drawings. As a result, the error that occurred while executing the pipe-work was that the vertical rise connecting the 6" backwash line to the 8" sanitary line was not enough, which caused splashing, ultimately resulting in having to install a 12' tank to regulate the flow. If the mechanical contractor could have taken more time to analyze and plan the layout of the room (especially calculating the proper vertical rise), the problem could have been avoided. The next example is in the basement; the project manager said that seismic regulations require that any basement walls that rise all the way to the ceiling, be braced. However, if the walls were made so that they didn't rise all the way to the ceiling, the metal angles wouldn't have been installed and $75K would have been saved. Again, if this problem could have been detected earlier, such as in the design phase, a hefty amount of money would have been saved.

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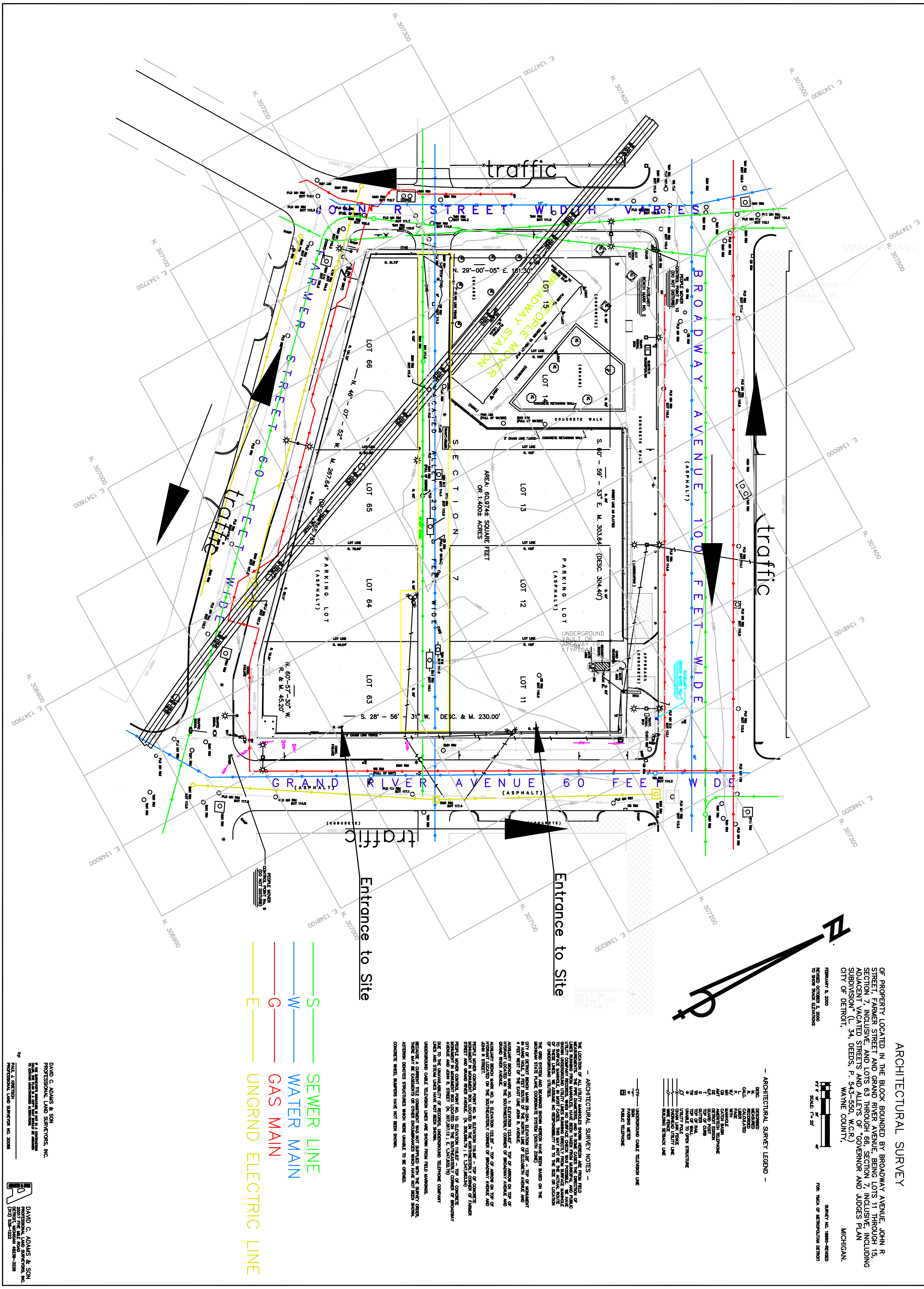
Appendices

Appendix A


JOHN R STREET WIDTH VARIES
BROADWAY AVENUE 100 FEET WIDE
GRAND RIVER AVENUE 60 FEET WIDE
FARMER STREET 60 FEET WIDE
BROADWAY PEOPLE MOVER STATION
traffic
traffic
traffic
traffic
Entrance to Site
Entrance to Site
LOT 66
LOT 65
LOT 64
LOT 63
LOT 15
LOT 14
LOT 13
LOT 12
LOT 11
SECTION 7
PARKING LOT (ASPHALT)
PARKING LOT (ASPHALT)
AREA: 60,974± SQUARE FEET OR 1.400± ACRES
S——— SEWER LINE
W——— WATER MAIN
G——— GAS MAIN
E——— UNGRND ELECTRIC LINE
ARCHITECTURAL SURVEY
— ARCHITECTURAL SURVEY LEGEND —
— ARCHITECTURAL SURVEY NOTES —
DAVID C. ADAMS & SON

Appendix A

Boll Family YMCA Project GSF: 101,730 SF

System	%	Dollars/SF	Total Cost
General Conditions / Precon Services	12.1%	1 LPSM	$2,961,200.00
Foundation	4.3%	10.36	$1,054,400.00
Basement Construction	7.1%	16.97	$1,726,700.00
Superstructure	11.3%	27.13	$2,760,000.00
Exterior Enclosure	13.5%	32.38	$3,293,800.00
Interior Construction	10.9%	26.14	$2,659,400.00
Finishes	5.7%	13.7	$1,394,200.00
Equipment	0.8%	1.83	$185,900.00
FF&E	6.3%	1 LPSM	$1,546,400.00
Special Construction	4.8%	11.54	$1,174,400.00
Conveying	0.7%	1.61	$163,400.00
Mechanical & FP	15.7%	37.68	$3,833,900.00
Electrical	7.0%	16.94	$1,723,600.00
			$24,477,300.00

PROJECT SUMMARY REPORT

YMCA of Metropolitan Detroit
Downtown YMCA
Detroit, Michigan
Post Bid Summary Revision
December 20, 2004

Appendix A

Base Summary

Description	Quantity		Unit Cost		Total Cost
CONSTRUCTION COST					
Project Component					
01 - New YMCA Facility including:	101,730	SQFT	$193.41	$	19,675,232
Theater items					
Gymnasium items					
Pool slide & water features					
02 - New YMCA Facility Site Items	2	ACRE	$529,750.00		$1,059,500
Contingencies					
Design Contingency	1.5%	OF	20,734,732		$311,021
Construction Contingency	5.0%	OF	$20,734,732		$1,036,737
Schedule Acceleration Contingency	0.0%	OF	$20,734,732		$0
Preconstruction Services / CM General Conditions	1	LPSM	$2,961,200		$2,961,200
CM Fee	3.0%	OF	25,043,689		$751,311
TOTAL CONSTRUCTION COST					**25,795,000**
Owner Cost					
FF&E Budget (less the items below)	1	LPSM	$1,500,000		**$1,355,000**
Climbing wall			$145,000		
TOTAL OWNER COST					**$1,355,000**
ADJUSTED TOTAL COST					**27,150,000**
Smith Group Design Fees	1	LPSM	$1,850,000		**$1,850,000**
TOTAL COST					**29,000,000**

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Barton Malow
Design/Construction Services

Appendix B

Structural Concrete

Description	Crew	Daily Output	Labor-Hours	Unit	2005 Bare Costs Mat.	Labor	Equip.	Total	Total Incl. O&P
Foundation mat, over 20 C.Y.	C-14C	56.4	1.986	C.Y.	144	65	0.42	209.42	260

Basement (SF)	Depth (Ft)	Total (Ft^3)	Conv. Factor to CY	Total CY
25,000	3.5	89,250	0.037	3,302.25

3,302.25 CY x $260/CY = $858,585

Structural C.I.P. Forms

Forms In Place, Mat Foundation	Crew	Daily Output	Labor-Hrs	Unit	Mat.	Labor	Eqpt.	Total	Total Inc. O&P
Job-built plywood, 4 use	C-2	350	0.137	SFCA	0.54	4.57		5.11	7.7

Basement Perimeter (ft)	Height of formwork (ft.)	Total SFCA	Total price of formwork
765	3.5	2677.5	$20,616.75

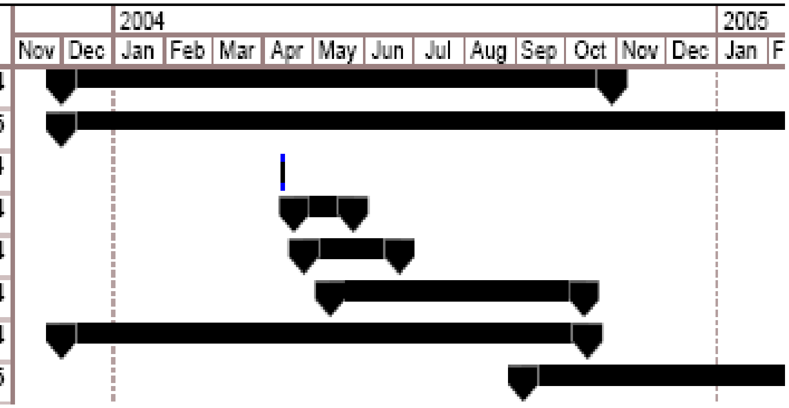
Crews

Crew Number	Bare Costs		Incl. Subs O&P		Cost per Labor-Hr	
Crew C-14C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Frmn (out)	$36.25	$290.00	$56.45	$451.60	$32.66	$51.14
6 Carpenters	34.25	1644	53.35	2560.8		
2 Rodmen	37.95	607.2	62.6	1001.6		
4 Laborers	26.7	854.4	41.55	1329.6		
1 Cement Finisher	32.85	262.8	48.35	386.8		
1 Gas Engine Vibrator		24		26.4	0.21	0.24
112 L.H., Daily Totals		$3,682.40		$5,756.80	$32.87	$51.38

Crew Number	Bare Costs		Incl. Subs O&P		Cost per Labor-Hr	
Crew C-2	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Frmn (out)	$36.25	$290.00	$56.45	$451.60	$33.33	$51.90
4 Carpenters	34.25	1096	53.35	1707.2		
1 Laborers	26.7	213.6	41.55	332.4		
48 L.H., Daily Totals		$1,599.60		$2,491.20	$33.33	$51.90

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
1	100%	Excavation & Earth Retention System	240 d	12/1/03	10/29/04
14	93%	General Concrete	391 d	12/1/03	5/27/05
15	100%	Mobilize	2 d	4/12/04	4/13/04
16	100%	Caissons	26 d	4/20/04	5/25/04
20	100%	Pier Caps and Spread Ftg.	42 d	4/26/04	6/22/04
24	100%	Walls, Piers, Base Plates	110 d	5/12/04	10/12/04
27	100%	Mud Mat	229 d	12/1/03	10/14/04
30	100%	Interior Slabs	126 d	9/6/04	2/28/05



Estimate Detail - Standard Construction Project

Detail - Without Taxes and Insurance

Appendix B

Estimator :
Project Size : sqft

ItemCode	Description	Quantity	UM	Lab.Unit	Mat.Unit	Eqp.Unit	Sub.Unit	Eqp.Rent.Unit	Temp.Mat.Unit	Other Unit	Tot.UnitCost	TotalCost
02300.902	* BASEMENT EXCAVATION AREA *	2,833.33	SQYD									
02310.127	EXCAV-LOAD BSMT EXCAV	12,277.78	CUYD	0.8842		0.710					1.594	19,573.23
02315.057	HAUL FROM SITE 3-4 MILES	12,277.78	CUYD	3.0160		2.200					5.216	64,040.89
02315.350	UNDERSLAB FILL	1,888.89	CUYD	6.1648	5.120	2.000					13.285	25,093.51
02316.304	EXCAVATE THICKENED SLAB	3,305.56	CUYD	7.6504		1.000					8.650	28,594.38
02315.100	BASEMENT EXCAVATION	3,305.56	CUYD	2.6331		1.950					4.583	15,149.69
02620.011	PERIMETER DRAINAGE SYSTEM	25,500.00	LNFT	11.9900	4.480						16.470	419,985.00
03110.120	FNDN WALL FORMS	51,000.00	SQFT	3.7173	1.600						5.317	271,182.30
03110.210	BASEMENT WALL FORMS	51,000.00	SQFT	4.1156	1.920						6.036	307,815.60
03210.109	SOG REBAR	1,322.22	CWT	32.3636	26.750						59.114	78,161.32
03313.135	CONCRETE @ SLAB ON GRADE	3,305.56	CUYD	10.8440	55.000						65.844	217,651.00
03350.130	MACHINE TROWEL FINISH	25,500.00	SQFT	0.3304							0.330	8,425.20
03350.131	POINT & PATCH	51,000.00	SQFT	0.1102	0.013						0.123	6,273.00
03390.010	PROTECT & CURE	25,500.00	SQFT	0.1102	0.019						0.129	3,299.70
Total Estimate												**$1,465,245**

YMCA of Metropolitan Detroit

Downtown YMCA
Detroit, Michigan
New YMCA Facility

Appendix C

Project GSF: 101730 SQFT
Estimate Type: Design Development 0
Estimate Date: 9/30/2003

101,730 SQFT

Description	Quantity	Unit Cost	Total Cost	Dollars / SF
0M6 Level 3 CMU Partition Wall	902 SQFT	13.00	11,726	
1M8 Level 3 CMU Partition Wall	221 SQFT	13.70	3,028	
CMU Wall Lateral Support Bracing	1 LSUM	5,000.00	5,000	
Steam Room Seating Framing	40 SQFT	13.14	526	
Steam Room Ceiling Framing	113 SQFT	11.14	1,253	4007
Sauna Room Ceiling Framing	200 SQFT	11.14	2,228	
Racquetball Room Ceiling Framing	1,764 SQFT	11.14	19,653	
1st Floor Toilet Room Ceiling Framing	336 SQFT	11.14	3,743	
Gym Room Storage Ceiling Framing	385 SQFT	11.14	4,289	
Gym Room Storage Ceiling Framing	375 SQFT	11.14	4,178	
Gym Room Office Ceiling Framing	520 SQFT	11.14	5,793	
Level 1 Wire Mesh Guard Railing	40 FNFT 6400	210.00 -160	8,400	
Level 2 Wire Mesh Guard Railing	105 FNFT 16800	210.00 160	22,050	251,200 - 1898[illegible]
Level 2A Wire Mesh Guard Railing	85 FNFT 13600	210.00 160	17,850	
Level 3 Wire Mesh Guard Railing	150 FNFT 24000	210.00 160	31,500	
Level 3 Track Wire Mesh Guard Railing	600 LNFT 96000	210.00 160	126,000	
Level 3A Wire Mesh Guard Railing	150 LNFT 24000	210.00 160	31,500	
Firestopping Basement Level Partitions	1,775 LNFT	8.03	14,261	
Firestopping Level 1 Partitions	1,460 LNFT	6.03	8,810	
Firestopping Level 2 Partitions	1,150 LNFT	6.03	6,939	
Firestopping Level 3 Partitions	510 LNFT	6.03	3,077	
Kawneer 1600 @ Level 1	950 SQFT	41.00	38,950	
Kawneer 1600 @ Level 2	2,832 SQFT	41.00	116,112	
Kawneer 1600 @ Level 3	1,348 SQFT	41.00	55,268	
Level 1-HM Sidelites	337 SQFT	31.00	10,447	
Level 2-HM Sidelites	60 SQFT	31.00	1,860	
Level 1-Alum. Sidelites	197 SQFT	43.91	8,650	
Pilkington Profilit Cast Glass Wall	1,200 SQFT	70.89	85,068	
2S4 Shaft #3 G.B. Shaft Wall	1,130 SQFT	9.14	10,328	
2S4 Elevator G.B. Shaft Wall	2,147 SQFT	9.14	19,624	
2S4 Shaft #2 G.B. Shaft Wall	538 SQFT	9.14	4,917	
2S4 Stair #1 G.B. Partition Wall	519 SQFT	9.14	4,744	
0F4 Stair #3 G.B. Partition Wall	912 SQFT	3.85	3,511	
0A4 Basement G.B. Partition Wall	615 SQFT	5.65	3,475	
1A4 Basement G.B. Partition Wall	272 SQFT	5.85	1,591	
F.R.G.B. Pool / Basement Partition Wall	2,400 SQFT	11.85	28,440	
0F4 Basement G.B. Partition Wall	238 SQFT	3.85	916	
0A4 Level 1 G.B. Partition Wall	6,064 SQFT	5.65	34,262	
2S4 Level 1 G.B. Shaft Wall	65 SQFT	9.14	594	
1A4 Level 1 G.B. Partition Wall	2,287 SQFT	5.85	13,379	
1A4 Level 1 G.B. Sound Wall	743 SQFT	6.05	4,495	
Lobby G.B. Facias / Level 1	397 SQFT	5.85	2,322	
Lobby G.B. Wall Misc. / Level 1	939 SQFT	5.85	5,493	
0A4 Level 1 G.B. Partition Wall	6,064 SQFT	5.65	34,262	
0F4 Level 2 G.B. Partition Wall	400 SQFT	3.85	1,540	
1A4 Level 2 G.B. Partition Wall	309 SQFT	5.85	1,808	
Level 2 Misc. G.B. Walls / Facias	2,720 SQFT	6.85	18,632	
0A4 Level 2 G.B. Partition Wall	9,676 SQFT	5.65	54,669	
0A6 Level 2 G.B. Partition Wall	5,065 SQFT	5.85	29,630	
2A4 Level 3 G.B. Partition Wall	52 SQFT	9.85	512	
0A4 Level 3 G.B. Partition Wall	273 SQFT	5.65	1,542	
1A4 Level 3 G.B. Partition Wall	791 SQFT	5.85	4,627	
Level 3 Misc. G.B. Walls / Facias	1,302 SQFT	6.85	8,919	

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Barton Malow
Design/Construction Services

[illegible]				
Men's & Women's Wardrobe Allowance	1 LSUM	2,000.00	2,000	
Level 1-Theatre Acoustical Panel Allowance	1,200 SQFT	16.00	19,200	
Basement Level-Suit Ringers	3 NIC 700	ADD	—	
Level 2-Ballet Bar In Aerobics Classroom	1 EACH	1,060.00	1,060	
Subtotal Fittings			**$420,200**	**$4.13**
Total Interior construction			**$2,454,900**	**$24.13**

Appendix C

Stairs

Stair construction

Electrical Room Steel Stair & Rail	12 RISE	257.68	3,092	
Mechanical Room Steel Stair & Rail	12 RISE	257.68	3,092	
Stair No. 1, Conc.Fill Metal Pan, Wire Mesh Rail	101 RISE	401.11	40,512	
Stair No. 2, Conc.Fill Metal Pan, Wire Mesh Rail	82 RISE	401.11	32,891	
Stair No. 2A, Conc.Fill Metal Pan, Wire Mesh Rail	16 RISE	401.11	6,418	
Stair No. 3, Conc.Fill Metal Pan, Wire Mesh Rail	89 RISE	401.11	35,699	
Stair No. 3A, Conc.Fill Metal Pan, Wire Mesh Rail	16 RISE	401.11	6,418	
Stair No. 1 Steel Pipe Wall Rail	140 LNFT	38.50	5,390	
Stair No. 2 Perimeter Wire Mesh Rail	110 LNFT	210.50	23,155	
Stair No. 2 Steel Pipe Wall Rail	80 LNFT	38.50	3,080	
Stair No. 2A Steel Pipe Wall Rail	20 LNFT	38.50	770	
Stair No. 3A Steel Pipe Wall Rail	20 LNFT	38.50	770	
Stair No. 3 Steel Pipe Wall Rail	100 LNFT	38.50	3,850	
Subtotal Stair construction			**$165,100**	**$1.62** ?

Stair finishes

Paint Stair No 1 & Railing	1 LSUM	6,500.00	6,500	
Paint Stair No 2 & Railing	1 LSUM	6,500.00	6,500	
Paint Stair No 2A & Railing	1 LSUM	1,850.00	1,850	
Paint Stair No 3 & Railing	1 LSUM	6,500.00	6,500	
Paint Stair No 3A & Railing	1 LSUM	1,850.00	1,850	
Paint Level 1 Wire Mesh Railings	40 LNFT	14.33	573	

Description	Quantity	Unit Cost	Total Cost	Dollars / SF
Paint Level 2 Wire Mesh Railings	105 LNFT	14.33	1,505	
Paint Level 2A Wire Mesh Railings	85 LNFT	14.33	1,218	
Paint Level 3 Wire Mesh Railings	150 LNFT	14.33	2,150	
Paint Level 3A Wire Mesh Railings	150 LNFT	14.33	2,150	
Paint Level 3 Track Railings	600 LNFT	14.33	8,599	
Subtotal Stair finishes			**$39,400**	**$0.39**
Total Stairs			**$204,500**	**$2.01**

Interior finishes

Wall finishes

Basement Level CTW1-Mosaic Wall Tile @ Pool	9,491 SQFT	11.00	104,401	
Level 1 CTW1-Ceramic Wall Tile	1,152 SQFT	11.00	12,672	
Level 2 CTW1-Ceramic Wall Tile	1,016 SQFT	11.00	11,176	
Level 3 CTW1-Ceramic Wall Tile	960 SQFT	11.00	10,560	
Level 2-Wood Panels	1,440 SQFT	13.00	18,720	
Level 3-Wood Panels	1,193 SQFT	13.00	15,509	
Level 2-Particle Board Panels @ Gym	13,215 SQFT	4.25	56,164	
Level 2-Paint Particle Board Panels @ Gym	NIC			
Basement Level-Paint CMU	6,887 SQFT	0.62	4,270	
Level 1-Paint CMU	25,000 SQFT	0.62	15,500	
Level 2-Paint CMU	32,215 SQFT	0.62	19,973	
Level 3-Paint CMU	12,560 SQFT	0.62	7,787	
Basement Level-High Performance Coating CMU	10,273 SQFT	3.17	32,565	
Level 1-High Performance Coating CMU	1,742 SQFT	3.17	5,522	
Basement Level-Paint Gypsum Board	11,407 SQFT	0.52	5,932	
Level 1-Paint Gypsum Board	4,824 SQFT	0.52	2,508	
Level 2-Paint Gypsum Board	9,560 SQFT	0.52	4,971	
Level 3-Paint Gypsum Board	1,540 SQFT	0.52	801	
Basement Level-High Performance Coating Gypsum Board	324 SQFT	2.75	891	
Level 1-High Performance Coating Gypsum Board	12,091 SQFT	2.75	33,250	
Level 2-Paint Racquetball Walls	4,800 SQFT	1.12	5,376	
Subtotal Wall finishes			**$368,500**	**$3.62**

Floor finishes

Exp. Joint @ Gym Floor Allowance	65 LNFT	20.54	1,335	
Vapor Barrier Under Gym Wood Floor	9,000 SQFT	4.00	36,000	
Basement Level-Ceramic Floor Tile	5,557 SQFT	12.14	67,462	
Level 2-Ceramic Floor Tile	150 SQFT	12.14	1,821	
Basement Level-Mosaic Floor Tile @ Pool	150 SQFT	14.20	2,130	
Basement Level-Ceramic Tile Base	2,483 LNFT	6.25	15,519	
Level 1-Ceramic Tile Base	421 LNFT	6.25	2,631	
Level 2-Ceramic Tile Base	157 LNFT	6.25	981	
Level 3-Ceramic Tile Base	128 LNFT	6.25	800	
Basement Level-Sealed Concrete	5,135 SQFT	0.55	2,824	
Level 1-Sealed Concrete	983 SQFT	0.55	541	
Level 2-Sealed Concrete	1,166 SQFT	0.55	641	
Level 3-Sealed Concrete	885 SQFT	0.55	487	
Basement Level-Concrete Retroplate	3,676 SQFT	7.25	26,651	
Level 1-Concrete Retroplate	8,810 SQFT	7.25	63,872	
Level 2-Concrete Retroplate	5,832 SQFT	7.25	42,282	
Level 3-Concrete Retroplate	2,458 SQFT	7.25	17,821	
Level 2-#2 Maple Wood Gym Flooring	9,000 SQFT	11.00	99,000	
Level 2-#2 Maple Wood Racquet Ball Flooring	1,600 SQFT	11.00	17,600	

Appendix C

the bulk of the present items (outlined throughout the body of the estimate) are considered allowances until greater detail and specification can be applied to differentiate the point. A few of the more notable allowances are as follows:

Allowances:

1. Civil / Site Electrical Relocation .... $150,000 lump sum
2. Pedestrian Protection @ People Mover .... $18,000 lump sum
3. Landscaping & Irrigation .... $84,000 lump sum
4. Class II Soil Removal & Dumping Fees .... $85,000 lump sum
5. Dewatering .... $20,000 lump sum
6. Exterior Building Signage .... $32,000 lump sum
7. Pilkington Cast Glass Wall Panel .... $85,000 lump sum
8. Interior Signage .... $15,000 lump sum
9. Swimming Pool .... $621,000 lump sum
10. Double-Loop Pool Slide (w/o foundations) .... $120,000 lump sum
11. Pool Water Play Features .... $90,000 lump sum
12. Pool Competition Equipment .... $19,000 lump sum
13. Whirlpool Bath .... $42,000 lump sum
14. Climbing Wall L/M .... $145,000 lump sum
15. Steam Room Equipment .... $7,500 lump sum
16. Sauna Interior Equipment & Fit-Out Kit .... $11,000 lump sum
17. Pedestrian Turn-style Mechanism .... $40,000 lump sum
18. Lobby Lighting .... $50.000 lump sum
19. Theater Lighting / Dimming & Rigging .... $125,000 lump sum
20. Surveillance & Security System .... $100,000 lump sum
21. Natatorium & Gymnasium Sound System .... $20,000 lump sum
22. Parking Lot Access Control Gate .... $25,000 lump sum
23. Theater Sound System .... $10,000 lump sum
24. Builder's Risk Insurance .... $100,000 lump sum
25. City Services "Tap Fees" .... $250,000 lump sum
26. Temperature Controls .... $300,000 lump sum
27. Construction Testing .... $125,000 lump sum
28. Steel Guard Railing w/ Woven-Wire Mesh In-Fill Panels .... $210.00 per L.F

9.0 **Exclusions** -- The following items are not included in the estimate.

Design & Review

- A/E fees & reimbursable consultants costs

General Requirements

- Independent inspections
- Performance & payment bonds for the Construction Manager are not included.
- All costs associated with overtime, shift time premiums and project acceleration.
- Owner administration costs
- Window washing equipment
- Owner project expenses
- Owner relocation (moving) cost
- Information technology move / relocation
- Professional fees

Appendix C

Square Ft. Calculation			
System	Tot. LF	Height (ft.)	Total SF
Aluminum	1130	4	4520
Wire Mesh	1130	4.25	4802.5

Crew No.	Bare costs		Cost per Labor-Hr	
Crew E4	Hr.	Daily	Bare costs	Incl. O&P
1 Struc. Steel Foreman	40.15	321.2	38.65	69.15
3 Struc. Steel Workers	38.15	915.6		
1 Gas Welding Machine		81.2	2.54	2.79
32 Labor Hrs, Daily Total		1318	41.19	71.94

2 carpenters	34.25	548	34.56	48.78

Appendix D

Product Name:

Sump Pump 5-6.4 HP **Cost:$ 2080.00**

Product Description:

Standard Equipment: All pumps are delivered with 50 ft. of appropriate cable and starter box. MSHA starter boxes are available
Discharge (outlets): Available with pipe thread or flange for use with hose clamps.
Pumping in series: To increase head capacity, two ore more pumps can easily be connected in a series with special flanges Available for all sizes.
Zinc anodes: To reduce corrosion problems, zinc anodes are available on all models.
Coatings: Special coatings are available for aggressive environments.

Model MLS750 High Head (HH) High Vol.(HV)	
Max Power Output HP	High Head 5 hp High Vol. 6.4 hp
Amp 3 phase 230v HH	21
Amp 3 phase HV 230v /460v /575v	17.8 / 8.9 / 8.6
Max Vol (GPM) HH / HV	355 / 500
Max Head (ft) HH / HV	102 / 110
Discharge In. (NPT) HH / HV	3" / 4"
Weight (lbs.)	80
Dimension (in.) width	9.75
Diameter	11
Height	27.25

Appendix D

Product Name:

Sump Pump 10 HP **Cost: $4,800.00**

Product Description:

Standard Equipment: All pumps are delivered with 50 ft. of appropriate cable and starter box. MSHA starter boxes are available
Discharge (outlets): Available with pipe thread or flange for use with hose clamps.
Pumping in series: To increase head capacity, two ore more pumps can easily be connected in a series with special flanges Available for all sizes.
Zinc anodes: To reduce corrosion problems, zinc anodes are available on all models.
Coatings: Special coatings are available for aggressive environments.

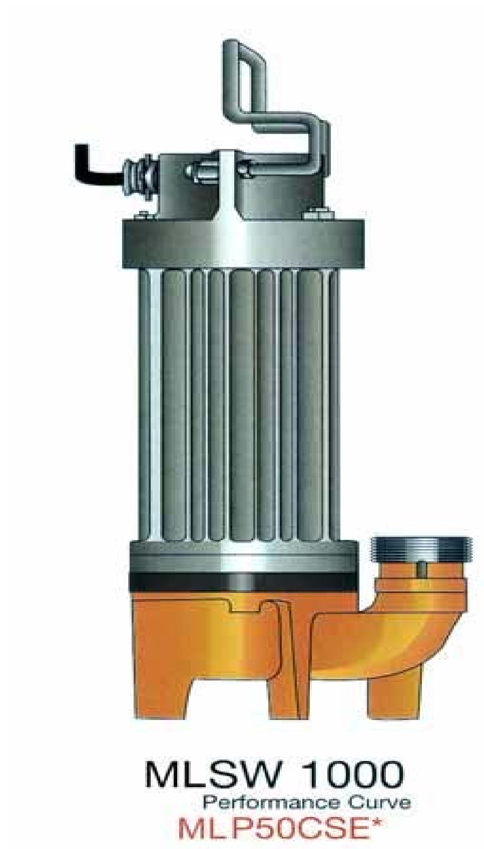
Model MLSW1000	
Max Power Output HP	10
Amp 3 phase 230v /460v /575v	28 / 14 / 11
Max Vol (GPM)	400
Max Head (ft)	116
Discharge In. (NPT)	3-4"
Weight (lbs.)	130
Dimension (in.) width	8.5
Diameter	135
Height	28.125

All information gathered and received from Mohawk Ltd.
http://www.mohawkltd.com/index.asp

Appendix D

Sump Pump Illustrations (Not to scale)

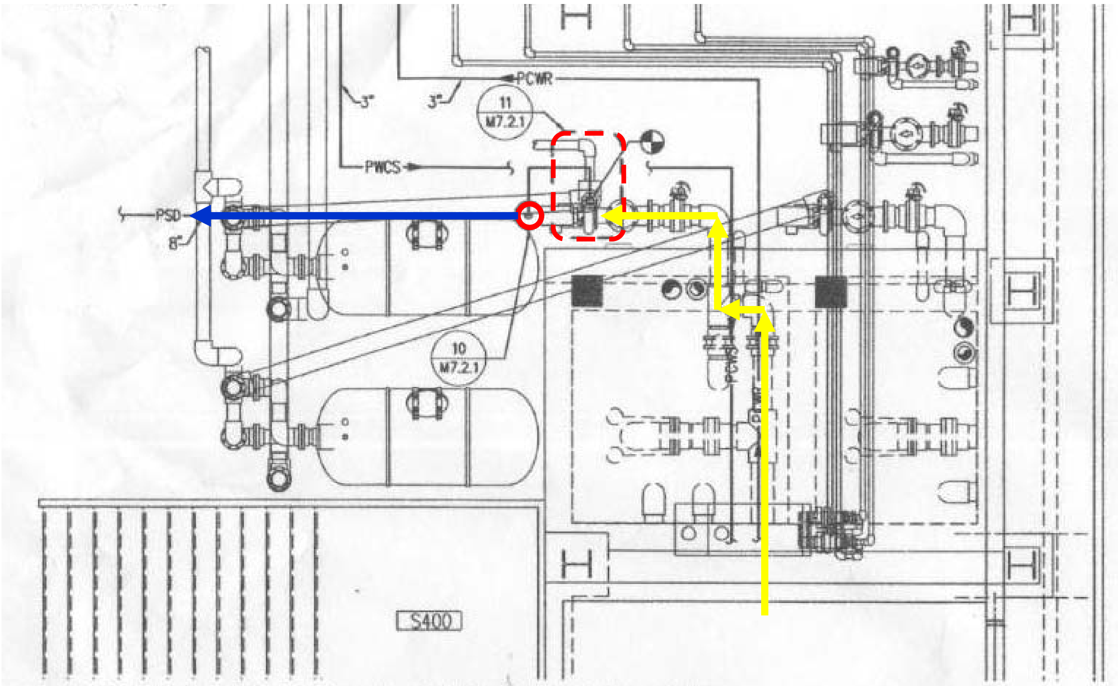
5 HP Sump Pump



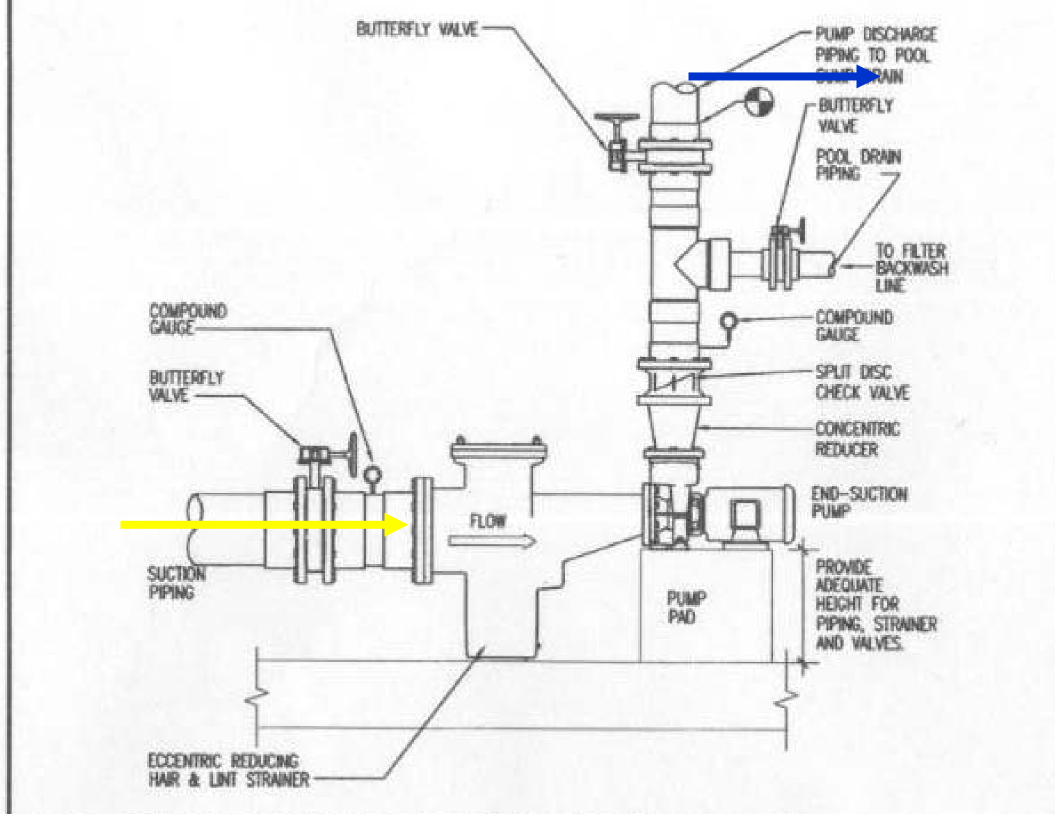
10 HP Sump Pump

Appendix D

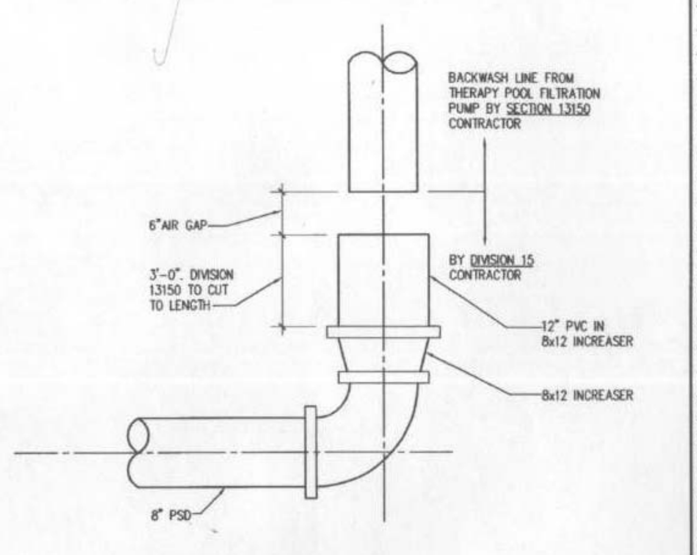
Additional Mechanical Room Illustrations



12 PART PLAN – PCWS&R PIPING CONNECTION TO POOL SYSTEM
SCALE: NONE



11 THERAPY POOL FILTRATION PUMP INSTALLATION DETAIL
SCALE: NONE



10 POOL SUMP DISCHARGE PIPING DETAIL
SCALE: NONE

YMCA of Metropolitan Detroit

Downtown YMCA
Detroit, Michigan
New YMCA Facility

Project GSF: 101730 SQFT
Estimate Type: Design Development 0
Estimate Date: 9/30/2003

101,730 SQFT

Description	Quantity	Unit Cost	Total Cost	Dollars / SF
Subtotal Domestic water piping system			**$174,700**	**$1.72**
Domestic water equipment				
Locker Room Trench Drains	100 LNFT	200.00	20,000	
Booster Pump Water System	1 LSUM	35,000.00	35,000	
Water Heater, 800,000 Btuh	2 EACH	12,000.00	24,000	
Lined Storage Tank	1 EACH	10,300.00	10,300	
Irrigation Stub-out	1 LSUM	2,751.34	2,751	
Tempering Valves	6 EACH	924.75	5,549	
Accomodation For Warm-up Kitchen	972 SQFT	4.38	4,255	
Recirculation Pumps	2 EACH	1,030.00	2,060	
Expansion Tank	1 EACH	2,575.00	2,575	
Subtotal Domestic water equipment			**$106,500**	**$1.05**
Domestic water insulation				
Fiberglass Insulation	****			
All Service Jacket, 1" Thick	****			
Pipe, 1/2"	1,280 LNFT	5.80	7,418	
Pipe, 3/4"	1,660 LNFT	6.22	10,323	
Pipe, 1"	1,440 LNFT	6.44	9,277	
Pipe, 1-1/4"	500 LNFT	6.88	3,440	
Pipe, 1-1/2"	750 LNFT	7.04	5,281	
Pipe, 2"	1,150 LNFT	7.50	8,628	
Pipe, 2-1/2"	80 LNFT	8.01	641	
Pipe, 3"	550 LNFT	8.69	4,777	
Pipe, 4"	200 LNFT	10.72	2,143	
Pipe, 6"	100 LNFT	13.24	1,324	
Pipe, 8"	100 LNFT	16.13	1,613	
30% Fittings	1 LSUM	16,457.81	16,458	
Subtotal Domestic water insulation			**$71,300**	**$0.70**
Sanitary waste and vent pipe systems				
Cast Iron, Single Hub - Underground	****			
Pipe,2"	300 LNFT	22.39	6,716	
Pipe,3"	200 LNFT	25.45	5,089	
Pipe,4"	590 LNFT	29.25	17,256	
AL Pipe,6"	130 LNFT	38.67	5,027	
Pipe,12"	60 LNFT	107.05	6,423	
Excavation and Backfill	1,280 LNFT	15.01	19,212	
Cast Iron Service Weight No-hub - Above ground	****			
Pipe,1-1/2"	850 LNFT	21.03	17,872	
Pipe,2"	1200 ~~1,000~~ LNFT	22.08	22,082	
Pipe,3"	510 LNFT	25.02	12,758	
Pipe,4"	1,150 LNFT	28.94	33,284	
Pipe,8"	120 LNFT	56.93	6,832	
Pipe,10"	75 LNFT	85.73	6,430	
Pipe, 12"	45 LNFT	116.31	5,234	
25% Fittings	1 LSUM	40,000.00	40,000	
Pipe Identification	1,305 LNFT	0.25	324	
✓ Locker Room Trench Drains	100 LNFT	250.16 ✓	25,016 ✓	
Duplex Submersible Sewage Pump, 1 1/2 Hp	1 EACH	2,500.00	2,500	
4" Floor Drain	45 ~~30~~ EACH	206.21	6,186	
✓ Pool Drains - Trench Drain	300 LNFT	150.10 ✓	45,029 ✓	
6" Floor Drain	12 EACH	261.67	3,140	
Cleanout	40 EACH	261.67	10,467	

ISO 9001 Barton Malow CERTIFIED

Barton Malow
Design/Construction Services

Estimate Detail - Standard Construction Project

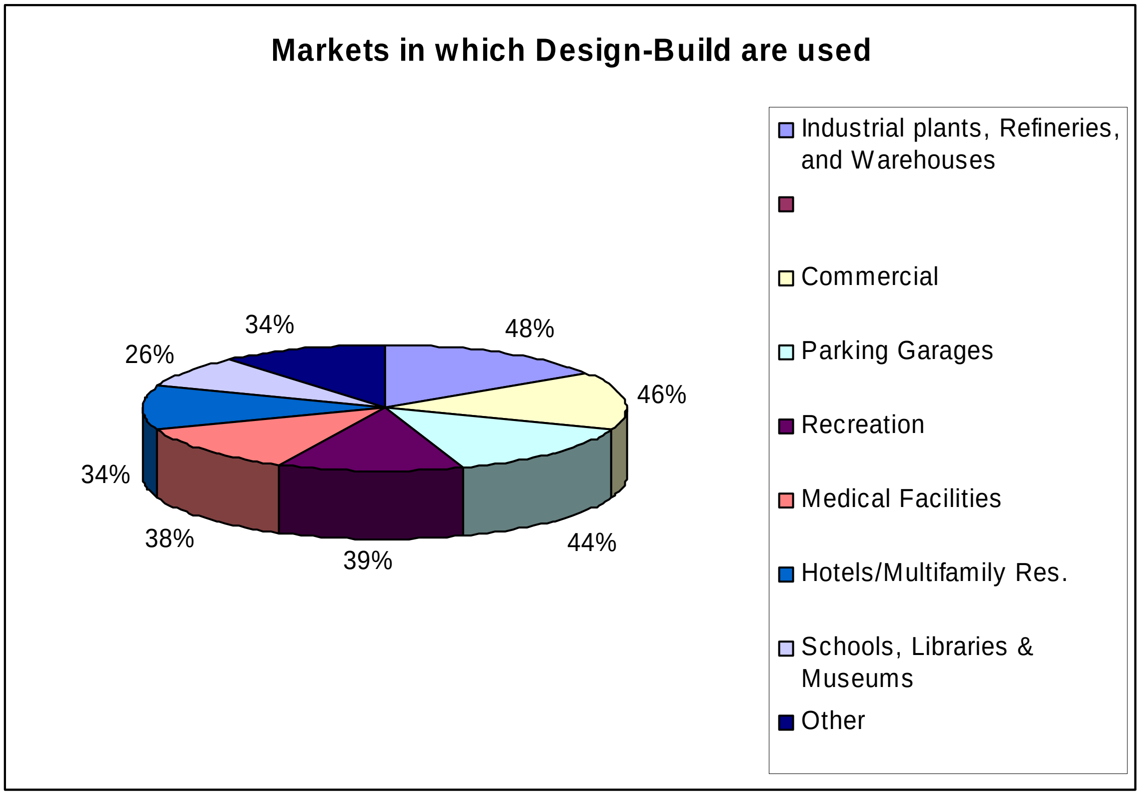
Detail - Without Taxes and Insurance

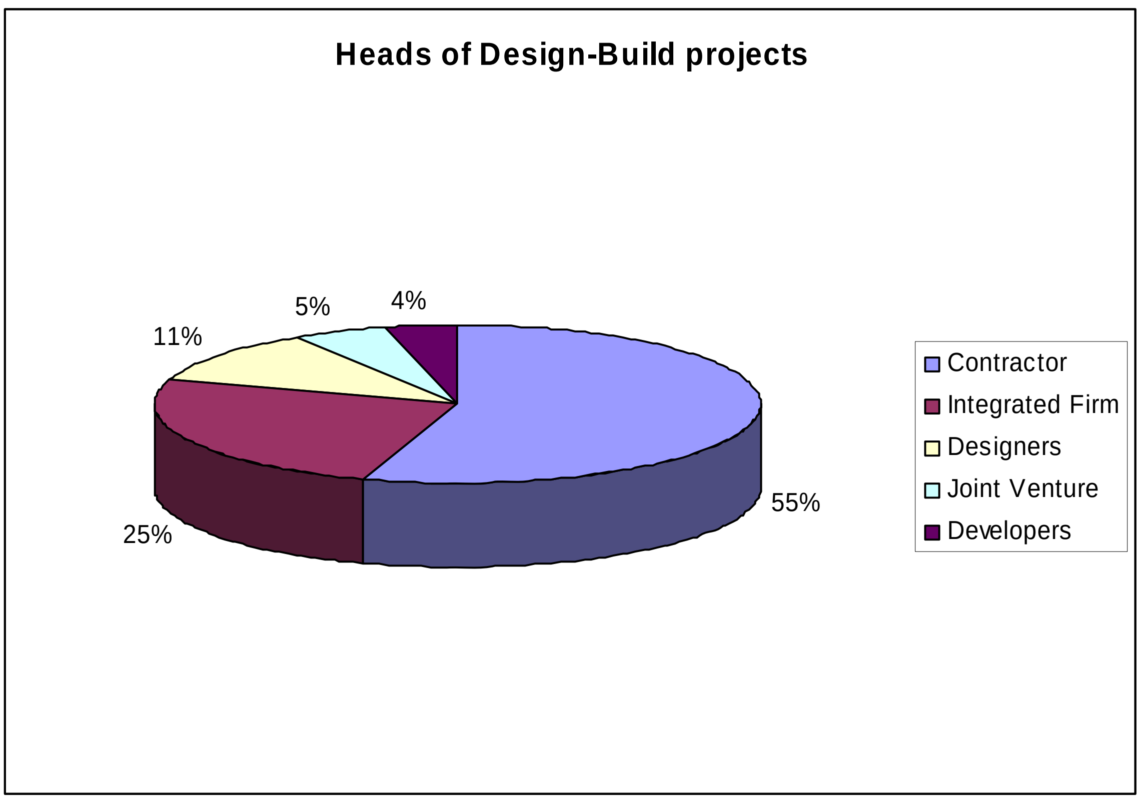
Appendix D

Estimator :
Project Size : sqft

ItemCode	Description	Quantity	UM	Lab.Unit	Mat.Unit	Eqp.Unit	Sub.Unit	Eqp.Rent.Unit	Temp.Mat.Unit	Other Unit	Tot.UnitCost	TotalCost
02300.902	* BASEMENT EXCAVATION AREA *	2,833.33	SQYD									
02310.127	EXCAV-LOAD BSMT EXCAV	12,277.78	CUYD	0.8842		0.710					1.594	19,573.23
02315.057	HAUL FROM SITE 3-4 MILES	12,277.78	CUYD	3.0160		2.200					5.216	64,040.89
02315.350	UNDERSLAB FILL	1,888.89	CUYD	6.1648	5.120	2.000					13.285	25,093.51
02316.304	EXCAVATE THICKENED SLAB	3,305.56	CUYD	7.6504		1.000					8.650	28,594.38
02315.100	BASEMENT EXCAVATION	3,305.56	CUYD	2.6331		1.950					4.583	15,149.69
02620.011	PERIMETER DRAINAGE SYSTEM	25,500.00	LNFT	11.9900	4.480						16.470	419,985.00
03110.120	FNDN WALL FORMS	51,000.00	SQFT	3.7173	1.600						5.317	271,182.30
03110.210	BASEMENT WALL FORMS	51,000.00	SQFT	4.1156	1.920						6.036	307,815.60
03210.109	SOG REBAR	1,322.22	CWT	32.3636	26.750						59.114	78,161.32
03313.135	CONCRETE @ SLAB ON GRADE	3,305.56	CUYD	10.8440	55.000						65.844	217,651.00
03350.130	MACHINE TROWEL FINISH	25,500.00	SQFT	0.3304							0.330	8,425.20
03350.131	POINT & PATCH	51,000.00	SQFT	0.1102	0.013						0.123	6,273.00
03390.010	PROTECT & CURE	25,500.00	SQFT	0.1102	0.019						0.129	3,299.70
Total Estimate												**$1,465,245**

Appendix E


Markets in which Design-Build are used
48%
46%
44%
39%
38%
34%
26%
34%
Industrial plants, Refineries, and Warehouses
Commercial
Parking Garages
Recreation
Medical Facilities
Hotels/Multifamily Res.
Schools, Libraries & Museums
Other

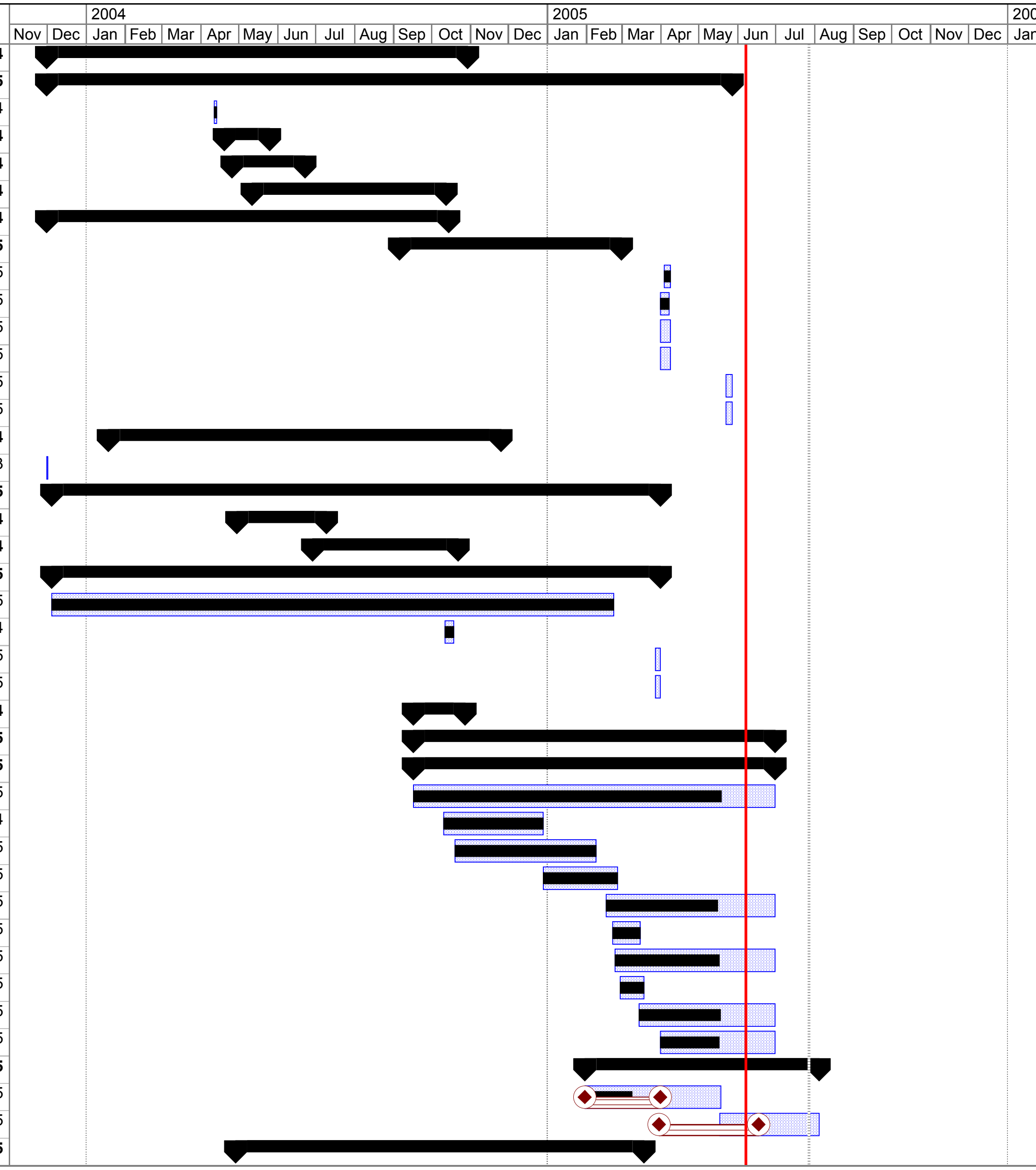

Heads of Design-Build projects
55%
25%
11%
5%
4%
Contractor
Integrated Firm
Designers
Joint Venture
Developers

Appendix F

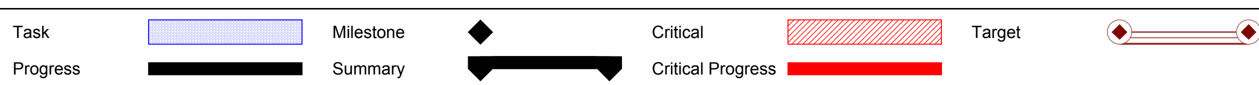
Barton Malow Co. Project Schedule

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
1	**100%**	**Excavation & Earth Retention System**	**240 d**	**12/1/03**	**10/29/04**
14	**93%**	**General Concrete**	**391 d**	**12/1/03**	**5/27/05**
15	100%	Mobilize	2 d	4/12/04	4/13/04
16	**100%**	**Caissons**	**26 d**	**4/20/04**	**5/25/04**
20	**100%**	**Pier Caps and Spread Ftg.**	**42 d**	**4/26/04**	**6/22/04**
24	**100%**	**Walls, Piers, Base Plates**	**110 d**	**5/12/04**	**10/12/04**
27	**100%**	**Mud Mat**	**229 d**	**12/1/03**	**10/14/04**
30	**100%**	**Interior Slabs**	**126 d**	**9/6/04**	**2/28/05**
43	100%	Slab @ Theatre Level 1A	5 d	4/4/05	4/8/05
44	100%	Interior Column Encasements	5 d	4/1/05	4/7/05
45	0%	Slab on Deck @ B.6/1-4	6 d	4/1/05	4/8/05
46	0%	Slab on Deck E-F @ 9	6 d	4/1/05	4/8/05
47	0%	Slab on Deck @ F-6/9-10	5 d	5/23/05	5/27/05
48	0%	Trench between Pools	5 d	5/23/05	5/27/05
49	**100%**	**Steel Erection**	**223.5 d**	**1/19/04**	**11/25/04**
141	0%	Miscellaneous Steel	1 d?	12/1/03	12/1/03
142	**98%**	**Waterproofing**	**346 d**	**12/5/03**	**3/31/05**
143	**100%**	**Footings and Keyways**	**51 d**	**4/30/04**	**7/9/04**
146	**100%**	**Walls and Elevator Pit**	**83.4 d**	**6/29/04**	**10/22/04**
149	**98%**	**Horizontal Basement Floor**	**346 d**	**12/5/03**	**3/31/05**
150	100%	Area 2	318 d	12/5/03	2/22/05
151	100%	Area 1	5 d	10/12/04	10/18/04
152	0%	Slab on Deck @ B.6/1-4	4 d	3/28/05	3/31/05
153	0%	Slab on Deck E-F @ 9	4 d	3/28/05	3/31/05
154	**100%**	**Fireproofing**	**29 d**	**9/17/04**	**10/27/04**
163	**79%**	**Exterior Closure**	**206 d**	**9/17/04**	**6/30/05**
164	**79%**	**Area 2 & Area 1**	**206 d**	**9/17/04**	**6/30/05**
165	85%	Masonry- All Elevations	206 d	9/17/04	6/30/05
166	100%	Exterior Wall Framing - All elevations	57 d	10/11/04	12/28/04
167	100%	Exterior Gypsum Board - All Elevations	80 d	10/20/04	2/8/05
168	100%	Metal Wall Panels MP1 - East, South, West Ele	43 d	12/29/04	2/25/05
169	65%	Complete Exterior Door Frames	96 d	2/17/05	6/30/05
170	100%	Stone - All Elevations	17 d	2/22/05	3/15/05
171	65%	Aluminum Frames - All Elevations	92 d	2/24/05	6/30/05
172	100%	Metal Wall Panels MP1 @ Roof	16 d	2/28/05	3/18/05
173	60%	Glazing - All Elevations	78 d	3/15/05	6/30/05
174	50%	Metal Wall Panels MP2	65 d	4/1/05	6/30/05
175	**21%**	**Elevators**	**135 d**	**1/31/05**	**8/4/05**
176	36%	Shaft Walls/Machine Room	79 d	1/31/05	5/18/05
177	0%	Installation	57 d	5/18/05	8/4/05
178	**100%**	**Mechanical, Electrical, Plumbing - Rough In**	**233 d**	**4/29/04**	**3/18/05**

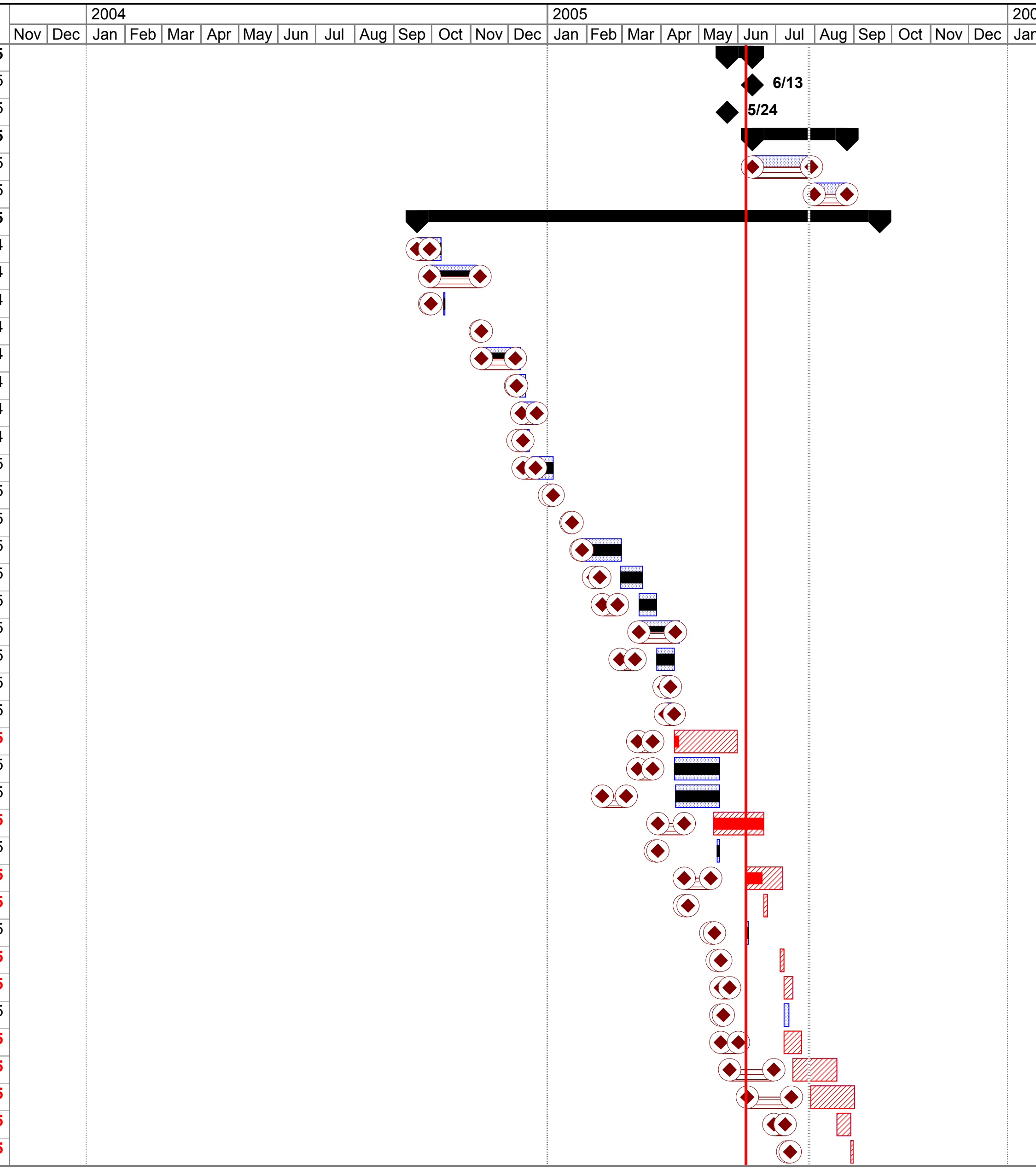


File: 6-21-05 Interior Finish Schedule Y
Print Date: 7/27/05



Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
203	**0%**	**AHU Start Up**	**14 d**	**5/24/05**	**6/13/05**
204	0%	A2 AHU Start Up	0 d	6/13/05	6/13/05
205	0%	A1 AHU Start Up	0 d	5/24/05	5/24/05
206	**0%**	**Stairs 2,7, and 8 Precast Terrazzo**	**55 d**	**6/13/05**	**8/26/05**
207	0%	Order Precast Terrazzo for Stairs 2,7, & 8	35 d	6/13/05	7/29/05
208	0%	Install Precast Terrazzo for Stairs 2,7, & 8	20 d	8/1/05	8/26/05
209	**66%**	**Natatorium**	**264 d**	**9/20/04**	**9/21/05**
210	100%	Excavate	15 d	9/20/04	10/8/04
211	100%	Underground piping/floor resteel	27 d	9/30/04	11/5/04
212	100%	Stone both pools	1 d	10/11/04	10/11/04
213	100%	Place pool bottoms	1 d	11/8/04	11/8/04
214	100%	Form walls/tie wall steel	24 d	11/9/04	12/10/04
215	100%	Place walls	3 d	12/10/04	12/14/04
216	100%	Demobilize for Concrete	10 d	12/10/04	12/23/04
217	100%	Strip and Clean	3 d	12/15/04	12/17/04
218	100%	Backfill	13 d	12/20/04	1/5/05
219	100%	Surge tank piping	3 d	1/3/05	1/5/05
220	100%	Mudmat	1 d	1/20/05	1/20/05
221	100%	Place Slab around Pool	22 d	1/28/05	2/28/05
222	100%	Erect Scaffold	15 d	2/28/05	3/17/05
223	100%	HVAC O/H Rough In	10 d	3/15/05	3/28/05
224	100%	Filtration Plumbing	24 d	3/15/05	4/15/05
225	100%	Electrical O/H Rough In	10 d	3/29/05	4/11/05
226	100%	Install Vapor Retarder at Perimeter (NCN 11)	5 d	4/4/05	4/8/05
227	100%	Add Stud Wall at Perimeter	5 d	4/5/05	4/11/05
228	**10%**	**Metal Stud Framing**	**36 d**	**4/12/05**	**5/31/05**
229	100%	Light Fixtures	26 d	4/12/05	5/17/05
230	100%	Interior Masonry	25 d	4/13/05	5/17/05
231	**99%**	**Install Drywall**	**28 d**	**5/13/05**	**6/21/05**
232	100%	Overhead Inspection	2 d	5/16/05	5/17/05
233	**45%**	**Finish Drywall (Acrylic Finish)**	**22 d**	**6/7/05**	**7/6/05**
234	**0%**	**Painting**	**3 d**	**6/22/05**	**6/24/05**
235	100%	HVAC Finish	3 d	6/7/05	6/9/05
236	**0%**	**Remove Scaffold**	**3 d**	**7/5/05**	**7/7/05**
237	**0%**	**Deck Imbeds**	**5 d**	**7/8/05**	**7/14/05**
238	0%	Sealer at Masonry	2 d	7/8/05	7/11/05
239	**0%**	**Trench Drains**	**10 d**	**7/8/05**	**7/21/05**
240	**0%**	**Ceramic Tile for Pool**	**25 d**	**7/15/05**	**8/18/05**
241	**0%**	**Ceramic Tile at Pool Deck Floor**	**25 d**	**7/29/05**	**9/1/05**
242	**0%**	**Water Test**	**7 d**	**8/19/05**	**8/29/05**
243	**0%**	**Paint Gutter**	**2 d**	**8/30/05**	**8/31/05**



File: 6-21-05 Interior Finish Schedule Y
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Task	Milestone	Critical	Target
Progress	Summary	Critical Progress	

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
244	0%	Install Grating	4 d	9/1/05	9/6/05
245	0%	Install Toys	2 d	9/1/05	9/2/05
246	0%	Install Deck Equipment	7 d	9/1/05	9/9/05
247	0%	Bondcote / Plaster Pool	4 d	9/12/05	9/15/05
248	0%	Start Up	3 d	9/16/05	9/20/05
249	0%	DEQ Inspection	1 d	9/21/05	9/21/05
250	40%	**Interior Finishes**	208 d	2/16/05	12/1/05
251	100%	**Bulletin 10 Lobby**	2 d	2/16/05	2/17/05
254	100%	**CCD 116 Childwatch Proposal**	65 d	2/21/05	5/19/05
259	100%	**Bulletin 11**	2 d	2/25/05	2/28/05
262	99%	**Bulletin 14 and Bulletin 14 R1**	21 d	5/9/05	6/6/05
263	100%	Bulletin 14 Drawings Received	1 d	5/9/05	5/9/05
264	100%	Bulletin 14 R1 Drawings Received	1 d	5/16/05	5/16/05
265	100%	Bulletin 14 and 14 R1 Owner Approval	1 d	6/6/05	6/6/05
266	99%	Bulletin 11 Issued for Pricing	6 d	5/17/05	5/24/05
267	100%	Interior Finishes Mobilize	5 d	3/14/05	3/18/05
268	71%	**Area 1 Level 3A**	113 d	3/8/05	8/11/05
269	100%	Metal Studs	16 d	3/8/05	3/29/05
270	100%	Electrical In Wall Rough In	21 d	3/8/05	4/5/05
271	100%	Plumbing Rough In	21 d	3/8/05	4/5/05
272	100%	Interior Masonry	10 d	3/16/05	3/29/05
273	100%	Door Frames	5 d	3/23/05	3/29/05
274	100%	Inspection In Wall	1 d	4/15/05	4/15/05
275	99%	Drywall	38 d	4/18/05	6/8/05
276	90%	Install Stair No. 8 and Rail	30 d	5/9/05	6/17/05
277	50%	Interior Framing and Glazing	5 d	5/16/05	5/20/05
278	0%	Owner - Telecom/Data	5 d	6/2/05	6/9/05
279	98%	Finish Drywall Partitions	7 d	5/31/05	6/8/05
280	50%	Ceiling Grid	5 d	6/9/05	6/15/05
281	0%	Painting	5 d	6/9/05	6/15/05
282	0%	MEP Finish	2 d	6/16/05	6/17/05
283	0%	Light Fixtures	5 d	6/16/05	6/22/05
284	0%	MEP Above Ceiling Inspection	1 d	6/23/05	6/23/05
285	0%	Specialties	5 d	7/20/05	7/26/05
286	0%	Doors and Hardware	5 d	7/20/05	7/26/05
287	0%	Millwork	5 d	7/20/05	7/26/05
288	0%	Ceiling Tile	3 d	7/20/05	7/22/05
289	0%	Wood Aerobic Flooring	10 d	7/27/05	8/9/05
290	0%	Flooring	7 d	8/3/05	8/11/05
291	67%	**Area 2 and Area 1 Level 3**	130 d	3/1/05	8/26/05
292	90%	Track Ornamental Railing	15 d	3/1/05	3/18/05

Timescale: 2004 — Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec; 2005 — Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec; 200 — Jan

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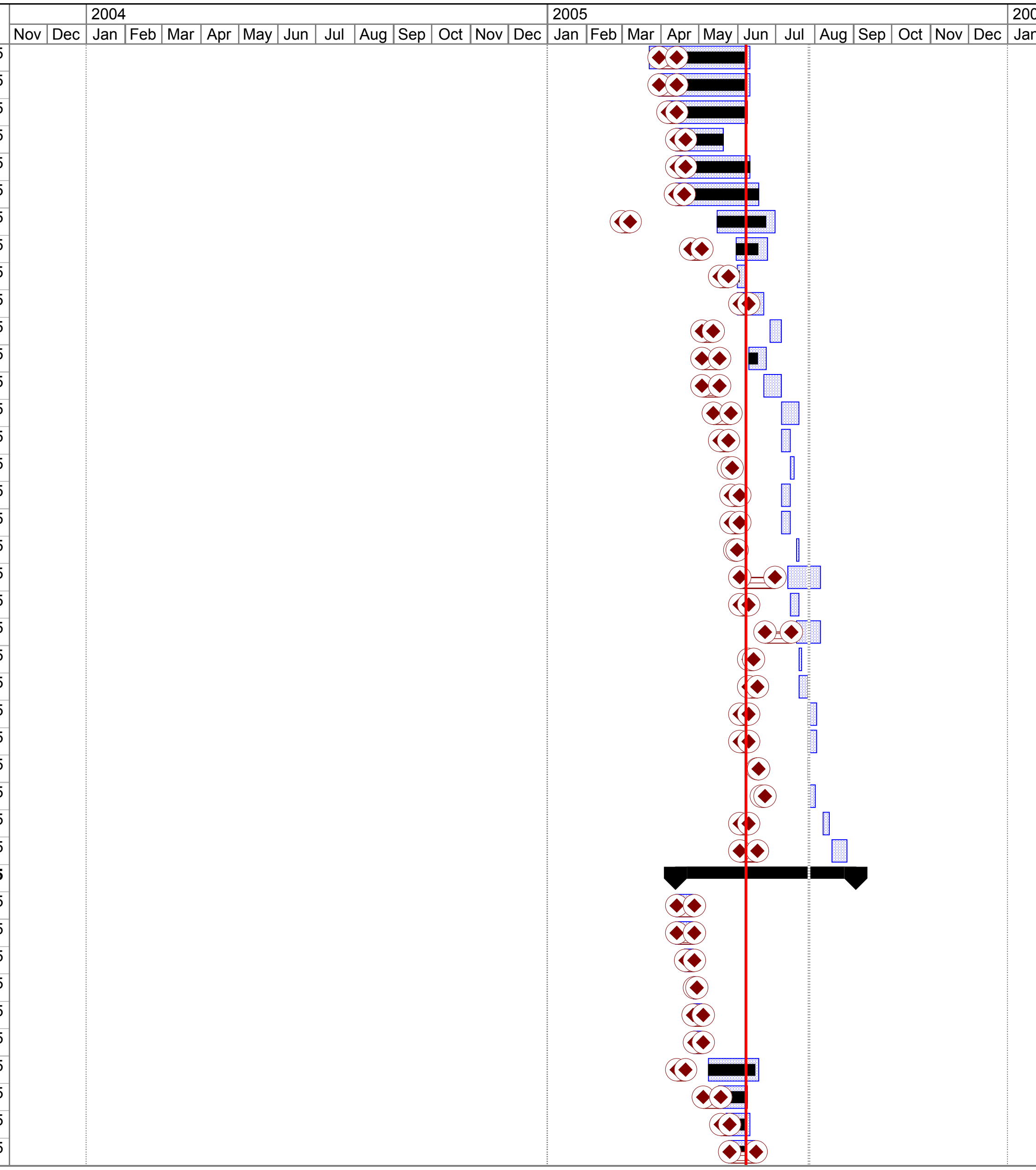
Task | Milestone | Critical | Target
Progress | Summary | Critical Progress

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
293	95%	Metal Studs	58 d	3/23/05	6/10/05
294	95%	Interior Masonry	53 d	3/30/05	6/10/05
295	95%	Door Frames	44 d	4/6/05	6/8/05
296	100%	Plumbing Rough In	28 d	4/13/05	5/20/05
297	100%	Electrical In Wall Rough In	43 d	4/13/05	6/10/05
298	100%	HVAC VAV Rough In	48 d	4/13/05	6/17/05
299	85%	Stair #9	34 d	5/16/05	6/30/05
300	70%	Drywall	19 d	5/31/05	6/24/05
301	30%	Interior Framing & Glazing	5 d	6/1/05	6/7/05
302	30%	Intumescent Fireproofing	15 d	6/1/05	6/21/05
303	0%	Drywall Ceilings	7 d	6/27/05	7/5/05
304	50%	Finish Drywall Partitions	10 d	6/10/05	6/23/05
305	0%	Ceramic Tile	10 d	6/22/05	7/5/05
306	0%	Finish Drywall Ceilings	10 d	7/6/05	7/19/05
307	0%	Plumbing Fixtures	5 d	7/6/05	7/12/05
308	0%	Toilet Partitions	3 d	7/13/05	7/15/05
309	0%	Painting	5 d	7/6/05	7/12/05
310	0%	Owner - Telecom/Data	5 d	7/6/05	7/13/05
311	0%	Toilet Accessories	2 d	7/18/05	7/19/05
312	0%	Millwork	20 d	7/11/05	8/5/05
313	0%	Ceiling Grid	5 d	7/13/05	7/19/05
314	0%	Terrazzo Placement	15 d	7/18/05	8/5/05
315	0%	MEP Finish	2 d	7/20/05	7/21/05
316	0%	Light Fixtures	5 d	7/20/05	7/26/05
317	0%	Specialties	5 d	7/27/05	8/2/05
318	0%	Doors and Hardware	5 d	7/27/05	8/2/05
319	0%	MEP Above Ceiling Inspection	1 d	7/27/05	7/27/05
320	0%	Ceiling Tile	3 d	7/28/05	8/1/05
321	0%	Flooring	5 d	8/8/05	8/12/05
322	0%	Track Flooring	10 d	8/15/05	8/26/05
323	**66%**	**Area 1 Level 2A**	**103 d**	**4/13/05**	**9/2/05**
324	100%	Interior Masonry	10 d	4/13/05	4/26/05
325	100%	Metal Studs	10 d	4/13/05	4/26/05
326	100%	Door Frames	5 d	4/20/05	4/26/05
327	100%	Plumbing Rough In	2 d	4/27/05	4/28/05
328	100%	HVAC VAV Rough In	5 d	4/27/05	5/3/05
329	100%	Electrical In Wall Rough In	5 d	4/27/05	5/3/05
330	90%	Stair #7 and Rail	30 d	5/9/05	6/17/05
331	100%	Drywall	17 d	5/17/05	6/8/05
332	80%	Finish Drywall	15 d	5/23/05	6/10/05
333	75%	Interior Framing and Glazing	15 d	5/25/05	6/14/05



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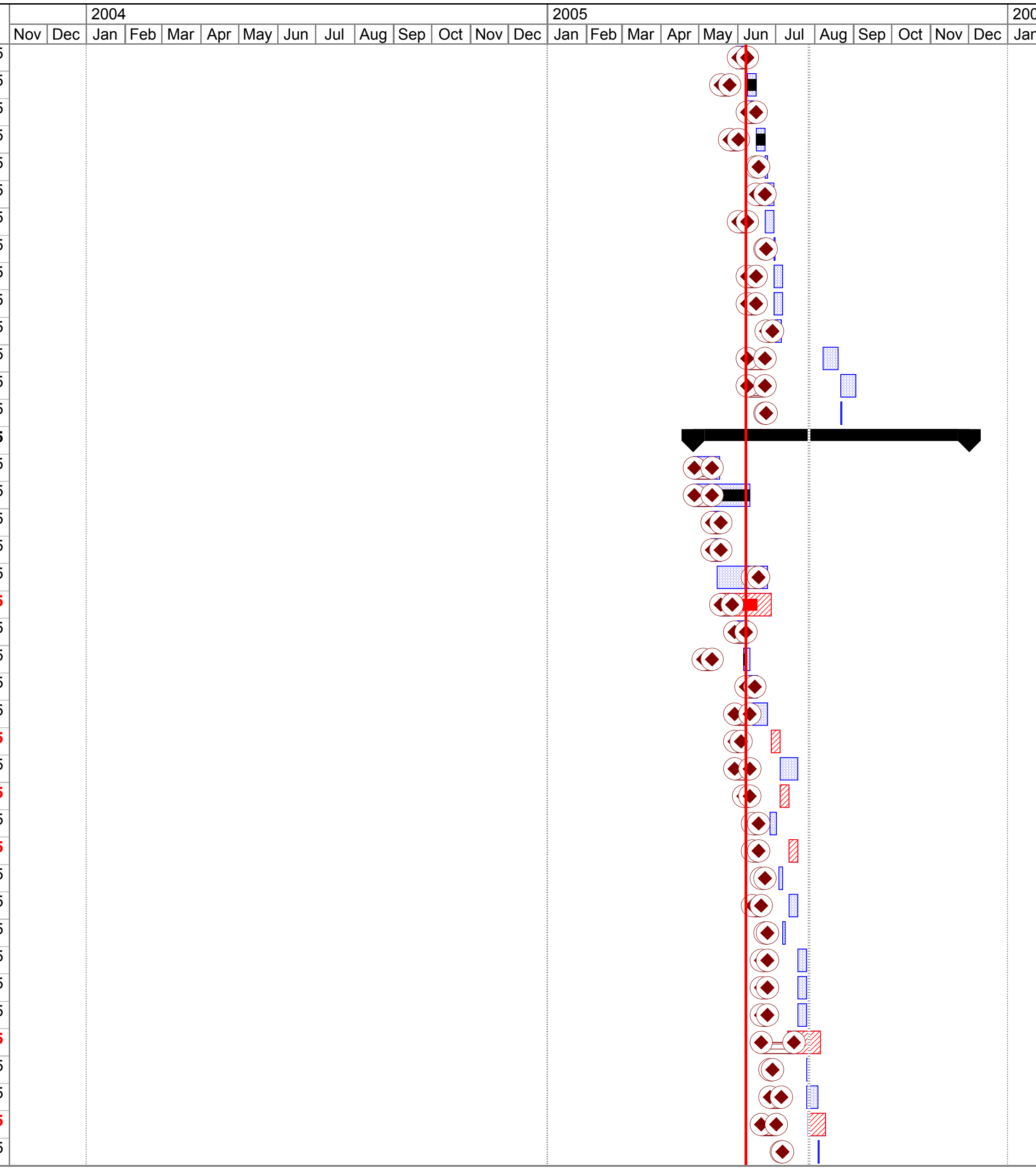
Task | Progress | Milestone | Summary | Critical | Critical Progress | Target

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
334	0%	Owner - Telecom/Data	5 d	5/31/05	6/7/05
335	100%	Drywall Ceilings	5 d	6/9/05	6/15/05
336	100%	Ceiling Grid	5 d	6/7/05	6/13/05
337	100%	Finish Drywall Ceilings	5 d	6/16/05	6/22/05
338	0%	MEP Finish	2 d	6/23/05	6/24/05
339	0%	Light Fixtures	5 d	6/23/05	6/29/05
340	0%	Painting	5 d	6/23/05	6/29/05
341	0%	MEP Above Ceiling Inspection	1 d	6/30/05	6/30/05
342	0%	Specialties	5 d	6/30/05	7/6/05
343	0%	Doors and Hardware	5 d	6/30/05	7/6/05
344	0%	Ceiling Tile	3 d	7/1/05	7/5/05
345	0%	Millwork	10 d	8/8/05	8/19/05
346	0%	Flooring	10 d	8/22/05	9/2/05
347	0%	Plumbing Fixtures	1 d	8/22/05	8/22/05
348	**30%**	**Area 1 Level 2**	**157 d**	**4/27/05**	**12/1/05**
349	98%	Interior Masonry	15 d	4/27/05	5/17/05
350	99%	Metal Studs	33 d	4/27/05	6/10/05
351	100%	Electrical In Wall Rough In	5 d	5/11/05	5/17/05
352	100%	Plumbing Rough In	6 d	5/11/05	5/18/05
353	0%	Intumescent Fireproofing	30 d	5/16/05	6/24/05
354	**75%**	**Drywall**	**29 d**	**5/18/05**	**6/27/05**
355	50%	Finish Drywall	7 d	6/1/05	6/9/05
356	50%	Door Frames	5 d	6/6/05	6/10/05
357	0%	Interior Framing and Glazing	5 d	6/10/05	6/16/05
358	25%	Ceramic Tile	10 d	6/13/05	6/24/05
359	**0%**	**Drywall Ceilings**	**5 d**	**6/28/05**	**7/4/05**
360	0%	Exterior Patio Pavers	10 d	7/5/05	7/18/05
361	**0%**	**Finish Drywall Ceilings**	**5 d**	**7/5/05**	**7/11/05**
362	0%	Plumbing Fixtures	5 d	6/27/05	7/1/05
363	**0%**	**Painting**	**5 d**	**7/12/05**	**7/18/05**
364	0%	Toilet Partitions	3 d	7/4/05	7/6/05
365	0%	Owner - Telecom/Data	5 d	7/12/05	7/19/05
366	0%	Toilet Accessories	2 d	7/7/05	7/8/05
367	0%	Specialties	5 d	7/19/05	7/25/05
368	0%	Doors and Hardware	5 d	7/19/05	7/25/05
369	0%	Ceiling Grid	5 d	7/19/05	7/25/05
370	**0%**	**Millwork**	**20 d**	**7/11/05**	**8/5/05**
371	0%	MEP Finish	2 d	7/26/05	7/27/05
372	0%	Light Fixtures	7 d	7/26/05	8/3/05
373	**0%**	**Wood Floor Aerobic Room**	**10 d**	**7/27/05**	**8/9/05**
374	0%	MEP Above Ceiling Inspection	1 d	8/4/05	8/4/05



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Task
Progress
Milestone
Summary
Critical
Critical Progress
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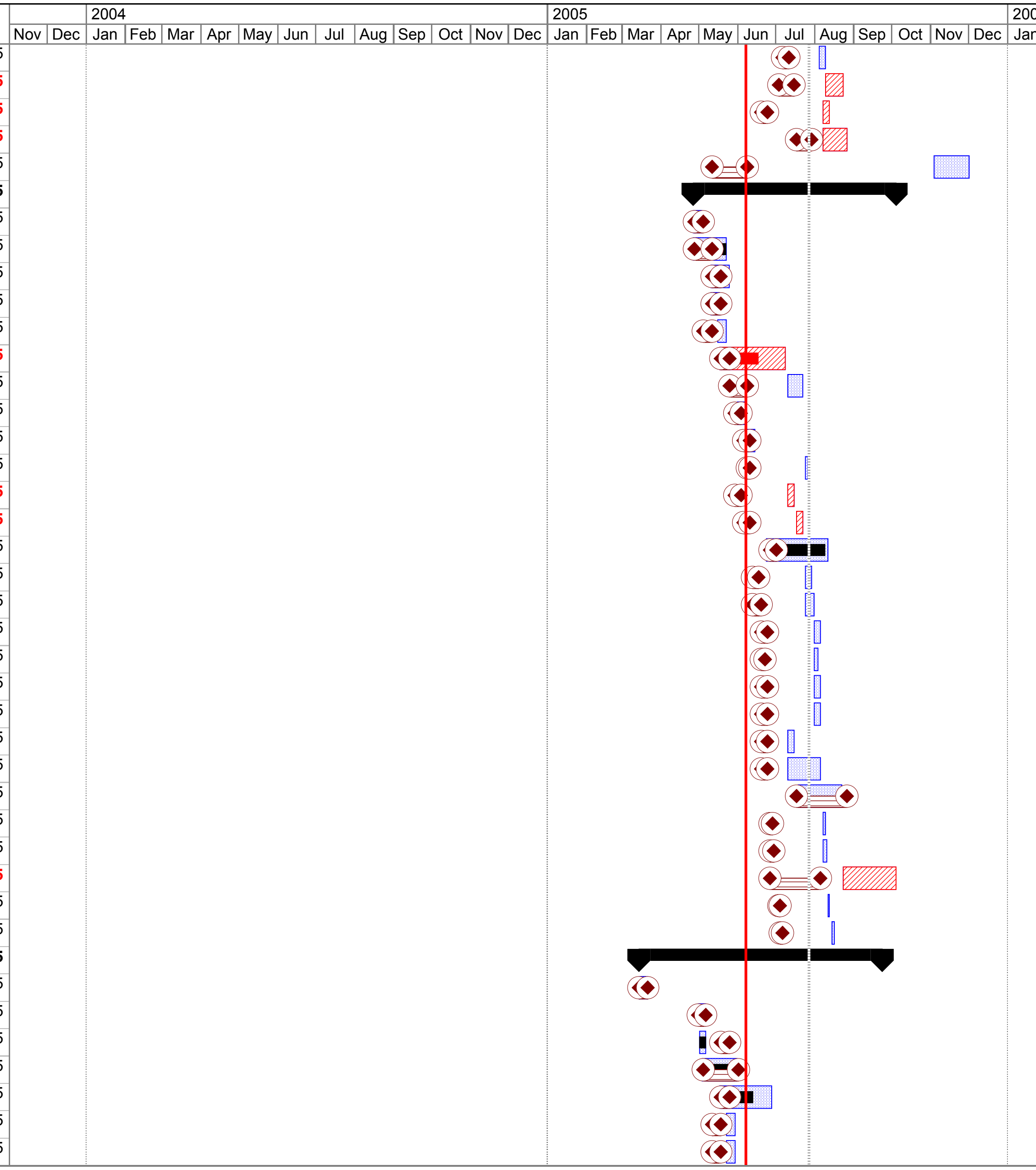
Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
375	0%	Ceiling Tile	3 d	8/5/05	8/9/05
376	**0%**	**Wood Floor at Member's Lounge**	**10 d**	**8/10/05**	**8/23/05**
377	**0%**	**Flooring**	**5 d**	**8/8/05**	**8/12/05**
378	**0%**	**Terrazzo**	**15 d**	**8/8/05**	**8/26/05**
379	0%	Owner - Climbing Wall	20 d	11/4/05	12/1/05
380	**25%**	**Area 2 Level 2**	**115 d**	**4/27/05**	**10/4/05**
381	99%	Interior Masonry	5 d	4/27/05	5/3/05
382	98%	Metal Studs	10 d	4/27/05	5/23/05
383	98%	Electrical In Wall Rough In	5 d	5/11/05	5/25/05
384	95%	Plumbing Rough In	5 d	5/11/05	5/17/05
385	25%	Door Frames	5 d	5/16/05	5/23/05
386	**60%**	**Drywall**	**38 d**	**5/18/05**	**7/8/05**
387	0%	Ceramic Tile	10 d	7/11/05	7/22/05
388	50%	Finish Drywall	5 d	6/1/05	6/7/05
389	25%	Interior Framing and Glazing	5 d	6/8/05	6/14/05
390	0%	Plumbing Fixtures	2 d	7/25/05	7/26/05
391	**0%**	**Drywall Ceilings**	**5 d**	**7/11/05**	**7/15/05**
392	**0%**	**Finish Drywall Ceilings**	**5 d**	**7/18/05**	**7/22/05**
393	50%	Light Fixtures	5 d	6/24/05	8/11/05
394	0%	Painting	5 d	7/25/05	7/29/05
395	0%	Owner - Telecom/Data	5 d	7/25/05	8/1/05
396	0%	Ceiling Grid	5 d	8/1/05	8/5/05
397	0%	Flooring	3 d	8/1/05	8/3/05
398	0%	Specialties	5 d	8/1/05	8/5/05
399	0%	Doors and Hardware	5 d	8/1/05	8/5/05
400	0%	Intumescant Fireproofing	5 d	7/11/05	7/15/05
401	0%	Millwork	20 d	7/11/05	8/5/05
402	0%	Raquetball Courts	25 d	7/19/05	8/22/05
403	0%	MEP Finish	2 d	8/8/05	8/9/05
404	0%	Fire Protection Finish	3 d	8/8/05	8/10/05
405	**0%**	**Wood Flooring at Gymnasium**	**30 d**	**8/24/05**	**10/4/05**
406	0%	MEP Above Ceiling Inspection	1 d	8/12/05	8/12/05
407	0%	Ceiling Tile	2 d	8/15/05	8/16/05
408	**20%**	**Area 1 Level 1**	**139 d**	**3/15/05**	**9/23/05**
409	100%	Concrete Column Encasements	5 d	3/15/05	3/21/05
410	100%	HVAC VAV Rough In- Theatre Area	5 d	5/1/05	5/6/05
411	100%	Plumbing Rough In	5 d	5/2/05	5/6/05
412	85%	Interior Masonry	20 d	5/4/05	5/31/05
413	50%	Electrical In Wall Rough In	22 d	5/18/05	6/28/05
414	50%	Metal Studs	5 d	5/23/05	5/30/05
415	75%	Door Frames	5 d	5/23/05	5/30/05



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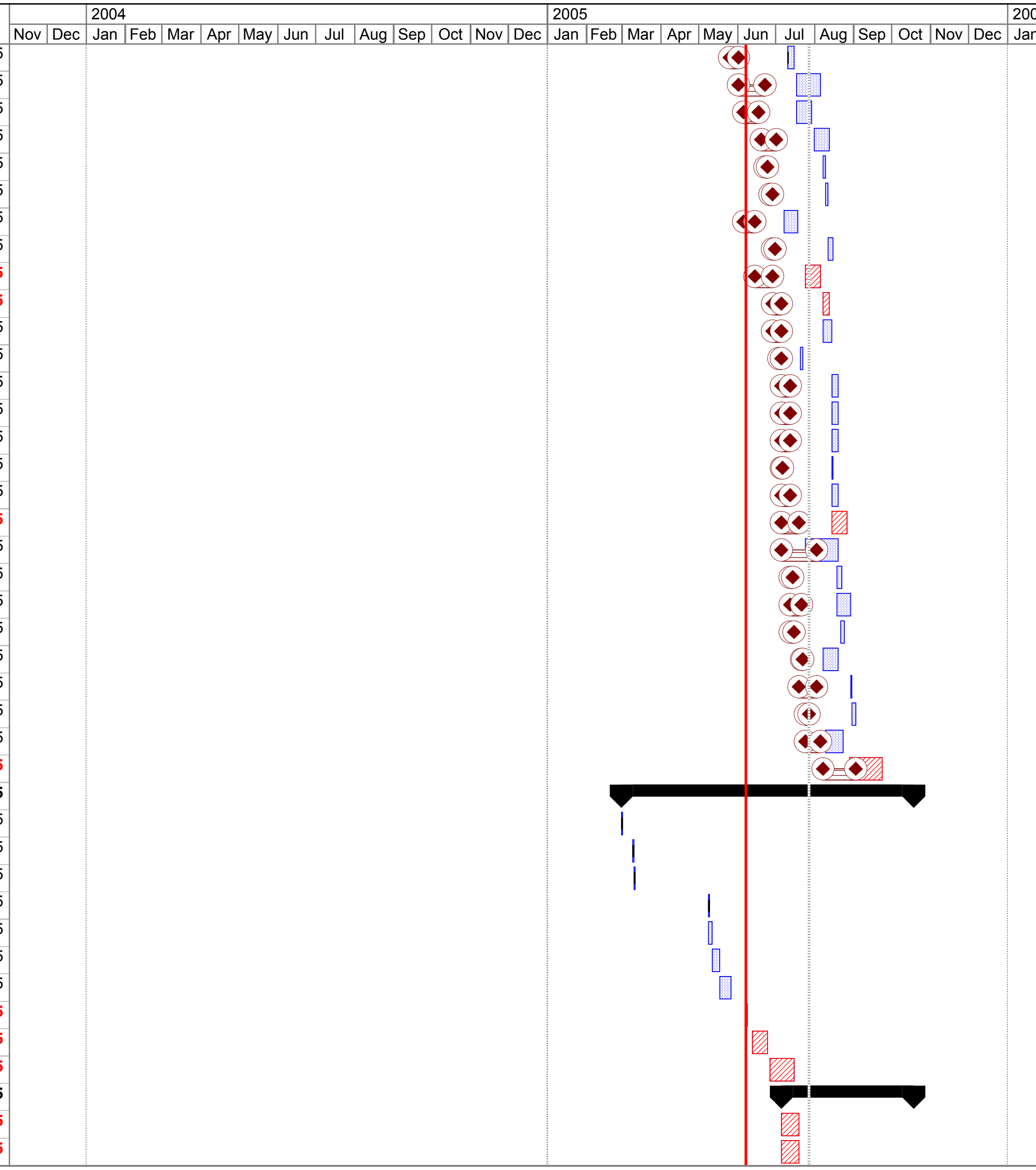
Task | Progress | Milestone | Summary | Critical | Critical Progress | Target

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
416	10%	Drywall	5 d	7/11/05	7/15/05
417	0%	Ceramic Tile	15 d	7/18/05	8/5/05
418	0%	Finish Drywall	10 d	7/18/05	7/29/05
419	0%	Interior Framing and Glazing	10 d	8/1/05	8/12/05
420	0%	Plumbing Fixtures	2 d	8/8/05	8/9/05
421	0%	Toilet Partitions	2 d	8/10/05	8/11/05
422	0%	Drywall Ceilings	7 d	7/8/05	7/18/05
423	0%	Toilet Accessories	2 d	8/12/05	8/15/05
424	0%	Finish Drywall Ceilings	10 d	7/25/05	8/5/05
425	0%	Painting	5 d	8/8/05	8/12/05
426	0%	Owner - Telecom/Data	5 d	8/8/05	8/15/05
427	0%	Theatre-Spray On Acoustical Treatment	2 d	7/21/05	7/22/05
428	0%	Specialties	5 d	8/15/05	8/19/05
429	0%	Doors and Hardware	5 d	8/15/05	8/19/05
430	0%	Ceiling Grid	5 d	8/15/05	8/19/05
431	0%	Owner - Supply Turnstyle to be Wired	1 d	8/15/05	8/15/05
432	0%	Electrical Wall Finishes	5 d	8/15/05	8/19/05
433	0%	Flooring	10 d	8/15/05	8/26/05
434	0%	Millwork	20 d	7/25/05	8/19/05
435	0%	MEP Finish	2 d	8/19/05	8/22/05
436	0%	Light Fixtures	7 d	8/19/05	8/29/05
437	0%	Fire Protection Finish	3 d	8/22/05	8/24/05
438	0%	Theatre Seating Platforms	10 d	8/8/05	8/19/05
439	0%	MEP Above Ceiling Inspection	1 d	8/30/05	8/30/05
440	0%	Ceiling Tile	3 d	8/31/05	9/2/05
441	0%	Wood Ceiling	10 d	8/10/05	8/23/05
442	0%	Terrazzo	20 d	8/29/05	9/23/05
443	2%	**Area 2 Level 1/Childcare Area**	167 d	3/1/05	10/18/05
444	100%	Owner Go/ No Go	1 d	3/1/05	3/1/05
445	100%	Verbal Go From Owner	1 d	3/10/05	3/10/05
446	100%	Written Go From Owner	1 d	3/11/05	3/11/05
447	100%	Change Documents Due From Owner & A/E	1 d	5/9/05	5/9/05
448	0%	BMC Review of Change Documents, Copies and	3 d	5/9/05	5/11/05
449	0%	Initiate Change Requests to Subcontractors	4 d	5/12/05	5/17/05
450	0%	Receive Review Quotes	7 d	5/18/05	5/26/05
451	0%	Owner Approval/ Issue Change Orders	2 d	6/7/05	6/8/05
452	0%	Submittals and Shop Drawings	10 d	6/13/05	6/24/05
453	0%	Order and Fabricate Materials	15 d	6/27/05	7/15/05
454	0%	**Construction**	75 d	7/6/05	10/18/05
455	0%	HVAC Rough In	10 d	7/6/05	7/19/05
456	0%	Metal Studs and Door Frames	10 d	7/6/05	7/19/05



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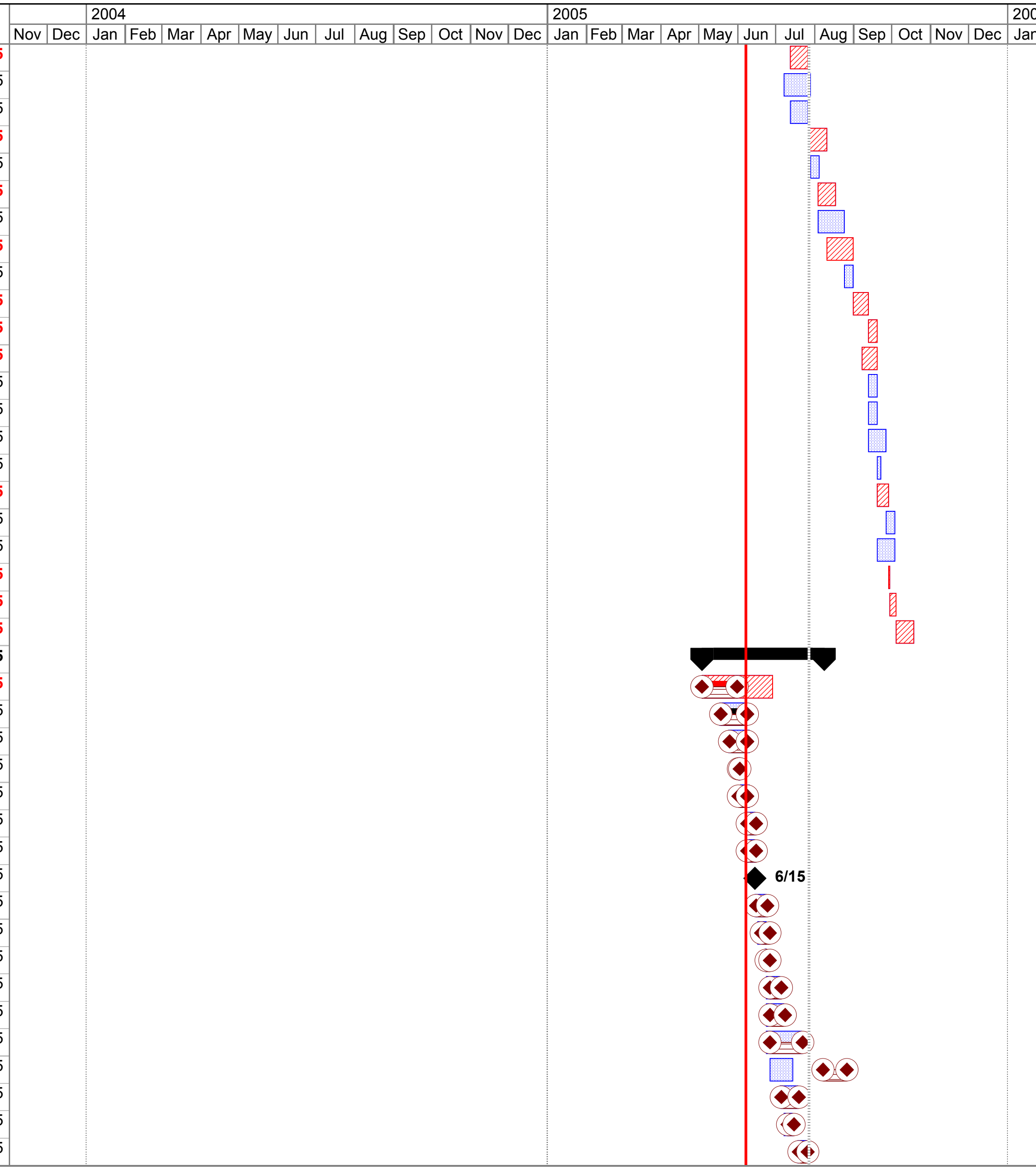
Task		Milestone		Critical		Target	
Progress		Summary		Critical Progress			

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
457	**0%**	**Electrical In Wall Rough In**	**10 d**	**7/13/05**	**7/26/05**
458	0%	Electrical OH Rough In	15 d	7/8/05	7/28/05
459	0%	Plumbing Rough In	10 d	7/13/05	7/26/05
460	**0%**	**Drywall**	**10 d**	**7/28/05**	**8/10/05**
461	0%	Fire Protection Rough In	5 d	7/29/05	8/4/05
462	**0%**	**Drywall Ceilings & Soffits**	**10 d**	**8/4/05**	**8/17/05**
463	0%	Finish Drywall	15 d	8/4/05	8/24/05
464	**0%**	**Finish Drywall Ceilings & Soffits**	**15 d**	**8/11/05**	**8/31/05**
465	0%	Interior Framing & Glazing	5 d	8/25/05	8/31/05
466	**0%**	**Painting**	**8 d**	**9/1/05**	**9/12/05**
467	**0%**	**Ceiling Grid**	**5 d**	**9/13/05**	**9/19/05**
468	**0%**	**Metal Ceiling**	**8 d**	**9/8/05**	**9/19/05**
469	0%	Specialties	5 d	9/13/05	9/19/05
470	0%	Doors and Hardware	5 d	9/13/05	9/19/05
471	0%	Millwork	10 d	9/13/05	9/26/05
472	0%	MEP Finish	3 d	9/20/05	9/22/05
473	**0%**	**Light Fixtures**	**7 d**	**9/20/05**	**9/28/05**
474	0%	Plumbing Fixtures	5 d	9/27/05	10/3/05
475	0%	Cork & Resinous Flooring	10 d	9/20/05	10/3/05
476	**0%**	**MEP Above Ceiling Inspection**	**1 d**	**9/29/05**	**9/29/05**
477	**0%**	**Ceiling Tile**	**3 d**	**9/30/05**	**10/4/05**
478	**0%**	**Punchlist**	**10 d**	**10/5/05**	**10/18/05**
479	**26%**	**Area 1 Basement Level**	**69 d**	**5/4/05**	**8/8/05**
480	**50%**	**HVAC Ductwork**	**40 d**	**5/4/05**	**6/28/05**
481	95%	Interior Masonry	15 d	5/18/05	6/7/05
482	80%	Metal Studs	10 d	5/25/05	6/10/05
483	0%	Owner - Provide Swimsuit Extractors	1 d	6/2/05	6/2/05
484	100%	Door Frames	5 d	6/3/05	6/10/05
485	98%	Electrical In Wall Rough In	5 d	6/8/05	6/14/05
486	100%	Plumbing Rough In	5 d	6/8/05	6/14/05
487	0%	Boiler Start Up	0 d	6/15/05	6/15/05
488	0%	Drywall	7 d	6/15/05	6/23/05
489	0%	Owner - Telecom/Data	5 d	6/17/05	6/24/05
490	0%	Above Ceiling Inspection - (Drywall)	1 d	6/23/05	6/24/05
491	0%	Drywall Ceilings	7 d	6/24/05	7/4/05
492	0%	Finish Drywall	10 d	6/24/05	7/7/05
493	0%	Ceramic Tile	20 d	6/24/05	7/21/05
494	0%	Terrazzo	14 d	6/27/05	7/14/05
495	0%	Finish Drywall Ceilings	10 d	7/5/05	7/18/05
496	0%	Interior Framing and Glazing	5 d	7/8/05	7/14/05
497	0%	Painting	5 d	7/19/05	7/25/05

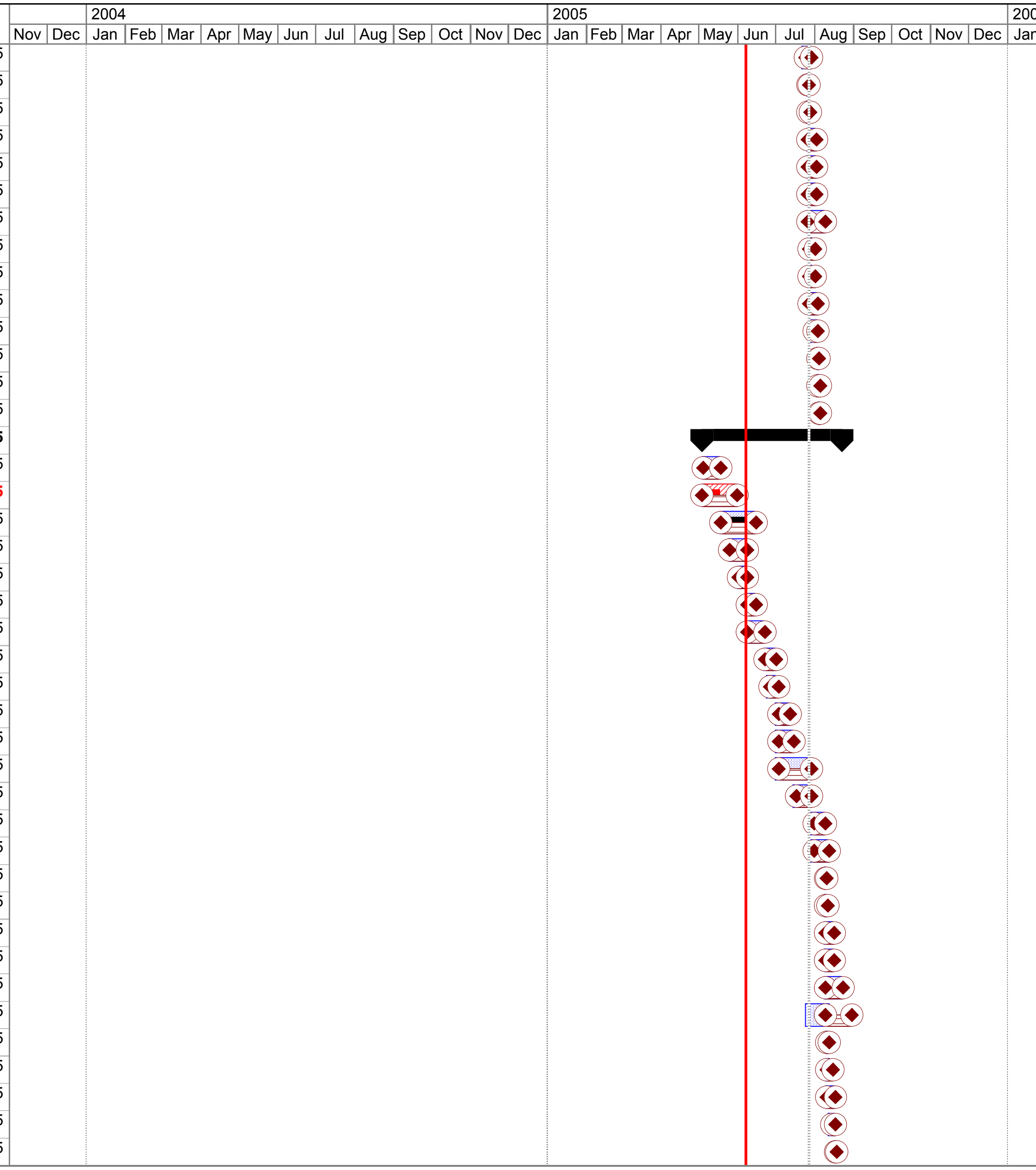


File: 6-21-05 Interior Finish Schedule Y
Print Date: 7/27/05

Task | Milestone | Critical | Target
Progress | Summary | Critical Progress

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
498	0%	Plumbing Fixtures	5 d	7/22/05	7/28/05
499	0%	Ceiling Grid	1 d	7/26/05	7/26/05
500	0%	Electrical Wall Finishes	2 d	7/26/05	7/27/05
501	0%	Flooring	5 d	7/26/05	8/1/05
502	0%	Specialties	5 d	7/26/05	8/1/05
503	0%	Doors and Hardware	5 d	7/26/05	8/1/05
504	0%	Millwork	10 d	7/26/05	8/8/05
505	0%	MEP Finish	3 d	7/27/05	7/29/05
506	0%	Fire Protection Finish	3 d	7/27/05	7/29/05
507	0%	Light Fixtures	5 d	7/27/05	8/2/05
508	0%	Toilet Partitions	3 d	7/29/05	8/2/05
509	0%	MEP Above Ceiling Inspection	1 d	8/3/05	8/3/05
510	0%	Toilet Accessories	2 d	8/3/05	8/4/05
511	0%	Ceiling Tile	1 d	8/4/05	8/4/05
512	**30%**	**Area 2 Basement Level**	**79 d**	**5/4/05**	**8/22/05**
513	80%	Concrete Floor Slab and Curbs	10 d	5/4/05	5/18/05
514	50%	HVAC Ductwork	20 d	5/4/05	5/31/05
515	90%	Interior Masonry	20 d	5/18/05	6/14/05
516	90%	Metal Studs	10 d	5/25/05	6/7/05
517	65%	Door Frames	5 d	6/1/05	6/7/05
518	95%	Electrical In Wall Rough In	5 d	6/8/05	6/14/05
519	95%	Plumbing Rough In	10 d	6/8/05	6/21/05
520	0%	Drywall	7 d	6/22/05	6/30/05
521	0%	Owner - Telecom/Data	5 d	6/24/05	7/1/05
522	0%	Finish Drywall	7 d	7/1/05	7/11/05
523	0%	Drywall Ceilings	10 d	7/1/05	7/14/05
524	0%	Ceramic Tile	20 d	7/1/05	7/28/05
525	0%	Finish Drywall Ceilings	10 d	7/15/05	7/28/05
526	0%	Painting	7 d	7/29/05	8/8/05
527	0%	Plumbing Fixtures	10 d	7/29/05	8/11/05
528	0%	Ceiling Grid	1 d	8/9/05	8/9/05
529	0%	Electrical Wall Finishes	2 d	8/9/05	8/10/05
530	0%	Specialties	5 d	8/9/05	8/15/05
531	0%	Doors and Hardware	5 d	8/9/05	8/15/05
532	0%	Millwork	10 d	8/9/05	8/22/05
533	0%	Lockers	15 d	7/25/05	8/12/05
534	0%	MEP Finish	2 d	8/10/05	8/11/05
535	0%	Fire Protection Finish	3 d	8/10/05	8/12/05
536	0%	Light Fixtures	5 d	8/10/05	8/16/05
537	0%	Toilet Partitions	3 d	8/12/05	8/16/05
538	0%	MEP Above Ceiling Inspection	1 d	8/17/05	8/17/05

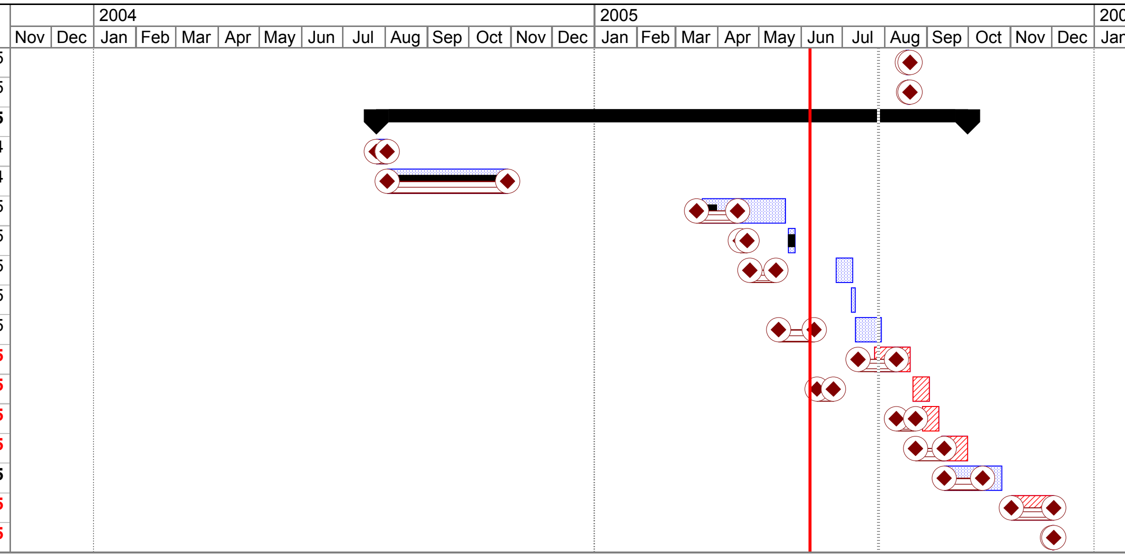


File: 6-21-05 Interior Finish Schedule Y
Print Date: 7/27/05

Task		Milestone		Critical		Target	
Progress		Summary		Critical Progress			

Downtown YMCA
Construction Schedule

ID	%	Task Name	Dur	Start	Finish
539	0%	Toilet Accessories	2 d	8/17/05	8/18/05
540	0%	Ceiling Tile	1 d	8/18/05	8/18/05
541	**42%**	**Site Preparation**	**311 d**	**7/26/04**	**9/30/05**
542	100%	Mobilize Site Development	6 d	7/26/04	8/2/04
543	100%	Site Utilities	64 d	8/3/04	10/29/04
544	20%	Site Concrete Foundations and Walls- North	45 d	3/21/05	5/20/05
545	95%	Site Grading Phase 1 (North)	5 d	5/23/05	5/27/05
546	0%	Site Paving and Sidewalks Phase 1 (North)	10 d	6/27/05	7/8/05
547	0%	SBC & Comcast Complete	1 d	7/8/05	7/11/05
548	0%	Site Grading Phase 2	15 d	7/11/05	7/29/05
549	**0%**	**Site Paving and Sidewalks Phase 2**	**20 d**	**7/25/05**	**8/19/05**
550	**0%**	**Landscaping Phase 1**	**10 d**	**8/22/05**	**9/2/05**
551	**0%**	**Landscaping Phase 2**	**10 d**	**8/29/05**	**9/9/05**
552	**0%**	**Exterior Finishes**	**15 d**	**9/12/05**	**9/30/05**
553	**0%**	**Punch & Clean**	**30 d**	**9/14/05**	**10/25/05**
554	**0%**	**Owner FF & E**	**23 d**	**11/2/05**	**12/2/05**
555	**0%**	**Beneficial Occupancy**	**1 d**	**12/2/05**	**12/2/05**



File: 6-21-05 Interior Finish Schedule Y
Print Date: 7/27/05

Task — Progress — Milestone — Summary — Critical — Critical Progress — Target

Appendix G

Geo-Technical Report

cc: Bob Ullman
Project File 0605
SmithGroup JJR

Jana Hayford
Bob Polri
Hikmat Georges.

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The Kramer Building
43980 Plymouth Oaks Blvd.
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tel (734) 454-9900
fax (734) 454-0629

www.sme-usa.com

August 14, 2003

Ms. Jill S. Stewart, AIA
SmithGroup
500 Griswold
Suite 200
Detroit, Michigan 48226

RE: Revised Geotechnical Engineering Recommendations
Downtown YMCA
Detroit, Michigan
SME Project No. PG34872

REF: SME *Geotechnical Evaluation Report*, dated December 30, 1999

Dear Ms. Stewart:

This letter is issued in response to the request for additional engineering recommendations presented in SmithGroup's letter dated June 10, 2003. This document should be considered an addendum to the original report, referenced above, and should not be considered apart from the entire text of the original report, with all of the discussions and qualifications discussed therein.

PROJECT BACKGROUND

The project site is located along the south side of John R. Street in Detroit, Michigan. The property is bounded to the west by Farmer Street, to the south by Grand River Avenue, and to the east by Broadway Street.

The site is currently used as a surface parking lot, and is generally covered with asphalt pavement. The Broadway Station of the Detroit People Mover is located near the northeast corner of the site, and the elevated People Mover track runs diagonally across the site from northeast to southwest. The track is supported on drilled piers (caissons), and the station is supported on shallow spread foundations.

SME previously provided geotechnical engineering services at the project site. Since completion of the initial report, we understand the proposed construction has changed significantly. The building will cover a smaller footprint than originally proposed, and will generally be located to avoid constructing immediately adjacent and/or over the People Mover facilities.

The proposed YMCA facility will be a multi-story structure constructed over a 10-foot deep basement. A below-grade pool and mechanical room are also planned, with the deepest (bottom of pool) levels established at about 17 feet below the ground surface. Maximum column loads of 100 to 600 kips are anticipated.

REVISED RECOMMENDATIONS

SmithGroup has requested SME provide revised geotechnical engineering recommendations for the currently proposed construction. The requested information and our revised recommendations are summarized below.

1. **Provide design pressures and coefficients for low site retaining walls on existing fill materials.** Retaining walls may bear on properly prepared existing fill materials, and retaining wall foundations can be sized for a maximum net allowable soil bearing pressure of 2,000 psf. There is a risk of additional settlement associated with construction over undocumented fill. This settlement can result in faulting and cracking of the retaining walls. In general, once the foundation bearing soils are properly prepared, the added risk of settlement is judged to be relatively small. However, if even this small risk is unacceptable, it will be necessary to remove at least a portion of the existing fill materials and replace them with engineered fill. In general, the more existing fill removed, the lower the risk of settlement.

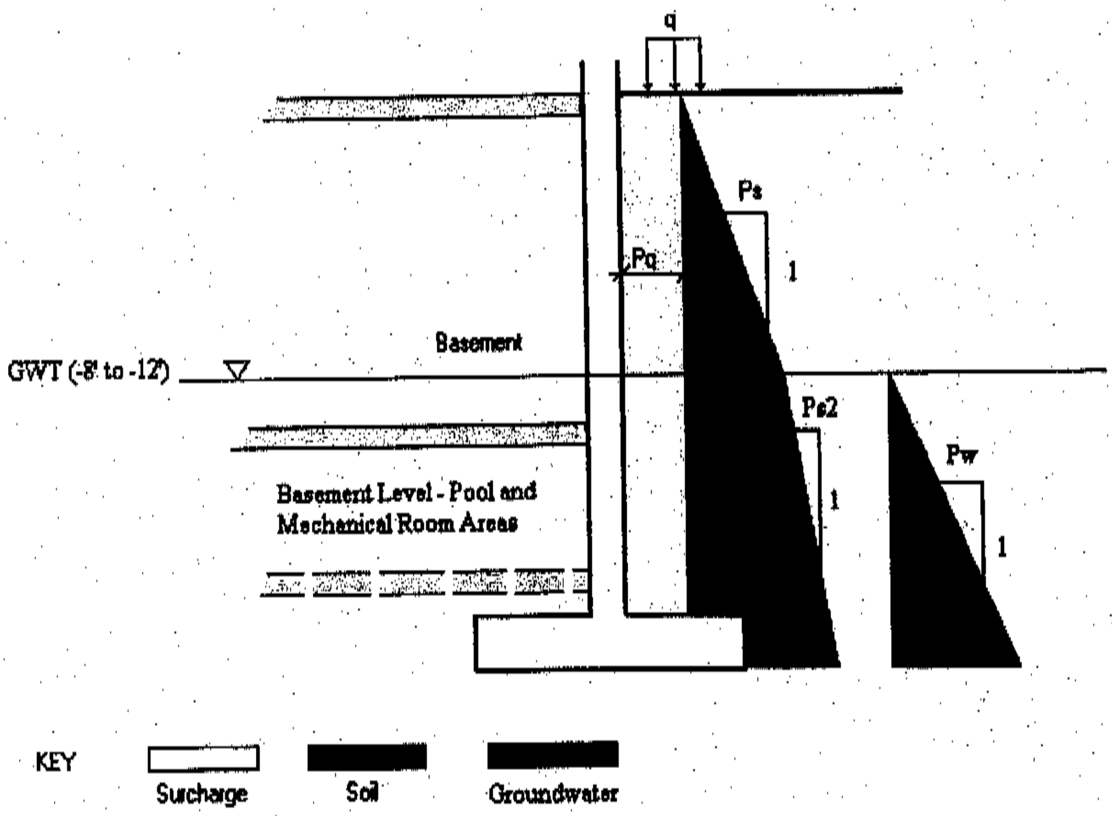
   Suitable existing fill materials should be free of organic materials and other unsuitable debris, free of large voids, relatively consistent with depth, and have sufficient strength to for the design bearing pressure. A comprehensive evaluation of the existing fill materials at the wall locations will be required during construction to verify the materials are suitable for support of foundations. At a minimum, foundation bearing materials should be probed to a minimum depth of 2.5 feet below the foundation bearing elevation. We recommend SME be retained to verify foundation bearing materials and to verify the subgrade conditions are as anticipated.

   To further evaluate the existing fill materials for suitability for support of shallow foundations, pavements, and floor slabs, a supplemental test pit evaluation should be considered. As the site is currently a surface parking lot, the test pits would be less disruptive after the site has been purchased and is no longer in use.

   Please refer to the recommendations presented in item 2, below, for lateral earth pressure coefficients for the design of the retaining walls.

2. **Provide design pressures and coefficients for basement level retaining walls at areaways and adjacent to property lines.** Long-term groundwater levels are estimated at 8 to 12 feet below the existing ground surface. For permanent below-grade walls, we expect the walls will be backfilled with a well-draining granular soil, such as MDOT Class II sand, compacted to a minimum of 95 percent of the maximum dry density, as determined by the Modified Proctor method. Surcharges resulting from floor, sidewalk, and/or pavement loads should also be considered in designing below-grade walls. For design of below-grade walls, please refer to the diagram presented below:

Earth Pressure Diagram



Where:

Backfill is MDOT Class II sand
Unit weight (γ) = 120 pcf
Unit weight of water (γ_w) = 62.4 pcf
Effective unit weight of soil below groundwater level (γ') = $\gamma - \gamma_w$
q = Surcharge loads from pavements, sidewalks, and/or streets
P_q = Lateral pressure due to surcharge = K*q
P_s = Lateral pressure from soil above water level = γK
P_{s2} = Lateral pressure from soil below water level = γ'*K
P_w = Hydrostatic pressure = γ_w
K = Earth pressure coefficients:
K_0 = At-rest earth pressure coefficient = 0.47
K_a = Active earth pressure coefficient = 0.31
K_p = Passive earth pressure coefficient = 3.25
Earth pressure coefficients based on friction angle (ϕ) of 32 degrees

Note: Other materials may be considered for backfill. Lateral earth pressures should be adjusted accordingly based on the unit weight and friction angle of the backfill material selected.

Drainage may be provided at the base of the retaining wall to reduce the lateral pressure from the groundwater. This would require a 4-inch diameter drain tile wrapped with a filter fabric and surrounded with a filter material (e.g., pea gravel). If possible, the drain should flow by gravity to a nearby storm sewer. However, if this is not possible, then a sump and pump system will be necessary to discharge the effluent.

3. **Provide seismic site classification and soil parameters per Michigan Building Code 2000.** The site is located along the south side of John R. Street, between Farmer and Broadway Streets in Detroit, Wayne County, Michigan. Based on the soil borings performed on this site and an adjacent sites, the geologic conditions at the site consist of 130 to 140 feet of glacial drift (consisting of one or a combination of sands and clays) over rock. Based on an average ground surface elevation of 120 feet (Detroit City Datum, DCD), bedrock is expected between elevations –10 to –20 feet DCD. Dense clay till (hardpan) at the project site and on neighboring site has typically been encountered at depths of 120 to 125 feet below the ground surface, or at approximate elevations 0 to –5 feet DCD.

The known N-values and shear strengths for drift at this and adjacent sites have been developed to the explored depths of up to 135 to 140 feet below the ground surface. The shear strengths and N-values within this depth range will average approximately 1,000 psf and greater than 15 blows per foot, respectively for these soils. Based on the referenced soil conditions averaged over the upper 100 feet of the profile, we conclude the seismic site Class D applies to this site according to the 2000 Michigan Building Code (MBC) requirements in Section 1615.1.1.

4. **Provide soil parameters for caisson design to resist lateral loads and overturning moments.** As discussed in item 5, below, shallow foundations could be considered for support of the proposed structure. However, drilled piers can be designed based on the recommended soil parameters presented in the following table:

RECOMMENDED SOIL PARAMETERS

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	Fill	0-10	120	20	2,000	300	750
2	Stiff to very stiff natural clays	10-25	130	20	2,500	400	1,250
3	Soft to medium clays	25-115	130	-	600	75	400
4	Hard clays Hard/dense till	115+	140	25	5,000+	1,000	2,500

5. **Recommend modulus of subgrade reaction for basement slabs placed on the engineered subbase drainage layer.** Based on empirical relationships between recommended bearing pressure and elastic modulus of the existing site clays and a 1-foot by 1-foot plate test, we recommend a vertical modulus of subgrade reaction (k_s) of 75 kcf (40 pci) for design of shallow foundations and floor slabs placed over suitably prepared subbase materials.

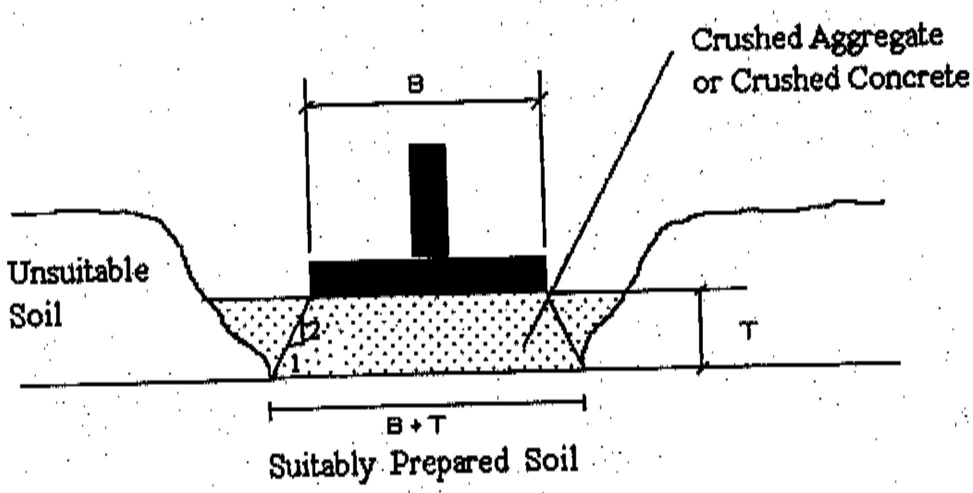
6. **Evaluate bearing capacity or heave considerations for the pool [and mechanical room] excavation[s] in the basement.** At the time the original geotechnical engineering report was prepared, column loads of as much as 2,000 kips, bearing at depths of as much as 25 feet below the existing ground surface were anticipated. Current plans indicate conventional foundations would bear at a maximum depth of about 19 feet below the ground surface, and column loads of 100 to 600 kips are anticipated. As an alternative to deep foundations, mat foundations or large combined footings may be considered for the pool and mechanical rooms.

   Based on the revised plans, shallow foundations bearing on engineered fill over the natural clays may be considered for support of the proposed facility. However, based on information presented in the original report, the depth of fill may extend to depths of as much as 20 feet. Therefore, relatively deep undercuts would be necessary in some areas. Deeper undercuts near the property lines will require deeper temporary retaining walls (see item 7).

   If shallow foundations are still considered to be feasible, we recommend a net allowable soil bearing pressure of 4,000 psf for shallow foundations (mats or footings) bearing on suitable natural soils or on engineered fill overlying suitable natural soils. Shallow foundations should bear at elevations of no more than 19 feet below the existing ground surface. Foundations below this level will require a lower design bearing pressure and/or an increase in settlement should be anticipated.

   Shallow foundations should bear at as high an elevation as feasible. Where undocumented fill is encountered at proposed foundation bearing levels, the fill should be removed and replaced with 1-to-3-inch crushed aggregate or crushed concrete "choked" with a thin layer of dense-graded aggregate, such as MDOT 21AA. The foundations should then bear on the crushed material at the design bearing elevation. Foundations should not extend below design bearing levels, nor should engineered fill other than the crushed materials described above be used as engineered fill beneath foundations without first obtaining written authorization from the geotechnical and structural engineers.

   Undercuts should extend outward from the edge of the foundation at a minimum rate of 2V:1H, as indicated in the following diagram:



For shallow foundations constructed as outlined above, and based on the currently proposed bearing levels and structural loads, settlement of approximately 1 inch or less is anticipated, with differential settlement estimated at approximately ½ of the total settlement. For mat foundations, less differential settlement between columns on the same mat would be anticipated due to the stiffness of the mat.

As outlined in the original geotechnical engineering report, care should be taken to properly protect the foundations for the people-mover facilities. Lateral support of the caissons supporting the elevated track must be provided.

7. **Recommend design parameters to be incorporated in a performance specification for the temporary earth retention system.** A temporary or permanent earth retention system (ERS) will be required for installation of the basement and pool and mechanical room areas. Either a soldier pile and timber lagging retaining wall or interlocking steel sheet piles may be used. However, soldier pile with timber lagging is less costly and has been used successfully for most of the recent downtown construction. The soldier piles may be installed by driving or drilling methods. Drilling methods should be used if noise or vibrations are a consideration, but will require additional costs. To reduce the length of piles required (and possibly the use of bracing or tiebacks), a pre-cut may be performed with the excavation sloping upward from the top of the ERS to the street level. Obviously, this will require sufficient distance between the wall and the edge of the construction zone. The angle of repose of the temporary cut slope will depend upon the nature of the fill encountered near the ground surface. For clay fill, a 1H:1V slope is feasible; a shallower slope will be required where granular fill is encountered.

   Depending on the depth of the excavation required and the amount of precutting available, lateral bracing may be necessary to either limit deflection at the top of the wall and/or to reduce the overall length of the piles required. For total excavation depths of 12 feet or less, we anticipate a cantilever wall (i.e., no bracing or tiebacks) will be feasible. For deeper excavations, at least one row of bracing (or tiebacks) will likely be required.

Soldier and sheet piles should consist of 50 ksi steel, and deflection at the top of the wall should be limited to 1.5 inches or less for areas without sensitive utilities or other structures within 20 feet of the wall. More restrictive deflection limits should be used near such sensitive structures. To avoid overstressing the ERS, soil and material stockpiles and heavy construction equipment shall be located no more than 20 feet from the top of the ERS. In addition, surface water should not be allowed to flow into the excavation from the street level. The soil parameters outlined in items 2 and 4, above, should be used in designing the ERS.

If desired, waterproofing and/or drainage boards can be applied directly to the face of the ERS, and the ERS used as the exterior form for cast-in-place concrete walls.

Based on the soil borings and our current understanding of the project, the risk of heave (deep slope failure) is relatively low, provided the ERS is properly installed and equipment and material is not stored near the top of the excavation.

The actual design of the temporary ERS should be performed by a registered professional engineer retained by the ERS contractor. The design should be based on performance criteria outlined in the project specifications. The final design plans and calculations should be submitted for review for compliance with the project specifications. The specifications should include monitoring the movements of the ERS to verify the wall is performing as anticipated and within the limits of the lateral deflection requirements.

8. **Recommend pavement design for parking lot and paved areas, i.e. recommend material and thickness.** Specific traffic information was not provided for use in developing these recommendations. We assume that weekly refuse haulers and occasional delivery trucks will traffic the access drives to access a refuse storage area. A heavy-duty asphalt concrete pavement section is provided for areas that will have occasional heavy trucks. A light-duty section is provided for the automobile and light passenger truck areas. Heavy and light duty Portland Cement Concrete sections are also provided. We assumed traffic volume will be low at a rate less than 50,000 Equivalent Single Axle Loads (ESAL) over a 20 year traffic period. A grading sheet showing the existing and proposed elevations at the site was not provided for our use. For preliminary design purposes, we have assumed that shallow cuts and fills less than about 1 to 2 feet in thickness will be used to develop the proposed grades at the site. Should these assumptions be found incorrect, SME should be contacted and asked to revise these recommendations accordingly.

Subgrade Conditions

Based on the soil borings, the exposed subgrade is generally expected to consist of mixed textured fill overlying silty clay in a stiff condition extending to about 15 feet below the ground surface and overlying a medium to soft clay deposit extending to relatively great depths. The fill is observed to be highly variable in consistency with N-values generally between about 10 and 20 bpf, but ranging between about 3 bpf and 50 blows for less than 1-inch of penetration. At most of the boring locations the fill was about 3 to 6 feet thick. However, at boring B3 the fill was noted to extend about 16.5 feet below the ground surface and contained layers or pieces of Portland cement concrete. Several previous buildings are known to have occupied the proposed pavement site and variable fills associated with their construction and demolition may be encountered

There is risk of reduced pavement performance associated with placing pavement structures on non-engineered fills or subgrades containing organics. Fills, especially non-engineered fills, can be susceptible to future settlements due to consolidation of the fill material, collapse of voids, and variable texture. Based on the soil boring data, we believe the overall risk of poor performance related to the on-site fill is relatively low and most of the material can be left in–place, provided the material is properly prepared and passes a through proofroll. However, because of the variable textures and SPT N-values encountered, we recommend a heavy-duty stabilization/separation fabric be placed below the pavement system.

The clayey fill and natural clay soils encountered at the site are sensitive to disturbance and moisture during construction. The subgrade will need compaction and preparation in order to provide a stable construction platform for paving operations.

Subgrade Preparation

All topsoil, tree roots, and root systems should be removed. The top 12 inches of the exposed subgrade as well as individual fill layers should be compacted to a minimum of 95 percent of the maximum dry density (Modified Proctor Test). The final subgrade should be sloped/graded for proper drainage. Compaction of the subgrade should be required during construction.

The final subgrade should be proofrolled using a fully loaded tandem axle truck in the presence of a qualified Geotechnical/Pavement Engineer. Any yielding or relatively soft areas should be stabilized by additional compaction or by other means as dictated by the site conditions at the time of construction. Without proper subgrade preparation, compaction of the pavement layers could be difficult. The criteria for the final proofroll should be a maximum of ¼-inch of deflection or visible rutting. For areas not passing proof rolling due to the presence of relatively deep weak fill/soil, it may be necessary to undercut the subgrade, compact the subgrade at a lower elevation, lower the fabric elevation, backfill the undercut with additional 21AA, and possibly add geogrid reinforcements within the pavement section. Other stabilization methods can also be used but should be determined at the time of construction by a qualified Pavement/Geotechnical Engineer and based on the specific conditions encountered.

Wet periods and construction traffic could disturb the subgrade before the pavement layers are placed. Therefore, prior to placement, we recommend the final subgrade elevation be proofrolled to verify suitable subgrade stability. Unsuitable areas should be properly repaired at this time. Once the subgrade is suitable, we recommend the pavement layers be placed soon thereafter to avoid further subgrade disturbance. If additional subgrade disturbance occurs prior to pavement placement, we recommend the subgrade be proofrolled again to evaluate the severity of the disturbance(s).

Undercutting and use of geogrid reinforcement may be required in order to provide a stable subgrade. Therefore, contingencies for these items should also be included in the project budget. A qualified geotechnical/pavement engineer should determine the type and quantity of subgrade stabilization to be used, based on the conditions encountered during construction.

Recommended Pavement Sections

The pavement sections below are recommended based on the discussions in the previous sections of this report and our experience with low traffic volume pavements and climate conditions in the region. The sections are considered minimum sections for the expected loading described above and soil conditions encountered in the soil borings.

The recommended layer materials shown below refer to standard material designations listed in the 1990 edition of the "Standard Specifications for Construction" prepared by the Michigan Department of Transportation (MDOT), unless otherwise modified in this report. The recommended pavement sections are estimated to have useful service lives of about 15 to 20 years. Routine maintenance such as crack sealing, patching and thin overlays should be anticipated and performed such that water infiltration and frost heave effects associated with the local climate are minimized. The following sections are based on the assumption that the subgrade will be prepared and pass a thorough proofroll, as described previously. The following tables present the layer material and thickness recommendations for the pavement sections:

LIGHT-DUTY AC PAVEMENT
AUTOMOBILE AND LIGHT PASSENGER TRUCK AREAS

LAYER	MATERIAL	THICKNESS (in.)
Surface	MDOT 1100T-20AA	1.5
Leveling	MDOT 1100L-20AA	1.5
Base	MDOT 21AA Crushed Limestone	10.0
Stabilization Fabric	AMOCO 2016 (or equal)	--

HEAVY-DUTY AC PAVEMENT
ACCESS DRIVES AND REFUSE HAULER PATHWAY

LAYER	MATERIAL	THICKNESS (in.)
Surface	MDOT 1100T-20AA	1.5
Leveling	MDOT 1100L-20AA	2.5
Base	MDOT 21AA Crushed Limestone	10.0
Stabilization Fabric	AMOCO 2016 (or equal)	--

Pavements built in a cut section or surrounded by concrete curbing should use an internal drainage system. This system should include runoff water cut-off drains along areas of adjacent higher ground and landscape berms, and finger drains at runoff water inlet structures. Crushed concrete meeting 21AA gradation can be substituted for the 21AA crushed limestone provided the base thickness is increased to 12 inches.

Project File 0605

CC: Jana Hayford
Bob Polri
Hikmat Beraes

GEOTECHNICAL EVALUATION REPORT

DOWNTOWN YMCA
DETROIT, MICHIGAN

SME PROJECT NO. PG34872
DECEMBER 30, 1999

sme

Consultants in the geosciences, materials and the environment

- *Caissons/Piles*
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- *Geosynthetics*
- *Ground Modification*
- *Instrumentation*
- *Settlement Analysis*
- *Site Condition Assessment*
- *Slope Stability*
- *Building Restoration*
- *Coatings*
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- *Condition Survey*
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- *Pavement Evaluation/Design*
- *Roof System Management*
- *Sealants/Waterproofing*
- *Structural Steel/Welding*
- *Air Quality*
- *Asbestos/Lead Based Paint*
- *Baseline Environmental Assessment*
- *Due Care Analysis*
- *Environmental Site Assessment*
- *Hydrogeologic Evaluation*
- *Industrial Hygiene*
- *Landfill Services*
- *Pollution Prevention*
- *Regulatory Compliance*
- *Remediation*
- *Risk Assessment*
- *Storm Water Discharge*
- *Underground Storage Tanks*

soil and materials engineers, inc.

43980 Plymouth Oaks Blvd. Plymouth, MI 48170-2584 (734) 454-9900 FAX (734) 454-0629

December 30, 1999

Ms. Jill Stewart
SHG, Inc.
500 Griswold Street
Suite 200
Detroit, Michigan 48226

RE: Final Geotechnical Evaluation Report
Downtown YMCA
Detroit, Michigan
SME Project No. PG34872

Dear Ms. Stewart:

We have completed the geotechnical evaluation for the proposed Downtown YMCA to be constructed in Detroit, Michigan. This report presents the results of our observations and analysis, and our recommendations for subgrade preparation, foundation and below-grade wall design, and construction considerations.

We appreciate the opportunity to assist you with this project. If you have any questions regarding this report, please contact us.

Very truly yours,

SOIL AND MATERIALS ENGINEERS, INC.

Timothy H. Bedenis, PE
Principal

Enclosed: One original (bound), and one original (unbound)

TABLE OF CONTENTS

SUMMARY

The report conclusions and recommendations are summarized as follows:

1. Soil conditions encountered at the soil boring locations generally consist of fill of varying types and depths overlying natural silty clays which generally decreased in strength with depth. Most of the fill is judged to be due to backfilling of previous basements of buildings which have since been demolished, and consists of either sand or clay. However, some areas of site may contain significant amounts of debris consisting of concrete, brick, and other building debris from the demolition of the former structures. Foundations and some of the floor slabs from the previous structures are believed to have been left in-place. The natural clays below the fill are underlain by dense sandy silty clay till ("hardpan").

2. Drilled pier foundations (caissons) are considered to be the most efficient foundation type and are generally recommended for support of the proposed structures. For caissons bearing on or extending into competent hardpan soils at depths of about 120 feet below the ground surface, (at about Detroit City Datum elevation of +0 to -2), a design end bearing pressure of 50 ksf can be used for design of the caisson foundations. In general, we anticipate the construction of belled caissons in the clay above the hardpan will be feasible.

3. Based on the current soil borings, as well as our review of borings previously performed in the area and our experience with similar construction, bottom heave of the basement cut is not expected. However, temporary retaining walls are expected during site excavation due to the site geometry. We anticipate these temporary systems will consist of steel H-piles and timber lagging with temporary tiebacks or interior bracing. Due to the debris in the fill, as well as concern with noise pollution in the area, pre-drilling may be necessary for installation of the piles.

4. Temporary lateral support of the People-Mover guideway caissons and piers, within the basement excavation, will be required. We recommend SHG work with the DTC Structural Engineer to design a temporary support system acceptable to the DTC.

5. Based on the current borings, the former basements and the existing fill extend to depths of 17 feet or less. Therefore, we anticipate the proposed basement finish floor level of about 25 feet below street level, will extend below the existing fill materials and former building debris. The earthwork contractor should be prepared to encounter large debris, including foundations, elevator pits, and foundation walls.

6. Groundwater seepage into excavations is not anticipated to be a significant factor during construction. Some perched water is likely to be encountered within the upper fill. It appears most groundwater accumulations can be controlled using normal sump and pit methods. In excavation areas where groundwater accumulates, or where relatively soft clays are encountered, a working surface of either crushed aggregate or crushed concrete may be required to protect the exposed surface from disturbance.

The summary presented above is general in nature and should not be considered apart from the entire text of the report with all the qualifications and considerations mentioned therein. Details of our findings and recommendations are discussed in the following sections and in the appendices of this report.

REPORT PREPARED BY:

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Project Engineer

REPORT REVIEWED BY:

Timothy H. Bedenis, PE
Principal Consultant

1. INTRODUCTION

This report presents the results of our geotechnical evaluation for the Downtown YMCA facility to be constructed in Detroit, Michigan. This evaluation was authorized by SHG, Inc. on behalf of the YMCA

1.1 Site Conditions

The site is located along the south side of John R. Street, in Detroit, Michigan. The property is bounded to the west by Farmer Street, to the south by Grand River Avenue, and to the east by Broadway Street.

The majority of the site is currently used as a surface parking lot, which is owned by the City of Detroit Municipal Parking Department. The Broadway Station of the Detroit People Mover is located near the northeast corner of the site, and the elevated People Mover track runs diagonally across the site, from northeast to southwest. Several guideway columns are located on the site. These columns are supported on deep caissons. The People Mover Station is supported on spread footings.

1.2 Site History

Based on our review of past SME projects, the site was previously occupied by multiple-story commercial structures, which were supported on shallow spread foundations. The structures typically had single or double-level basements, with the deepest basement level extending about 18 feet below street level. The largest building, formerly covering the southern portion of the site, and labeled building No. 28 on Figure B, was supported on a single-level basement at about 10 feet below street level.

The buildings at the northeast corner and along the north side were also constructed with single-level basements, while records indicate the building formerly located at the northwest corner of the site was constructed with two basement levels. The deeper fill encountered at boring B3 seems to support this information.

The existing Broadway Station and Detroit People Mover guideway were constructed in 1983. The Broadway Station is supported on shallow spread foundations, bearing at elevations as deep as 113.0 feet Detroit City Datum (DCD). The foundation plans for the Broadway Station are included in Appendix A, as Figure D.

The people-mover guideway is supported on 5 to 6-foot diameter caissons, extending into the hardpan soils at about elevation 0 (DCD). The caisson inspection reports for the four caissons in the vicinity of the project property are included in Appendix A.

1.3 Project Description

The project will consist of the design and construction of a new YMCA facility. The facility will have two levels of below-grade parking, with the lower level finish floor at about 22 feet below existing street level. Five additional levels will be constructed above grade, with two levels of above-grade parking, and a three-level YMCA facility constructed over the parking decks.

The structure is expected to be of pre-cast concrete for the parking structure, with the fitness center constructed as a steel-frame structure. Maximum column loads are anticipated to be less than 2,000 kips, with exterior wall loads of approximately 2 to 4 kips per lineal foot.

The existing Broadway Station will be demolished, and a new station will be constructed along the north side of the site, parallel to John R. Street. The new YMCA building will be constructed around the existing People-Mover guideway, with the guideway passing through the building, in a manner similar to Cobo Hall and the Millender Center.

1.4 Scope of Services

The scope of services for this evaluation is described in our revised proposal dated July 19, 1999. The services were performed in general accordance with our proposal.

2. EVALUATION PROCEDURES

2.1 Field Exploration

Six soil borings (B1 through B6) were performed by SME on December 9 through December 15, 1999. The borings were extended 40 to 134.7 feet below the existing ground surface. The boring locations are shown on the Soil Boring Location Diagram included in Appendix A. The number, depth, and locations of the borings were jointly determined by SHG, Inc. and SME to meet the needs of the project. The borings were located in the field by SME, by taping from existing site features. Ground surface elevations at the boring locations were estimated from observed site conditions and previous topographical surveys encountered in our records.

The soil borings were drilled using a truck-mounted rotary-type drill rig, and the deep borings were advanced to the sampling depths using continuous flight hollow stem augers and wash rotary drilling methods. Conventional solid stem continuous-flight augers were used to advance borings B5 and B6. The borings included soil sampling based upon the Split-Barrel Sampling Procedure. In addition, thin-walled Shelby tubes were also obtained at selected depths. At completion of the soil borings, the boreholes were backfilled to the ground surface with cement and bentonite grout. The samples were sealed in glass jars or Shelby tubes in the field and returned to the laboratory for further examination and testing.

Groundwater measurements were recorded during drilling operations. Since wash water was used to advance the borings, groundwater levels upon completion of drilling operations are not available from the deep soil borings; however, water levels upon completion of drilling operations were obtained from the 40-foot deep borings. In addition, since the boreholes were backfilled shortly after drilling, long-term water level information is not available.

The boring log information includes materials encountered, penetration resistances, and pertinent field observations made during the drilling operations. The logs are included in Appendix A.

2.2 Laboratory Testing

The general laboratory testing program consisted of performing visual soil classification, moisture content and hand penetrometer or Torvane shear tests on portions of cohesive samples obtained. In addition, unconfined compression tests were conducted on the cohesive Shelby tube samples recovered from the soil borings.

The soil samples were visually classified in general accordance with the Unified Soil Classification System (USCS). The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the soil boring logs in Appendix A. The appended General Notes sheet includes a brief summary of the general method of describing the soil and assigning an appropriate USCS group symbol.

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to penetration of a small-calibrated spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tsf. The shear strength reported on the soil boring logs is theoretically one-half of the unconfined compressive strength.

In the Torvane shear test, the shear strength of relatively soft cohesive material is estimated by subjecting the sample to a torque applied through vanes inserted into the soil sample. The Torvane shear strength is approximately equal to one-half the unconfined compressive strength.

For the unconfined compressive strength tests, a soil sample is subjected to a uniformly increasing load and loaded to failure or 15 percent deformation.

The results of the laboratory testing are included on the soil boring logs contained in Appendix A.

Soil samples retained over a long time, even in sealed jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, SME typically retains the soil samples in our laboratory for 60 days and then disposes of them, unless instructed otherwise.

2.3 Previous Soil Borings

SME previously performed four soil borings at the site prior to the 1983 construction of the Detroit People-Mover system. Four soil borings (Broadway Sta., FA-41, EA-42, and EB-2) were performed in 1983. The location of the Broadway Sta. boring is shown on Figure C, included in Appendix A. The remaining borings were performed at the referenced caisson locations, which are shown in Figure B. These boring logs are also contained in Appendix A.

2.4 Record Search

SME performed a records search through our project files to obtain soil borings, foundation plans, and other pertinent information regarding past work performed at the subject site. The former building locations are shown in Figure B, included in Appendix A. In addition, Figure D presents the foundation plan for the Broadway Station.

3. SUBSURFACE CONDITIONS

3.1 Soil Conditions

The soil conditions encountered at the current soil boring locations appear consistent with the borings previously performed at the project site. The soil profile generally consists of sand and clay fill near the surface, overlying low plasticity soft to hard natural silty clays. Beneath the silty clays, dense silty sandy clay (hardpan) was encountered, to the explored depths of the soil borings. The following gives a generalized summary description of the soils encountered in the current borings performed at the subject site, beginning at the ground surface and proceeding downward:

Stratum 1: Asphaltic and Portland Cement Concrete and Base Material. Two to six inches of asphaltic concrete overlying 5 to 9 inches of crushed slag base material reported at five of the current soil boring locations.

Three inches Portland cement concrete was reported at boring B4.

Stratum 2: Various Fill Materials. At the most recent borings, sand and clay fill with varying amounts of construction debris, was encountered beneath the Stratum 1 materials, extending to depths of 5.5 to 17 feet. Standard Penetration Test (SPT) resistances (N-values) of 5 blows per foot (bpf) to 50 blows per one inch were obtained in the fill. Shear strengths obtained on the clays ranged between 0.4 and 3.0 kips per square foot (ksf), with corresponding moisture contents of 10 to 39 percent. The granular fill is in a loose to very dense condition, while the clay fill is in a soft to very stiff state.

Some of the higher blow counts obtained in the fill materials are likely due to the presence of construction debris, including brick and concrete, in the fill materials. Brick and concrete fill, including possible concrete slabs, was encountered at several of the boring locations. N-values in excess of 50 blows per six inches were obtained in the construction debris.

Stratum 3: Natural Silty/Sandy Clays. Natural silty and sandy clays were typically encountered below the fill, extending to depths of 119 to 121 feet. Shear strengths ranged from 0.2 to 4.5 ksf, indicating a very soft to stiff condition. However, the clays in the upper 20 to 30 feet were hard to stiff. Below this level, the clays were typically in a medium condition. Corresponding moisture contents varied from 14 to 40 percent.

Natural medium dense sands and sandy silts were encountered beneath the fill materials at boring B6, extending to a depth of 16 feet. A single N-value of 29 bpf was obtained in these materials.

Stratum 4: Clay Hardpan. Dense silty sandy clays (hardpan soils) were encountered beneath the Stratum 3 clays, extending to the explored depths of the soil borings. N-values obtained in the hardpan ranged between 37 bpf to 110 blows per zero-inch increment, with corresponding shear strengths typically in excess of 4.5 ksf and moisture contents ranging from 9 to 13 percent.

The soil descriptions and properties, in addition to groundwater conditions observed by the driller, are graphically presented in the soil boring logs appended to this report along with a boring location diagram. Please refer to the boring logs for the soil conditions at the specific soil boring locations. Stratification lines on the boring logs indicate a general transition between soil types. They are not intended to show an area of exact geological change. The soil descriptions are based on visual classification of the soils encountered.

3.2 Groundwater Conditions

Due to wash rotary drilling methods used to advance the deeper soil borings, groundwater levels upon completion of the current borings are not available for the deep soil borings; however, groundwater was encountered at depths of 19.5 to 13 feet during drilling operations, and at a depth of 36 feet below the ground surface upon completion of drilling operations at boring B6.

In cohesive soils, a long time may be required for the water level in the borehole to reach an equilibrium position. Thus, the short term groundwater level readings at the boring locations during and after drilling may not represent the existing groundwater level. However, a change in color from brown to gray is often an indicator of the long term groundwater level, and can sometimes be used to estimate the site groundwater levels. Based on this color change and our experience with other projects in the area, we believe the existing groundwater levels are about 8 to 12 feet below the existing ground surface.

The groundwater levels should be anticipated to fluctuate throughout the year due to variations in precipitation, evaporation, surface runoff and certain construction activities.

3.3 Previous Below-Grade Construction

Below-grade construction at the site associated with existing structures, (other than utilities), consist of drilled shafts (caissons) constructed for the Detroit People Mover (DPM) guideway. As discussed previously, the DPM guideway extends diagonally across the site from northeast to southwest, with the Broadway Station located near the northeast corner of the site. The Broadway Station for the DPM is supported on conventional shallow spread foundations. The foundation plan for the existing station is included as Figure D in Appendix A, and the caisson reports for the four caissons in the vicinity of the site are also included in Appendix A. In addition, the caissons for the existing guideway are also shown in Figure B, included in Appendix A. Both the guideway and the Broadway Station were constructed in 1984.

Based on information obtained during our record review, the project area was cleared sometime prior to 1980, prior to construction of the DPM. Prior to 1980, the site was occupied by several commercial structures. Figure B, included in the Appendix, indicates the former building locations.

Based on information obtained from our records, the former buildings were supported on shallow spread foundations, and had either single or double-level basements. In general, it appears the buildings located at the northwest and west portions of the site were constructed with either double-level basements, or a single deep basement, with lower level finish floor elevations about 15 to 18 feet below the current street level. The remaining buildings appear to have been supported on single-level basements, with finish floor elevations about 8 to 12 feet below street level.

Additional information pertaining to previous structures are presented in Section 1.2 of this report (*Site History*).

4. ANALYSIS AND RECOMMENDATIONS

Based on the available information, most of the foundations from the former buildings appear to have been spread footings bearing below lower basement floor levels between depths of 5 and 20 feet. Most of these foundations will have to be removed for the construction of the below-grade parking areas. After excavation of the lower levels, we recommend drilled piers (caissons) bearing on hardpan soils at depths of about 120 feet below street level (0 feet DCD) for support of the new structures.

A temporary earth retention system will be required to construct the below-grade portions of the structure. Recommendations for design of the temporary retention system are presented in Section 4.4 of this report.

Groundwater seepage into excavations is generally not anticipated to be a significant factor during construction due to the primarily clay soils. It appears most groundwater accumulations can be controlled using normal sump and pit methods. Due to anticipated water accumulations from groundwater seepage and stormwater runoff, as well as the relatively soft nature of the clays encountered near the anticipated lower level finish floor elevation, a working surface of either crushed aggregate or limestone or a thin concrete mudmat can be used to protect the subgrade soils at the bottom of the excavation.

Our specific recommendations for site earthwork, foundations, below-grade walls, temporary earth retention systems, and floor slab construction are presented below.

4.1 Site Preparation and Earthwork

4.1.1 Excavation Operations

Excavations for the below-grade parking areas are expected to extend to a depth of about 22 feet below the existing ground surface. Within this depth, a wide range of materials is expected to be encountered, including reinforced concrete, rubble, floors slabs (reinforced and non-reinforced), sand, clay, brick, and mixtures thereof. The existing foundations, fill and debris are expected to be removed during the mass excavation for the basement. The below-grade parking areas are expected to extend to the property lines. Based on the numerous public utilities, a temporary earth retention system will be necessary to support the excavation until the permanent structure is completed. See Section 4.4 of this report for additional comments on the earth retention system.

Due to the presence of the debris in the fill materials, the fill excavated from the site is expected to be disposed of in a Class II landfill.

Some water is expected to accumulate in the excavation due to groundwater infiltration and stormwater and snowmelt runoff. In addition, the relatively soft silty clays anticipated at the bottom of the excavation are prone to disturbance from the combined effects of ponded water and construction traffic. Therefore, to protect the exposed clay subgrade, a protective layer of either coarse crushed aggregate or concrete or a lean concrete mudmat be placed over the exposed clay subgrade should be considered. For either case, we recommend a minimum of 12 inches of material be placed over the clays. For the coarse crushed aggregate or concrete, we recommend a minimum of 9 inches of 1 to 3 inch sized crushed material, "choked" with a minimum of 3 inches of dense-grade material, such as MDOT 21AA.

If a mudmat is placed over the clay subgrade, we recommend the subgrade first be evaluated by SME, as discussed in Section 4.1.2, below.

4.1.2 Subgrade Preparation for Floor Slabs

Following excavation for construction of the floor slab, the exposed subgrade is generally expected to consist of natural medium to stiff silty clays.

Prior to construction of the floor slab, the exposed subgrade should be evaluated by SME to determine if any areas require remediation.

Should some of the existing clays require compaction, or the contractor wish to attempt to reuse some of the excavated clays as engineered fill, the clays will require drying prior to use as engineered fill since these clays exhibited natural moisture contents estimated to be near or above the optimum moisture content of the material. Some of the clay may require disking, aeration, and drying to allow for proper compaction. However, based on the property size and the proposed construction, reuse of the site clays is expected to be difficult and is generally not anticipated.

In areas where placement of compacted fill is difficult due to access, we recommend a low-strength flowable fill be utilized as backfill behind the walls.

4.2 Foundations

Soil conditions below the fill are considered to be cohesive with only occasional groundwater seepage. In addition, the hardpan soils encountered below the medium to stiff clays provide a very good bearing material for foundations. Therefore, we recommend the proposed facility be supported on drilled piers (caissons), extending through the upper soft to stiff clays, to bear on or into the hardpan soils encountered at about elevation +0 to -2 DCD, or about 120 feet below the existing street level. Caissons can be sized for a maximum net allowable end bearing pressure of 50 ksf, and may be constructed as either straight-shaft or belled. Temporary steel casings for the upper portion of the excavation may be required to prevent groundwater accumulation into the caisson excavations. Since the conditions may vary, the use of casing will depend on specific conditions at the drilled pier location. Deep wet sand layers are occasionally encountered in the upper clays. Therefore, the contractor should be prepared to use longer or full length casing, if required, to prevent sloughing and caving of the side walls. However, this is expected to be necessary only in isolated locations.

As discussed previously, several structures previously existed within the proposed building footprint. Based on our record search, it appears most buildings were supported on shallow spread foundations at elevations at or above 100 feet. Therefore, we anticipate the basement excavation will extend through the existing fill materials and old footings, thus removing them prior to beginning foundation construction.

A minimum caisson shaft diameter of 36 inches in recommended to facilitate access to the bearing surface for cleaning, observation, and testing, if necessary. The caisson should be observed by SME to verify proper bearing material has been reached and that the bearing surface has been properly cleaned.

Although boulders were not encountered at the boring locations, boulder or cobbles have been known to be encountered overlying the hardpan soils. The contractor should be prepared to remove such obstructions with the proper drilling equipment (rock augers, core barrels, etc.)

We recommend concrete with a 5 to 7 inch slump be used for all caisson concreting operations. Provided the concrete is placed in a relatively dry excavation and the concrete is directed to the center of the caisson, it is not necessary to use a tremie for placement of concrete. However, in the unusual case of a "wet pier" which cannot be bailed dry, a tremie should be used to place the concrete beneath the water. In addition, a positive head of concrete, relative to water trapped outside the temporary casing, should always be maintained within the casing to prevent water and/or soil from infiltrating the caisson shaft.

We understand the design of the caisson to resist lateral loads and overturning moments will be performed by the Structural Engineer. Therefore, no specific lateral load analysis has been performed for this evaluation at this time. For lateral load resistance, the drilled pier concrete should be placed in direct contact with the excavation sidewalls. Therefore, if any portion of the caisson shaft is drilled oversize and/or if caving and sloughing of the caisson sidewalls occur, the oversize and/or voids should be filled with concrete.

We estimate total settlement for the caisson foundations should be less than one inch, based on elastic compression of the concrete.

4.3 Below-Grade Walls and Drainage

Below-grade walls should be backfilled with a clean granular material meeting the requirements of MDOT Class II. As discussed previously, where fill placement behind below-grade walls is difficult, a low-strength flowable fill should be used as engineered fill. All wall backfill should be compacted to a minimum of 95 percent of the maximum dry density, as determined by the Modified Proctor Test. Precautions should be considered to avoid overstressing the walls with compaction equipment during backfilling.

An 18-inch layer of compacted clay should be placed above the Class II granular wall backfill to reduce infiltration from surface runoff. Where pavements will be placed near basement walls, the pavements should be sloped to drain away from the building to divert surface water away from the building. Roof drains should be conducted away from the walls.

For a drained Class II granular backfill, an equivalent fluid active earth pressure of 35 psf per foot of wall height should be used for the design of flexible walls with a granular backfill. [redacted] This earth pressure [redacted] permit the active earth pressure condition to be reached. An inward movement equal to approximately 0.001 times the height of the wall is generally required to achieve the active earth pressure condition for granular backfill. For the proposed basement walls, we anticipate the active condition will likely be obtained and the above lateral earth pressures may be used for design.

However, if the wall is restrained, or is rigid enough so that it does not rotate sufficiently to reach the active earth pressure condition, a higher lateral earth pressure should be used for design. For rigid basement walls backfilled with a free draining granular material, we recommend an equivalent fluid pressure of 55 psf per foot of wall height be used in design.

The above lateral pressures for flexible conditions assume the use of a drained granular wall backfill or a drainage panel attached to the temporary retaining wall. If adequate drainage is not provided, the hydrostatic water pressure should be added to the earth pressure computed using the submerged unit weight of the backfill. However, we strongly recommend drainage be provided to assist in removing hydrostatic water pressure from the walls. Additionally, lateral wall loads resulting from surcharge loading, such as adjacent floor loads or parked vehicles, should be added to the above earth pressures.

To eliminate the build-up of hydrostatic pressure along the exterior of the below-grade walls, perimeter edge drains or drainage boards should be installed along the perimeter of the structure. If space permits, the perimeter edge drains should consist of a 4-inch diameter perforated plastic drain tile, wrapped with a filter fabric and surrounded by 6 inches of a filter material, such as pea gravel. As indicated above, the walls should be backfilled with a MDOT Class II sand with a clay cap near the surface. Other drainage details can be developed to collect the water from the drainage boards for walls cast against the temporary retaining walls. The drainage board should be connected to a collector drain tile at the base of the wall in lieu of the edge drains. The drain tiles or drainage boards should be tied into a sump system or to a nearby storm drain.

In order to prevent groundwater accumulation beneath grade slabs, a gravel drainage blanket should be installed below the floor slabs. The gravel drainage blanket should consist of a minimum of 9 inches of a coarse aggregate or gravel (such as a MDOT 6AA material). The aggregate material used to protect the subgrade may also be used for drainage if the aggregate does not become clogged with clays during construction. The coarse aggregates should be "choked off" with a thin layer of MDOT 21AA dense grade aggregate. To remove water collected by the drainage blanket, either interior underdrains or weep holes installed below the floor slab are recommended to allow drainage to an exterior perimeter drainage system. Weep holes should be installed through foundation walls beneath the floor slab.

Regular maintenance will be required to keep the edge drains in good working order. Clean-outs should be provided to access the drains. To provide an additional level of protection from moisture seepage, a waterproofing membrane, in contrast to a damp-proofing application, should be applied to the exterior walls.

4.4 Temporary Retaining Walls and Cut Slopes

Side slopes for open, unbraced excavations should conform to MI-OSHA requirements. Based upon the soil conditions encountered at the soil boring locations, a 1.5H:1V slope is recommended in the fill soils, while a 1H:1V slope can be implemented within the natural site soils. For slopes greater than those recommended above, soil conditions would have to be assessed at the time of construction. Factors affecting the allowable angle of repose include the presence/absence of sands and silts, the amount of time the cut will remain open, and the use of heavy machinery or surcharge loads near the top of the slope.

Based upon the relatively tight site constraints, we anticipate a temporary earth retention systems will be required for at least some portions of the excavation. Based upon the construction debris encountered at some of the soil boring locations and the numerous utilities, a soldier pile and timber lagging retention system is recommended, should such a system be required.

The soldier piles would be installed by driving or drilling to the required depth. Lagging would then be placed between the piles until the excavation bottom has been reached. If the soldier piles are installed by driving, we anticipate significant noise and vibrations will be generated by the pile driving, especially in the upper dense fill materials. The noise can be disruptive to other neighboring businesses and vibrations can potentially cause damage to sensitive or weak structures (depending on the location, direction and magnitude of the vibrations). In addition, based on our experience with similar projects, if piles are driven at the site, the Detroit Transportation Corporation will require vibration monitoring of the DPM piers and guideways within the project site. Alternatively, the piles can be installed by drilling a hole slightly larger than the diagonal pile width, placing the pile in the hole and backfilling the space with a lean concrete. This would eliminate the noise and vibration from the pile driving. In addition, drilling methods should be used near critical utilities. One potential problem associated with drilling is obstructions within the relatively small excavations (such as large pieces of concrete). Removal of obstructions will require extraordinary drilling methods, such as the use of rock augers or core barrels.

Lateral support for either the soldier piles in the form of walers, struts and/or tiebacks will be necessary based the depth of the excavation and the location of the adjacent structures or utilities. Internal bracing with struts or inclined rakers is considered feasible, however, this will complicate construction of the foundations and wall. External temporary tiebacks may also be to provide a clear and open excavation. However, the tiebacks will have to extend into the public right-of-ways, below and around existing utilities.

The length of the piles required, as well as the spacing and sizing of walers and struts, are determined by the depth of cut and the lateral earth pressures both above and below the bottom of the excavation. The final lateral earth pressure on the walls depends on the final design depths, type of sheeting, and sequence of excavation construction. More specific recommendations for temporary earth retention systems can be provided once specific cross sections have been determined.

4.6 Construction Considerations

Cuts of about 22 feet will be required adjacent to the existing DPM piers. These piers are designed to be support laterally by the soil below a depth of about 8 feet. Therefore, temporary bracing will be required at the pier locations to provide adequate lateral support until the structure can be completed. The DTC Structural Engineer, Consoer Townsend Envirodyne, should be consulted regarding design lateral loads and the proposed bracing system. Design of a temporary bracing system around the DPM piers is beyond the scope of this evaluation.

Groundwater seepage into foundation and utility excavations is generally not anticipated to be a significant factor during construction. However, some accumulation from perched water in the upper fill soils or from precipitation or surface water run-off could be encountered. We anticipate standard sump pit and pumping procedures are adequate to control these accumulations on a localized basis.

As indicated in the previous sections, the subgrade for the floor slabs are highly susceptible to disturbance during construction. Disturbed soils should be recompacted in-place or removed and replaced with engineered fill or crushed aggregate.

The contractor must provide a safely sloped excavation or an adequately constructed and braced shoring system in accordance with federal, state and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground. If material is stored or heavy equipment is operated near an excavation, stronger shoring must be used to resist the extra pressure due to the superimposed loads.

5. GENERAL COMMENTS

Basis of Geotechnical Report

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design of this project. If the site plan or the project design criteria are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information described in this report, and the data obtained from the 6 current soil borings and 4 previous borings performed at the approximate locations indicated on the appended location plan. This report does not reflect variations which may occur between or away from the soil borings. The nature and extent of the variations may not become evident until the time of construction. If significant variations then become evident, it may be necessary for us to reevaluate the recommendations of this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the drilling and sampling operations that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the final logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the final boring logs. Our recommendations are based on the contents of the final logs and the information contained therein.

Design, Plan and Specification Review

As part of our continued service to the project, we should be provided the opportunity to review the design details, project plans and specifications to verify the project factors affecting foundation and earth retention system performance are consistent with the design recommendations set forth in this report.

Field Verification of Geotechnical Conditions

The site earthwork operations should be observed and tested by SME to verify subgrade soils are suitable for placement of engineered fill and to verify engineered fill for the building is properly placed and compacted. The foundation construction activities should be monitored by SME, and the foundation bearing soils tested by SME to verify conditions are as anticipated. As geotechnical engineer of record, SME is well suited to verify the recommendations of this report are properly incorporated in the design of this project, and properly implemented during construction.

Project Information for Contractor

This report and any future addenda or reports should be made available to bidders prior to submitting their proposals and to the successful contractor and subcontractors for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the contractor encounters conditions during construction which differ from those presented in this report, he/she should promptly notify the owner so that the geotechnical engineer can be contacted to verify those conditions. Subsequently, the contractor should describe the nature and extent of the differing conditions in writing. We recommend the construction contract include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in the contract provisions based on our experience.

Furthermore, the contractor should be prepared to handle environmental conditions encountered at this site which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this property should be made available for review by bidders and the successful contractor.

APPENDIX A

1. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT
2. FIGURE A: SOIL BORING LOCATION DIAGRAM
3. FIGURE B: FORMER BUILDING LOCATIONS
4. FIGURE C: STATION BORING LOCATION DIAGRAM
5. FIGURE D: BROADWAY STATION FOUNDATION PLAN
6. GENERAL NOTES
7. UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
8. CURRENT BORING LOGS (B1 THROUGH B6)
9. 1983 BORING LOGS (BROADWAY STA., FA-41, EA-42, AND EB-2)
10. CAISSON INSPECTION REPORTS (FA-41, EA-42, FB-1, AND EB-2)
11. SUMMARY OF LABORATORY TESTING

...d materials
...ineers, inc

CENTRAL AUTOMATED TRANSIT SYSTEM

Report No. 48
Date 3-9-84
SME No. 7000-0

CAISSON INSPECTION REPORT

...east Michigan Transportation Authority
...Dailey & Prater, Wells & Associates, Inc.
...ture Guideway
...on Type C-1A

UTDC (USA) Inc.
The Millgard Corporation
Caisson Designation EB 2
Date Started 3-9-84
Date Completed 3-9-84
Elevation 119.61 DCD

Ground Surface

SOIL PROFILE

...h	Description	Qp
...To 5	Mixed Clay & Brick	
...To 12	Silty Clay-Gray	4.5+
...To 17	Silty Clay-Gray	3.0
...To 22	Silty Clay-Gray	2.0
...To 27	Silty Clay-Gray	1.5
...To		
...To		

...file in Accordance with ...ign Assumptions ok
...porary Casing 80"x15',48"x56',42"x49
...manent Casing: 60"x17' cmp
...sel Penetration Test(Blows/6") 45
...owable Soil Bearing ...ssure 50 KSF
...tructions: A brick wall with concrete ...oting was removed from a depth of 5 t... 8 feet. A 2 foot boulder was encountered ... a depth of about 117 feet. A two foot ...ick boulder of unknown lateral extent was ...countered at the hardpan elevation at ...out 117 feet below the surface (see ...agram).

...pth Embedded Into Hardpan 36 Inches

Surface Alignment
Design ±3" Actual ok
Plumb Deviation
Design 1"/10' Actual 4"W
Bottom of Cap
Depth 15.80
Elevation 103.81
Diameter
Design 5'0"
Actual 5'0"

Depth
Elevation
Diameter
Design 5'0"
Actual 5'0"

Depth 59.36
Elevation 60.25

REINFORCING STEEL

TOP SEGMENT
Full Steel 38 -# 11, Top Elev 117 DCD
Cutoff Points 19 -# 11 @ 83 DCD
19 -# 11 @ 62 DCD

BOTTOM SEGMENT
4 -# 9 From 67 To 7 DCD
4 -#10

Steel Size and Length In Accordance with Project Documents ok

CONCRETE

Started 6:20 Finished 7:30
Volume 64 yd^3 Design Strength 3,000 psi

Remarks: Based on the test results, our visual observations, and available soil information, we verified that the soil at the caisson bearing surface was suitable for the design bearing pressure (see diagram).

Diameter: Design 4'0" Actual 4'0"
Bell Diameter: Design
Actual

Bearing Surface
Depth 120.83 Elevation -0.22 DCD

...ified By: Timothy Bedenis
Soil and Materials Engineers, Inc.

James Brannigan
Millgard Corporation

...te: Any oversize is the responsibility of the Contractor unless noted otherwise.

ıng ıaterials
gı s, inc

CENTRAL AUTOMATED TRANSIT SYSTEM

Report No. 49
Date 3-12-84
SME No. 7000-0

CAISSON INSPECTION REPORT

heast Michigan Transportation Authority — UTDC (USA) Inc.
Dalley & Prater, Wells & Associates, Inc. — The Millgard Corporation

:ture Guideway — Caisson Designation FB 1
son Type C-1B — Date Started 3-12-84 — Date Completed 3-12-84

Ground Surface — Elevation 119.78 DCD

Surface Alignment Design ±3" Actual ok
Plumb Deviation Design 1"/10' Actual 4"N
Bottom of Cap Depth 15.72 Elevation 104.06
Diameter Design 5'0" Actual 5'0"

SOIL PROFILE

th	Description	Qp
-To 5	Mixed Clay Fill	
-To 12	Silty Clay-Grey	4.5+
-To 17	Silty Clay-Grey	3.75
-To 22	Silty Clay-Grey	2.5
-To 27	Silty Clay=Grey	1.5
-To		

File in Accordance with ign Assumptions ok
porary Casing: 78"x15',48"x56',42"x49'
manent Casing: 60"x17' cmp
sel Penetration Test(Blows/6") 38
owable Soil Bearing ssure 50 KSF
tructions: None

REINFORCING STEEL

TOP SEGMENT
Full Steel 51 -# 11, Top Elev. 117 DCD
Cutoff Points 17 -# 11 @ 84 DCD
17 -# 11 @ 73 DCD
BOTTOM SEGMENT 17-# 11 @ 57½ DCD
4 -# 9 From 63 To 3 DCD
4 -#10
Steel Size and Length In Accordance with Project Documents ok

Depth
Elevation
Diameter Design 5'0" Actual 5'0"

CONCRETE

Started 12:25 Finished 2:50
Volume 64 yd^3 Design Strength 3,000 psi
Remarks: Based on the test results, our visual observations and available soil information, we verified that the soil at the caisson bearing surface was suitable for the design bearing pressure.

Depth 66.13
Elevation 53.65

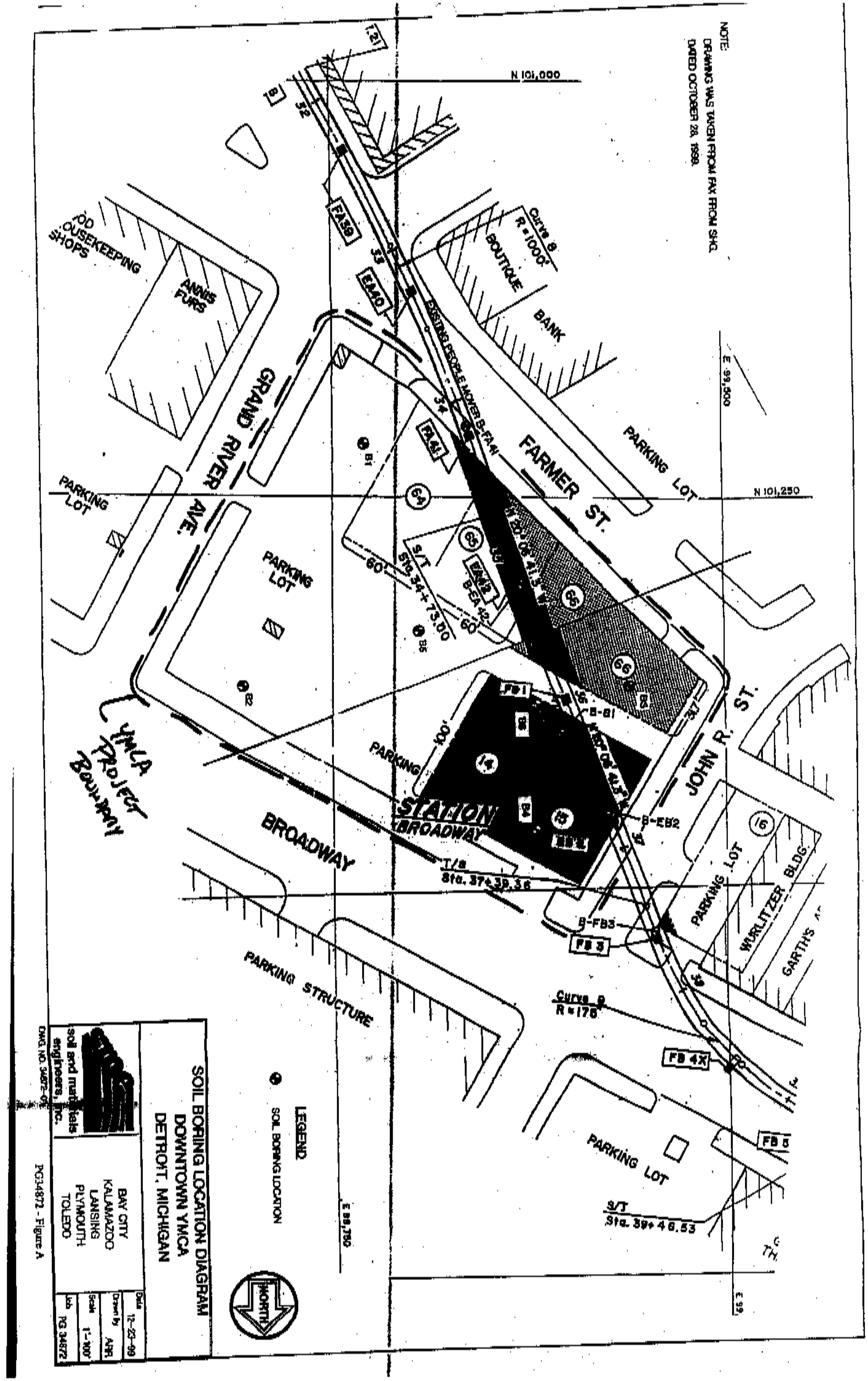
Diameter: Design 4'0" Actual 4'0"
Bell Diameter: Design
Actual

th Embedded Into Hardpan 24 Inches

Bearing Surface
Depth 118.60 Elevation 1.18 DCD

ified By: Timothy Bedenis — James Brannigan
Soil and Materials Engineers, Inc. — Millgard Corporation

e: Any oversize is the responsibility of the Contractor unless noted otherwise.


NOTE:
DRAWING WAS TAKEN FROM FAX FROM SHG
DATED OCTOBER 28, 1999.
N 101,000
N 101,250
E 99,500
E 98,750
FARMER ST.
GRAND RIVER AVE.
JOHN R. ST.
BROADWAY
PARKING LOT
PARKING STRUCTURE
BOUTIQUE
BANK
ANNIS FURS
WURLITZER BLDG.
STATION BROADWAY
EXISTING PEOPLE MOVER
Curve 8
R = 1000'
Curve 9
R = 175'
S/T
Sta. 34 + 73.00
T/S
Sta. 37+39.36
S/T
Sta. 39+46.53
FB 1
FB 3
FB 4X
FB 5
B-FB3
B-EB2
B-B1
YMCA PROJECT BOUNDARY
LEGEND
SOIL BORING LOCATION
SOIL BORING LOCATION DIAGRAM
DOWNTOWN YMCA
DETROIT, MICHIGAN
soil and materials engineers, inc.
BAY CITY
KALAMAZOO
LANSING
PLYMOUTH
TOLEDO
Date 12-23-99
Drawn by APR
Scale 1"=100'
Job PG 34872
NORTH
PG34872 - Figure A

Summary of Laboratory Testing
on Shelby Tubes Obtained For

Proposed Downtown YMCA
Detroit, Michigan
SME Project no. PG34872

Sample Depth (feet)	Hand Penetrometer Results (ksf)	Torvane Shear Results (ksf)	Unconfined Compressive Strength Results (ksf)	Dry Unit Weight (pcf)	Moisture Content (%)
5.0 - 7.0	3.0				16.9
38.0 - 40.0		0.50	0.76	112.0	18.5
23.0 - 25.0	1.0		1.07	111.8	17.8
33.0 - 35.0		0.50	0.59	115.2	18.4
8.0 - 10.0	1.5				16.0
18.0 - 20.0	2.0		1.78	121.0	14.7
28.0 - 30.0		0.60	1.00	118.6	17.8
38.0 - 40.0		0.40	0.55	109.3	20.9

le for testing was not recovered from the Shelby tube.