The Detroit Integrated Transportation Campus

Shane Goodman

Construction Management

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Executive Summary

This Technical Report is an initial examination of the design and construction of the Detroit Integrated Transportation Campus (DITC), located in Detroit, MI. This report focuses on the construction management aspects of the project, and specifically looks into the project schedule, project cost, existing site conditions, local conditions, project delivery system, and the construction staffing plan. The construction of the DITC was originally scheduled to start in September of 2008; however, due to delays, the construction it is now scheduled to begin in October of 2008. Due to this delay some information about the schedule, cost, and construction methods were not yet obtainable. As the project progresses and more information is available it will be represented in future reports.

The Detroit Integrated Transportation Campus is a 45,000 Square Foot office and operations building for the State of Michigan. Located within the building are offices and a 24 hour operations center for the Michigan Department of Transportation. The building also includes a 24 hour operations center for The Michigan State Police, which includes space for police control, dispatch, warrants, and server storage.

The original design intent of the building was to achieve LEED certification, however due to budget constraints the building is no longer seeking LEED certification. The DITC was still designed with sustainability in mind, and features such as the sun shades and efficient HVAC system reflect this goal. Building Information Modeling was integrated into the project's design by the Architect, Barton Malow Design, and the Structural Engineer, Desai Nasr Consulting Engineers. Both parties coordinated the design with 3D models of their systems.

The project's delivery system is a typical Design-Bid-Build with a Guaranteed Maximum Price contract between The State of Michigan and the general contractor, Jenkins Construction. Jenkins Construction was selected for the project as the low bidder.

Project Schedule Summary

The State of Michigan and Barton Malow Design have just recently finished the design of the Detroit Integrated Transportation Campus and Jenkins Construction has been selected to be the General Contractor. Construction is set to begin on October 1st, 2008. Substantial completion of the project is set for a year after the start of construction on October 1st, 2009, with the State of Michigan moving in the following two weeks. Because a project schedule was not yet attainable I have created a summary schedule, with input from similar projects and industry professionals, to fit the one year construction period. The summary schedule can be found in *Appendix A*, and has been broken down into five major project portions. These portions include Design, Site Work, Shell and Enclosure, Interiors, and Completion and Closeout.

<u>Foundation</u>

The foundation system for the DITC includes cast-in-place interior concrete footings, pier footings, and grade beams. I decided to break down the foundation work into 3 equal sequences flowing from plan East to plan West. This sequencing allows for the Structure to follow behind without interrupting the foundation work.

<u>Structure</u>

Similar to the foundation sequencing, I planned for the structure to be broken down into 3 equal sequences. The steel will follow the foundation work from East to West. The metal decking for the second floor and roof will follow the steel sequencing, allowing the slab on grade and slab on deck concrete to be poured from bottom to top in the same three sequences.

<u>Finishes</u>

I have planned for the interior finishes to follow the enclosure of the building. The interior finishes flow in the same direction as the structure sequencing, from East to West. The interior finishes will proceed through the building in the following order:

1) Metal Studs
2) MEP Branch Installation
3) MEP in Wall Installation
4) Drywall
5) Plumbing Fixtures
6) Ceiling Grid and Light Fixtures
7) Floor Finishes

Building Systems Summary

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

Structural Steel

The Detroit Integrated Transportation Campus structural steel frame is the main support for the 2-story 45,000 square foot building. The structural steel used is mostly W-Shapes: ASTM A992, Grade 50. Open web joists, which include K-series steel joists and Long-span steel joists, are also integrated into the roof support.

Bracing for the structural steel frame is provided by W-Shape rigid frames, and include no cross bracing members. There are six rigid frames running North and South that span the whole width of the building at grid lines 18, 14, 9, 7, 5, and 1. There are also six rigid frames running East and West that each span one to three bays.

The second floor is mostly comprised of 3 inches of regular weight concrete with welded wire fabric, on 3" 20 gauge galvanized composite steel deck. The second floor also includes acoustical floor deck enclosure above the open office spaces on the first floor. The roof of the DITC is comprised of 3 ½ inches of regular weight concrete with welded wire fabric, on 2" 20 Gauge Epicore steel roof deck.

Because building construction has not yet begun and the contractor was just selected information on the type of crane being used is not available. However, due to the length of the building it would be most efficient to use a crawler crane. The heaviest lift is 3496lb at a maximum radius of 80 feet, and a 50 ton crane with an 86' boom can safely lift 3,700lb. If it is kept on site, this crane can also safely lift the heaviest air handling unit, which is 7,600lb and within a 40' radius.

Cast in Place Concrete

Cast in Place Concrete is utilized on the DITC for footings, piers, grade beams, and composite structural slabs. The Concrete foundations require a minimum allowable bearing capacity of 3,000 psi. There is no exposed concrete for the DITC, therefore the concrete can be rough-formed, which would allow for plywood, lumber, and metal formwork.

Mechanical System

The Detroit Integrated Transportation Campus is regulated by four central rooftop air handling units that are fed from city utilities. Two units weigh 3,500 lb and supply 6,505 CFM to service the operations zone and the other two units weigh 7600 lb and supply 16,430 CFM to service the non-operations zone. The cooling for each unit is controlled by a supply-air refrigerant coil and an outdoor-air refrigerant coil, which each circulate R-407C Refrigerant. The heating for each unit is controlled by factory assembled gas furnaces, which are fueled by natural gas supplied from city utilities.

Variable air volume (VAV) boxes with reheat are used to control the temperature throughout the different rooms in the building. Theses VAV boxes allow for a constant supply of air from the air handling units, while varying the amount of air flow for each room to control specific room temperatures. The boxes have hot water reheat to recycle return air, and save the energy the Air Handling units would have to expend to heat 100% outdoor air.

Four cabinet unit heaters are used to heat the stairwells and vestibules. These units are supplied with hot water from the boilers.

Hot water is supplied throughout the building from two 44 GPM boilers which heat the water with natural gas supplied from city utilities. These boilers are located in the boiler room, which is on the second floor in the central North area of the building. Electric domestic water heaters help to control water temperature within the break rooms and toilet rooms. Chilled water is supplied to the building from city utilities.

Fire suppression for the DITC was designed to be an automatic wet pipe sprinkler system that can provide a flow of 1800 GPM with a density of .2 GPM per square foot.

Electrical System

The Detroit Integrated Transportation Campus is fed by a 1000 KVA, 3-Φ 480Y/277 V Primary Feeder with power supplied by DTE Energy. The 15 KV Primary Switchgear is located outside the building, and the Electrical Room, which houses the electrical distribution equipment, is located on the second floor in the North East corner of the building. The emergency backup is provided by an outdoor 3-Φ 480/277 V Diesel Generator. To ensure constant power to the buildings computer system, an Uninterrupted Power System is located in the buildings Server Room.

Masonry

The masonry for the DITC is located at the South West corner of the building. The masonry is a 4" x 12" brick veneer that is non-load bearing. The bricks are tied to 6" metal studs by adjustable masonry anchors at 16" on center, and 12" vertical. This exterior wall also includes an air space, a continuous vapor retarder, and ½" exterior sheathing.

Curtain Wall

The curtain wall system for the Detroit Integrated Transportation Campus is comprised of a metal panel system and a glass curtain wall system. The glass curtain wall system can be found at the North East and North West stairwells of the building. The system is a prefinished aluminum curtain wall system with 1" insulating glass. The system is supported by the buildings structural frame. The metal panel system makes up the rest of the building's façade, and is comprised of 12" pre-finished metal wall panels connected to a 7/8" hat channel. The hat channel is connected to the ½" exterior sheathing and metal studs by a 3" Z clip. The subcontractor will be responsible for the detailed design and P.E. stamp of the metal panel wall system.

Because the building is only two stories, I am assuming a JLG lift with a small moment crane will be used to construct curtain wall system of the DITC.

Support of Excavation

The site is not restricted by size and the foundations do not go very deep so I am assuming there will be enough room to layback any excavation, and no excavation support system will be needed.

According to the Underground Soils Report, the estimated static ground-water levels are estimated to be between 12' and 14' below the existing ground surface, therefore there may be a need for some temporary sump pit and pump methods during excavation and construction.

Project Cost Evaluation

All costs below do not represent the actual costs of the building. The actual cost estimates were obtained from the very early stages of design and do not represent the actual construction costs or budget for the Detroit Integrated Transportation Campus.

<u>Construction Cost (CC)</u>

Construction Cost is the total cost for construction of the building. It does not include land costs, site work, permitting, or design fees.

Construction Cost	=	$9,480,000
Construction Cost per Square Foot	=	$9,480,000 / 45,378 SF
	=	$208.90 per Square Foot

<u>Total Project Cost (TC)</u>

Total Project Cost	=	$12,000,000
Total Cost per Square Foot	=	$12,000,000 / 45,378 SF
	=	$264.44 per Square Foot

<u>Building Systems Cost</u>

Mechanical Systems Cost	=	$1,811,700
Mechanical Systems Cost / SF	=	$1,811,700 / 45,378 SF
	=	$39.92 per Square Foot
Electrical Systems Cost	=	$1,376,000
Electrical Systems Cost / SF	=	$1,376,000 / 45,378 SF
	=	$30.32 per Square Foot
Structural Systems Cost	=	$2,969,500
Structural Systems Cost / SF	=	$2,969,500 / 45,378 SF
	=	$60.44 per Square Foot

R.S. Means Square Foot Estimate

R.S. Means 2008 Square Foot Estimate (pages 176, 177, and 454) was used to perform this estimate. The base building for this estimate is a 2-4 story office building because the Detroit Integrated Transportation Campus is a 2 story office building.

Area:	45,378 SF
Perimeter:	836 SF
Interpolated Unit Cost:	$163.32 / SF
Perimeter Addition:	$32.18 / SF
Story Height Addition:	$4 / SF
Adjusted Unit Cost:	$199.50 / SF
Detroit Location Factor:	1.04
Total Estimated Cost:	**$9,415,216**

The R.S. Means references pages can be found in *Appendix C*.

Parametric Estimate

For the parametric estimate I utilized D4Cost V9 software. I selected three similar projects in D4 and combined those projects to get an estimate for the Detroit Integrated Transportation Campus. I selected these project based on their similar square footage and number of floors. I also selected projects with high costs due to the fact that the DITC is an above average office building. The total cost estimated by D4 was **$9,896,118**.

The D4Cost estimate breakdown can be found in *Appendix B.*

Estimate Comparison

The R.S. Means Square Foot Estimate was very close to the actual estimate. The R.S. Means Estimate came out at $9,415,216, which is only $64,784 less than the actual Construction Cost of $9,480,000, and only 0.7% off the actual Construction Cost. However, the actual Construction Cost does not include the design fees; therefore this estimate would be even higher. I was not able to obtain the design fees for the project, but even with the addition of design fees to the Construction Cost, the R.S. Means Estimate would still be relatively close.

The D4Cost Parametric Estimate was also close to the actual estimate. The D4 Cost Estimate came out at $9,896,118, which is $416,118 more than the actual Construction Cost of $9,480,000, and 4.4% off the actual Construction Cost.

Site Plan of Existing Conditions

See *Appendix D* for the Site Plan of the Existing Conditions for the Detroit Integrated Transportation Campus.

Local Conditions

Located on Fort Street, between 5th and 6th Street, in downtown Detroit, the Detroit Integrated Transportation Campus has both positives and negatives that come with the project's location. The site is less than one block from the John C Lodge Freeway, which makes it a great location for workers to get to site and for site deliveries to be made. However, the site is located in a section of Detroit where crime will be a concern. A site fence and security cameras will be installed early in the construction of the building to help lessen the possibility of crime on site. Site parking will not be an issue for the construction of the DITC. The site has a large area that will become the parking lot for the DITC, and can be utilized as a temporary area for parking. If there is not enough room on site there are many parking garages and lots close to the site.

In Detroit there is no preferred method of structure; it is decided by the current costs of concrete and steel, and the specific project needs. Detroit has relatively low tipping and recycling fees for a major city, about $60/ton tipping fee, and $10/ton recycling fee. Jenkins construction should consider implementing a recycling plan on site, and save on the cost of tipping fees.

According to the Underground Soils Report, the existing site for the Detroit Integrated Transportation Campus is covered mostly with 2 to 4 inches of asphalt concrete, and 1 to 6 inches of topsoil in other areas. Clay fill and some sand fill was encountered below the site surface, extending about 8 inches to 10 feet below the surface. Natural clays were encountered beneath the fill. The estimated static ground-water levels are estimated to be between 12' and 14' below the existing ground surface.

Client Information

The Detroit Integrated Transportation Campus is owned by the State of Michigan. The project is being run by the Michigan Department of Management and Budget Office of Facilities, and the building will be occupied by the Michigan Department of Transportation (MDOT) and the Michigan State Police. The East zone of the building will be an office space for employees of MDOT, and the West zone of the building will be a 24 hour operations zone for MDOT and the Michigan State Police. MDOT typically runs construction projects 24 hours a day, therefore the operations zone is needed to support their construction operations. The Michigan State Police also operate 24 hours a day, and the DITC has space for police control, dispatch, warrants, and server storage.

The State of Michigan is building the DITC for office relocation and to upgrade their facilities. Located in downtown Detroit, the DITC is a central location for the Michigan State Police's operations in Detroit. The building is also in close proximity to many of Detroit's major highways, and therefore is a central location for MDOT operations in the city of Detroit. It is a goal of the Michigan Department of Management and Budget Office Facilities to constantly upgrade their facilities. The DITC provides a new, high-tech, and aesthetically pleasing work space for employees of MDOT and the Michigan State Police.

Cost, quality, schedule, and safety are all very important to the State of Michigan on the DITC project. There is a set budget for the project, which cannot be exceeded, and has governed the design of the DITC. The Michigan Department of Management and Budget Office of Facilities is a very experienced owner, and on all their projects, quality and safety are important factors in the success of a construction project. MDOT and the Michigan State Police are scheduled to move in at the beginning of October, 2009. It is very important that the building is ready for owner move in by this date so that employees can be relocated efficiently. All employees will be moved in to the DITC within a two week period, and there are no phased occupancy requirements for the project.

A successful project for the State of Michigan is not only on time, under budget, high quality, and safe, but should also build strong relationships with the other parties involved. The State of Michigan is always building and upgrading facilities, and wants to maintain strong relationships with the Architects, Engineers, and Contractors who help to build those facilities.

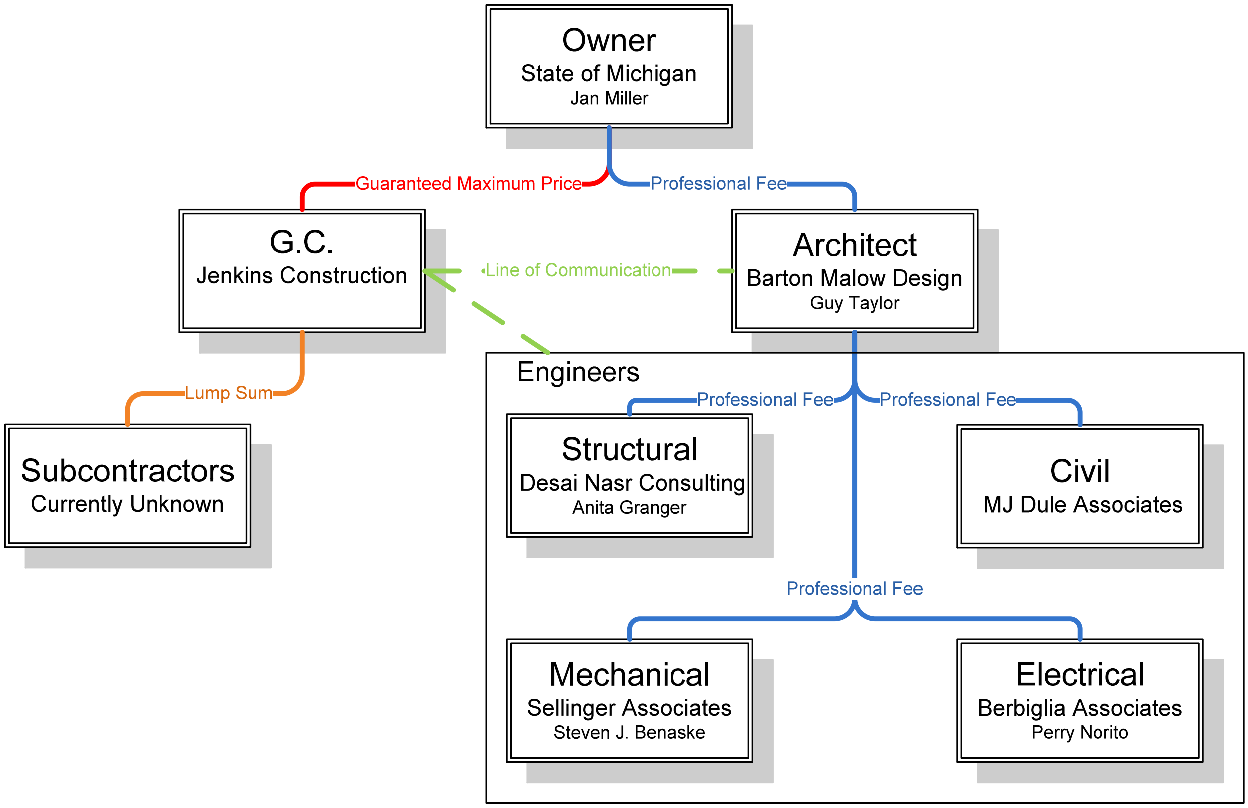
Project Delivery System

The Detroit Integrated Transportation Campus is being delivered using a Design-Bid-Build project delivery system. Barton Malow Design was chosen to be the Architect for the project, and Jenkins Construction was chosen to be the General Contractor (GC). Jenkins Construction won the job by being the lowest bidding GC. This delivery system was chosen because it is typical for a project of this size, standard complexity, and reasonable time constraints. An organizational chart is provided on the following page to show the contractual and communication relationships on the DITC.

The State of Michigan holds two contracts in this project set up. One contract is a Professional Fee contract with Barton Malow Design (BMD), the Architect, in which BMD agrees to deliver the design of the building to the level of professional standards for a set fee. Barton Malow Design holds Professional Fee contracts with the engineers and design consultants, who help the Architect deliver the project design, and ultimately the construction documents. One special requirement on the DITC project is the contract between BMD and Desai Nasr Consulting, the structural engineer. BMD planned to design the building in 3D using Autodesk Revit Architecture, and wanted to coordinate this effort with the structural engineer. Therefore, Desai Nasr Consulting was contracted to provide a structural model of the design in a 3D format that could be coordinated with the architectural model.

The other contract held by the State of Michigan is a Guaranteed Maximum Price (GMP) contract with Jenkins Construction, the General Contract, in which Jenkins Construction agrees to deliver the DITC and all other project deliverables. Any added cost change orders that occur on the project are submitted with an estimate to the owner in order to increase the GMP of the project. A GMP is a good contract for a project like the DITC, which has a set budget that the project cost must be under. Jenkins Construction will hold Lump Sum contracts with each of the subcontractors that are selected for the project. A Lump Sum contract guarantees that the contractor will perform their required work for a set price, and any added cost change orders that occur will be submitted with an estimate in order to increase the value of the contract. The subcontractors will be selected using a standard bid process in which the lowest bidder will be selected to perform the required work. The contractors selected for the DITC have to be fully bonded with payment and performance bonds. In addition to being fully bonded, the contractors will be required to have workers compensation, employers' liability, commercial general liability, and automotive liability.

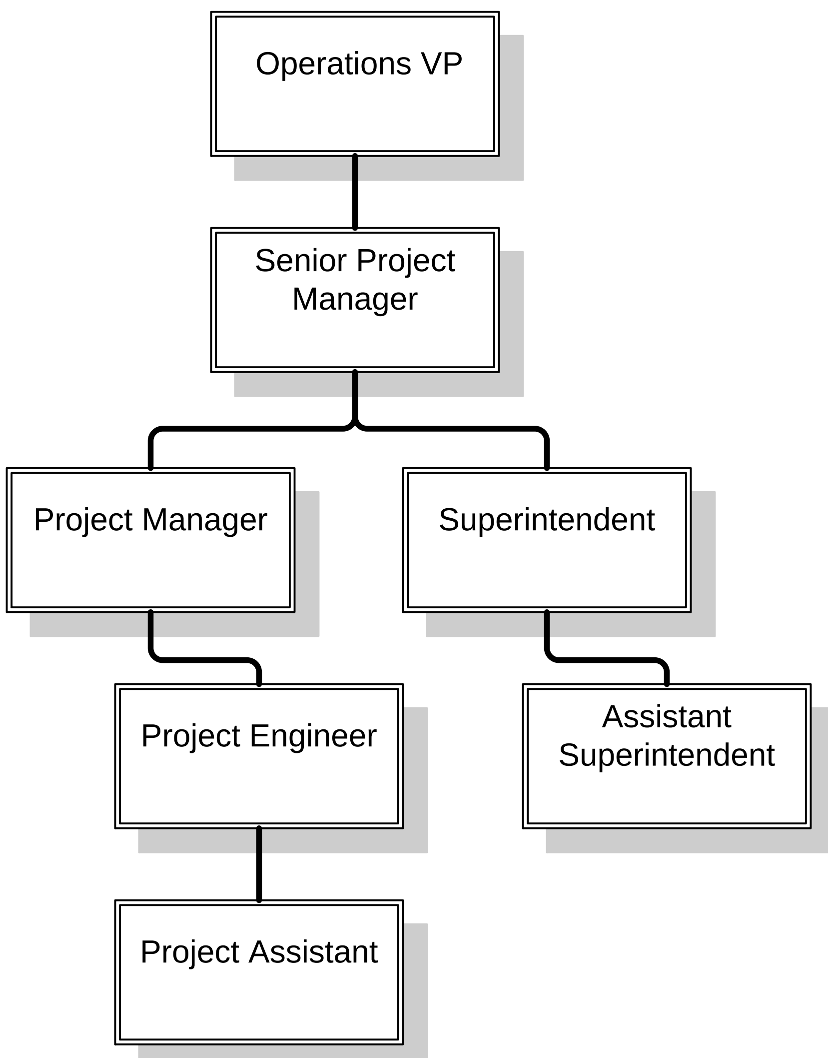
In summary, I believe this organizational structure and contract agreements make sense for the Detroit Integrated Transportation Campus. There was a reasonable amount of time allotted for the design of the project, and there is a reasonable amount of time allowed for the construction of the project, therefore a Design-Bid-Build delivery is sensible for the DITC. The Guaranteed Maximum Price contract with Jenkins Construction is also sensible, because it guarantees the project cost will be under the budget set by the State of Michigan.


Owner
State of Michigan
Jan Miller
Guaranteed Maximum Price
Professional Fee
G.C.
Jenkins Construction
Line of Communication
Architect
Barton Malow Design
Guy Taylor
Lump Sum
Engineers
Professional Fee
Professional Fee
Subcontractors
Currently Unknown
Structural
Desai Nasr Consulting
Anita Granger
Civil
MJ Dule Associates
Professional Fee
Mechanical
Sellinger Associates
Steven J. Benaske
Electrical
Berbiglia Associates
Perry Norito

Staffing Plan

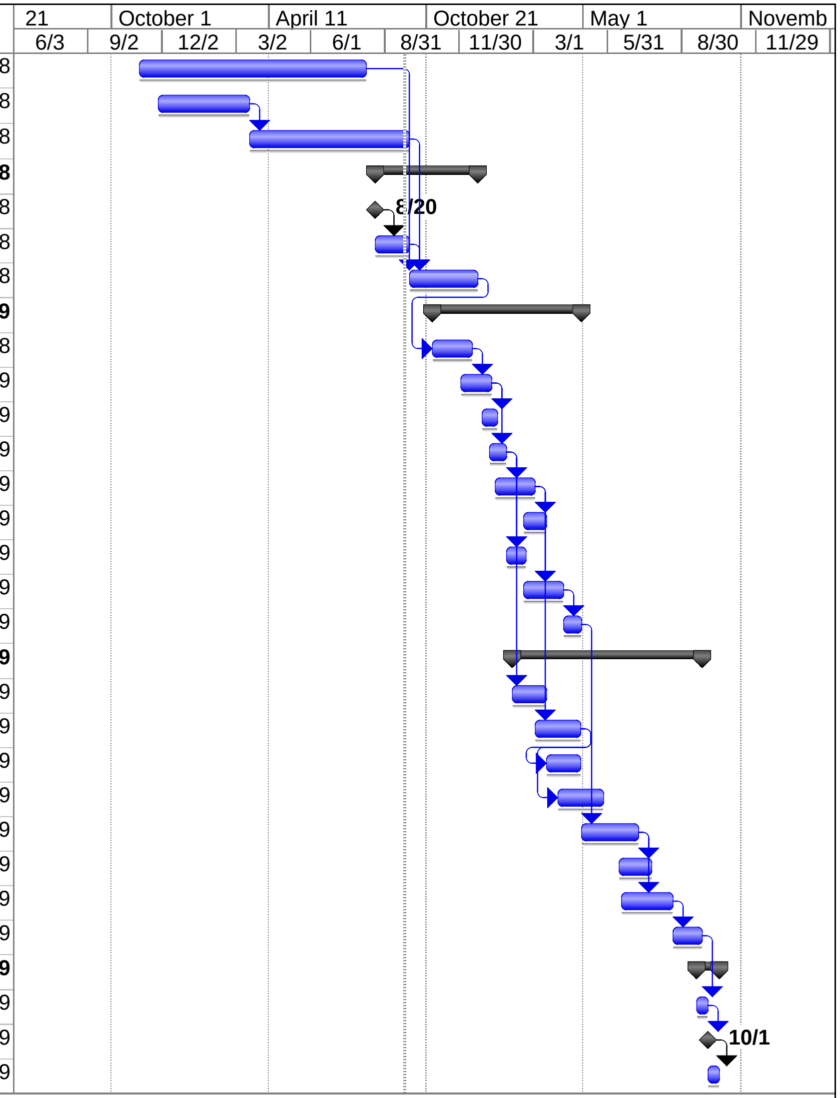
Jenkins Construction is a General Contracting / Construction Management firm founded and based in Detroit Michigan. As they were just selected as the General Contractor for the Detroit Integrated Transportation Campus, I have not yet been able to establish contact with Jenkins Construction. Therefore, after speaking with some industry professionals I have developed a project staffing plan that would be appropriate for the project size. I am uncertain how much of the work will be self performed, therefore no specific trades were added to the staffing plan.

The DITC project would be overseen by the Operations VP and a Senior Project Manager, out of Jenkins Construction's main office. On site, and under the Senior Project Manage, a Project Manager would be in charge of one project engineer and one project assistant. Also under the Senior Project Manager would be an on-site Superintendent in charge of an Assistant Superintendant.



Appendix A: Project Schedule Summary

ID	Task Name	Duration	Start	Finish
1	**APPROVALS/PERMITS**	200 days	Mon 11/5/07	Fri 8/8/08
2	**DESIGN DEVELOPMENT**	80 days	Wed 11/28/07	Tue 3/18/08
3	**CONSTRUCTION DOCUMENTS/BID/PROCUREMENT**	140 days	Wed 3/19/08	Tue 9/30/08
4	**SITEWORK**	**90 days**	**Wed 8/20/08**	**Tue 12/23/08**
5	Mobilze on Site	0 days	Wed 8/20/08	Wed 8/20/08
6	Site Grading	30 days	Wed 8/20/08	Tue 9/30/08
7	Sitework	60 days	Wed 10/1/08	Tue 12/23/08
8	**SHELL AND ENCLOSURE**	**131 days**	**Wed 10/29/08**	**Wed 4/29/09**
9	Foundation Concrete	35 days	Wed 10/29/08	Tue 12/16/08
10	Steel Erection	28 days	Wed 12/3/08	Fri 1/9/09
11	Underground Plumbing	15 days	Mon 12/29/08	Fri 1/16/09
12	Concrete SOG, 2nd Floor, and Roof	15 days	Wed 1/7/09	Tue 1/27/09
13	Exterior Stud Framing	35 days	Wed 1/14/09	Tue 3/3/09
14	Brick Masonry	20 days	Wed 2/18/09	Tue 3/17/09
15	Built-Up Roofing	18 days	Wed 1/28/09	Fri 2/20/09
16	Metal Panel Curtain Wall	35 days	Wed 2/18/09	Tue 4/7/09
17	Aluminum Windows	16 days	Wed 4/8/09	Wed 4/29/09
18	**INTERIORS**	**167 days**	**Wed 2/4/09**	**Thu 9/24/09**
19	Boiler Room Mechanical	30 days	Wed 2/4/09	Tue 3/17/09
20	Interior Metal Studs	40 days	Wed 3/4/09	Tue 4/28/09
21	MEP Branch Work	30 days	Wed 3/18/09	Tue 4/28/09
22	MEP in Wall	40 days	Wed 4/1/09	Tue 5/26/09
23	Drywall	50 days	Thu 4/30/09	Wed 7/8/09
24	Plumbing Fixtures	30 days	Mon 6/15/09	Fri 7/24/09
25	Ceiling Grid & Light Fixtures	45 days	Thu 6/18/09	Wed 8/19/09
26	Floor Finishes	26 days	Thu 8/20/09	Thu 9/24/09
27	**COMPLETION AND CLOSEOUT**	**20 days**	**Fri 9/18/09**	**Thu 10/15/09**
28	Testing & Air Balancing	10 days	Fri 9/18/09	Thu 10/1/09
29	Substantial Completion	0 days	Thu 10/1/09	Thu 10/1/09
30	Owner Move-In	10 days	Fri 10/2/09	Thu 10/15/09



Project: Detroit Integrated Trasportation Center
Summary Schedule
Issued By: Shane Goodman

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Appendix B: D4 Cost Estimate Summary

Statement of Probable Cost

Detriot Integrated Transportation C - Oct 2009 - MI - Detroit

Prepared By: **Shane Goodman**
The Pennsylvania State University

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Fax:

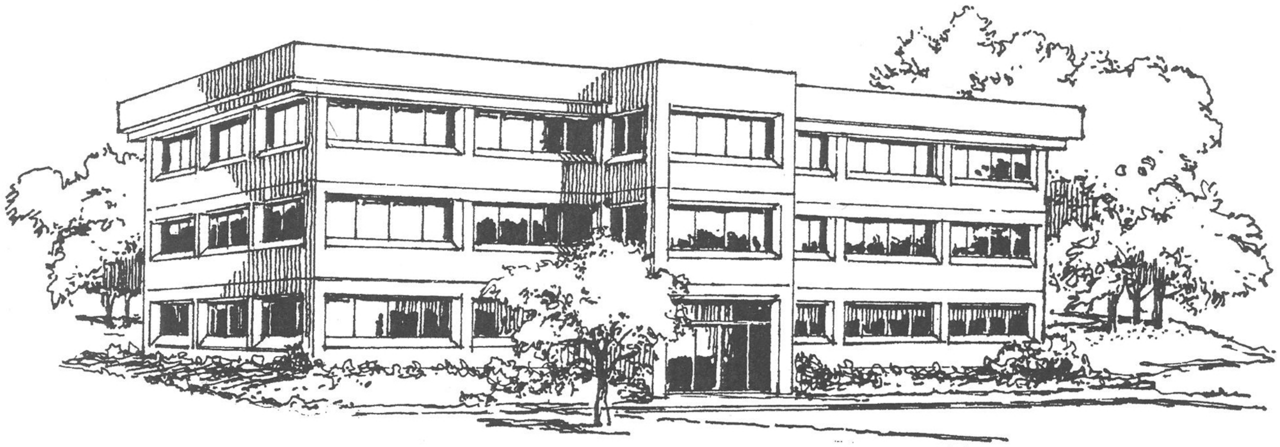
Prepared For: **John Messner, Ph.D.**
The Pennsylvania State Univeristy

,
Fax:

Building Sq. Size:	**45378**	Site Sq. Size:	**216628**
Bid Date:		Building use:	**Office**
No. of floors:	**2**	Foundation:	**CON**
No. of buildings:	**1**	Exterior Walls:	**MET**
Project Height:	**30**	Interior Walls:	**GYP**
1st Floor Height:	**14**	Roof Type:	**BUP**
1st Floor Size:	**22694**	Floor Type:	**N/A**
		Project Type:	**NEW**

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**1.78**	**3.88**	**176,269**
	Bidding Requirements	1.78	3.88	176,269
01	**General Requirements**	**4.10**	**8.93**	**405,262**
	General Requirements	4.10	8.93	405,262
02	**Site Work**	**9.14**	**19.93**	**904,518**
	Site Work	9.14	19.93	904,518
03	**Concrete**	**4.10**	**8.94**	**405,457**
	Concrete	4.10	8.94	405,457
04	**Masonry**	**5.78**	**12.60**	**571,949**
	Masonry	5.78	12.60	571,949
05	**Metals**	**8.70**	**18.97**	**860,916**
	Metals	8.70	18.97	860,916
06	**Wood & Plastics**	**3.70**	**8.06**	**365,840**
	Wood & Plastics	3.70	8.06	365,840
07	**Thermal & Moisture Protection**	**5.43**	**11.84**	**537,464**
	Thermal & Moisture Protection	5.43	11.84	537,464
08	**Doors & Windows**	**5.45**	**11.89**	**539,649**
	Doors & Windows	5.45	11.89	539,649
09	**Finishes**	**12.16**	**26.52**	**1,203,323**
	Finishes	12.16	26.52	1,203,323
10	**Specialties**	**2.21**	**4.82**	**218,861**
	Specialties	2.21	4.82	218,861
11	**Equipment**	**0.14**	**0.30**	**13,518**
	Equipment	0.14	0.30	13,518
12	**Furnishings**	**6.96**	**15.17**	**688,578**
	Furnishings	6.96	15.17	688,578
14	**Conveying Systems**	**0.75**	**1.63**	**73,852**
	Conveying Systems	0.75	1.63	73,852
15	**Mechanical**	**18.97**	**41.36**	**1,876,929**
	Mechanical	18.97	41.36	1,876,929
16	**Electrical**	**10.65**	**23.22**	**1,053,734**
	Electrical	10.65	23.22	1,053,734
Total Building Costs		**100.00**	**218.08**	**9,896,118**
Total Non-Building Costs		**100.00**	**0.00**	**0**

Appendix C: R.S. Means Reference



Costs per square foot of floor area

Exterior Wall	S.F. Area	5000	8000	12000	16000	20000	35000	50000	65000	80000
	L.F. Perimeter	220	260	310	330	360	440	490	548	580
Face Brick with Concrete Block Back-up	Wood Joists	220.10	188.10	169.75	157.35	150.80	137.85	131.65	128.50	126.00
	Steel Joists	222.20	190.20	171.90	159.45	152.85	139.95	133.80	130.65	128.15
Glass and Metal Curtain Wall	Steel Frame	255.30	215.90	193.35	177.55	169.35	152.90	144.95	140.95	137.70
	R/Conc. Frame	252.50	213.10	190.55	174.75	166.50	150.10	142.15	138.15	134.90
Wood Siding	Wood Frame	173.65	150.00	136.55	127.90	123.25	114.25	110.10	107.95	106.35
Brick Veneer	Wood Frame	195.60	166.20	149.40	138.20	132.20	120.50	115.00	112.15	109.95
Perimeter Adj., Add or Deduct	Per 100 L.F.	34.95	21.80	14.50	10.90	8.70	5.00	3.50	2.70	2.20
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	5.70	4.15	3.40	2.65	2.30	1.60	1.25	1.10	1.00
***For Basement**, add $30.95 per square foot of basement area*										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $61.00 to $236.25 per S.F.

Common additives

Description	Unit	$ Cost
Clock System		
20 room	Each	15,400
50 room	Each	37,400
Closed Circuit Surveillance, One station		
Camera and monitor	Each	1750
For additional camera stations, add	Each	940
Directory Boards, Plastic, glass covered		
30" x 20"	Each	580
36" x 48"	Each	1450
Aluminum, 24" x 18"	Each	570
36" x 24"	Each	635
48" x 32"	Each	925
48" x 60"	Each	1950
Elevators, Hydraulic passenger, 2 stops		
1500# capacity	Each	55,100
2500# capacity	Each	57,800
3500# capacity	Each	62,100
Additional stop, add	Each	9000
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	278
Nickel cadmium	Each	800

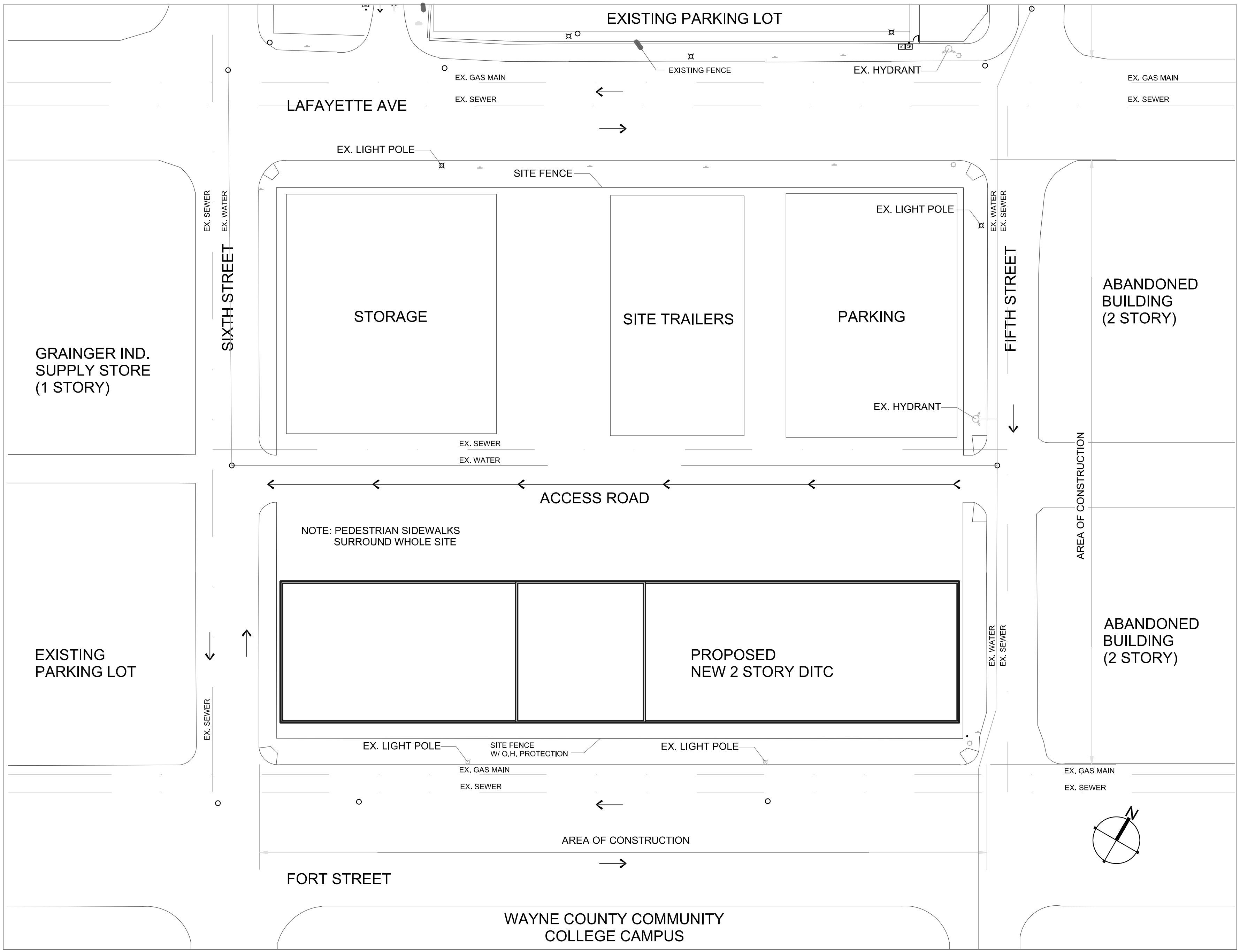
Description	Unit	$ Cost
Smoke Detectors		
Ceiling type	Each	174
Duct type	Each	445
Sound System		
Amplifier, 250 watts	Each	2225
Speaker, ceiling or wall	Each	181
Trumpet	Each	345
TV Antenna, Master system, 12 outlet	Outlet	299
30 outlet	Outlet	192
100 outlet	Outlet	179

Model costs calculated for a 3 story building with 12′ story height and 20,000 square feet of floor area

Office, 2-4 Story

			Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE						
1010	Standard Foundations	Poured concrete; strip and spread footings	S.F. Ground	6.78	2.26	4.7%
1020	Special Foundations	N/A	—	—	—	
1030	Slab on Grade	4″ reinforced concrete with vapor barrier and granular base	S.F. Slab	4.63	1.54	
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing	S.F. Ground	.15	.05	
2020	Basement Walls	4′ foundation wall	L.F. Wall	65	1.47	
B. SHELL						
	B10 Superstructure					
1010	Floor Construction	Open web steel joists, slab form, concrete, columns	S.F. Floor	16.44	10.96	11.4%
1020	Roof Construction	Metal deck, open web steel joists, columns	S.F. Roof	6.24	2.08	
	B20 Exterior Enclosure					
2010	Exterior Walls	Face brick with concrete block backup *80% of wall*	S.F. Wall	29.55	15.32	17.4%
2020	Exterior Windows	Aluminum outward projecting *20% of wall*	Each	656	3.70	
2030	Exterior Doors	Aluminum and glass, hollow metal	Each	2764	.85	
	B30 Roofing					
3010	Roof Coverings	Built-up tar and gravel with flashing; perlite/EPS composite	S.F. Roof	5.94	1.98	1.7%
3020	Roof Openings	N/A	—	—	—	
C. INTERIORS						
1010	Partitions	Gypsum board on metal studs *20 S.F. Floor/L.F. Partition*	S.F. Partition	8.60	3.44	22.5%
1020	Interior Doors	Single leaf hollow metal *200 S.F. Floor/Door*	Each	842	4.22	
1030	Fittings	Toilet partitions	S.F. Floor	1.05	1.05	
2010	Stair Construction	Concrete filled metal pan	Flight	12,150	4.25	
3010	Wall Finishes	60% vinyl wall covering, 40% paint	S.F. Surface	1.29	1.03	
3020	Floor Finishes	60% carpet, 30% vinyl composition tile, 10% ceramic tile	S.F. Floor	7.03	7.03	
3030	Ceiling Finishes	Mineral fiber tile on concealed zee bars	S.F. Ceiling	4.74	4.74	
D. SERVICES						
	D10 Conveying					
1010	Elevators & Lifts	Two hydraulic passenger elevators	Each	95,200	9.52	8.3%
1020	Escalators & Moving Walks	N/A	—	—	—	
	D20 Plumbing					
2010	Plumbing Fixtures	Toilet and service fixtures, supply and drainage *1 Fixture/1320 S.F. Floor*	Each	2363	1.79	2.1%
2020	Domestic Water Distribution	Gas fired water heater	S.F. Floor	.29	.29	
2040	Rain Water Drainage	Roof drains	S.F. Roof	.96	.32	
	D30 HVAC					
3010	Energy Supply	N/A	—	—	—	14.0 %
3020	Heat Generating Systems	Included in D3050	—	—	—	
3030	Cooling Generating Systems	N/A	—	—	—	
3050	Terminal & Package Units	Multizone unit gas heating, electric cooling	S.F. Floor	15.95	15.95	
3090	Other HVAC Sys. & Equipment	N/A	—	—	—	
	D40 Fire Protection					
4010	Sprinklers	N/A	—	—	—	0.8 %
4020	Standpipes	Standpipes and hose systems	S.F. Floor	.89	.89	
	D50 Electrical					
5010	Electrical Service/Distribution	1000 ampere service, panel board and feeders	S.F. Floor	4.23	4.23	17.1%
5020	Lighting & Branch Wiring	Fluorescent fixtures, receptacles, switches, A.C. and misc. power	S.F. Floor	10.46	10.46	
5030	Communications & Security	Alarm systems, internet and phone wiring, and emergency lighting	S.F. Floor	4.68	4.68	
5090	Other Electrical Systems	Emergency generator, 7.5 kW, uninterruptible power supply	S.F. Floor	.21	.21	
E. EQUIPMENT & FURNISHINGS						
1010	Commercial Equipment	N/A	—	—	—	0.0 %
1020	Institutional Equipment	N/A	—	—	—	
1030	Vehicular Equipment	N/A	—	—	—	
1090	Other Equipment	N/A	—	—	—	
F. SPECIAL CONSTRUCTION						
1020	Integrated Construction	N/A	—	—	—	0.0 %
1040	Special Facilities	N/A	—	—	—	
G. BUILDING SITEWORK		**N/A**				
				Sub-Total	114.31	**100%**
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)			*25%*	28.54	
	ARCHITECT FEES			*7%*	10	
				Total Building Cost	**152.85**	

Appendix D: Building Site Plan



STATE OF MICHIGAN

DETROIT INTEGRATED TRANSPORTATION CENTER

NO.	DATE	REVISION	BY

SITE PLAN OF EXISTING CONDITIONS & SITE UTILIZATION PLAN

AS-101

SHANE GOODMAN, CONSTRUCTION MANAGEMENT

APPENDIX C