1 - Project Introduction

The Detroit Integrated Transportation Campus (DITC) is a two-story, 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 DITC is located within the city limits of Detroit Michigan, south of the city center, on Fort Street. It is conveniently located less than one block from the John C Lodge Freeway, a major highway in Detroit. The city is attempting to rebuild the area where the DITC Is located, as it was once a very industrious part of the city. The location of the DITC can be seen below in Image 1.1.

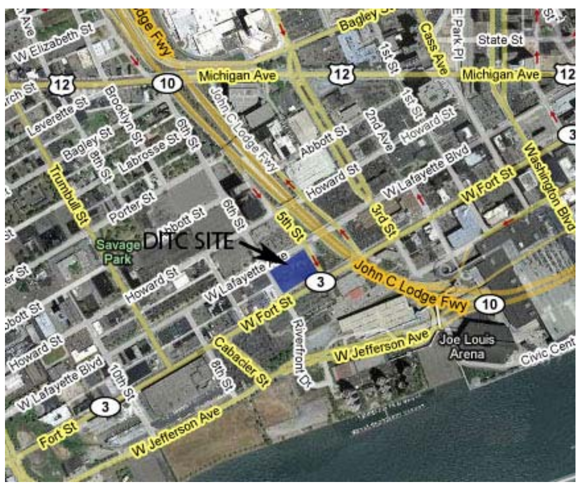

Image 1.1, DITC Location, Google Maps

Construction of the DITC was originally scheduled to start in early October, 2009; however, complications with the general contractor bid process have held back the start date. As of March, 2009 a subcontractor has yet to be selected, and a start date has yet to be determined. Due to this delay some information about the schedule, cost, and construction methods were not yet obtainable.

2 - Project Overview

2.1 - Building Design

Architectural design of the Detroit Integrated Transportation Campus was based off the program requirements from the State of Michigan. Barton Malow Design knew the building site and requirements, and Algis Bublys, the design executive, created the DITC with both in mind. The building was designed to have an urban feel; therefore the building was pushed up against the street, and lengthened to run the whole block. This also reflects the design of the greyhound bus station in Detroit, a basis for the design of the DITC. Two stories was a product of the length and the program requirements.

The building envelope of the DITC is made up of three different wall systems and a single roof system. The roof system is a flat PVC roofing system comprised of a PVC membrane, rigid insulation, and metal deck. Three different wall systems include a glass curtain wall system, a masonry wall system, and a metal panel wall system.

Structural steel frame is the main support for the 2-story 45,000 square foot building. Structural steel for the building 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 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.

HVAC for the DITC 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. Cooling for each unit is controlled by a supply-air refrigerant coil and an outdoor-air refrigerant coil, which each circulate R-407C Refrigerant. 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. These 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 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.

Electricity to the DITC 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. Emergency backup is provided by an outdoor 3-Φ 480/277 V Diesel Generator. To ensure constant power to the buildings computer systems, an Uninterrupted Power System is located in the buildings Server Room.

Lighting is provided to the DITC site and exterior by Metal Halide Lamps. The south entry ramp is illuminated with metal halide lamps that are recessed in the building's exterior façade. Inside, most of the DITC's office and operations spaces are lit with compact fluorescent lamps recessed in box fixtures in these spaces hung ceilings. Open office area is also illuminated with compact fluorescent lamps housed in low profile continuous row fixtures which are hung at 9 feet above the finished floor. These fixtures are hung from the ceiling above with air craft cable mounting. Hallways and common spaces in the DITC are lit with metal halide lamps in round, wall wash fixtures that are recessed in the ceiling.

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. Both floors of the DITC have a full building fire alarm system, with visual and audible alarms placed throughout the building. These alarms are all connected to four fire alarm panels, with two located on each floor.

One hydraulic elevator located in the center on the north side of the building, which services both floors. The elevator is an under-the-car single cylinder hydraulic elevator with a rated load of 3,500 pounds, and the car's interior is 80 inches wide, 51 inches deep, and 94 inches tall. It is incased in a shaft wall and supported by tube steel that runs the whole height of the shaft.

2.2 - Project Schedule

Barton Malow Design finished the design of the Detroit Integrated Transportation Campus for the State of Michigan in August of 2008. Construction was set to start at the beginning of October, however complications with the general contractor bid process have held back the start date, and it is yet to be determined. The detailed schedule is based on 5-day work weeks, was created using Primavera Project Manager, and can be found in *Appendix A*. It is based off the original start of construction, which is October 1st, 2008, and is divided into the categories shown below in Figure 2.1.

	Start	Finish
Design and Preconstruction	9/3/2007	6/5/2009
Site Work	7/28/2008	12/16/2008
Structure	11/12/2008	2/3/2009
Exterior MEP	12/16/2008	2/13/2009
Building Enclosure	1/15/2009	4/7/2009
Site Paving and Landscaping	4/8/2009	1/23/2009
Interiors	1/26/2009	9/1/2009
Completion and Closeout	6/29/2009	10/13/2009

Figure 2.1, Schedule Summary.

In order to finish on time the trades were scheduled to move into an area once the predecessor trade finishes in that area. Lag times were applied at the beginning of certain trade activities to ensure these trades can move throughout the building without interruption. The nature of this scheduling method leads to the fact that the critical path only exists in the first couple of sequences for most activities. Once these activities have moved past the first couple of sequences, the next activity begins in that area and the critical path is passed to that activity. It is therefore imperative for these trades to begin on time and get a good start on their activity. Exceptions to this are the exterior stud framing, brick masonry, interior stud framing, and drywall activities. Due to their sequence duration and critical connections with other activities, these activities are on the critical path for most or all of their duration on site.

As shown in Figure 2.2 below, flow of construction for all trades is from East to West, therefore the trades can closely follow their predecessors, starting on the East side of the building. Seventeen different work areas (noted as sequences in the detailed schedule) were defined to break up the work throughout the building. The structure and building enclosure phases of construction follow a tight schedule, allowing the building to be enclosed early and the interior trades to begin their work.

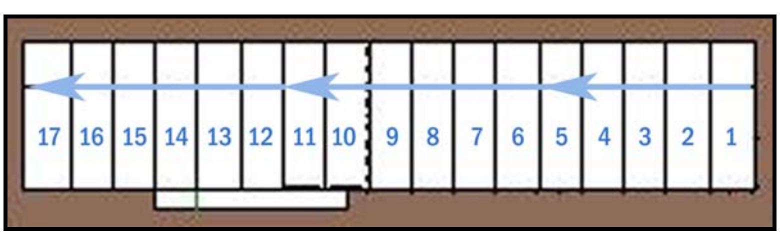

Figure 2.2, Sequence Breakdown

2.3 - Project Cost

All costs below do not represent the actual costs of the building. The 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.

Construction Cost (CC)

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

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

Total Project Cost (TC)

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

Building Systems Cost

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

2.4 - Site Layout

Located 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.

Even though the Detroit Integrated Transportation Campus is an urban construction project, site space is not an issue for this project. The on-site future parking lot to the North of the building is large enough to provide space for parking, trailers, dumpsters, and on-site storage. A temporary road through the middle of the site keeps site traffic in one direction, and allows for easy site deliveries from Interstate 75. A temporary site fence surrounds the entire site to keep pedestrians and crime off site.

During the Superstructure phase of construction the major activities taking place will be concrete foundations, slab on grade, steel, metal deck, and slab on deck. Site traffic will consist of concrete deliveries, steel deliveries, and a crane for steel erection. The heaviest lift is 3496 lb at a maximum distance of 75 feet, which requires a 50 ton crawler crane with an 86' boom. A snapshot of site layout during the superstructure phase can be found below in Figure 3.

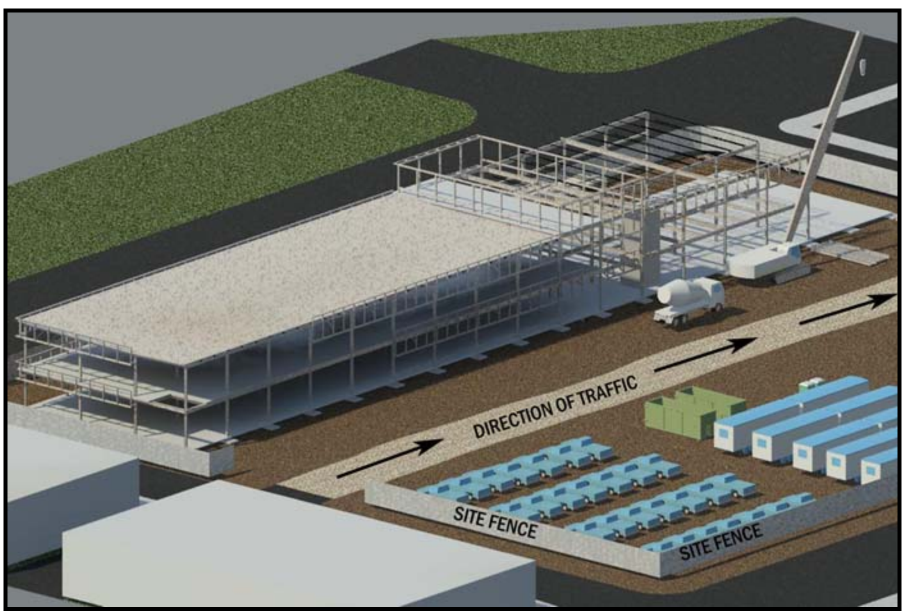

Figure 2.3, Superstructure Site Layout

2.5 - Project Delivery

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 due to complications with the bid process, a general contractor has yet to be selected. The project contract requirements can be seen below in Figure 2.4.

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. No structure has been set so the models can be used by the general contractor or subs for construction BIM uses.

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.

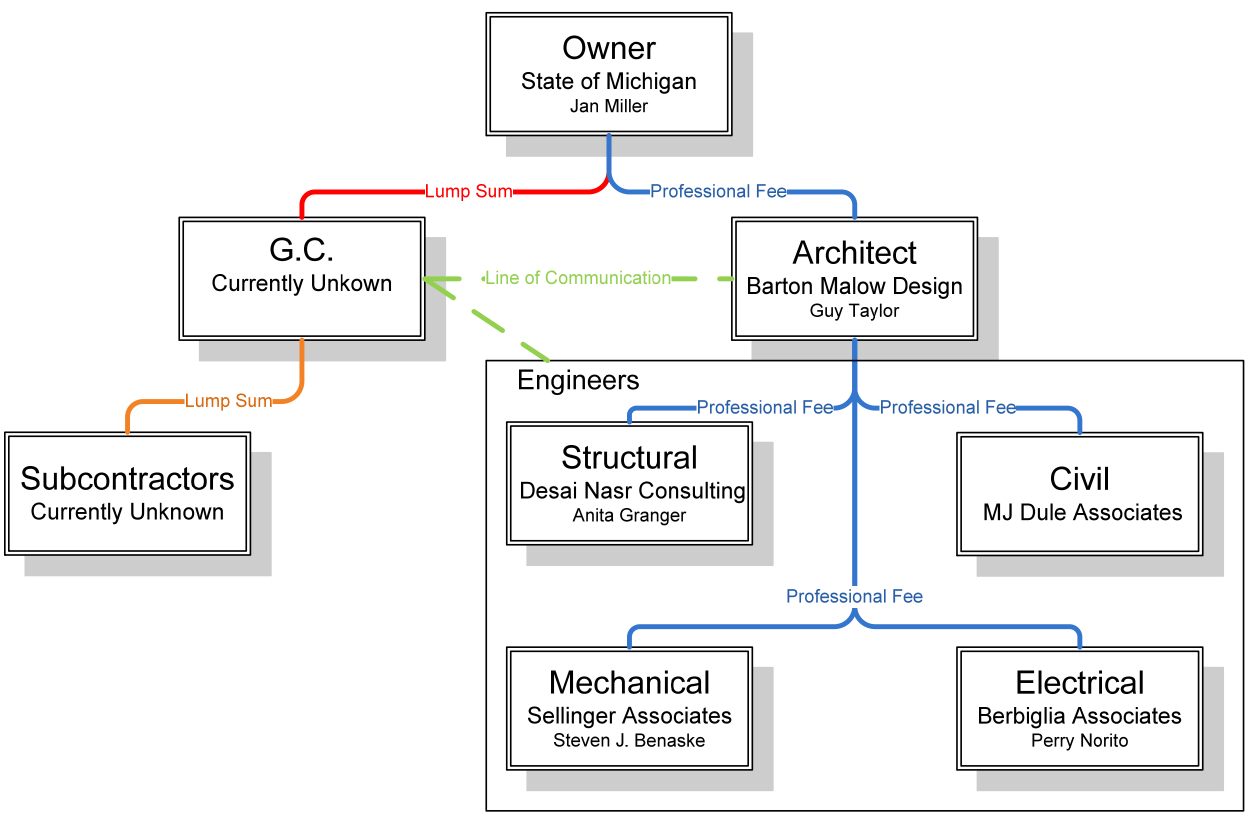

Figure 2.4, Project Contract Requirements