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Executive Summary

Stadium Academia, a senior design team from Calvin College, seeks to produce plans for a proposed athletic complex on Calvin’s campus. The complex would include two artificial turf fields, stands for spectators and other necessary site components for hosting athletic events. The goal of team Stadium Academia is to produce a set of preliminary drawings for the construction of such a complex and report the feasibility, cost and implementation process of the proposed design.

Calvin College is a liberal arts college in the Reformed tradition of Christianity. Calvin College is located in suburban Grand Rapids, Michigan. In February of 2011, the Football Feasibility Task Force was established to “examine the implications for the identity, mission and programming of Calvin College of initiating a co-curricular football program.” and seeks to report its findings to the college’s Planning and Priorities Committee.¹ Regardless of the outcome of the Football Feasibility Task Force’s findings or the College’s decision whether or not to add a football program, Stadium Academia saw an opportunity to propose a design for an athletic complex that would meet Calvin’s needs.

Stadium Academia’s design will be guided by the target cost established by GMB Architecture + Engineering in their preliminary study of the project. The goal of the design is to serve Calvin’s current needs and provide opportunity for future growth. The athletic complex will incorporate architectural elements from campus in order to integrate the design into the existing campus environment.

¹ Calvin College Football Feasibility Task Force Mandate http://www.calvin.edu/football/mandate.html
Based on a budget specified by the Calvin College Physical Plant, the estimated cost of the complex is $7,100,000. This cost includes the construction materials and labor, as well as a contingency for design and engineering fees.
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Introduction

Team 9 is designing a multipurpose sports stadium complex to support Calvin College’s growing athletics and intramurals. This design consists of two fields: 1) A football field that will also double as a lacrosse field and 2) a soccer field. Buildings are to be included in the design to house the necessary facilities for sustaining the proposed football team and other athletics at Calvin College. This project will involve architectural and structural design of the buildings and stands as well as hydrologic and traffic flow impacts on the campus. Team 9 is made up for four senior engineering majors in the civil and environmental concentration: Mark Kiemel, Elliot Spronk, Dan Van Slooten, and Reid Veenstra. This project is to be completed for Senior Design 339/340 as part of the engineering curriculum at Calvin College.

Acknowledgements

Team 9 wishes to thank people who have helped us throughout the project. Our team advisor, Professor David Wunder, helped get this project from the clouds to the ground, and encouraged us in so many ways to pursue a project that interested us. Dr. Jim Timmer, Calvin College’s Athletic Director, for taking countless hours out of his schedule to keep in touch with a bunch of kids, and for being encouraging of our project and Professor Leonard De Rooy for structural engineering assistance. We'd also like to thank Mr. Jeffery Posendek of Trine University and Mr. Tom Simmons of Ohio Northern University for their incredible hospitality when giving us a tour of their respective stadium facilities.
Schedule

Scheduling was done using Microsoft Office Project to create a Gantt chart comprised of all the tasks that Team 9 needed to complete the project. These tasks are comprised of design decisions and issues that arose as the project developed. The schedule is updated whenever a new task arises, or when a task has fallen behind schedule and needs adjusting. The schedule is used as a tool to make sure that all members of the team are aware of what needs to be done so that the project is completed. If a scheduling issue arises, the team will evaluate the situation with respect to the entire project and come to a mutual decision for the benefit of the project. The average time spent on the project per person each week is estimated to be around 10 hours currently, and is projected to increase as the semester goes on and as we move closer towards the deadline of the project.

Team Organization

Team 9 – Stadium Academia is comprised of four civil/environmental engineering students; Elliot Spronk, Reid Veenstra, Dan Van Slooten, and Mark Kiemel. The team advisor is Dr. David Wunder and team consultant is Mr. Roger Lamer. All these people play an important part in the preliminary design of a Calvin College football stadium complex. Team meetings are conducted every Thursday and Friday where we dive up work, check progress, and plan what needs to be accomplished by the next meeting. All documents for the project can be found at S:\Engineering\Scratch\Cloud 9 on the Calvin network.
Business Plan

The stadium complex will be a site specific construction project and will not be marketed outside Calvin College. Because of this no business plan was implemented in the design of the structure, but an integrate budget will be created and refined throughout the project, starting with the approximate budget acquired from the Calvin College Physical Plant (Append 0). Note: the traditional 6% engineer and architect fee was not included) for a total of $7,122,500.

Stadium Research

Trine University

Trine University constructed a new football stadium in 2008 (Figure 1). We visited this stadium on October 11, 2011 to gather ideas for our design. Their stadium seats approximately 2500 – 2700 on steel I-beam bleachers. The building contains coaches’ offices, training room, home locker room, weight room, and a laundry room. This is similar to the types of rooms we will include in Calvin’s stadium design with the exception of the coaching offices. The field is artificial turf with only football lines sewn in. Mr. Posendek, the school’s athletic director, explained to us that storage was the only thing missing from the stadium building. Storage is something easily overlooked and will be considered in our design of the stadium.
Ohio Northern University

Ohio Northern University is still in the process of upgrading their athletic facilities. They currently have a stadium with home seating for 3500 on a steel I-beam platform stands and a natural grass field (see Figure 2). The unique features of this stadium are the elevated stands, siting almost seven feet above the ground, and all the restrooms and concessions are located inside the building under the stands. Our design of Calvin’s stadium would like to incorporate the elements of the elevated stands and indoors spectator facilities. Again this stadium had a lack of space for the necessary storage.
Requirements

There are three primary aspects of the project: the football stadium, the soccer stadium, and a connecting plaza.

Football

The football stadium is the primary task of the project due to its importance and complexity. The stadium will include an artificial turf surface with football lines sewn in. Additional items that NCAA Football regulations require are two field goal posts as well as two play clocks on either end of the field. The field will also be used for men’s and women’s lacrosse, but to avoid surface
clutter, those lines will be painted on during the spring season. The home stands will includeleachers for 3500 spectators, a press box with two levels; the first will be a hospitality suite, the
second will have a score/announcer room, two coaches rooms, a media room, and radio room,
and a building underneath containing a first level for a home locker room, visiting locker room,
training room, weight room, and officials room, and a second level with fan restrooms,
concessions, team meeting room, and storage. There will also be stands on the away side with
seating for 500 guests. Space underneath these stands will be used for storage.

**Soccer**

The soccer stadium will only service men’s and women’s soccer on a varsity sport basis, but may
also be used for intermural sports. This will also require an artificial turf field, and will only have
soccer lines sewn in. There will be only one set of stands, which will be located on the home side
and seat 750 fans.

**Plaza**

Having two separate stadiums creates a problem for ticketing and entrances. To simplify the
entrances, the project is to make the away football stands and soccer stands one complex. This
will be accomplished by building a plaza in the space between the two stadiums that will house
the away stands of the football stadium as well as a building which would contain guest
restrooms and concessions for football and soccer spectators. Ideally, a way to separate the two
stadiums will be implemented in case of events being hosted at the same time need to be isolated
from each other (for ticketing purposes.) A fence will be installed around the entire complex, and
on the eastern most side (the east side of the soccer stadium,) the fence will also be covered with
a wind-breaking sheet.
Basis of Design

Site
The location planned for the design will be the north side of Calvin College’s campus where the current soccer stadium and west and north practice fields currently reside. This location was specified by Jim Timmer, Athletic Director at Calvin College and illustrated by GMB Architecture + Engineering in their preliminary analysis of the project. This location on Calvin’s campus is the best choice (Figure 3). The location is directly adjacent to the Spoelhof Fieldhouse Complex, which houses many of the other athletic facilities on campus, so this placement maintains the current organization of campus. The athletic complex is also close enough to the rest of campus, including student dorms, that students will be able to walk to athletic contests and other events held at the complex.

A potential field layout was obtained from GMB and was analyzed to ensure the layout was workable. The soccer field was left at the location given by GMB and the football field layout was moved approximately 30 feet east, closer to the soccer field. This change leaves more room for the home stands, which we determined would need more space than suggested by GMB. Between the space needed for the fields and field sidelines, about 100 feet of room is available. This area will be utilized as a plaza connecting the two fields. The plaza will be approximately 100 feet wide by 150 feet long. The fields are oriented north-south so that players will not be looking directly into the sun at evening games. The athletic field complex will be edged by a fence on all sides for security and admittance purposes.

For the same reason, the stands for both fields are located on the west side of the field. This placement also works well for the football stadium because the majority of spectators will approach the athletic complex from the parking lots to the south and west. All three sets of stands
(3500 home football, 500 visiting football, 750 home soccer) will be centered on the fields to provide the best view for the spectators. Along with these three structures, a small building will be located on the plaza between fields. This building will have restrooms and a concessions stand for the soccer spectators and visitor football spectators. The building will also include an official’s locker room; in accordance with the preference of many officials, this distances their locker rooms from the majority of the spectators as well as the team locker rooms.

Another advantage of the complexes proximity to the Spoelhof Fieldhouse Complex is the opportunity to use the parking allocated for events at the Fieldhouse. The assumption is that large athletic events (primarily home football games) would not take place at the same time as a home basketball game. Since the anticipated number of spectators at a home football game is less than the number of spectators that the Spoelhof Fieldhouse Complex is designed for, the current available parking should be adequate.

The majority of spectators for a home football game will park in the west parking lots and will approach the stadium from the south and west. Therefore, a main entrance gate will be located in the southwest corner of the complex. Another entrance will be located between the two fields at the south side of the plaza. This entrance will be used mostly by students, however may serve spectators who wish to park in the north student parking lot.

**Utilities**

Since our team is made up of civil and environmental engineering majors we will only focus on the connections of drinking water, sanitary sewage, and storm water utilities only. The proposed connects are shown in Figure 4.
Figure 3: Site Layout
Figure 4: Utilities and Proposed Connections
Storm sewer

The proposed storm sewer was designed for a 24hr, 100 year storm event with 6.15 in of rainfall\(^2\). Precipitation on the synthetic turf fields does not create any runoff. Instead it will travel vertically through the infill and gravel. \(^3\) Some of the water will infiltrate into the ground while the rest will travel approximately 30 yards to the edges of the field where flat panel drains collect the water and outlet it into the proposed storm sewer drain. Pipes will be constructed out of smooth PVC pipe and sized according to the turf contractor’s policies.

Sanitary Sewer

The existing sanitary sewer is located on the North-East corner of the TNT building. We proposed connecting to this existing pipe through pipes branching out from the home stand building and the concessions building. These pipes will be designed to handle 14,000gpd from the home stand building and 5,000gpd from the plaza building based on 4 gal/seat/day.

Water Main

Because of the high volume of people, it is imperative that the current water distribution system for Calvin College can handle a large water load over a relatively short amount of time (3-6 hours.) A study on the water demands from a stadium by the University of Central Florida\(^4\) stated that a demand of 4 gallons per day (gpd) per seat (spectator) could be assumed with a peaking factor of 2. For approx. 4000 spectators, this would mean a demand of 32,000 gpd. The locker room would also require a large demand based on shower use by both teams as well as

\(^2\) Drainage Rules.: Kent County Drain Commission, 2006 Table 1, Section 3
toilet/urinal and sink use. It was found\(^5\) that a shower head emits a maximum of 2.2 gallons per minute, a toilet uses 1.6 gallons per flush, a urinal uses 1 gallon per flush, and a sink uses 0.5 gallons per minute. Assuming a 20 minute shower per player and 200 total players (approx. 100 per team), the locker rooms would require 16,200 gpd. This means a grand total of 48,200 gpd for the stadium. The current water distribution system for Calvin College goes as far as the northern-most part of the Track and Tennis Center, and the northwestern-most part of Van Reken dormitory. For supplying the stadium, one option would be to tie in to the water main through the track and tennis center for the home stands restrooms and locker rooms, and have the plaza concessions building tie into the same line by following the sanitary sewer line that will run from the concessions building into the sanitary sewer main in the Track and Tennis Center.

**Design Loads**

<table>
<thead>
<tr>
<th></th>
<th>Dead Load</th>
<th>Live Load</th>
<th>Snow Load</th>
<th>Horizontal Force</th>
<th>Seismic Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Stands</td>
<td>100 psf</td>
<td>100 psf</td>
<td>35 psf</td>
<td>24 plf parallel to seats row</td>
<td>5.3 x gravity laterally</td>
</tr>
<tr>
<td></td>
<td>(estimate)</td>
<td></td>
<td></td>
<td>10 plf perpendicular to seats row</td>
<td></td>
</tr>
<tr>
<td>Interior Levels</td>
<td>75 psf</td>
<td>100 psf</td>
<td>-</td>
<td>-</td>
<td>5.3 x gravity laterally</td>
</tr>
<tr>
<td></td>
<td>(estimate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof</td>
<td>30 psf</td>
<td>-</td>
<td>35 psf</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(estimate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dead loads on structural elements depend on the weight of the structure itself. Once the sizes of the members and flooring are estimated using the estimated dead loads, actual dead loads can be calculated based on a density of 150 psf for standard structural reinforced concrete. The density

\(^5\) http://wiki.answers.com/Q/What_is_the_average_flow_rate_of_shower_water
can be less if lightweight concrete is used in which case the density must be determined from trial batches or specified by supplier. 

The foundation of the building will be designed to distribute the weight of the complex to 3500 psf.

Wind loading will be based on exterior dimensions and 90mph, 3 second gusts in accordance with ASCE 7 chapter 6. The pressures resulting from this wind will be calculated when the final exterior design is completed.

**Home Stand Building**

The building is bound by, among other things, physical space requirements, projected construction cost limits, and adherence to a general set of architectural guidelines that create an aesthetically uniform campus.

**Building Architecture**

Aesthetically, it is important to keep the building within the architectural precedent set for Calvin’s campus, maintaining the architectural integrity of the campus. The prospect of set of stands with the capacity to seat over 3000 people presents a significant challenge to the design. Calvin’s architecture is of a very distinct style, following from that of architect Frank Lloyd Wright. Original campus architect Bill Fyfe, a student of Wright, took a less formal approach to the layout and style of campus, taking into consideration natural land contours and creating harmony between the buildings and these landforms.

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7 Per Professor Leonard DeRoooy
designs while contributing new elements to the architectural palette of campus. Within our
design, the home stands must be appropriately blended into the existing setting while expressing
signs of a new direction for Calvin.

First Level

The home stands building must contain a number of rooms and spaces – both for teams, coaches
and officials, and for the spectators. First, the building must include locker rooms for football
and lacrosse teams. During football season in the fall, the ideal configuration is a home locker
room for 130 users and a visiting locker room for 70 users. In the spring, during lacrosse season,
there would preferably be two home locker rooms, one each for men’s and women’s teams, as
well as a space for visiting teams to use as a locker room. Additionally, if the fields are ever used
for high school competitions or other events, up to four locker rooms may be useful. Locker
rooms are also required to have 50 gross square feet per occupant. This requirement means the
locker rooms have a large footprint, for example when designing the home locker rooms to
accommodate 130 players, coaches and trainers the room must be at least 6500 square feet.

After evaluating all of these components, a general schematic was chosen (Figure 6). Our design
choice consists of two large locker rooms, each with the ability to be closed off into two separate
spaces, resulting in four available locker rooms (Figure 5). Each large locker room will have a
restroom, sink and shower area that will be adjacent to each divided half, so that one set of
amenities can serve both sides. The locker rooms will be accessible from the main tunnel onto
the field and will also have emergency exits. The dividable halves of each of the locker rooms
will also be accessible directly from the field for when they are being used separately.

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9 International Building Code 1003.1.1
10 International Building Code, 2000
In addition to the locker rooms, the main floor of the building will have a weight room, trainer’s room, laundry room, mechanical space, and storage capacity. If a weight room is not included in the final design, athletes could use the expandable team weight room located in the Spoelhof Fieldhouse Complex. The option of a weight room at the stadium was recommended by the Athletic Directors of both Trine University and Ohio Northern University. The football team would require a rather unique weight set and arrangement, which wouldn’t be as compatible with other teams. Also, since the football locker room is located at the stadium, this would also be the ideal location for their weight room. Our design specifies a small weight room with direct access from the home locker room.
Second Level

After defining the needs for public restrooms, which will be designed according to ADAAG requirements\textsuperscript{11} (Figure 7), concessions and means of egress from the home stands, Team Stadium Academia decided to add a second level of rooms to the building. With a large set of rooms,

stands, there is considerable space underneath the seating area to be taken advantage of. Since available space on site is limited, using the space efficiently is important. Making use of the space on the second level (Figure 8) not only offers more square footage, but also will offer a unique experience for visitors to the stadium by making use of a concourse style approach that is found in many large stadiums. Spectator amenities (i.e. concessions and restrooms) as well as a fan merchandise store will be located on the second level of the structure (Figure 9).

Figure 7: ADAAG Public Restroom Requirements
Figure 8: South elevation view of home stands building

Figure 9: Second Floor Layout
Another aspect of the available space analysis takes into account the spectator experience when visiting the stadium. The approach and entry to the home stands must accommodate a large amount of people, (i.e. 3500). There must be appropriate means of egress, which consists of wide enough stairways, ramps and exits. Team Stadium Academia laid out two different options for how visitors and fans would approach the home stands.

First, all access points could be from the front, or the very lowest point of the stands (Figure 10). This leaves for a relatively simple layout, with stairways leading into the stands from the different access points. This design is utilized at the Fred Zollner Stadium at Trine University, shown in Figure 1. While it is a straightforward layout, the disadvantage of it is that spectators must pass directly adjacent to the sidelines of the field to find their seats or during the game to use the restroom and visit the concessions stand. The Athletic Director at Trine did identify this as a problem, saying that temporary barriers must be set up for each game to maintain a boundary between the spectators and the sideline of the field.
A second seating layout option places a horizontal walkway somewhere among the rows of seating (Figure 11). This type of design is utilized at the Dial-Roberts Stadium of Ohio Northern University. One advantage of this layout is that the distance from the furthest seat from the exit is generally less. Another factor is the interaction between the sidelines, where the teams and coaches will be standing during games, and the spectators entering and exiting the stands. Ideally, there would be appropriate separation between these two, and placing a walkway midway through the stands allows for this. With a mid-level walkway, spectators approach the stands from underneath, walk out towards the field in a tunnel beneath the stands, and come out onto the mid-level walkway.

Figure 10: Front Access Bleachers\textsuperscript{12}

Team Stadium Academia has chosen to implement the second option, placing a walkway somewhere around one-third of the way up into the stands. The second level in our design would incorporate a concourse that would serve as the main access route for the spectators, with a number of tunnels leading out to the walkway in the stands. The interior of this level would include all of the public restrooms, the concessions stand, a spirit store, and possibly a team meeting room for video showing if space allows for it.

**Third Level**

The third level of the home stands building will include press boxes, coaching boxes and a hospitality suite. There will be elevator access to this floor as well as access from a stairwell. This level will sit above the home stands and overlook the field.

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13 Middle Tennessee State University, http://football.ballparks.com/NCAA/SunBelt/MiddleTennessee/index.htm
Stands

The stands will be designed with the following criteria in mind:

- Designed seating capacities for each grand stand are shown in Table 2.

<table>
<thead>
<tr>
<th>Seating Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Stands (Football) 3500 people</td>
</tr>
<tr>
<td>Away Stands (Football)  500 people</td>
</tr>
<tr>
<td>Soccer Stands       750 people</td>
</tr>
</tbody>
</table>

- The home stands will be designed to allow for maximum useable area on the underside of the seats.
- The away and soccer stands will be designed with usable space underneath the stands for storage purposes.

Alternatives—Structures

Four alternative designs were considered for the construction of the sports stadium stands.

Table 3 displays the design matrix for the selection of this material.

<table>
<thead>
<tr>
<th>Weight</th>
<th>Aesthetics</th>
<th>Upfront cost</th>
<th>Maintenance cost</th>
<th>Life</th>
<th>Construction Time</th>
<th>Usable square footage underneath</th>
<th>Vibration Control</th>
<th>Customer Preference</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Open Deck</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>312</td>
</tr>
<tr>
<td>Steel Closed</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>355</td>
</tr>
<tr>
<td>Deck</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cast in place</td>
<td>10</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>2</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>307</td>
</tr>
<tr>
<td>Concrete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precast Concrete</td>
<td>10</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>462</td>
</tr>
</tbody>
</table>
Steel Open Deck Stands

Steel open deck stands (Figure 12) are typically portable stands constructed out of aluminum with an open deck with large gaps between the seat benches and the walkway floor. This design is the lowest cost yet does not provide the aesthetics, vibration and deflection control, or water seep resistance that is desired for this project.

Figure 12: Open deck bleachers

Steel I-beam Closed Deck Grandstand

This alternative is similar to steel open deck but does not have the open gaps beneath the seat benches and the walkway floors. This alternative provides adequate aesthetics to the stands along with some vibration and deflection control and water proofing to below area. The steel design material is a lower cost than the concrete. This design will provide problems for usable

area underneath and has a higher maintenance cost than the concrete alternatives. This alternative would be considered if costs of the project are too high. Figure 13 displays a picture of the closed decking system.

![Figure 13: John Jacobs’s Track and Field Complex University of Oklahoma, closed deck stands](http://www.stadiumbleachers.com/project-portfolio/university-of-oklahoma-track#)

**Cast in Place Concrete**

This alternative uses forms built on the job site to construct a solid concrete grandstand. This design would provide adequate vibration and deflection control, be aesthetically pleasing, be water resistant and have a lower maintenance cost. It does have a higher cost associated with the construction of forms and an increased construction time based on weather variations and concrete curing time. Figure 14 shows a concrete stadium that was cast in place.

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Precast Concrete

This method uses a single form to produce slabs of concrete, or stadia, in the concrete company’s warehouse under environmentally controlled conditions. The pre-casting design allows for faster production of stadia and a shortened construction time. With the environmentally controlled conditions the concrete can be cured in a way to increase compressive strength and decrease the weight. This method has a much lower cost than cast in place with all the benefits of concrete as shown earlier. Concrete also requires little or no maintenance to preserve original look. This form is recommended for the project. Figure 15 displays how a stadia piece is installed in the precast stadium.

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Supports

There are two main supports used for the bleacher options. Steel I beam supports, used primarily with steel closed deck systems and concrete supports, used primarily with precast concrete. Both can be used to support the selected precast stadia. To simplify the process of construction and purchasing the supports will also be made out of reinforced precast concrete.

Seating

The seating is recommended to be between 18 – 24 inches per person parallel to the seat way. The seating can be single seats or a bench system. The recommended amount would be to install aluminum bench system. This provides low cost and adequate space.

Construction Traffic

Construction of the athletic facilities is not likely to stress the current traffic system that Calvin College utilizes due to the location of the project site. The project is to be staged in a parking lot.

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sitting north of the Calvin College Track and Tennis Center. This will allow for construction to proceed without traffic concerns.

**Parking**

The team was advised by interested parties to ensure that the commuter lot for Calvin College will be able to service all parking needs for events to be held in the stadiums. Currently, the commuter lot adequately serves parking purposes for the largest of Calvin events and therefore will be able to provide enough parking for stadium events.

**Detailed Design**

Much of the integration and testing of the athletic facility design will be done through the use of various software packages and computer modeling. Integrating the new systems into the existing utilities and amenities on campus will be an important part of the design. In coordination with the Physical Plant office, detailed information about the existing features of the site have been obtained in the form of various AutoCAD files.

The fields and surrounding plaza spaces will produce significant storm water runoff, which will need to be handled appropriately by the existing storm water network on campus. Additionally, the new water demands of the complex will need to be identified and quantified. This will include the daily demands for showers and laundry, as well as the peak demands for water that will occur during and after games.

Depending on the materials selected for design, the structural design will be modeled using RAM Structural System and STAAD Pro.
Revit Architecture will be used to generate a computer model of the stadium and surrounding site. Through the production of an accurate computer model, realistic renderings can be generated as well as walkthrough videos of the complex. These items will be useful for the final presentation of the project. Additionally, a physical scale model may be built, in order to better present the final design.

Team Budget

A stipend of $500 was given to each team at the beginning of the semester, with the potential for additional funding if absolutely necessary. A budget was discussed among group members, and it was decided that the funds would primarily go towards car rental and travel for visiting Fred Zollner Athletic stadium at Trine University in Angola, Indiana, as well as the Dial-Roberson All-Events Stadium at Ohio Northern University in Ada, Ohio. Additional funds were requested by Team 9 from Dr. James Timmer, Calvin College Athletic Director, for travel expenses. The request was granted, and funds for all fuel expenses were covered. Additional needs for funds may include a scale model of the complex, as well as any printing fees incurred. Elliot has the responsibility for the budget, and updates it on a use by use basis. Detailed budget can be seen in Table 4.
Table 4: Detailed Budget for Team 9

<table>
<thead>
<tr>
<th>Item</th>
<th>Additional Information</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trine Visit:</td>
<td>Mid-size Budget Rental</td>
<td>$ (36.00)</td>
</tr>
<tr>
<td>Ohio Northern Visit:</td>
<td>Mid-size Budget Rental</td>
<td>$ (36.00)</td>
</tr>
<tr>
<td>Visits to Trine and Ohio Northern</td>
<td>Cost of gas paid for by Football Feasibility Task Force</td>
<td></td>
</tr>
<tr>
<td>Printing</td>
<td>Final posters for display</td>
<td>$ (20.00)</td>
</tr>
<tr>
<td>ILL late fees</td>
<td>Books through interlibrary loan</td>
<td>$ (20.00)</td>
</tr>
<tr>
<td>Scale model?</td>
<td>Possibly will build a scale model</td>
<td>$ (50.00)</td>
</tr>
<tr>
<td>Remaining Budget:</td>
<td></td>
<td>$ 338.00</td>
</tr>
</tbody>
</table>

Conclusion

Whether or not Calvin College decides to add a football team as a varsity sport next year or twenty years later, this stadium design will meet the parameters of size, content, and campus-wide aesthetics while redefining the present and future architecture at Calvin and set a standard for NCAA Division III stadiums all around the country.
## Appendix

### I. Athletic Fields Master Plan: Stadium Section

Conceptual Budget  
3/20/2011

Table 5: Conceptual Budget - Football Stadium  
**Football Stadium**

<table>
<thead>
<tr>
<th>Item:</th>
<th>Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site work &amp; Utilities</td>
<td>$800,000.00</td>
</tr>
<tr>
<td>Stadium Building w/press box (seats for 3000)</td>
<td>$3,000,000.00</td>
</tr>
<tr>
<td>Concessions Building</td>
<td>$400,000.00</td>
</tr>
<tr>
<td>Artificial Turf Field</td>
<td>$750,000.00</td>
</tr>
<tr>
<td>Visitor Bleachers for 500</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Plaza &amp; Walkways</td>
<td>$75,000.00</td>
</tr>
<tr>
<td>Contingency</td>
<td>$512,500.00</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>$5,637,500.00</strong></td>
</tr>
</tbody>
</table>

Table 6: Conceptual Budget: Soccer Stadium  
**Soccer Stadium**

<table>
<thead>
<tr>
<th>Item:</th>
<th>Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove Current Track</td>
<td>$50,000.00</td>
</tr>
<tr>
<td>Soccer Field site work w/ Artificial Turf</td>
<td>$1,000,000.00</td>
</tr>
<tr>
<td>Soccer Bleachers</td>
<td>$150,000.00</td>
</tr>
</tbody>
</table>
### Contingency Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry Connection/Structure</td>
<td>$120,000.00</td>
</tr>
<tr>
<td>Total</td>
<td>$1,320,000.00</td>
</tr>
</tbody>
</table>

#### Table 7: Conceptual Budget: Connector

**Connector**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry Connection/Structure</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Landscaping</td>
<td>$50,000.00</td>
</tr>
<tr>
<td>Contingency</td>
<td>$15,000.00</td>
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<tr>
<td>Total</td>
<td>$165,000.00</td>
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</tbody>
</table>