

1.0 Project Description

Blue Devil Design Build is a student civil engineering team that is qualified to address structural, geotechnical, transportation, water resources, environmental, and construction engineering.

Blue Devil Design Build (BDDDB) designed the State Fair Transit Center in Detroit, Michigan. This transit center will serve as a transportation hub for Metro Detroit, offering transit by both bus and train. The site is located at the southeast corner of the intersection of 8 Mile Road and Woodward Avenue, which held the Michigan State Fair for over a century. The team designed a new transit center building, parking lots and roadways, and restoration of historical structures on the site.

In the Detroit area, transportation options are limited. There is a need for more transportation options that extend into more areas of the community. Currently, the most used public transportation options include DDOT buses and SMART buses. There is a low reliability and access to these buses. Many available routes do not connect the suburbs to neighborhoods in the city. Due to this, the community is disconnected from many job opportunities that could provide economic growth. This also limits exposure to the variety of cultures and ideas in different areas of the community.

1.1 Project Site

The State Fair Transit Center is located at the corner of 8 Mile and Woodward Avenue in Detroit, Michigan. One side of the transit center building is skewed to be parallel to the existing train tracks, which will be incorporated into the project as a new train stop for passengers. There is an existing Amazon warehouse south of the proposed structure that will share the roads around the site. The cattle barn, a historic structure, is located to the west of the Amazon structure and will be restored and used as a community gathering space. South of the cattle barn, the team proposes a park that could also be used for events such as concerts or weddings. The site layout is shown in Figure 1 below.



Figure 1: Site Plan

1.2 Project Components

The transit center will have a hotel to accommodate travelers needing a place to stay. The center features lounges and locker rooms for the bus drivers and train operators. These additions are to respond to the driver shortage that Detroit is experiencing. A main cause of these shortages is the lack of a safe work environment and facilities for the drivers. The transit center also has a centralized security office to create a safe public space for the community. The building features a library to promote education and a visitors center to highlight Detroit's history and local attractions.

1.3 Project Scope

BDDDB worked as a team to address the structural, geotechnical, transportation, water resources, environmental, and construction engineering aspects of the project. The structural lead was responsible for the layout, load analysis, and structural design of the transit center structure. The geotechnical lead focused on analyzing soil borings to find soil properties and design the footings for the transit center structure. The transportation lead designed the parking lots, roadways, pavement sections, and traffic signals. The water resources and environmental lead

conducted an environmental site assessment, created a pipe network, and made a stormwater management plan. The construction lead was responsible for creating a project schedule, estimate, SUE plan, TTC plan, safety plan, and track LEED credits.

2.0 Collaboration of Faculty, Students, and Licensed Professional Engineers

To complete this project, BDDDB has collaborated as a team with guidance from faculty and licensed professional engineers. Throughout the duration of the project, the team met at least once every two weeks with a faculty team advisor. During these meetings, the team and advisor would discuss the status of the project and share feedback. These meetings were imperative to ensure that the team was designing a cohesive project and working together on shared scope items. Each subdiscipline lead also had biweekly meetings with a subdiscipline faculty advisor to focus on individual scope items.

Throughout the project, several presentations were given by the team to share the progress of the project. Four presentations were given to the faculty and followed by valuable questions and feedback for the team. Two poster presentation sessions were held for faculty and an advisory board consisting of licensed professional engineers that also provided feedback for the team. Two industry breakout sessions were also held to allow the students to break into groups based on subdiscipline, present specific subdiscipline progress, and ask questions to licensed professional engineers.

The collaboration of the students, faculty, and licensed engineers was not only beneficial for the project but also for the professional growth of the students. The faculty supported the team by providing further instruction on detailed scope items and helping the students apply what they had learned in classes. The industry professionals were able to help the team make real world connections to the work done for the project and share knowledge of what is practical in the industry regarding constructability, material availability, and economic influences.

Many faculty members and industry professionals involved in the project are licensed professional engineers. They were able to share the importance of licensure and the steps required for that achievement. To start the path to licensure, two BDDDB students have passed the FE exam and one of those two has also passed the PE exam. The other three team members are planning on taking the FE exam in the summer of 2024. All team members are working towards gaining the practical experience required for licensure.

3.0 Protection of Health, Safety, and Welfare of the Public

The State Fair Transit Center will have a significant positive impact on the community of Detroit. The center will provide new jobs and increase access to other jobs in the area by providing additional means of transportation to the area. Previously, the community did not have many options regarding public transportation. This will allow the community the freedom to choose the means of transportation that will best suit their wants and needs.

The project will preserve and feature the history of the site by incorporating parts of the historical state fair structures. The cattle barn will be kept and used as a community gathering space to bring the community together. A portion of the coliseum will also be kept and used as a focal point for a more open community gathering space. Both structures will be inspected for structural repairs and restored with their historical significance in mind. This space will be incorporated as a local park for public use. Along with being a public space, the park could also host events such as weddings, concerts, and other gatherings.

The site is currently empty space that will be transformed into a buzzing public space that will be utilized by community residents and visitors. Security based out of the transit center building will be on site at all times to ensure that the site remains a safe gathering space.

Inside the transit center, there will be a visitors center with information about Detroit's history and local attractions. A ticket machine will be available for purchasing tickets to the nearby

Detroit Zoo. To promote education and access to reading materials, there will also be a library in the transit center that will serve as an extension of the Detroit library.

The team's proposed transit center will provide numerous economic opportunities for the surrounding area including the ability for people who are not local to acquire jobs in the neighborhood. Examples of local jobs are at the neighboring Meijer and Amazon facilities. The transit center also allows for the local community to get jobs that they would not have been able to before due to this new ability to commute across the city and neighboring cities with the addition of the Amtrak station. Both of these create an economic boost for the community surrounding the transit center.

The team analyzed the project to be conscious of the global, environmental, societal, and economic impacts of the project. Potential impacts were kept in mind during all stages of the project to best serve the public. The global impact of the project is providing transportation access, which is an issue around the world. The societal impact is creating job opportunities and restoring a historical Detroit site. The environmental impact includes implementing Low Impact Developments, such as a green roof, to minimize the impact on the environment. The economic impact of the project is the creation of jobs and local sourcing of materials. These four considerations make the project more sustainable for the Metro Detroit community.

4.0 Multi-Discipline and Allied Profession Participation

This project involved multiple civil engineering subdisciplines. Five civil engineering students composed the group; one student being the lead for structural, geotechnical, transportation, water resources/environmental, and construction engineering. The team had to work together within their specialized areas to create a cohesive project. Communication and organization were the focus of the group to be successful. The subdisciplines overlapped for certain scope items, providing further opportunity to work together. The structural lead had to find the column loads and give those to the geotechnical lead, who then designed the footings. The transportation and water resources/environmental leads had to work together on the site layout and drainage plan to

make sure that the roadway and parking lot layouts worked with the drainage system. The transportation lead also worked with the construction lead to develop the temporary traffic control plan to maintain traffic for the redesign of the new intersection and traffic signal on the site. The construction lead had to work with each subdiscipline lead to get information for the estimate, LEED sustainability plan, and schedule. These are just a few examples of how the team had to work together and combine knowledge from each civil engineering subdiscipline.

5.0 Knowledge and Skills Gained

This project was a valuable learning experience for the BDDDB team. The two semester project required students to collaborate together, work with faculty, and utilize constructive criticism. This project helped the team develop skills such as critical thinking. The team had to consider the effects of design choices on the project itself, the work of other subdiscipline leads, and the community. The students also learned strong communication skills. With the large number of components, it was crucial for the team to communicate among each other to keep the project organized, cohesive, and on schedule. Along with communicating as a team, BDDDB had several presentations to communicate the team's work to faculty, industry professionals, and fellow students. It was important that the team could communicate the project's progress in a clear and concise manner. The team also developed empathy through this project. An important part of the beginning of the project was researching the site and the Detroit community to understand the history and needs of the community. This allowed BDDDB to best meet the needs of the community through the State Fair Transit Center.

The team also gained technical skills through this project. This capstone project allowed the team to use what has been learned in classes and put it into a real world use. Many subdisciplines had to learn more and expand on what was taught in classes to fit the scope of the project. The collaboration of the faculty and industry professionals was imperative for this. The subdiscipline faculty advisors worked closely with students to fill the gaps of knowledge and help transfer that knowledge to real world situations.

Local, state, and national codes were followed as necessary to keep the project within code. Some of these codes are AISC, ASCE, AASHTO, MDOT, FHWA, and OSHA. The team also had to work with a range of software. Many software programs utilized by the teams are used in the industry. This helped prepare the team for working in the industry. Some of the software used includes:

- Revit
- AutoCAD
- Mathcad
- Primavera P6
- RAM Structural System
- Acrobat
- MDOT TDMS
- EPA SWMM
- StormCAD
- MS Office
- Illustrator