

IOWA STATE UNIVERSITY

Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

ISU Transportation Facility Modernization

Nicholas Stanley ^a, Sean Hosch ^b, Jeremy Cox ^c, Patrick Pogwizd ^d, Michael Anderson ^{e*} and Jacek A. Koziel ^{f*}

^a Industrial Technology, ABE, ISU, nstanley@iastate.edu

^b Industrial Technology, ABE, ISU, smhosch@iastate.edu

^c Industrial Technology, ABE, ISU, jacox@iastate.edu

^d Industrial Technology, ABE, ISU, ppogwizd@iastate.edu

^e Dept. of Agricultural and Biosystems Engineering, ISU, 2358 Elings Hall, Ames, IA 50011, mea1@iastate.edu, 515-294-2129

^f Dept. of Agricultural and Biosystems Engineering, ISU, 4350 Elings Hall, Ames, IA 50011, koziel@iastate.edu, 515-294-4206

*Course instructors and corresponding authors.

Client: ISU Transportation Services, 919 Haber Road, Ames, IA, Zip-50011, company website

Contact(s):

- Kathy Wellik, Director, kwellik@iastate.edu, (515)-294-1657
- Butch Hansen, Shop Manager, butchh@iastate.edu, (515)-294-7552

1 Problem Statement

Problem Statement

Our client is the Iowa State Transportation Services. They rent out and maintain vehicles for use in the University and university-related travel, excluding CyRide buses.

- The Transportation Services shop is becoming outdated with both the building's structure and the available resources and technology. The shop needs to be redesigned so that it can serve a more significant number of cars at one time, with a focus on the newer electric vehicles.
- In terms of repairing their cars in between rentals, the existing layout wastes a lot of time. They have no potential to enhance their process in terms of speeding up time and being more efficient with vehicle turnaround, given their available space.
- They have achieved their full capacity in the existing space and require a new structure that will provide them with more space. This gives them greater flexibility in their work process and allows them to reduce the time it takes for each vehicle to be ready to go on a return. They also require a more substantial capacity to interact more efficiently with one another in the new location.
- One of the few unknowns we still have regarding this project is the cost and how much they are willing or able to spend to complete the new facility. The client has not specified what the University is willing to spend on their new shop, so we are still working on a more specific budget.

ISU Transportation is experiencing issues such as lack of space and available technology, and these are struggles that many other companies share as well. After taking a tour of Karl Chevrolet in Ankeny, Iowa, we were able to see what a well-developed and spaced-out shop looked like, which was highly beneficial. After walking through such a well-designed shop, we realized that some issues or valuable additions from Karl's could exist in any shop and the best thing we can do is plan projects our client will take on.

Business Case

ISU Transportation Services need a more effective method of vehicle maintenance. This is because they currently have too many automobiles for the space available. Because of the overabundance of automobiles, ISU Transportation Services staff run out of materials, space, and parking too often. The personnel are doing everything they can with their space, but they need additional space to ensure they can be more efficient. This will provide technicians with additional areas to work on vehicles, more places to store components, and a far more simplified approach for working on automobiles effectively. Other variables such as fueling stations, wash bays, and storage must be considered for the technicians to work as effectively as possible. These elements must be in such a manner that they do not obstruct the main building or disrupt the main building process flow for the technicians to work as effectively as possible, these elements must be in such a manner that they do not obstruct the main building or disrupt the flow throughout the main shop.

2. MAIN OBJECTIVE

Fixing the root cause issues for this establishment includes a ground-up redesign and a complete overhaul of the existing facility. The overall goal for this project is to modernize, and this includes tooling, infrastructure, and vehicle handling systems.

- Research that was conducted included onsite measurements, inventory of current tooling methods and procedures, and verbal feedback on what needs to change.
- Some of the biggest tangible improvements come within the realm of earth-friendly and sustainable changes. With the automotive landscape heading towards electrification, the new facility will be designed with this in mind. This alone could cut upwards of 100% of pollutants and emissions in the future.
- When talking about tooling, we have collected an objective list that will help add what is needed in the facility. This will be a cost-effective change that will allow worker efficiency to increase by 50%.
- Finally, one huge goal for the ISU transportation team was to be located centrally, all together, as a team to accomplish tasks and improve team communication and efficiency.
- **Main Objective(s) and Specific Objectives**
 - The main design objective is to increase productivity and modernize the facility to meet the growing needs of Iowa State University Transportation.
 - (1) Design a new floor plan that meets all client criteria and constraints:
 - Client criteria #1: Larger space for use
 - Client criteria #2: Two Floor Design
 - Client criteria #3: More Easily climate controlled.
 - Client criteria #4: Within the new shop, provide office space.
 - Constraint #1: Use existing facility grounds
 - Constraint #2: Centrally locate employees
 - Constraint #3: Remain open and functional during construction

- **Rationale**
 - Upon project completion, the client will be able to:
 - More effectively communicate as a team
 - Work at twice the efficiency in the shop portion as before.
 - Handle the next generation of automobile technology.
 - There will be a significant increase in storage capacity.
- **Project Scope**
 - Boundaries of the project included the following:
 - Use existing facility grounds (Land Constraints)
 - Include a touchless carwash system.
 - Ensure all employees are centrally located (Team efficiency)
 - Include storage space for vehicle accessories.
 - 1 Building Design.
 - Taller Garage Doors to accommodate more vehicles.
 - Upgrade the existing fuel pumps

3 METHODS/APPROACH

- A. **Methods/Approach:** We had to start with a meeting with the client to gather what they wanted out of the project. Moving on from there, we got access to both the physical-digital drawings of their current facility to inform our final design and worked together to complete the current layout for the floor plan. The shop's flow has been established, and the shop manager will have an office in the shop to keep an eye on the day-to-day operations and make modifications to the shop floor while maintaining the existing level of efficiency once the building transitions.
- **Data collection:** Most of the data collection for this project was physical measurements and subjective data from the workers at the Transportation facility on what they had problems with while working.
 - **Skills:** We used a lot of the things we learned in the AutoCAD and Facility Planning courses taken at Iowa State. The group's diligence was instrumental in getting as far as we have, plus our weekly meetings were a terrific way of making sure everyone was always on the same page. To enhance efficiency, we needed to identify the company's weak spots using time studies and line balancing techniques associated with Lean Practices.
 - **Solutions:** Our solution has amounted to a floor, and wall plan for the newly requested facility, the measure of how successful our solution is has come from the client directly giving us feedback on our plans for the new facility and whether they liked our proposal.
 - **Organization:** We met every week throughout the two semesters we worked on this project, not just with the group but also with the professors and the clients. We reached the milestones of collecting data from the client through a survey and collecting the measurements for the land and space we were able to use. Each of our group members completed the tasks promptly, with only the minor setback of having issues with gathering the measuring equipment from the University.

4 RESULTS

Results/Deliverables:

- Project deliverables are going to look like CAD drawings and a 3D model of the proposed layout. We are hoping to have a few detailed drawings that give the client a clear understanding of what their new facility is going to solve for them. Our team developed a workflow diagram to present to the client to assist in the reasoning behind our decisions.

- Our project deliverables should exceed our clients' expectations because we will give them more than just the CAD drawings they are expecting. The drawings and files give the client a chance to see every change we made and how we incorporated all their needs and requests.
- The project was completed on time, and the client was presented with all the information they were expecting. The client plans to analyze our innovative design in the Spring of 2022 with hopes of having a built and functioning shop by the fall of 2026.

Recommendations

- *Focus on continuous improvement.*
- *Implement essential Lean Practices to utilize the building capabilities fully.*
- *Develop and maintain detailed records.*
- *Take the designs to the Ames Facility planner*

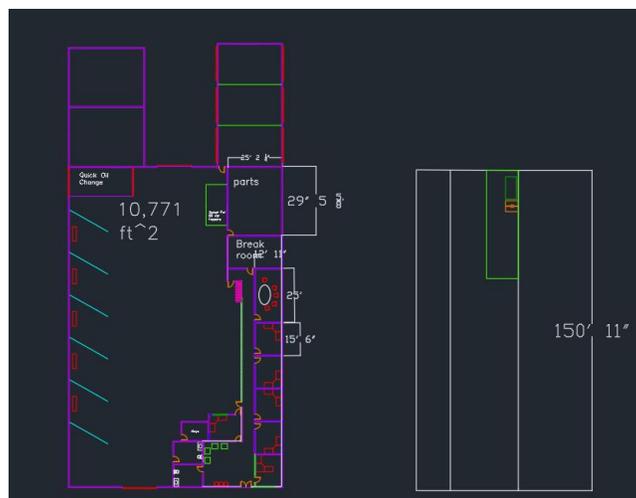
5. BROADER OPPORTUNITY STATEMENT

This project focuses on improving the workspace and improving the quality of life for every employee involved. The average person wishes to be comfortable at work, so this would appeal to all types of people. It is also important to note that we tried to include all types of employees in our discussions to ensure everyone will get what they need in the future, no matter their position. Our project helps with the workplace safety of the facility we are redesigning. A newer, more modern, open space will allow the entire staff to move more freely and have less risk of being struck by moving vehicles and will allow all the members who work there to keep their jobs and facilitate expansion in the future.

Other similar problems would be experienced all over the manufacturing industry when they begin to expand faster than they were expecting and will need a more extensive facility to continue to thrive in the market, continue to do jobs, and improve the economy. Most industries that operate in brick space could use a similar solution to ours, but not the exact same as the design of the building. Specifically, other car dealerships and others in the same field, such as Karl Chevrolet, could use the same tactics, like building an entirely new facility. They took a different solution and ended up with a confusing building layout for new hires and most ordinary people.

Cost is one of the things that we did not get significantly in-depth with. We were told to be moderate and try not to get over our heads since the University will be covering the cost of construction. This design was more focused on the employees and their overall productivity. This is because they are a university facility and are not concerned with profits or gains but the experience of the customer.

6. TRANSPORTATION GROUP 3: MAIN FACILITY FLOOR PLAN



7 REFERENCES

- <https://www.transportation.iastate.edu/>
- Google Maps - 919 Haber Rd Ames, Iowa 50014
- Facility Drawings obtained from the University
- Karl Chevrolet
https://www.karlchevrolet.com/?utm_source=google&utm_medium=organic&utm_campaign=gmb-website

8 APPENDIXES

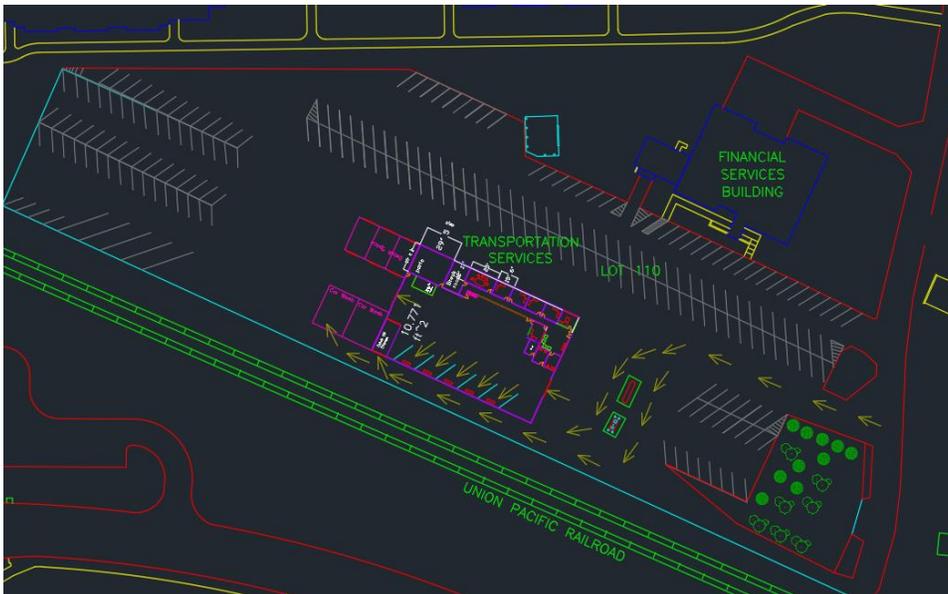


Figure 1. Flow Charts Showing Flow of Operation

The final presented floor plan for the new facility for Iowa State transportation is how in Figure 1. Office space is on the right of the building, and garage space is on the left. The entire building is 206ft by 100 ft. The top left is 2 touchless car washes, and the top right is three detail bays. There is a storage space (pictured on the right) for truck toppers and other parts that will be above the office spaces.

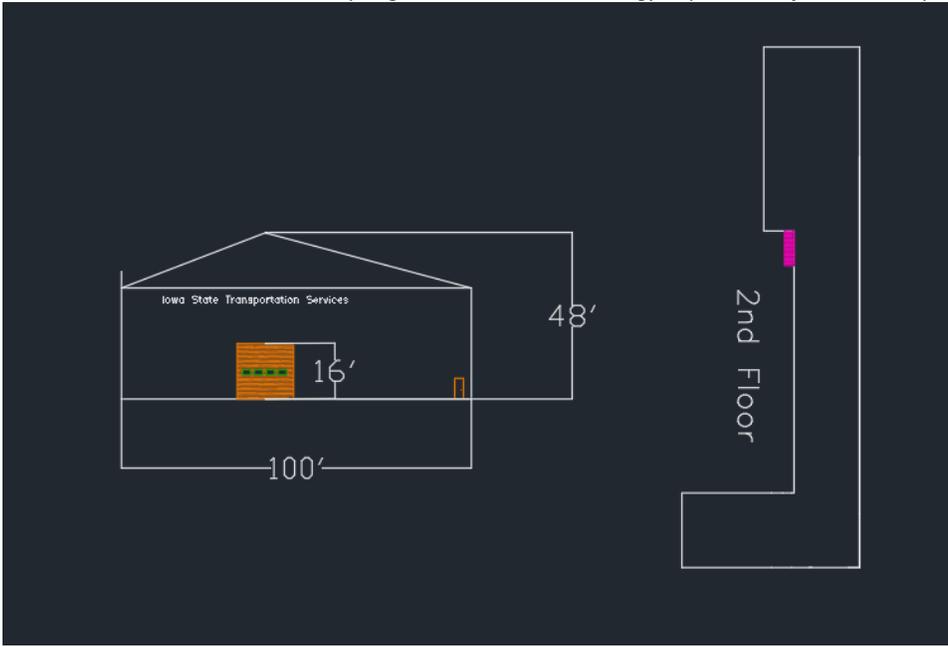


Figure 2. AutoCAD Drawings – New Building Design