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Driving Simulators as Educational Outreach for Freight Transportation

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1 Project Description

1.1 Project Overview and Objectives

The purpose of this project is to enhance outreach efforts for middle and high school student groups for freight career awareness by using truck driving simulators. While many STEM outreach programs and college curricula centered on transportation topics focus on the careers of engineers and planners, the roles of front-line workforce of our freight systems (drivers, pilots, and operators) are rarely highlighted. Yet, students may better connect with the impacts of engineering and planning work by witnessing how transportation projects impact front-line workers like truck drivers. Moreover, the trucking industry reports workforce shortages as a top critical issue on annual industry reports. Workforce development, for engineers and planners as well as drivers and pilots (for waterway navigation), is a critical issue that can be addressed in part through specialized outreach initiatives. This project developed an outreach program designed around the popularity and use of driving simulators to enhance outreach efforts for middle and high school student groups for freight career awareness. Many universities and, more recently, public libraries and workforce centers, allow public access to driving simulators. To this effect, more than twenty-five middle school girls through the University of Arkansas sponsored summer camp called, GirlTREC, participated in our driving simulator outreach program. GirlTREC is sponsored by the Maritime Transportation Research and Education Center (MarTREC) which is a US Department of Transportation Tier 1 University Transportation Center.

This work shares the lesson plans and lessons learned in engaging middle school students in driving simulator-based activities. This can be a challenging age for introducing transportation topics and driving simulators, as students are not drivers themselves and typically are unaware of transportation system functions. The central goals of the lesson plans are for students to be able to list transportation careers, identify transportation system challenges, and describe the benefits of transportation systems for everyday life. Active learning approaches included in the lesson plans include brainstorming transportation industry careers and reasons for the current shortage of truck drivers, operating four driving simulators including a truck, forklift, excavator, and car. Despite the difficulty in completing some driving tasks on the simulator, e.g., size and scale of equipment relative to student physiques and lack of knowledge on vehicle operations, the girls noted increased awareness of freight careers as well as an appreciation for the transportation industry. Ultimately, this developed outreach module can be used by any university and/or workforce center equipped with a driving simulator to organize their own outreach events.

The specific objectives of this project are to:

I. **Develop an educational learning module for middle/high school and college students to introduce transportation engineering concepts of design and planning as they relate to freight transportation, and**

II. **Implement the learning module in a summer program for the City of Fayetteville public library in coordination with their Center for Innovation as well as at future GirlTREC events hosted by MarTREC.**

1.2 Motivation and Contribution

In relation to the objectives of the MarTREC research program, this project contributes to the areas of maritime and multimodal transportation education and workforce development activities by (1) developing instructional modules and case studies (2) developing resource banks of pertinent data sources, publications, organizations, and educational programs.

The goal of this project is to develop lesson plans targeting workforce development for multimodal freight transportation careers. The stakeholders include the City of Fayetteville public library system and the US Army Corp of Engineers. The City of Fayetteville recently purchased a driving simulator and expressed great interest in working with the research team on using the simulator for educational and vocational outreach. A critical need is fulfilled through this project for the City with broader impacts for faculty and other simulator owners who wish to expand the use of their simulators from research to education. The modules could also be extended to other types of simulators such as that used by the USACE to train navigation pilots in Vicksburg, MS. Through these efforts, the project advance students awareness of careers in freight transportation as planners, engineers, and system operators.

This work produces lesson plans, and through the implementation of the plans at a day-long outreach program, generate increased awareness of freight transportation careers. All learning modules will be made publicly available through the PIs website, the MarTREC website, and the University of Arkansas ScholarWorks research repository. The outreach programs were conducted through the City of Fayetteville public library system and the MarTREC summer programs in 2022. The target audiences were middle and high school students, with preference for participation of minority students. The partnership with the City of Fayetteville library has a strong history of providing services to the community and implementing educational programs for students. They have expressed an eagerness to adopt programs that would use the simulator.

1.3 Background

The success of the transportation industry depends on recruitment and employee retention. To achieve this, it is important to develop an interest in young people (Sherry et al., 2016). The use of driving simulators is one of the latest strategies of recruitment (Espié et al., 2005; Stoesz, 2022). Simulators used for training and education show many benefits, including reduced risk, reproducibility of scenarios, time savings, and lower expenses for training (Espié et al., 2005). Driving simulators are becoming more affordable and many universities are purchasing the technology for research purposes. While many labs may use the simulators for outreach simply by providing a lab tour, these impressive technology systems can be more impactful if used within active learning programs for outreach. This project provides a unique resource that is not currently available to researchers and educators while alleviating the need for them to develop their own educational tools. The project contributes to the multimodal transportation body of knowledge by advancing methods for workforce development. Uniquely, the work aims to attract and bring awareness to engineering and planning as well as the front-line workforce including truck drivers, dispatchers, and managers.

1.3.1 Driving Simulators

The City of Fayetteville recently completed an 82,500 square foot expansion of its library facilities to include a children and teen library, multi-purpose community space, teaching kitchen, and Center for

Innovation[1]. The Center for Innovation includes recording and photography studios, a simulation lab, virtual reality lab, fabrication, and robotics labs, and editing suites. Among the technology additions, the Expansion project includes a truck driving simulator (Figure 1). The simulator, EF-Truck NG, is made by Simulator Systems International and is full motion (3-axis) with OEM truck cab components, an ultra-wide screen system, and has automatic and manual (multi-speed synchronized) transmissions[2]. The accompanying software contains ready-to-go lessons and the possibility of creating user-defined scenarios. Setting such as time of day, weather, and traffic conditions can be set by the user.

Figure 1. EF-Truck full motion driving simulator available at the City of Fayetteville Library[2]

The purpose of the simulator within the Center for Innovation is to allow computer-based training for Commercial Driver's License (CDL) requirements. Many truck driving schools around the U.S. operate similar simulators for training. During the 2020 Covid-19 pandemic there was discussion among regulators of allowing simulators to be used for CDL requirements to alleviate the need for in-person licensing tests[3]. In addition to the availability of truck driving simulators through commercial driving schools and technical colleges, many research universities now own driving simulators. While these are mostly used for research studies, they can also be leveraged for educational outreach. There is strong rationale for developing outreach programs that use driving simulators, as these technologies are becoming ubiquitous.

[1] City of Fayetteville Library Expansion Project details: https://www.faylibfoundation.org/expansion-project/
[2] Simulator Systems International EF Trucking NG model documentation: https://www.simulatorsystems.com/ef-truck
[3] Transportation Research Board Webinar "Keep on Truckin'-Using Simulators for CDL Testing During COVID-19": https://www.nationalacademies.org/event/11-06-2020/trb-webinar-keep-on-truckin-using-simulators-for-cdl-testing-during-covid-19

1.3.2 Workforce Challenges for Freight Trucking

The trucking industry has suffered from driver shortages and high turnover over the last several decades. This situation was further exacerbated during the COVID-19 with trucking employment falling by 6% in March and April, 2020 (Ansell & Mullins, 2021). This has far reaching supply chain impacts since trucks deliver nearly 70% of all freight in the US (CareerOneStop, 2020). Some of the industry issues can be addressed through re-examining the potential labor pool through targeted attraction, training, and retention programs for truck drivers (O'Brien et al. 2020; Robinson et al., 2019). There is also a significant shift in what it may mean to be a truck driver given the future of driving automation. There is a strong current moving towards digitization of transportation services and this is spurring re-skilling needs for truck drivers. . The digitization of the transportation services evolving in the truck industry is one of the major causes of these shortages. For example, Hours of Service (HOS) logging used to be done by paper logbook. But since 2018, electronic logbooks are mandatory. Now drivers must learn data entry and data sharing protocols for these electronic devices. Moreover, many trucks are now equipped with advanced driver assistance technologies that require additional technical skills. Beyond drivers, the freight trucking industry employs dispatchers, supervisors, logisticians, etc. Each of these groups must advance in their technical skills to keep pace with digitization and automation. Additional factors causing a shortage of truck drivers include misinformed public perception of the truck driving profession, low wages, low job satisfaction among others (O'Brien et al., 2020; Robinson & Bentley, 2019).

Recruitment of qualified and highly skilled personnel is both expensive and time-consuming. The cost of recruiting a driver is approximately 30% of the truck driver's annual salary (Mumphrey, 2020). Workforce development for trucking and, more generally, for freight careers takes place after K-12 schooling at technical workforce centers, community colleges, and carrier programs. However, research shows that early introduction to transportation and freight careers, especially in trucking, can help expand workforce markets and work to attract underrepresented groups including women (Sherry et al., 2016).

In Arkansas, an organization called the Associated Industries of Arkansas is tackling career awareness for the trucking profession. They created the 'Be Pro, Be Proud' workforce development initiative that features a 53-foot semi-trailer which houses a dozen driving simulator stations, a locomotive driving simulator, and construction equipment (backhoe, excavator) simulators[4]. The trailer visits schools and community events and touts serving over 98,700 students since Fall 2020. The goal of the initiative is to attract students to skilled jobs as truck drivers and diesel mechanics, fields which have experienced labor pool shortages. Georgia, Kentucky, North Carolina, Tennessee, and New Mexico either have or are developing similar programs.

The research work built on these workforce development efforts by extending outreach to student as early as middle school and by creating a series of learning modules that faculty and other driving simulator owners can use for freight career awareness outreach events.

[4] Transport Topics, Arkansas's Mobile Job Simulator Promotes Industry, Online December 7th, 2020: https://www.ttnews.com/articles/arkansas-mobile-job-simulator-promotes-industry

2 Methodological Approach

The methodology presented in this section consists of three main steps: i) Simulator Training; ii) Lesson Plan Design, and iii) Camp Activity.

2.1 Simulator Training

To effectively incorporate a driving simulator into future lesson plans, it is essential to have a working knowledge of the system and to possess the skill to operate the simulator. By working with the driving simulators at the Fayetteville Public Library, lessons were taken to operate the simulators and discover their unique features, which could prove beneficial to future students in the program. The simulators have programmed lessons that cover the basics of truck driving, such as shifting gears, and also allow for "free driving". However, since the lessons can take several hours to complete, it may not be possible for camp participants to go through them in their entirety. Therefore, it was necessary to identify and gather the most important information and operating skills for future instruction without the built-in lessons.

Figure 1 shows the primary truck driving simulator used for practice driving, which enables users to customize various parameters such as the size of the truck, type of transmission, weather conditions, traffic density, and road type (urban or rural) for their free driving experience. The simulator is also capable of programming extreme events, such as tire blowouts or other maintenance issues. The screens located in front of the simulator display the road ahead, but can be manually switched to show the side mirrors or the view alongside the truck. Additionally, the simulator produces audio that simulates the environment being depicted, including sounds of horns, wind, and engine revving. Another notable feature of this truck driving simulator is that the seat can move, reclining as the truck ascends a hill or jerking when braking is too abrupt or when the truck collides with an object.

In addition to the truck driving simulator, practice sessions were also conducted using the standard car and forklift simulators, as shown in Figures 2 and 3, respectively. However, the curriculum design was mainly focused on the truck driving simulator, resulting in less practice with these two simulators. These simulators were intended to provide supplementary experiences for participants while others were using the truck driving simulator. Both simulators have a similar programming layout, allowing users to "free drive" or complete pre-programmed lessons or tests. While there was no physical motion in either of these simulators, they still included simulated environmental sounds and visuals of what the driver or operator would see. The car simulator functioned similarly to the truck simulator, requiring the operator to sit in a chair, use foot pedals, and steer using the wheel. In contrast, the forklift simulator utilized virtual reality technology, necessitating the operator to wear a virtual reality headset while seated in the operator's chair to view the necessary visuals. This simulator functioned in a more unique manner, as all controls, except the steering wheel, were operated using levers or buttons located on the right armrest. The forklift environments were limited to loading areas where the forklift had to maneuver through cones and transport freight. The screen located in front of the forklift simulator displayed precisely what

the operator was seeing through the headset, providing observers with an understanding of the tasks accomplished and the conditions experienced by the operator.

Figure 2. EF-Car driving simulator available at the City of Fayetteville Library[5]

[5] Exail's EF – Car/ Car Driving Simulator model documentation: https://www.ecagroup.com/en/solutions/ef-car-driving-simulator

Figure 3. CB Forklift simulator available at the City of Fayetteville Library[6]

Apart from practicing on the simulators, research was done on ways to introduce driving simulators to middle and high school students. An Arkansas-based company called "Be Pro Be Proud" was examined, which travels to various cities to educate students about technical and skilled work, such as commercial driving, using a variety of simulators for hands-on experience. An interview with a lead instructor at "Be Pro Be Proud" was conducted to gain insight into teaching middle school students about careers and simulator usage. Observations were also made on how workers interacted with students as they experienced the simulators for the first time. The company's approach involves gathering students together to briefly discuss the sixteen careers they promote and how to enter the workforce in those areas. The students are then given the opportunity to explore the variety of simulators and machines in their truck, which contains all the simulators and travels with them to each school, as shown in Figure 4. Although there are a few staff members available to answer questions during this time, it is mostly an unstructured time for students to try the careers that interest them the most. "Be Pro Be Proud" also connects participants with sponsors who can help fund the necessary training or education to enter any of these sixteen careers. Due to the value this company offers students in resources, experiences, and information, they are in high demand, going on tours across the state and booked out over a year ahead of time.

[6] Standalone Sit Down CB Forklift Simulator model documentation: https://forklift-simulator.com/standalone-sit-down-cb-forklift-simulator/

Figure 4. Be Pro Be Proud Truck

Furthermore, the training time spent on the driving simulator provided valuable insight into the available space for the outreach program. This was crucial information to consider while developing lesson plans, as limitations or opportunities presented by the space or setting could impact the program's size, feasibility of certain activities, and generate new ideas for optimizing the program time. Additionally, this training time facilitated further collaboration with the Fayetteville Public Library staff, who shared their valuable suggestions and recommendations regarding program logistics, space utilization, and troubleshooting issues with the simulators.

During the program, participants had the opportunity to practice driving standard cars, operating forklifts, and excavators using simulators. While the camp was primarily focused on using the truck driving simulator, participants understood the benefits of simulators and their relevance to other careers in transportation.

2.2 Lesson Plan Design

This work produced five learning plans implemented at the summer program using active learning strategies in increasing awareness of freight transportation careers. All of the lessons were created with middle school and high school students in mind, but they may be adapted to fit diverse age groups. Many of these students are not drivers and can also have a hard time understanding the impacts of engineers and planners on their daily life. Therefore, base level knowledge must be taught before going in depth in any content area or activity. Each module includes: learning objectives, a short overview presentation slide deck, a series of activity-based learning tasks, and a closing/debrief handout, group activity, and/or presentation. With the different amounts of time allotted for each of the five modules, the outreach program is anticipated to be finished in 2.5 hours, e.g., an approximate morning or afternoon session for a typical summer camp program. While the first lesson provides a

stronger emphasis on background knowledge, the four successive lessons build upon the knowledge or skills taught in the preceding lesson(s). A trial program was hosted in July 2022 with the participation of 25 middle school girls.

***Table 1. Summary of the Five Created Lesson Plans*.**

Lesson	Learning Objective *Students should be able to...*	Activity	Duration (mins)
1	Explain the current state of the freight transportation industry and identify solutions to reduce the shortage's impact.	Creation of a brainstorm web of causes and potential solutions of the driver shortage.	25
2	Identify nine separate transportation careers and two aspects that make each career unique.	Creation of a one-minute paper on each career to summarize understanding.	25
3	Demonstrate beginner level driving skills that a commercial truck driver must possess.	Completion of driving task on truck driving simulator without crashing or breaking a law.	40
4	Identify difficult situations freight drivers experience and develop ways that engineers and planners could positively influence these situations.	Case study investigation and written responses to handle the scenarios.	28
5	Communicate an understanding of one transportation career in-depth and how to enter that field.	Creating and presenting a promotional poster on how to become a professional in the transportation career of choice.	32

2.2.1 Module 1: "What's the Shortage? What's the Solution?"

By the end of this module, participants should be able **to explain the current state of the freight transportation industry and identify solutions to reduce the shortage's impact**. Participants are given a general overview of the outreach program which involves a short two-minute video on the transportation industry. Important information and facts learned from the video such as the various careers in transportation and the function of freight transportation are utilized as the basis for brainstorming and exchanging ideas on the causes and solutions of the truck driver shortage. The participants are then asked to brainstorm using a word web, in small groups, possible solutions for the issues raised. Participants then attempt to link transportation career suggestions offered by the instructor to the suggested solutions. As an example, during the 2022 session, participants brainstormed causes such as low pay, being away from home, and not seeing family as reasons for the shortage to which participants suggested better scheduling (logistics) as a possible solution. This module is approximately 20 minutes.

2.2.2 Module 2: "What Careers Exist in Transportation?"

By the end of this module, participants should be able **to identify three separate transportation careers and two aspects that make each career unique.** The first activity is a one-minute brainstorming challenge for participants who can come up with the most transportation-related occupations. These careers identified are shared between the participants. A career 'BINGO' game is used in the second part of the lesson. The goal of the game is for participants to identify nine transportation careers based on clues provided by the instructor. Careers include logisticians, mechanical and automotive engineers, dispatchers, freight loaders, software engineers, transportation engineers, data analysts, diesel mechanics, and warehouse managers. The details include a brief description of the career, median annual salary, required skillset, education or experience to generally work in that field. The driving career is focused on through a video and further discussion. One of the nine presentation slides is shown in Figure 5 below. This module is approximately 25 minutes.

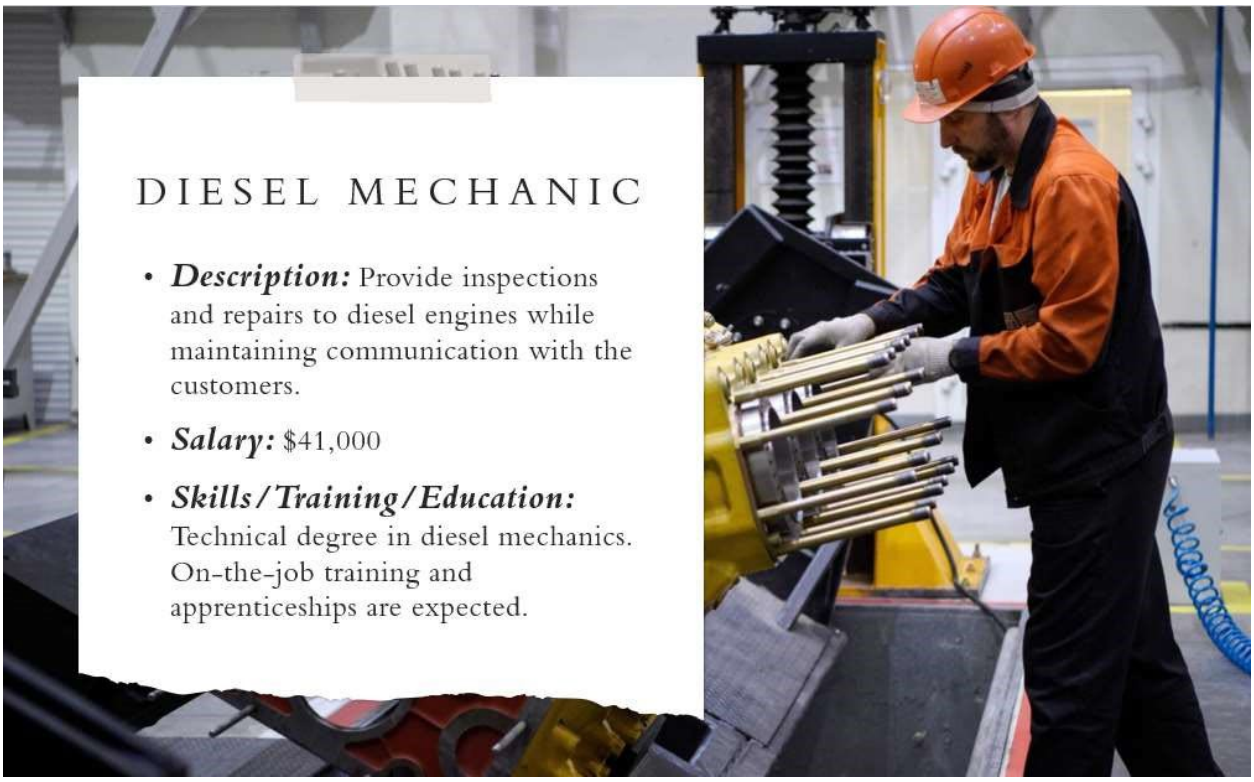

Figure 5. Example of Career BINGO Slide for Diesel Mechanics.

2.2.3 Module 3: "What's it Like to be a Truck Driver?"

By the end of this module participants should be able **to demonstrate beginner level driving skills that a commercial truck driver must possess.** This lesson utilizes the driving simulators to enable participants get hands-on experience of being truck drivers. Basic operations of a truck or car include gas and brake pedals, gears, steering, and headlights. The use of the simulator is first demonstrated by the instructor (Figure 6). Participants are split up into smaller groups and are allowed to attempt using the simulators on their own with one student as the operator and the others as observers. Scenarios based on weather, traffic, other driving conditions can be adjusted. Once every participant has had a chance to use a simulator, the participants switch between the simulators. This module's time is dependent on the

number of simulators available. For a group of 25 students with access to four simulators, the activity took approximately 40 minutes.

Figure 6. (Left) Demonstration of excavator operation, (Middle) Participant using the Virtual Reality forklift simulator, (Right) Participant using truck driving simulator.

2.2.4 Module 4: "What Can WE do to Make it Better?"

By the end of this module participants should be able **to identify difficult situations freight drivers experience and develop ways that engineers and planners could contribute positive outcomes**. This lesson builds up from the lesson on driving simulators where the participants have a broader understanding of driving challenges. Participants are asked to think of an example of a difficult driving situation, e.g., "I think drivers would struggle with.... Because when I drove, I…" and create a case study poster. Then as a peripatetic exercise, participants rotate the case study poster every 90 seconds to generate solutions that an engineer or planner could address. Examples from the 2022 session included topics such as: (1) weather, (2) driver availability, (3) angry customers, (4) vehicle maintenance, (5) utilizing multiple drivers, (6) environmental concerns, (7) warehouse delays, (8) traffic, (9) truck parking, and (10) trucker health. While this is a non-exhaustive list of potential issues faced daily by workers in the transportation industry, it is designed to show a variety of problems that require unique solutions. This module is approximately 25 minutes.

2.2.5 Module 5: "How Can I Help?"

By the end of this module participants should be able **to design a step-by-step process on how to transition from camp to the first day in the role of a transportation career of choice.** Participants will create and present a promotional poster on how to become a professional in the transportation career of choice (Figure 7). They are then given materials to make the poster to aid their presentation, like poster paper and markers. Participants are then free to work on researching, poster design, and script writing. Participants can complete this activity individually or with a partner. This activity serves as a debrief of the session. It's important for participants in the outreach program to leave with a sense of ease in discussing with their peers about various careers and aspects of the transportation industry. This positive word-of-mouth can help with the recruitment and promotion of vital transportation careers, such as freight drivers, while also improving the broader societal understanding of their significance for the US economy and culture. This module is approximately 30 minutes and concludes the outreach program.

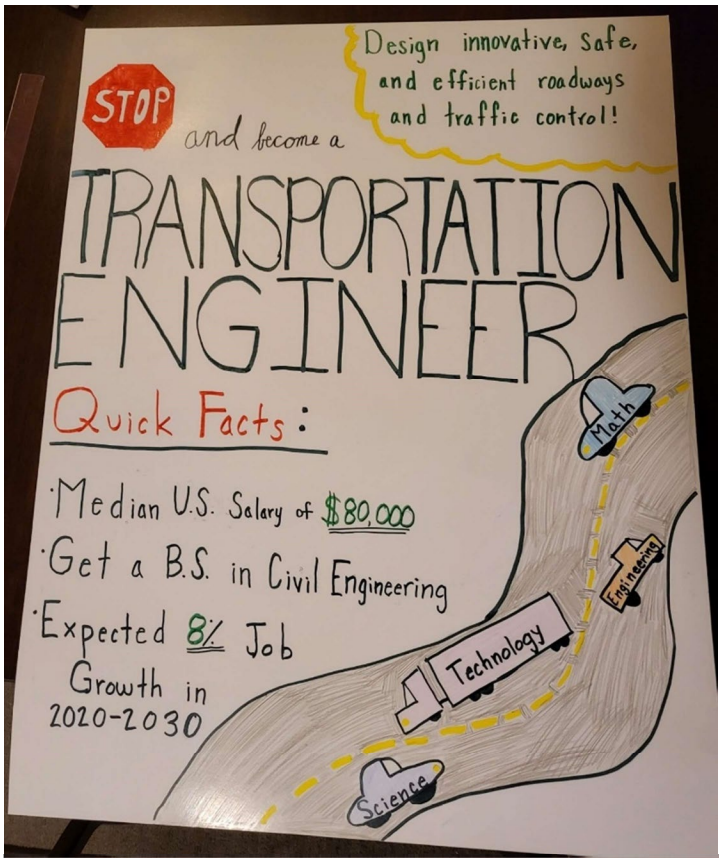

Figure 7. Example of career poster.

2.2.6 Created Resources

All the necessary resources for each lesson have been developed and are included into the lesson plans. Program instructors have the flexibility to modify the PowerPoint presentation that encompasses all the lessons. Worksheets and handouts such as the "1-Minute Paper" for career BINGO, case studies, and the reflection worksheet on the use of driving simulators, are also provided to participants. Instructor resources include a driving simulator conditions list, sample causes and statistics for the freight driver shortage, career BINGO grid key, career BINGO prompts, and an example poster and elevator pitch script for the final lesson.

Each lesson plan contains a list of additional materials or set-up required that are not provided. This includes items like presenting screens, driving simulators, pencils, internet-enabled devices, and paper. Instructors have access to the quantity needed for each material, along with notes or suggestions for alternative materials. Although the lessons are designed for a group of around 10 participants, the materials and set-up may need to be adaptable for groups of varying sizes.

2.3 Camp Activity

GirlTREC is an engineering summer camp sponsored by the University of Arkansas and funded by the US Department of Transportation through the Maritime Transportation Research & Education Center

(MarTREC). This camp is specifically designed for girls who are currently in 5th and 6th grades (entering 6th and 7th in Fall 2023). It aims to provide engaging and interactive activities related to transportation engineering, covering different aspects from roads to railroads to waterways. The program seeks to encourage young girls to consider future careers in transportation and inspire them to pursue engineering disciplines.

The 2022 GirlTREC summer camp was held on July 12th, 2022 at the Fayetteville Public Library. The location provided easy access for the participants and was equipped with the necessary resources for the program. 25 girls participated in the camp, where each participant had personalized attention and support from the program instructors.

The camp was facilitated by four students mentors and the PI, who helped to guide and support the participants throughout the program. Prior to the program, the students mentors were taken through the lesson plans and were involved in facilitating the demonstration of the driving simulators, ensuring that they were well-equipped to guide and mentor the campers.

To ensure that the program ran smoothly, there were several logistical considerations that had to be taken into account. For example, the program required the use of driving simulators, which had to be set up and made ready prior to the start of the program. In addition, the program required the use of other materials such as papers, pencils, pens, poster paper which was supplied by the PI. These resources were carefully sourced and prepared in advance to ensure that they were readily available when needed.

Overall, the success of the 2022 GirlTREC summer camp can be attributed to the careful planning and attention to detail that went into the logistics and preparation of the program. By taking into account the specific needs of the program and ensuring that all necessary resources were available and in good condition, the program was able to run smoothly and provide an engaging and rewarding experience for all the participants.

3 Results/Findings

All the five lesson plans were delivered as planned, within the scheduled 2.5 hours. Photographs of the University of Arkansas student mentors, faculty and the GirlTREC participants are provided in this section. As shown in the photographs (Figure 8), the students adhered to the instructions provided to them by the mentors who were instrumental in encouraging and assisting the female students.

3.1 Camp Successes

The University of Arkansas student mentors were asked a few questions to gather their input on the outreach program. The questions were aimed at determining the success of the program, its overall experience, and the extent to which its objectives were met. The purpose of obtaining this feedback is to make necessary modifications and recommendations to ensure future camps are just as successful. Overall, the student mentors agreed that the objectives of the outreach were achieved. The success are briefly summarized below.

3.1.1 Creative brainstorming with high levels of participation.

The brainstorming web became much larger than anticipated and the girls were able to give answers and ideas that wasn't previously considered. The resource of example causes of the driver shortage was beneficial to initiate the brainstorming process to get ideas flowing and at the end to show them some of the ideas that they had not come up with. As the brainstorming moved towards generating solutions and potential careers, the girls were able to think about each cause independently, allowing them to delve more deeply into each issue and explore creative and effective solutions. This approach facilitated the girls' brainstorming process and led to a comprehensive and diverse range of ideas.

3.1.2 Sufficient time for the driving simulators to be used.

During the program, a dedicated time of forty minutes was allocated for the participants to observe, learn, and experience the driving simulators. The girls were divided into groups and given the opportunity to try out the different simulators including the car, forklift, and excavator simulators. This provided enough time for the participants to get a feel of each simulator, and they could choose to spend more time on a specific simulator of their interest. The ensured that each participant had an equal opportunity to engage with the simulators.

3.1.3 Energy change from simulators to case studies.

The simulators were a high energy level activity and allowed participants and the facilitators to be very social. However, as the participants then had to transition back to sitting in the classroom, this high energy level needed to be calmed down and channeled into the next activity. This required a deliberate effort from the facilitators to manage the group's energy level and redirect their attention towards the upcoming tasks. The students were able to make this transition smoothly and were well comported during this period.

3.1.4 Freedom during the poster creation and presentation.

Participants were paired up during the activity with enough supplies to work with. This strategy was beneficial as it allowed for a collaborative environment that encouraged shy participants to work with others and share their ideas, and it also resulted in visually appealing and well-organized posters. By working together, participants were able to create posters that presented cohesive and thoughtful ideas, demonstrating a good understanding of the concepts presented.

Figure 8. Students working collaboratively in pairs on task to create a poster highlighting different transportation careers for their presentations.

4 Recommendations and Conclusion

Freight transportation is vital to US supply chains and the global economy. Driver shortages have plagued the industry in recent years which worsened due to the recent COVID-19 pandemic. To address the issue of driver shortage, strategies include re-examining the potential labor pool through targeted attraction, training, and retention programs for truck drivers.
Instructional modules related to engineering and planning for multimodal transportation systems were developed to recruit middle and high school students to the truck driving industry. This work developed an outreach program with active learning approaches designed around the use of a driving simulator. This project would also contribute to the multimodal transportation body of knowledge by advancing methods for workforce development.

The developed lesson plans were carried out in July 2022 during the MarTREC GirlTREC summer camp targeting sixth grade girls. Twenty-five students participated with the assistance of four students mentor and faculty. One of the critical challenges encountered for the session was the lack of driving experience among 12-year-old students and the physical size of students which limited their ability to operate the simulators. To address this challenge, it is recommended to have well-trained staff stationed at each simulator to guide and assist younger participants who are likely to visit the library at their leisure time.

However, these challenges did not limit the experience or success of the session. The girls were very hardworking, showing great enthusiasm and engagement with the simulators, discussions, and presentations. Anecdotally, we noted high engagement with the material, with students suggesting creative and thoughtful content related to driver challenges, professions, and solutions. The students demonstrated a better understanding of the transportation industry and professional freight drivers, which was the ultimate goal of the program.

To further promote the transportation industry and engage more students, it is recommended that future sessions involve collaboration with more agencies and schools. This would allow for a wider reach and impact in promoting the industry to more students. Moreover, there can be a focus on training professionals to implement these lesson plans as part of community engagement initiatives. This would help sustain the impact of the program and make it more widely available. Overall, it is recommended that efforts like these continue to be made to engage students in the transportation industry, and that collaborations and partnerships be utilized to achieve this goal on a broader scale.

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A1. Full Lesson Plans

The following 33 pages include all lesson plans and resources necessary for the activities. Page numbers shown indicate the page of the lesson plan, not the project report.

DRIVING THE CHANGE: CAREERS SUPPORTING THE FREIGHT DRIVING INDUSTRY

Educational and Experiential Camp

Abstract

In a world of both worker and goods shortages, it is no surprise that the intersection of these is a shortage in freight drivers themselves. However, many careers are in the background of the freight trucking industry and could be part of the solution in improving conditions for the drivers and improving the reliability and efficiency of goods distribution. This camp is designed for middle and high school students to not only learn about these shortages, but also to experience the truck driving conditions through a driving simulator. After experiencing this and learning about higher education pathways that deal with freight transportation, the students should be able to develop ideas on ways that workers behind the scenes can improve the freight industry. This camp has five main segments to be completed chronologically and requires no prior driving or industry knowledge for camp participants.

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Contents

A.1.1 Overview and Recommendations

Lesson	Summary
1: What's the shortage? What's the solution?	Students will learn background information on the transportation industry and current shortage of freight drivers. They will then brainstorm as a collective group what could be causing the shortage and ways to mitigate the consequences or lessen the shortage.
2: What careers exist in transportation?	Students will look at their proposed solutions from lesson one and connect their ideas to careers. After brainstorming careers that can help, they will then collectively learn about major career areas through an interactive BINGO game. While students are hearing about the careers, they will have a sheet to jot down notes or comments.
3: So this is what it's like to be a truck driver.	Students will group into pairs or teams of three to experience the driving simulators. After a demonstration on how to use the simulators by the leader, teams will rotate between machines and try driving. Non-driving members will watch their teammates and attempt to learn from their mistakes before driving themselves. Students can either choose their own driving conditions or randomize them.
4: That was tough. What can we do to make it better?	Students will discuss the troubles that were experienced while driving on the simulators. Then, they will rotate through case studies on problems that drivers and other industry members face. Individually, they will come up with solutions and how to prevent them in the future. After students have completed the rotation, a few of the case studies will be discussed as a large group to compare ideas.
5: How can I help?	Using the notes taken about the careers in lesson two, the students will create advertisement posters and elevator pitches for the transportation careers. They will form into pairs or teams of three, choose their career, research the required education or training, create their poster and practice their pitch, then present to the class.
Overall	Students will learn about and be able to empathize with drivers and all transportation professionals. They will be able to walk away appreciating the industry more and be able to share their knowledge with those around them.

Sense of Community: These activities require students to actively exchange ideas, work together in teams and as a large group, think critically and creatively, and speak in front of their peers. It is important, therefore, for students to feel comfortable, welcomed, and encouraged to participate.

- Consider personalities, strengths and weaknesses, and relationships when forming their teams or pairs.
- Accept and encourage all genuine answers, even if they are incorrect.
- Show appreciation for participation, excitement for the topic and questions, and celebrate accomplishments throughout the camp.

Modifications: Some lessons will describe suggested ways to modify the lessons or activities based on available equipment, time, or community. These are only the beginning of modifications. Use your judgment of your group, resources, and time to create the most impactful experience for your camp, even if it does not follow these plans.

Leader Requirements: The leader of this camp must be knowledgeable, speak comfortably in front of groups, have leadership skills to handle groups of students, and enthusiasm for the topic of transportation careers. The leader's tasks, recommended flow of conversations, and necessary materials are listed under each lesson. However, it is the responsibility of the leader to have read through the lessons, practiced them, and be prepared for questions to be asked outside of the given knowledge. Additionally, the leader should either be proficient in working the driving simulators or have additional help in demonstrating the skills and helping students utilize the simulators.

A.1.2 Lesson Plan #1: What's the shortage? What's the solution?

Learning Outcome:

At the end of this activity, each camp participant will be able to…	**Explain the current state of the freight transportation industry and identify solutions to reduce the shortage's impact**
This learning objective will be measured by…	Creation of a brainstorm web of causes and potential solutions of the driver shortage

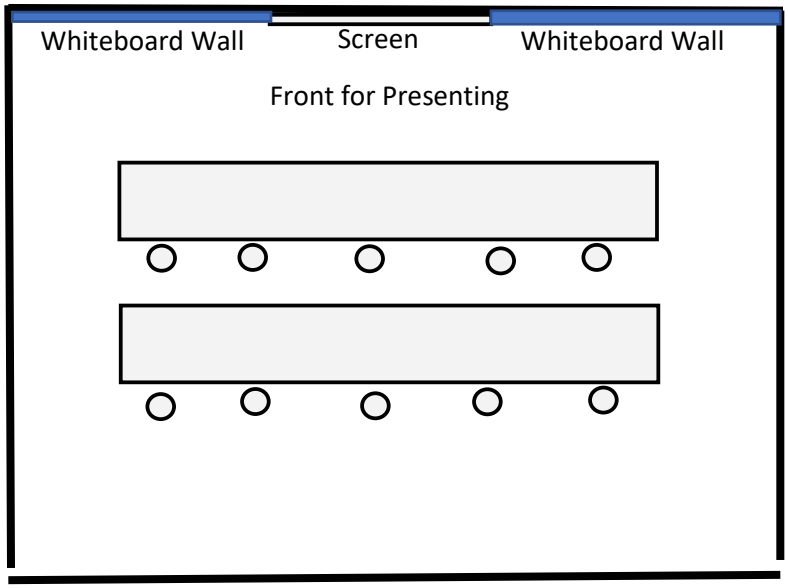
Supplies:

Item	Quantity	Additional Notes
Presenting Screen	1	Where all participants can see it, equipped with volume
Dry-erase Markers	4	Each a unique color for each level of the web
Whiteboard Wall	1	Can also use a chalk board, white board, or the presenting screen
Welcome/lesson1/lesson2 PowerPoint	1	Downloaded, displayed on screen
Lesson 1 Sample Ideas Resource	1	Printed for leader

Learning Environment:

Description: room for students around the tables, chairs positioned towards the front, area in front of the room for leader to stand and present, white-board wall at the front

Example:



Preparation:
Have welcome/lesson1/lesson2 PowerPoint on screen.
Have YouTube video up and already through any ads.
Whiteboard wall should be completely clean.
Have a list of problems printed or on a screen that only the leader can see.

Schedule:

Activity	**Duration**	**Time**
Leader introduction, welcome, define purpose	3 minutes	9:30-9:33
Participant introductions	2 minutes	9:33-9:35
Video	3 minutes	9:35-9:38
Overview of shortage	5 minutes	9:38-9:43
Brainstorm causes	5 minutes	9:43-9:48
Brainstorm solutions	5 minutes	9:48-9:53
Connect solutions to careers	2 minutes	9:53-9:55
Total	**25 minutes**	**9:30-9:55**

Narrative:

Leader: Hello everyone and welcome to "Driving the Change"! Hopefully you are ready to think a lot about the world of transportation and have some fun while doing it.
My name is *_____* and I get the privilege of leading us through some activities and discussions. I am *fill in information about yourself* and the topic of transportation matters to me because *_____*. I am/plan to be a *insert career and why*. A transportation or driving fun fact about me is *_____*. If at any point in time you have any questions about anything, feel free to throw your hand up and I'll get to you as soon as I can.
That's enough about me for now. I would love to hear about you all as well. We'll go around the room and share your name, what year you are in school, what you are hoping to learn or experience while you're here today, and a fun transportation fact, fear, short story, trivia, or anything else! Let's start with *pick one of the students*.
Students: *Each student will share their introductions*
Leader: Awesome! Thank you for all sharing, I can sense that we have a great group and will have a great time together today. If you are still wondering what we'll be talking about, don't worry. We have five major activities that'll we'll go through to get us all on the same page and then think and learn together. Just as a brief overview, let's discuss what questions we hope to answer and our goals for the day. *Go through PowerPoint slide on goals, adding in comments and without reciting directly from the screen. *
Next up we have a short video just to give a brief background summary of the transportation industry and get a preview into what the shortage is. I think there are some really interesting statistics and ideas in the video, so pay attention to see what stands out to you. *Watch the video*.
Even in that brief video, I feel like there was a lot of information given, so let's digest that together. Did anything stand out to anyone? *Call on students if they have ideas. If there are none, see if anyone is able to fill in the blanks on the screen*.
Students: *Share what stood out to them or fill in the blanks on the screen*.
Leader: Those were great takeaways! Hopefully if nothing else, you were able to takeaway that the transportation industry is complicated, huge, and super important to our everyday lives. With that in mind, this shortage can seem concerning. But as you would with any large problem, we will try to break it down into smaller pieces to better understand it. All together we will be brainstorming what could be causing the driving shortage and then ways to potentially solve the problem.
A few rules about brainstorming before we begin: there's no right or wrong. If you think of an idea, just shout it out and we'll right it down. Think as critically and creatively as you can, even if you are unsure if it makes sense, and feel free to build off of each other's ideas. The

goal here isn't to decide on the best pathway to solving it, but rather to get as many ideas down as we can. To encourage your crazy thinking, there will even be a prize for the person with the most creative idea, as long as you are able to explain it.
Let's start with the center of our web. *Write "Driving Shortage" in the middle*. Now we can begin! Right now let's focus on coming up with potential causes of the shortage. *if students don't start talking, either call on someone for an idea, or give them a starter question or idea from the sheet*.
Students: *volunteering ideas* (as this happens, make sure the leader writes them down on the board around the center bubble)
Leader: (as ideas start slowing down, check the sample idea sheet to see if there are any majors ones that they missed and suggest them to the group) Those are lots of great ideas! As you can see, there are lots of factors that could be contributing to the shortage. However, let's try to get just as many solutions as we did causes. Your solutions can tie directly to one of the causes on the board or just a general idea. Go!
Students: *volunteering ideas* (as this happens, make sure the leader is connecting them to the causes on the whiteboard)
Leader: (as ideas start slowing down, think if there are any major ideas the leader can suggest to the group) Great job thinking of all of those solutions! Even if all of those solutions wouldn't necessarily work, maybe they can create more solutions that would. (Leader reads over the ideas and picks the craziest one) Do you guys think *insert creative answer* is the most creative one up there? That's super unique but I love the out-of-the-box thinking, so that is our winner.
We have one last layer to our brainstorm web. Looking at all of those solutions, are you able to think of any careers that would tie directly to some of them?
Students: *volunteer ideas on careers either in general or that connect to specific "solution" bubbles*
Leader: Great! That leads us right into our next activity!

Back-up Plan

Screen not working: Bring projector to display PowerPoint on a wall.
PowerPoint not working: Have PowerPoint slides printed off for students to follow along with.
Volume not working: Either turned on closed captions or skip the video and just discuss the points that the video would have made.

- Average age of truck drivers is 55 (about to retire)
- Must be 21 to get a CDL (federal requirement)
- Women are only 6% of truck drivers (untapped demographic)
- Away from family for long periods of time
- Poor health lifestyle (sedentary, often filled with fast food)
- Unable to attend the 6-week licensing classes
- Miss holidays (unfavorable schedule)
- Long driving days
- Delays from warehouses (not cause of shortage, but wastes the time of the drivers)
- Angry customers, employers
- Difficult driving conditions and skills
- Supply chain issues lead to difficulty repairing and serving trucks
- Potential negative stereotypes
- High stress/high pressure job (must get there on time no matter your sleep, weather, health, traffic, or accidents)
- Pay is below national average

A.1.3 Lesson Plan #2: What careers exist in transportation?

Learning Outcome:

At the end of this activity, each camp participant will be able to…	**Identify three separate transportation careers and two aspects that make each career unique.**
This learning objective will be measured by…	One minute paper on each career

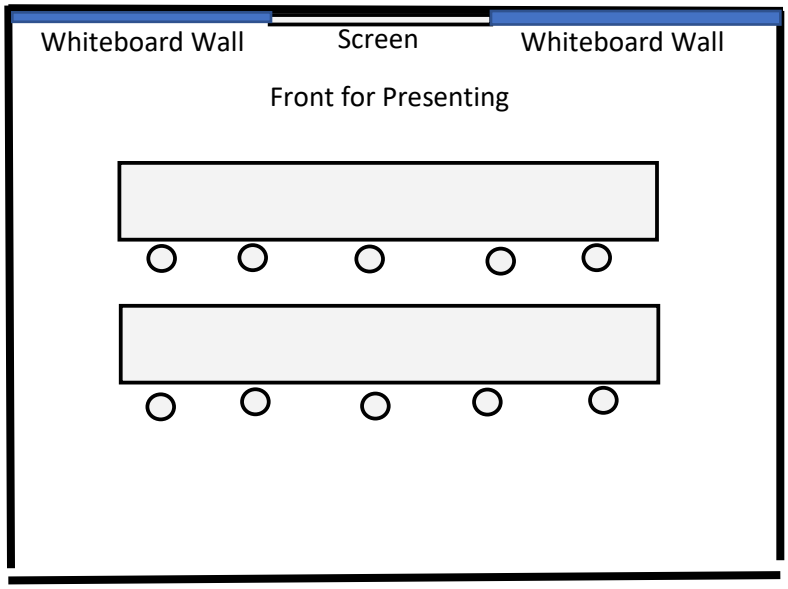
Supplies:

Item	Quantity	Additional Notes
1 Minute Paper Worksheet	1 per person	Could also use plain paper
Welcome/lesson1/lesson2 PowerPoint	1	Start on lesson 2 slides
Presenting Screen	1	Equipped with volume
Pencils	1 per person	Sharpened, with eraser
Career Bingo Resource	1	For leader only, printed or on personal screen
Whiteboard Wall	1	Or whiteboard, chalk board, etc.
Dry-erase Marker	1	

Learning Environment:

Description: room for students around the tables, chairs positioned towards the front, area in front of the room for leader to stand and present, white-board wall at the front

Example:



Preparation:
Worksheets must be printed out.
PowerPoint Career Resource printed or on leader's screen.
PowerPoint will be on screen on lesson 2 slides.

Schedule:

Activity	**Duration**	**Time**
Pass out worksheets and pencils	1 minute	9:55-9:56
Explain PowerPoint board and worksheet	1 minute	9:56-9:57
1 minute timer of brainstorming as many careers as possible individually. See who has the highest.	3 minutes	9:57-10:00
Go through each career box	15 minutes	10:00-10:15
End with driving careers	5 minutes	10:15-10:20
Total	**25 minutes**	**9:55-10:20**

Narrative:

Leader: We're going to be keeping along that string of thought and start discussing the wide range of careers within the transportation industry (while saying this, pass out "1 Minute Paper" worksheets and pencils to each student). For the time being, have your worksheet blank side up. Now that we have practiced our brainstorming skills, we're going to do one last round of brainstorming individually. Using the video we watched earlier, the careers we just thought about for the solutions, and any other ideas you have, I want you to write as many careers that could impact the transportation industry as you can in one minute. With all the moving parts in transportation, there are lots of careers that directly and indirectly connect. We'll need your list of careers for our next activity, so try your best. On your marks, get set, go! *click start on timer*

Time's up! Everybody quickly count up how many careers you were able to write down. Raise your hand if you were able to think of at least 5? Keep your hand up if you thought of 10? 15? *…continue until no hands are up*. Great job! We're going to now combine all of our lists together. Our goal is to uncover each of these squares to get a "blackout" BINGO together. We'll also write down all of the other ideas you guys thought up. As we click on the boxes, we'll also get to learn a little bit about what these workers do. *name of student will most careers written down* how about you start us off. Can you share one career that you thought of?

Student: I put *career idea*.

Leader: *If that is under one of the squares* Awesome, that is one the squares on the way to our BINGO. *click on square and go through info*. *If that is not one of the squares but is a transportation career* Another great idea! It isn't one of our squares, but they are important to transportation because they *give mini job description and write it on the whiteboard*.*If that is not under a square and you cannot think of how it connects to transportation, ask the student to explain more. Either write it on the board or thank them for the idea and move on*. (Repeat until all squares are done and students are out of career ideas. If they are unable to think of some of the squares, give them prompts or questions to lead them to the answers, or eventually just give the answer if running out of time or ideas on how to have them guess it)

Awesome! We'll finish this activity up with talking about the job you may be most familiar with -the drivers! We have another short video to watch and then we'll discuss some of the benefits that you may not think of when you see the freight drivers on the roads. (watch video) Thanks for being great listeners. What stood out to you about the drivers or what didn't you think about before?

Students: I had never realized… (repeat until students with ideas have all shared)

Leader: These are all great thoughts. I know it is easy to take for granted the fact that groceries will be at stores and things that are ordered will be delivered, but it is important to remember that we have that privilege because there are drivers out there. As any career has it's drawbacks, so does trucking, but, as you have already mentioned, there are some great benefits to driving too. Let's discuss some of those. (Go through ideas on PowerPoint slide and add comments expanding on the ideas)
Now that we have a better understanding about what the drivers do, let's see if we can practice the physical job by using those driving simulators!

Back-up Plan

Screen not working: Bring projector to display PowerPoint on a wall.
PowerPoint not working: Have PowerPoint slides printed off for students to follow along with.
Volume not working: Either turned on closed captions or skip the video and just discuss the points that the video would have made.

Optional Modification

Rather than having the participants randomly guess transportation careers, read out a prompt from the "Career BINGO Prompts" resource before having students guess each box. This modification should reduce time spent on guessing and ensure that participants will be able to get each box during BINGO.

Career BINGO KEY

	A	B	C
1	Logisticians	Mechanical and Automotive Engineers	Dispatchers
2	Freight Loader	Transportation Software Engineer	Transportation Engineers
3	Data Analysts	Diesel Mechanics	Warehouse Managers

1-Minute Paper: Career BINGO Handout

1a. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

2a. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

3a. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

1b. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

2b. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

3b. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

1c. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

2c. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

3c. Career: _____

Description: _____

Notes/Questions/Thoughts: _____

Career BINGO Prompts

1a. Logisticians: What is the position of the person who plans and tracks shipments to ensure that loads can get from point A to point B?

1b. Mechanical and Automotive Engineers: What is the position of the person who designs the machinery within the trucks?

1c. Dispatchers: What is the position of the person who keeps communication between companies and drivers throughout the transportation process?

2a. Freight Loader: What is the position of the person who gets materials from companies or warehouses onto trucks to be transported?

2b. Transportation Software Engineer: What is the position of the person who does programming and develops technology that improves many aspects during the transportation process?

2c. Transportation Engineer: What is the position of the person who designs roads and traffic control that freight trucks go over?

3a. Data Analyst: What is the position of the person who looks at facts and figures to predict or improve future shipments?

3b. Diesel Mechanics: What is the position of the person who conducts maintenance or repairs on trucks to keep them running?

3c. Warehouse Managers: What is the name of the person who ensures that goods are properly stored and transported at this midpoint in the transporting process?

A.1.4 Lesson Plan #3: So this is what it's like to be a truck driver.

Learning Outcome:

At the end of this activity, each camp participant will be able to…	**Demonstrate beginner level driving skills that a commercial truck driver must possess.**
This learning objective will be measured by…	Completion of driving task on truck driving simulator without crashing or breaking a law

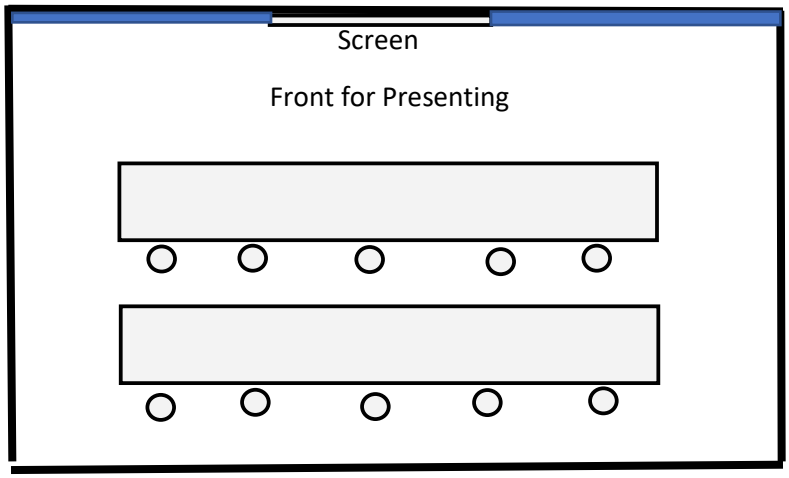
Supplies:

Item	Quantity	Additional Notes
Cup or bowl	6	Labeled with conditions, can also use an online generator
"Conditions" resource	1 sheet	Can be printed or handwritten
Scissors	1	To cut "conditions" resource
EF-Truck NG Driving Simulator	1 or more	
Student Driver Simulator	1 or more	Not required, but beneficial for larger groups or for participants without driving experience
Driver Manual	1 per simulator	
Table	1	Small and mobile, to hold the 6 cups
Screen	1	At front

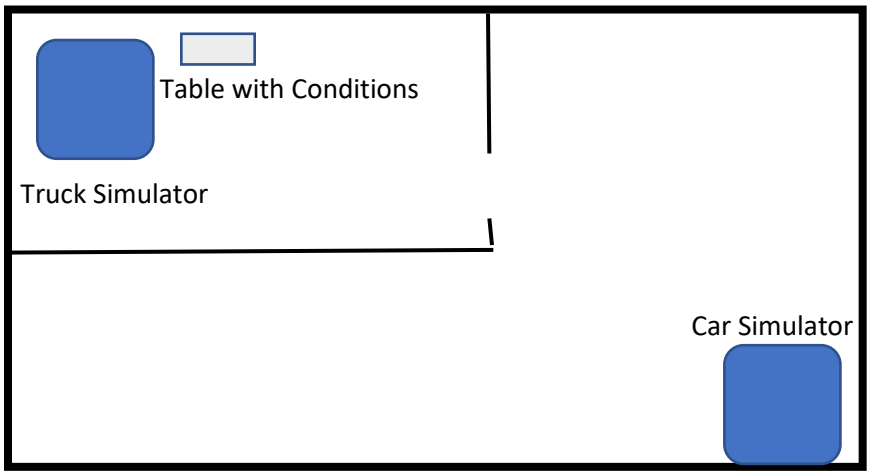
Learning Environment:

Description: will include two separate areas. 1: teaching area with students positioned to see the leader in the front, screen in front. 2: driving simulator space with room around for students to watch demo and watch team members, table by truck simulator for "conditions" cups.

Example 1:



Example 2:



Preparation:
Leader must be familiar with using the truck and car simulators.
Driver manuals must be printed and at each simulator.
Put table up by truck simulator.
"Conditions" resource must be printed, cut into strips, cups labeled, and displayed on table by the truck driving simulator.
Screen should have driving gears image up.
Schedule:

Activity	**Duration**	**Time**
Overview of simulators, gears, and conditions (in classroom)	5 minutes	10:20-10:25
Demonstration of simulators	5 minutes	10:25-10:30
Participants rotate through simulators (bathroom break for those not driving)	30 minutes	10:30-11:00
Total	**40 minutes**	**10:20-11:00**

Narrative:

Leader: This activity will be done in your teams, so get into __ even groups (participants divided by number of simulators available). By raise of hands, how many of you have driven a manual before? *some students may raise their hands* If you have, driving a large truck may some slightly easier to you. If you look at the screen here, you can see the gear layout that will be on the truck driving simulator. You'll go from low gears to higher gears as you increase speed, and vice versa. We'll demonstrate this in a minute, but try to get this picture in your mind. A couple rules for this activity: stay with your team and watch and learn from their driving successes and mistakes. If you come across a problem with the simulator and can't figure it out as a group, get my attention and I'll help you out. While these are great learning tools and can be lots of fun, remember to treat them respectfully. Additionally, as truck drivers would not intentionally crash or drive poorly, you too should try your best on the simulators.

The simulators can do many things, and unfortunately we don't have enough time today for everyone to try everything, but everyone will get a chance to drive both simulators. You can leave everything here and follow me to the truck driving simulator. (take everyone to the simulator and have them gather around where they can see)
This is the truck driving simulator. When your team is here, you'll have two options. You can either design your own driving conditions, like weather and traffic, or you can have me randomize it for you. That will be up to you. I will now demonstrate the basic skills, but I will also be around to help once we start rotating through to help.
First, climb on and buckle your seat belt. Make sure the parking break is on and that you are in neutral. Today, we will just be doing free driving. This simulator has great capabilities in going through lessons and tests, but to ensure everyone can go, we will stick to free-driving. (click on free driving option) Once you are in the free-driving program, you can turn the key, turn off the parking break, and begin driving. (demonstrate changing the gears, using the clutch, and turning, while narrating what you are doing) It will take a second to get used to, but once you feel comfortable, now we can play with the driving conditions. (demonstrate how to turn on rain and the wipers, or make it dark and turn on the brights) That's all that we will be doing today on this simulator. Are there any questions that benefit the whole group? *call on students if they have questions and answer them*
Great, let's get started. If your team is not on either simulator and you need to visit the bathroom, now is a great time to do that, just please come tell me before you go. (divide up teams to their simulators and answer questions and help students while they drive)
(Once everyone has driven) Great job everyone. Let's head back into the classroom and discuss.

Back-up Plan

Screen not working: Bring projector to display PowerPoint on a wall.
PowerPoint not working: Have PowerPoint slides printed off for students to follow along with.
Simulators not working: Have videos using the simulators ready to show and describe scenarios that would have been experienced (snow, gear shifting, darkness, difficult turning and accelerating, etc.)

Optional Modification

Before releasing participants to use the simulators, hand out the "Driving Simulator Reflections" resource and pencil to each person. Instruct them to pay attention to others driving and to answer the questions before and after using the simulator. This will keep participants more focused and quieter while waiting for their turn on the simulators. Additionally, this should speed up the activity as participants will be able to learn how to use the machine by watching others, reducing the frequency of operating questions and time spent before actually driving.

Lesson Plan #4: That was tough. What can we do to make it better?

Learning Outcome:

At the end of this activity, each camp participant will be able to…	**Identify difficult situations freight drivers experience and develop ways that engineers and planners could positively influence these situations.**
This learning objective will be measured by…	Writing responses to multiple driving scenarios

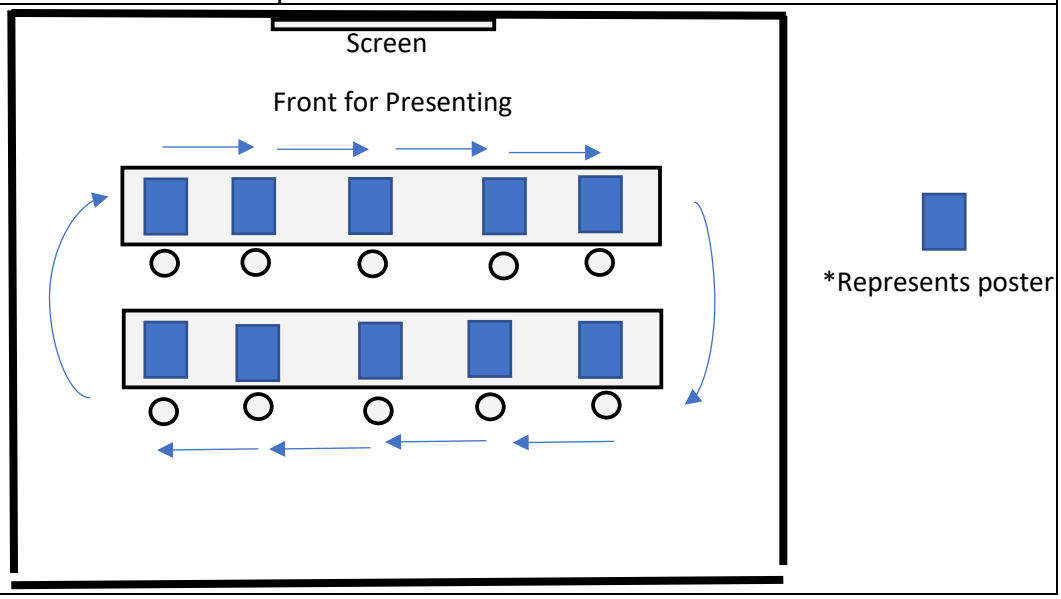
Supplies:

Item	Quantity	Additional Notes
Poster Paper	1 per person	Must be prepped with scenario written on them
Colored Pencils	1 per person	Each person should have a distinct color
Presenting Screen	1	Will display a timer
Scenario Resource	1	For leader to prep posters

Learning Environment:

Description: room for students around the tables, tables able to fit poster paper, area in front of the room for leader to stand and present.

Example:



Preparation:

Each poster must have the scenario already written on top of it in bold.
A colored pencil should be placed at each student's spot at the tables.
Screen should be set to display 1' 30" timer.

Schedule:

Activity	Duration	Time
Discuss simulator challenges	5 minutes	11:00-11:05
Explain activity and rotation	2 minutes	11:05-11:07
Poster rotation (# of participants * 1' 45")	15 minutes	11:07-11:22

Discuss answers on a few challenging posters	6 minutes	11:22-11:28
Total	**28 minutes**	**11:00-11:28**

Narrative:

Leader: Hopefully you all enjoyed getting to test out the simulators and watch your teammates. Hopefully you also got to see some of the challenges and fun aspects of it too. What do you think would be some of the challenges that drivers face, based on what you just went through? (if they don't respond, call on one of the students and ask what was the hardest thing that they experienced or saw their teammates go through)

Students: I think drivers would struggle with…. Because when I drove, I …. (Repeat until all students have had a chance to share if they want)

Leader: Those are all great observations. Driving takes lots of skill and training, along with good reflexes, and attention span for those long hauls, among other qualities. While it does get easier over time, there are no two days exactly alike in trucking since traffic, weather, location, and random events are always changing.

The next activity we have will keep you thinking about the difficult situations and decisions that happen in the transportation industry. There are *___#__* of case studies around the room that you all will have the chance to read and decide what you would do. You will have 1'30" for each prompt to read, reflect, and write your response. If you have time, write how you could also possibly prevent this issue in the future. Write small enough that other people have room to write, as everyone will go through every prompt. I'll start the timer, have you answer, and then we'll rotate and repeat. Are there any questions? (Answer questions if there are any?

Okay. Ready, set, go! (Start timer, let it get to zero, tell students to rotate, and repeat until all students have done all prompts)

Leader: That was the last one, so head back to your seats and we'll discuss a few of them. What do you guys think was the hardest situation or decision to make? (Let students answer or call on someone) Why was that one difficult for you? (Let them explain while picking up that poster) That's a great point. Let's see what other responses on this prompt were… (discuss the different options that students came up with).

(Either ask students again for a prompt that was the hardest or have your favorite one picked out to discuss next and repeat. Go through 2 or 3 total before running out of time)

As you have all noticed by now, difficult decisions means that we need smart, hardworking professionals in these transportation careers! That leads us into our final activity for the day.

Back-up Plan

Screen not working: Bring projector to display PowerPoint on a wall.

PowerPoint not working: Have PowerPoint slides printed off for students to follow along with.

Timer not working: Use phone to time the scenarios.

Colored pencil lead breaks: Have a regular pencil at each poster for students to use.

Optional Modification

Split the participants in groups of two or three and pass out the more in-depth case study "Group Case Study". The groups will work together to answer all the questions on the sheet and will not rotate through multiple case studies. After the fifteen minutes have passed, ask the groups questions about the intermediate and final question and discuss the different ideas.

Time	**Visibility**	**Weather**
Daylight	Clear	Clear
Night	Good	Rain
	Ok	Snow
	Poor	
Breaks Down	**Traffic**	**Wind**
Yes	None	None
No	Low	Low
	Medium	Medium
	High	High

Driving Simulator Reflections Handout

1. Before the driving simulator will allow you to drive, what three steps must happen?

   _____

   _____

   _____

2. Where are each of the following controls located?

   Windshield wipers: _____

   Turn signal: _____

   Headlights: _____

3. **Watch two other participants use the simulator.** What seems to be difficult?
   Driver 1: _____

   Driver 2: _____

4. **Before driving the simulator**, what is one thing you hope to learn or experience while driving?

_____

5. **Before driving the simulator**, what do you think will be the hardest part?

_____

6. **After driving the simulator**, describe the experience (aspects that were difficult, easy, fun, etc.).

_____

_____

_____

_____

A.1.5 Lesson Plan #5: How can I help?

Learning Outcome:

At the end of this activity, each camp participant will be able to…	**Design a step-by-step process on how to go from the day of the camp to the first day in the role of a transportation career of choice.**
This learning objective will be measured by…	Creating and presenting a promotional poster on how to become a professional in the transportation career of choice

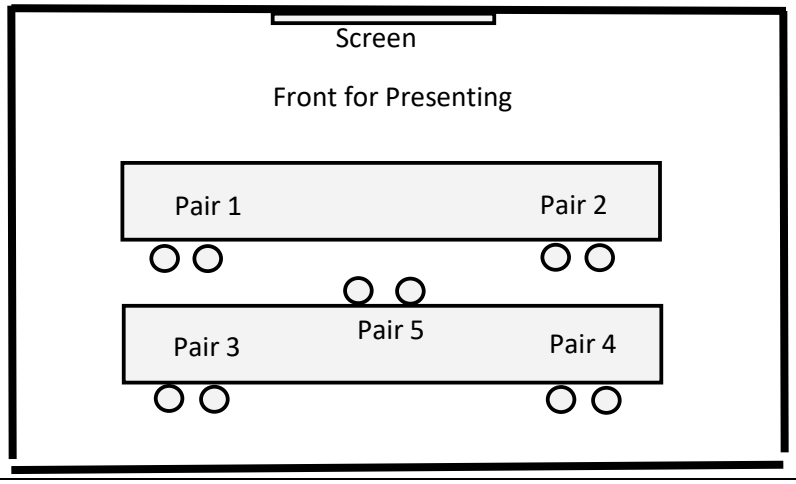
Supplies:

Item	Quantity	Additional Notes
Poster Paper	1 per team	Must be large enough to be seen in the back of presentation room
Example Poster	1	Must be prepared in advance
Markers	1 pack per team	Can use any kind, can create a large pile for students to share between teams
Scratch Paper	1 sheet per team	Only used for preliminary sketching
Pencils	1 per team or per person	Sharpened and with erasers
Computer/Phone	1 per team or per person	Must be connected to internet
Tape	1 roll	Must be safe to put on wall

Learning Environment:

Description: room for students to spread out into pairs, tables able to fit poster paper, area in front of the room for students to stand and present, large screen in front.

Example:



Preparation:
Have example poster and elevator pitch prepared for any one of the careers.
Tape the example poster on front wall.
Pull up “List of Careers” in Word on front screen in “editable” mode.
Ensure computers are on or that at least one student per team has a device with access to the internet.

Schedule:

Activity	**Duration**	**Time**
Explain activity and pass out materials	2 minutes	11:28-11:30
Show example poster and pitch	2 minutes	11:30-11:32
Divide into teams/pairs	1 minute	11:32-11:33
Teams pick career	2 minutes	11:33-11:35
Poster and pitch creation	16 minutes	11:35-11:51
Teams present posters	6 minutes	11:51-11:57
Sendoff	3 minutes	11:57-12:00
Total	**32 minutes**	**11:28-12:00**

Narrative:

Leader: Our last activity of the day is going to let you research a little further into one of the careers we discussed today and make a mini advertisement for it. Hopefully this will help you feel more confident in the information and feel comfortable sharing it with a friend who maybe would be a good fit for the career or who is interested in it. While it is great for you all to have learned something today, I hope you take this knowledge and talk about it with those around you, so we'll practice doing that.

I'll show you an example so you get an idea, but this activity will involve you getting with a partner, picking a career, researching the training or education required for it, creating a poster to display the key information about the career, develop a little 30 to 60 second pitch about it, and then we all will present! I'll go now so you can get a better idea of the project (perform pitch while displaying the poster)

Are there any questions about how this will work? (answer questions as necessary) Great, let's get started. Everyone pick a partner (or assign partners). The winner from our brainstorming challenge gets his/her prize now, which is getting to choose the career they want the most before anyone else can choose it! *insert name of winner* what would you and your partner like to do? (let them answer) Sounds good, now nobody else can choose that career or the one I presented on. What does the next group pick? (repeat until all pairs have a career chosen).

Let's get started! Feel free to use the scratch paper to sketch poster ideas or write your pitch, and use your notes that you took earlier on your career to start your design. Remember to include information on the required education or training in your poster or pitch. You'll have about 15 minutes to work on it before each group presents. Go! (Let 15 minutes go by before calming them back down and moving on)

Alright, since you got to pick the first career, you also get to present first. Let's be a good audience for all the pitches. Start once you're ready. (Let them present). Great job team. (repeat until all teams have presented).

That wraps up our day! Thank you all for participating and I hope you got some good info and critical thinking in today.

A few announcements before you leave:

If you enjoyed these simulators, they are completely free and able to be reserved whenever the library is open. Feel free to come back and keep trying them out or the other simulators.

Please sign the card to thank the library for hosting us today and letting us use their space and simulators.

If you feel comfortable, please stick around for a minute and we'll grab a group picture with all of our posters.

Finally, expect a follow-up email in the next few days with a survey to fill out. It will be completely anonymous but will help us learn how we can improve the experience.
If you're sticking around for the picture and to sign the card, great. Otherwise, hope you enjoyed your time and be on the lookout for that follow-up survey!

Back-up Plan

Screen not working: Bring projector to display PowerPoint on a wall.
PowerPoint not working: Have PowerPoint slides printed off for students to follow along with.
Timer not working: Use phone to time design process.
No internet: Have fact sheets printed out in more detail for each career that the students can reference.

Optional Modifications

Have articles explaining each career in more depth. As participants choose which career to research, hand out the article on that career to the participant or group. This will remove the need for the internet or devices to research by themselves, along with reducing time spent researching.
These can be printed from careeronestop.org and searching for as many transportation careers as participants. These do not necessarily need to be the same careers shown during BINGO.
Have the posters be an optional part of the activity. Students would still research their selected careers and present in front of everyone, but could present in a verbal or acting manner. Would reduce necessary supplies and time of the activity.

Scenario Poster Prompts Handout

1. **Weather:** A truckload of fresh produce must be delivered to Minneapolis ASAP. However, a major snowstorm is expected to develop along your route in 15 hours. The travel in normal conditions takes 12 hours. How many hours from now can you tell the store to expect the delivery?
   FYI: The driver can only go 11 hours before taking a mandatory 10 hour break. If poor weather is encountered during those 11 hours, his shift can be extended by 2 hours to last 13 hours.
2. **Driver Unavailable:** A family emergency arises for your driver, who last minute must cancel his delivery for the day. There are no other free drivers to take the freight today, even though it is a fairly short distance to travel. Your client has threatened to stop using your trucking business if there are more late deliveries. What should you do?
3. **Angry Customer:** The office gets a call from an angry customer. After looking into that delivery's file, you notice that the delivery was expected only 10 minutes ago. The caller is demanding to know the phone number of the driver and wants a discount for their troubles. How do you respond the caller?
4. **Truck Maintenance:** A freight driver calls the office and tells you that the truck has been making strange noises for the last few minutes en route. The driver has not experienced any other problems but is concerned for his safety. He is still about 45 minutes away from a serviceman and the cost to tow the truck there is quite expensive. The delivery location is only an hour from his current location. As the only apparent issue is the sound, do you tell the driver to drive to the serviceman, get him a tow truck, have him deliver the freight then take care of the problem, or something else?
5. **Multiple Drivers:** You receive a call at the office that one of your driving teams (2 truckers taking turns at the wheel) has gotten into an accident due to drowsy driving. The driver while the accident occurred blames his teammate for not agreeing to switch positions, while the passenger at the time says she wasn't aware of the severity of the situation. With company policy, the accident must be added to the driver's record and must take a remedial class before his next trip. However, there is no policy for the teammate. What would you put for the teammate, if anything in her record and should she be required to take the class too?
6. **Environmental Concerns:** The Environmental Protection Agency just passed a new initiative to reduce emissions from large trucks. Your company's trucks do not meet these new requirements and could face fines if improvements or changes are not made. However, the upgrades or new vehicles would be very expensive and take significant time to get.
7. **Warehouse Delay:** Your driver calls the office to tell you that he has been waiting for 6 hours at the warehouse to pick up his freight. He also had requested tomorrow off of work for his daughter's birthday and needed to be able to make it back home in time for her party, but now will not be able to. Additionally, he complains that since he gets paid by the mile and not for any hours spent waiting, that he would like a bonus. He also adds that he isn't sure he can keep working in an industry that keeps him away from his family. How do you handle his day off that will not be spent traveling, his demand for a bonus, and concerns that he may quit?
8. **Traffic:** One of your newest drivers has been assigned a route that will go through a heavily trafficked area that is also experiencing thinner lanes due to construction. He expresses his confidence in his abilities to take the route, but you check his driving evaluation from when he was hired and found that he hit multiple cones when going through these kinds of conditions. You want to avoid any accidents, but also want to show him that you trust him and want him to learn. What do you do?

9. **Parking Problems:** You are reaching the end of your allowed 11 hours of driving before taking a break. Due to traffic putting you behind schedule, you will be unable to make it to the truck stop that was planned out for you. The only legal space for you to pull over is along an exit ramp. Once you get there, you realize that the shoulder is not wide enough for the truck to pull off completely and are dangerously close to the lane. What do you do?
10. **Trucker Health:** One of the data analysts at your company has noticed a trend of health problems by many of your drivers. After running the trends past healthcare experts, they recommend improving the sleeping areas and beds in the trucks to better support their backs and to encourage better eating practices for the drivers. Upgrading all your trucks is outside of the company's budget now. The company has a daily payment to drivers to cover food and incidentals while traveling, but raising the meal allowance to accommodate for higher quality food each day for every driver would also add up quickly. What do you do?

Group Case Study Handout

This case study will go through one really bad day for all parties involved in transporting new produce "Yellowberry". Work together to solve intermediate questions and discuss together what should happen to prevent some of these issues in the future.

A new order for one truckload of Yellowberries just was sent to your company. Your company is in Northwest Arkansas and the shipment must get to Minneapolis, Minnesota ASAP to keep the fruit in the best shape and the most likely to sell to customers. Your computer program to plan fuel stops has a bug, so you will need to calculate amount of fuel needed, cost of the fuel, and how many fuel stops will be necessary. DATA: 700 miles to travel, average gas mileage of 7mpg, fuel tank holds up to 200 gallons, average cost of fuel is $5/gallon, and average speed limit of 60 mph

Amount of fuel needed:

Number of fuel stops:

Cost of fuel:

Time duration of driving:

After checking the weather, it appears that Minnesota will be experiencing a blizzard during the desired time of delivery. You know this could impact driving conditions and how fast the truck will be able to go. You must inform the company ordering the Yellowberries when to expect the shipment to be delivered. Using your calculated duration above, considering mandatory breaks and the potential impact of bad weather on driving times, how long from now should you tell the company to expect their order? Assume the fruit is already on the truck and could leave immediately. FYI: the driver can only go 11 hours before taking a mandatory 10 hour break.

When to expect order:

The Yellowberries are on the way to Minneapolis when you receive a call from the truck driver. She tells you that the truck has been making strange noises for the last few minutes en route. The driver has not experienced any other problems but is concerned for her safety. She is still about 45 minutes away from a serviceman. The delivery location is only an hour from her current location. As the only apparent issue is the sound, do you tell the driver to drive to the serviceman, get her a tow truck, have her deliver the Yellowberries then take care of the problem, or something else?

Tell her:

Due to weather and the maintenance concern, the estimated time given to the company was not met. Your company receives an angry call from them about the importance of on-time delivery, demanding that something is done to make the situation "right". What do you tell or offer the company?

Tell the company:

Now that the truck is empty, it must stop at a warehouse to pick up a different shipment. The warehouse was running six hours behind schedule. You get a call from the driver angry that her six hours spent at the warehouse were a waste of her time since she is only paid per mile driven. What do you tell her?

Tell her:

Look at these problems or predict other problems that could come up. How could they be prevented?

Example Elevator Pitch Handout

Have you ever wondered who designs our roadways? Or wondered how stoplights can seem perfectly timed to be efficient and safe? With the dangerous possibilities that could occur, or extra time spent in traffic if our roads were free-for-alls, thank goodness there are transportation engineers keeping us safe and moving! After graduating from high school, transportation engineers get a four-year degree in civil engineering. They learn how to apply math, science, and design principles to our transportation systems and infrastructure, along with many other topics. After graduating, completing years of experience and the FE and PE exams, these beginner engineers can become official Professional Engineers able to sign and seal their designs. With salaries above the national average and being in a growing field, do you think you have the desire and what it takes to be a transportation engineer?

A.1.6 Optional Activity: Driver Testimonial

Concept: Contact a current or retired professional freight driver to see if they would be willing to speak to the participants. This could be done through a live video call or in person, depending on availability and convenience. While the activity would best fit after using the driving simulators or at the very end of the camp, the timing would be dependent upon the availability of the driver. Have the driver introduce himself/herself and background in the career, then let participants ask questions. If there is time in an earlier lesson to let participants brainstorm questions ahead of time, that would be ideal to ensure that the question time is well spent.
Time: Plan for five minutes of introduction and ten minutes for questions. Talk with driver before the camp to determine their schedule and how much they would like to speak or the length of stories they would want to share.
Materials: If video call is used, ensure both parties are familiar with the setup and ensure internet connection is available, along with speakers and microphone to communicate during the call.

A.1.7 References

Overall:

https://digital.lib.washington.edu/researchworks/bitstream/handle/1773/45595/Willis%20PacTransProjectReportFinal-InspiringK-12.pdf?sequence=1&isAllowed=y

https://rosap.ntl.bts.gov/view/dot/16335

https://journals.sagepub.com/doi/pdf/10.3141/2320-11

https://www.theatlantic.com/ideas/archive/2021/12/truck-driver-shortage/621057/

https://www.redwoodlogistics.com/truck-driver-shortage-causes-problems-solutions/

https://www.fmcsa.dot.gov/regulations/hours-service/summary-hours-service-regulations

Careers:

https://www.bls.gov/ooh/business-and-financial/logisticians.htm

https://www.thebalancecareers.com/what-does-a-truck-dispatcher-do-1361590

https://educatingengineers.com/careers/automotive-engineer

https://www.mymajors.com/career/freight-loader/skills/

https://www.talentdesk.com/career-finder/transportation-sciences-degree-jobs

https://www.raise.me/careers/architecture-and-engineering/civil-engineers/transportation-engineers/

https://www.nntw.org/career-pathway/transportation-safety-data-analyst/

https://www.beprobeproud.org/professions/diesel-technician/

https://www.ajilon.com/job-descriptions/warehouse-manager-job-description/

A2. Outreach Program Presentation

The following 12 pages show each slide of the PowerPoint presentation that was utilized while lessons were conducted during the outreach program. Page numbers shown indicate the page of the PowerPoint presentation, not the project report.

DRIVING THE CHANGE: CAREERS SUPPORTING THE FREIGHT TRUCKING INDUSTRY

Educational and Experiential Outreach Camp

1

INTRODUCTIONS

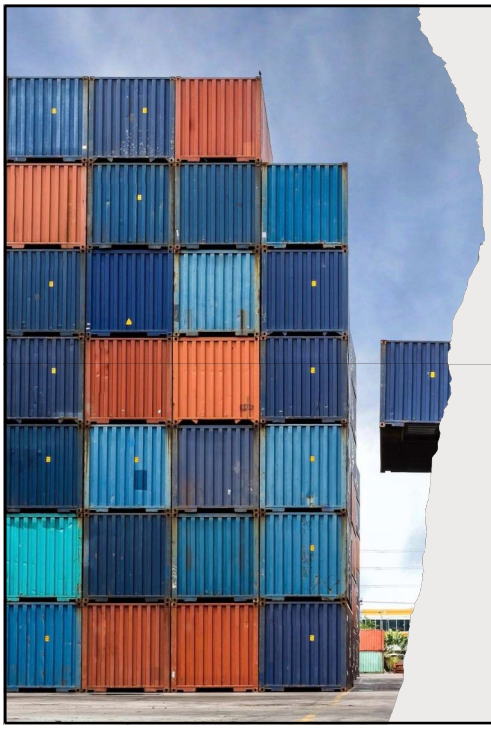
- WHO: Breanna Stoesz
- WHAT: Civil Engineering student at the University of Arkansas, May '22 graduate
- WHY: Transportation engineering, education, thesis
- FUTURE: Technical Solutions Engineer, hopeful high school STEM teacher
- DRIVING FUN FACT: My dream car is a yellow Volkswagen Beetle

2

INTRODUCTIONS: YOUR TURN!

- WHO: Name you want to be called
- WHAT:Year in school, major
- WHY:What are you hoping to take away from this camp?
- DRIVING FUN FACT: Fear, unique story, trivia, etc.

3



LET'S DEFINE TODAY'S GOALS

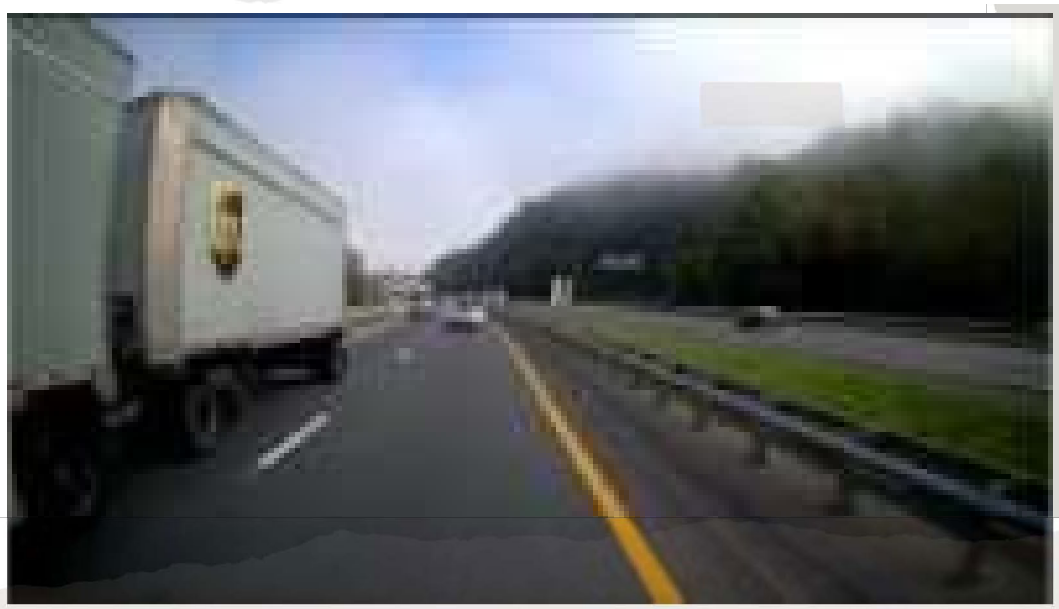
- EDUCATION:
- What is the current state of the freight trucking industry?
- What problems are there and are there ways to solve them?
- What careers exist in the transportation industry?

- EXPERIENCE:
- What is it like being a truck driver? (driving simulators!!)
- How can we share our new powerful knowledge?
- Let's have FUN!

- OVERALL:
- Gain an appreciation for the workers in our transportation industry.

4

OVERVIEW



5

KEY POINTS

- To move things: quickly, safely, and at low cost
- How many workers are in the transportation industry? >5 million
- 50,000 unfilled drivers, but since the pandemic that number is closer to 80,000
- Trucks deliver 70 % of all freight
- Trucks deliver things like food, furniture, clothing, electronics
- How much is spent on transportation logistics each year? $ 1.64 trillion
- Other transportation methods: aircraft , railroad , waterways , pipelines
- Importance of warehouse workers
- What else stood out to you or do you know about the industry?

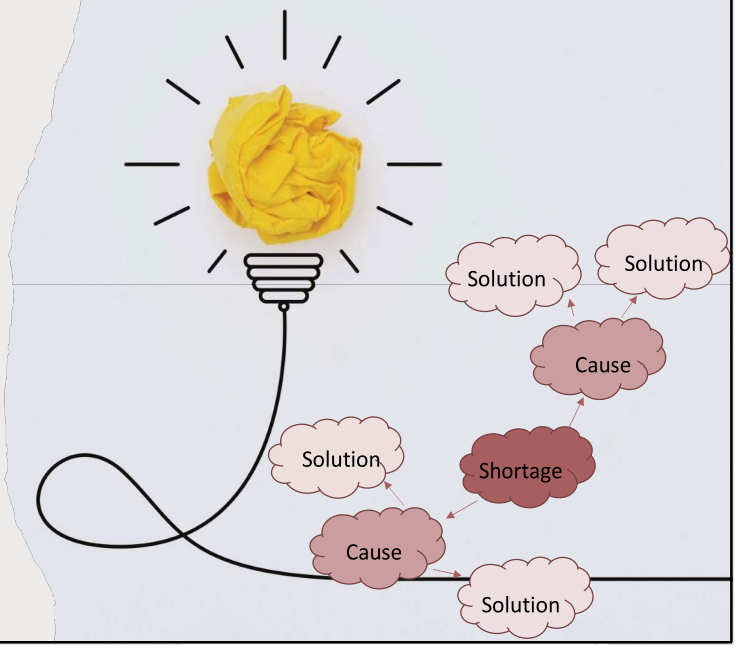
6

Activity #1

LET'S BRAINSTORM

- There's no right or wrong in brainstorming
- Think critically and creatively
- Let's get as many ideas down as we can

- The person with the most creative answer gets a prize to be revealed later. As long as you can at least somewhat justify it…



7

Activity #2

CAREERS IMPACTING TRANSPORTATION

8

COLLABORATIVE CAREER BINGO

Activity #2

	A	B	C
1	?	?	?
2	?	?	?
3	?	?	?

Everything Except the Driver!

01:00

9

FREIGHT DRIVERS

Activity #2

10

Activity #2

FREIGHT DRIVERS

- Knowledge that your job is valuable
- Average salary of $50,000
  - and many financial incentives
- Freedom
- Travel
- Independence
- 6 week education and training
- Flexible distances
- Career change and advancement opportunities
  - manage, train, owner-operator

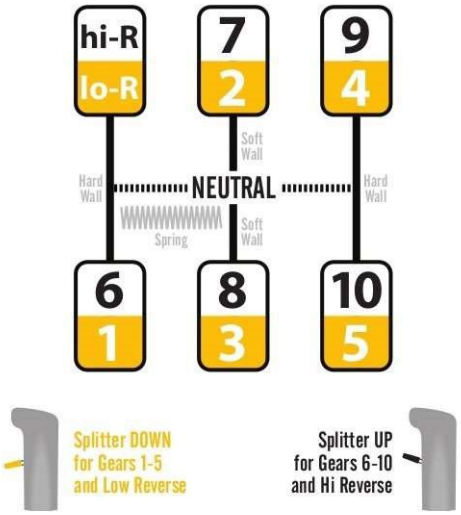
11

Activity #3

DRIVING SIMULATORS

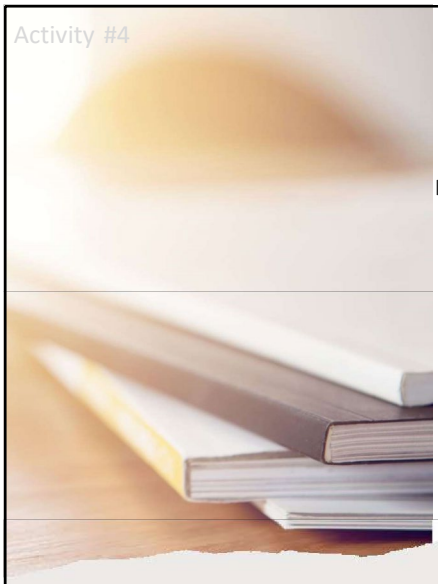
Get into pairs or teams of three

Watch and learn from your teammates' mistakes



12

Activity #4



Write down something for every scenario, even if you're not sure what is the best action

If you have time, what could you do to possibly prevent this issue in the future?

01:17

WHAT WOULD YOU DO?

13

Activity #5

5P : PICK, PLAN, POSTER, PRACTICE, PRESENT

- Pick your career
- Develop a plan for someone who would want to go into that field
- Create a poster to explain these steps and advertise the career
- Practice giving an elevator pitch about the career
- Present!

14

LOGISTICIAN

Description: Manage goods from raw materials to being sold. Attempt to reduce time and cost of this cycle while maintaining professional relationships and communication with customers and producers.

Salary: $76,000

Skills/Training/Education: Associates or bachelor's degree in supply chain, logistics, or related business field. On-the-job training typically involves learning software programs.

15

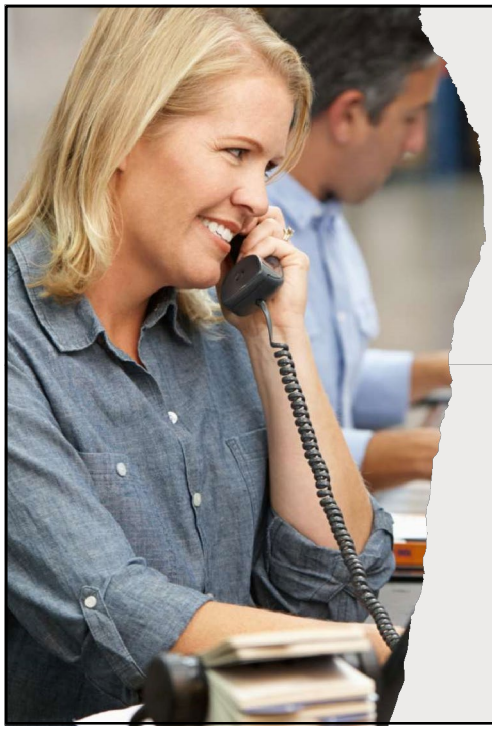
AUTOMOTIVE AND MECHANICAL ENGINEERS

Description: Research, design, and develop automotive parts and systems

Salary: $85,000

Skills/Training/Education: Bachelor's in Mechanical Engineering

16



DISPATCHER

Description: Point of contact for both drivers and customers. Will manage orders, assign routes, and log all information. Must be ready to change plans at any time when a problem arises.

Salary: $47,000

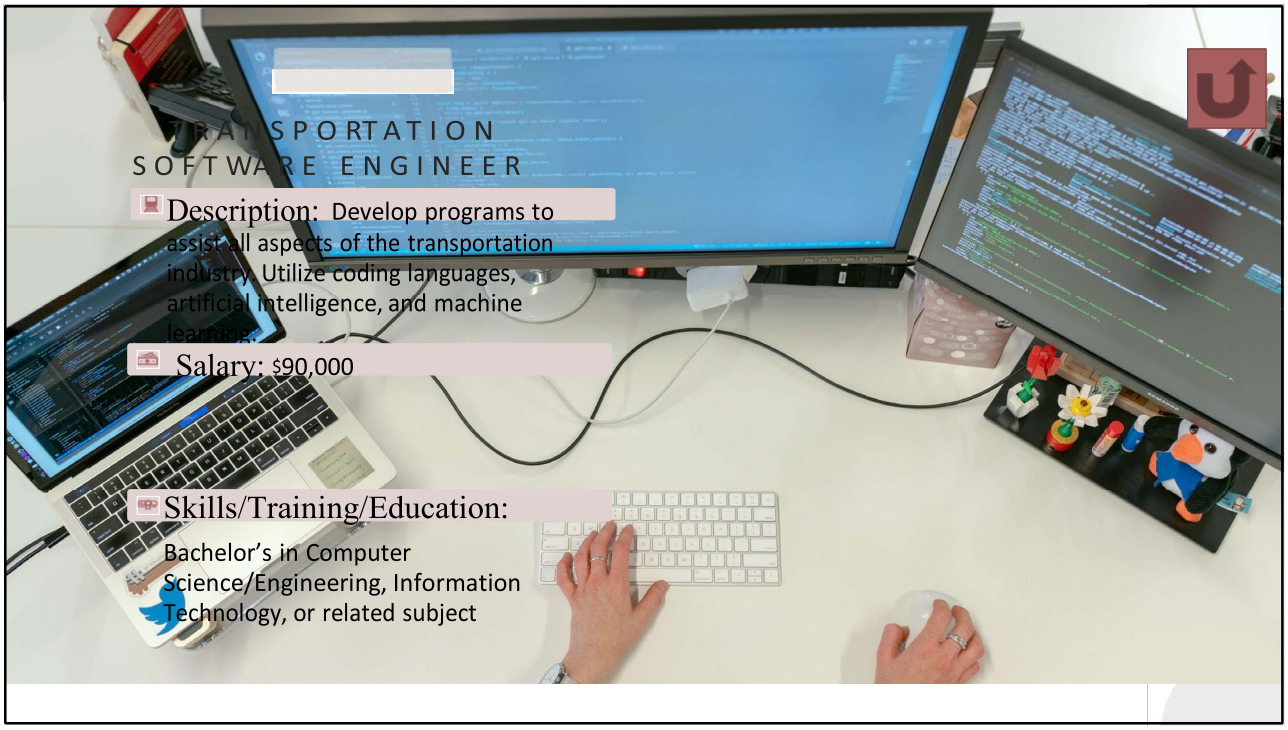
Skills/Training/Education: Varies by company (HS diploma through Bachelor's degrees) and some knowledge on the transportation industry. Must have strong communication skills.

17

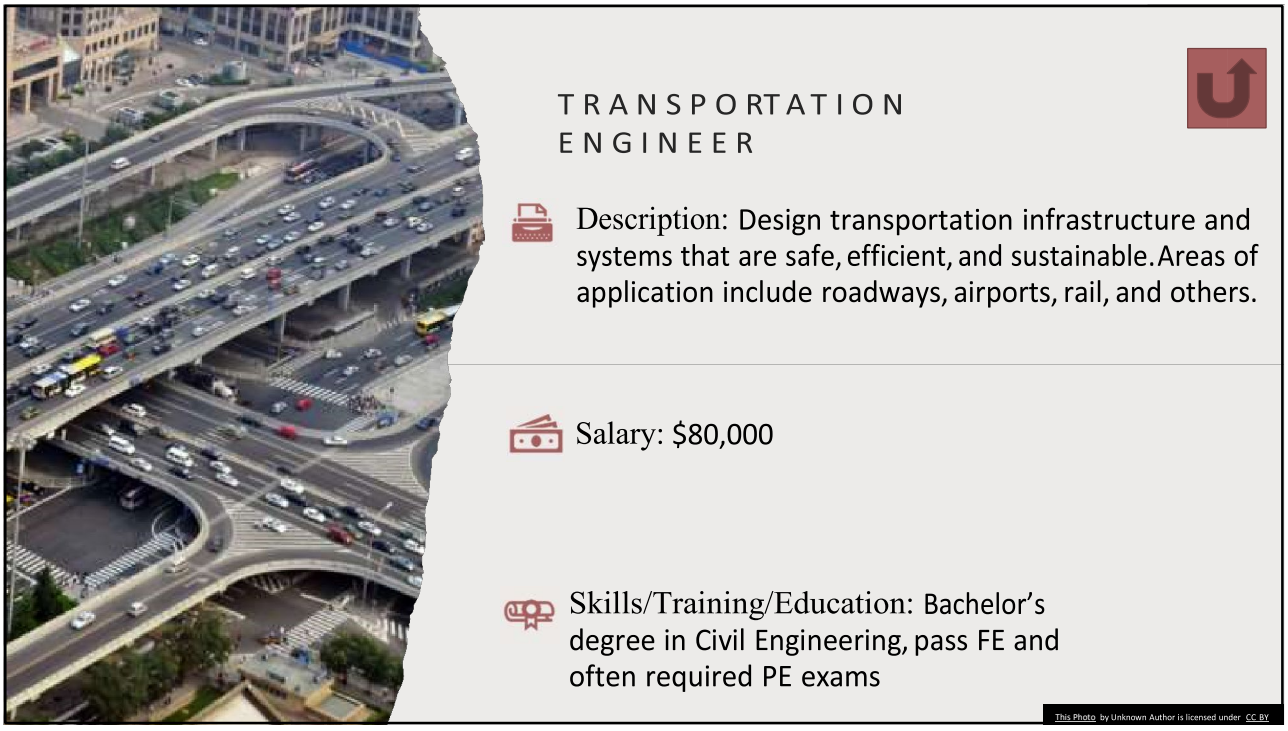
FREIGHT LOADER

- Description: Help stock, move, or load freight either through physical labor or use of machinery, sort cargo, and fulfill orders.
- Salary: $35,000
- Skills/Training/Education: High school diploma, training or certification in necessary machinery

18


TRANSPORTATION
SOFTWARE ENGINEER
Description: Develop programs to assist all aspects of the transportation industry. Utilize coding languages, artificial intelligence, and machine
Salary: $90,000
Skills/Training/Education:
Bachelor's in Computer Science/Engineering, Information Technology, or related subject

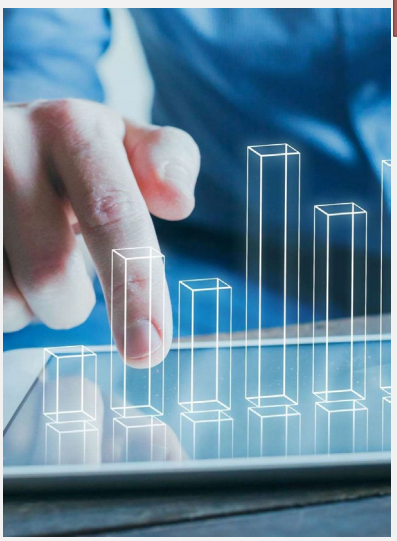
19


TRANSPORTATION
ENGINEER
Description: Design transportation infrastructure and systems that are safe, efficient, and sustainable. Areas of application include roadways, airports, rail, and others.
Salary: $80,000
Skills/Training/Education: Bachelor's degree in Civil Engineering, pass FE and often required PE exams
This Photo by Unknown Author is licensed under CC BY

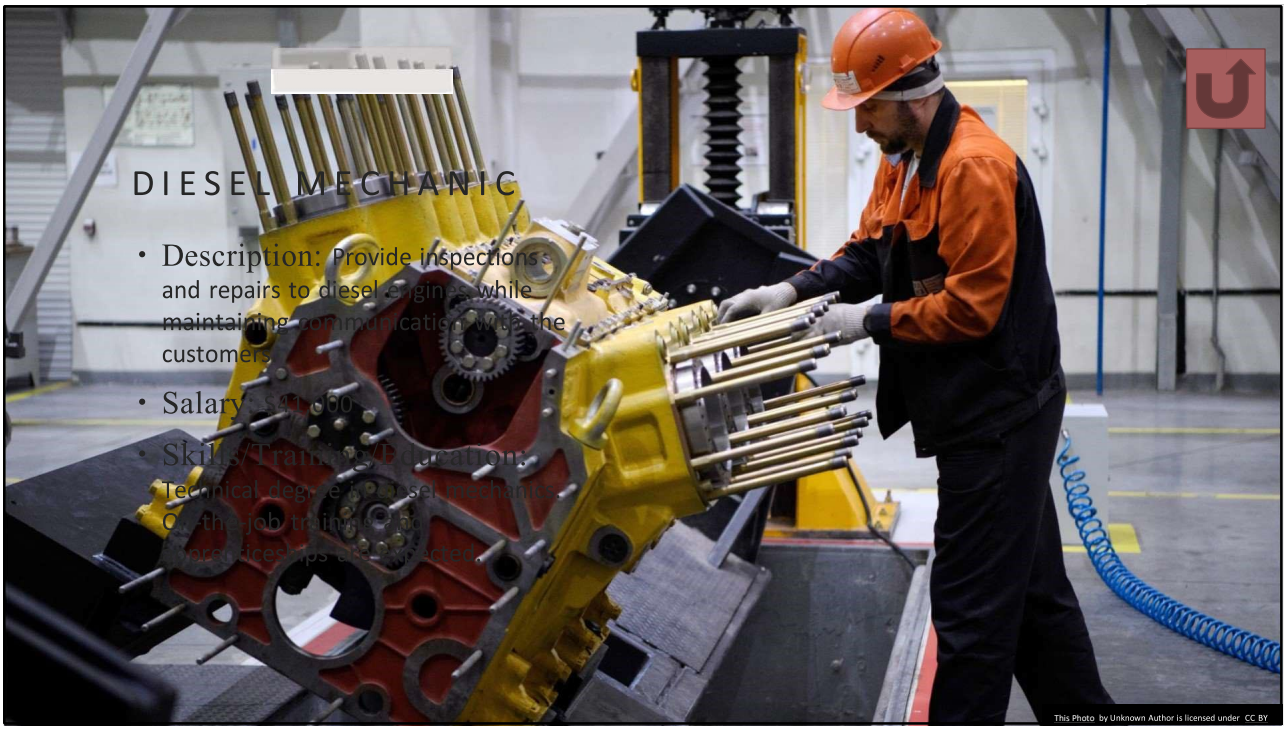
20

DATA ANALYST

- Description: Track, interpret, share, and communicate data to assist in decision-making. Create projections and models to mitigate risk.
- Salary: $85,000
- Skills/Training/Education: Bachelor's in computer science, statistics, mathematics, or related field. If transportation classes were not yet taken, additional transportation training is provided to be able to accurately understand and apply data.



21



DIESEL MECHANIC

- Description: Provide inspections and repairs to diesel engines while maintaining communication with the customers.
- Salary: $41,000
- Skills/Training/Education: Technical degree in diesel mechanics. On-the-job training and apprenticeships are expected.

22


WAREHOUSE SUPERVISOR
Description: Coordinate and lead warehouse operations and team members in a safe environment. Promote efficiency in operations.
Salary: $60,000
Skills/Training/Education: High school diploma. Required experience working in or managing warehouses
This Photo by Unknown Author is licensed under CC BY-NC-ND

23

A3. Truck Simulator Manual

The following 21 pages include the manual for the truck simulator at the Fayetteville Public Library necessary for the outreach demonstration. Page numbers shown indicate the page of simulator manual, not the project report.

Truck Driving Simulator

User Manual

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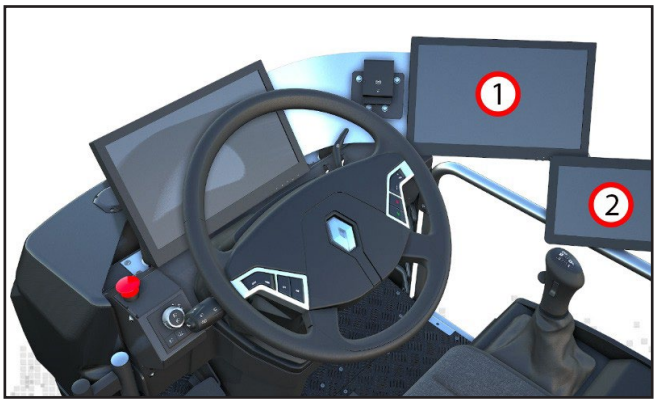
Table of Contents

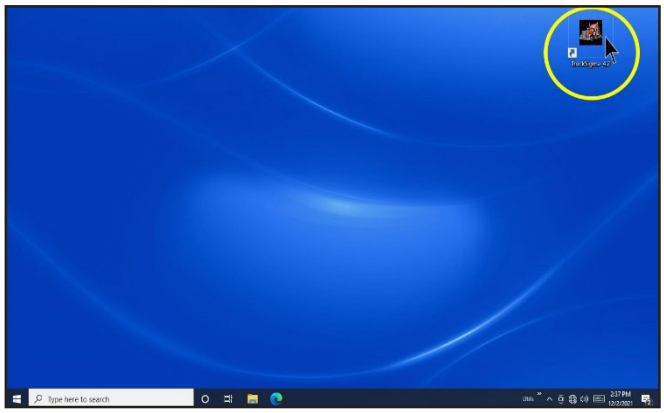
System Setup

There are 2 touchscreens that are used to operate this simulator. They are located to the right of the driver. **Screen 1** displays various truck components. Use this touchscreen to operate these functions.

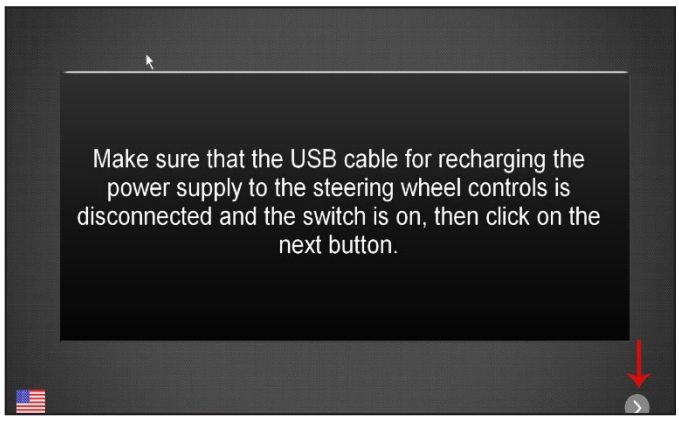


Screen 2 is used to open the simulation software and navigate through the program.

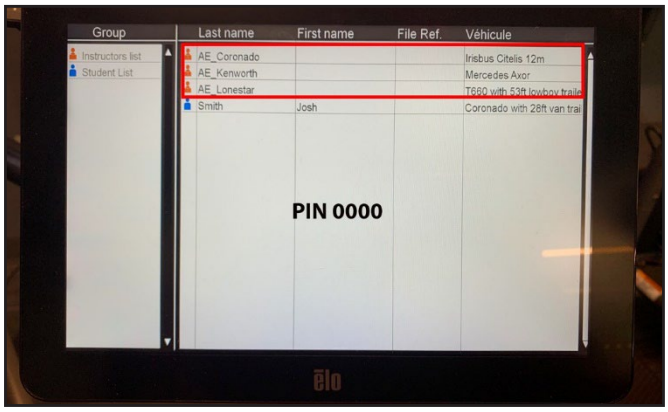
The simulator takes a minute to get started. Once the desktop has loaded, double tap this icon, found on **screen 2**.



Ignore this screen. Press the **NEXT** button, found in the lower right corner to continue.



Select from one of these 3 trucks to get started. The pin number is 0000. You can always change your truck later. If you have a student log in, select your name and enter your PIN.



From this screen you can navigate to several built-in-simulation lessons. Select the License tab, then click **The vehicle** if this is your first time using the simulator. This will lead you to several lessons that will teach you how to operate this simulator.

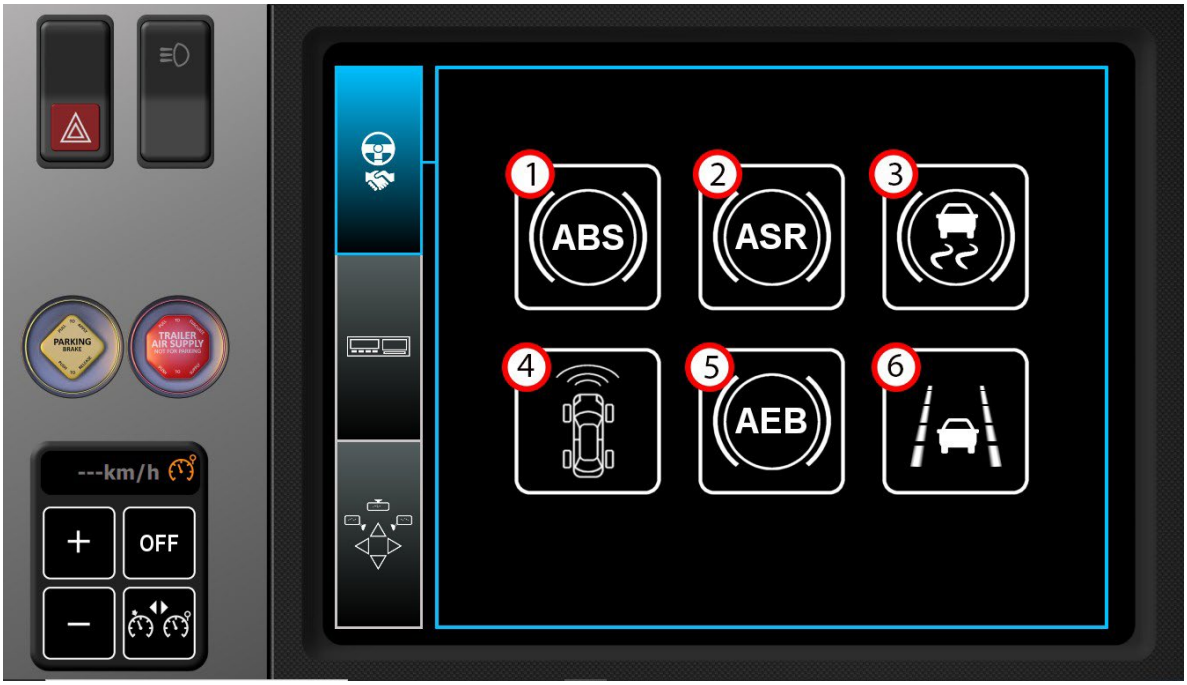
Note: You **MUST** wear your seatbelt to activate the motion platform. The machine will reproduce the motions and vibrations of a real vehicle.

Console Controls

(1) This tab contains a selection of **power aids**.
(2) This tab contains a **tachograph**. This records speed, distance traveled, and stopping periods, used to control the driver's legal hours of work.
(3) This tab allows you to adjust the rear-view **mirrors**.
(4) This turns on/off the **hazard warning lights**. This is used to warn other vehicles that you are obstructing traffic. Only use when the truck is stationary.
(5) This button activates the **long-range lights**. These are used for higher speeds and highways, but only when you can maintain at least 500 feet between the next vehicle.
(6) This is the **parking brake**. Press to apply and the button will become highlighted in yellow. Press again to release the parking brake.
(7) The **trailer air supply** control is used to control the tractor protection valve. Press to supply the trailer with air and the button will be highlighted in red. Press again to shut the air off.
(8) This group of controls is used to modify the **cruise control/speed limiter**. The cruise control is used to maintain a fixed speed. The speed limiter keeps the truck from reaching over the assigned top speed.

Note: Any button highlighted in blue means it is active.

Power aid Controls



(1) The **anti-lock braking system** (ABS) will activate on its own when needed. ABS helps keep the truck under control during hard braking and keeps the wheels from locking up. The ABS button will look a little different depending on the truck type (tractor or trailer) but has the same function.

(2) The **traction control system** or TCS, is a secondary safety feature that works with the ABS to help prevent the vehicle's wheels from losing traction.

(3) The **electronic stability control** or ESC is an automatic computer-controlled braking system. It is designed to reduce untripped rollovers and mitigate severe understeer or oversteer conditions that lead to loss of control by using.

(4) Press this to turn on the **collision avoidance system** or CAS. This warns the driver if they are getting too close to a metal object. Some systems include automatic braking.

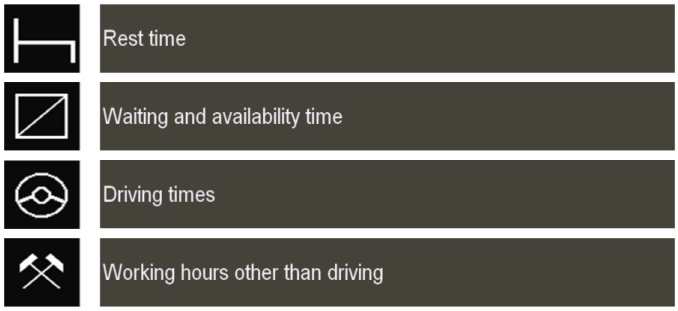
(5) Press this to apply the **braking assistance system** or BAS. This is a driver adaptive safety system that applies maximum brake force when activated by a driver's panic or emergency braking.

(6) Press this to apply the **lane guard system** or LGS. This system monitors the vehicle's position with respect to the lane and emits an acoustic signal to warn the driver if the lane marking is accidentally crossed.

Note: Any button highlighted in blue means it is active.

Tachograph

This image describes the meaning of the icons to follow on the tachograph.



(1)To start the tachograph, press 1. The device asks to input manual activities, press NO to continue without input. If you would like to enter input skip to step 5.

(2)It then requests an input of the location of daily period start, press NO to cancel input or press OK to validate and then confirm with OK.

NOTE: A red light should flash on the tachograph when a button has been pressed, otherwise it did not register your choice.

Tachograph

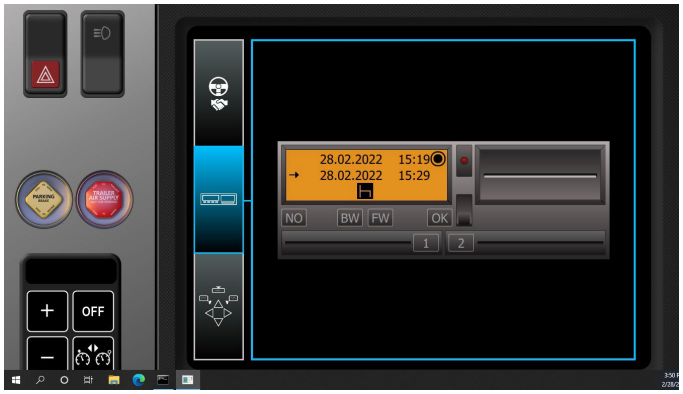
(3) Press 1 to scroll through the different activities.

(4)Press FW and BW to modify an existing activity.

(5.) Press OK to modify the selected activity.

Tachograph

Enter the correct date and time for the activity, then press OK.



Press OK again to confirm.

Helpful video: Go to the License tab in the main

menu >> The vehicle >> The tacho- graph.

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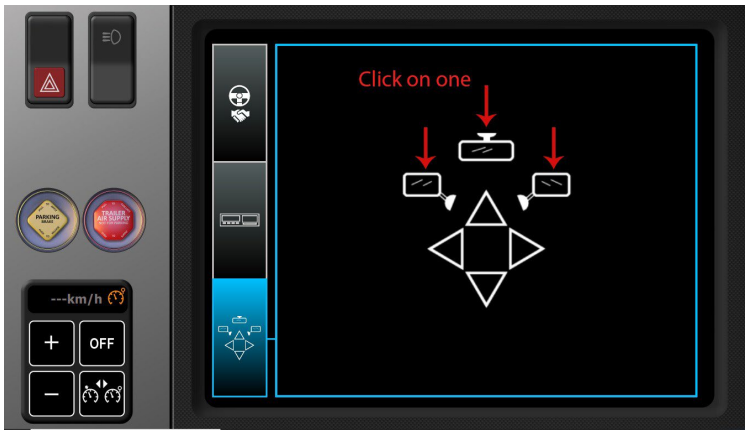
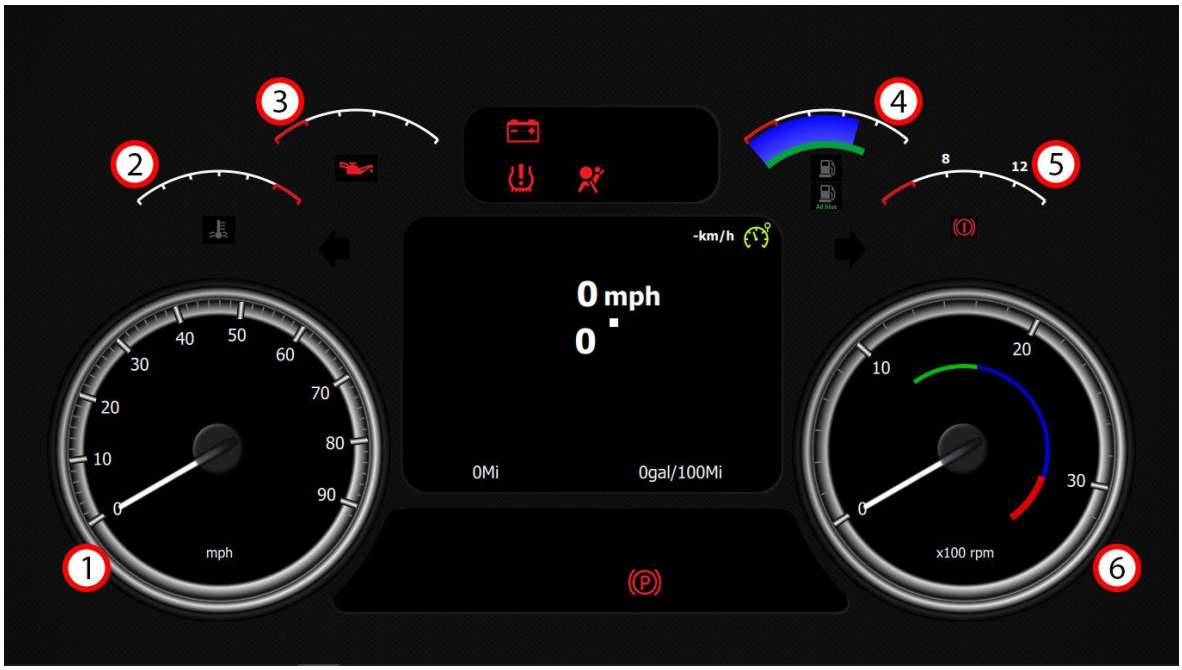
Adjusting Mirrors

1. Select which mirror you want to adjust.



2. After selecting a mirror, use the multi-directional button to adjust its position. You should see the mirror shift on the tv screen.

Learning Dashboard Controls



(1) This is the **speedometer**, it indicates the current speed of the truck.

(2) This is the **engine coolant level**, it indicates the engine's temperature. The presence of the needle in the red zone shows that the engine temperature exceeds 250°F and adding coolant is necessary.

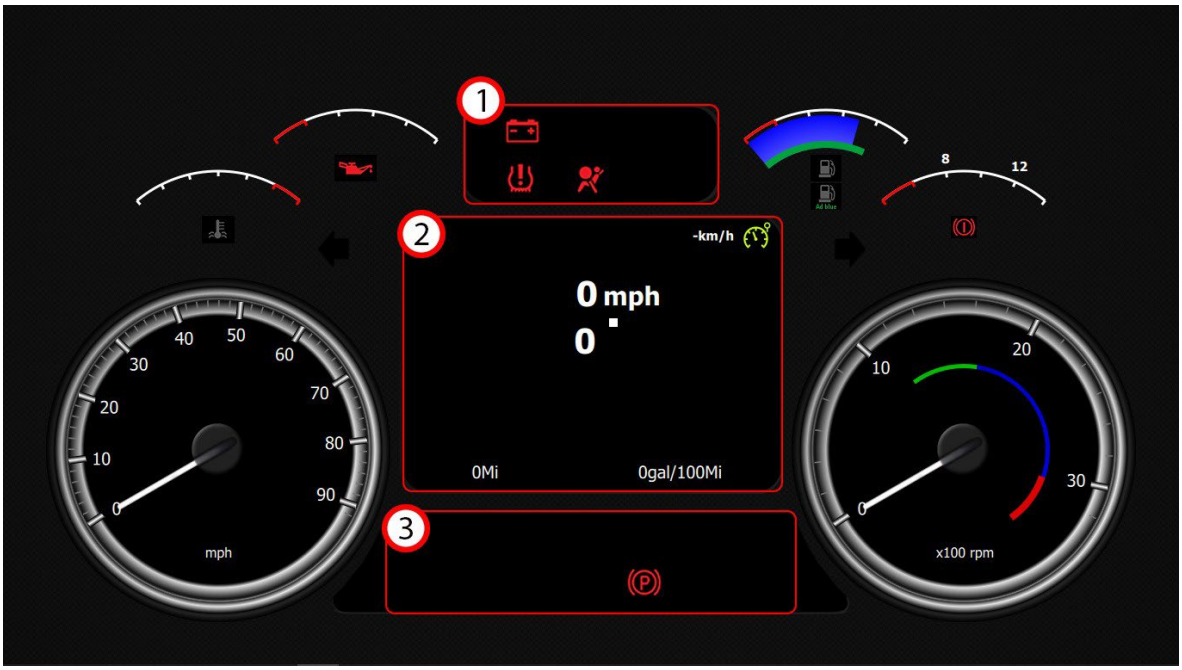
(3) This is the **engine oil level**, it displays how hot the motor oil is. Excessively high temperatures may lead to engine damage.

(4) This is the **fuel** gauge, it indicates when refueling is necessary. Right below is the **AdBlue** indicator which measures the AdBlue additive that helps reduce CO2 emissions. If the AdBlue reserve indicator is on, the AdBlue tank is empty.

(5) This gauge measures the **air pressure**. This indicator is used for the service brakes and parking brake. Air levels must be always monitored as a loss of air pressure will result in brake lockup.

(6) This is the **tachometer**, it measures the engines speed in revolutions per minute (RPM). The needle should be maintained in the green-blue zone when the truck is in motion.

Learning Dashboard Controls



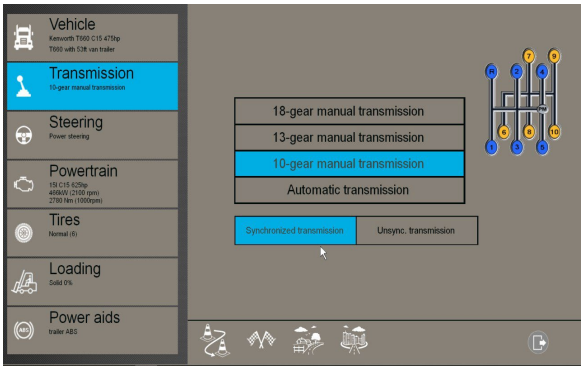
(1) This is a group of **warning lights** such as the tire pressure light, the battery warning light, and airbag warning light. These warnings should go away after a few seconds after turning on the truck. If any of these lights remain active, they should be resolved before continuing to operate the truck.

(2) This group contains information pertaining to the **speed** of the truck. This includes how fast the truck is moving in mph, the gear the truck is in, and if the cruise control indicator is on.

(3) This is a group of lights that show any **active controls** like the parking brake, low beams, high beams, emergency light, check engine light, and retarders. If the symbol is not displayed, then that control is turned off.

Learning Gears

1. Before getting started, make sure you are on a manual transmission by going to the truck settings then click on the Transmission tab. Then, proceed to the main menu and choose free driving.

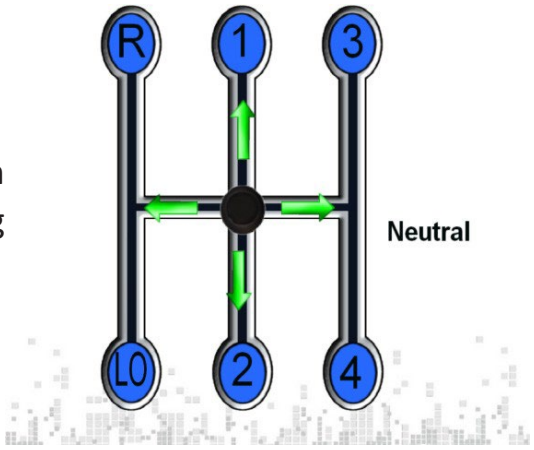


2. Locate the gear on your right side. Next, locate the clutch pedal on your left side.

When shifting gears, you must:

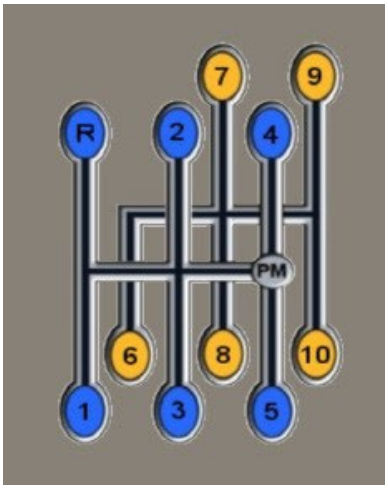
1. Press on the clutch pedal.
2. Select the desired gear.
3. Release the clutch pedal.

Note: When you are not in any gear, the gearshift is in neutral. The gear must be in this position when starting or stopping the truck.



Learning Gears

3. Using the shifter. In order to access all gears, you must use the black shifter located below the gear handle. On a 10-gear transmission, when the shifter is in the downward position you can access gears R-5. When the shifter is in the upward position you can change gears 6-10.

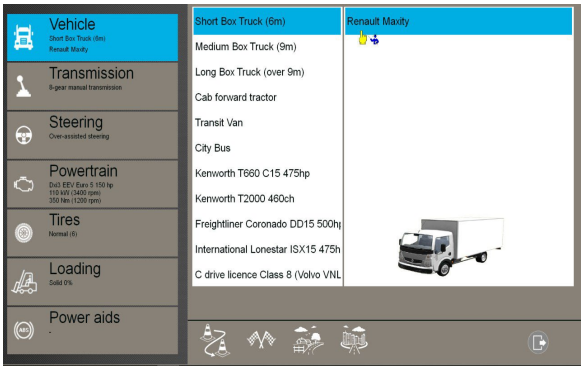


4. The best way to get good at shifting gears is by practicing. You can find helpful tutorials by going to the License tab in the main menu >> The vehicle >> Shifting gears (part 1)

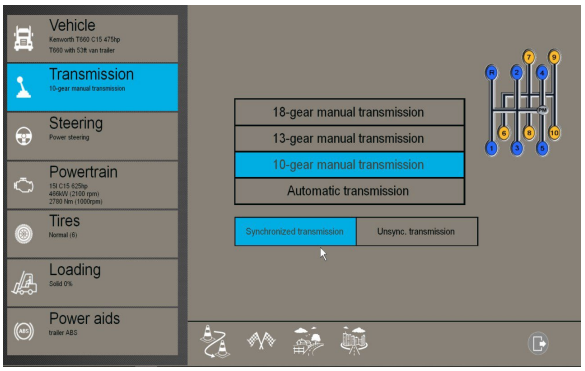
Truck Settings

1. Click on the truck icon to open the truck settings.

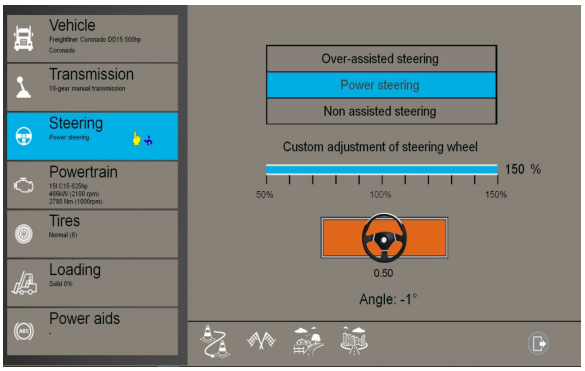
2. This tab allows you to change your **vehicle**.



3. This tab allows you to change the type of **transmission** on your vehicle.

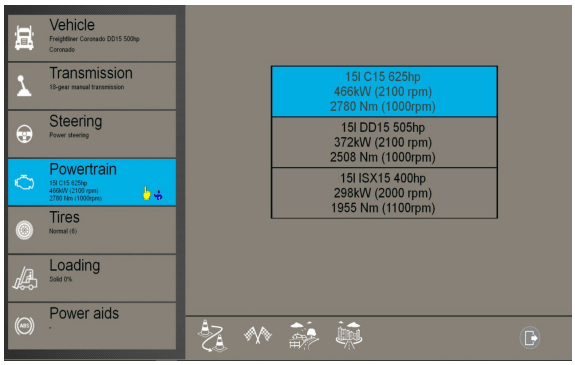


4. This tab allows you to modify the **steering**.

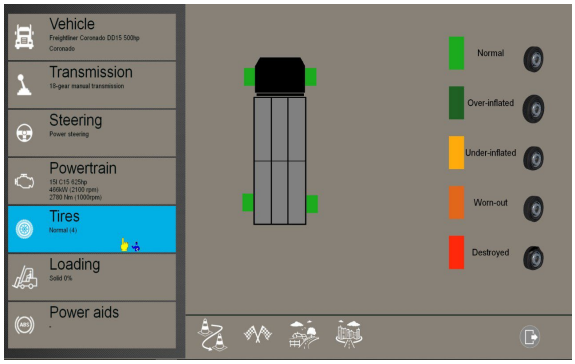


Truck Settings

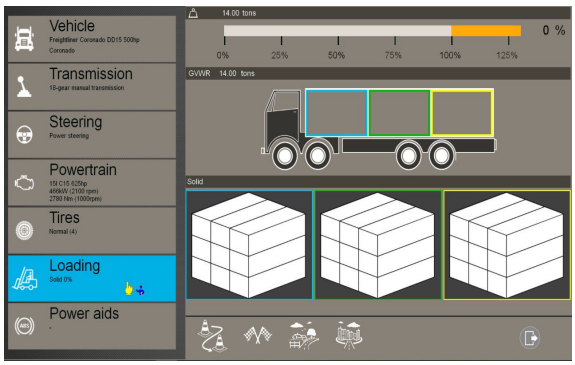
5. This tab allows you to change the **powertrain** of the truck.



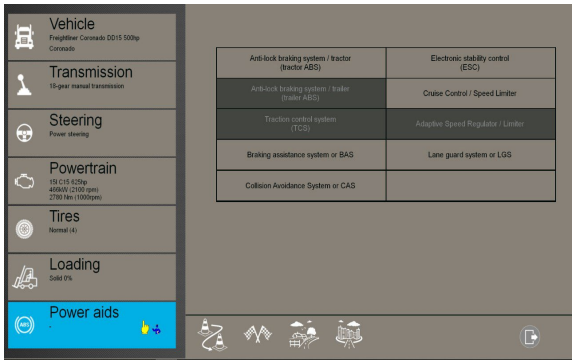
6. This tab allows you to change the air pressure of your **tires**. Click on one of the tires, then choose a color that describes the type of tire you want.



7. The **loading** tab allows you to increase the weight of the truck. Slide your finger across the top row to adjust.

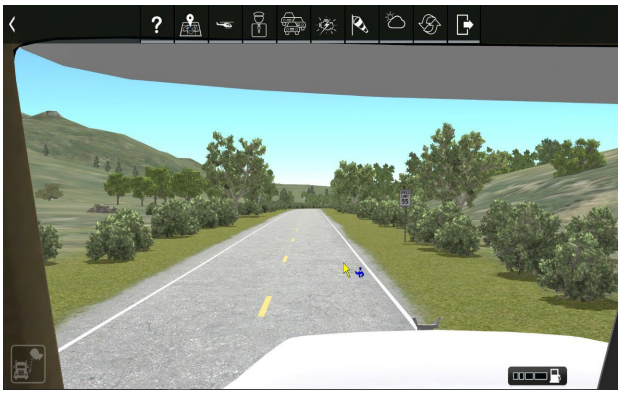


8. The **Power aids** tab has the same buttons that activate the power aids in your first touchscreen.



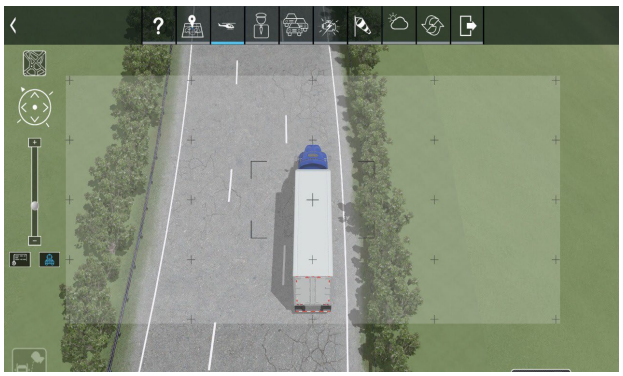
Environmental Settings

1. When you are free driving, you have the ability to change your surroundings.

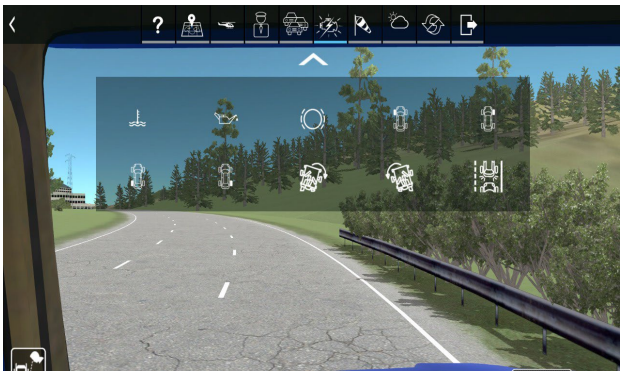


2. Locate the top ribbon on your screen and click on the question mark to view the meaning of each icon. Some of these settings allow you to:

See an **aerial view** of your truck.

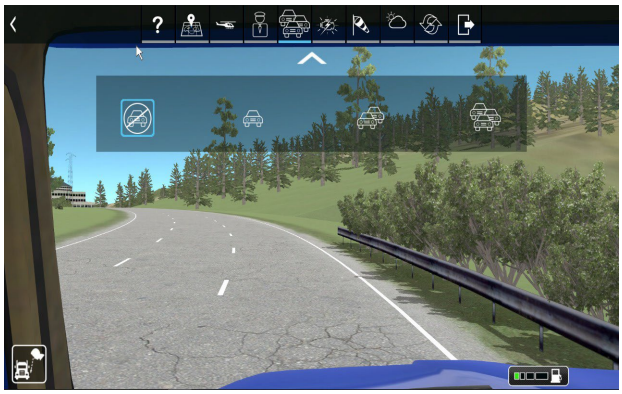


Simulate a **breakdown.**

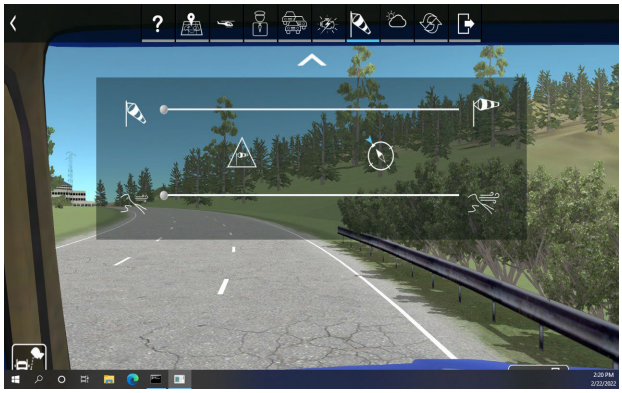


Environmental Settings

Adjust **traffic** density.

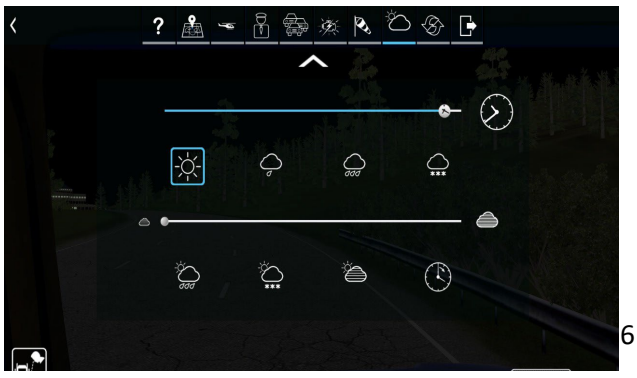


Change the **wind and sand** direction.



Change the **weather** conditions.

Change the **time** of day.



Troubleshooting Tips

Sometimes you may notice some words in French. Try your best to interpret. When the screen says, *retarde*, (delay, in French) it typically means the switch behind the steering wheel should be used.

The emergency stop button (in red) is located on the left side of the steering wheel. It can be used to quickly shut down the machine.

When the button is pushed down, the machine may not function properly. When the simulator is in use, the button should be popped up.