

STEM Day

Location: Bell Engineering CVEG computer Lab (2nd Floor).

Duration: 60 minutes.

Time: 04/08/2017 (9:30AM - 3:15PM)



Overview:

High school students will be introduced to transportation planning. The students will work with computer based game to compare controlling traffic manually versus using the fixed-time controls.

Learning Outcomes:

This workshop was designed with the objective of letting high school students interact with traffic control systems and have a better understanding of concepts related to the area of transportation engineering

<i>Outcomes</i>	<i>How will the students achieve this outcome?</i>
#1: Students will be able to have a different perspective about transit planning and the careers in transportation engineering such as traffic engineering, and city and regional planning.	PowerPoint mini-lecture will be presented to the students.
#2: Students will develop engineering skills, experience the thinking process and creativity of engineering, and work on teams .	Students will follow the scientific method to conduct an experiment, interacting with a simulator simultaneously.
#3: Identify how variables such as traffic volumes, speeds, network size, and signal timing influence the system performance.	Interacting with a simulator and analyzing the graphs for fixed and manual time system.

Supplies Needed:

<i>Quantity</i>	<i>Item Name</i>	<i>Specifics:</i>
30	STEM Day – Student Handout	Each student will be supplied with a handout.
20	Computers with Internet connection and Java enabled for each student or small group of students	Students should be seated by groups. Depending on the attendance, each computer can be formed with 3 or 4 students.
1	Flip chart papers or Board	For the instructor. Remember to get some markers or chalk.
20+	Pencils with erasers	Provide 3-4 per group
45+	Index Cards	To help
6+	Color Permanent Markers	

 Room Configuration:

How will the room be set up?	
-	Organize the computers by groups of three or four depending on attendance. Try to spread the groups throughout the classroom. Not only in one section of the lab.
-	Two students will be observers and one will be game controller. Role exchange may occur during the workshop.
-	Print 30 handout for the students and place 4 copies per computer.
-	Verify that the software is installed and ready to use in all computers.

 Preparation:

Check List:	What needs to be done in advance?
	Load Power-Point with the mini-lecture prepared.
	Print and place the “STEM Day – Students Handout” with pencils and index cards in the computers that will be used.
	Test the Traffic Control simulation on each student machine.

 Workshop Schedule:

Stage	Begin Time	End Time	Total time
1. Welcome and introduction to the workshop.			10 min.
<p>NARRATIVE:</p> <p><i>Slide 1: "Transportation Engineering: Traffic Control Simulator"</i> Welcome everyone to transportation Engineering workshop! We are so excited to work with all of you and get to know each other. Today we have only few minutes for this workshop but we have a lot to accomplish. That being said, let's just get started.</p> <p><i>Slide 2: "Who We Are?"</i> Every member of the group can introduce themselves. Name, country, what do you do?</p> <p><i>Slide 3: "What Are We Going to Do Today?"</i></p> <ul style="list-style-type: none">• First, we will give you a little introduction about what transportation engineering is and what types of careers are offered in this field.• Then, you will learn essential concepts about signal timing that will help you with the simulator we have prepared for you today.• After that, working in group, you will have a chance to play with the traffic control simulator.• And of course! the most important part is to have a lot of fun while we are learning. <p><i>Slide 4: "How do you get to the movie theater?"</i> This slide is hide. Tempting Ice Breaker Activity (ask around the classroom, expect one answer from every girl). This activity should be no more than 5 minutes. Everyone should say their name and their favorite mode of transportation. For example, my name is _____ and my favorite mode of transportation is _____.</p> <p><i>Slide 5: "What is transportation Engineering?"</i> Today we are here to learn a little more about transportation engineering. But first let's think about what the word transportation and what it really means for us in our daily life...</p> <p>For example, imagine if there are no busses, cars, airplanes, trains, or bikes in the world and you really need to get to the concert of your favorite artist and your house is 20 miles apart from it. How would you get there? Would you walk?... I wouldn't. That why I recognize the important value of transportation modes in my daily life. These modes can take me from one location to another and you can see them available almost everywhere. Even though walking is one of these modes of transportation. It sometimes can make people's life more difficult. To make it easier transportation engineers come up with ideas and innovations that facilitate our daily life and probably we don't even think about it we just use them. SO, how can we define transportation engineering?</p>			

Slide 6: "Transportation Engineering"

- Transportation planning is a sub-discipline of civil engineering.
- Transportation Engineers focus on designing new transportation systems and infrastructures, including
 - Highways
 - Airports
 - Trains
 - Bridges, etc.
- They do this by **analyzing** data, **identifying** problems, and **solving** them with innovative solutions.

Slide 7: "Video"

Slide 8: "Careers Options in Transportation"

Some career options found on transportation engineering are:

- Be a City Traffic Engineer.
- Traffic Engineer Consultant.
- Design Freeways, Mass transit, Rail or street.
- Design traffic signal.
- Design High Intelligent Transportation.
- Invent New Innovative Products/ Devices.
- Run your own Engineering Business.
- MANY MORE!!

Slide 9: "Which intersection is "better"?"

Now that we have a better idea of what transportation engineering is and what careers are offered. Let's see what you think... Unconsciously, you have been a passive observer of many of the problems that transportation engineers have identified. One example are the figures shown. Imagine you are exhausted from a school, all the knowledge you have received in the day and when you get to the first signal light you find something like the figure on the left. That will make you so sad. Obviously the one on the left seems to be more congested. Meanwhile, the one on the right presents a smoother flow of cars. How do you think would be the technical term to use in this case?

Technically, transportation engineers call this phenomenon GRIDLOCK, this is a situation of very severe traffic congestion. Transportation engineers develop strategies that are then tested in a simulator like the someone you will have a chance to interact with today.

Slide 10,11,12: "Gridlock buster!"

- Did you know that Transportation Engineers use simulator that are just similar to this one to develop more efficient signal timing pattern and produce a better traffic flow?
- You will have **5 minutes** to interact with the simulator.

Open the Gridlock Buster for students, let them play!

How does it feel to be a transportation engineer?

What are the things that made it difficult.?

What made you decide to change from red to green?

2. Activity 1: Introduction to Signal Timing and Traffic Control Simulator			20 min
<p><i>Slide 13: Figure</i> <i>Talk about simulators.</i></p> <p><i>Slide 14: "Introduction to Signal Timing & Traffic Control".</i> Now that you have practiced being a traffic signal operator, let's apply the scientific method to improve how we can control traffic signals. Our goal as transportation engineers is to move people as safely and efficiently as possible!</p> <p><i>Slide 15: "Activity 1: Simulator Interaction (Follow Handout)"</i> [Distribute Handout] The handout has instructions that go along with the next activity. Stop me if you are not following along with me or if you have any question in general. In this activity we will explore how to improve signal timing.</p> <p><i>Slide 16: "Important Terms for Traffic Signal Timing".</i> During this activity, some technical words will be mentioned and it is important to us that you follow along. On the first page of your handout, there is some space for you to write down the definition of these terms.</p> <ul style="list-style-type: none"> - Delay – When a vehicle has to stop at a red light, the driver experiences delay. - Queue – a line of vehicles waiting at a red light. - Efficiency – How well a traffic signal operates to reduce the amount of traffic delay. - Performance Index - queue length + amount of time delayed. <p><i>Slide 17: "Objectives of Traffic Simulator".</i> The objectives of this simulator are:</p> <ul style="list-style-type: none"> • Traffic engineers use computer simulations to test new traffic signal timing. • We follow the scientific method to conduct an experiment → which signal timing is the most efficient? • Compare graphs generated by traffic patterns to select the most efficient traffic signal timing <p><i>Slide 18: "What are you responsible for in this simulation?"</i></p> <ul style="list-style-type: none"> - Working in groups, students will use the traffic control simulator to complete several experiments to determine how to create a consistent traffic pattern. - Make sure to: <ul style="list-style-type: none"> • Take screen captures of graphs and paste them into a word processing document. • Write down or include in your capture the score, performance index (PI), and ending of queuing length. <p><i>Slide 19: "How the Simulator Works?"</i></p> <ul style="list-style-type: none"> • <i>First, you will choose the simulation settings. In your handout we have provided the initial network settings.</i> <p><i>Slide 20: "Run the simulation"</i> Explain how it pause and play and where to get the graph from.</p>			

Slide 21: "Now it's your turn."

You should all have the simulator already open in your computers, if anybody needs help finding the simulator please let us know. You will have a couple minutes to interact with the traffic control simulation. You can choose the settings you like. (*GIVE THEM 2-3 MINUTES TO INTERACT WITH THE SIMULATOR*).

Slide 22: "Record your Results"

As the pictures in the right show, you will have the game and then you can hit pause and select graph. Then in the new window you select: Queue(veh) and then OK. That should display the graph from the model you just created with the simulator.

Slide 23: "Queue Statistics"

- After you interact with the simulator you will generate a statistical graph that represent the Queue Length (number of vehicle in queue) and the x-axis is the simulation time when the queue happens.
- Read blue box.
- Explain the representation og the lines.

Slide 24: "Group Discussion"

- What is the longest queue you created?
- How many cycles are there in your simulation?
- How consistent is your pattern?
- Compare your graph to the 1 x 1 Fixed Time graph shown below. This graph is also included in Page 4. Which is more consistent? Why?

Slide 25: "Explanation"

- You just performed Manual Traffic control!
- Transition to fixed time control.

3. Activity 2: Variable Experiment Using the Scientific Method

20 min

Slide 26: "Activity 2: The most Efficient Signal".

Slide 27: "What can you change to improve the signal timing?"

Slide 28,29, 30,31: "Show the students how the scientific method applies to our workshop.

Slide 31: "Presentations"

Slide 32: "Thank you slide! End of workshop."