Modeling Traffic Solutions

Summary:
We’ve all driven in traffic where the cars just don’t seem to be moving fast enough. Traffic congestion and delays can have a significant impact on people’s lives. Engineers work to create and maintain road networks that serve the needs of the community in which they are built.

Apart from the immediate benefit of shorter travel times, improving traffic flow can have other major consequences. During an emergency evacuation, smooth traffic flow can mean the difference between life or death for those trying to evacuate to safety. Emergency vehicles also require smooth traffic flow to navigate to the scene of an emergency. There are environmental impacts as well. The longer cars sit in traffic the more fuel they consume, leading to increased CO₂ and other pollutants.

In this activity, students will make observations of traffic flow in an area that is significant to them. From their observations, students will design and demonstrate how a roadway project could lead to increased traffic flow and therefore improved mobility.

Objectives:
Students will identify a traffic problem and propose a solution. Students will generate a list of priorities/goals for their project and will determine their own criteria for success. If time allows, students will design and test their solution using traffic modeling software.

Engineering Connection:
Students will engage in the engineering design process. They will also have the opportunity to evaluate their solution based on their success criteria. Engineers develop solutions to complex problems by breaking them down into smaller, more manageable pieces. Engineers also use modeling to analyze their proposed solutions and use that data to predict the impact. Students will engage in these same practices as they tackle real world traffic problems by taking a small area and designing a solution. Modeling can provide valuable information and feedback for the student engineers that they can then incorporate into their re-designs.
Keywords:
- Traffic, engineering design, urban planning, urban sprawl, environmental impact, autonomous vehicles

Total Time: Ten 45 minute class periods

Pacing Guide:

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kick-off Activity</td>
<td>Background information:</td>
<td>Design and Evaluate a solution using a model</td>
<td>Modeling Software:</td>
<td>Designing Solution</td>
</tr>
<tr>
<td>Observations:</td>
<td>Traffic management principles, local laws,</td>
<td>Assign groups, determine area of focus,</td>
<td>Learn the modeling software</td>
<td>Use software to model students’ solution(s)</td>
</tr>
<tr>
<td>Collect data on current traffic flow/patterns for a given area.</td>
<td>jurisdiction (who would pay for improvements?)</td>
<td>brainstorm solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes:</td>
<td>Engineering Design Process</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 6</th>
<th>Day 7</th>
<th>Day 8</th>
<th>Day 9</th>
<th>Day 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designing Solution</td>
<td>Data Analysis:</td>
<td>Conclusions:</td>
<td>Conclusions:</td>
<td>Communicating Results:</td>
</tr>
<tr>
<td>Finalize solution in the software, double check work</td>
<td>Run simulation and collect data.</td>
<td>Creating classroom presentations and engineering reports</td>
<td>Finalize classroom presentations and engineering reports</td>
<td>Presentation of findings and final comparisons between solutions.</td>
</tr>
<tr>
<td></td>
<td>Begin analysis of data and compare</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Required Resources:

Traffic Modeling Software:
- [https://www.eclipse.org/sumo/](https://www.eclipse.org/sumo/)

Images:
Credit: Zach Dwyer - St Cloud Times
Subject Area:
Environmental Science, Grades 11-12

Contributors:
Josh Rogers, Davies High School

Acknowledgements:
This curriculum was developed under National Science Foundation RET grant # 1953102. However, these contents do not necessarily represent the policies of the National Science Foundation, and you should not assume endorsement by the federal government.