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.

Image 1: Road Construction

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 CO_2 and other pollutants.

Image 2: Road congestion

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:

Day 1	Day 2	Day 3	Day 4	Day 5
Kick-off Activity **Observations:** Collect data on current traffic flow/patterns for a given area.	**Background information:** Traffic management principles, local laws, jurisdiction (who would pay for improvements?) Notes: Engineering Design Process	**Design and Evaluate a solution using a model** Assign groups, determine area of focus, brainstorm solutions	**Modeling Software:** Learn the modeling software	**Designing Solution** Use software to model students' solution(s)
Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
Designing Solution Finalize solution in the software, double check work	**Data Analysis:** Run simulation and collect data. Begin analysis of data and compare	**Conclusions:** Creating classroom presentations and engineering reports	**Conclusions:** Finalize classroom presentations and engineering reports	**Communicating Results:** Presentation of findings and final comparisons between solutions.

Required Resources:

Traffic Modeling Software:

- https://www.eclipse.org/sumo/
- https://www.ptvgroup.com/en/solutions/products/ptv-vissim/

Images:

Image 1 Source - https://www.sctimes.com/story/news/local/2020/04/20/what-know-2020-construction-season-central-minnesota-stearns-st-cloud-benton-road/5145020002/
Credit: Zach Dwyer - St Cloud Times

Image 2 Source - https://newsroom.unsw.edu.au/news/science-tech/traffic-jams-are-contagious-understanding-how-they-spread-can-help-make-them-less
Credit: UNSW Sydney

Subject Area:

Environmental Science, Grades 11-12

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