Traffic Operations:

Toll Payments

THE CHALLENGE
Find out how the way payments are collected on a tolled roadway affects congestion and air pollution.

GRADE LEVEL
Middle School. The activity will work best if there are 20-25 students. If fewer students are present, modify activity to have just two toll lanes (Lane One/all cash and Lane Three/all electronic).

ACTIVITY DURATION
Approximately 5 to 10 minute introduction. 15 to 20 minute activity, followed by a 5 to 10 minute discussion.

MATERIALS
• Chairs or other furniture to create “toll lanes.” Tape on the floor would also work (see attached figure for setup).
• Paper play “money” and paper receipts.
• Stopwatch or timer.

SET UP
See the attached figure for the room layout. Set up chairs (or other furniture or tape on the floor) to create three ‘channels’ each about five chairs long on each side and just wide enough for one student to walk through.

The setup simulates three different types of toll collection at a booth:
• Lane One – every toll is paid by cash and the toll collector provides a paper receipt.
• Lane Two – two of every three vehicle tolls are paid by cash in return for a paper receipt; the third vehicle toll is paid by electronic transponder (“toll tag”) with no paper receipt.
• Lane Three – every vehicle toll is paid by toll tag with no paper receipt provided.

For Lane One, choose one student to be the toll collector, who will collect cash tolls and provide paper receipts to every car. Choose a second student who will assist this toll collector by replenishing the money to cars at the end of the queue and the supply of receipts.

For Lane Two, choose one student to be the toll collector, who will collect cash tolls and provide paper receipts to two of every three cars. Choose a second student who will assist this toll collector by replenishing the money to cars at the end of the queue and the supply of receipts.

Assign a student to each toll booth lane to count the ‘cars’ (students) as they exit the toll booth area.

ACTIVITY
Provide a brief introduction to toll booths and why some states use them to help pay for their transportation systems. Ask the students if they’ve ever been through a toll booth and if so what they remember about it. Show the kids the photos on the attached pages and talk to them about the different ways that tolls are collected (cash-only with a human toll collector, by electronic transponder, or a combination of both).

Agree with the students up-front the speed with which they will walk through the “toll booths.”

Lane One
Have the toll collector take paper money and AFTER money is in hand, give the patron a paper receipt. The ‘car” will then exit the channel (toll booth), drop off the receipt, pick up more paper money before re-entering at the back of the ‘channel’. Have a student responsible for collecting the receipts and handing out paper money as the student returns to the back of the ‘channel’. Have another student serve as the counter for Lane One and count each student as they exit the ‘channel’.

Engineers use technology to save time, reduce congestion and reduce air pollution. Many students will be familiar with toll roads and those who don’t ... will be introduced.
**Lane Two**

For two of every three ‘cars,’ have the toll collector take paper money and AFTER money is in hand, give the patron a paper receipt. These ‘cars’ will then exit the channel (toll booth), drop off the receipt, and pick up more paper money before re-entering at the back of the ‘channel.’ Allow the third student to walk through with no paper transactions – just walk through without stopping. Have a student responsible for collecting the receipts and handing out paper money as the student returns to the back of the ‘channel.’ Have another student serve as the counter for Lane Two and count each student as they exit the ‘channel’. Each student is free to rotate from a paperless customer to a cash customer but in all cases, the first two students pay and the third does not pay with cash.

**Lane Three**

Have each student walk through the ‘channel’/toll booth without stopping and go back around and walk through again. NO STOPPING. Have another student serve as the counter for Lane Three and count each student as they exit the ‘channel’.

At the conclusion of time (approximately five to ten minutes), convert the collected numbers from each of the three ‘lanes’ to the number of cars that would pass in one hour.

**FOR DISCUSSION**

You can ask students questions like this:

- Show the photo of cars backed up at a toll booth and point out the delay when drivers can only pay with cash or when there is a mix of cash and toll tags, vs the ‘lane’ where cars do not stop because payments are collected by toll tags (or “pay-by-plate” technology).

- Explain how engineers use technology to save time, reduce congestion and eliminate air pollution that results from cars and trucks sitting in a queue waiting to pay a toll.

- Ask the students which they think is better and why they think not all toll roads are cashless. What might the downsides be of making vehicles use a toll tag to pay their tolls? (Explain that not everyone can afford to have a pre-paid toll tag and that some people don’t want anyone to know that they went on the toll road or what time they went through the lane.)

- Also explain that toll booths were necessary years ago because technology didn’t exist to pay with a toll tag or by just billing the license plate owner.

- Ask students which lane they would want to be in if they were driving home - why?

- In this example, every driver who paid with cash used exact change. What would happen if the toll collector had to provide change? Or if drivers were able to pay with a credit card?

- Explain to students that toll roads are often called “turnpikes,” because many years ago there was literally a “pike” or a gate, that had to be physically turned to allow passage after a toll was paid, often to a private road owner.

*How far we’ve come in toll collection technology (and cost)!*
Room Set-Up

Timer (2 or 5 minutes)

Cash and Receipt
Toll tag

Take cash give receipt
Count students

Take cash give receipt 2of3
Count students

Count students
Toll Booths and a Toll Collector Taking Cash
Lanes at Toll Booths Where Cash may be Used

https://www.flickr.com/photos/hopkinsii/9289042075
Lanes at Toll Booths where Cash may be Used, continued
Lanes at “Toll Booths” that Only Use Electronic Toll Collection
Lanes at “Toll Booths” that Only Use Electronic Toll Collection, continued