Grade Level Expectation:5-6
Traffic Tally
Content Area: Mathematics

Lesson time:
2-3 class periods

Materials:
1. Pencils and erasers

2. Watches with minute/ second hands, stopwatches, or clicker counters

3. Clipboards (if available)

4. Additional staff support (classroom assistants or parent volunteers)

5. Signed parental consent forms (if taking students off of school premises

6. Student Worksheets (following the lesson)

7. Photographs for further exploration can be at: www.swt.org/share/bguard.html

Objective:
Students will understand the connection between vehicle traffic, air pollution, and health by designing and conducting a traffic survey to explore traffic volumes on familiar roadways. This lesson is adapted from the Walking for Health & the Environment Curriculum, Walk Boston.

Summary:
This activity is a mini-field trip that provides students with hands-on experience in conducting a traffic survey in their own community, analyzing their data, and presenting it in a graphic form that shows traffic volumes.

Standards:
5th Grade
1. Patterns, Functions and Algebraic Structures
    1. Number patterns and relationships can be described using a variety of tools
    3. Quantities can be expressed and compared using ratios and rates
3. Data, Analysis, Statistics and Probability
    1. Visual displays and summary statistics are used to describe and interpret data

6th Grade
1. Patterns, Functions and Algebraic Structures
    1. Patterns can be described using words, tables and graphs
3. Data, Analysis, Statistics and Probability
    1. Questions can be answered by collecting and analysing data and data displays

Discussion:
Do you think there is too much traffic along the main roads in your community? If so, how many vehicles do you think travel along these roads during morning rush-hour traffic? How many people do you think are typically in each vehicle?

How might the amount of traffic be reduced?
(Possible answers: More people walking, bicycling, carpooling, and taking subways, trains, and buses)

How might the amount of air pollution from this traffic be reduced?
(Possible answers: Having fewer motor vehicles on the road; driving smaller or hybrid cars; more people walking, bicycling, carpooling, and taking light rail, trains, and buses)

What might be some of the benefits of reducing traffic and air pollution from vehicles?
(Possible answers: Fewer traffic jams; safer

streets to walk and bike on; fewer health problems from air pollution, such as breathing problems [e.g., asthma], and heart disease; and possibly healthier people because more people might be walking and getting exercise)

What things might affect the accuracy of a traffic survey's results? (Possible answers: Bad weather; if the day was a holiday; if different groups started counting traffic at different times; if some people missed counting some vehicles; if some people put some vehicles into the wrong categories; if some people "double-counted" some vehicles)

What vehicles produce the most pollution per person? (Possible answer: Trucks with just one person in them.)

What vehicles produce the least pollution per person? (Possible answer: Bicycles)

Preparation:
Make important arrangements, such as obtaining parental permission slips to go to off-school locations, and getting commitments from adult classroom assistants and/or parent volunteers to accompany the class groups. (Note: If going offsite is problematic, you can instead conduct the traffic survey on school premises, near the driveway to the school.)

Choose the roads on which the class will survey traffic volume and vehicle types.

Choose a minimum of two roads for comparison purposes.

Choose roads that are within easy walking distance of the school and are busy 2-lane (one travel lane each direction) roadways.

Select a time of day when the roads have moderately busy traffic, such as morning rush hour. The number of roads chosen will depend on how many groups you want to divide the class into (which in turn will depend in part on how many adult assistants/volunteers you have, and the size of your class).

(Note: The class will not be surveying major 4-lane or larger highways; the purpose is to determine local/community traffic impacts.)

Give students an overview of the traffic survey. Inform students that the class will conduct a traffic survey to explore traffic volumes on key local roads, and the connection between vehicle traffic and air pollution. Discuss the "Key Questions" above with the class. Tell the class that they will divide up into groups of at least 6 students per group, stand safely by the sides of different busy roads, and count the number of vehicles driving by for a

fifteen-minute period (e.g., during morning rush hour). They will also identify the type of each vehicle (e.g., car, truck, etc.) and the number of people in each vehicle.

1. Explain a tally chart.
Tell students that to conduct the survey, they will make tally charts that keep track of the number and types of vehicles and the number of people in each vehicle, and that the class is first going to practice making these charts. On the chalkboard, illustrate tally marks.

2. Practice a traffic tally in class. Tell students to use the back of their Student Worksheets to practice recording the number and types of vehicles that you will list for them.

3. Explain roles.
Explain to students that they will conduct the survey in four pairs:

1st Pair: One person will call out loud to his or her partner each time a vehicle passes in one direction (one side of the street) the type of the vehicle (e.g., “car,” “truck”), while the other partner will record the data on the Tally Student Worksheet #1.

2nd Pair: One person will call out vehicles passing in the other direction (on the other side of the street), while the other partner records the data.

3rd Pair: One person will call out the number of people in each vehicle in one direction, while the other partner will record the number of persons per vehicle. For buses, have the students determine an estimate of the number of people they will use (e.g., average of 15 people per bus) and make sure all students are using the same number.

4th Pair: One person will call out the number of people in each vehicle in the other direction, while the other partner will record the number of persons per vehicle. For buses, use the same estimated average number of people as discussed in “3rd Pair” above, and make sure all students are using the same number.

4. Explain methodology
Also explain to the class that in order for the survey to be accurate, it is important that each group and each pair of students do things exactly the same way. For example, each group must start the survey at the same time, and each group must conduct the survey for exactly 15 minutes – not longer and not shorter.

5. Assign roles
Assign the students to survey groups and assign an adult assistant to each group. Have students in each group divide up into pairs; help them decide

who will be an “announcer” (calling out the type of each vehicle that passes, or the number of people in each vehicle) and who will be the “recorder” in each pair. Assign one person (perhaps the adult assistant) to be the timekeeper, who will tell students when to begin and end the survey and will record the exact starting and ending times.

6. Conduct the traffic survey.
Conduct the traffic survey at the designated locations, using Student Worksheet #1. If possible, don’t have students cross any streets. Be sure to remind students to practice safety: stand back from the roadway; if crossing a street is necessary, do so carefully when the adult assistant says it is safe to do so, make sure students are standing in a way that allows other pedestrian to pass easily, and that they are polite to people.

7. Discuss and analyze survey results in class.
Calculate totals. Back in the classroom (on the same day or another day), have each group add up the totals for their group, including the total number of vehicles, and the total number of each type of vehicle, using Student Worksheet #2. Also have each group add up the total number of people traveling in these vehicles. Ask a spokesperson from each group to read aloud the totals for their group, write these on the chalkboard, and add up the totals for the entire class.

Discuss results. Compare and contrast the different categories for each group. Which roadway had the most traffic? Why does the class think this is so?

Calculate different vehicle types. Of the total traffic, have the class calculate the portion of each vehicle type (e.g., cars, trucks, buses, bicycles). For younger students, this might be calculated as fractions. For older students, this might be calculated as fractions and percentages.

Discuss the accuracy of the methodology and results. Identify any potential problems regarding the data collection methods: Did one group collect data for 20 minutes instead of 15? Did some people miss counting some vehicles (e.g., because they weren’t paying attention, because they sneezed, etc.)? Did some people “double count” one or more vehicles? Could students really see the number of passengers inside vehicles? Did some people put certain types of vehicles in the wrong categories? Did one group start earlier or later than another group? Did the weather suddenly change during the tally? Inform the class that any of these or other factors can affect the accuracy of the survey results. Ask the class if they have any ideas about how the survey could have been done more accurately.

8. Discuss the relationship between traffic volume, number of people in vehicles, and air pollution.

Ask: If the number of vehicles on the road were reduced, might this reduce air pollution? (Correct answer: Yes).

Why? (Correct answer: Because gasoline-powered vehicles emit air pollutants, and fewer vehicles would mean less pollution.)

What are some benefits from reducing air pollution? (Correct answer: Fewer breathing problems, like asthma, less heart disease, and more people might get exercise by walking or bicycling instead of driving. Healthier trees and plants. Also reducing some sources [vehicles] of global warming). Also discuss how fewer vehicles, ones that have higher miles-per-gallon, carpooling, and using public transportation would use less gasoline and thus produce less pollution.

9. Have students present the survey results.
Either during the same session or on another day, tell the class that they will now prepare a presentation of the traffic survey data. Depending on time available, either assign how the class should present the data, or, if more time is available, have the class discuss different ways of presenting the data and determine the best way to present the information (e.g., line graph, pie chart, pictogram, and/or bar graph). If time permits, you may want to have different groups present their data results in different ways.

Building on prior classroom experience with the different presentation formats, explain to the class how to develop the type of presentation format you choose. Decide what units, scales, colors, symbols, spacing, etc. to use, as appropriate. If computers are available, consider having students check the Internet or use relevant software to create charts or graphs.

10. Tell students that tranportation agencies perform traffy tally studies. Ask the students how they think agencies would use this data. Consider calling your local plannig agency. Local planners (City, region, DOT) may be willing to come talk to the class about how this information is used.

11. Class display.
Have the students create a class display of the survey results.

12. Discuss presentation methods.
Discuss which type(s) of chart or graph conveys the information most effectively and why.

Adaptations
For Grades K-2, conduct the traffic survey as a whole class instead of dividing up into groups (with enough adult classroom assistants). Have the teacher and adult assistants, rather than the students, count the

number of cars and people in the cars. Back in class, the teacher can call out the totals for the students to record. For presentation purposes, help the students develop pictograms and/or pie charts (instead of more complex bar graphs, etc.).

Further exploration

Have students explore the mean and range of the different groups' data sets and of the grand totals. Have students develop a database, computerized if possible, of the data collected.

If your school is near a busy business district where there is a lot of foot traffic, students can tally the numbers of pedestrians (in addition to vehicles) along a road. This exercise, and the accompanying four photographs at the end of this lesson, can show students how much less space is taken up by people on foot or bicycles than by people in cars. It can also prompt a discussion about polluting versus non-polluting modes of travel. Perform this pedestrian traffic tally at a time of day that's busy for shops and stores, such as lunchtime. Assign a fifth pair of students to count pedestrians – one student for each sidewalk along the road.

Resources

UK Department for Transport Primary School Teaching Resource – Numeracy: Local Traffic Survey. URL:http://primarylinks.co.uk/category/links/geography/page/3/

The Beacon School Interactive Website – Geography Department. URL:http://www.bbc.co.uk/schools/gcsebitesize/geography/

The Tampa Tribune – "Packing Pavement," 7/18/99, by Jim Beamguard, writer, and Phil Sheffield, photographer. Photos used with permission. Complete article can be viewed online at URL: http://www.swt.org/share/bguard.html

Tally Sheet for Traffic Survey

Location (name of road, and main intersection, if appropriate):

_____

Fill out while coducting the traffic survey:

Number of Each Vehicle Type

	Tally	Totals
Cars		
Trucks		
Buses		
Bicycles		
Pedestrians		

Number of people in each vehicle

Survey Analysis and Presentation

Location (name of road, and main intersection if appropriate):

_____

Fill out in classroom after conducing the survey:

Total number of cars: _____ Total number of people in cars:_____
Total number of trucks: _____ Total number of pople in trucks: _____
Total number of buses: _____ Total number of pople in buses: _____
Total number of bicycles: _____ Total number of pople on bicycles: _____
Total number of pedestrians: _____

Total number of all types of vehicles: _____ Total number of people, all vehicle types: _____

Present your results (as a line graph, pie chart, bar graph and/or pictogram).