

The Physics of Highway Safety

The Highway Safety module addresses a number of issues related to the determination of local safety problems, to identifying and prioritizing high-accident locations, and, on a limited budget, to trying to fix them. The module also illustrates the physics involved in traffic crashes, including the effects of the first collision (the vehicle striking a tree causing damage to the vehicle) as it related to the conservation of momentum and the impact of mass and velocity on the effectiveness of crash impact attenuators.



One Safety Module will supply hands-on experience for a class of approximately 25 students.

	Estimated Classroom Time	Module Contents
Activity 1	20 minutes reading, 40 minutes class time	Safety Manual Scenario Posters Result Pockets Money Bags Interactive Physics Software
Activity 2	10 minutes reading plus software installation 90 minutes class time	TRAC™ Money Result Cards
Activity 3	10 minutes reading plus software installation 30 minutes class time per activity	

Quick Fixes for High-Crash Highways, the first activity in the module, deals with basic methods of problem identification, how to determine the reliability and validity of data, and the extent to which such data can be used to select solutions that have the highest probability of improving situations.

This is done in the context of making decisions that often fall to local traffic engineers or local governing bodies concerning highway improvements. In addition to problem solving techniques, students will be exposed to traffic engineering concepts, such as crashes and traffic conflict, the effect of driver decision points on delay, access control, sight distance and its relationship to safe speed, congestion and traffic volume, and land use planning and its effect on traffic. Since students have small budgets that will fall short of addressing every problem, they must select the solutions most likely to reduce crashes for the least amount of money.

Specific relationships between these concepts and the National Science Education Standards (NSES) relating to these topics are outlined in the activities chart. These

concepts not only highlight the work of the traffic professional, but also make students better consumers of transportation services in the future.

Collision Calamity and **Barrier Bumping** use Interactive Physics™ educational software to illustrate the series of impacts that result from the vehicle colliding with another vehicle or a fixed object. In the Collision Calamity activity, students cause a test vehicle to impact other vehicles of various sizes and masses at differing speeds, and then calculate the forces involved as they relate to the outcome.

The students can use three different experiments to explore the concept of conservation of momentum in traffic crashes, first under ideal conditions and second, in a more real world setting where friction plays a role.

The second Interactive Physics activity, Barrier Bumping, simulates the scientific vehicle crashes tests so often seen on television. The student “drivers” can create a collision between a moving vehicle and a stationary barrier at various speeds and then calculate the forces on the vehicle at any time during the crash. By allowing students to fill the barrels making up the barrier with different materials, this activity also illustrates the effect of the “impact attenuator” in absorbing energy that would otherwise be transferred to the vehicle and ultimately, its occupants.

****NOTE: Class visits by NDDOT TRAC volunteers are available for this module. These visits include a presentation on NDDOT’s use of Impulse and Momentum principals used for designing safety barriers and video on crash testing safety equipment. Also a presentation on engineering is given.***