

Portland Bureau of Transportation

Treatment of School Pedestrian Crossings: A Comparison of Traffic Calming Tools

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by Scott Batson

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Introduction

Elementary school children are of special concern regarding their interaction with motorized vehicles. Adults often have difficulty guessing how fast a car is traveling, even with their experience operating an automobile. Children are less able to make such judgments, being less attentive to their surroundings. A child's difficulty at determining a safe time to cross a busy street is compounded at a corner where the child must keep track of two directions of traffic and side-street cars turning into the pathway.

School grounds are natural pedestrian attractors. Playground equipment and large open spaces, in addition to after-hours building use, mean pedestrians of all ages will be found near a school, at unpredictable times. In 1994 the City of Portland, Oregon, started the School Safety Program. The focus of the program is to improve the safety of elementary school-age pedestrians, especially near schools. [Portland's School Safety Program](#) initiates projects based on traffic conditions within a school's school speed zones, assigning points for speed and volume of traffic, and addresses the highest scoring schools first.

This paper will outline the tools available to increase the safety of school crossings, as applied in Portland, Oregon, and discuss some benefits and tradeoffs associated with each option.

School Speed Zones and Markings

School speed zones, 20 miles per hour when children present, coupled with cross walk signs and cross walk markings are the most common types of devices in use. These should be the first tools employed to improve safety at crossings directly associated with school children. Signs and roadway markings are intended to alert drivers to special locations designated for use by younger pedestrians.

A clear advantage of signs and markings is their relative low cost. Unfortunately, signs are only as good as the driver who sees and obeys them. Over time, repeated exposure to any sign reduces its effectiveness. A sign seen every day starts to blend into the

background, becoming part of the "scenery." Some drivers disregard such warnings and exceed the regular posted speed when traveling through a school zone.

Crossing Guards

School crossing guards are organized by the local school to increase the awareness of automobile drivers to the school crossing's highest use time, when classes are starting or ending.

Crossing guards are good supplements to school crossing signs and pavement markings, alerting drivers to a specific situation. Their effectiveness varies with the amount of adult supervision available, and what other controls are in place at the crossing. Crossing guards are often on duty for only 15-20 minutes before or after school. The play grounds and parks associated with elementary schools in Portland are available 24 hours a day, seven days a week. Crossing guards require no expense from the City.

Mid-Block Cross Walks

Cross walk relocation involves moving a cross walk away from an intersection to reduce the number of conflicts a pedestrian must avoid.

Cross walks, by law, are located at intersections, marked or not. Also by law, marked crossings are to be chosen by pedestrians over unmarked crossings. Intersection cross walks present children with traffic conflicts from several directions, from the right and left and from vehicles turning from the side streets. Mid-block crossings reduce the number of directions from which vehicles approach a child's path. Additionally, school entrances are often some distance from the designated intersection crossings. Children may be crossing a street mid-block as a natural continuation of their exit from the school, or prompting from a ride provider.

Habits are difficult to change. Where it is not convenient, many children will not recognize a benefit to walking a little further to use a mid-block crossing. Cross walk relocation may involve parking adjustments or removals, but is relatively inexpensive.

School Zone Beacons

School zone beacons are flashing yellow lights installed above the 20 miles per hour speed limit sign for school zones. The school zone sign is modified to read "or when lights are flashing" below "when children are present." Beacons are normally placed on busier streets with high pedestrian crossings. The beacons are turned on and off remotely by the Bureau of Traffic Management based on requests made by the school. Typically, beacons are turned on one-half hour before to fifteen minutes after the start of school, and fifteen minutes before to one-half hour after the end of school.

School zone beacons provide a high level of warning to alert the driver to a specific time when children are expected to be at the crossing. Beacons also allow better enforcement

of the school zone by traffic control officers. Motorists can argue that they did not see the children, but the flashing beacon is difficult to miss. The cost of beacon installations varies greatly between each location, depending on convenient access to power, but is comparable to pedestrian refuges.

Speed Bumps

Speed bumps, or 'humps', are raised sections of pavement, constructed along a street, which cause drivers to reduce their speed. Portland currently constructs two sizes of speed bumps. The bumps are three inches at their highest point and have a gradual ramp up to that high point. The speed bumps typically placed on Local Service¹ streets are fourteen feet long, start to finish, when driving over them, and are intended for streets posted 25 miles per hour. The speed bumps typically placed on Neighborhood Collector¹ streets are twenty-two feet long, when driving over them, and are intended for streets posted 30-35 miles per hour, or where designated transit or emergency vehicle routes exist.

Typical vehicle speeds* measured at a fourteen-foot speed bump are 17-20 miles per hour, and the average speed on the street after bump construction is between 24-28 miles per hour. The typical vehicle speeds measured at a twenty-two-foot speed bump are 25-28 miles per hour, and the average speed on the street after bump construction is between 28-32 miles per hour.

Speed bumps are the most effective devices for reducing vehicle speeds. Reduced vehicle speed allows drivers to observe a wider area near their vehicle and decreases the distance required to bring the vehicle to a stop. When drivers are observing a wider area more near their vehicle, they will be better able to see children along the roadside. When drivers are traveling slower, they can more quickly react to unexpected events, like children running out from between parked cars. Speed bumps sometimes reduce the traffic volume, but are not intended to do so. A reduction in traffic volume associated with a speed bump installation indicates more appropriate arterial routes exist elsewhere. Before and after studies of the parallel alternatives are necessary to insure excessive neighborhood infiltration has not occurred.

The extent to which a series of speed bumps will reduce the street's speed is affected by several factors, including the space between bumps, the individual driver's perception of comfort, and the type of vehicle being driven. Speed bumps' greatest effect is on drivers exceeding the posted speed limit by more than 10 mph. The trade off is that they affect all drivers, even those drivers who obey the speed limit. Longer and heavier vehicles like buses, garbage trucks, and larger fire vehicles, will need to go slower over speed bumps than automobiles. Also, there may be an increase in noise when these larger vehicles travel over the speed bumps. Speed bumps are easily constructed and are relatively low cost.

Pedestrian Refuges

Pedestrian refuges are islands built in the center of the roadway, often at marked cross walks. The widths of the islands vary with the width of the street, but are usually six to eight feet wide, with standard six inch curbs, and may include landscaping on the inside.

Pedestrian refuges allow the children to concentrate on a single direction of traffic, crossing half the street at a time. Pedestrian refuges provide a physical barrier in the middle of the street to protect children, allowing them to concentrate on one direction of traffic before continuing across the second half of the street.

Parking removal is often necessary to install a pedestrian refuge so that vehicles can safely travel around the device. Where a bus stop coincides with a pedestrian refuge, occasional delays may result while the bus stops for passenger boarding and drop-off. Since pedestrian refuges are built in the middle of the street, modification of the storm drainage system is often unnecessary, reducing the cost of installation.

Curb Extensions

Curb extensions, sometimes called bulb-outs, are street curbs constructed out closer to the vehicle travel lane, often in the on-street parking area. They are most often built at the corners of intersections, but can also be placed mid-block.

Curb extensions shorten the crossing distance between the curbs. This increases the number of opportunities to cross by allowing children to use naturally occurring shorter gaps in traffic. Curb extensions also bring pedestrians out from behind parked cars so they can see and be seen better.

Curb extensions have their limitations. Children trying to cross the street will still be required to cross the same number of traffic lanes. So, while the lengths of time children are exposed to traffic may decrease, the amount of information they must process, to decide when crossing is safe, does not greatly change. On-street parking is often removed as part of curb extension construction, a difficult subject in some neighborhoods. The construction of curb extensions can be expensive if catch basin relocation is necessary.

Pedestrian Signals

Pedestrian signals are specialized traffic signals on a main street activated by a pedestrian wishing to cross the street.

Pedestrian signals are a very high level of control, giving the pedestrian exclusive use of the roadway when cross traffic is stopped. A pedestrian pushes a button and, when the signal changes to "WALK," the pedestrian then has the right of way. If no traffic is present, the pedestrian must still, by law, wait until the signal changes to "WALK" before the full effectiveness of the signal is available.

A pedestrian activated signal still does not guarantee a safe crossing. Drivers who travel the street every day become accustomed to a green light. Signals that are usually green

blend into the background and the driver expects them always to be green. When the signal turns red, the driver is often unaware of the change. A pedestrian's safety at a crossing depends on the driver recognizing that the light has changed to red and stopping. The other scenario that may cause drivers to disregard a pedestrian signal is a red signal and no pedestrians. The pedestrian has pushed the button, and did not wait for the signal change before crossing. Children are especially impatient, and waiting for the signal to change when it looks safe to cross is a difficult thing to do. When they do wait for the signal to change to "WALK," they cross the street immediately. Children trust that because the sign says "WALK" and the traffic signal is red, the traffic will stop. When the child's trust of the signal is combined with the inattentive driver, there exists a recipe for disaster. In addition, a signal attracts drivers to the cross street who may consider it a through route, because it has the signal.

As for cost, a pedestrian signal is the most expensive option to construct, costing ten to twenty times the cost of other alternatives.

Summary

Portland uses several tools to reduce the interaction between children and automobiles. Signs and cross walk markings are clearly the first steps to alerting drivers to the presence of children. Crossing guards further increase the awareness of drivers. Moving cross walks away from intersections decreases the number of conflicts a child must keep track of. School zone flashing beacons provide a high level of notification and give law enforcement positive indication of speed violation. Pedestrian refuges provide a stopping place, permitting children to cross one lane of traffic at a time. Speed bumps slow automobiles. Curb extensions reduce the crossing distance and increase crossing opportunities. Pedestrian signals depend on drivers recognizing a changed signal and children being alert.

The extent to which the automobile-child interaction can be eliminated has the greatest benefit on the safety of the child. The reduction in the interaction of children with automobiles also benefits the driver. Each physical device to increase a child-pedestrian's safety requires additional thought and action from the operator of an automobile. Since complete elimination of the child-automobile interaction is difficult, if not impossible, we are left with different levels of interaction, or safety, from which to choose. Different tools are available to achieve these different levels of safety. However, choosing one solution often means not choosing another. As every choice has different tradeoffs, not everyone will agree what the proper choice should be. It is up to local jurisdictions, schools and parents to evaluate the alternatives and tradeoffs and determine where each user of the public right-of-way, child-pedestrian, automobile driver, or others, will have higher priority.

Glossary

Local Service Street - A City of Portland traffic street classification. Local Service streets are intended to provide access to private property from streets of higher

classification. Vehicle speed and traffic volume should be low due to the primarily residential nature of such streets. Local Service streets are the lowest level classification of a traffic street.

Neighborhood Collector Street - A City of Portland traffic street classification. Neighborhood Collector streets are intended to provide access between Local Service streets and streets of higher classification. Neighborhood Collector streets are the lowest level of an arterial-class traffic street.

Traffic Calming - Active management of motorized vehicle traffic to reduce the negative impacts on neighborhood streets, enhancing the safety of the non motorized road users, and increasing the livability of a neighborhood.

Commentary

The value society places on children and their protection reinforces the need to provide safe interaction between young pedestrians and motorized vehicles. The City of Portland currently has several programs in place to enhance the safety of the non motorized road users. Pedestrian, Bike and School Safety programs are necessary components to a balanced and equitable use of the public right of way.

The public right of way has always had many users. In the past the transportation professional has concentrated on the automobile user with other users only as an afterthought. The broader, multi-user, roadway designs now mandated by the non motorized road user, with state and local planning law, will level the playing field for pedestrians and bicyclists.

Some automobile drivers will perceive themselves as the "loser" in this endeavor and will be the most vocal opponent to the many changes discussed in this paper. These drivers should be engaged in the discussions to evaluate the various costs and benefits associated with the different options available for enhancing the safety of pedestrian crossings. Persons who travel the roadway primarily by automobile will, at some time, be traveling by foot or bicycle.

Appendix A

1997 Cost Estimates for Pedestrian Crossing Improvements

Minimum construction cost estimates for various devices constructed in Portland based on bids received. Actual project costs vary depending on project size and complexity.

School/Pedestrian Crossing

Signs and Cross Walks.....	\$ 1,500.00 total
Cross Walk Relocation.....	\$ 2,000.00 total
School Zone Beacons	\$ 5,000.00 per set
Speed Bumps.....	\$ 1,500.00 each

Pedestrian Refuges

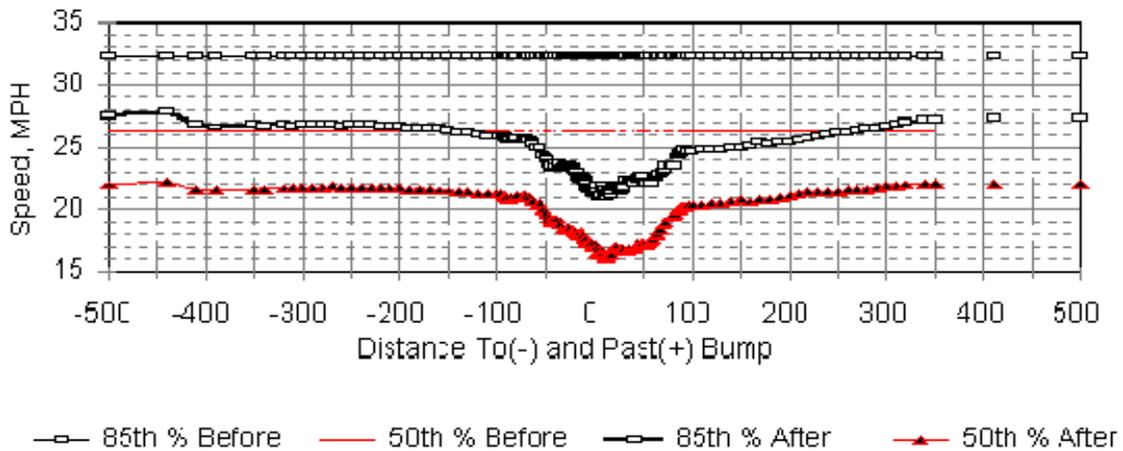
- 6 foot wide.....\$ 150.00 per foot
- 8 foot wide..... 180.00 per foot
- Curb Extensions.....\$ 6,000.00 each
- Pedestrian Signal.....\$50,000.00 minimum

Appendix B

Speed Bump Driver Response Graphs

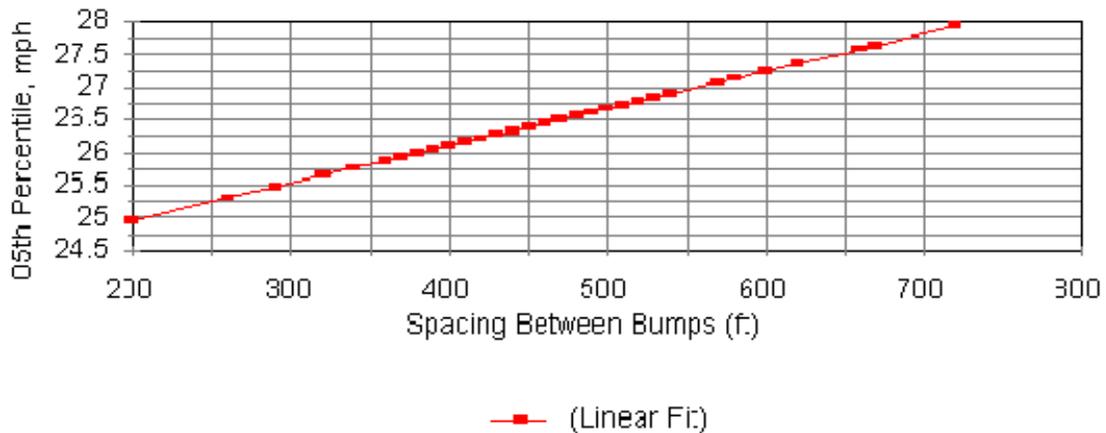
Speeds over 14 ft Speed Bumps

Mov'g Avg (P=15) of Avg of 32 Streets



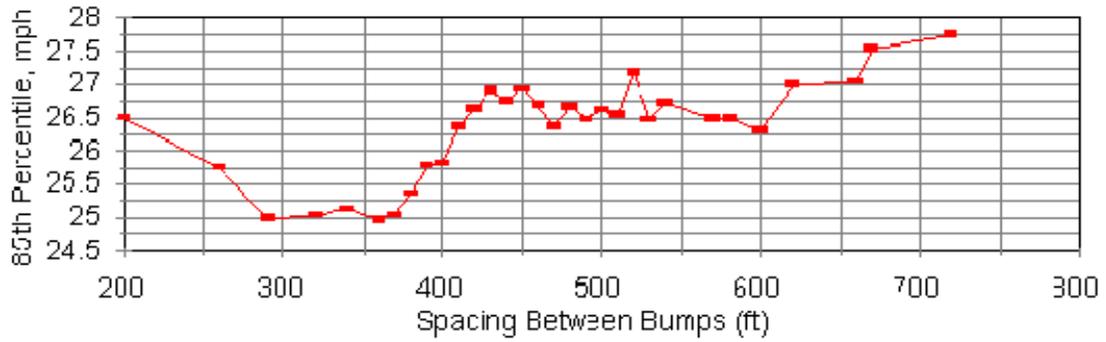
14' Speed Bump - Spacing v. Speed

31 Streets



14' Speed Bump - Spacing v. Speed

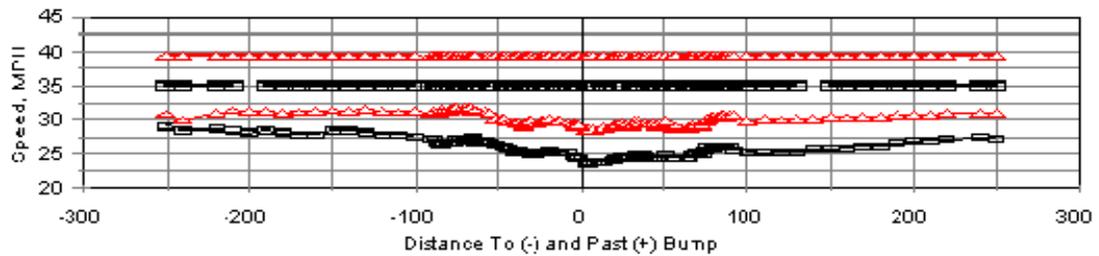
Moving Avg (p=5) - 31 Streets



(Moving Average)

Speed over a 22' Speed Bump

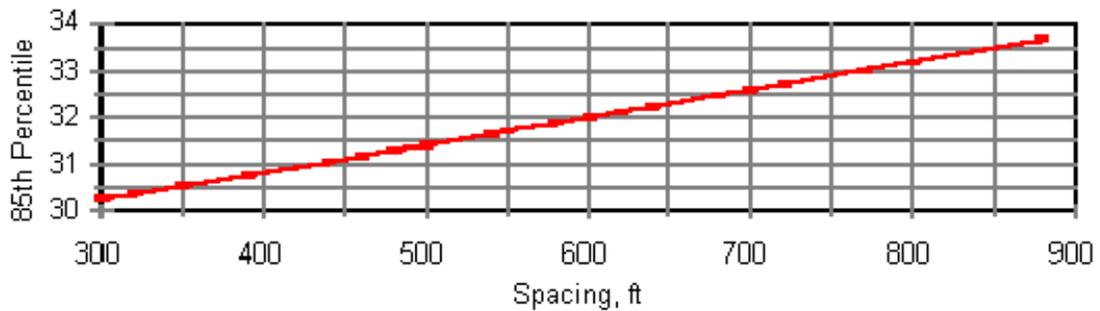
Moving Average, F = 10; 8 Projects



85th Before 50th Before 85th After 50th After

22 ft Speed Bump - Spacing v. Speed

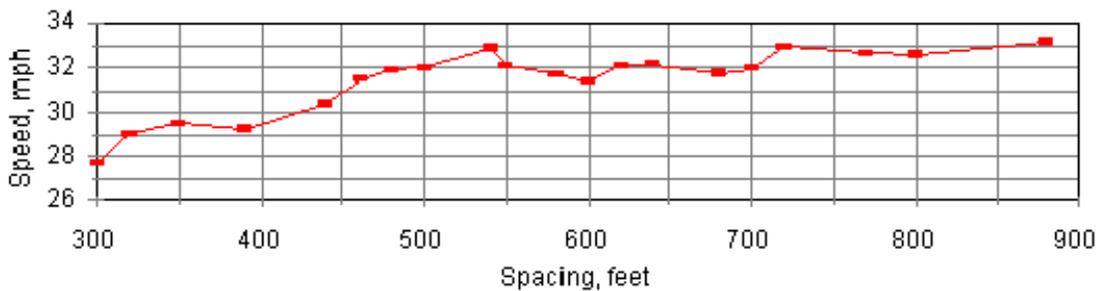
9 Streets



(Exponential Fit)

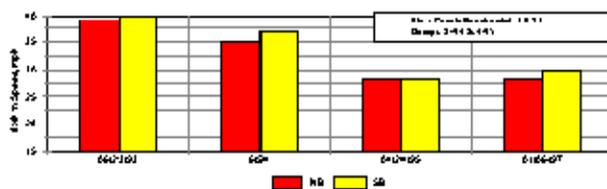
22' Speed Bump - Spacing v. Speed

Moving Avg (p=5) - 9 Streets



(Moving Average)

NE 15th/Shaver Pedestrian Refuge



Cornell Road Pedestrian Refuge

Mid-block Crossing

