Countermeasure Strategies for Pedestrian Safety

Traffic Calming

Peter Eun
Federal Highway Administration

Pete Lagerwey
Toole Design Group

December 17, 2015

Today's Presentation

- **Introduction and housekeeping**
- **Audio issues?**
  Dial into the phone line instead of using "mic & speakers"
- **PBIC Trainings and Webinars**
  www.pedbikeinfo.org/training
- **Registration and Archives at**
  pedbikeinfo.org/webinars
- **PBIC News and updates on Facebook**
  www.facebook.com/pedbike
- **Questions at the end**

Countermeasure Strategies for Pedestrian Safety Webinar Series

Upcoming Webinars

Pedestrian Safety at Roundabouts

Wednesday, January 6 (1:00 – 2:30 PM Eastern Time)

Transit and Pedestrian Safety

Wednesday, January 20 (1:00 – 2:30 PM Eastern Time)

To view the full series and register for the webinars, visit
www.pedbikeinfo.org/training/webinars_PSAP_countermeasurestrategies.cfm

WALK THIS WAY: Traffic Calming & Diversion

HOST

- Peter Eun
- FHWA Resource Center
- Transportation Safety Engineer

Special Guest

- Peter Lagerwey
- Regional Office Director
- Toole Design Group
- FHWA Consultant

Livable Communities

Location: Santa Cruz, California

Taken in 2006 by Dan Burden

Location: Kirkland, Washington

Taken in 2008 by Carl Sundstrom

WHAT IS TRAFFIC CALMING?

A way to design streets, using self-enforcing physical measures, to encourage people to drive more slowly and safely

Reduced Speeds = Reduction of crashes and crash severity

What is Traffic Calming?

- “Addressing the issue through law enforcement alone often leads to temporary compliance at a significant cost. A more permanent way to reinforce the need to reduce speed is to **change the look and feel of the road** by installing traffic calming treatments that communicate to drivers that the function of the roadway is changing.”

- -- FHWA TechBrief: Traffic Calming on Main Roads Through Rural Communities

Guess the Speed Limit

Traffic Calming Methods

- Look and feel
- Narrowing roadway (Cross-Section
- Horizontal deflection
- Vertical deflection

WHAT IS TRAFFIC DIVERSION?

Use of traditional traffic control devices or diverters to manage traffic volumes and routes

- Diverters
- Full Street Closure
- Partial Street Closure
- Turn Prohibitions

4 Proven Countermeasures

Reduced Traffic Volume = Reduction of crashes and crash severity

Traffic Calming - Approach

Three Prong Program Approach

Major Institutions - Schools

Geographic Equity – All Streets

Requests

TRAFFIC CALMING COUNTERMEASURES

I. Street Messaging or Cross-Sectional Methods

- Intersections
- Sidewalks & Landscaping
- Gateways
- Special Paving Treatments
- Slow Zones

Reduced Speed = Reduction of crashes and crash severity

Intersections

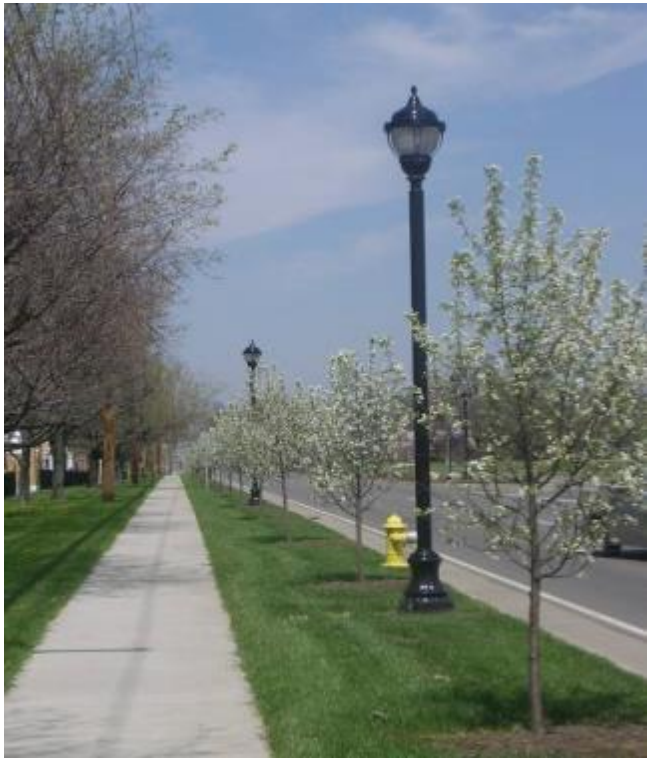
Design intersections that encourage slower turning speeds

Pedestrians & bicyclists are most often hit at intersections.

SIDEWALKS & LANDSCAPING

Passive or Cross-Sectional Countermeasures

- Creates a visual narrowing of the roadway.
- Creates expectation that there will be pedestrians



SIDEWALKS & LANDSCAPING

- Provides a buffer
- Enhances walking environment

GATEWAYS

- Physical or geometric landmark
- Indicates a change in speed
- Can be a combination of treatments

SPECIFIC PAVING TREATMENTS

Passive or Cross-Sectional Countermeasures

- Send a visual cue to motorists about the street.
- Can Enhance aesthetics
- Can also be part of a Gateway

SPECIAL PAVING TREATMENTS

Passive or Cross-Sectional Countermeasures

Photo: Tiffany Robinson.

Considerations

- Cost
- Bumpy surfaces
- Maintenance

SLOW ZONES

Passive or Cross-Sectional Countermeasures

Map of the Slow Zone in Boerum Hill and Gowanus, Brooklyn. The major streets, in yellow, form a strong boundary around the interior streets, in blue.

Considerations

- Safety
- Neighborhood features
- Schools - other attractors
- Public support

Case study

SLOW ZONES

Case Study: NYC DOT Claremont Neighborhood

Problem: Claremont neighborhood in the Bronx was very residential and was delineated by an elevated train, industrial zone and highway. Claremont ranked first in the number of killed or seriously injured pedestrians per 100,000 people, and ranked #2 for the total number of schools in the neighborhood. Claremont had a pedestrian fatality each year between 2005 and 2009.

- 2011 - NYC DOT created the Neighborhood Slow Zone program.
- Slow Zones were residential areas that encompassed about a ¼ square mile, or five city blocks by five city blocks.
- Deployed traffic calming measures that self-enforce 20 mph speed limit.
- Slow Zones generally had defined boundaries such as major roadways, rail lines, or commercial zones.

SLOW ZONES

Case Study: NYC DOT Claremont Neighborhood

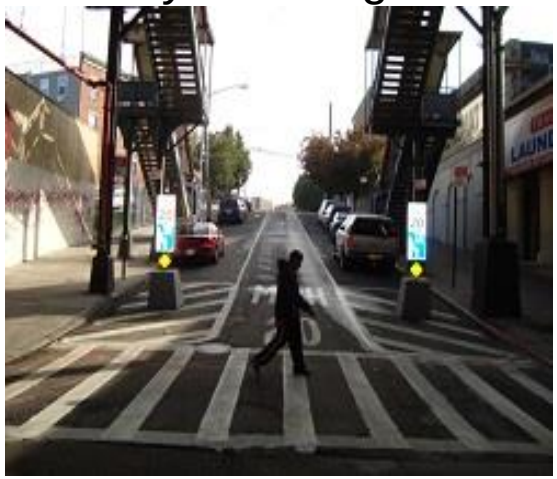
Solution: NYCDOT installed gateways at neighborhood entryways. Gateways narrowed neighborhood entrances with road markings, and 20 mph markings and in-street signs informed drivers they were entering a 20 mph area.

- One to two parking spaces were removed to install each gateway treatment.
- Speed humps were used throughout the Slow Zone – About one speed hump per three blocks.
- 20 mph in-street markings were placed throughout the Slow Zone.

In-street speed markings

Gateway in School Zone

Gateway into Neighborhood



SLOW ZONES

Case Study: NYC DOT Claremont Neighborhood

Results:

- Claremont neighborhood Slow Zone received favorable reviews.
- Police officers report less aggressive driving in the area. 85th percentile speed was reduced at 6 of 7 locations with speed humps
- Creation of Neighborhood Slow Zone was simple because it used standard treatments, and only required crash and speed data.
- Only issue as of January 2012 - about half of the in-street gateway signs were damaged by vehicles.

The NYC DOT implemented 13 Slow Zones in 2012 and 2013.

Source: www.nylink.org

Source: www.thebrooklynink.com

TRAFFIC CALMING COUNTERMEASURES

II. Active Intervention: Periodic Horizontal Deflection

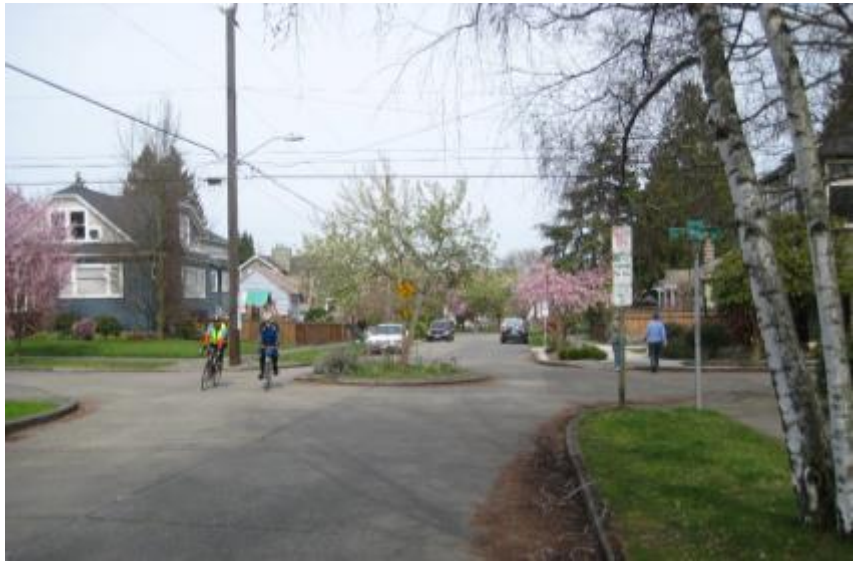
- Mini-circles
- Chokers
- Chicanes
- Serpentine Streets
- Trials & Temporary Installations

Slows traffic by periodically deflecting flow horizontally

MINI-CIRCLES

- They reduce vehicle speeds
- Can take the place of a four-way STOP or signal.

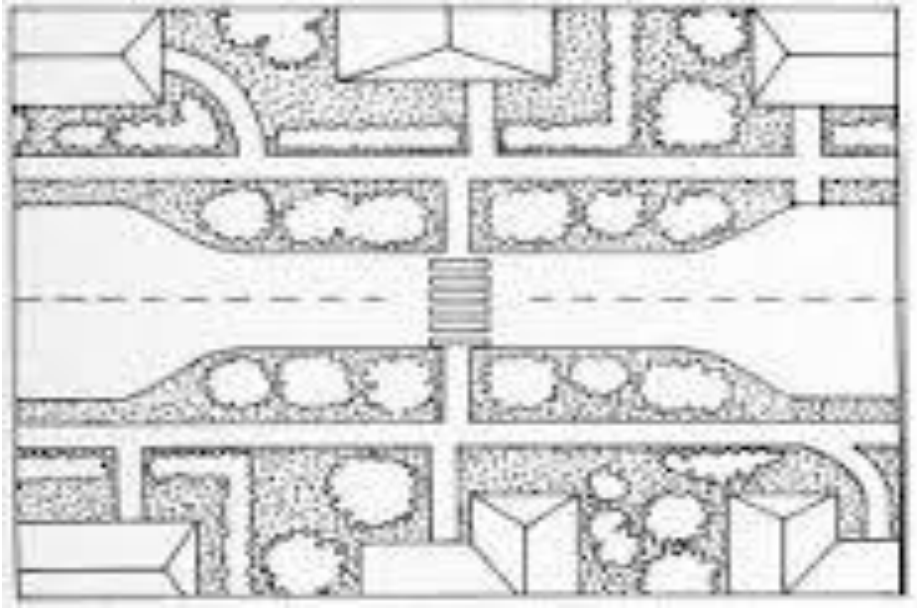
MINI-CIRCLES



Other Benefits

- Reduce crashes for all modes
- Reduce noise
- Provide landscaping opportunities

CHOKERS



- Curb extensions narrow the street
- Traffic speeds are lowered
- Can provide transition between neighborhood and commercial
- Create space for landscaping/street furniture

Source: www.fhwa.dot.gov

CHOKERS

Considerations

- Consult first responders
- Bicycle access can be an issue
- One lane vs. two lanes

CHICANES

- Horizontal traffic control measure
- Used to reduce vehicle speeds
- Provides opportunity to provide more landscaping

CHICANES

Considerations

- Chicanes may reduce on-street parking
- Maintain good visibility when adding landscaping
- Ensure bicyclists' safety and mobility are not diminished
- Consider drainage

SERPENTINE DESIGN

- Changes look and feel of a street
- Purpose is to slow traffic
- Provides opportunities for landscaping
- Can be costly
- Coordinate with driveways, drainage & utilities

TRIALS & TEMPORARY INSTALLATIONS

Active Horizontal Deflection Measures

- Way to try something for the first time
- Aesthetics can be a concern
- Snow can be an issue – best used in summer

Case Studies

CHOKERS

Case Study: Fifth St Traffic Calming, Tempe, AZ

Problem: Residents concerned about increasing volumes, excessive speeds, and air pollution on a major collector street. Wanted street redesigned.

- Fifth St is a major collector street in the middle of the Riverside and Sunset neighborhoods. Adjacent to parks, schools, markets and a community center.
- In 1995, residents approached Tempe with concerns about increasing traffic volumes and speeds on Fifth St.
- Residents wanted to move around safely and easily by bicycle, bus, or foot; reduce high-speed, cut-through traffic, and vehicle emissions; and maintain the neighborhood character.
- Instituted Fifth St Pedestrian Enhancement and Traffic Calming Project.

CHOKERS

Case Study: Fifth St Traffic Calming, Tempe, AZ

Solution: The City obtained a Federal grant to add traffic calming and pedestrian enhancements. Temporary traffic calming devices were placed on Fifth St to allow residents to understand the operation of the final project.

- Following a successful test, the city constructed permanent traffic calming and

- Sidewalks widened to 6 and 8 ft.
- Added 5-ft bike lanes
- Added traffic chokers, intersection bulb-outs, pedestrian-level lighting, shade trees and low shrubs.
- Design elements approved by a majority of residents

CHOKERS

Case Study: Fifth St Traffic Calming, Tempe, AZ

Results: In 1995, counts on Fifth St were nearly 10,000 ADT. The narrowed lanes and chokers cut traffic by 40% to 6,000 ADT.

- Volumes on adjacent segments reduced: Fifth St east of Ash Ave dropped 21% from 9,898 ADT before to 7,789 ADT after project. Volumes between Roosevelt and Wilson fell 63% from 10,186 ADT to 3,804 ADT.
- Cut-through traffic and speeds decreased, bus service to the area increased, and the neighborhood character remained intact.

TRAFFIC CALMING COUNTERMEASURES

III. Active Intervention: Periodic Vertical Deflection

- Speed Humps
- Speed Tables
- Speed Cushions/Trials & Temporary Installations

Slows traffic by periodically deflecting flow vertically

SPEED HUMPS

- 15 to 30 mph design speed
- Most common on residential streets
- Consider the needs of first responders
- Avoid steep hills that are bike routes

SPEED Humps

- Provisions for large vehicles

SPEED CUSHIONS/ TRIALS & TEMPORARY INSTALLATIONS

Active Vertical Deflection Measures

- Can be permanent
- May not be attractive
- May encourage avoidance
- Accommodates large vehicles

SPEED TABLES

- Flat topped speed hump
- Often used in combination with a marked crosswalk
- Most often used on residential streets
- Consider first responders, busses, and freight
- Drainage often an issue - expensive

SPEED TABLES

Drainage Accommodation

- Modified inlet
- Scupper
- Drainage bypass

TRAFFIC DIVERSION COUNTERMEASURES

Traditional traffic control devices to manage volumes and routes of traffic.

- Diverters
- Partial Street Closure
- Full Street Closure
- Turn Prohibitions (using signs)

Reduced Traffic Volumes= Reduction of crashes and crash severity

DIVERTERS

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

- Discourages or prevents through motor vehicle traffic
- Forces left or right turns
- Typically allows for bicycle and pedestrian access
- Sometimes used in conjunction with bicycle boulevards

DIVERTERS

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

Considerations

- The “toothpaste” effect
- Increased trip length
- Generally does not reduce speed
- Consult first responders
- Consider mail, garbage other delivery services
- Implement as part of a larger neighborhood plan

PARTIAL STREET CLOSURE

11-46

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

- Closes one direction of travel
- Street remains two-way
- Allows for emergency access
- Implement as part of a larger neighborhood plan

PARTIAL STREET CLOSURE

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

- Creates out-of-the-way travel for locals
- May experience poor compliance
- Relatively cheap to install
- Consider impact on buses, schools and trash pick-up

FULL STREET CLOSURE

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

Considerations

- Pedestrian and bicycle access
- Emergency vehicle access
- Diversion of motor vehicle traffic
- Implement as part of a larger neighborhood/traffic management plan
- Consider economic impacts

LEFT TURN PROHIBITIONS

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

Source: www.safety.fhwa.dot.gov

- Eliminates left turn crashes
- Benefits all modes
- May increase capacity of street
- Requires traffic study
- Implement within the context of a larger neighborhood transportation plan

LEFT TURN PROHIBITIONS

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

Considerations

- Provide bicycle and pedestrian access
- Increased trip length
- Traffic diversion to local streets
- Emergency access; other service vehicles

SIGN PROHIBITIONS

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

SIGN PROHIBITIONS

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

Using signs to create part-time one-way streets

Case Studies

- Diverters

DIVERTERS

Case Study: Portland, OR School Zone Traffic Calming

Problem: City Traffic Calming program identified Sabin Elementary School as a high priority for intervention. Safety issues existed at two arterial streets crossed by many students walking and bicycling to school.

- In 1997, the Portland Traffic Calming Program (TCP) undertook a School Safety Project on streets adjacent to Sabin Elementary School to improve student safety.
- School staff, parents, and neighborhood residents identified additional traffic safety hazards that TCP assessment had not identified, including school-related bus/auto traffic congestion in front of school and on surrounding streets.
- Another concern was parking that screened students crossing the street by parents using No-Parking zones to drop-off or pick-up their children.

DIVERTERS

Case Study: Portland, OR School Zone Traffic Calming

Solution: TCP staff and committee established goals to minimize traffic congestion and enhance safety of students. Objectives to decrease speeds on 17th and 18th Aves, improve visibility at 17th and Shaver, and improve crossing safety at nearby arterial streets of Prescott and Fremont.

- Semi-diverters installed on 17th and 18th Aves to encourage a clockwise circulation pattern around the school. This creates predominant northbound traffic on 17th and southbound traffic on 18th in the two-block region between Mason and Failing Sts. Expected increase in speeding due to the one-way circulation mitigated by new speed humps on 17th and 18th Aves.

- Older semi-diverter at 17th and Shaver that obscured crossing pedestrians was removed and a marked school crosswalk added.

- Test diverters were installed for three months before follow-up data collected.

DIVERTER

Reduced Traffic Volumes= Reduction of Crashes and Crash Severity

Case Study: Portland, OR School Zone Traffic Calming

Results: Sabin Elementary School Safety Project met its primary goals.

- Traffic flow around school changed from two-way to one-way clock-wise
- Potential for two-way traffic conflict, where space exists for only one vehicle, was significantly reduced.
- Pedestrians cross only one direction of traffic at a time
- Tests showed speed did not increase as feared. Speed humps were eliminated from the project. Speeds remain similar to pre-project measurements.
- Pedestrians benefited from removal of older semi-diverter on 17th Ave that obscured visibility. New diverter does not have same intense landscaping.
- After implementation, Sabin School principal discussed project with adjacent residents. They agreed new traffic pattern reduced congestion and conflicts between buses and automobile traffic.

Resource Slide

Active Vertical Deflection Measures

Effectiveness: A 2001 article by Huang and Cynecki summarized speed hump evaluation studies in different cities. While few examine the direct impact on pedestrian safety, examples show speed hump effectiveness to slow vehicles:

- 1993 study by Klik and Faghri looked at pre- and post-treatment vehicle speeds at 10 speed hump locations in Omaha, NE. Analysis showed statistically significant reduction in 85th percentile speeds. Data collected from 19 locations revealed a decrease in injury accidents.
- A 1994 FHWA publication by Clarke and Dornfeld considered the impact of 16 speed humps installed in 5 residential neighborhoods in Bellevue, WA. "Before" speed hump installation, 85th percentile speeds ranged from 36 to 39 mph. "After" installation, speeds decreased to 24 to 27 mph.
- Two evaluation efforts in MD. In Montgomery County, a 1998 evaluation by Loughery and Katzman indicated speed humps led to decrease in 85th percentile speeds of 4 to 7 mph. In Howard County, a 1995 ITE Journal article by Walter reported 85th percentile speeds decreased by 9 to 23 mph.
- 1993 presentation by Cline evaluated 5 speed humps on a road in Agoura Hills, CA. Following installation, 85th percentile speeds decreased by 6 to 9 mph. Other speed humps in Westlake Village, CA, resulted in 9 to 14 mph reduction in 85th percentile speeds.

Source: Huang, H. F. and M. J. Cynecki. *The Effects of Traffic Calming Measures on Pedestrian and Motorist Behavior*. Publication
FHWA-RD-00-104, FHWA, U.S. Department of Transportation, 2001.

Resource Slide

- PEDSAFE
  - http://pedbikesafe.org/PEDSAFE/countermeasures.cfm
- ITE Traffic Calming Website
  - http://www.ite.org/traffic/index.asp

Questions?

Thank You!

- **Archive at www.pedbikeinfo.org/webinars**
  - Downloadable/streaming recording and presentation slides
- **Questions?**
  webinars@hsrc.unc.edu