

Traffic Calming Measures: What, Why, Where, and How

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This review of current practice is based on surveys of localities known to have active traffic calming programs. The survey included eight jurisdictions within Florida and 12 jurisdictions outside. A questionnaire was sent to each jurisdiction with a cover letter describing our purpose in surveying them. Lengthy telephone interviews were conducted to record their responses. The give-and-take of interviews proved invaluable, as we discovered in three cases where written responses were supplied first. Only through open-ended interviews could we probe for details, respond with follow-up questions, and challenge statements that ran counter to conventional wisdom.

Answers to First Question: What traffic calming measures are used in your jurisdiction...?

Traffic calming programs are sometimes structured around three E's -- education, enforcement, and engineering. Upon request from a neighborhood, they start with a traffic safety campaign (flyers distributed to neighbors); if necessary, escalate to a speed watch program (speed measurements and warning letters); and only as a last resort, install engineering measures to force drivers to slow down.

Without dismissing the first two Es, we focus on engineering measures because, properly designed, they are guaranteed to reduce speeds and cut-through traffic volumes.

As for education and enforcement, they may have some effect on speeding; the evidence is mixed. They may provide legal and political cover for local government; all other alternatives have been exhausted before engineering measures are finally invoked. They may make neighbors feel better because something is being done about traffic. Thus, while de-emphasized in what follows, education and enforcement are not dismissed entirely. They will be mentioned where appropriate.

Array of Measures

Florida jurisdictions use a limited array of traffic calming measures (Table 1). Individual communities typically have two or three favorites upon which they rely exclusively. Ft. Lauderdale and Sarasota are exceptions, testing several new measures as part of recent areawide traffic calming plans.

The jurisdictions outside Florida, many acknowledged national leaders in traffic calming, have experimented with more measures (Table 2). But with the exception of Seattle, they too are not taking advantage of the full range of options from continental Europe, Britain, and Australia.

Speed vs. Volume Controls

Speed controls are much more widely used than volume controls. Communities with traditional street grids make use of both speed and volume controls but tend to favor the former. Portland and Seattle are examples. Volume controls divert through-traffic rather than simply slowing it down. Those interviewed worry, rightly, about impacts on parallel streets.

Communities with curvilinear street networks have little need for volume controls. Their branching street hierarchies ending in cul-de-sacs keep cut-through traffic off residential streets. Bellevue and Howard County are examples. Yet, even in these communities, speeding can be a problem. Residential subcollectors and collectors, in particular, are long enough, straight enough, and wide enough to generate excessive speeds.

Table 1
Traffic Calming Measures in Florida

	Ft. Lauderdale	Gainesville	Lee County	Naples	Sarasota	Tallahassee	Tampa	West Palm Beach
Speed Control Measures								
Standard Speed Humps	■	□	■		■		■	□
Long Humps/Speed Tables	■	□		□	■	■		□
Traffic Circles		■	■	■		□		■
Chicanes	■					■	■	■
Neckdowns				■	■	■		■
Chokers	■			■				■
Raised Intersections		□						■
Volume Control Measures								
Street Closures	■	■	■		■		■	■
Full Diverters	■			□				
Semi-Diverters	■	■		□	□		■	
Restrictive One-Way Streets		■	■				■	
Areawide Traffic Calming	■				■			■

■ measures in place □ measures proposed

Table 2
Traffic Calming Measures Outside Florida

	Arlington Co, VA	Austin, TX	Bellevue, WA	Berkeley, CA	Boulder, CO	Charlotte, NC	Gwinnett Co, GA	Howard Co, MD	Phoenix, AZ	Portland, OR	Sacramento , CA	Seattle, WA
Speed Control Measures												
Standard Speed		■	■	■	■	□		■	■	■	■	■
Humps												
Long Humps/Speed Tables	□	■	□	■	■		■	■		■		■
Traffic Circles	■	□	■	■	■	■	■			■	□	■
Chicanes		□	■	■	■						■	■
Neckdowns	■	■	■	■	■	■		■	■	■	□	■
Chokers			■					■				■
Raised Intersections								■		■		■
Volume Control Measures												
Street Closures	■	■	■	■	■	■	■		■	■	■	■
Full Diverters	■			■	■				■	■	■	■
Semi-Diverters	■	■		■			■		■	■	■	■
Restrictive One-Way Streets	■	■			■	■	■					■
Areawide Traffic Calming				■	■			■			□	■

■ measures in place □ measures proposed

Standard Speed Humps

The most common form of speed control is the Watts profile hump, developed in Britain by the Transport and Road Research Laboratory (TRRL). It is the only hump, at present, recommended by the Institute of Transportation Engineers (ITE). It is 12 feet long, 3 to 4 inches high, parabolic in shape, and has a design speed of 15 to 20 mph. The predominance of humps, as a traffic calming measure, is confirmed by a recent ITE survey in which 84 of 165 responding agency throughout North America indicated their use of humps. Speed humps proved much more common than any other engineering measure.

While very common, several jurisdictions have reservations about standard speed humps, including some jurisdictions that already have them in place. Appearance is an issue. Humps are often described as "ugly," which is not entirely fair since they can be rendered innocuous with tree cover and moderate striping. Liability is another issue. Both Lee County and Tampa have stopped installing speed humps, both due to liability concerns. Gainesville has avoided speed humps on the advice of its city attorney. The rough ride caused by standard humps is a third issue. Several communities require an extraordinary level of neighborhood support before they will consider humps. Sacramento, for example, requires majority support for other measures, but a super-majority (two-thirds) for speed humps.

Longer Humps and Speed Tables

The most common alternative to the standard hump is the "Seminole County" hump. The Seminole County hump is 22 feet long, 3 to 4 inches high, with a 6-foot ramp at each end and a 10-foot flat section on top. The Seminole County hump is less jarring than the standard one and better proportioned for aesthetics. The flat section is long enough for the entire wheelbase of a passenger car to rest upon it. It has a higher design speed, 25 to 30 mph, and this speed tends to be maintained between humps (whereas standard humps produce alternating deceleration and acceleration).

Within Florida, there seems to be a shift from standard humps to longer humps or speed tables. Tallahassee has installed only Seminole County speed humps. Neighbors like them so much that these gentle humps continue to be installed despite a seemingly impossible 75% signature requirement. When the time comes, Naples is likewise inclined to install this profile hump rather than the standard one. Sarasota is experimenting

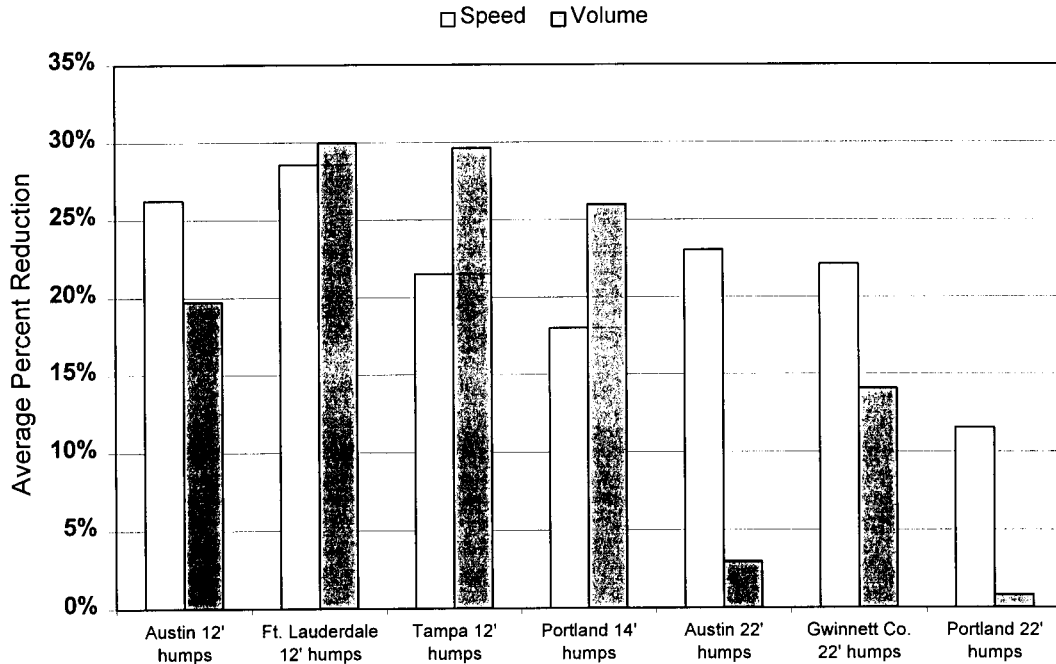
with a device similar to the Seminole County hump, a European-style speed table with 6-foot concrete ramps and a 10-foot plateau decked with colored pavers.

Outside Florida, the same shift is occurring to longer humps or speed tables. Austin, Gwinnett County, and Portland outfitted test streets with a variety of hump profiles, and then ran fire trucks, police cars, and other vehicles over them. In Austin and Gwinnett County, the Seminole County hump was the consensus choice. In Portland, two less severe profiles (a 14 foot parabolic hump and the Seminole County hump) were chosen over the standard hump. In Howard County, standard humps are now installed only where limited sight distances demand lower speeds. At all other locations, Seminole County humps are used instead.

The shift to longer humps and speed tables is, in part, an attempt to accommodate other public agencies. Austin, Gwinnett County, and Portland are accommodating their fire departments. Arlington County opted for flat-topped humps over standard ones to overcome opposition from the Public Works Department. Boulder, which already has something akin to Sarasota's speed table, is experimenting with an even longer plateau, long enough for the wheels of a fire truck to rest entirely upon the flat section. This will reduce the jolt to fire trucks as they pass over, and thereby, planners hope, neutralize the fire chief's opposition.

Another reason for the shift is the applicability of longer humps and speed tables to higher-order streets, where volumes and speeds are too high for standard humps (under ITE guidelines). In Portland, only Seminole County humps are even considered on collector streets or local streets served by transit. Another consideration is the ability of longer humps and speed tables, where appropriately marked, to serve as raised crosswalks. Standard humps are too rounded and sloped to perform this function. Raised crosswalks bring the street up to sidewalk level, making it pedestrian territory. Flat-topped humps or speed tables are used this way in Sarasota, Tallahassee, Bellevue, Boulder, and Howard County. Finally, longer humps and speed tables may not divert traffic to the same extent as shorter humps, a plus when parallel streets cannot handle the excess traffic. Figure 1 summarizes several before-and-after studies of speed humps. 22-foot humps appear to have a modest effect on traffic volumes, while still slowing traffic significantly.

Figure 1
Impacts of Speed Humps on Traffic Speeds and Volumes



New Hump Profiles

Expect to see a proliferation of different hump profiles in the future, as has occurred in Europe. After experimenting with the Seminole County hump, Ft. Lauderdale decided it was "not severe enough" to solve a speeding problem. A third profile was therefore developed, a hump as long as the Seminole County hump (22 feet) but with more vertical rise and a curved profile. In the opinion of the city's traffic engineer, this represents a perfect compromise between the two other profiles. Other hybrid profiles include the 14-foot parabolic hump developed in Portland; a 14-foot hump with 4-foot ramps at each end and a 6-foot flat top being tested by Broward County, the county surrounding Ft. Lauderdale; a 20-foot hump with 5-foot ramps and a 10-foot flat top used routinely in New York City; and a 12-foot hump with a sinusoidal rather than a parabolic rise being tested in Toronto. The sinusoidal design, long used in continental Europe, promises a more comfortable ride and easier snow removal.

Traffic Circles

Traffic circles, strictly for speed control on low-volume neighborhood streets, are the second most common speed control measure, being used by 52 of 165 agencies responding to the ITE survey. Mini-traffic circles (5-10 foot diameter), like those pioneered in Seattle, are relatively rare. Larger circles (20-30 foot diameter) are much more common. Circles do not appear to slow traffic as much as do humps. Their impact on traffic volumes appears to be slight, like the impact of longer humps.

While not as controversial as speed humps, traffic circles also raise concerns. The main one is the inability of large vehicles to turn around small radius curves. Large vehicle access can usually be maintained by installing mountable curbs or aprons around small landscaped center islands. Where this proves impractical, the landscaped island can be dropped altogether and a mountable raised circle placed at the center of the intersection.

One caveat relating to mini-traffic circles was mentioned in three separate interviews. With very tight intersections, where circulation around center

islands is impossible, the minis allow left turns in front of the islands. This creates no hazard *per se* on low-volume residential streets. However, it may create some confusion for motorists when used in the same communities as larger circles or roundabouts that require counter-clockwise circulation around center islands. Two surveyed localities have avoided Seattle-style circles for this reason, and Tallahassee is testing them with some trepidation.

Other Speed Control Measures

After humps and circles, the next most common speed control measures are curb extensions at intersections (variously called neckdowns, bulbouts, and knuckles). Neckdowns "pedestrianize" intersections not only by slowing traffic, particularly turning traffic, but by shortening crossing distances. The Florida examples are all part of downtown redevelopment projects. Neckdowns go hand-in-hand with on-street parking bays and crosswalks for shoppers (in "safe cross" designs).

In a few places outside Florida, neckdowns have been used in suburban settings. Howard County, for example, has redesigned some large radii corners to reduce crossing distances from as much 66 feet to 30 feet or less. Very few problems are reported with such measures. According to one respondent, even the local fire chief, who opposes speed humps and traffic circles, is tolerant of neckdowns. His department plans emergency access routes to avoid turns off local streets ("they plan for straight shots").

A wide assortment of other speed control measures are available, and used by an occasional jurisdiction. Some involve changes in vertical alignment, such as raised intersections and textured surfaces, while others involve changes in horizontal alignment, such as chicanes and single-lane chokers.

Combined Speed Control Measures

Combined measures at a single slow point or along a single stretch of street, so common in Europe and Australia, are still the exception in the United States. Bellevue is probably the national leader in combined measures. It has chokers combined with speed humps, neckdowns with traffic circles, speed tables with central island narrowings, and chokers with mini-chicanes (so-called twisted chokers). Berkeley has one street, six blocks long, with a mix of neckdowns, chicanes, speed humps, and landscaped islands. Arlington County has added traffic circles when

neckdowns alone failed to achieve desired speed reductions. Howard County is considering a combined measure -- a choker with a flat-topped speed hump -- at the site of recent school crossing accident. In that combinations of measures can slow traffic down to "walking speeds," the shortage of examples from the U.S. may reflect our enduring belief that streets are for cars, not for pedestrians, even in "shared street" designs.

Underdesigned Speed Control Measures

On site visits, we came across a few traffic calming measures that were so clearly underdesigned that they caused little or no reduction in speed. This is the case with 1- and 2-inch high speed humps in one locality, gently sloped speed tables in another, and a roundabout that does not compel vertical deflection in a third. For speed control, there must be an abrupt change in either horizontal or vertical alignment. Even a dramatic narrowing may not bring speeds down appreciably unless combined with other measures.

Street Closures

Of measures to deal with cut-through traffic, street closures are the most common. They are also the most controversial, and in this respect are much like speed humps. Several jurisdictions no longer permit street closures, and one, Sacramento, permits them only on a temporary basis for crime control. Others treat them as the measure of last resort, used only when nothing else will solve a cut-through traffic problem. There are instances when this is the case, due of course to a poorly designed street network.

Ft. Lauderdale had a rash of closures a few years ago. They were controversial enough for the city to now require two public hearings and a 65 percent super-majority of resident support for any measure that diverts traffic (but not for those that merely slow it down). It has been two years since Ft. Lauderdale last closed a street. Having closed eight east-west streets in a row, West Palm Beach realized that its capacity to handle east-west traffic was being eroded and its neighborhoods were becoming isolated. The city began substituting speed control measures for closures as requests came in.

Other Volume Control Measures

Given concerns about traffic diversion, we might expect less restrictive forms of volume control to be in widespread use. They are not. One explanation is that

less restrictive forms are easily violated, as when motorists drive around semi-diverters (partial closures). Yet, from the limited evidence available, violation rates are not so high as to negate the advantage of such measures compared to street closures. Smart design is the key. When drivers routinely went around narrow barriers at its intersections, Ft. Lauderdale built a semi-diverter that extends 30 feet upstream of the intersection. Drivers are reluctant to travel in the wrong direction for such a distance.

Traffic Diversion Policies

Boulder and Portland have general policies limiting how much traffic may be diverted to parallel streets. In Boulder, the policy is so strict it tends to preclude many traffic calming schemes, including speed controls that slow traffic enough to divert some of it. The policy was adopted in response to a traffic calming plan in one particular neighborhood that, in hindsight, compromised the connectivity of the street network by overrelying on closures and full diverters.

In Portland, the policy is less restrictive, and instead leads to traffic calming measures on parallel streets to maintain balanced traffic flows. Any measure that might divert traffic from a collector to a local street is not allowed. If traffic grows beyond a threshold value (150 vehicles per day) on any local street, due to measures taken on parallel streets, the city promises to solve the problem by modifying the original design or adding measures on the impacted street.

Avoiding Traffic Diversion

Insofar as certain measures slow traffic without causing much diversion, they are preferred in cases where residential streets will experience the spillover. This is one advantage of traffic circles and long speed humps, for example, over street closures and standard speed humps, (again, see Figures 1 and 2). Naples was considering a street closure but chose instead to install traffic circles along the street in question. During construction, thousands of cars per day were diverted to parallel streets, causing resident protests and proving that earlier fears were justified. Since construction ended, speeds on the traffic calmed street are way down but volumes have returned to normal. Naples' experience with circles, in terms of diversion, parallels experiences of Seattle and Portland.

Temporary vs. Permanent Installations

Many jurisdictions install traffic calming measures on a trial basis, at the end of which a decision is made to install them permanently or remove them. These jurisdictions have the choice of installing temporary measures, which cost less but are unaesthetic, or installing permanent measures, which look good but represent a bigger waste of public money if ultimately removed. If they install temporary measures, such as construction barricades to simulate a traffic circle or plastic planters to simulate a street closure, they run the risk of public opposition solely due to aesthetics. As one respondent put it, "criticism of appearance becomes criticism of effectiveness." Fearing a negative reaction to aesthetics, the Naples City Council opted for landscaped traffic circles over the trial barricades and flashers recommended by staff. The relatively few measures ever removed, according to our surveys, suggest the wisdom of installing permanent measures.

Areawide vs. Spot Treatments

The need for areawide traffic calming is clear from several examples. In Gainesville, all-way stop signs were installed on one neighborhood street. They created a problem of cut-through traffic on another street as drivers sought to avoid the stop. Many drivers also ran the stop signs, always a problem when unwarranted stop signs are used simply to slow traffic.

The cut-through problem was solved only by closing another street to create a circuitous route through the neighborhood. Two Florida cities, Ft. Lauderdale and Sarasota, are in the process of implementing neighborhood traffic calming plans that treat multiple streets in a coordinated manner.

The national experience suggests that traffic calming should be planned on an areawide basis, but not over such a wide area that it becomes difficult to achieve consensus on a plan. Having prepared plans for individual streets and for large subareas of the city, Portland has settled on the individual neighborhood as the optimal scale for planning purposes.

Conclusion

This article, and the survey upon which it is based, represent the first steps in a larger state-of-the-art study for the Institute of Transportation Engineers and U.S. Federal Highway Administration. Our sample will be expanded, as will the range of issues addressed. Insofar as possible, quantitative analyses will supplement the qualitative ones in this article. Canadian lessons will be drawn from a parallel effort by the Canadian Institute of Transportation Engineers and Transportation Association of Canada. In the end, we hope to refine and expand the conclusions set forth in this article. Please stay tuned.