CHAPTER 8

Warrants, Project Selection Procedures, and Public Involvement

Traffic managers in the featured communities strive for balance between "study it to death" and "get it built now," and between "respond to neighborhood wishes" and "use your best technical judgment." They also report that they attempt to be sufficiently process-oriented to avoid political and legal fallout, yet sufficiently output-oriented to satisfy constituents.

Finding a proper balance is not always easy, as Portland, OR, discovered. Through the early 1990's, Portland was at the "process" end of the process-output continuum (see figure 8.1). Portland's North Ida project, described in chapter 4, began in 1987, when residents first contacted the city. Construction was not completed until 1995, and the evaluation phase continued into 1996. The process would have taken even longer except that a test period was not required on this particular project.

The process in place at the time of the North Ida project is outlined in table 8.1. The nominal time from start to finish, if everything went right, was about 3 years.

Pressure from neighborhoods to get more traffic calming measures on the ground caused Portland to streamline its process. In 1992, the Streamlined Speed Bump Program (or unofficially, the "buy a bump" program) was created.[1] Speed hump projects meeting strict program guidelines could be built on an expedited basis at neighbors' expense. In 1994, Portland's basic program was also restructured to be easier and faster. The old process required a petition to initiate and a neighborhood traffic committee to help with planning and implementation. The new process substituted a neighborhood survey for the petition process and replaced the traffic committee with a one-time focus group.

After 12 years of traffic calming measure implementation throughout the city, the new process produced the program's first rejection (in a ballot) of new speed tables and chokers proposed for a residential collector street. Those living on the street were generally supportive of the project, but those using the street as a through route were adamantly opposed and even resorted to threats and smear tactics. The neighborhood never assumed ownership of the process.

This loss resulted in the reinstatement of neighbor-

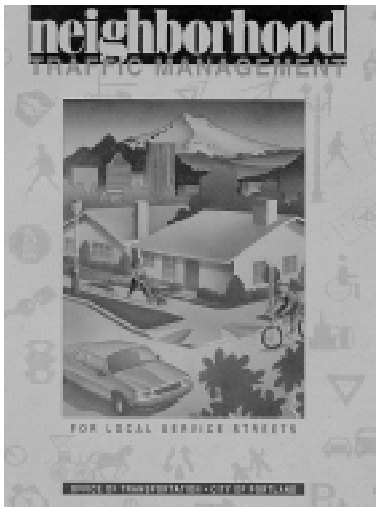


Figure 8.1. Portland: Process-Oriented.

Table 8.1. Planning and Implementation Process. (Portland, OR)

Action	Time frame
Project requests	Ongoing
Preliminary review	Within 6 months of request
Priority ranking	July/August
Petition-to-study	2 1/2 months
Plan development	5 months
Petition-to-test/ test installation	4 months
Project evaluation	1 month
Ballot to install permanently	1 1/2 months
Council action	1 month
Design	5 months
Construction	3–4 months
Monitoring	Ongoing
Follow-up evaluation	Within 3–5 years

Source: Bureau of Traffic Management, "Neighborhood Traffic Management for Local Service Streets," City of Portland, OR, March 1992, p. 10.

hood traffic committees and the return to more meetings. While painful, Portland's search for its equilibrium point has apparently paid off. The program has garnered a string of affirmative votes in neighborhood balloting since its one loss.

Basic Program Options

A traffic calming program may be reactive, responding to citizen requests for action, or it may be proactive, with staff identifying problems and initiating action. A nationwide survey by researchers at the University of California at Berkeley determined that all but a "handful" of programs are reactive.[2]

A traffic calming program may make *spot* improvements, street by street, or it may plan and implement improvements on an *areawide* basis, with multiple streets treated at the same time. The same survey by the University of California at Berkeley found that almost all programs operate on a spot improvement basis.

With two choices in each of two program areas, traffic managers are faced with four distinct options (table 8.2). As far as can be determined, three of the four alternatives work well enough. Proactive/areawide treatments have theoretical advantages over the others; experience with them has been good. The fourth alternative, reactive/areawide treatment, has been less successful. The reason, it seems, is that areawide treatment involves extensive coordination and consensus-building, something unlikely to occur without proactive involvement of staff.

Table 8.2. Alternative Program Options.

	Reactive	Proactive
Spot treatment	Somewhat successful	More successful
Areawide treatment	Less successful	Most successful

The experiences of four communities illustrate the pros and cons of different program structures.

Reactive Spot Treatment → Proactive Areawide Treatment (Austin, TX)

In the wake of a moratorium on speed humps, Austin formed task forces to address the most thorny issues facing the city's traffic managers: traffic diversion, emergency response, funding, treatment of residential collectors, and neighborhood endorsement procedures. The primary recommendation to emerge from the process was to replace spot treatments with areawide treatments based on city priorities. The city council agreed and funded a $500,000 pilot program. Areawide plans have been formulated for five city neighborhoods (see figure 8.2), deploying such novel measures as speed cushions and split humps (see chapter 7 for definitions). Implementation began in mid-1998.

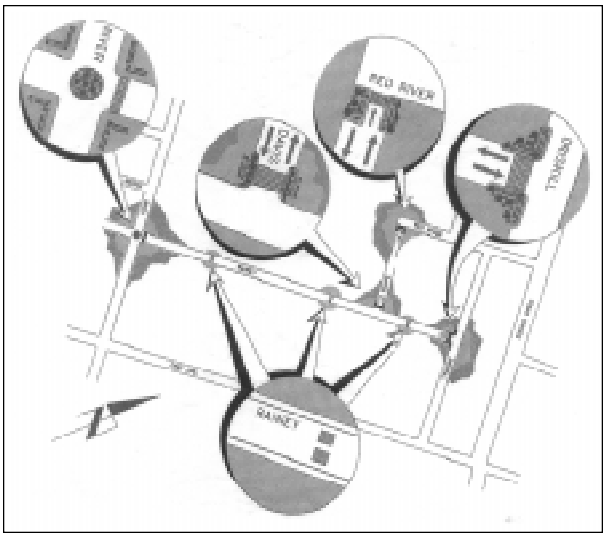


Figure 8.2. One of the Pilot Projects Under New Areawide Policy. (Austin, TX)

Source: Department of Public Works and Transportation, "Rainey Street Neighborhood—Pilot Project Area," Austin, TX, May 1998.

Reactive Spot Treatment → Proactive Spot Treatment (Seattle, WA)

The original Seattle program simply responded to complaints. There was no guarantee that the most serious problems would be addressed, only those with the loudest constituencies. While still responding to neighborhood requests, for this is necessary to maintain political support and funding, the program now proactively seeks out high accident locations and gives them funding priority (see figure 8.3). Neighborhood residents are then contacted to determine levels of support for traffic calming. From this point on, the program functions conventionally. Nothing is forced upon residents. Public opinion surveys demonstrate overwhelming support for Seattle's program.

Reactive Spot Treatment → Proactive Areawide Treatment (Sarasota, FL)

Although Sarasota still responds to resident petitions, the city favors areawide traffic calming initiated by staff. The reason: spot treatments generate opposition from residents of neighboring areas who fear that traffic problems will

RANK	REQ NO.	LOCATION		ACCIDENTS					VOLUME		SPEED	
		AVENUE	& CROSS-STREET	YR 3+ TOTAL	NO OF YEARS	ACC/YR	MIDBLOCK XTRA PTS	POINTS	AWDT	POINTS	85% MPH	POINTS
1	362	1 AV NW	& NW 87 ST	14	3	4.67		12	3916	3	31.7	1
2	333	SUNNYSIDE AV N	& N 77 ST	9	3	3.00		7	380	0	28.4	0.5
3	39	4 AV NW	& NW 127 ST	8	3	2.67		6	578	0.5	27.9	0.5
4	343	18 AV	& E PINE ST	7	3	2.33		5	1801	1.5	27.8	0.5
5	218	38 AV S	& S ALASKA ST	5	3	1.67	0.5	4.5	1781	1.5	26.2	0.5
6	307	DAYTON AV N	& N 77 ST	6	3	2.00		4	559	0.5	32.3	1.5
7	159	25 AV E	& E JOHN ST	5	3	1.67		4	2431	2	24.4	0
8	252	13 AV NW	& NW 73 ST	5	3	1.67		4	213	0	33.6	1.5
9	304	FREMONT AV N	& N 76 ST	5	3	1.67		4	563	0.5	30.7	1
10	32	28 AV SW	& SW KENYON ST	5	3	1.67		4	503	0.5	30.2	1
11	168	30 AV NE	& NE 113 ST	4	3	1.33		3	543	0.5	35.9	2
12	283	28 AV NE	& NE 82 ST	3	3	1.00		2	1381	1	39.1	2.5

Figure 8.3. 1998 Funding Priorities for Spot Treatments. (Seattle, WA)

Source: Unpublished listing from the Engineering Department, City of Seattle, WA.

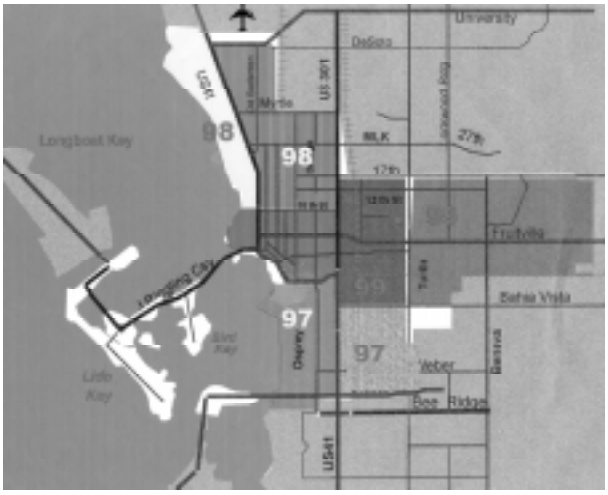


Figure 8.4. Seven Districts Being Master Planned. (Sarasota, FL)

Source: Engineering Department, City of Sarasota, FL.

spill over onto their streets. The city has been divided into seven sections, and a master plan is being prepared for each section in turn (see figure 8.4). Buy-in is achieved by treating traffic calming as part of a comprehensive neighborhood improvement program; creating committees to deal with each identified problem; and offering around $1 million of public funding per section to implement committee-generated plans. Traffic calming becomes part of a well-funded program of tree planting, sidewalk construction, street light installation, and other improvements.

Reactive Areawide Treatment → Reactive Spot Treatment (San Jose, CA)

San Jose adopted its first traffic calming policy back in 1978. The policy provided for spot treatments of individual streets. In the early 1980's, San Jose developed its first areawide traffic calming plan. The experience led to adoption of a second policy, independent of the first, for neighborhood traffic management. The city's motivation was stated in the policy itself: "[L]ocalized treatments of residential traffic problems have resulted in the transfer of similar problems to adjacent streets...."[3]

The new program, with its own staff and funding, was to develop areawide plans in response to neighborhood requests. Six years and two plans later, with little interest from other neighborhoods and the city facing a fiscal crisis, the program was abolished. The two plans took longer to develop than expected and generated less neighborhood support than desired, because half the streets in a neighborhood did not want to inherit problems from the half that was traffic calmed. Despite the demise of its Neighborhood Traffic Management Program, San Jose continues to experience demand for localized traffic calming (particularly for speed humps) and continues to make spot improvements.

Warrants and Guidelines

Beyond the choice between reactive and proactive programming, and between spot and areawide treatment, several program options are available to traffic managers. The most controversial is the decision to establish warrants for traffic calming measures. Articles have appeared advocating both in favor of and against warrants.[4]

Two Types of Warrants

Featured programs have established two types of warrants. (As the term is used in the *Manual on Uniform Traffic Control Devices for Streets and Highways* [*MUTCD*], warrants are minimum requirements that should be met, in most cases, before a given device is installed.) Some featured programs have general warrants that apply to all traffic calming activity, in some cases even to traffic calming studies. Typical are the warrants established by Sarasota (see table 8.3). Two of five must be met before the city will even accept a petition from a neighborhood for a full-scale traffic study.

Other traffic calming programs have warrants for specific measures, particularly speed humps and speed tables. In Montgomery County, MD, three different sets of speed hump warrants, adopted sequentially, bound the typical range of requirements (see table 8.4).

To assist with the restructuring of its speed hump program, San Diego, CA, commissioned a national survey of speed hump policies. Many communities have found it convenient to standardize eligibility requirements for speed humps. They have, in effect, imposed warrants on themselves (see table 8.5).

An Alternative to Warrants

Guidelines offer a variation to warrants. Guidelines consider the same factors as do warrants (e.g., speeds, volumes, collisions, pedestrians) when a decision is being made whether or not to traffic calm a street. However, warrants tend to have criteria with definitive thresholds (e.g., when design speed is above value A, then traffic calming measure B should be used). In contrast, guideline criteria can be more qualitative, and the preferred traffic calming measures are suggested rather than mandated.

Bellevue, WA, developed a "control matrix" for different traffic calming measures that is as complete a set of guidelines as anyone's. It is reproduced here for both its illustrative value and its content (see figure 8.5).

Table 8.3. General Warrants. (Sarasota, FL)

Warrant	Major Collectors	Minor Collectors	Local Residential Streets
1. Minimum traffic volume	>8,000 vpd or 800 vph	>4,000 vpd or 400 vph	>1,000 vpd or 100 vph
2. Anticipated cut-through traffic	50%	40%	25%
3. 85th percentile speed	10 mph > speed limit	10 mph > speed limit	> speed limit
4. Pedestrian crossing volume	>100 per hour	>50 per hour	>25 per hour
5. Accidents per year	6	6	3

vpd = vehicles per day; vph = vehicles per hour

Source: Engineering Department, City of Sarasota, FL.

Table 8.4. Speed Hump Warrants. (Montgomery County, MD)

Criterion	Original	Interim	Present
Minimum volume	60 vph	100 vph	100 vph
Minimum 85th percentile speed Secondary street Primary street	 31 mph 34 mph	 31 mph 31 or 36 mph (depending on speed limit)	 32 mph 34 or 39 mph (depending on speed limit)
Minimum length of segment	None	1,000 feet	1,000 feet
Resident concurrence	67%	80% on treated street	80% on treated street 50% on side streets

vph = vehicles per hour; mph = miles per hour

Source: Department of Public Works and Transportation, Montgomery County, MD.

Table 8.5. Speed Hump Eligibility Requirements. (Survey of 42 Agencies)

Requirement	Number of Agencies Setting Requirement	Median Value for Agencies with Requirement
Resident approval by petition	30	67%
Maximum street width	8	40 feet
Minimum traffic volume	11	1,000 vehicles per day
Maximum traffic volume	12	5,000 vehicles per day
Maximum grade	12	6%
Prohibition on emergency routes	27	
Prohibition on transit routes	7	

Source: Kimley-Horn and Associates, Inc., *Road Hump Evaluation Program "Final,"* Prepared for the City of San Diego, CA, 1997.

Classification	*Collector*	*Local Streets*		*Other Considerations*										
		Neighborhood Collector	*Local Access*	Curbs & Gutters	% Grade	Curvature of Stretch	School Bus Route/Metro	Adjacent Arterials	Previous Traffic Eng. Improve. Unsuccessful	Impacts to Police/Fire	Delay Accident	Homes Front Street	Acceptable Impacts	*Control Device Use May be Considered*
Land Use	*Small Commercial Residential*	*Residential*	*Residential*											
Traffic Engineering & Specialized Improvements	Yes	Yes	Yes	—	—	—	—•	—	—	—	—	—	—	High Speeds
Police Enforcement Neighborhood Speed Watch Program	Yes	Yes	Yes	—	—	—	—	—	—	—	—	—	—	High Speeds
Speed Humps	No	Vol ≤3000 vpd 85% ≥35	Vol ≥300 85% ≥35	Yes	Not > 10%	300—	Yes	Yes	Yes	Yes	—	Yes	Yes	High Speeds & Cut-through Volumes
Traffic Circles	No	Vol ≤3000 vpd 85% ≥35	Vol ≥300 85% ≥35	Yes	Not > 10%	—	Yes	Yes	Yes	Yes	—	Yes	Yes	Speeds or Accident History
Stop Signs	MUTCD	MUTCD	MUTCD	—	—	—	—	—	—	—	—	—	—	Accident History
Diverter	No	No	Vol ≥300	Yes	—	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High cut-through Volumes
One-Way/ Chokers	No	Vol ≥2,500	Vol ≥300	Yes	—	—	Yes	Yes	Yes	Yes	Yes	—	Yes	High cut-through Volumes
Street Closure	No	Yes, If Vol ≥6,000 Non-Local ≥20%	Yes, If Vol ≥3,000 Non-Local ≥20%	—	—	—	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High cut-through Volumes

Notes:
1. All volumes in units of typical daily traffic volumes.
2. Source for street type designation—City of Bellevue Street Classification.
3. Control devices may be considered when either the speed criteria, volume criteria or both criteria are exceeded.

MUTCD = Manual on Uniform Traffic Control Devices for Streets and Highways; vpd = vehicle per day

Figure 8.5. Traffic Calming Control Matrix. (Bellevue, WA)

Source: City of Bellevue, Transportation Department, Bellevue, WA.

Arguments For and Against Warrants

The strongest argument for warrants is standardization. Traffic control devices in the United States follow the *MUTCD*. Australians and Canadians have opted for standardization of traffic calming measures as well. Warrants may serve to insulate traffic managers from political pressure to install traffic calming measures where inappropriate. One such case, in San Diego, was described in chapter 1. As a result, San Diego is moving toward adoption of new stringent warrants for speed humps.

The strongest counterargument is that warrants stifle creativity, that every traffic calming application is unique. Warrants cannot be developed for every factor that might justify treatment (enhanced neighborhood pride, for example). Safety is one thing, and the *MUTCD* serves that purpose admirably. But livability and walkability—both valid justifications for traffic calming—are another. The city transportation planner of West Palm Beach said: "[T]raffic calming warrants relegate traffic calming to the realm of a traditional reactive program instead of allowing it to reach its full potential as a proactive approach to good street design."[5]

The debate may result in part from confusion over the nature of warrants. Warrants compel nothing. Transportation engineers always have a degree of discretion, and street improvements are always subject to availability of funds. In this sense, if speed humps were subject to warrants, traffic managers would not be required to install humps if the warrants were met, only discouraged from installing them if the warrants were not met.

The debate over warrants may also result from confusion over who would impose them on whom. *MUTCD* warrants are applied nationwide, with the Federal Highway Administration (FHWA) as their source. If a local governing body establishes warrants for a local traffic calming program, these differ little from the kind of policy guidance elected officials are supposed to give their operating staffs.

The potential downside of warrants is illustrated by two featured programs: Sarasota and Montgomery County. The warrants themselves (i.e., the criteria and standards chosen) are typical of warrants nationwide. The experiences with warrants in these programs, however, are atypical.

Warrants may fail to consider the interrelationship of streets within a network. As previously described, Sarasota's program is shifting from spot to areawide improvements. Many of the individual streets treated in Sarasota's areawide plans would not qualify under the city's general warrants for individual streets (see figure 8.6). Apparently, viewed in isolation, these streets are not problems. However, in a broader context, when other city plans were considered, these streets were in need of traffic calming.

Warrants may be used disingenuously to impair a program with stringent thresholds. Montgomery County's speed hump program has been tightened twice (as presented in table 8.4). The first tightening, in October 1997, was generally viewed as a valid midcourse adjustment. A staff analysis found that, in a sample of 32 streets treated under the original criteria, 17 would have qualified under the new criteria. However, in February 1998, the program underwent further tightening. The requirement of 50 percent approval by residents of side streets who may be inconvenienced by speed humps on the treated streets would seem difficult to meet.

Warrants That Address Diversion

Diversion of traffic to other streets following the installation of traffic calming measures can be a positive or a negative result. A positive result involves diversion of traffic to higher order roads that are better able to handle it. Boulder, CO, describes good diversion this way: "Arterials are the most desirable facilities for through traffic. Feasible opportunities for rerouting traffic from one street to a higher classification street will be explored."[6]

Figure 8.6. Public Relations Piece Announcing Deviation from Warrants. (Sarasota, FL)

Source: South Sarasota Public Hearing, May 1995.

In Boulder, diversion that evens out traffic volumes on parallel streets at the same level in the functional hierarchy without overloading any of them is also acceptable. Boulder's description: "Traffic may be rerouted from a street of equal classification as a result of a neighborhood traffic mitigation project if the end result is more equal distribution of the traffic burden."

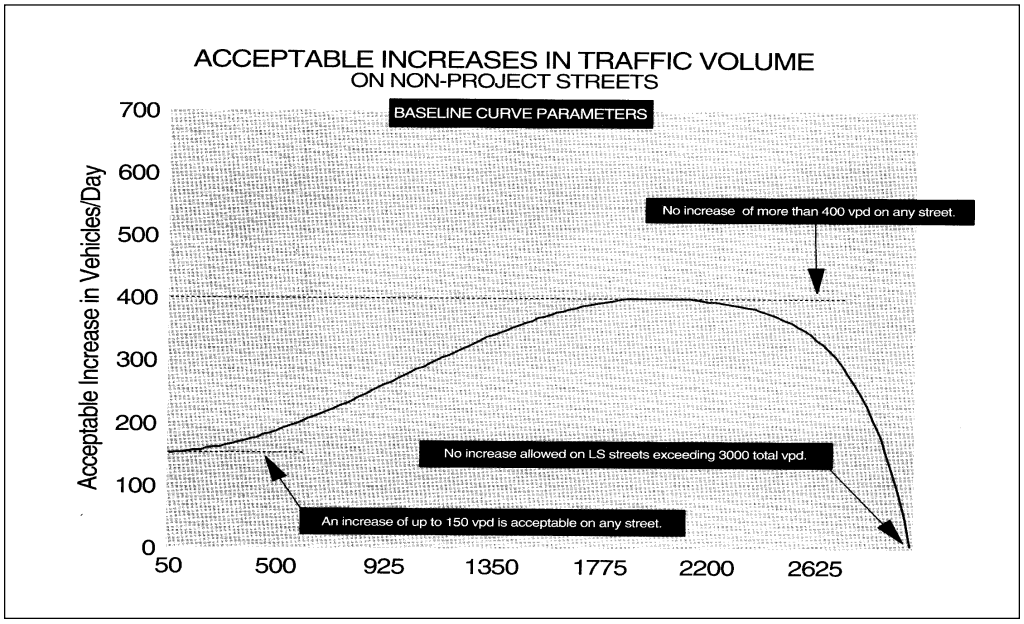
In the communities surveyed, an unacceptable variety of diversion sends traffic to lower order streets or overloads streets of the same order. This kind of diversion is the Achilles' heel of traffic calming. Citizens rarely turn out in protest over degradation of emergency response times since the possibility of emergencies seems remote. Outsiders inconvenienced by neighborhood traffic calming may call to complain or show up at a public hearing individually, but they rarely turn out en masse to protest a plan. Residents of nearby streets, whose quality of life may be hurt by diverted traffic, are the only ones with enough at stake to protest en masse.

Realizing this, a few communities have provided a warranty of sorts to those concerned about traffic diversion to their streets. If undesired diversion occurs, the local government will take action to mitigate the impact. Two featured communities, Boulder and Portland, have such policies.

In 1992, Portland adopted a so-called impact threshold curve that limits the amount of diversion it will accept. The curve is shown in figure 8.7. If traffic grows beyond a threshold value on any local street as a result of traffic calming measures taken on parallel streets, the city attempts to solve the problem by modifying the original design or installing traffic calming measures on the impacted street. The acceptable traffic growth threshold starts at 150 vehicles per day (vpd) for the lowest volume streets and increases to 400 vpd for streets with existing volumes of approximately 2,000 vpd. In no case may the increase on any local street exceed 400 vpd, nor may the resulting traffic volume exceed 3,000 vpd. This policy led, for example, to the replacement of 14-foot humps with 22-foot tables on a street that had diverted too much traffic. The redesign solved the diversion problem.

The Boulder policy is stricter, so strict it tends to preclude certain traffic calming measures, including speed controls that slow traffic enough to divert a little of it. The policy was adopted in response to a traffic calming plan that, in hindsight, compromised the connectivity of the street network (see figure 8.8).

The Boulder policy states that if traffic on any lower order street grows by more than 10 percent as a result of traffic mitigation, the city will "mitigate the mitigation." On a street with 200 vpd, a 10 percent increase amounts to only 20 cars per day. This threshold value lies within the daily variation of traffic volumes. Boulder staff members point to Portland's policy, which sets an absolute



LS = local service; vpd = vehicles per day

Figure 8.7. Impact Threshold Curve. (Portland, OR)

Source: Bureau of Traffic Management, "Neighborhood Traffic Management for Local Service Streets," City of Portland, OR, March 1992, p. 13.

Figure 8.8. Project that Provoked a Strict Diversion Policy. (Boulder, CO)

threshold rather than a relative one, as an alternative.

As an example of Boulder's diversion policy in action, traffic circles installed on Arapahoe Avenue may have diverted traffic to Marine Street. Four traffic counts on Marine Street showed increases of 62, 77, 0, and 40 percent over pre-calming levels. While ambiguous, the counts implied a traffic increase of more than 10 percent, triggering the mitigation policy. Residents of Marine Street were asked to vote on an array of traffic calming options for their street (see table 8.6). Ultimately, no mitigation was undertaken for lack of resident support.

Table 8.6. Options Offered to Marine Street Residents. (Boulder, CO)

Narrowed List of Options
Raised crossing and narrowing
Street closure
Raised intersection and neckdowns (with $60,000 cost borne largely by neighborhood)
Modification of Arapahoe Avenue circles
Additional Options Offered But Initially Rejected
Humps
Small median islands
Traffic circle
Do nothing
Other low cost solution

Project Priority Rating Systems

Priority rating systems differ from warrants in two respects. First, priority rating systems rank projects in order of funding priority, while warrants are used to simply qualify or disqualify projects for funding. Only if budgeted funds were just sufficient to cover all eligible projects, and no others, would priority rating systems and warrants produce the same funding outcomes. Second, priority rating systems allow tradeoffs among factors, while warrants treat qualifying factors as minimum requirements. Lower traffic speeds may balance higher traffic volumes (see figure 8.9). Some experts believe that this is the way residents perceive traffic problems. For just this reason, San Diego has considered converting two of its speed hump warrants—those relating to average daily traffic volume and 85th percentile speed (the speed below which 85 percent of the vehicles travel)—into priority rating factors. Quoting a city traffic engineer, these warrants are "screening out good candidate projects" and hence are "difficult to justify" to the public.

It is the opinion of some traffic managers that speed and volume are not substitutable for one another in some simple fashion per an economist's indifference curve. Residents may actually find an occasional speeding vehicle on their street more distressing than a steady stream of speeding vehicles that they are primed to look out for. If true, priority rating systems will not rank problem streets very accurately. This is an area for further study.

The fact that priority rating systems combine qualifying factors into one composite score makes them potentially useful for more than just setting funding priorities. They can be used in cost-sharing formulas, where lower scores translate into higher neighborhood matching requirements (see "Cost-Sharing Arrangements" in the next section). They can also be used to screen projects, much as warrants are. Boca Raton, FL, requires a minimum score in its rating system to qualify for physical traffic calming. Below the minimum, streets are only eligible for neighborhood speed awareness flyers, neighborhood speed watch, and other education and enforcement activities.

Seattle's priority rating system has been in place longer than any other, and has been adopted with minor modification by many other jurisdictions. This widely accepted model is outlined in table 8.7. Note the priority given to high-accident locations. A priority rating system simply reflects the goals of local policy makers. Seattle has made traffic safety the prime rationale for its traffic calming program, which has helped shield the program from budget cuts and emergency response controversies.

Other systems differ from Seattle's in the relative weight given to traffic volume versus speed, the volume and speed thresholds above which points are awarded, and the additional factors considered when assigning priority. Table 8.8 summarizes these differences for many systems. In

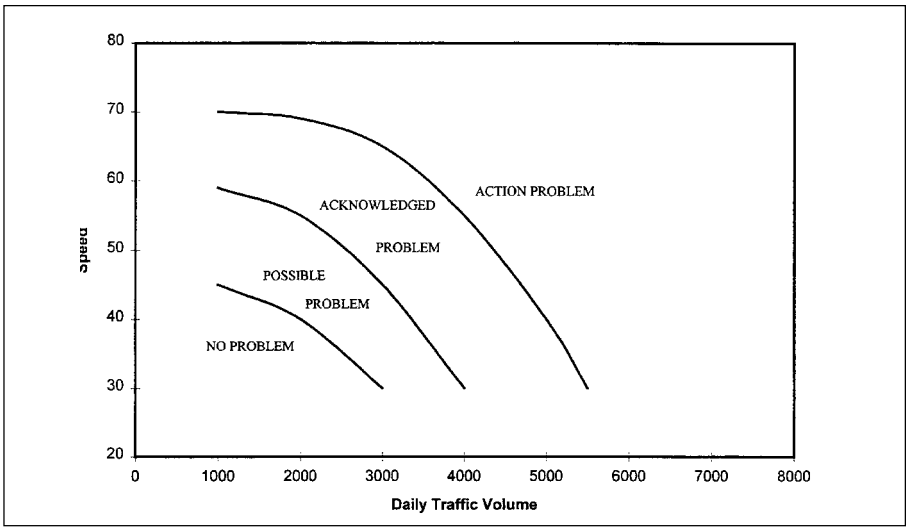


Figure 8.9. Traffic Speed (kilometers per hour) and Volume as a Combined Problem.

Source: A.P. O'Brien et al., "Some Australian Experiences with Warrants," *Transportation and Sustainable Communities*, (Resource Papers for 1997 ITE International Conference), Institute of Transportation Engineers, Washington, DC, 1997, pp. 71.

Table 8.7. Details of One Priority Rating System. (Seattle's Traffic Circle Program)

Factor	Points
Recorded correctable accidents for past 3 years (accidents per year)	
0.5–0.875	1
0.876–1.250	2
1.251–1.625	3
1.626–2.000	4
2.001–2.375	5
2.376–2.750	6
If "non-correctable" accidents exceed an average of 2 per year	1/2
If accidents at midblock exceed an average of 2 per year	1/2
Average daily volume (vehicles per day)	
500–1,100	1/2
1,101–1,700	1
1,701–2,300	1 1/2
2,301–2,701	2
85th percentile speed (miles per hour)	
26–29	1/2
29.1–32	1
32.1–35	1 1/2
35.1–38	2
38.1–41	2 1/2
41.1–44	3

Source: Engineering Department, "Traffic Circles—Neighborhood Traffic Control Program," City of Seattle, WA. Undated.

Table 8.8. Summary of Priority Rating Systems.

Community	Volume/Speed Tradeoff	Other Factors in Index
Austin, TX (humps)	50 vph = 1 mph for volumes > 50 vph and 85th percentile speeds > 5 mph over speed limit	Speed-related accidents Schools within $^1/_2$ mile Pedestrian generators within 1,000 feet Lack of sidewalks
Boca Raton, FL (local residential streets)	200 vpd = 1 mph for volumes >500 vpd and 85th percentile speeds >25 mph	Correctable accidents
Berkeley, CA (humps)	200 vpd = 1% of vehicles traveling > 30 mph for volumes > 1,000 vpd	Speed-related accidents Schools/parks/institutions on block Block length Enforcement/education/engineering Alternatives considered
Boulder, CO	1,000 vpd = 1 mph for all volumes and 95th percentile, 85th percentile, or average speeds > speed limit	Gaps sufficient for street crossing Residential densities Pedestrian/bicyclist traffic Bus stops/shops/hospitals/parks Planned street improvements
Brookline, MA	200 vpd = 1 mph for volumes > 500 vpd and 85th percentile speeds > 25 mph	Correctable accidents
Dallas, TX	133 vpd = 1 mph for volumes > 500 vpd and 85th percentile speeds > 30 mph	Correctable accidents
Madison, WI	33 vpd = 1% of vehicles traveling > speed limit for all volumes	Accidents Elementary or middle schools on street Pedestrian generators School walk route Bicycle route Scheduled road reconstruction
Portland , OR (local streets)	1,000 vpd = 1% of vehicles speeding for volumes > 5,000 vpd and 85th percentile speeds > 10 mph over speed limit	Elementary school zones Pedestrian generators Pedestrian routes Bicycle routes Transit routes Lack of sidewalks
Portland, OR (humps)	200 vpd = 1 mph for volumes > 400 vpd and 85th percentile speeds > 5 mph over speed limit	Lack of sidewalks
Portland , OR (neighborhood collectors)	1,200 vpd = 1 mph for all volumes and 85th percentile speeds > 35 mph	Residential densities Lack of sidewalks Elementary school crossing Pedestrian generators
Orlando, FL	33 vpd = 1% of vehicles traveling > 30 mph for all volumes	Reported accidents Schools on street Other pedestrian generators Designated pedestrian or bicycle routes Lack of sidewalks
Sacramento, CA (residential streets)	50 vpd = 1 mph for all volumes and 85th percentile speeds	Residential densities Correctable accidents
Tallahassee, FL	200 vpd = 1 mph for volumes > 500 vpd and 85th percentile speeds > 25 mph	Accidents Schools within 1 mile Pedestrian generators Lack of sidewalks Residential densities

mph = miles per hour; vpd = vehicles per day;
vph = vehicles per hour

Source: Unpublished documents supplied by the traffic calming programs.

Sacramento, CA, each additional mile per hour in speed is weighted the same as 50 additional vehicles per day in traffic volume. In Portland, on collector roads, an additional mile per hour is equivalent to 1,200 additional vehicles per day. That is, Portland's scoring system gives 24 times more weight to speed (relative to volume) than does Sacramento's. Generalizing the systems summarized in table 8.8, the typical system assigns points to speeds and volumes at a rate of 1 mph = 200 vpd, has thresholds of 500 vpd and 25 mph above which points start to accumulate, and also assigns points for collisions, pedestrian traffic generators, and lack of sidewalks.

The predecessor to this state-of-the-practice report, a report prepared for FHWA (1981), used experimental methods to assess acceptable speeds and volumes on residential streets.[7] A traffic speed of 15 mph proved acceptable to almost all residents, while a speed of 30 mph was unacceptable (a speed differential of 15 mph). A peak traffic volume of 1 vehicle per minute, or about 600 vpd, was generally acceptable to residents, while a peak volume of 6 vehicles per minute, or about 3,600 vpd, was generally unacceptable (a volume differential of 3,000 vpd). Thus, in terms of marginal disutility, a 1-mph increase in speed appears equivalent to a 200-vpd increase in volume (3,000 vpd/15 mph = 200 vpd/1 mph). Whether coincidental or not, the typical priority rating system conforms to its weightings for local residential streets. The volume threshold is also about right. However, the speed threshold may be a little high for a local residential street.

Higher order streets may require different weights, as in Portland. No comparable study is available.

Public Involvement

In the years since the passage of Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the public has become increasingly involved in transportation planning in general. Though most traffic calming is financed with local funds, and therefore falls outside ISTEA's requirements, the same emphasis (or even more) has been placed on public involvement in traffic calming programs.

Residents consider the streets they live on to be extensions of their homes. They care deeply about conditions on their streets and about government actions affecting their streets. They harbor strong opinions about the nature and extent of traffic problems, and about appropriate solutions. As has been noted in several sections of this report, it is a practical necessity to involve residents in the planning and implementation of traffic calming measures.

The relatively few traffic calming measures ever removed testify to the level of up-front public involvement that takes place in traffic calming programs (see table 8.9). Given the many reasons why traffic calming measures might fall into disfavor with residents, this record is remarkable.

Of Seattle's 600-plus traffic circles, only 2 have been taken out at the request of neighbors. Of Portland's 300-plus speed humps, just 2 sets have been removed, and 1 was replaced with speed tables. In 14 years of active programming, Bellevue has had to remove only 1 measure in response to neighborhood opposition.

Approval Requirements

It is likely that the main reason so few measures are ever removed is the show of neighborhood support required to install measures in the first place. In most places, strong support must be demonstrated before measures are even tested. Before they are installed permanently, 50, 60, or even 70 percent of property owners and/or residents must concur.

The exceptions prove the rule. In Berkeley, a fair number of diverters and traffic circles have been removed over the long history of their program. No humps have ever been removed. One reason may be the requirement of petition signatures for speed humps, but not for other traffic calming measures.

Three issues surround public approval. One is how public support should be assessed, whether by petition, ballot, or survey. Another is what margin of public support should be required. The third is how large an area should be contacted for approval.

Petitions Versus Ballots

Petition requirements are the most common way of establishing support. They serve as a screening mechanism for depth of commitment since residents must take the time to solicit signatures. Petition requirements are also easier to administer than are ballots or surveys.

On the negative side, signed petitions may not be the best indicator of public sentiment. Among featured communities, stories surfaced of residents feeling pressured to sign or being misled into signing by advocates of traffic calming.

It may be possible to structure petition processes so as to avoid such problems. In Gwinnett County, GA, all property owners must be given the opportunity to express their preferences. The petition itself requires the property owner to vote "yes" or "no" on the installation of humps (see figure 8.10). In Montgomery County, residents signing petitions are required to certify that they have reviewed an attached map of hump locations. The form lists neighborhood association contacts, with phone numbers, who can be called with any questions.

Table 8.9. Removal of Traffic Calming Measures.

Community	Measures Removed	Reasons
Austin, TX	One diagonal diverter	Trial installation—cut-through traffic complained
Bellevue, WA	One set of humps	"Political" humps not warranted in first place
Berkeley, CA	Unknown number of traffic circles and diverters	Circles confusing and failed to slow traffic—diverters outgrown by neighborhoods
Boulder, CO	Speed tables on two streets	Emergency response concerns and resident opposition
Charlotte, NC	One-lane chicane, several diverters, and turn restrictions	Lack of resident support at end of trial period
Dayton, OH	One closure—a few speed humps	Closure left only one way into neighborhood—humps ultimately opposed by neighbors
Eugene, OR	None	
Ft. Lauderdale, FL	5% of measures at end of trial period—mostly half closures	Half closures driven around—diverters used for drug exchanges
Gainesville, FL	One closure and four circles	Lack of resident support at end of trial period—circles replaced with humps
Gwinnett County, GA	None	
Howard County, MD	None	
Montgomery County, MD	Two sets of humps	Resident opposition developed
Phoenix, AZ	Several temporary diverters at end of trial period—one circle after 3 days	"Political" circle on a street with high volumes
Portland, OR	Two sets of humps	Ineffective trial installation—excessive diversion under Impact Threshold policy
San Diego, CA	Two temporary center islands Two sets of humps	Plastic islands considered ugly Humps installed on collectors serving as emergency routes in violation of city's own policy
San Jose, CA	Many temporary measures	Plan developed by residents modified by staff—ineffective circles removed
Sarasota, FL	One semi-diverter	Traffic diversion to next street
Seattle, WA	Two traffic circles, two sets of chicanes, and two dozen temporary diverters	Inappropriate locations for circles and chicanes
Tallahassee, FL	One chicane	Considered ugly by neighbors
West Palm Beach, FL	One roundabout	Poorly designed and unwarranted

Source: Interviews with staffs of traffic calming programs.

Even such safeguards may result in biased outcomes if residents feel pressured when approached by neighbors. One alternative is a mail-in ballot. In Dayton, OH, a petition process was generating hundreds of requests for humps. A majority of residents would casually sign petitions to install humps. Residents would wake up one morning to find humps they did not really favor. Then, a majority (including many of the same individuals) would sign petitions to remove the humps. Neighbors were unhappy, and public funds were wasted.

In response, Dayton added a balloting procedure, making it more difficult to qualify. After a petition is initially submitted, ballots are sent to all residents within the affected area. Two-thirds of all residents, not just two-thirds of all respondents, must concur before measures may be installed. By contrast, Austin has made it easier to qualify by switching from petitions to ballots. Austin had required two-thirds of residents to sign petitions. Austin now requires a simple majority of the ballots returned to be affirmative.

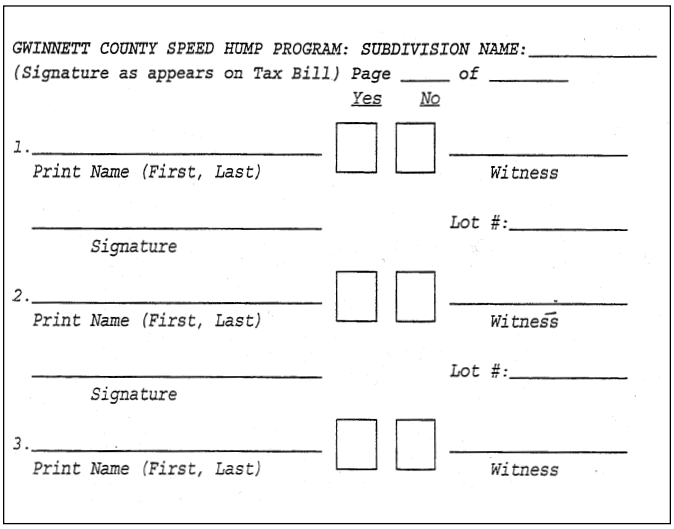
Margin of Approval

Does approval by a simple majority of property owners or residents constitute adequate support for traffic calming? Or should a super-majority be required as a form of insurance? If a super-majority is required, how large should the margin be?

In San Diego's survey of 42 public agencies, the median approval requirement for speed humps was 67 percent; the range was 51 to 80 percent. Two things are apparent from the communities surveyed. Where a balloting procedure is used, judging neighborhood support is typically based on the proportion of affirmative ballots returned, not the proportion of all residents responding in the affirmative. Also, the required proportion is typically well in excess of 50 percent.

In the first test of Austin's new procedure, about a quarter of the ballots were returned, and two-thirds of respondents agreed to a neighborhood pilot project. If this response rate is typical, Dayton's requirement is clearly stringent, and Austin's may be lax (at least for permanent installations). Under Dayton's requirement, even unanimous approval by respondents would have failed to qualify the neighborhood for traffic calming. On the other hand, under Austin's new requirement, a mere 12 percent of all residents were allowed to decide for the rest, a prescription for disaster. Viewing respondents as a random sample of the entire neighborhood, super-majority support of respondents is likely necessary to have any confidence that the neighborhood as a whole is supportive. Sampling theory can be used to determine the necessary percentage support for any given sample size and any given confidence level.[8]

The higher the required approval margin, the more demand for traffic calming may be suppressed. In a community with excess demand, far beyond the supply of traffic calming funds, it is tempting to create administrative hurdles that disqualify competitors. One traffic manager spoke of curtailing 90 percent of the demand for traffic calming funds by making the process difficult; a 70 percent approval requirement is part of his process. The problem with raising administrative hurdles is that it decreases the ability to ensure the selection of the most worthy projects.



GWINNETT COUNTY SPEED HUMP PROGRAM: SUBDIVISION NAME:_____
(Signature as appears on Tax Bill) Page _____ of _____

	Yes	No	
1. _____ Print Name (First, Last)	☐	☐	_____ Witness
_____ Signature			Lot #:_____
2. _____ Print Name (First, Last)	☐	☐	_____ Witness
_____ Signature			Lot #:_____
3. _____ Print Name (First, Last)	☐	☐	_____ Witness

Figure 8.10. Speed Hump Petition Offering a Choice. (Gwinnett County, GA)

Extent of Area Polled

Support for traffic calming measures is typically greatest on the streets being treated; support turns to opposition as polling moves to nearby streets that may be adversely impacted by diverted traffic. This phenomenon is illustrated by survey results from San Diego, where the issue was whether to retain traffic circles on Crest Way (see table 8.10).

One way to account for diversion is directly, by setting limits on diverted traffic, monitoring traffic levels, and taking remedial actions if limits are exceeded (see "Warrants That Address Diversion"). Another, indirect, way is to apply approval requirements to a larger area, not just to the particular street being treated. Several featured communities do so in cases where diversion is likely.

Table 8.10. Survey Response to Question, "Should the traffic circles remain?"

Survey Respondents	"Yes"	"No"
Residents living on Crest Way	83%	17%
Residents living on adjacent streets	33%	67%

Source: City of San Diego, CA, Unpublished memo to the Transportation and Land Use Committee, October 9, 1991, Attachment 2.

In Seattle, the petition area for speed control measures is one block in each direction from a measure. The petition area for traffic diverters (i.e., volume control measures) is the "impacted area" as defined by staff. While 60 percent written support of residents is required for both types of measures, approval is harder to secure for traffic diverters with large impacted areas.

In Phoenix, the petition area for speed humps and traffic circles is the street itself and, at staff discretion, parallel streets. The petition area is expanded to include the entire quarter section (0.25 square mile) around diagonal diverters, semi-diverters, and half closures. Again, although 70 percent approval is required in all cases, the requirement is harder to meet for volume control measures.

Other variations on this theme are found in Dayton, Ft. Lauderdale, and San Diego.

Cost-Sharing Arrangements

Willingness to directly participate in the funding of traffic calming measures may be the ultimate test of public support. However, there is debate over the appropriate level of cost sharing, whether the level should vary with circumstances, and what circumstances are relevant.

At one extreme, Bellevue is opposed to cost sharing and has actually declined neighborhood offers to pay for traffic calming measures in return for expedited installation. For Bellevue, it is a matter of fairness. If traffic calming is a basic neighborhood right, then ability to pay should not be a decisive factor.

At the other extreme is Phoenix, which at one time had no public funding for traffic calming and still has limited public funds. Phoenix has found that residents are quick to spend available public funds, but must truly value traffic calming measures before they will spend their own money.

Many featured programs offer cost-sharing options. A few programs have sought to further local policies and priorities by placing neighborhoods' share of costs on sliding scales (see table 8.11). In addition to the bases for cost sharing shown in the table, Boulder has considered raising the neighborhood's share where local traffic rather than through traffic is creating a problem. Charlotte has debated a higher neighborhood share for "stable" than for "fragile" neighborhoods.

Collaborative Planning Processes

Approval requirements and cost sharing are valuable tools for assessing public support for traffic calming measures. But several communities have found that public involvement should be more than an up-or-down vote on a staff-formulated plan. The plan is likely to be better, and to be more favorably received, if those most affected have a say in its formulation.

There are many ways of engaging the public in what were once viewed as purely technical matters, best left to experts. They are described in *Public Involvement Techniques for Transportation Decision-Making*, a how-to guide available from FHWA and the Federal Transit Administration.[9] Beyond the traditional techniques, such as public hearings, opinion polls, and citizen advisory committees, new techniques have been developed to

Table 8.11. Creative Cost-Sharing Formulas.

Location	Neighborhood Share	Basis for Neighborhood Share
Austin, TX	0–100% (sliding scale, based on point score)	Priority rating of project (discontinued)
Boca Raton, FL	0% and up	Incremental cost of more elaborate measures
Boulder, CO	50% (high priority) 100% (low priority)	Priority rating of project
Charlotte, NC	0% and up	Incremental cost of more elaborate measures

Source: Unpublished documents supplied by traffic calming programs.

help citizens visualize design alternatives and participate constructively in the design process. These new techniques have been put to good use in traffic calming projects:

- Guided tours of traffic calming sites
- Computer imaging (see figure 8.11)
- Visual preference surveys (see figure 8.12)
- Design charrettes (see figure 8.13)
- Focus groups (see figure 8.14)
- Neighborhood traffic committees[10]

This is not to suggest that design decisions be turned over to residents, only that residents be fully involved. Several featured communities have had bad experiences with delegated decision making. Honoring a pledge by the mayor, planning for traffic calming in one neighborhood in San Jose was turned over to a project steering committee. Implementation followed planning, and 2,500 enraged telephone calls followed implementation. The citizen-generated plan was soon replaced by a plan developed by staff, and the complaints ceased.

Likewise, a street closure in Austin was turned over to an upper-income neighborhood, which proceeded to design and build a full closure in the form of a wall. Amazingly, the full closure was not even left open to pedestrians and bicyclists. This is in contrast to street closures in places like Boulder, which while controversial for their impacts on traffic, at least remain permeable to pedestrians, bicyclists, and even emergency vehicles. Contrast figure 8.15 with figure 8.8 shown previously.

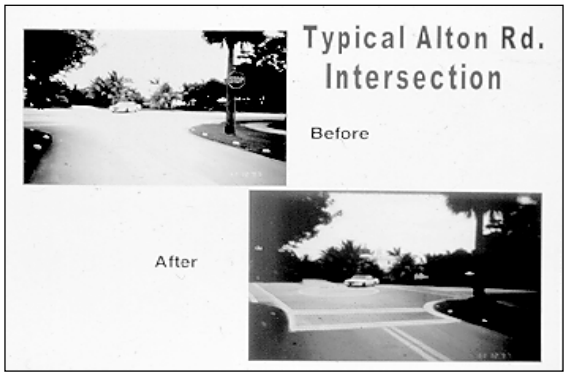


Figure 8.11. Computer Simulation Showing One Possible Treatment of a High-Volume Intersection.

Source: Author's study for the Alton Road Homeowners' Association, Miami Beach, FL.

Photo Credit: Susan Van Wagoner. Printed with permission of the Route 50 Corridor Coalition.

Figure 8.13. Design Charrette Used to Develop the Plan for Rural Route 50. (Loudoun County, VA)

Lowest Rated Image (average score = 3.0)

Highest Rated Image (average score = 6.4)

Figure 8.12. Visual Preferences of Residents Shown Alternatives for Calming a Major Collector (on a scale of 1 to 7).

Source: Author's study for the Ardens, DE.

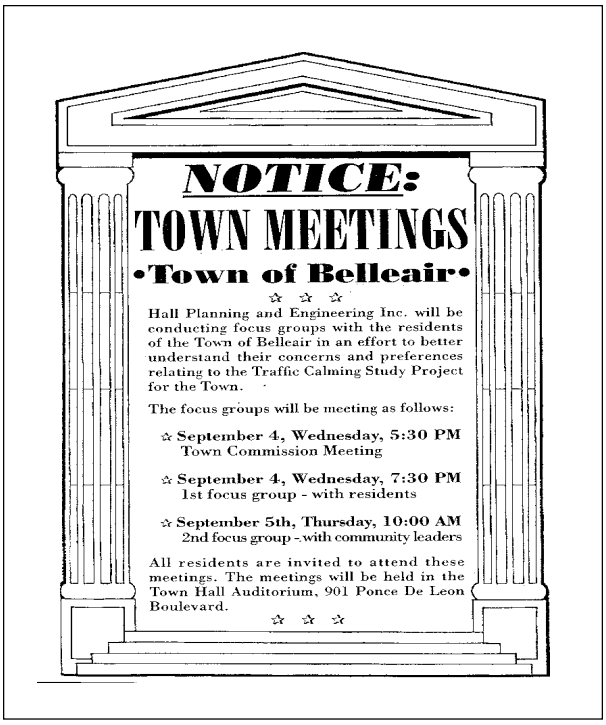


Figure 8.14. Announcement of Focus Groups for a Citywide Traffic Calming Project. (Belleair, FL)

Figure 8.15. Impenetrable Street Closure. (Austin, TX)

Endnotes

1. Portland and several other places call their speed humps by the name "bumps."
2. A. Weinstein and E. Deakin, "A Survey of Traffic Calming Programs in the United States," paper presented at the ITE International Conference in Monterey, CA, Institute of Transportation Engineers, Washington, DC, 1998.
3. City of San Jose, "Council Policy—Neighborhood Traffic Management Programs," approved on August 4, 1997.
4. J.P. Perone, "Developing and Implementing Traffic Calming Warrants," *1996 Compendium of Technical Papers,* Institute of Transportation Engineers, Washington, DC, 1996, pp. 351–353; B.D. Kanely, "Neighborhood Traffic Calming—Do We Need Warrants?" *Transportation and Sustainable Communities: Challenge and Opportunities for the Transportation Professional,* Resource Papers for the 1997 ITE International Conference, Institute of Transportation Engineers, Washington, DC, 1997, pp. 60–64; I.M. Lockwood, "Do We Need Traffic Calming Warrants?" *Transportation and Sustainable Communities: Challenge and Opportunities for the Transportation Professional,* Resource Papers for the 1997 ITE International Conference, Institute of Transportation Engineers, Washington, DC, 1997, pp. 55–59; A.P. O'Brien, "The Need for Warrants—The Australian Experience," *Transportation and Sustainable Communities: Challenge and Opportunities for the Transportation Professional,* Resource Papers for the 1997 ITE International Conference, Institute of Transportation Engineers, Washington, DC, 1997, pp. 65–82; and A. O'Brien, R. Brindle, and R. Fairlie, "Some Australian Experiences with Warrants," *1997 Compendium of Technical Papers for the 67th ITE Annual Meeting,* (Boston, MA, 1997), Institute of Transportation Engineers, Washington, DC, 1997, CD-ROM.
5. Lockwood, op. cit.
6. City of Boulder, "Neighborhood Traffic Mitigation Program—A Status Report," City Council Study Session, April 8, 1997, p. 4.
7. D.T. Smith and D. Appleyard, "Studies of Speed and Volume on Residential Streets," *Improving the Residential Street Environment—Final Report,* Federal Highway Administration, Washington, DC, 1981, pp. 113–130.
8. See, for example, L.M. Rea and R.A. Parker, *Designing and Conducting Survey Research,* Jossey-Bass, San Francisco, CA, 1992, pp. 107–124.
9. *Public Involvement Techniques for Transportation Decision-Making,* prepared by Howard/Stein-Hudson Associates and Parsons, Brinckerhoff, Quade, & Douglas, Administration, Washington, DC, 1996.
10. A particularly readable source is C.N. Moore, *Participation Tools for Better Land-Use Planning,* Center for Livable Communities, Local Government Commission, Sacramento, CA, 1995.