Sacramento County Neighborhood Traffic Management Program (NTMP)

"Best Practices" White Paper

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Submitted to:
County of Sacramento

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I.   Background

The County of Sacramento responds to speeding on residential streets through the "Countywide Speed Control Program" (CSCP) which uses speed bumps and stop signs for speed control. The CSCP was approved by the Board of Supervisors in 1981 and later amended in 1996 by the adoption of the "Care About Neighborhoods Program" (CAN). Since the program's inception, more than 250 streets have been treated through implementation of speed bumps, stop signs, and radar enforcement. The development of the Neighborhood Traffic Management program (NTMP) represents a comprehensive update to Sacramento County's current approach towards addressing neighborhood traffic related issues.

The NTMP is anticipated to include the following key elements:

- A manual to educate residents on what tools are available and their effects
- A systematic approach to initiating citizen requests to treat neighborhood traffic issues
- A priority system that allows staff to prioritize limited resources
- Neighborhood involvement in developing and approving a neighborhood traffic management plan
- A broader "Toolbox" providing more options to treat traffic related issues
- New street design guidelines for new developments to reduce the future need for neighborhood traffic management devices

Project Overview

The NTMP is anticipated to update and/or replace the County's current CSCP and CAN programs to provide Department of Transportation (DOT) staff with a more comprehensive approach to address neighborhood traffic related concerns. Development of the NTMP will be managed by DOT Staff, with input from a Technical Advisory Committee (TAC) and a Citizens Advisory Committee (CAC). The TAC's role is to advise the DOT staff on key decisions and program details. The TAC serves as a forum for other County staff and community service providers to discuss their needs or concerns with respect to neighborhood traffic management.   The City of Rancho Cordova is developing its initial NTMP, and they are utilizing the same TAC for input to develop their program, in part because many of the service providers (police, fire, etc.) are common to both agencies.

The CAC is comprised of citizens from the Community Planning Advisory Councils (CPAC) and advocacy groups within the County. It serves as a forum to discuss the many interests and concerns associated with residential streets from the citizen's perspective. The CAC will also advise DOT staff on key decisions and program details.

Throughout the nine month development process, DOT staff, the TAC, and CAC will review and make key decisions regarding the four following elements of the program.

- "Toolbox" of Neighborhood Traffic Management Measures
- Street Design Guidelines for New Developments
- Programmatic Elements (i.e. initiating, processing, implementing neighborhood involvement, and ,BOS approvals.)
- NTMP Manual

The TAC and CAC will be asked for input on key elements and will provide recommendations to DOT staff. The draft products will then be presented to the community at-large and key stakeholder groups for the solicitation of feedback. The feedback generated from the community outreach will ultimately be incorporated where appropriate and then presented to the County Board of Supervisors for approval.

Purpose of this White Paper

The "Best Practices" White Paper is an educational piece summarizing the neighborhood traffic management practices of 20 progressive agencies from across the nation[1]. The "Best Practices" White Paper provides insight into the range and/or common practices and best practices (if apparent) that are employed by the agencies involved in this survey.

In addition to summarizing the practices of the agencies surveyed, this document compares the findings to those documented in the *Traffic Calming State of the Practice[2] (SOP)*. This White Paper is the first detailed survey of U.S. traffic calming programs since those conducted in 1996 and 1997 for the August 1997 special issue on traffic calming of the ITE Journal,[3] and for *Traffic Calming State-of-the-Practice*, the national report for ITE/FHWA. As such, this "Best Practices" White Paper will allow us to see how policies and practices have changed as the field has matured. Throughout this report we compare and contrast our findings with those of the earlier surveys. We also note similarities and differences across programs as they operate today. The similarities suggest preferred approaches to traffic calming and the differences represent distinct choices available to the staff.

The remainder of this White Paper is formatted in a question/answer method discussing the findings and trends. Specifically, Section 2 summarizes the programmatic elements

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[1] *A total of 30 agencies were contacted and 20 responded.*
[2] *R. Ewing, Traffic Calming State-of-the-Practice, Institute of Transportation Engineers/Federal Highway Administration, 1999.*
[3] *R. Ewing and C. Kooshian, "U.S. Experience with Traffic Calming," ITE Journal, August 1997, pp. 28-33.*

of the agencies ranging from program initiation, administration, and applicability to new developments and rural areas. Section 3 documents the process issues of the NTMP while Section 4 discusses technical issues such as the project eligibility and toolbox of neighborhood traffic management measures. Section 5 discusses the practice of calming arterial streets. Appendix A contains summary tables highlighting key elements of each agency's practices and Appendix B contains the survey responses conducted during the interview process of the "Best Practices" White Paper.

How Surveys were Conducted

The basis for the "Best Practices" White Paper is the surveys of 20 progressive agencies' neighborhood traffic management practices. The agencies selected for the survey were narrowed down from a long list of over a hundred agencies based on knowledge gained through research conducted for the SOP, working with the agencies on neighborhood traffic management programs or plans, and review of the agencies' program materials. Listed below are the 20 agencies that responded to the survey:

1. City of Albuquerque, NM
2. City of Bellevue, WA
3. Broward County, FL
4. City of Charlotte, NC
5. City of Charlottesville, VA
6. City of Colorado Springs, CO
7. City of Eugene, OR
8. Gwinnett County, GA
9. Hillsborough County, FL (TBP)[4]
10. Howard County, MD
11. Los Angeles County, CA
12. City of Minneapolis, MN
13. Montgomery County, MD
14. City of Portland, OR
15. City of Tucson, AZ
16. City of Riverside, CA
17. City of Sacramento, CA
18. City of Seattle, WA
19. City of Vancouver, WA
20. City of Walnut Creek, CA

To conduct the surveys, the project team (County staff and consultant team) developed a questionnaire to capture, through a phone interview, key elements of each agency's program. To be respectful of the interviewee's other time commitments; interviewers reviewed each agency's website to gain familiarity with its practices prior to contacting the

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[4] *The survey for Hillsborough County will be provided at a later date.*

agency. After we reviewed the website, each agency was contacted so that we could confirm and gather additional information not readily available from the website. In all, the phone surveys lasted approximately 20-40 minutes and subsequent follow up phone calls were made to confirm unclear or incomplete information.   Appendix B contains the summaries of the agency surveys.

II. Programmatic Findings

Program Initiation

- *What factors motivated the development of your NTMP?*

    Most surveyed programs were established in response to public demands for relief from traffic speeding through neighborhoods, and to a lesser extent, excessive traffic volumes on residential streets (presumably due to cut-through traffic). Three programs were motivated in part by safety concerns. Three programs were created in response by broader neighborhood livability concerns.

    What wasn't picked up in this survey are supplemental purposes of traffic calming documented in Traffic Calming State-of-the-Practice, including business development, neighborhood revitalization, and crime prevention.

- *Year program started?*

    Programs surveyed had their start dates as early as the late 1970s (Portland and Seattle) and as late as 2003 (Los Angeles). Most started sometime during the 1990s. These dates are a little misleading, in that many localities had done ad-hoc treatments before launching formal programs.

    The interesting question that arises in connection with start dates is whether the older programs have different policies and practices than the new ones, which may reflect different points on the learning curve.

    Related and also of interest is how programs changed over time, again reflecting their learning curves. In these updates, we did not ask specifically about changes over time, but Howard County noted a major change in 1995 (expansion from speed humps to a more complete toolbox of measures). Colorado Springs also reported one round of program revisions, while Albuquerque reported two.

    From surveys for ITE's Traffic Calming State-of-the-Practice almost a decade ago, we know that major programmatic changes are commonplace. Among the trends documented: from simple to diverse toolboxes; from reliance on volume controls to reliance on speed controls; from spot to area-wide treatments; from reactive to proactive treatments; and from retrofits to application to new developments.

Program Administration

- *Department that administers program?*

    Traffic calming programs are almost universally located within transportation or public works departments. Where they are housed within these larger departments varies from place to place. Some are more operations oriented such as Montgomery County's Traffic and Parking Services Division, while others are more planning oriented such as Albuquerque's Office of Neighborhood Coordination (three programs are housed within special neighborhood services units).

    These results suggest a marginal change has occurred since surveys for Traffic Calming State-of-the-Practice almost a decade ago, when traffic calming programs were occasionally housed within subunits of Planning Departments. Not surprisingly, now traffic calming is primarily viewed as a traffic related function rather than a general planning function.

Program Staffing

- *# of Staff who administer program (FTEs)?*

    Staffing levels vary from a fraction of an FTE in Eugene to 7 FTEs in the City of Sacramento. Most agencies have staff assigned exclusively to traffic calming functions. This presumably enables staff to develop true expertise in traffic calming by immersing them in the practice.

    An alternative is to have staff split their time between traffic calming and other traffic-related functions. For example, in Los Angeles, six staff members devote approximately 5-10 percent of their time to traffic calming, for a total of 0.5 FTE's. In Walnut Creek, five individuals spend about 10 percent of their time on traffic calming. For the smaller programs, split responsibilities have the advantage of allowing staff resources to be programmed where they are most needed at any given moment.

- *Education and professional credentials of program staff?*

    Engineers dominate other professions in the traffic calming field, while planners are also well-represented. Sometimes both disciplines are represented within a given program (as in Bellevue, Charlottesville, and Gwinnett County). This suggests that both skill sets may be useful in the practice of traffic calming (one more technical, the other more communicative and people-oriented)

Staff is mostly college educated. Non-college educated personnel sometimes serve as technicians.

While the surveys for Traffic Calming State-of-the-Practice did not ask comprehensively about staff backgrounds, it is our impression that staffing has shifted somewhat toward engineering backgrounds. If true, this could reflect the mainstreaming of traffic calming within the transportation engineering profession.

Program Funding

- *Program annual budget? Capital? Operating?*

The City of Sacramento has the largest capital budget at $570 k per, $420 k of which funds the NTMP and another $150 k for spot treatments. The typical earmarked program has a capital budget between $100k and $250k. Several programs have no set budget, but instead compete for transportation or public works department funds generally or are funded primarily by residents on an on-demand basis.

Many of the agencies surveyed were unable to identify operating budgets. This may be due to the nature of the program and lack of staff dedicated to the traffic calming program. Of the agency's citing operating budgets, one of the best known, Portland, Oregon has a $50k operating budget and a $30k capital budget. Two other programs, Eugene's and Howard County's, have been left unfunded by budget cuts during the recent fiscal crisis.

By contrast, the City of Seattle has an operating and capital budget of $600 k per year. Seattle's success in competing for local funds was highlighted in Traffic Calming State-of-the-Practice. It was attributed both to Seattle's emphasis on and success in reducing traffic accidents, and also to its combination of proactive and reactive approaches to fund allocation.

- Budget per neighborhood plan or street (planning, design, construction)?

Providing neighborhoods with a set budget, and allowing them to decide how the money is spent, has worked well in certain places. However, it is not a common programmatic structure. Of places surveyed, only Charlottesville, the City of Sacramento, and Howard County (before recent budget cuts) have opted for this approach. The rest have funded traffic calming on a discretionary, competitive basis, rather than converting it into more of an entitlement. One might imagine that the entitlement approach would generate a fair amount of political support for traffic calming, but might not lead to the most efficient and problem-focused allocation of resources.

- *Primary public funding sources?*

  The general fund remains the main source of funds for traffic calming, often in combination with gas tax revenues. As such, traffic calming competes with all other local governmental priorities, or at least with other local transportation priorities.

  Few places have dedicated revenue sources. The exceptions: Gwinnett County has a 1 percent sales tax from which traffic calming and other transportation programs are funded. This sales tax will generate approximately one million dollars over the course of four years. The City of Sacramento funds its program through gas and transportation sales taxes (Measure A). Albuquerque and Howard County both rely on local bond funds, which have certain logic for longer lived investments.

- *Do residents participate in funding of devices, and if so, to what extent and through what assessment mechanism?*

  One big change since Traffic Calming State-of-the-Practice is the greater reliance on neighborhood residents to help finance their own traffic calming projects. At that earlier time, many jurisdictions had a bias against any funding mechanism that might favor wealthy neighborhoods over poorer ones. Now, perhaps due to local fiscal constraints, about half of the governments surveyed rely partially or fully on private financing: Bellevue (fully for gateway treatments but not other measures); Broward County (fully); Charlottesville (fully in the speed hump program); Minneapolis (fully); Portland (partially through a matching requirement); Riverside (partially through a matching requirement); and Seattle (partially through a matching requirement);

  Vancouver has proposed the POP (Property Owner Purchased) program. Portland will soon have three matching levels: 25, 50, 100 percent privately funded. The private contribution can be through up-front fee or local improvement district. Gwinnett County levies a $12 per year maintenance fee on residents of the plan area through the county property tax. Eugene sometimes requires residents to pay for traffic calming measures, and plans to rely more heavily in the future on local assessment districts.

- *At the neighborhood's request, would more elaborate devices be constructed with local neighborhood funding for costs above and beyond basic costs?*

  Localities that rely on private financing mostly allow local residents to pay for aesthetic upgrades. This too represents a change from Traffic Calming State-of-the-Practice, when equity considerations ruled. In Charlotte, for example, residents can opt to pay for decorative features and concurrently move themselves to head of list of funded projects. While Albuquerque offers the same option, no neighborhood has yet taken advantage of

it. This brings home one advantage of private financing schemes: asking residents to pay for traffic calming measures is the surest test of the value they place in them.

Controversies

- *Has your program been controversial, if so, why and how have you addressed controversies?*

About half of the surveyed programs report controversies. Most sound minor and specific to individual plans (as opposed to general and spilling over to the program as a whole). The one major exception is Eugene, where people are said to either love traffic calming (if they live on streets with measures) or hate it (if they want to use the same streets as a cut-through routes).

The level of controversy seems diminished compared to that reported in Traffic Calming State-of-the-Practice. Portland, for example, had experienced controversy over emergency response and a streamlined approval process. At this time, program personnel report that "up-front public involvement has avoided significant controversy" and that "Fire Bureau concerns were solved in 1998 with new street classification Primary Emergency Response Routes." Up-front public involvement and avoidance of emergency routes are two ways of minimizing controversy. Other reported approaches involve planning for the entire street network (not just individual streets), formalizing program policies (as opposed to more ad hoc treatment), and requiring applicants to work through neighborhood associations.

We would like to think that most of the reported difference in controversy levels between surveys is due to the more established and routine nature of traffic calming nowadays.

Liability and Litigation

- *Has there been any litigation involving your program? Any significant damage claims? What were the circumstances?*

Most places surveyed report no litigation at all, and those with litigation mostly report old lawsuits. Overall, only three new lawsuits have been filed since Traffic Calming State-of-the-Practice. One was settled out of court, and the other two were decided in the cities' favor. So the earlier conclusion, that a carefully designed and administered program can avoid liability, seems to still hold.

For old cases, see Chapter 6, Traffic Calming State-of-the-Practice. New cases were: in Montgomery County, a person injured on a speed hump received a $10k out-of-court settlement; in Portland, a driver claiming injury due to "incomplete speed humps" lost his lawsuit; and in Seattle, a boy hit at an intersection where a traffic circle had been requested lost his suit. The last two suits, and a threatened suit in Bellevue over the removal of speed tables, illustrate an interesting trend. There is more litigation now for failure to calm traffic than for calming traffic and thereby somehow contributing to accidents. The decision to spend money on traffic calming, or to spend money on a particular street, is discretionary function of government. It is not a ministerial function with little room for discretion. As the case of The Friends H Street v. City of Sacramento suggests, lawsuit for failure to calm traffic are unlikely to be successful.

Only a couple damage claims were reported, and these involve small payouts.

Maintenance

- *Who maintains landscaping in devices, and if the public is involved, what legal and other mechanisms are used to be sure they perform their duties?*

Traffic Calming State-of-the-Practice found that landscaped devices such as traffic circles were almost universally maintained by nearby residents. One of the few exceptions was Portland, where the city assumed maintenance responsibility to achieve high uniform aesthetic quality. Elsewhere, maintenance was less consistent and few good enforcement mechanisms existed.

Now responding jurisdictions are split about evenly between those that maintain and those that rely on citizens to maintain. Portland maintains older devices but has come to rely on maintenance agreements with developers for new devices. By contrast, Vancouver is moving away from reliance on private parties toward city maintenance.

Where residents are responsible for landscaping, the main means of enforcement continues to be the threat of unsightly alternatives. Minneapolis will fill in landscaped areas with materials that do not require maintenance. Seattle will force residents to deal with the problem by allowing its devices to become unsightly; it may also pave over circles with asphalt, creating unaesthetic "black buttons." The City of Sacramento will initially either landscapes or uses river rock in devices depending on the neighborhood preference. The City also relies on residents to maintain devices and will river rock over previously landscaped devices if the neighborhood is unable to maintain it.

Applicability to New Developments

- *Are neighborhood traffic management (traffic calming) devices ever required in new developments, and if so, what devices and under what circumstances?*

  Traffic Calming State-of-the-Practice foresaw a shift in emphasis from retrofits to traffic calming with in new developments. This trend has not exactly materialized, but we may be moving in that direction.

  Albuquerque, Eugene, Minneapolis, and City of Sacramento make case-by-case recommendations as part of the development review and approval process. None reported opposition from developers. Charlotte and Vancouver are developing formal policies on traffic calming in new developments. Vancouver reports that developers are more receptive to traffic calming than they once were. Howard County already has such a policy in place. Slow points are required at regular intervals between 600 and 1,000 feet. Adopting formal requirements today may be the best way to avoid the need for retrofits in the future.

Applicability to Rural Areas

- *Are urban and rural residential areas treated differently in respect to eligibility, devices, public vote/survey?*

  The answer to this question was mostly "no" or "not applicable." Surveyed jurisdictions either have no rural lands within their boundaries or have no demand for traffic calming in their rural areas. The one exception was the City of Sacramento, which reported one plan for a semi-rural area that included signing, striping, and a street closure.

  The County of Sacramento is unique in that a large population lives in the unincorporated areas with densities similar to that of typical urban areas, but with rural characteristics (i.e. no sidewalks, ditches along side of the roadway, larger lots, etc.). Consequently, the County may find it appropriate to treat rural areas, but perhaps with a different toolbox than urban areas.

Use of Consultants

- *Use consultants to develop neighborhood traffic management plans, and if so, under what circumstances?*

About half of the surveyed jurisdictions use consultants at least occasionally, while the other half do all the planning in-house. Only one of the respondents, Charlottesville, indicates that it uses consultants for virtually all planning work.

For those using consultants occasionally, the main factor motivating their use is plan complexity. Seattle, for example, contracts out the larger more complex plans; in such cases, city staff is in a supportive role. Walnut Creek has used consultants on two major projects over the past 10 years. Programs limited to simple devices, such as Riverside's speed hump program, have no use for consultants.

Another factor in the use of consultants is funding availability. One interesting variation on this theme involves cases where neighborhoods help pay for projects. In Albuquerque, residents have the option of hiring outside consultants, but have never exercised this option. Eugene also provides this option but, to save neighborhoods money, often walks applicants through the process, provides standard plans and other guidance.

III. Process Issues

Project Initiation

- *How is the street or neighborhood selection process initiated (agency action, complaint driven, or other)?*

    Traffic Calming State-of-the-Practice predicted a more proactive, staff-driven approach to project initiation in ensuing years. Instead, project initiation has remained largely reactive; projects are initiated mainly through complaints from residents. Even in Seattle, known for proactively targeting high accident locations, about 95 percent of projects are neighbor-initiated.

    Within complaint-driven processes, different threshold levels of neighborhood support are required before any action is taken. Some (Bellevue and Howard County) allow individuals to initiate a needs study with a phone call, written request, or on-line request. Others (Charlotte and Los Angeles) require petitions signed by a specified number or percentage of residents. Still others (Montgomery County and Vancouver) require the responsible neighborhood association (or city councilmember where no association exists) to request a study. And a few (Broward County and Minneapolis) first require a petition with signatures, and then concurrence of a neighborhood association. The increased emphasis on neighborhood associations is a new trend since the SOP.

    Some processes accept applications year-round. Others have open filing periods beginning on a set date, and running until all funds are committed.

Project Planning

- *How is the public involved in development of plans?*

    In about half of the places surveyed, public involvement is limited to passing petitions, voting on plans, or voicing opinions at public hearings. The public reacts to plans, but does not participate in the development of them. It is an up or down, go or no-go, support or oppose decision for the public.

    The remaining places involve citizens in planning through one of two mechanisms. 1.) Involvement occurs informally through citizen surveys to solicit ideas, meetings with staff to discuss ideas, or open houses to get comments on a draft plan. Or, 2.) A formal neighborhood traffic calming committee is established to work with staff or consultants on a plan. Since Traffic Calming State-of-the-Practice, the latter

approach has gained in popularity. Practitioners include Albuquerque, Bellevue, Howard County, Los Angeles, Montgomery County, and the City of Sacramento.

The appropriate type of public involvement may depend on the nature of the treatment. On simple speed hump projects, Portland staff prepares a plan and holds open house, while residents pass petitions and gather funds. On complex projects, a volunteer committee is formed and staff acts as consultant to the committee regarding policies, regulations, and devices.

- *If committees are used, how are members selected?*

Typically, either volunteers are recruited, or members are appointed by neighborhood associations. Committees consist of anywhere from three or four members in Howard County to as many as 30 members in Albuquerque. The City of Sacramento believes that five to 10 members is the ideal size for neighborhood traffic calming committee (with provision for alternates).

Public Approval

- *Is a public vote/survey taken before the plan is adopted? If so, what area is surveyed?*

With three exceptions, all jurisdictions surveyed require a vote (usually by mail) before plans are adopted and implemented. The exceptions, such as Gwinnett County and Riverside, use initial petitions to judge public support for projects and the traffic calming devices are simple ones. Charlotte also relies on petitions, but will add a public vote on the final plan as it diversifies its program.

For the many jurisdictions with voting requirements, those living in the "affected area" or the "study area" are eligible to vote. The affected area is defined differently in different jurisdictions. In some jurisdictions, staff has discretion to draw boundaries subject only to general guidance. In Los Angeles, the affected area includes but is not limited to "properties where normal travel routes… are to be altered by the neighborhood traffic management and calming measures, and/or properties that are significantly impacted by traffic that is to be diverted." In other jurisdictions, the affected area is defined by major physical features. In Minneapolis, it consists of all surrounding blocks bounded by through streets or other natural barriers. And in still other jurisdictions, the affected area is defined as the treated street and certain connecting streets. In Montgomery County, it includes all properties that front on the street in question and cul-de-sacs and streets connecting through this street.

The affected area may vary with the type of treatment or the functional classification of the treated street. For traffic circles in Seattle, the affected area includes all properties

within one block of the treated intersection. For other measures, it is delineated by staff on a case-by-case basis. For local and collector streets in Charlottesville, the affected area includes all properties within one block of an intersection treatment and all properties on the block itself for a mid-block treatment. In addition, roads that have their main access from the study blocks are included in the affected area. For arterials in Charlottesville, the affected area is defined as with local and collector streets but includes potentially impacted parallel roads. Also, if the study street passes through more than one neighborhood, each neighborhood has a vote on the plan.

- *Is the vote/survey distributed to homeowners only, or all residents? Do only residents get a vote, or do business proprietors also get one? What percent of neighborhood acceptance is needed for plan approval?*

Typically, all residents, both property owners and renters, are eligible to vote on traffic calming plans. In about half the surveyed jurisdictions, eligibility extends to business proprietors.

Every jurisdiction has its own plurality requirements for plan approval. Minimum approval rates vary from 30 percent of those voting for temporary measures in Charlottesville, to 100 percent of those voting for permanent measures paid for with special assessments in Broward County. The median approval requirement for jurisdictions surveyed is two-thirds of those voting.

Some jurisdictions also have required response rates for those eligible to vote. Such requirements are imposed to ensure a degree of general public acceptance. Minimum response rates vary from 25 percent for speed control measures in the City of Sacramento to 90 percent for any measure in Los Angeles. For those jurisdictions with such requirements, the median required response rate is 50 percent (not an easy requirement to meet).

Several programs have variable approval and/or response rate requirements. The City of Sacramento requires higher approval and response rates for volume control measures than speed control measures. Broward County has higher approval requirements for permanent than temporary measures. Charlottesville does as well, and adds a response rate requirement for permanent measures. Montgomery County has higher approval requirements for residents of treated streets than connecting streets.

Interagency Consultation

- *How are the fire department's interests considered?*

Fire department interests are most often accommodated by allowing them to review and comment on traffic calming plans. This mechanism is used by at least nine of the surveyed jurisdictions. In one jurisdiction, Riverside, the fire department not only reviews and comments but also must approve speed hump installations. Riverside reports that the department usually grants its approval.

Another way in which fire interests are accommodated is in the geometric design of measures. In this survey, only Gwinnett County mentioned selecting a speed table profile based on the needs of fire-rescue. But Traffic Calming State-of-the-Practice cites other examples from Portland, Seattle, and elsewhere.

A third way in which fire interests are accommodated is the designation of primary emergency response routes, which are subsequently ineligible for traffic calming or, alternatively, eligible for a restricted set of measures. Designation of such routes ended the moratorium on traffic calming in Portland. Like Portland, Vancouver also avoids primary emergency response routes and, in addition, seeks to make street connections that provide alternate routes to fire emergencies.

Chapter 7 of Traffic Calming State-of-the-Practice reports other approaches to reconciling traffic calming and emergency response goals, including the use of experimental measures such as speed cushions and split humps.

- *How are ambulance interests considered?*

  Medical emergency responders are accommodated in the same way as fire responders. They are often one and the same, as fire-rescue operations provide emergency medical services and fire engines are often the first on the scene at medical emergencies. Three jurisdictions reported that ambulance services, in particular, are considered secondary to fire services and are given less priority in traffic calming plans.

- *How are other interests such as waste collection and snow removal considered?*

  Waste collection is either not considered at all or accommodated indirectly through planning for fire response. In Portland, the SU-30 design vehicle is used for waste collection, while larger vehicles are used for fire response.

  Snow clearance is a separate issue, but one that creates few problems due to the mild climates of most surveyed jurisdictions. Minneapolis and Eugene, two areas that get some snow, report that they typically do not apply traffic calming to primary snow removal routes. Based on surveys of Toronto, Dayton, Yakama, WA, and other northern cities, Chapter 7 of Traffic Calming State-of-the-Practice reports other approaches to reconciling conflicts between snow clearance and traffic calming, such as using specialized equipment or installing object markers that extend above snow levels.

Design Process

- *Who prepares the final designs of devices?*

  Final designs are prepared almost exclusively in-house by city or county staffs. This is the case even where consultants prepare traffic calming plans. One exception is Vancouver, where consultants design complex devices when time and funding permit. Bellevue is also an occasional exception.

  Within local governments, responsibilities for traffic calming are sometimes divided among subunits. In Portland, speed hump projects are designed and constructed by the Maintenance Bureau (being completely routine now). More complex treatments are designed by the Design Section of the Transportation Bureau. In Charlottesville, the Department of Neighborhood Development Services designs treatments and the Public Service Department installs them.

Trials

- *Are devices installed for a trial period, if so, for how long?*

  A little over half of the surveyed jurisdictions use trial periods to test treatments. Seattle stopped doing so for traffic circles (which are hardly ever removed) but continues to hold trials for partial closures and speed humps. Portland no longer conducts trials for speed control measures but continues to do them for volume control measures meant to divert traffic. Among surveyed jurisdictions, the minimum time of a trial is one month, the maximum is one year, and the most common range is one to six months. In areas with a range of trial times, the exact time depends on the nature of the treatment.

Evaluation

- *Are post-construction evaluations conducted?*

  Post-construction speed data are routinely gathered in connection with trial installations. Volume data are gathered too, though not as consistently.

  In several jurisdictions, performance data are also gathered in connection with permanent installations. This is useful for documenting program successes and lessons learned from program failures.

Two jurisdictions, that have not gathered speed and volume data routinely in the past, plan to do so in the future (those being Charlotte and Eugene).

One interesting finding from this survey, which reinforces earlier surveys for Traffic Calming State-of-the-Practice, is that no U.S. jurisdiction is conducting complete before-and-after evaluations, looking at the full range of relevant impacts. No one is measuring noise levels, no one is taking pedestrian counts, no one is comparing property values. Indeed, the only supplemental information (beyond speeds and volumes) reportedly gathered by surveyed jurisdictions is resident satisfaction with traffic calming treatments in Los Angeles. European governments have long conducted more complete evaluations of traffic calming treatments. This would appear to represent a lost opportunity for advancing the state-of-the-practice in the United States.

Project Removal

- *Under what circumstances are devices removed, and what process is followed for removal?*

Jurisdictions surveyed report few instances in which permanent measures have been removed. Gwinnett County has never had to remove any of its hundreds of speed tables. Seattle has had to remove only a few of its hundreds of traffic circles. The City of Sacramento reports no instances of removal among its hundreds of devices. The only jurisdiction reporting significant removal is Vancouver, which is switching from speed humps to speed cushions in response to concerns about emergency response. So removal of traffic calming devices tends to be more a theoretical than a practical concern.

Measures can always be removed by staff if they are determined to be unsafe. In Minneapolis and Portland, measures can also be removed at staff's discretion if they cause excessive diversion; Portland has numerical thresholds for what is deemed unacceptable diversion.

In addition to staff-initiated removal, several jurisdictions have formal policies for citizen-initiated removal of permanent devices. Charlottesville, Howard County, and Vancouver follow essential the same data collection, problem assessment, and voting procedures for removal as initial installation (with one catch, property owners are usually required to pay for removal). It takes 60 percent approval to install in Seattle and 60 percent approval to remove. It takes 60 percent approval to install in Albuquerque, and only a slightly higher percentage, two-thirds, to remove. This makes it slightly harder to remove than install in the first place.

IV. Technical Issues

Project Eligibility

- *How is street or neighborhood eligibility determined?*

   Many surveyed jurisdictions have standards or guidelines determining street eligibility for treatment. The standards or guidelines are usually tied to traffic speed and/or volume, and often vary with street functional classification level. As an illustration, Montgomery County bases eligibility on six criteria:

   1. classified as a primary or secondary residential street
   2. posted speed limit of 25 or 30 mph
   3. 85th percentile speed at least 7 mph above statutory speed limit on a secondary street or 9 mph above speed limit on a primary residential street
   4. peak hour traffic volume of at least 100 vehicles
   5. special consideration for alternative routes if ADT exceeds 4,000
   6. minimum length of 1,000 feet.

   Among the surveyed jurisdictions, the median qualifying 85th percentile speed is 9 mph above the posted speed limit, while the median qualifying average daily traffic volume is greater than 1,200 vehicles per day. Some jurisdictions have established maximum volume warrants

   The other way of qualifying streets for traffic calming is a priority rating system. With such a system, a weighted sum of factors such as speed and volume substitutes for qualifying values of such factors. More information on priority rating is provided in the next section.

- *Which streets are eligible for treatment (local, collector, arterial, residential only or commercial too)?*

   Surveyed jurisdictions vary in the types of streets eligible for traffic calming. Some such as Broward County and Seattle limit traffic calming to local streets. More jurisdictions, including Albuquerque, Montgomery County, and Portland, extend eligibility to collector streets.

   Traffic Calming State-of-the-Practice predicted an expansion of U.S. programs to streets higher up the functional hierarchy. To a limited degree, this has occurred. Six surveyed jurisdictions—Bellevue, Charlottesville, Eugene, Howard County, Portland, and Vancouver—traffic calm arterials at least occasionally. This is mostly done on a case-by-case basis with a limited array of measures deemed appropriate (see Appendix C for arterial traffic management treatments).

Almost half of surveyed jurisdictions limit traffic calming to residential streets. Among them are Albuquerque, Charlotte, Gwinnett County, Los Angeles, and Riverside. The City of Sacramento focuses heavily on residential streets.

- *Are neighborhood traffic management devices constructed on dedicated emergency response routes? If so, which devices are eligible?*

Where emergency response routes are designated (and not all jurisdictions have done so), traffic calming is handled in one of three ways: 1) Either these routes are ineligible for treatment, or 2) they are treated only in consultation with and/or after the approval of emergency response officials, or 3) they are treated only with certain fire emergency-friendly devices.

An example of the first approach is Minneapolis, where emergency response routes tend to coincide with primary snow removal routes and are not treated. Minneapolis has a few such routes previously treated with speed humps and reports they cause problems.

An example of the second approach is Seattle. The Fire Department generally shows flexibility and acquiesces to traffic calming, but the final decision is theirs. A Primary Emergency Response Route map has recently been prepared and is being considered as a basis for resolving traffic calming-emergency response issues.

There are several contrasting examples of the third approach. Montgomery County uses only 22-foot speed tables (not 12-foot humps) on its emergency response routes. Portland plans to use only offset speed tables (what used to be called split humps) on its routes. Vancouver is using only speed cushions and the City of Sacramento is using only speed lumps (a close cousin to speed cushion) on their routes. Bellevue has two options for such routes: speed cushions or fixed radar speed signs. The adoption of speed cushions and other emergency-friendly devices represents a change from the time of Traffic Calming State-of-the-Practice, when these measures were considered experimental and were just beginning to be tested in the U.S.

Prioritization

- *How are priorities established between streets and/or neighborhoods?*

The great majority of surveyed jurisdictions have adopted priority rating systems to determine priority among competing traffic calming projects. The reason for doing so is achieve a degree of objectivity and effectiveness in funding decisions in the face of public demands exceeding the supply of available funds.

In Colorado Springs, priorities are established based on vehicle speeds, cut-through traffic volumes, numbers of accidents, proximity to schools, hospitals, or parks, and volumes of pedestrian and bicycle traffic. Charlottesville includes speed, volume, accidents, and proximity to schools in its formula as well (these are most common factors across rating systems) but replaces the remaining factors in the Colorado Springs formula with residential density, street width, and absence of sidewalks.

One promising variation on a priority rating system is Howard County's street-type priorities. Priority is assigned in the following order: school walking routes, connector or through streets, and cul-de-sacs or isolated networks.

The main alternative to priority-based systems is first come, first served. This is the approach taken in Gwinnett County and Minneapolis. An uncommon alternative is a lottery, as in the City of Sacramento when initiating its program (subsequent requests were taken in the order of application).

Toolbox of Measures

- *Have guidelines or warrants been established to limit eligibility for different treatments?*

  Over half of the surveyed jurisdictions have warrants or guidelines for installation of different traffic calming measures. Warrants are minimum requirements that must be met before individual measures are installed. Guidelines are the similar in content but are advisory.

  Bellevue, Charlotte, Minneapolis, Portland, and Vancouver have sets of guidelines for their different measures. These places illustrate a trend away from warrants and toward guidelines, and also toward application of objective standards to entire toolboxes rather than a measure here or there.

  The exception is speed humps, which for various historical reasons still have warrants attached to them. In Seattle, speed humps are warranted only for streets with 85th percentile speeds of 35 mph or more and traffic volumes of 400 vehicles per day or more. In Riverside, the minimum qualifying 85th percentile speed is 6 mph over the speed limit, and the minimum qualifying traffic volume is 500 vehicles per day. From Traffic Calming State-of-the-Practice, the median values of common speed hump warrants are: minimum traffic volume of 1,000 vehicles per day, maximum traffic volume of 5,000 vehicles per day, and maximum slope of 6 percent.

  Traffic Calming State-of-the-Practice discusses the pros and cons of both warrants and guidelines, and leans toward guidelines as a more flexible alternative.

- *What types of devices are eligible for use on different types of streets (vertical, horizontal, narrowing, other)? What devices are excluded from use? Why?*

Two surveyed jurisdictions have small traffic calming toolboxes. While it has experimented with other measures, Gwinnett County has settled on 22-ft speed tables as the tool of choice. Riverside currently uses only speed humps and stop signs.

Other jurisdictions have more complete toolboxes with a full range of devices such as:

- Vertical speed control devices (speed humps, cushions, tables, etc.)
- Horizontal speed control devices (traffic circles, roundabouts, lateral shifts, etc.)
- Narrowing speed control devices (neckdowns, center island narrowings, chokers, etc.)
- Volume control measures (full closures, partial closures, diagonal diverters, etc.)

The survey responses generally recognize local streets as eligible for the full array of treatments, while collectors and arterials are eligible for fewer treatments. For example, Howard County has a complete toolbox for local streets but limits major collectors to re-striping, roundabouts, chokers, and medians (and only if enforcement and education have proven ineffective). Vancouver is similar with respect to local streets, but limits arterials to landscaping, high visibility striping, roundabouts, chokers, medians, and photo enforcement. Portland excludes volume control measures such as partial closures from neighborhood collectors. Eugene excludes speed humps from higher order streets. Charlottesville will not install any vertical measure on high order streets.

One volume control measure has been dropped from the toolboxes of places such as Seattle. This is a full closure, which turns a through street into a cul-de-sac. It is just too restrictive to traffic flow, emergency access, and public service generally. If volume controls are used at all, they typically take the form of half closures, median barriers, or forced turn islands.

- *What practices if any are used to calm traffic on arterials?*

As already noted, arterials are not treated in most surveyed jurisdictions, and when treated, are subject to a limited array of measures (see Appendix C for greater detail). One interesting approach that emerged from our interviews is the use of traffic signal timing and progression to slow traffic on arterials. This apparently has been done in Gwinnett County and Seattle. While this technique has been applied to arterials, it blurs the distinction between traffic calming measures and traffic control devices.

- *Are stop signs ever used for traffic calming purposes, and if so, under what circumstances?*

  About half of the surveyed jurisdictions summarily reject stop signs as a traffic calming measure. This is in keeping with the Manual on Uniform Traffic Control Devices (MUTCD), recommending that stop signs should not be used as speed control devices.

  Of the remaining jurisdictions, half reject stop signs as a traffic calming measure but still use them occasionally under political pressure. The rest have developed policies that provide for stop sign use in special cases where MUTCD warrants are not met.

  The third group is the most interesting. Albuquerque installs stop signs on all approaches to unsignalized intersections, which means that stop signs appear at many unwarranted locations. Any traffic calming benefits are incidental. Eugene, Los Angeles, and the City of Sacramento generally avoid the use of stop signs for traffic calming, but find them useful in special cases: in Eugene, at strategic locations as part of neighborhood-wide plans; in Los Angeles, to reduce cut-through traffic though not for speed control; and in Sacramento, in special cases where the city's own warrants are met. Only Riverside treats stop signs as a standard part of its traffic calming toolbox, and has permissive warrants to match. See Traffic Calming State-of-the-Practice for data on the impacts of stop signs on speeds and cut-through volumes.

- *Are "temporary" devices used during trial periods or are "permanent" devices used and removed, where necessary?*

  As already noted, slightly over half of the surveyed jurisdictions conduct trials of one to six months to test out installations. Traffic Calming State-of-the-Practice laid out two different views on the use of temporary measures during trials. One view is that low-cost, movable, temporary measures are preferred because they are easy and inexpensive to remove when necessary. The other view is that permanent measures are preferred because trials are usually successful and residents may react negatively to the aesthetics of temporary measures, even if they are effective. Traffic Calming State-of-the-Practice argued for good aesthetics, whether in permanent or temporary measures.

  A few places such as Charlotte and Vancouver install permanent measures and take their chances. The rest employ temporary measures during trials whenever possible. These employ temporary signage, tubular markers, plastic planters, rubberized and thermoplastic forms, and pre-cast concrete curbs. Temporary speed humps, tables, and cushions are now available from multiple vendors and are being widely used.

- *Have experimental devices been considered, and if so, what kinds?*

Some jurisdictions express no interest in experimental devices. Most are open to new ideas but have few good candidate devices. Two places mentioned measures that are new to them but were developed decades ago and were in regular use at the time of Traffic Calming State-of-the-Practice: Charlottesville has built its first diagonal diverter and Sacramento its first raised crosswalk.

The most innovative devices mentioned in the interviews were offset speed tables developed and tested by Portland several years ago but never fully deployed; speed cushions developed in Europe and being deployed in Charlotte; and a "circle hump" being constructed in Vancouver (something we have not come across before unless by another name). The most impressive response to this survey question came from Bellevue, which has budgeted $50k a year to develop new technology.

One potential for innovation lies in combining measures at a single slow point. For example, raised crosswalks can be combined with chokers, or center island narrowings can be combined with chicanes. No innovations of this type were cited in our interviews.

Engineering Details

- *If vertical measures are used (humps, cushions, raised crosswalk…) how is the edge taper constructed (across bike lane or parking lane, curb to curb…)? Any issues with ADA (disabled access) in locations with no sidewalk?*

In nearly every surveyed jurisdiction, vertical devices are constructed from gutter to gutter, leaving 1' or 1.5' gaps for drainage between tapers and outside curbs. No jurisdiction leaves wider clearance to keep bike or parking lanes level, as is sometimes done in Europe. Eugene noted that cyclists can comfortably go over humps, and cars can easily park on humps. Vancouver suggested that the 1' or 1.5' gaps between tapers and outside curbs were also useful to cyclists (though substandard in terms of clearance to curb face).

Bigger threats to cyclists than vertical devices are chokers and other horizontal devices that squeeze cyclists between motor vehicles and vertical curbs. While not specifically queried, one jurisdiction, Howard County, volunteered that it provides bypass lanes between chokers and street edges. Common in Europe, this treatment uses the choker itself to separate cyclists from motor vehicles.

- *If curb to curb vertical devices are constructed, how is drainage handled?*

Even with raised crosswalks and raised intersections, most jurisdictions leave gaps for drainage between vertical devices and outside curbs. This requires that curbs and devices have APA compliant ramps, a challenge in the short distance between the two.

In jurisdictions that extend crosswalks and raised intersections from curb to curb, drainage is handled in different ways. Most often, drainage inlets are relocated to upstream locations. The problem with this approach is its high cost. Three jurisdictions, Sacramento, Seattle, and Vancouver, have embedded drainage pipes within crosswalks to avoid the expense of drainage retrofits. The problem with this approach is clogging.

- *At traffic circles, are large vehicles permitted to turn left in front of center islands? (Conflicts with vehicle codes? If so how do they get around it?)*

Most surveyed jurisdictions allow left turns in front of center islands of traffic circles. This left-turn movement is seldom signed as permitted, but also is seldom signed as prohibited. Portland reports that this particular movement is illegal under state law and regulatory signing, but is a "rare event" and officials "look the other way."

The turning radii of large vehicles leave them with no alternative to left turns in front of center islands at small intersections. At small intersections, even placing mountable aprons on center islands will not provide enough clearance for large vehicles to circulate counterclockwise.

Four of the surveyed jurisdictions do not permit left turns in front of center islands, and a fifth is trying to get away from the practice. In these jurisdictions, circles are ruled out at particular intersections unless the turning radii of large vehicles are fully accommodated. One of the five, Howard County, has experimented with fully mountable center islands to allow counterclockwise movement and still accommodate large vehicles.

- *What signing and marking conventions are you using for different devices? Are you using the new (2000) MUTCD conventions?*

For the first time in 2000, MUTCD established marking patterns for speed humps and tables, and warning signs for traffic circles and roundabouts. Most jurisdictions surveyed report that they follow the new MUTCD conventions. Whether they are referring specifically to the new marking and signing conventions or to compliance with MUTCD generally, is unclear.

Surveys and site visits for Traffic Calming State-of-the-Practice uncovered almost a dozen different traffic circle signs and almost a dozen different speed hump marking patterns being used across the U.S. It is not reasonable to presume that all of these jurisdictions would re-sign or re-mark all of their devices to conform to MUTCD conventions, particularly when the conventions are permitted rather than required.

The City of Sacramento began signing its circles before MUTCD 2000 specified standard signage. It is continuing to use its old traffic circle sign in order to remain

consistent with existing signage. Seattle circles date back to 1978, and hundreds of circles are already in place. While Seattle follows general guidelines for warning signs, it has not adopted the new MUTCD traffic circle sign. Eugene and Portland have been installing speed humps for years, and are reluctant to re-mark all of their humps in the new MUTCD pattern. They are satisfied with their existing patterns, a chevron pattern in Portland and a sharks tooth pattern in Eugene.

Appendix C

Arterial Traffic Management Practices

Introduction

The previous sections of this White Paper summarized neighborhood traffic management practices on two-lane residential streets. Although many of the agencies surveyed have varying descriptions and standards of what a two-lane residential street is (ideal volume served, street width, etc..), one theme is common between them, the streets on which residents live. Consequently, the quality of life for residents of these streets can be dramatically effected by excessive speeding and traffic volumes on the vary streets that they walk, bike, and play. What is often not discussed in many of the NTMPs but questioned by the community over and over again is traffic speeds and volumes on higher order arterial streets. This single concept often conflicts with the very purpose of arterial streets, which is to carry traffic from point A to B in the quickest possible way. This section looks at traffic management practices of the agencies surveyed both in this White Paper and Traffic Calming State of the Practice.

Summary of Practices

As the issue of traffic management on arterial streets typically conflicts with the inherent purpose of mobility on arterial streets, a number of agencies across the nation and to a larger degree in Europe have implemented devices or strategies that are not in direct competition with the purpose of the street. Often many strategies implemented are complementary to adjacent land uses and serve both pedestrians and motorists.

Of the survey responses generated, six agencies indicated that they would consider treating arterials for speed issues. Although this is not a commonplace, data is collected to determine the severity of the problem and solutions are developed specific to the location and problem type. All of these agencies prohibit the use of vertical devices but indicated that they would employ less obtrusive measures such as gateway treatments, narrowing travel lanes, bulbouts, curb extensions, parking bays, on-street parking, detached sidewalks, bicycle lanes, and textured pavement at pedestrian crossings. Although these treatments may not dramatically decrease traffic speeds on arterial streets, they do address the underlying concerns of safety and the quality of the experience or sense of place created for pedestrians, bicyclists, and motorists use.

The term arterial is used to describe higher order roadways and does not necessarily share the same design characteristics among all jurisdictions. For example, the City of Eugene permits parking bays on major arterials and on-street parking along minor arterials, while the County of Sacramento does permit either.

Specific Examples

Gwinnett County, Georgia and the City of Seattle, Washington have experimented with traffic signal timing and progression to slow traffic on arterials. Reducing the signal progression of traffic on arterials involves retiming of traffic signals to provide a continuous series of green lights on a given street, but at lower a speed. For example, if the signal progression was set at 25 mph drivers would be able to consistently pass through numerous intersections at this speed, while drivers traveling above 25 mph would approach downstream intersections on a red light. For this strategy to be most effective, the roadway needs to consist of closely spaced intersections at regular intervals with consistent side-street volumes. This strategy may inadvertently create more congestion and longer delays thereby diverting traffic to alternative routes, but may prove valuable in high pedestrian areas such as school zones or commercial areas.

The City of Minneapolis, Minnesota proceeded with a trial installation of throating (aka bulbouts) as a possible solution to concerns of speeding on a specific arterial. Although the City does not typically treat arterial streets, it does consider speed and volume issues on a case-by-case basis and will investigate potential solutions when appropriate. After implementation of the temporary measure, the City observed the effectiveness of the design and collected traffic data to evaluate the benefit of the trial device. Upon reviewing the observations and data, it was determined that throating at this location did not result in a measurable decrease in traffic speeds and therefore a permanent device was not constructed.

The City of Eugene, Oregon permits traffic calming on all street types within the City with restrictions placed on dedicated emergency response routes and snow removal routes. The City's *Arterial and Collector Street Plan*, City of Eugene, Oregon, 1999 provides specific direction on transportation policies as they apply to Eugene's major streets. Specifically, street design guidelines and standards for arterial and collector streets include the use of traffic management strategies to varying degrees per each street type. The table below illustrates the City's policy on application of traffic management devices to each street type.

Traffic Calming on Major Streets

Traffic Calming Device	Major Arterial	Minor Arterial	Major Collector	Neighborhood Collector
Roundabouts	Yes	Yes	Yes	Yes
Traffic Circles	No	No	No	Yes
Raised Crosswalks	No	No	Yes	Yes
Curb Extensions	No	Yes	Yes	Yes
Parking Bays	Yes	Yes	Yes	Yes
Chicanes	No	Yes	Yes	Yes
Street Closure	No	No	No	No
Half Diverter	No	No	No	No
Diagonal Diverter	No	No	No	No
Star Diverter	No	No	No	No
Raised Median	Yes	Yes	Yes	Yes
Pavement Surface Modification	Yes	Yes	Yes	Yes
Speed Actuated Signing	No	No	No	No
Speed Humps	No	No	No	No
Speed Tables	No	No	No	Yes
Landscaped Roadway	Yes	Yes	Yes	Yes
Midblock Neckdown	No	No	Yes	Yes
Angled Slow Point with Median	No	No	Yes	Yes

Figure 16

Source: City of Eugene, Oregon, 1999 Arterial and Collector Street Plan

The application of traffic management devices to arterials can be generalized as devices that do not limit capacity or create an immediate safety impact for motorists and service providers. For example, the City of Eugene permits the use of roundabouts, parking bays, raised medians, pavement surface modification, and landscaped roadways all of which have an inherent safety element. While these strategies do not dramatically reduce vehicle speeds, they can improve the facilities for other users of the roadway. Many of these strategies can be found in the beatification plans developed or implemented for arterial roadways within Sacramento County (with the exception of parking bays) such as Watt Avenue, Marconi Avenue, Sunrise Boulevard, and Greenback Lane.

Conclusion

Although no standard traffic management practice was identified to treat arterial roadways, many agencies have implemented strategies used successfully in Europe and the U.S. to treat speed related issues and improve the street environment. Many of the strategies separate and elevate the pedestrian environment to the motorists' level, thereby providing a greater balance between users of the roadway.

As each agency has developed a NTMP unique to its community, arterial traffic management deserves an even greater sense of individuality not only between each agency but within the boundaries of the agency as land uses interactions vary. In the absence of formal practices or guidelines from which to draw , a common range of devices has emerged that represent an ad-hoc "Toolbox" of arterial devices that could be applied to Sacramento County roadways where deemed appropriate.