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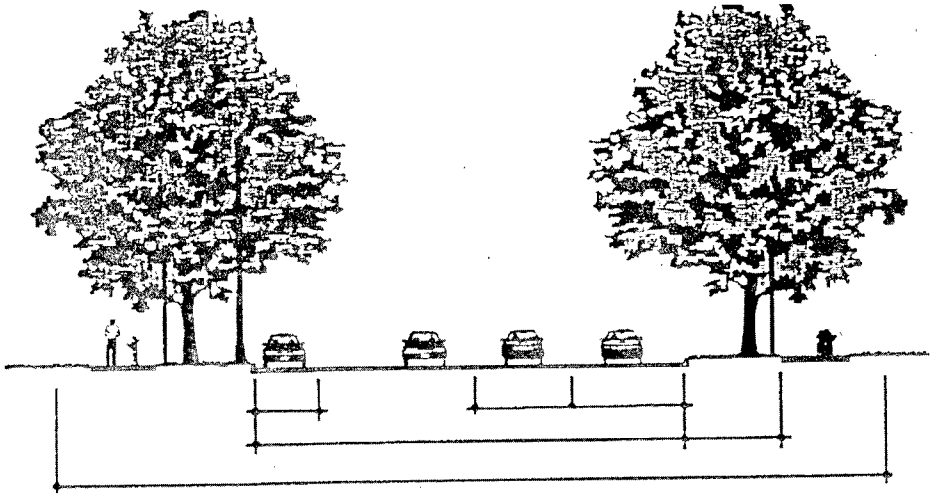

# Traffic Calming Activity in Minnesota



Local Road Research Board

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This research examines the extent of traffic calming activity in Minnesota and the degree of actual and perceived success of such projects. Traffic calming activities, which range from traditional actions such as turn prohibitions and stop signs to changes in roadway width and appearance, have gained popularity as neighborhoods attempt to reduce traffic, reduce speeds, and create a safer and more attractive street environment.

The research objectives included determining how widespread traffic calming activities have become in the state; determining whether implemented traffic calming strategies have achieved their purposes; and determining whether proposed design changes are compatible with local and state design standards, and--if they are not--to suggest guidelines for future applications.

A comprehensive survey was sent to cities, counties, and agencies. Fifty-three percent responded and identified 67 projects, both implemented and planned. The great majority of respondents report satisfaction with project results. However, quantitative information--in the form of before-and-after data--in support of these results is limited. Perceived results, while positive, do not always reflect the achievement of the initial project objectives. A handful of projects are being considered for implementation on minor arterials, which are designed to carry higher volumes of traffic, at higher speeds, than neighborhood streets and collectors. It is on these roads, primarily, where the objectives of traffic calming can conflict with the function of the roadway and its design elements.

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# Traffic Calming Activity in Minnesota

## Final Report

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## EXECUTIVE SUMMARY

This research examines the extent of traffic calming activity in Minnesota and the degree of actual and perceived success of such projects. In particular, the research focuses on traffic calming activity on streets classified as major collectors and minor arterials. The study discusses the compatibility between design changes proposed in support of traffic calming activities and the State Aid design standards that govern the facilities being calmed.

The research consisted of the following tasks:

- A brief literature review
- A survey of traffic calming activity within the State of Minnesota
- An assessment of the effectiveness of various traffic calming actions
- A review of State Aid Rules
- An attempt to collect before/after data on several projects located on streets classified as major collectors and minor arterials that were scheduled to be constructed during the summer of 1997. (Due to unforeseen data collection problems, a decision was made to terminate this data collection effort.)

The survey responses indicated that:

- Fifty-three percent of the respondents had implemented or planned to implement traffic calming projects. Eighty-one percent of the traffic calming projects reported have been implemented on local streets and minor collectors. Fifteen percent of the reported projects have been implemented on major collectors and minor arterials.
- The most frequent reasons that initiated a project include: negative street environment, high traffic volumes, and high speeds.

- Twenty-one distinct traffic calming methods were reported. The most frequently used devices fall under the following groupings: street width adjustments and traditional traffic control techniques.

- The most frequent project outcomes reported were enhanced street environment, improved street safety and improved traffic conditions.

- In 61 percent of the projects, residents fronting the projects are reported to have reacted positively to the project.

- Only 37 percent of the reported projects had collected some form of before/after data to verify their effectiveness. In most cases, the amount of data collected was very limited.

- For traffic calming projects in which before/after ADT and 85-percentile speed data had been collected, all except one, reported reductions in both ADT and 85-percentile speeds.

It appears that the reported success of traffic calming activities lies not only in the perceived "calming" of traffic on residential streets, but in the perception of what we have called the "enhanced street environment," which includes the sense that not only has street safety improved, but that street "livability" and overall quality have also improved.

Numerous devices and actions are being employed to "calm" traffic, with generally positive results, but with some unintended negative consequences as well. Unintended consequences include snow removal problems, emergency vehicle response delays, and, in some cases, increased noise.

One implication of the speed/width relationships in the State Aid Rules is that if the driving lanes on an urban 35-plus mph design-speed roadway are reduced from 12 to 11 feet, and the parking lanes from 10 to 8 feet, the design speed is also affected; that is, the corresponding design speed may become 30-35 mph. Since the design speed must equal or exceed the posted speed limit, it follows that the speed limit can be as low as 30 mph but no higher than 35 mph. However, other speed-related design factors such as stopping sight distance, horizontal and vertical curves, and

rate of superelevation, which affect the "feel" of the road, influence the speed that drivers feel comfortable driving. It follows that if the lane width changes do not result in a speed reduction, as revealed by speed studies, it may not be possible to justify reducing the posted speed limit. Considerations regarding design changes may be more appropriate for roads in residential neighborhoods, where speed and safety are the major concerns.

Municipal and county engineers and planners, urban designers and neighborhood residents hear about traffic calming concepts and are eager to see more data on the actual effectiveness of these devices. Numerous studies are being performed statewide and throughout the country, yet most of the data is in the form of specific case studies and most of the case studies are located on local residential streets. There are few standards that designers can reference when trying to select the most appropriate traffic calming device or when trying to determine appropriate geometric standards to follow when designing these devices.

It is important that additional research be performed on traffic calming, especially as it relates to projects that are proposed for streets classified as major collectors and minor arterials. This research should be performed under controlled conditions to better understand how driving behavior is affected by different devices, and the degree of driver behavior change. Future research should also examine long-term versus short-term effects of various traffic calming actions and devices.

# 1. INTRODUCTION

The concept of traffic calming has rapidly gained attention and acceptance across the United States, including the State of Minnesota. In cases across the country, traffic calming techniques are being applied to both rural and urban roadways and on roads with functional classification ranging from local streets to trunk highways. This research examines the extent of traffic calming activity in Minnesota and the degree of actual and perceived success achieved in such projects. In particular, the research focuses on traffic calming activity on streets classified as major collectors and minor arterials. In addition, the study examines the compatibility between design changes proposed on major collectors and minor arterials and State Aid standards for the same roads.

The research consisted of the following tasks:

- A brief literature review
- A survey of traffic calming activity in the State of Minnesota
- An assessment of the effectiveness of various traffic calming actions
- A review of State-Aid Rules
- An attempt to collect before/after data on several projects located on streets classified as major collectors and minor arterials that were scheduled to be constructed during the summer of 1997.

The first step in the traffic calming study was a review of an annotated bibliography that addressed the topic of traffic calming. The annotated bibliography is included in a report titled *Increasing Trip Capacity through Traffic Calming,* and was prepared for the Minnesota Department of Transportation (Mn/DOT) by the Human Factors Research Laboratory at the University of Minnesota. The annotated bibliography provided insight on the following issues and topics:

- History and underlying theories of traffic calming,

- Current traffic calming practices in the United States and abroad, and
- Effectiveness of various traffic calming actions (predominantly European case studies).

Most of the data regarding the effectiveness of traffic calming actions are from projects in western Europe. This research examines whether similar types of actions achieve similar results in the State of Minnesota.

The study was funded by the Local Roads Research Board (LRRB) and the Minnesota Department of Transportation, and was sponsored by Hennepin County, the City of St. Paul and the City of Eagan.

## 2. TRAFFIC CALMING ACTIVITY SURVEY

### 2.1 Purpose of the Survey

When this research was initiated, there was not a clear understanding of the type and extent of traffic calming activity that was occurring within the Minneapolis/St. Paul metropolitan area or in cities in outstate Minnesota. A decision was made to conduct a survey to gather information on the following issues:

- Extent and type of traffic calming activity
- Reasons or problems that the traffic calming projects were intended to address
- Traffic calming devices and design standards used
- Types of roads on which projects are being implemented
- Degree to which traffic calming objectives are being achieved.

### 2.2 Survey Methodology

A total of 92 survey questionnaires were sent to the following jurisdictions and entities:

- All cities in the Mn/DOT eight-county metropolitan area with populations greater than 5,000;
- All counties in the Mn/DOT eight-county metropolitan area;
- Select cities outside of the eight-county area that were thought to have performed traffic calming projects; and
- Select consulting firms that were thought to have consulted on traffic calming projects.

The survey, which was conducted in January and February 1997, focused on projects that have been implemented since 1990 or were scheduled to be built in the future.

The survey questionnaire is included in Appendix A of this report. The detailed survey response summary and cross-tabulations are included in Appendix B.

## 2.3 Survey Results

### Extent of Traffic Calming Activity

A total of 92 questionnaires were distributed. Forty-nine cities responded (a response rate of 53 percent). Of these, 26 cities (53 percent) reported that they had implemented 51 traffic calming projects and planned to implement an additional 16. Table 2.1 summarizes the status of the reported traffic calming projects. The first two columns summarize the traffic calming survey responses for all of the projects. The last two columns breakout the responses for projects located on streets classified as major collectors and minor arterials. Table 2.2 summarizes the geographic locations of the reported traffic calming projects.

**Table 2.1**

**Implementation Status of Traffic Calming Projects**

| Status | Total Responses | | Major Collectors & Minor Arterials | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| Permanent projects | 39 | 58 | 3 | |
| Temporary projects | 12 | 18 | 2 | |
| Subtotal | 51 | 76 | 5 | 50 |
| Projects planned | 16 | 24 | 5 | 50 |
| Total projects | 67 | 100 | 10 | 100 |

**Table 2.2**

**Traffic Calming Project Locations**

| Status | Total Responses | | Major Collectors & Minor Arterials | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| Minneapolis/St. Paul | 23 | 34 | 6 | 60 |
| First Ring Suburb | 11 | 17 | 2 | 20 |
| Second Ring Suburb | 4 | 6 | | |
| Third Ring Suburb | 19 | 28 | 2 | 20 |
| Cities located in Greater Minnesota | 10 | 15 | — | — |
| | 67 | 100 | 10 | 100 |

## Reasons for Traffic Calming Projects

Respondents to the survey indicated that traffic calming projects were initiated in response to three basic types of problems:

- **Too Much Traffic** – Problems created by high traffic volumes and cut-through traffic are included in this group. Also included are traffic management issues and the perception of high vehicular traffic volumes.

- **High Speeds** – Includes problems created by high vehicular speeds or by the perception of high vehicular speeds.

- **Negative Environment** – This includes dissatisfaction with the current street environment or the desire for changes to respond to new development or changes in land use zoning.

- **Lack of Safety** – This includes concern about accidents and traffic creating a barrier to pedestrian/bicycle movement.

Traffic calming projects are initiated most often to respond to negative environment problems (33 percent), followed by traffic-related problems (29 percent) and by speed problems (21 percent) (see Table 2.3). When major collectors and minor arterials are analyzed separately, traffic calming projects are initiated most often to respond to traffic-related problems.

**Table 2.3**
**Reasons Given for Implementing Traffic Calming Projects**

| Type of Problem | Total Responses | | Major Collectors & Minor Arterials | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| Negative Environment | 53 | 33 | 8 | 27 |
| Too Much Traffic | 46 | 29 | 11 | 37 |
| Speeds too High | 34 | 21 | 5 | 17 |
| Lack of Safety | 15 | 9 | 5 | 17 |
| Other | 12 | 8 | 1 | 2 |
| Total number of problems reported[a] | 160 | 100 | 30 | 100 |

[a] The total number of reported problems is greater than the total number of projects (67) because most projects involve multiple problems.

## Traffic Calming Devices Used

Twenty-one types of traffic calming devices or actions were reported. The following list shows the traffic calming devices and actions, and how they have been grouped for analysis purposes.

Street width adjustments:
- Street narrowing
- Choker
- Median island
- On-street angled parking
- Protected parking bays

Traditional traffic control techniques:
- Vehicle restrictions
- Turn restrictions
- One-way streets
- Variable-speed display board
- Trumpet island
- Marked crosswalks
- Stop signs
- Basket-weave stop signs

Vertical or horizontal realignments:
- Speed hump or bump
- Traffic circle
- Chicane

Route modifications:
- Street closure (cul-de-sac)
- Diagonal diverter
- Semi-diverter

Perceptual enhancements:
- Change in road surface material or color
- Streetscape material or landscape plantings

Street width adjustments were the most frequently used devices (33 percent of all devices reported) followed by traditional traffic control techniques (20 percent) and vertical or horizontal realignments (19 percent) (see Table 2.4). Note that traditional traffic control techniques would not usually be included in a strict definition of "traffic calming," but the survey responses indicated that many of the respondents felt that these devices were effective techniques for calming traffic. Major collectors and minor arterials predominantly use street width adjustments, followed by traditional traffic control techniques.

**Table 2.4**
**Traffic Calming Devices Used**

| Type of Device | Total Responses Number | Total Responses Percent | Major Collectors & Minor Arterials Number | Major Collectors & Minor Arterials Percent |
|---|---|---|---|---|
| Street width adjustments | 48 | 33 | 12 | 46 |
| Traditional traffic control techniques | 30 | 20 | 8 | 30 |
| Vertical or horizontal realignments | 28 | 19 | 2 | 8 |
| Route modifications | 16 | 11 | 2 | 8 |
| Perceptual enhancements | 14 | 9 | 2 | 8 |
| Other | 12 | 8 | — | — |
| Total devices [a] | 148 | 100 | 26 | 100 |

[a] The total number of devices is greater than the total number of projects because a single project can use multiple devices.

**Reasons for Traffic Calming Projects and Devices Used**

Table 2.5 summarizes the traffic calming devices most frequently used in response to the reasons given for installing traffic calming projects.

**Table 2.5**
**Reasons Cited for Traffic Calming Projects and Devices Used**

| Reason for Traffic Calming Project | Devices Most Frequently Used | Total Responses Percent | Major Collectors & Minor Arterials Percent |
|---|---|---|---|
| Traffic Problems | Street width adjustments | 29 | 53 |
| | Traditional traffic control techniques | 26 | 35 |
| | Vertical or horizontal realignments | 17 | 6 |
| | Route modifications | 17 | 6 |
| | Other devices | 11 | — |
| | | 100 | 100 |
| Speed Problems | Street width adjustments | 25 | 31 |
| | Vertical or horizontal realignment | 25 | 15 |
| | Traditional traffic control techniques | 21 | 31 |
| | Route modifications | 13 | 15 |
| | Other devices | 16 | 8 |
| | | 100 | 100 |
| Street Environment Concerns | Street width adjustments | 34 | 47 |
| | Traditional traffic control techniques | 22 | 33 |
| | Vertical or horizontal realignments | 17 | 3 |
| | Perpetual enhancements | 8 | 10 |
| | Other devices | 19 | 7 |
| | | 100 | 100 |
| Safety Concerns | Traditional traffic control techniques | 38 | 29 |
| | Street width adjustments | 24 | 47 |
| | Vertical or horizontal realignments | 14 | 6 |
| | Perpetual enhancements | 7 | 12 |
| | Other devices | 17 | 6 |
| | | 100 | 100 |

Traditional traffic control techniques are being used in response to the actual or perceived problems traffic calming are intended to address. Changes in the street physical design (width, alignment, diverters, etc.) also predominate, especially for streets classified as major collectors or minor arterials.

**Roadway Classifications and Design Standards**

The questionnaire responses highlight the following roadway classification and design standard trends for traffic calming projects:

- 97 percent of the traffic calming projects are retrofit projects on existing streets.
- The great majority of projects reported (81 percent) were implemented on roads classified as local streets or minor collectors (see Table 2.6).
- Projects on roads classified as major collectors or minor arterials accounted for 15 percent of the projects.
- Traffic calming projects were located most frequently on streets designated as city or local (54 percent), followed by streets designated as MSA (21 percent).
- The design standards used in constructing traffic calming projects are not always consistent with the roadway designation. In a few cases, non-MSA or non-CSAH standards are used on MSA and CSAH roads; conversely, MSA standards were also used on non-MSA local streets.

**Table 2.6**
**Functional Classification of Streets Where Traffic Calming Projects are Located**

| Functional Classification | Total Responses Number | Percent |
|---|---|---|
| Local street or minor collector | 54 | 81 |
| Major collector or minor arterial | 10 | 15 |
| No information provided | 3 | 4 |
| Total number of projects | 67 | 100 |

## Funding Sources Used

Since most of the traffic calming projects are on local and minor collector streets (81 percent), most of the projects are funded by cities (65 percent) and through other local sources (23 percent) such as developers and neighborhood revitalization funds as shown in Table 2.7. The survey responses indicate that projects located on major collectors and minor arterials are predominantly funded by cities.

**Table 2.7**
**Funding Sources Used to Pay for Projects**

| | Total Responses | | Major Collector & Minor Arterials | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| City | 43 | 65 | 7 | 88 |
| Mn/DOT | 3 | 4 | 1 | 12 |
| Special Assessments | 5 | 8 | | |
| Other/local | 15 | 23 | – | – |
| Total [a] | 66 | 100 | 8 | 100 |

[a] Several projects received funds from multiple sources; twelve cities provided no information on a specific project.

## Traffic Calming Project Outcomes

Respondents reported a broad variety of actual or perceived outcomes resulting from the traffic calming projects. For ease of analysis, the outcomes were grouped as follows:

- Improved traffic conditions – This category includes reductions in traffic volumes and in cut-through traffic.
- Enhanced street environment – This category includes responses such as additional greenery, changes in the psychological feel of the street, increased community life and vitality, and maintenance of neighborhood character.
- Improved street safety – This category includes responses such as reductions in collision severity and frequency, and improved safety for non-motorized street users, and reduced speeds.

Table 2.8 shows that an enhanced street environment was the result in 36 percent of the projects; improved street safety, including reduced speeds, was reported as an outcome in 33 percent of the cases; and 28 percent of the projects were reported to have resulted in improved traffic conditions. When major collectors and minor arterials are analyzed separately, improved traffic conditions was the result in 50 percent of the projects.

**Table 2.8**
**Traffic Calming Project Outcomes**

| | Total Responses | | Major Collector & Minor Arterials | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| Enhanced street environment | 47 | 36 | 4 | 33 |
| Improved street safety | 42 | 33 | 2 | 17 |
| Improved traffic conditions | 36 | 28 | 6 | 50 |
| Other | 4 | 3 | — | — |
| Total number of outcomes [a] | 129 | 100 | 12 | 100 |

[a] The total number of outcomes is greater than the total number of projects because some projects have multiple outcomes.

### Reasons Given and Reported Project Outcomes

Table 2.9 summarizes the most frequent project outcomes in relationship to the reasons given for the traffic calming projects. This table addresses the question: Did the traffic calming project solve the problem it was intended to solve? Only total responses are shown in this table. There was insufficient data to break out the major collector and minor arterial projects.

**Table 2.9**
**Reasons for Traffic Calming Projects and Project Outcomes**

| Reason Given | Predominant Outcomes | Percent |
|---|---|---|
| Street Environment Concerns | Enhanced street environment | 48 |
| | Improved street safety/speed reduction | 24 |
| | Improved traffic conditions | 24 |
| | Other outcomes | 4 |
| | | 100 |
| High Speeds | Improved street safety/speed reduction | 36 |
| | Enhanced street environment | 36 |
| | Improved traffic conditions | 26 |
| | Other | 2 |
| | | 100 |
| Safety Concerns | Improved street safety/speed reduction | 47 |
| | Enhanced street environment | 47 |
| | Other outcomes | 6 |
| | | 100 |
| Traffic Problems | Improved traffic conditions | 40 |
| | Enhanced street environment | 34 |
| | Improved street safety | 26 |
| | | 100 |

About half of the respondents that cited a street environment concern as the reason indicated that the traffic calming project enhanced street environment. Similarly, close to half of the respondents that cited safety concerns indicated "improved street safety" as an outcome. A somewhat lower percentage of respondents (36 and 40 percent respectively) reported that high speed problems were reduced or that traffic problems were improved after the project.

It is noteworthy that, regardless of the reason given for implementing the traffic calming project, the most consistent response in terms of what the project accomplished was "enhanced street environment." Respondents perceive that the project accomplished something positive.

**Relationship Between Devices Used and Reported Outcomes**

Table 2.10 summarizes the most frequent project outcomes for each of the traffic calming device categories.

- The first observation is that "enhanced street environment" is reported as the most frequent outcome of using three of the five device categories, and as the second most frequent in one of the remaining categories.

- Traffic Flow Diversions are reported to be most effective in improving traffic conditions.

- Vertical/Horizontal Realignments, Street Width Adjustments, Traditional Traffic Control Techniques and Perceptual Enhancements are all reported to result in improved street safety.

**Table 2.10**
**Devices Used and Reported Outcomes**

| Traffic Calming Device | Predominant Outcomes | Percent |
|---|---|---|
| Street Width Adjustments | Enhanced street environment | 53 |
| | Improved street safety/reduced speeds | 23 |
| | Reduced traffic problems | 17 |
| | Other outcomes | 7 |
| | | 100 |
| Traditional Traffic Control Techniques | Enhanced street environment | 44 |
| | Improved street safety/reduced speeds | 30 |
| | Reduced traffic problems | 25 |
| | Other outcomes | 1 |
| | | 100 |
| Vertical or Horizontal Realignments | Improved street safety/reduced speeds | 39 |
| | Enhanced street environment | 35 |
| | Improved traffic conditions | 22 |
| | Other outcomes | 4 |
| | | 100 |
| Perceptual Enhancements | Enhanced street environment | 60 |
| | Improved street safety/reduced speeds | 33 |
| | Other outcomes | 7 |
| | | 100 |
| Traffic Flow Diversions | Improved traffic conditions | 47 |
| | Improved street safety/reduced speeds | 26 |
| | Enhanced street environment | 24 |
| | Other outcomes | 3 |
| | | 100 |

**Before/After Data**

The preceding responses regarding the outcomes of the traffic calming projects have been qualitative in nature. The judgment on whether the project is a success or a failure depends to some extent on the perception of the survey respondents. In many cases, the subjective evaluation of a project by the neighboring residents and city staff is a valid and important method for judging the success or failure of a project. It is also important, however, to review before/after data to evaluate whether the initial project objectives (e.g., reduce speed, reduce traffic, reduce accidents), have been achieved.

Survey respondents were asked to provide any before/after data that had been collected for the traffic calming projects reported. The most frequently collected before/after data consisted of traffic volume, accident experience, resident surveys and 85-percentile speeds (i.e., that speed at, or below, which 85-percentile of the traffic travels) (see Table 2.11). However, only a small number of respondents reported collecting before/after data as shown in Table 2.12. All projects (eight) that reported both before/after data for either ADT or 85-percentile speeds were located on streets classified as either local or minor collectors. Reductions in both ADT and speeds were reported for all projects, except for one project for which the speed remained the same. Regardless of the problem that initiated these traffic calming projects, they appear to be more successful in diverting traffic away from the affected streets than they are in slowing vehicle speeds.

The before/after data indicates that traffic calming projects designed with the intent of modifying drivers' routes do in fact reduce traffic volumes, and in some cases also reduce speeds. The data also indicates that speed humps encourage route modification while also reducing by speeds 9 to 13 percent.

**Differences in Response by Various Groups**

Based on city staff perception, residents that front traffic calming projects had positive reactions to most of the projects (61 percent). Residents on adjacent streets and businesses fronting the

**Table 2.11**
**Extent of Before/After Data Collection**

| Type of Data | Before | | After | |
|---|---|---|---|---|
| | Number of Projects | Percent of Total Projects (67 Projects) | Number of Projects | Percent of Total Projects (50 Projects) (a) |
| 85% vehicle speeds | 13 | 19% | 10 | 20% |
| Daily Traffic Volume (ADT) | 25 | 37% | 9 | 18% |
| Accident Experience | 25 | 37% | 11 | 22% |
| Trip origin-destination | 2 | 3% | 0 | 0% |
| Vehicle travel time | 1 | 1% | 1 | 2% |
| Survey of residents | 21 | 31% | 11 | 22% |
| Survey of businesses | 7 | 10% | 3 | 6% |
| Other | 3 | 4% | 0 | 0% |

(a) Does not include planned projects.

**Table 2.12**
**Before and After Data Analysis (Local Streets and Minor Collectors)**

| City | Project Location | Project Description | 85% Speeds (km/h) Before | After | % Change | Before |
|---|---|---|---|---|---|---|
| 1. Brooklyn Park | West River Road and Riverdale Drive | Street closure of both roads between 73rd Ave. and Brookdale Dr. | 72 | 56 | -22% | 888 |
| 2. Burnsville | Hollow Park Drive (Burnsville Pkwy to Southcross Drive) | Turn restrictions to right-out only (from Hollow Park Drive to Burnsville Pkwy). | 50 | 46 | -7% | 1200 |
| 3. Burnsville | 140th St., Friendship Lane, Stevens Ave., 139th St., and Thomas Ave. | Speed humps on all of these streets to discourage cut-through traffic and speeds between Co. Rd 5 and Burnsville Pkwy. | 54 | 47 | -13% | 985 |
| 4. Burnsville | Knox Drive (Burnsville Pkwy to 136th St.) | Speed humps | 47 | 43 | -9% | 690 |
| 5. Burnsville | James Ave. (138th to James Ct.) | Street closure | 51 | 49 | -4% | 1600 |
| 6. Fridley | Meadowmoor Drive | Street closure | 48 | 48 | 0% | |
| 7. St. Louis Park | W. 38th Street (France Ave. to Excelsior Blvd) | Diagonal diverters and stop signs (discourage cut-through traffic) | | | | 5700 |
| 8. St. Paul | Cleveland Ave at Montreal Ave. | Bumpouts on east side of Cleveland at Montreal | 66 | 63 | -5% | |

projects had only a modest positive reaction to the projects (28 and 22 percent respectively). Residents on adjacent streets also had the highest negative reaction (18 percent) of any of the groups except through traffic, whose level of negative reaction was reported at 22 percent.

## Negative Consequences Reported

Problems with vehicular access, including emergency, maintenance, public transit and snow removal vehicles, were the most frequent negative impact associated with the traffic calming projects. These results are summarized in Table 2.13.

**Table 2.13**

**Negative Impacts Associated With Traffic Calming Projects**

| | Total Responses | | Major Collectors & Minor Arterials | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| Vehicular access limitations | 33 | 61 | 2 | 100 |
| Snow storage problems | 7 | 13 | | |
| Lack of visibility of traffic calming device | 4 | 7 | | |
| Other | 10 | 19 | — | — |
| Negative impacts reported | 54 | 100 | 2 | 100 |

## Future Plans

Of the 20 cities that had traffic calming projects in place, 12 (60 percent) cities reported that they plan to implement similar projects. Of the eight cities that had no plans to implement similar projects, two cities reported poor results or resident dissatisfaction with their in-place projects; two cities reported that they had not received any requests for similar devices; and the remaining four cities did not comment.

**Summary of Survey Findings**

- A wide variety of traffic calming techniques have been implemented (21 distinct methods were employed in response to actual or perceived problems). The techniques can be generally classified into five groups: street width adjustments, traditional traffic control techniques, vertical or horizontal realignments, route modifications, and perceptual enhancements.

- Street Width Adjustments are the most often used traffic calming devices and include street narrowing, chokers, median islands, on-street angled parking, and protected parking bays.

- Responses indicate that traditional traffic control techniques are, on average, the second most commonly used devices.

- Negative Street Environment is the most commonly reported reason for implementing traffic calming projects, followed by Too Much Traffic and High Speeds. When major collectors and minor arterials are analyzed independently, too much traffic is the most commonly reported reason for implementing traffic calming projects, followed by negative environment. Too much traffic consists predominantly of high traffic volumes and cut-through traffic. Negative Street Environment consists of such reasons as resident or business dissatisfaction with the street environment, high noise levels, and changes brought about due to new development or land use/zoning changes.

- Enhanced Street Environments was the most commonly reported outcome, followed by Improved Street Safety and Improved Traffic Conditions. Enhanced Street Environments includes such outcomes as a change in the psychological feel of the street, additional greenery, increased pedestrian, bicycle or transit use of the street, reductions in noise levels, and increase community life vitality.

- About half of the respondents that cited Street Environment Concerns as the reason for the traffic calming project indicated that the project enhanced the street environment.

Street width adjustments were the most commonly reported devices implemented in response to these concerns.

- Close to half of the respondents that cited Safety Concerns as the reason for implementing traffic calming indicated Improved Street Safety as an outcome. Traditional traffic control techniques were the most commonly reported devices implemented in response to these concerns. Street width adjustments were the most commonly reported devices implemented in response to these concerns on major collectors and minor arterials.

- A little over a third of the respondents that cited High Speeds as the reason indicated Improved Street Safety/Speed Reduction as an outcome. Street Width Adjustments and Vertical or Horizontal Realignments were the most commonly reported devices implemented in response to this concern. Street width adjustments and traditional traffic control techniques were the most commonly reported devices implemented in response to this concern on major collectors and minor arterials.

- Forty percent of the respondents that cited Traffic Problems as the reason indicated that the traffic calming project improved traffic conditions. Street width adjustments and traditional traffic control techniques were the most commonly reported devices implemented in response to this reason.

- Too much traffic was the most common reason given for implementing traffic calming devices along major collectors and minor arterials. But when the survey responses were analyzed individually, many of the complaints about high traffic volumes and cut-through traffic were originating from local residential streets adjacent to the collectors and arterials. The traffic calming devices implemented on the collectors and arterials were actually attempts to keep the traffic on the collectors and arterials and off the adjacent local streets. The devices usually implemented in these situations were either turn or vehicle restrictions, street closures or diverters.

- When high speeds were identified as a problem along collectors or arterials, the travel lanes appeared to range from 14 feet to 20 feet. This supports the concept that wider streets encourage faster vehicle speeds. The design responses for most of these projects involved narrowing the street width, but the designs were attempting to do more than just narrow the streets. They usually incorporated either median islands, curb bulbouts, marked crosswalks and widened bike lanes that enhanced the pedestrian and bicycle movement.

- There does not appear to be consistency between the type of traffic calming devices being implemented and the problems they are attempting to solve.

- In 61 percent of the projects, residents fronting on the projects are reported to have reacted positively to the project.

- Concerns over vehicular access (buses, maintenance vehicles, emergency vehicles) were the most frequently reported (61 percent) unanticipated negative impacts of calming actions.

- Eighty-one percent of the traffic calming projects reported have been implemented on local streets and minor collectors. Fifteen percent of the reported projects have been implemented on major collectors and minor arterials.

- Only 19 of the 51 projects implemented (37 percent) had some form of before/after data . Only 9 projects (18 percent) had both before/after data for speed and volumes.

- For the traffic calming projects where before/after ADT and 85-percentile speed data was collected, all of the projects reported reductions in both ADT and 85-percentile speeds, except one where the 85-percentile speeds remained the same.

## 3. PROJECTS LOCATED ON STREETS CLASSIFIED AS MAJOR COLLECTORS OR MINOR ARTERIALS

This research project was aimed at determining the extent of traffic calming activity in the region and statewide. In particular, the research focused on projects located on major collectors and minor arterials roads. Even though these classifications account for only 15 percent of the traffic calming projects reported, these roads service large volumes of traffic and are generally higher speed facilities. This is especially true for minor arterials. Implementation of traffic calming devices on these roads tend to generate more controversy than projects constructed on local streets because of several factors. First, minor arterials are predominantly under county or state jurisdictions, but the traffic calming projects proposed on these facilities are usually generated by residential neighborhoods requesting that their local city government implement the project. This often results in conflicts between governmental jurisdictions. Secondly, many higher function minor arterials roads, which are intended to carry higher volumes and provide greater mobility (i.e., reduced travel time), often pass through residential neighborhoods, thus creating conflicts between roadway function and neighborhood desire for safety, quiet and avoidance of disruption.

Table 14 lists the 10 traffic calming projects that survey respondents indicated were located on either major collectors or minor arterials. These projects were evaluated to determine if they could be used as test sites for collection of additional before/after data. However, this data collection effort proved to be problematic. The following comments highlight the problems encountered:

- The data collection effort focused on traffic calming projects on major collectors and minor arterials that had been scheduled to be constructed in the summer of 1997, or on projects that had already been constructed and had good before data. This screening resulted in only six projects.

- Subsequent to site selection, local construction delays resulted in postponement of two of the six sites.

- Cities where the remaining projects were being constructed volunteered to collect the required data. Unfortunately, busy city staff summer schedules further limited the time and staff available to collect the data.

Because of the limited number of projects and the data collection limitations, the decision was made to terminate the data collection efforts in this phase of the study. Instead, data will be collected as part of a follow-up study. This approach will result in a data collection effort that is carried out under more controlled conditions.

**Table 3.1**
**In-Place and Proposed Projects on Streets Classified as a Major Collector or Minor Arterial**

| City | Project Location | Project Description | Street Classification | Status | Before Data Available? |
|---|---|---|---|---|---|
| 1. Eden Prairie | Homeward Hills Road (Sunnybrook Road to Anderson Lakes Pkwy.) | Turn prohibition off of Homeward Hills Road onto residential streets during AM peak. (Prevent traffic from cutting through a residential neighborhood. | Major Collector | In place - perm. | No |
| 2. Minneapolis | Franklin Ave. S.E. / Emerald Street S.E. | Traffic circle | Minor Arterial | In place - temp. | 85%, ADT, accident, res. & bus. surveys After data avail.-temp. |
| 3. Minneapolis | E. 22nd Street / 26th Ave. | Partial Diverter restricting access to E. 22nd St. | Minor Arterial | In place - temp. | No |
| 4. Plymouth | Plymouth Blvd. / 36th Ave. | Traffic Circle | Major Collector | Planned<br>Start: mid-July<br>End: mid-August | No |
| 5. Robbinsdale | W. Broadway / France Ave. (36th to 40th Ave.) | Narrow street width, install chokers at corners and at certain mid-block locations on W. Broadway / France Ave. | Minor Arterial | Planned<br>Start: late-July<br>End: early-Fall | ADT data |
| 6. St. Louis Park | Excelsior Blvd. (France Ave. to T.H. 100) | Narrow street width, landscape, protected parking bays and crosswalks. | Minor Arterial | In place/planned<br>Start Ph.2: early - July<br>End Ph.2: early - Fall<br>landscape - 1998 | ADT data |
| 7. St. Paul | Highland Pkwy / Woodlawn Ave. | Bump-outs with crosswalks and median island on Highland Ave. | Major Collector | In place - perm. | No |
| 8. St. Paul | St. Clair / Victoria | Center island on St. Clair with parking ban. | Minor Arterial | Planned<br>Start: late-May | No |
| 9. St. Paul | W. 7th Street / Munster | Closure of access to/from W. 7th Street for both N. and S. Wheeler Ave. and W. Munster. Trumpet island at E. Munster. Extension of median island along W. 7th Street. | Minor Arterial | Planned<br>(Spring '97)<br>Temp.: early June<br>Perm.: Aug./Sept | ADT, accident, surveys |
| 10. St. Paul | Summit Ave. / Ramsey Hill | Median island on Summit Ave. east of Ramsey. Removal of parking lane and replace with bike lanes. | Minor Arterial | In place - perm. | Survey only |

# 4. TRAFFIC CALMING DEVICE EFFECTIVENESS RANKING

Table 4.1 depicts the relative effectiveness of various traffic calming device groupings. The ranking is based upon the perceived effectiveness indicated in the survey responses and on the reported before/after data.

The table indicates that an Enhanced Street Environment was reported as the most frequent outcome associated with the use of three of the five traffic calming device categories, and as the second most frequent in one of the remaining categories.

Traffic Flow Diversions and Vertical or Horizontal Realignments were reported as the most effective traffic calming devices for improving traffic conditions, including reducing cut-through traffic and traffic volumes.

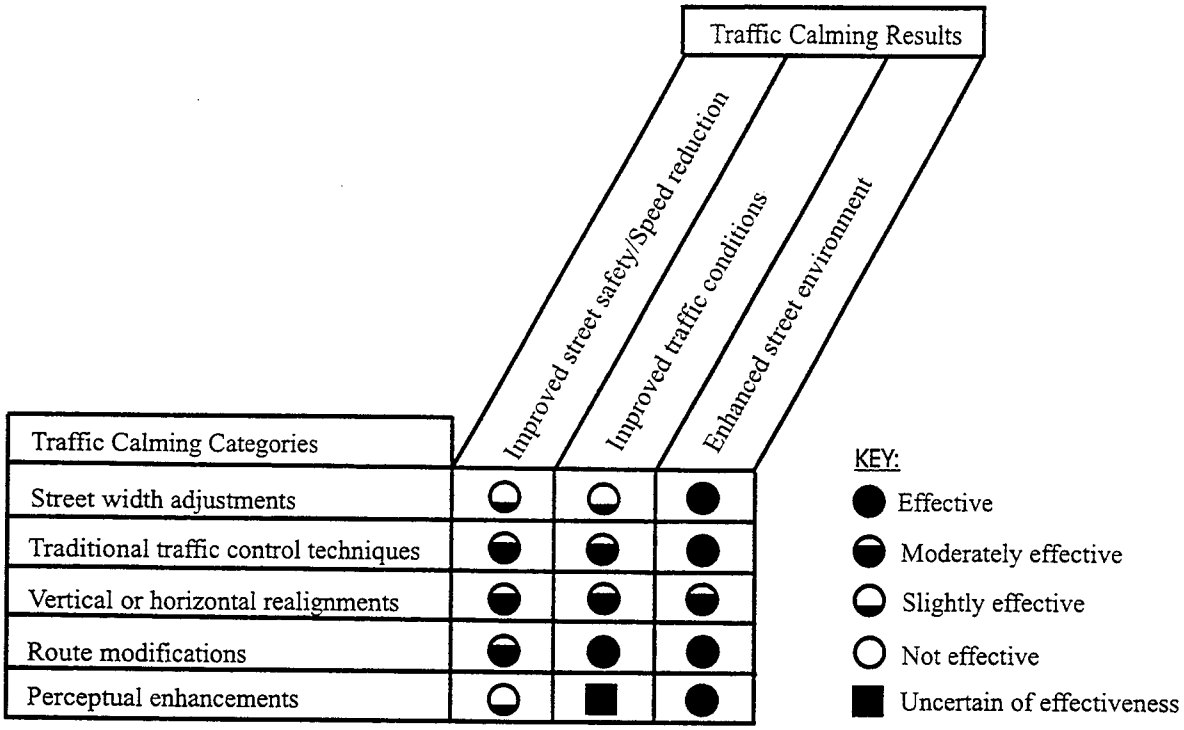
Vertical or Horizontal Realignment Devices, Traditional Traffic Control Techniques and Perceptual Enhancements were all reported to be moderately effective in improving street safety and reducing speeds.

Tables 4.2 - 4.5 are a more detailed attempt to indicate the effectiveness of the various traffic calming measures in alleviating the most commonly cited traffic and environmental problems. These tables were based predominantly upon the survey responses, the reported before/after data and previous research findings. It is important to stress that different traffic calming actions achieve different benefits. Therefore, it is important to choose actions that are more likely to achieve the desired effect. Tables 4.2-4.5 highlight the effectiveness of various traffic calming measures in achieving the following desired effects:

- Reduction in traffic volume
- Reduction in vehicle speed
- Enhancement in the street environment
- Improved street safety

**Table 4.1**

**Traffic Calming Device Groupings**
**Effectiveness Ranking**




**Street width adjustments:**

- Street narrowing
- Choker
- Median island
- On-street angled parking
- Protected parking bays

**Traditional traffic control techniques:**

- Vehicle restrictions
- Turn restrictions
- One-way streets
- Variable-speed display board
- Trumpet island
- Marked crosswalk
- Stop signs
- Basket-weave stop signs

**Vertical or horizontal realignments:**

- Speed hump or bump
- Traffic circle
- Chicane

**Route modifications:**

- Street closure (cul-de-sac)
- Diagonal diverter
- Semi-diverter

**Perceptual enhancements**

- Change in road surface material or color
- Streeetscape material or landscape plantings

**Table 4.2**
**Effectiveness of Traffic Calming Measures on Traffic Volumes**

| | Traffic Calming Measures | Highly Effective | Effective | Slightly Effective | Uncertain of Effectiveness | Not Effective |
|---|---|---|---|---|---|---|
| | **Street width adjustments:** | | | | | |
| 1. | Street narrowing | | | X | | |
| 2. | Choker | | | X | | |
| 3. | Median island | | | X | | |
| 4. | On-street angled parking | | | | X | |
| 5. | Protected parking bays | | | | X | |
| | | | | | | |
| | **Traditional traffic control techniques:** | | | | | |
| 6. | Vehicle restrictions | | X | | | |
| 7. | Turn restrictions | X | | | | |
| 8. | One-way streets | | X | | | |
| 9. | Variable-speed display board | | | | X | |
| 10. | Trumpet island | | | X | | |
| 11. | Marked crosswalks | | | | | X |
| 12. | Stop signs | | | X | | |
| 13. | Basket weave stop signs | | | X | | |
| | | | | | | |
| | **Vertical or horizontal realignments:** | | | | | |
| 14. | Speed hump or bump | | X | | | |
| 15. | Traffic circle | | | X | | |
| 16. | Chicane | | | | X | |
| | | | | | | |
| | **Route modifications:** | | | | | |
| 17. | Street closure (cul-de-sac) | X | | | | |
| 18. | Diagonal diverter | X | | | | |
| 19. | Semi-diverter | X | | | | |
| | | | | | | |
| | **Perceptual enhancements:** | | | | | |
| 20. | Change in road surface materials or color | | | | X | |
| 21. | Streetscape materials or landscape plantings | | | | X | |

**Table 4.3**
**Effectiveness of Traffic Calming Measures on Vehicle Speeds**

| | Traffic Calming Measures | Highly Effective | Effective | Slightly Effective | Uncertain of Effectiveness | Not Effective |
|---|---|---|---|---|---|---|
| | **Street width adjustments:** | | | | | |
| 1. | Street narrowing | | | X | | |
| 2. | Choker | | X | | | |
| 3. | Median island | | | X | | |
| 4. | On-street angled parking | | | X | | |
| 5. | Protected parking bays | | | X | | |
| | | | | | | |
| | **Traditional traffic control techniques:** | | | | | |
| 6. | Vehicle restrictions | | | | | X |
| 7. | Turn restrictions | | | | | X |
| 8. | One-way streets | | | | X | |
| 9. | Variable-speed display board | | X | | | |
| 10. | Trumpet island | | | | X | |
| 11. | Marked crosswalks | | | X | | |
| 12. | Stop signs | | | X | | |
| 13. | Basket weave stop signs | | X | | | |
| | | | | | | |
| | **Vertical or horizontal realignments:** | | | | | |
| 14. | Speed hump or bump | | X | | | |
| 15. | Traffic circle | | X | | | |
| 16. | Chicane | | | | X | |
| | | | | | | |
| | **Route modifications:** | | | | | |
| 17. | Street closure (cul-de-sac) | | | X | | |
| 18. | Diagonal diverter | | X | | | |
| 19. | Semi-diverter | | | | X | |
| | | | | | | |
| | **Perceptual enhancements:** | | | | | |
| 20. | Change in road surface materials or color | | | | X | |
| 21. | Streetscape materials or landscape plantings | | | X | | |

**Table 4.4**
**Effectiveness of Traffic Calming Measures for Enhancing Perceived Street Environment**

| | Traffic Calming Measures | Highly Effective | Effective | Slightly Effective | Uncertain of Effectiveness | Not Effective |
|---|---|---|---|---|---|---|
| | **Street width adjustments:** | | | | | |
| 1. | Street narrowing | X | | | | |
| 2. | Choker | X | | | | |
| 3. | Median island | X | | | | |
| 4. | On-street angled parking | | | X | | |
| 5. | Protected parking bays | | | X | | |
| | | | | | | |
| | **Traditional traffic control techniques:** | | | | | |
| 6. | Vehicle restrictions | | X | | | |
| 7. | Turn restrictions | | X | | | |
| 8. | One-way streets | | | | X | |
| 9. | Variable-speed display board | | | | X | |
| 10. | Trumpet island | | | | X | |
| 11. | Marked crosswalks | | X | | | |
| 12. | Stop signs | | | X | | |
| 13. | Basket weave stop signs | | | | X | |
| | | | | | | |
| | **Vertical or horizontal realignments:** | | | | | |
| 14. | Speed hump or bump | | | X | | |
| 15. | Traffic circle | | X | | | |
| 16. | Chicane | | | | X | |
| | | | | | | |
| | **Route modifications:** | | | | | |
| 17. | Street closure (cul-de-sac) | | X | | | |
| 18. | Diagonal diverter | | X | | | |
| 19. | Semi-diverter | | X | | | |
| | | | | | | |
| | **Perceptual enhancements:** | | | | | |
| 20. | Change in road surface materials or color | | X | | | |
| 21. | Streetscape materials or landscape plantings | X | | | | |

**Table 4.5**
**Effectiveness of Traffic Calming Measures To Improve Street Safety**

| | Traffic Calming Measures | Highly Effective | Effective | Slightly Effective | Uncertain of Effectiveness | Not Effective |
|---|---|---|---|---|---|---|
| | **Street width adjustments:** | | | | | |
| 1. | Street narrowing | | | X | | |
| 2. | Choker | | | X | | |
| 3. | Median island | | | X | | |
| 4. | On-street angled parking | | | | X | |
| 5. | Protected parking bays | | | X | | |
| | | | | | | |
| | **Traditional traffic control techniques:** | | | | | |
| 6. | Vehicle restrictions | | X | | | |
| 7. | Turn restrictions | | | | X | |
| 8. | One-way streets | | | | X | |
| 9. | Variable-speed display board | | | X | | |
| 10. | Trumpet island | | | X | | |
| 11. | Marked crosswalks | | | X | | |
| 12. | Stop signs | | X | | | |
| 13. | Basket weave stop signs | | X | | | |
| | | | | | | |
| | **Vertical or horizontal realignments:** | | | | | |
| 14. | Speed hump or bump | | | | X | |
| 15. | Traffic circle | | | | X | |
| 16. | Chicane | | | | X | |
| | | | | | | |
| | **Route modifications:** | | | | | |
| 17. | Street closure (cul-de-sac) | | X | | | |
| 18. | Diagonal diverter | | | | X | |
| 19. | Semi-diverter | | | X | | |
| | | | | | | |
| | **Perceptual enhancements:** | | | | | |
| 20. | Change in road surface materials or color | | | | | X |
| 21. | Streetscape materials or landscape plantings | | | X | | |

# 5. EVALUATION, SELECTION AND IMPLEMENTATION PROCEDURES

## 5.1 Evaluation Procedures

When installing traffic calming measures, before/after data should be collected, first, to document and understand whether the reported problem exists and, second, to evaluate the effectiveness of the measures implemented. The following table presents a list of suggested before/after data requirements as a function of project objective. It is also recommended that resident and business surveys be conducted before and after the project is implemented. Sample data collection forms can be found in Appendix C.

**Table 5.1**
**Before/After Data Required for Project Evaluation as a Function of Project Objectives**

| Traffic Calming Project Objectives |
|---|
| • Improve safety |
| * Accident data by type (last three years) |
| * Daily and peak hour traffic |
| * Speed profile (average, maximum, pace [a], 85-percentile, standard deviation) |
| * On-street parking availability and use |
| • Reduce speed |
| * Speed profile (average, maximum, pace [a], 85-percentile, standard deviation) |
| * Pedestrian/bicycle activity |
| * Accident data (last three years) |
| • Reduce traffic volumes |
| * Daily and peak hour volumes on affected street and on adjacent streets |
| * Peak hour turning movements if turn-prohibitions are involved |
| • Reduce through traffic/cut through traffic |
| * Origin-destination, license plate or trace survey |
| * Daily and peak hour traffic on affected and adjacent streets |
| • Enhance street environment (other than by the means listed above) |
| * Accident data (vehicle/pedestrian, vehicle/bicycle for last three years) |
| * Pedestrian/bicycle activity |
| * Inventory of street furniture, landscaping, image (visual appearance), traffic noise level, truck traffic |

(a) Pace is the 16 km/h (10 mph) speed range which contains the largest number of observations.

## 5.2 Selection Procedures

Before a project is selected for implementation, it must first be identified and evaluated by the appropriate staff and officials. The identification process is usually initiated by concerned residents or businesses along the affected street or area. Literature indicates that the most successful programs are those that have a pre-determined procedure for considering and approving traffic calming requests (Guzda 1997). Before data in Table 5.1 are criteria that can help city and county officials and concerned streets users to determine the severity of the existing problem. The items listed in Table 5.2 are additional items that should be considered when evaluating a potential project.

**Table 5.2**
**Selection Criteria**

- Proximity to activity generators (schools, parks, commercial)
- Support by residents and businesses (petition process)
- Estimated project cost
- Project funding source
- Roadway classification
- Existing roadway alignment and profile
- Adjacent land uses (residential, commercial, industrial)

Many cities are currently being overwhelmed with requests for traffic calming projects. An established set of selection criteria greatly helps in the selection and prioritization of proposed projects. The issue of utilizing the warrant approach in the selection/prioritization process is currently being debated. The following discussion highlights some of the arguments both for and against using the warrant system for traffic calming projects:

Arguments For Warrants

- Warrants are an efficient and economical evaluation process.

- Warrants can be designed to create some restraint on implementation in response to the level of resources available. The fewer resources available, the more difficult it is to meet the selection criteria.

Arguments Against Warrants

- Traffic calming projects provide many diverse amenities that are specific to the sites where they are located. It would be very difficult to develop a formula that could fairly take all of the diverse effects into account.

- Warrants imply a reactive rather than a proactive approach to good street design (Lockwood 1997).

A more thorough objective discussion of the benefits and drawbacks of the warrant system can be found an article titled *The Need for Warrants - The Australian Experience,* by Andrew P. O'Brien (O'Brien 1997).

## 5.3 Implementation Procedures

It is recommended that a set of procedures be put in place to assist all involved in understanding the steps that will be followed once the decision to implement a project has been reached.

Table 5.3 suggests some of the key elements and represents a starting point for developing implementation procedures.

**Table 5.3**
**Implementation Procedures**

| | |
|---|---|
| 1. | Upfront coordination between implementing agency and agencies with jurisdiction over road(s) |
| 2. | "Before" data collection |
| 3. | Step up law enforcement |
| 4. | Inform affected residents and businesses |
| 5. | Open house/working groups to help design the traffic calming actions |
| 6. | Review of plans by fire, ambulance and police |
| 7. | Review of plans by bicycle clubs, if applicable |
| 8. | Temporary implementation of the project |
| 9. | Data collection during temporary installation |
| 10. | Resident approval before final implementation |
| 11. | Staging of the project to accommodate supporting changes (transit, parking management, land use changes) |
| 12. | "After" data collection |

# 6. RELATIONSHIP BETWEEN STATE AID RULES AND TRAFFIC CALMING OBJECTIVES

The 1996 State Aid Operations Rules were reviewed to determine how current standards relate to traffic calming objectives. Table 6.1, Geometric Design Standards in Urban Areas (State Aid Operations Rules Table 8820.9936) reproduced below, is informative and relevant.

This table specifies that collector streets with daily volumes lower than 10,000 vehicles can be designed with 50-60 kph (30-35 mph) design speeds, 3.3-meter (11-foot) driving lanes and 2.4 meter (8-foot) parking lanes. (This table does not distinguish minor collectors from major collectors.) If the design speed is over 60 kph (35 mph), driving lanes must be 3.6 meters (12 feet) and parking lanes 3.0 meters (10 feet).

**Table 6.1**
**Geometric Design Standards, Urban; New or Reconstruction**

| Functional Classification and Projected Traffic Volume | Design Speed in km/h and (mph) | Lane Width in meters and (feet) | Curb Reaction Distance in meters and (feet) | Parking Lane Width in meters and (feet) |
|---|---|---|---|---|
| Collectors or Locals with ADT <10,000 | 50-60 (30-35) | 3.3 (11) | 0.6 (2) | 2.4 (8) |
| | over 60 (over 35) | 3.6 (12) | 0.6 (2) | 3.0 (10) |
| Collectors or Locals with ADT ≥ 10,000 and Arterials | 50-60 (30 -35) | 3.3 (11) | 1.2 (4) | 3.0 (10) |
| | over 60 (over 35) | 3.6 (12) | 1.2 (4) | 3.0 (10) |

Source: State Aid Operations Rules, Chapter 8820, page 41. Mn/DOT, 1996.

For collectors with 10,000 or more daily volumes and for arterials, design speeds of 50-60 kph (30-35 mph) require 3.3-meter (11-foot) driving lanes and 3.0-meter (10-foot) parking lanes. However, if the design speed is over 60 kph (35 mph), driving lanes must be 3.6 meters (12 feet) wide and parking lanes 3.0 meters (10 feet).

One implication of these speed/width relationships is that if the driving lanes on a 35-plus mph design-speed roadway are reduced from 12 to 11 feet, and the parking lanes from 10 to 8 feet, the design speed is also affected; that is, the corresponding design speed may become 30-35 mph. Since the design speed must equal or exceed the posted speed limit, it follows that the speed limit can be as low as 30 mph but no higher than 35 mph. However, other speed-related design factors such as stopping sight distance, horizontal and vertical curves, and rate of superelevation, which affect the "feel" of the road, influence the speed that drivers feel comfortable driving. It follows that if the lane width changes do not result in a speed reduction, as revealed by speed studies, it may not be possible to justify reducing the posted speed limit.

Finally, considerations regarding design changes may be more appropriate for roads in residential neighborhoods, where speed and safety are the major concerns.

For suburban areas, the geometric design standards, partially reproduced below, do not vary by speed, although a broad speed range is allowed.

**Table 6.2**
**Geometric Design Standards, Suburban; New or Reconstruction**

| Projected ADT | Lane Width in meters (feet) | Shoulder Width in meters (feet) | Recover Area in meters (feet) | Design Speed in km/h (mph) |
|---|---|---|---|---|
| Less than 1,000 | 3.6 (12) | 1.8 (6) | 3 (10) | 50-80 (30-50) |
| Over 1,000 | 3.6 (12) | 2.4 (8) | 6 (20)[a] | 50-80 (30-50) |

a) Where the posted speed limit is 60 km/h (35 mph) or less, the minimum recovery area may be reduced to 3 meters (10 feet).

# 7. CONCLUSIONS

Traffic calming is progressively becoming accepted practice for managing traffic in the Twin Cities region, and it is also gaining acceptance in Greater Minnesota. This is evidenced by the number of professional journal articles, seminars and conferences on the subject, and by the large number of projects (67) identified in response to our survey. Traffic calming projects are generally implemented in response to negative street environment problems associated with high traffic volumes and high vehicle speeds near residential areas.

Numerous devices and actions are being employed to "calm" traffic, with generally positive results, but with some unintended negative consequences as well. It appears that the reported success of traffic calming activities lies not only in perceived "calming" of traffic on residential streets, but in the perception of what can be called an "enhanced street environment" which includes the sense that not only has street safety improved, but that street "livability" and overall quality of life have also improved.

Municipal and county engineers, urban designers and neighborhood residents hear about traffic calming concepts and are eager to see more data on the actual effectiveness of these devices. Numerous studies are being performed statewide and throughout the country, yet most of the data is in the form of specific case studies and most of the case studies are located on local residential streets. There are few standards that designers can reference when trying to select the most appropriate traffic calming device or when trying to determine appropriate geometric standards to follow when designing these devices.

Therefore, it is important that additional research be performed on traffic calming, especially as it relates to projects that are proposed for streets classified as major collectors and minor arterials. This research should be performed under controlled conditions to better understand the different driving behavior that can be achieved with the different devices and to understand the degree to which these devices can affect driver behavior.

## 8. NEXT STEPS

The survey responses indicated that a number of traffic calming projects constructed on major collectors and minor arterials employed more than one device in the design of the project. The implementation of several devices simultaneously makes it difficult to identify the causal effects associated with the individual devices. The goal of a proposed second study is to determine the effect on traffic of a select number of traffic calming devices, both individually and jointly, in a more controlled data collection environment.

One way to achieve a controlled data collection environment is to use the wrap-around driving simulator at the Human Factors Research Laboratory at the University of Minnesota. This study highlighted five classifications of traffic calming actions: traditional traffic control devices, route modifications, street width adjustments, vertical or horizontal realignments and perceptual enhancements. Through the use of a simulator, a typical major collector or minor arterial test street with various traffic calming actions could be simulated. The effect of individual traffic calming devices could be measured using the simulator along with the incremental effect of using multiple devices.

The variation in speeds based on driver reaction could be associated with the traffic calming device just simulated. This method of collecting data would allow a ranking of the effectiveness of various traffic calming devices in terms of their effect on vehicle speeds. One drawback of using the simulator is the definition of "effectiveness" is limited to the issue of traffic speeds, not volumes. The simulator would also allow for the manipulation of geometric standards (lane widths and parking widths) to see if the changes have any impact on vehicle speeds.

Simulation experiments would allow the researchers to introduce various traffic calming devices to the test street and run a statistically significant number of drivers down the test street for each scenario. Once the data is collected and analyzed, one or two of the simulation scenarios could be

tested against before/after data collected on a project to be implemented to see if the test results reflect the actual built environment. This approach provides the control needed to evaluate multiple traffic calming variations and the application of findings to a manageable number of implemented projects.

This research could help municipal engineers, county engineers and neighborhood residents gain a better understanding of the effectiveness of various traffic calming actions in slowing down vehicle speeds. It will also benefit other potential users of the wrap-around simulator by helping to calibrate the simulator to actual physical environments. Provided the simulator can be calibrated to reflect the actual physical environment, it could be used as a design tool by cities and counties to test the effectiveness of alternative traffic calming scenarios.

The proposed research will include the following tasks:

1. A task force of municipal and county engineers and other interested parties will be formed to provide input into the research project design and implementation.
2. One or two test sites will be selected. These will be sites that are already planned and scheduled to be constructed in the summer of 1998.
3. "Before" speed data will be collected for the test sites by SRF.
4. The test sites will be modeled on the simulator using various traffic calming actions and groups of actions.
5. Data will be collected on the simulations.
6. "After" data will be collected by SRF once the project is constructed. It should be noted that the most effective simulation scenario will not necessarily be the design that is constructed due to the fact that the projects selected will have been designed prior to the simulation exercise.
7. A comparison of projected and actual driver behavior will be performed.

## REFERENCES


1. Guzda, M. Kathleen, Traffic Calming, First draft.

2. Lockwood, Dan M., "Do We Need Traffic Calming Warrants?" Transportation and Sustainable Communities, Institute of Transportation Engineers, 1997.

3. O'Brien, Andrew P., "The Need for Warrants – The Australian Experience," Transportation and Sustainable Communities, Institute of Transportation Engineers, 1997.

4. Stackhouse, Stirling and Hautamaki, Bonnie. Increasing Trip Capacity Through Traffic Calming. Minnesota Department of Transportation, 1996.

# APPENDIX A

## Survey Questionnaire

# Hennepin County

An Equal Opportunity Employer

**MEMORANDUM**

TO: Distribution List

FROM: James Grube, P.E., Transportation Division Engineer, Hennepin Cty.
Tom Eggum, P.E., City Engineer, City of St. Paul
Tom Colbert, P.E., Director of Public Works, City of Eagan

DATE: December 23, 1996

SUBJECT: TRAFFIC CALMING PROJECT

The concept of traffic calming is rapidly gaining attention and acceptance within the Minneapolis/St. Paul metropolitan area. Hennepin County, along with the cities of St. Paul and Eagan, have received funding from the Local Road Research Board (LRRB) and Mn/DOT to study the extent of traffic calming activity in the metropolitan area and the degree of actual and perceived success of such projects. As a part of this study, cities, counties and other groups, are being surveyed to gain an understanding of the extent and type of traffic calming activity that is occurring.

Traffic calming can be defined as a combination of policies and actions that help mitigate some of the adverse effects of motorized vehicle use on individuals and communities. Traffic calming incorporates street design modifications and redefines the role of streets to serve a broader range of transportation, social and environmental objectives. The goals of traffic calming are to:

- increase the quality of urban life;
- improve conditions for people;
- create safe and attractive streets;
- reduce collision frequency and severity; and
- help reduce the adverse effects of motorized vehicles on the environment.

Traffic calming is usually thought to be confined to local residential streets. However, in the Minneapolis/ St. Paul metropolitan area, many streets classified as major collectors and minor arterials also serve a residential access function. Therefore, if conditions are favorable, major collectors and minor arterials may also be viewed as candidates for traffic calming. This study will attempt to determine if "favorable" conditions exist and what traffic calming actions are likely to be accepted for use on major collectors and minor arterials.

To help us in this research effort, we are asking that you, or someone designated by you, fill out an attached questionnaire for each traffic calming project implemented since 1990 or scheduled to be built in the future. If no projects have been planned, please complete questions #1 and #2 in the questionnaire. Two copies of the questionnaire have been included. Please make additional copies of the questionnaire as needed. Once completed, return the questionnaire(s) to the research project consultants, SRF Consulting Group, Inc. by January 24, 1997. Thank you for your participation.

**Department of Public Works**
320 Washington Avenue South
Hopkins, Minnesota 55343-8496
(612) 930-2500 FAX: (612) 930-2513 TDD: (612) 930-2696

## TRAFFIC CALMING STUDY SURVEY

**Please fill out one survey form for each project that has been planned or implemented. If no projects have been planned, please fill out questions #1 & #2 and return to the address shown on the back page of the questionnaire.**

1. Contact name_____ Title_____

   Agency_____

   Telephone Number_____ Fax Number_____

2. Has your agency planned a traffic calming project? a. ___ Yes b. ___ No

3. a. City where traffic calming project is located _____

   b. Project location (e.g. 2nd Avenue between Streets A and B)

   _____

   _____

4. General description of the traffic calming project _____

   _____

5. This project is: a. ___ in place (permanent) b. ___ in place (temporary) c. ___ planned

6. Is this action on an existing road(s)? a. ___ Yes b. ___ No

7. Project implementation date_____
   (Month / Year)

8. Description of devices or actions involved in the traffic calming project (Check all that are a part of this specific project)

   a. ____ Speed Hump (or Speed bump)
   b. ____ Traffic circle (Roundabout)
   c. ____ Street narrowing (Skinny streets)
   d. ____ Choker (Neck-down)
   e. ____ Chicane (Curvilinear reconstruction)
   f. ____ Street closure (Cul-de-sac)
   g. ____ Change in road surface materials or color
   h. ____ Rumble strip
   i. ____ Streetscape materials/Landscape plantings
   j. ____ Vehicle restrictions/prohibitions
   k. ____ Turn restrictions
   l. ____ One-way streets
   m. ____ Variable speed display board
   n. ____ Diagonal diverter (Diagonal closure)
   o. ____ Semi-diverter (Partial street closure)
   p. ____ Median island (Median barrier)
   q. ____ Trumpet island (Pork Chop)
   r. ____ Elevated intersection
   s. ____ Elevated crosswalk
   t. ____ Marked crosswalks
   u. ____ On-street angle parking
   v. ____ Protected parking bays
   w. ____ Stop signs
   x. ____ Basket Weave Stop Signs
   y. ____ Other (please specify)
   _____

9. Road classification:

a. ___Local Street b. ___Minor Collector c. ___Major Collector d. ___Minor Arterial

10. Roadway designation:

a. ___MSA b. ___CSAH c. ___Trunk Highway (TH) d. ___Other _____

11. Standards used in the design or construction of this project:

a. ___MSA b. ___CSAH c. ___Trunk Highway (TH) d. ___Other _____

12. Please provide available data: (Fill in data and collection date. Note "None" if data is not available.)

| | Before | (Mo/Yr) | After | (Mo/Yr) |
|---|---|---|---|---|
| a. 85% vehicle speed (mph)..... | ____ | ____ | ____ | ____ |
| b. Daily traffic volume on project street (ADT)..... | ____ | ____ | ____ | ____ |

13. What other data is available for this project (Indicate with a check)

| | Before | After |
|---|---|---|
| a. Accident experience..... | ____ | ____ |
| b. Trip origin-destination ..... | ____ | ____ |
| c. Vehicle travel time..... | ____ | ____ |
| d. Survey of residents..... | ____ | ____ |
| e. Survey of businesses..... | ____ | ____ |
| f. Noise level..... | ____ | ____ |
| g. Air quality..... | ____ | ____ |
| h. Other (please specify) ..... | ____ | ____ |

14. Did the availability of either staff time or funding affect data collection efforts? a. ___ Yes b. ___ No

If yes, please describe how _____

_____

15. What top three reasons or problems created the need for this project? (Please mark top reason = 1, second = 2, third = 3)

a. ____ High vehicular speeds
b. ____ High traffic volumes
c. ____ Accident experience
d. ____ High noise levels
e. ____ Air quality
f. ____ Traffic management
g. ____ Land use or zoning changes
h. ____ New development
i. ____ Resident dissatisfaction with street environment
j. ____ Business dissatisfaction with street environment
k. ____ Traffic creates a barrier to pedestrian/bicycle movement
l. ____ Cut-through traffic
m. ____ Perception of high vehicle speeds or traffic volumes
n. ____ Other (please specify)

_____

**IF PROJECT HAS NOT BEEN IMPLEMENTED YET, PLEASE SKIP TO QUESTION #22.**

16. What were the top three actual or perceived outcomes? (Top = 1, Second = 2, Third = 3)

a. ____ Reduction in vehicle speeds
b. ____ Reduction in traffic volumes
c. ____ Reduction of cut-through traffic
d. ____ Reduction in noise levels
e. ____ Improvement in air quality
f. ____ Increased community life vitality
g. ____ Reduced collision frequency and severity
h. ____ Increase in pedestrian, bicycle, and/or transit use
i ____ Improved safety for non-motorized street users
j. ____ Additional greenery (i.e. trees and shrubs)
k. ____ Maintenance of neighborhood character
l. ____ Change the psychological feel of the street
m. ____ Other (please specify) _____

17. Are there plans to implement similar projects elsewhere? a. ___ Yes b. ___ No

If no, why? _____

_____

18. Has the project negatively impacted any of the following? (Check all that apply)

a. ____ Emergency vehicle access
b. ____ Maintenance vehicle access
c. ____ Public transit access
d. ____ Snow removal storage
e. ____ Snow removal vehicle access
f. ____ Visibility of traffic calming device/ motorist safety
g. ____ Other (please specify) _____

19. Have any *unanticipated* negative impacts occurred? a. ___ Yes b. ___ No

If yes, please specify _____

_____

20. How have the following groups of people generally reacted to the project?

| | Positive | Negative | Neutral | No Information |
|---|---|---|---|---|
| a. Residents fronting on the project..... | _____ | _____ | _____ | _____ |
| b. Businesses fronting on the project..... | _____ | _____ | _____ | _____ |
| c. Residents on adjacent streets..... | _____ | _____ | _____ | _____ |
| d. Businesses on adjacent streets..... | _____ | _____ | _____ | _____ |
| e. Through traffic (non-local) ..... | _____ | _____ | _____ | _____ |

21. What funds did you use to pay for this project (check all that apply)

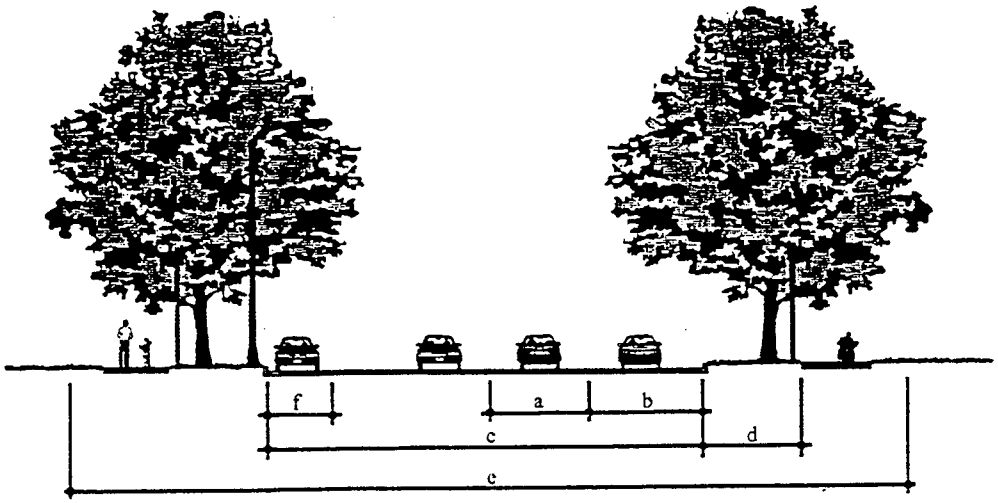
a. ____ City
b. ____ County
c. ____ Mn/DOT
d. ____ Special Assessments
e. ____ Other (please specify) _____

22. Any additional comments?_____

_____

_____

**ADDITIONAL QUESTIONS ON NEXT PAGE**




23. Please provide roadway geometric information

| | | Before | After |
|---|---|---|---|
| a. | Inner travel lane width | ____ | ____ |
| b. | Outer travel lane width (to curb face) | ____ | ____ |
| c. | Total roadway width (curb face to curb face) | ____ | ____ |
| d. | Boulevard width | ____ | ____ |
| e. | Right-of-way width | ____ | ____ |
| f. | Fill in type of parking allowed: Parallel (P), Diagonal (D), None (N) | ____ | ____ |
| g. | Parking allowed on one side (1) or both (2)? | ____ | ____ |

24. Please attach an 8 ½" x 11" sheet or use the remaining space to provide a dimensioned drawing of any additional pertinent before-and-after design information.

**Thank you for your participation! Please return by January 24, 1996**

SRF Consulting Group, Inc. One Carlson Parkway North, Suite 150 Minneapolis, MN 55447-4443
Telephone (612) 475-0010 Fax (612) 475-2429

# APPENDIX B

# Tabulation of Survey Results

# Traffic Calming Survey Summary[A]

## 1 Traffic Calming Project Location Summary

| | City | In Place | | | Planned | Grand Total |
|---|---|---|---|---|---|---|
| | | Permanent | Temporary | Total | | |
| 1 | Andover | 1 | | 1 | | 1 |
| 2 | Blaine | 2 | | 2 | | 2 |
| 3 | Brooklyn Center | 2 | | 2 | | 2 |
| 4 | Brooklyn Park | 1 | | 1 | | 1 |
| 5 | Burnsville | 2 | 2 | 4 | 1 | 5 |
| 6 | Duluth | 1 | | 1 | | 1 |
| 7 | Eden Prarie | 2 | | 2 | | 2 |
| 8 | Farmington | 1 | | 1 | | 1 |
| 9 | Fridley | | 1 | 1 | | 1 |
| 10 | Lake Elmo | | | 0 | 1 | 1 |
| 11 | Mankato | | | 0 | 1 | 1 |
| 12 | Minneapolis | 3 | 7 | 10 | 1 | 11 |
| 13 | Mound | | | 0 | 1 | 1 |
| 14 | North Branch | | | 0 | 1 | 1 |
| 15 | Plymouth | 2 | | 2 | 1 | 3 |
| 16 | Prior Lake | 1 | | 1 | | 1 |
| 17 | Richfield | 1 | 1 | 2 | 2 | 4 |
| 18 | Robbinsdale | | | 0 | 2 | 2 |
| 19 | Rochester | 5 | | 5 | 1 | 6 |
| 20 | Rosemount | | | 0 | 1 | 1 |
| 21 | Roseville | 1 | | 1 | | 1 |
| 22 | St. Cloud | 1 | | 1 | | 1 |
| 23 | St. Louis Park | 2 | | 2 | | 2 |
| 24 | St. Paul | 9 | 1 | 10 | 2 | 12 |
| 25 | Stillwater | | | 0 | 1 | 1 |
| 26 | White Bear Lake | 2 | | 2 | | 2 |
| | **Total** | **39** | **12** | **51** | **16** | **67** |
| | **Percentage of Total** | **58%** | **18%** | **76%** | **24%** | **100%** |

## 2 Is traffic calming action on an existing road?

| | In Place | Planned | Grand Total | Percentage |
|---|---|---|---|---|
| Yes | 50 | 15 | 65 | **97%** |
| No | 1 | 1 | 2 | **3%** |
| **Total** | **51** | **16** | **67** | **100%** |

(A) Survey responses received for 49 cities. 26 cities (53%) had performed or planned to perform a traffic calming project.

23 cities (47%) had not performed or planned to perform a project.

3 **Summary of devices or actions used in traffic calming projects.**

| Devices or Action | In Place | | | Planned | Grand Total | Percent of Total |
|---|---|---|---|---|---|---|
| | Permanent | Temporary | Total | | | |
| 1 Street width adjustments | 22 | 5 | 27 | 21 | 48 | 33% |
| 2 Traditional traffic management techniques | 14 | 4 | 18 | 12 | 30 | 20% |
| 3 Vertical or horizontal realignments | 14 | 4 | 18 | 10 | 28 | 19% |
| 4 Traffic flow diversions | 7 | 6 | 13 | 3 | 16 | 11% |
| 5 Perceptual enhancements | 7 | 1 | 8 | 6 | 14 | 9% |
| 6 Other | 7 | 3 | 10 | 2 | 12 | 8% |
| **Total Devices or Actions** | **71** | **23** | **94** | **54** | **148** | **100%** |

Note: Total is greater than number of projects because a project can have multiple actions or devices

**Device Groupings**

**1. Street width adjustments**
- Street narrowing
- Choker
- Median island
- On-street angle parking
- Protected parking bays

**2. Traditional traffic management techniques**
- Vehicle restrictions
- Turn restrictions
- One-way streets
- Trumpet island
- Stop signs
- Basket weave stop signs
- Marked crosswalks
- Variable speed display board

**3. Vertical or horizontal realignments**
- Speed hump or bump
- Traffic circle
- Chicane

**4. Traffic flow diversions**
- Street closure -(cul de sac)
- Diagonal diverter
- Semi-diverter

**5. Perceptual enhancements**
- Change in road surface materials or color
- Streetscape material or landscape planting

| | In Place | | | | Grand | Percent of |
|---|---|---|---|---|---|---|
| | Permanent | Temporary | Total | Planned | Total | Total |
| **4a Road Classification** | | | | | | |
| Local Street | 24 | 7 | 31 | 7 | 38 | |
| Minor Collector | 8 | 3 | 11 | 4 | 15 | |
| Alley | 1 | 0 | 1 | 0 | 1 | |
| **Subtotal** | **33** | **10** | **43** | **11** | **54** | **81%** |
| Major Collector | 2 | 0 | 2 | 1 | 3 | |
| Minor Arterial | 2 | 2 | 4 | 3 | 7 | |
| **Subtotal** | **4** | **2** | **6** | **4** | **10** | **15%** |
| No information | 2 | 0 | 2 | 1 | 3 | **4%** |
| **Total** | **39** | **12** | **51** | **16** | **67** | **100%** |
| **4b Road Designation** | | | | | | |
| MSA | 5 | 4 | 9 | 5 | 14 | **21%** |
| CSAH | 3 | 1 | 4 | 1 | 5 | **7%** |
| TH | 0 | 0 | 0 | 1 | 1 | **2%** |
| Other[(A)] | 28 | 7 | 35 | 8 | 43 | **64%** |
| No information | 3 | 0 | 3 | 1 | 4 | **6%** |
| **Total** | **39** | **12** | **51** | **16** | **67** | **100%** |
| **4c Road standard** | | | | | | |
| MSA | 7 | 3 | 10 | 5 | 15 | **22%** |
| CSAH | 3 | 0 | 3 | 0 | 3 | **5%** |
| Other[(B)] | 25 | 8 | 33 | 9 | 42 | **63%** |
| No information | 4 | 1 | 5 | 2 | 7 | **10%** |
| **Total** | **39** | **12** | **51** | **16** | **67** | **100%** |

**4d Project design standards used**

| Roadway | Design Standards | | | | | |
|---|---|---|---|---|---|---|
| Designation | MSA | CSAH | TH | Other | No info | Total |
| MSA | 9 | 1 | 0 | 2 | 2 | 14 |
| CSAH | 0 | 2 | 0 | 3 | 0 | 5 |
| TH | 1 | 0 | 0 | 0 | 0 | 1 |
| Other | 5 | 0 | 0 | 36 | 2 | 43 |
| No information | 0 | 0 | 0 | 1 | 3 | 4 |
| **Total** | **15** | **3** | **0** | **42** | **7** | **67** |

(A) 84% responded city or local street.

(B) 68% responded city or local street.

**5 Reasons or problems that created the need for these projects**

| Reasons or problems | In Place | | | Planned | Grand Total | Percent of Total |
|---|---|---|---|---|---|---|
| | Permanent | Temporary | Total | | | |
| 1 Negative Environment | 25 | 11 | 36 | 17 | 53 | 33% |
| 2 Heavy Traffic | 27 | 12 | 39 | 7 | 46 | 29% |
| 3 High Speeds | 19 | 7 | 26 | 8 | 34 | 21% |
| 4 Lack of Safety | 10 | 0 | 10 | 5 | 15 | 9% |
| 5 Other | 6 | 3 | 9 | 3 | 12 | 8% |
| **Total** | **87** | **33** | **120** | **40** | **160** | **100%** |

Note: Total is greater than number of projects because a project can have multiple reasons or problems.

**Reasons or problems groupings**

**1. Negative Environment**
- Resident dissatisfaction
- Business dissatisfaction
- High noise levels
- Land use or zoning changes
- New development

**2. Heavy Traffic**
- Cut through traffic
- High traffic volumes
- Traffic management
- Perception of high volumes

**3. High Speeds**
- High vehicular speeds
- Perception of high speeds

**4. Lack of Safety**
- Accident experience
- Traffic creates pedestrian or bicycle barrier

6 Actual or perceived outcomes resulting from project

| Outcomes | In Place | | | Planned | Grand Total | Percent of Total |
|---|---|---|---|---|---|---|
| | Permanent | Temporary | Total | | | |
| 1 Enhanced street environment | 29 | 12 | 41 | 6 | 47 | 36% |
| 2 Improved street safety / reduced speed | 27 | 9 | 36 | 6 | 42 | 33% |
| 3 Improved traffic conditions | 25 | 8 | 33 | 3 | 36 | 28% |
| 4 Other | 2 | 2 | 4 | 0 | 4 | 3% |
| **Total** | **83** | **31** | **114** | **15** | **129** | **100%** |

Note: Total is greater than number of projects because a project can have multiple outcomes.

Perceived or actual outcome groupings

**1. Enhanced street environment**
Additional greenery
Change psychological feel of the street
Increase in pedestrian, bike or transit use
Increased community life vitality
Reduction in noise levels

**2. Improved street safety / reduced speed**
Reduction in vehicle speeds
Improved safety for non-motorized street users
Reduced collision severity and frequency

**3. Improved traffic conditions**
Reduction of cut - through traffic
Reduction in traffic volumes

**7 Negative impacts resulting from projects**

| 7a Negative impacts | In Place | | | Percent of total |
|---|---|---|---|---|
| | Permanent | Temporary | Total | |
| 1 Emergency vehicle access | 5 | 5 | 10 | 19% |
| 2 Maintenance vehicle access | 4 | 5 | 9 | 16% |
| 3 Public transit access | 3 | 4 | 7 | 13% |
| 4 Snow removal storage | 5 | 2 | 7 | 13% |
| 5 Snow removal vehicle access | 3 | 4 | 7 | 13% |
| 6 Visibility of traffic calming device | 1 | 3 | 4 | 7% |
| 7 Other | 8 | 2 | 10 | 19% |
| **Total** | **29** | **25** | **54** | **100%** |

Note: Total is greater than number of projects because a project can have multiple negative impacts.

**7b Have any unanticipated negative impacts occured?**

| | In Place | Percentage |
|---|---|---|
| Yes | 15 | 29% |
| No | 35 | 69% |
| No Information | 1 | 2% |
| **Total** | **51** | **100%** |

**7c Unanticipated negative impacts.**

- One daycare provider discovered the turning restriction in the AM was inconvenient for one customer (turn restrictions).

- Neighborhoods unable to agree on design or funding (semi-diverter).

- No alternate route provided (semi-diverter).

- Residents changed their perspective when their kids got tickets (street closure).

- Cul-de-sac versus on street resident disagreements heightened to the point that closure was removed.

- Build up of ice and poor drainage (speed humps).

- Needed additional clearance to accommodate snow accumulation (circle to corner). Reduction in circle to 16 feet (traffic circle).

- Tests indicated that traffic circles at "T" intersections are inappropriate application of technique. Some circle to curb clearances are inadequate for lift-equipped MCTO buses (traffic circle).

- Planned circle to corner clearance (20 feet) was too small to allow MCTO bus clearance and 4 foot snow accumulation. Five hit and run accidents with the data collection device. Happened between 1 and 3 AM and all were unreported (traffic circle).

- Increased difficulty for wintertime access to Orlin east of test. 7% or greater up slope on hill east of project (altered intersection).

- Horn honking by passing cars (speed humps).

- Dissatisfied residents cause unnecessary noise - honking horns (speed humps).

- Neighborhood group complained about "unsightly" chevron signs (chokers).

| 8a Funding sources | In Place | | | Planned | Total | Percent of total |
|---|---|---|---|---|---|---|
| | Permanent | Temporary | Total | | | |
| City | 32 | 7 | 39 | 4 | 43 | 55% |
| County | 0 | 0 | 0 | 0 | 0 | 0% |
| MN/Dot | 2 | 0 | 2 | 1 | 3 | 4% |
| Special Assessments | 3 | 0 | 3 | 2 | 5 | 7% |
| Other | 9 | 4 | 13 | 2 | 15 | 19% |
| No Information | 2 | 0 | 2 | 10 | 12 | 15% |
| **Total** | **48** | **11** | **59** | **19** | **78** (a) | **100%** |

(a) Total number of funding sources is greater than the total number of projects because several projects had multiple funding sources.

**8b Did the availability of either staff time or funding affect data collection efforts?**

| | In Place | Planned | Grand Total | Percentage |
|---|---|---|---|---|
| Yes | 23 | 5 | 28 | 42% |
| No | 25 | 9 | 34 | 51% |
| No Information | 3 | 2 | 5 | 7% |
| **Total** | **51** | **16** | **67** | **100%** |

**8c Staff and funding problem comments.**

- City's traffic data collectors are antiquated. Cannot record speed, number of axles, etc. No access to this type of equipment.
- A developer proposed a new retail business which triggered a major staff investment.
- With a very limited staff there wasn't the time or the money to do the survey or the study.
- Studies were done that minimized the need for staff time (i.e. tube counts, available existing data review, etc.).
- Numerous requests delayed survey and neighborhood meetings until 1997.
- Numerous other projects and requests for studies delayed data collection and implementation.
- Money and time.
- Was constructed with large CSSP project. Construction engineers designed because desire of neighborhood group (chokers).
- Too large a project to do major data collection (basket weave stop signs).

**9 Plans to implement similar projects**

**9a Are there plans to implement similar projects elsewhere?**

| | In Place | | | Percent |
|---|---|---|---|---|
| | Permanent | Temporary | Total | of Total |
| Yes | 25 | 11 | 36 | 71% |
| No | 14 | 1 | 15 | 29% |
| **Total** | **39** | **12** | **51** | **100%** |

**9b Reasons for no future plans to implement similar projects.**

- Neighborhood situation is unique (unwarranted stop sign).
- No requests from areas with similar issues (turn restrictions).
- Residents not satisfied (street closure).
- No street with similar issues have requested traffic calming (trumpet island/ turn restrictions).
- The technique accomplished very little (if any) reduction in speed. Devices are also a maintenance inconvenience, particularly in winters with excessive snow accumulations (chokers).
- We have installed chokers recently at two locations and effects on speed appear to be little, if any. When pavement markings were covered with snow, motorists were driving in the parking bays (chokers/ protected parking bays).
- Such projects are usually initiated by resident petition and no petitions have been received (street closure).
- Community is not currently demanding or requesting traffic circles.
- Entire City was basket-weaved with stops on this project.
- On hold until further evaluation in 1997 (speed humps).
- This project is designed specifically for this location - may use cul-de-dacs in other locations (cul-de-sac).

## 10 Population reaction to projects

| | Population reaction | In place | | | Percentage of total |
|---|---|---|---|---|---|
| | | Permanent | Temporary | Total | |
| **10a** | **Residents fronting** | | | | |
| | Positive | 25 | 7 | 32 | 61% |
| | Neutral | 2 | 2 | 4 | 8% |
| | Negative | 3 | 2 | 5 | 10% |
| | No Info. | 10 | 1 | 11 | 21% |
| | **Total** | **40** | **12** | **52** (a) | **100%** |
| **10b** | **Businesses fronting** | | | | |
| | Positive | 10 | 1 | 11 | 22% |
| | Neutral | 3 | 1 | 4 | 8% |
| | Negative | 0 | 4 | 4 | 8% |
| | No Info. | 26 | 6 | 32 | 62% |
| | **Total** | **39** | **12** | **51** | **100%** |
| **10c** | **Residents Adjacent** | | | | |
| | Positive | 11 | 4 | 15 | 29% |
| | Neutral | 4 | 3 | 7 | 14% |
| | Negative | 7 | 2 | 9 | 18% |
| | No Info. | 17 | 3 | 20 | 39% |
| | **Total** | **39** | **12** | **51** | **100%** |
| **10d** | **Businesses Adjacent** | | | | |
| | Positive | 6 | 2 | 8 | 16% |
| | Neutral | 1 | 1 | 2 | 4% |
| | Negative | 1 | 0 | 1 | 2% |
| | No Info. | 31 | 9 | 40 | 78% |
| | **Total** | **39** | **12** | **51** | **100%** |
| **10e** | **Through traffic** | | | | |
| | Positive | 4 | 1 | 5 | 10% |
| | Neutral | 2 | 1 | 3 | 6% |
| | Negative | 5 | 6 | 11 | 22% |
| | No Info. | 28 | 4 | 32 | 62% |
| | **Total** | **39** | **12** | **51** | **100%** |

(a) Total number of responses is greater than the total number of projects because one project had multiple responses.

**Reasons for traffic calming project versus traffic calming devices.**

| Reasons / Devices | Negative Environment | Lack of Safety | High Speed | Heavy Traffic | Other | Total | Percent of grand total |
|---|---|---|---|---|---|---|---|
| Street width adjustments | 26 | 7 | 13 | 30 | 10 | **86** | **30%** |
| Traditional traffic mgmt techniques | 17 | 11 | 11 | 27 | 2 | **68** | **24%** |
| Vertical or horizontal realignment | 13 | 4 | 13 | 17 | 3 | **50** | **18%** |
| Perceptual enhancements | 6 | 2 | 4 | 4 | 1 | **17** | **6%** |
| Traffic flow diversions | 8 | 3 | 7 | 17 | 3 | **38** | **14%** |
| Other | 7 | 2 | 4 | 7 | 2 | **22** | **8%** |
| **Total** | **77** | **29** | **52** | **102** | **21** | **281** | **100%** |
| **Percent of grand total** | **27%** | **10%** | **19%** | **36%** | **8%** | **100%** | |

**Reasons for traffic calming project versus project outcome.**

| Outcomes \ Reasons | Negative Environment | Lack of Safety | High Speed | Heavy Traffic | Other | Total | Percent of grand total |
|---|---|---|---|---|---|---|---|
| Enhanced street environment | 40 | 16 | 25 | 49 | 6 | **136** | **39%** |
| Improved street safety | 5 | 10 | 5 | 12 | 1 | **33** | **9%** |
| Reduction in vehicle speeds | 15 | 6 | 20 | 25 | 6 | **72** | **20%** |
| Reduction in cut through traffic | 10 | 0 | 8 | 28 | 2 | **48** | **14%** |
| Reduction in traffic volumes | 10 | 2 | 10 | 30 | 2 | **54** | **15%** |
| Other | 4 | 0 | 1 | 2 | 3 | **10** | **3%** |
| **Total** | **84** | **34** | **69** | **146** | **20** | **353** | **100%** |
| **Percent of grand total** | **24%** | **9%** | **20%** | **41%** | **6%** | **100%** | |

Note: Reduction in cut-through traffic and reduction in traffic volumes are grouped together in the technical memorandum as "Heavy Traffic."

**Traffic calming devices versus project outcome.**

| Devices \ Outcomes | Enhanced street environment | Improved street safety | Reduced vehicle speeds | Reduced traffic problems | Other | Total | Percent of grand total |
|---|---|---|---|---|---|---|---|
| Street width adjustment | 39 | 4 | 13 | 12 | 5 | **73** | **29%** |
| Traditional traffic mgmt techniques | 28 | 10 | 9 | 16 | 1 | **64** | **25%** |
| Vertical or horizontal realignments | 16 | 3 | 15 | 10 | 2 | **46** | **18%** |
| Perceptual enhancements | 9 | 2 | 3 | 1 | 0 | **15** | **6%** |
| Traffic flow diversions | 9 | 5 | 5 | 18 | 1 | **38** | **15%** |
| Other | 7 | 2 | 3 | 5 | 1 | **18** | **7%** |
| **Total** | **108** | **26** | **48** | **62** | **10** | **254** | **100%** |
| **Percent of grand total** | **42%** | **10%** | **19%** | **25%** | **4%** | **100%** | |

# APPENDIX C

# Sample Data Collection Forms

# 1997 PERFORMANCE & RESULTS SURVEY
# Neighborhood Traffic Management Programs

Agency:

Location: State:

Population:

Contact Name:

Phone/Fax/E-Mail:

**If you have used the following measures, please state the *ACTUAL* performance you achieved.**

CHECK measures where you have before and after performance data. FILL IN THE BLANK with the actual results you achieved in the field, as measured in a study or survey. Provide a RANGE if you have done several projects (please indicate the number of study projects). This can be in speed (mph) or volume reduction (vehicles per day or hour - please note which). Public satisfaction should be from a survey of neighbors affected by the NTM project (if no survey, please indicate HIGH, MEDIUM or LOW in this column). If you have no performance data, please check the bottom box. ***Please attach any summary documentation you may have.***

| | RESULTS | | | |
|---|---|---|---|---|
| | No. of Studies | Speed (mph) Reduction | Volume Change (ADT) | Percent Positive Public Satisfaction |
| ☐ Circles | | | | |
| ☐ Chokers (curb extensions, medians) | | | | |
| ☐ Diverters/Street Closures/ One Way Routes | | | | |
| ☐ Hump/Bumps/Undulations | | | | |
| ☐ Narrow Streets (WIDTH = _____ft.) | | | | |
| ☐ Neighborhood Traffic Watch | | | | |
| ☐ Selective Traffic Enforcement | | | | |
| ☐ Speed Trailer/Reader Board Wagon | | | | |
| ☐ Video Enforcement | | | | |

☐ NO PERFORMANCE DATA AVAILABLE

Notes: _____

FAX TO: R. S. McCourt 503/243-1934

# Neighborhood Traffic Management Program
# Project Application Form

Contact Name _____ Day Phone _____

Neighborhood _____ Today's Date _____

Local Address _____

Which neighborhood street(s) are of concern? _____

_____

What traffic problems have you identified affecting the above street(s)? _____

_____

_____

_____

_____

How many households and/or businesses did you and staff identify in your petition area? _____

Have you received the minimum required (greater than 50%) signatures on your petition form?

☐ Yes ☐ No

What signature percentage have you received? _____%

Please return the completed application form along with the signed petition forms to:

Collier County Transportation Services Department
3301 East Tamiami Trail
Naples, FL 33962 Phone: 774-8494

For Office Use Only

Project Number _____ Date Application Received _____

Date Preliminary Analysis Completed _____ Identified Problems: ☐ Exist ☐ Perceived

Date of First Neighborhood Workshop _____ Traffic Team: ☐ Yes ☐ No

Date of Project Presentation to Neighborhood _____ Consensus Reached: ☐ Yes ☐ No

Date of Project Presentation to County Commission _____

County Commission Action: ☐ Favorable ☐ Unfavorable

Date of Project Implementation _____

Project Review Date _____ Project Successful: ☐ Yes ☐ No

FORM A

# Neighborhood Traffic Management Program
# Petition Form

We, the undersigned, as residents of the _____ neighborhood, hereby request the evaluation of the traffic problems on _____ street(s), the problems being identified as _____

_____

and the development of a Neighborhood Traffic Management project.

Please list all addresses in the petition area. One signature per household or business.

| Date | Name (please print) | Address | Signature |
|---|---|---|---|
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FORM B Page _____ of _____

(Sample Before Survey)
PROJECT AND CITY NAME
SURVEY OF RESIDENTS/BUSINESSES

1. What are the problems you perceive with the existing street conditions?

2. How would you rate the severity of the problem?

   a. _____ Severe  b. _____ Moderate  c. _____ Minimal

3. The following traffic calming actions are being proposed to deal with the reported problems:

4. What is your reaction to the proposed project?

   a. _____ In favor of the project
   b. _____ Neutral
   c. _____ Against the project

5. If you are in favor of the project, how do you think it will address the existing problems you identified? Be specific, please.

6. If you are against the project, could you tell us why?

(Sample After Survey)
PROJECT AND CITY NAME
SURVEY OF RESIDENTS/BUSINESSES

1. On ___(date)___, the city implemented a traffic calming project at the request of a group of residents. The following actions were taken:

2. Did you think there was a problem before the project was implemented?

   a. _____ Yes  b. _____ No  c. _____ Don't Know

3. If yes, what were the problems? Be specific, please.

4. After the project was in place what effect, if any, did it have?

   a. _____ Reduced the problem significantly
   b. _____ Reduced the problem moderately
   c. _____ Didn't change anything
   d. _____ Things got worse

5. What is your reaction to the project?

   a. _____ Favorable
   b. _____ Neutral
   c. _____ Negative

6. What specific problems listed in question #3 were made better?

7. If your reaction to the project is negative, could you tell us why?