A Guidebook for Residential Traffic Management

Final Report

December 1994

Washington State Department of Transportation
TransAid Service Center
Northwest Technology Transfer Center

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WA-RD 368.1

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16. Abstract

This report provides a comprehensive reference on initiating and running a residential traffic management (RTM) program. Although aimed at smaller cities, towns and counties, the procedures are applicable in any jurisdiction. The Guidebook takes a "toolbox" approach to implementing traffic management projects, with various RTM devices and procedures being the "tools" in each box. Contents include: Introduction — a perspective on controlling traffic in residential areas; A Look at RTM — history, background and worldwide examples of RTM efforts; Getting Started — the first steps to take in starting an RTM program, and using involvement, learning and consensus building tools to build alliances; The RTM Toolboxes — a listing of RTM devices categorized by Speeding, Volume, Accidents and Miscellaneous Toolboxes; Common Design Issues — do's and don'ts for the design and installation of RTM devices; Legal Issues — authority for RTM programs under Washington state and federal statutes, regulations and case law; The Politics of RTM — a realistic look at how to make RTM a political as well as engineering success; and Concluding Thoughts — the author's view of the keys to success for an RTM program.

The Guidebook is illustrated with over 30 photographs of RTM devices in place, plus extensive references for further details.

The Guidebook includes a glossary of RTM terms, an annotated bibliography, a pictorial glossary of RTM devices excerpted from a report prepared by the City of Everett Department of Public Works, and an appendix on "Setting Up a Self-managed RTM Program in a Small Community."

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A Guidebook for

Residential Traffic Management

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Chapter 1. Introduction

Throughout the United States citizens are asking their local officials to stop the decline in their residential environmental quality caused by excessive traffic volumes and speeding on their local streets. People are demanding actions that divert or slow the flow of cars on their streets. Many actions are available — and in choosing the best ones for an area, it is important that both local governments and citizens understand all of the issues involved.

Although many technical reports and professional references are available, they are not frequently used at the local level and their examples and recommendations are not always practical for smaller jurisdictions with limited resources.

This guidebook on residential traffic management (RTM) is intended to be an off-the-shelf resource for local jurisdictions that are looking for ways to address traffic issues on neighborhood streets. It presents a "state of the art" review of technical information in the field, and compiles key elements of successful residential traffic management programs used by local jurisdictions, primarily those in the Pacific Northwest. It is aimed at transportation professionals and citizens interested in learning more about neighborhood traffic management. As such, it functions as a "short course" on how to approach and resolve traffic problems in residential areas.

The goal of residential traffic management programs is to influence driver behavior through a variety of measures and devices, including physical, psychological, visual, social and legal means.

A Perspective on Residential Streets

The issues covered here arise from a desire for safe, functional and attractive streets in residential areas. In many communities, speeding, unnecessary through traffic, noise and air pollution, and parking problems threaten this vision. Residents also voice concerns about the safety of pedestrians, bicyclists and children. As traffic volumes grow and congestion increases on nearby through and arterial streets, these issues become more acute.

> Residential streets become part of the neighborhood and are eventually used for a variety of purposes for which they were not designed. Residential streets provide direct auto access for the occupant to his home; they carry traffic past his home; they provide a visual setting, an entryway for each house; a pedestrian circulation system; a meeting place for the residents; a play area [whether one likes it or not] for the children, etc. (*Performance Streets*, Bucks County (PA) Planning Commission, Doylestown, Pa, 1980)

Residential streets do more than carry cars and provide access to homes; they are an integral part of the neighborhood environment. A residential street typically:

- provides vehicular access to abutting property,
- provides vehicular access within or through a local area,
- provides a means to enable social interaction within a neighborhood,
- often serves as a play area or as community open space,
- provides access for emergency and service vehicles, and
- contributes visually to the living environment[1].

Recognizing this multiplicity of functions, traffic engineers have developed design standards for new residential streets. Standard references emphasize that residential streets are inherently different from arterials, and they need different design and traffic control treatments. Some recent examples include *Residential Streets, Second Edition*[2], by the American Society of Civil Engineers, and the Institute of Transportation Engineers' *Residential Street Design and Traffic Control*[3] and *Traffic Engineering Handbook*[4] (citations are listed at the end of this chapter). Residential traffic management techniques have even been introduced into the standard traffic engineering curriculums[5].

Not a cure-all

RTM programs cannot solve all traffic problems in residential areas. Traffic circles, speed humps and other devices won't make up for problems caused by poor zoning and planning, or reckless driving. They also can't substitute for needed improvements on congested arterials.

Often, a residential street starts out serving a few homes in a sparsely developed area on the fringes of town, but they become a busy collector or minor arterial as development occurs. Without enough alternate routes, the through traffic on this residential street may not have anywhere else to go. A common complaint by residents in such situations is that they can't "back out onto the street from their driveway" as they did "when they first moved there."

Residential streets may also suffer from cut-through traffic trying to escape congestion on the major arterial routes nearby. While RTM techniques may slow cut-through traffic to more acceptable speeds, very little may be accomplished in terms of reducing actual traffic volumes.

Purpose of this guidebook

Technical reports and professional references on residential traffic management offer detailed and comprehensive discussions of the key issues that must be part of a RTM program. Most are technical and do not provide hands-on guidance in developing a community program.

> The view of Paul C. Box, a consulting traffic engineer in Skokie, Illinois is shared by many in the profession: "I feel that the public agency should first strive to improve operation conditions [on the parallel arterials] and reduce the incentive for bypassing [congested areas] by use of local streets." (*ITE Journal*, August 1993; letter to the Editor)

Genre	Primary Functions
Home Owners	Vehicle access to abutting property.
	Vehicle access within or through local area.
Neighborhood	Provides a means to enable social interaction.
	Contributes visually to the living environment.
Children	Often serves as a play area or community open space.
Public Services	Provides access for emergency and service vehicles.

Table 1-1. Functions of a residential street

This guidebook was prepared to help transportation professionals, local jurisdictions and neighborhood residents who are looking for ways to reduce the impact of traffic in residential neighborhoods.

The guidebook covers:

- traffic control devices that can be applied to traffic problems on residential streets,
- what planning steps are needed to implement a successful RTM program,
- new developments in urban design that may affect neighborhood traffic,
- the planning and design aspects of traffic control devices as they affect traffic, emergency services, and other issues,
- the concept and practice of "traffic calming",
- the legal considerations of RTM programs, devices and systems,
- examples of Pacific Northwest RTM traffic control devices in place, and
- examples of effective RTM programs.

- **Starting an RTM program**
- **Research and reference**
- **Selecting an appropriate RTM device**
- **Education about RTM**

Table 1-2. Uses of this guidebook

Endnotes

[1] National Association of Australian State Road Authorities (NAASRA), *Traffic Engineering Practice Part 10,* "Local Area Traffic Management", Sydney, Australia, 1992.

[2] *Residential Streets, Second Edition*, ASCE, National Association of Homebuilders and the Urban Land Institute, Washington, D.C., 1990.

[3] Homburger, Wolfgang and Deakin, Elizabeth, et al., *Residential Street Design and Traffic Control,* Institute of Transportation Engineers, 1989; page 64.

[4] Institute of Transportation Engineers, *Traffic Engineering Handbook,* 5th Edition, Prentice-Hall, Englewood Cliffs, N.J., 1992.

[5] For example, see *Fundamentals of Traffic Engineering*, 12th Edition, which is a standard text for traffic engineering classes.

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Chapter 2.
A Look At RTM

Programs and practices to manage traffic in residential areas have many names: neighborhood traffic control (NTC), traffic restraint, traffic calming, local area traffic management and environmental traffic management (ETM). The key words are "calming," "restraint", and "management." Nearly all RTM programs seek to make the residential streets safer and reduce traffic intrusion by reducing traffic speeds and, to a lesser extent, traffic volumes.

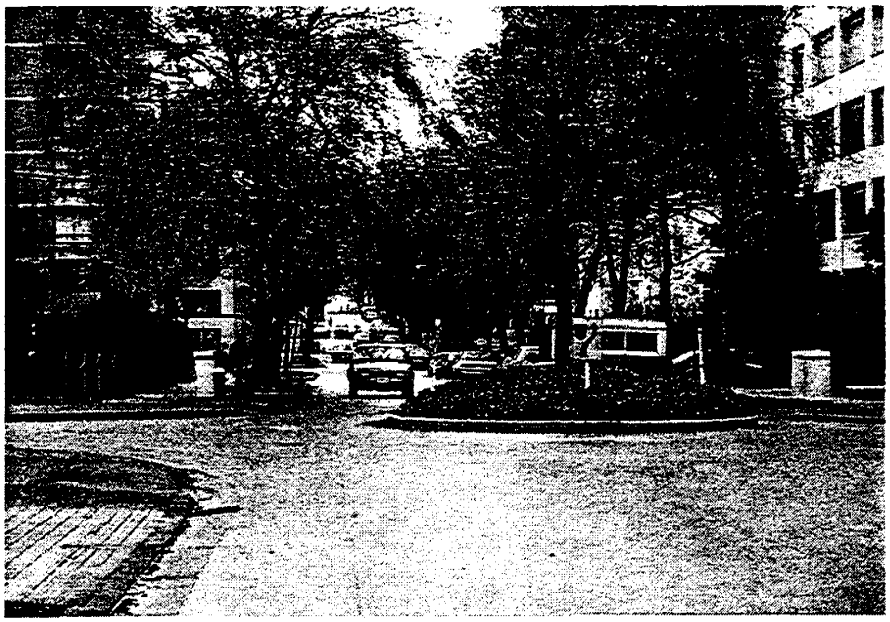
RTM – An Example

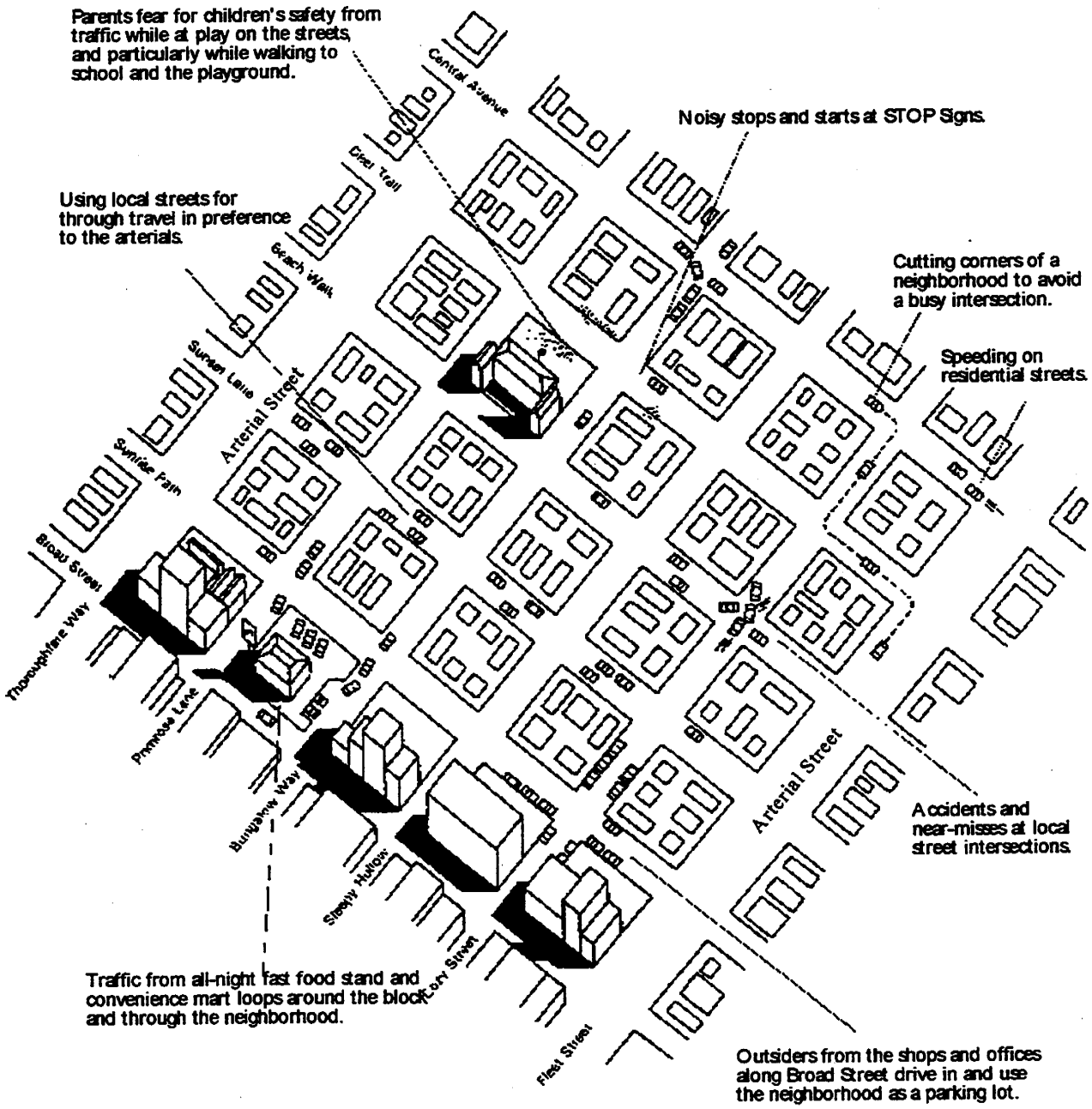
The problems with a high closely-spaced grid system in a high density urban area can be used to illustrate residential traffic management applications. As shown in Figure 2-1, cut-through traffic from the adjacent arterials (Thoroughfare Way, Fleet Street, Broad Street and Central Avenue) can impact streets designed to provide access to local residents only. The expectations of neighborhood residents to a quiet and safe environment conflict with those of motorists who believe they have the right to use any street available. In addition, commercial activities along the arterial create spill-over traffic and parking impacts on the nearby residential streets.

An example of a neighborhood traffic control plans to address these kinds of problems is illustrated in Figure 2-2. This example, from an early report on RTM techniques by Appleyard and Smith[1] for the Federal Highway Administration, shows how a series of RTM devices and control measures can work together to achieve the desired results. The resulting RTM system discourages cut-through traffic, reduces speeding and protects the residential streets from commercially-oriented traffic. Although smaller jurisdictions may not face the intensity of problems indicated in these illustrations, they provide a good overview of RTM applications.

RTM – A Working Definition

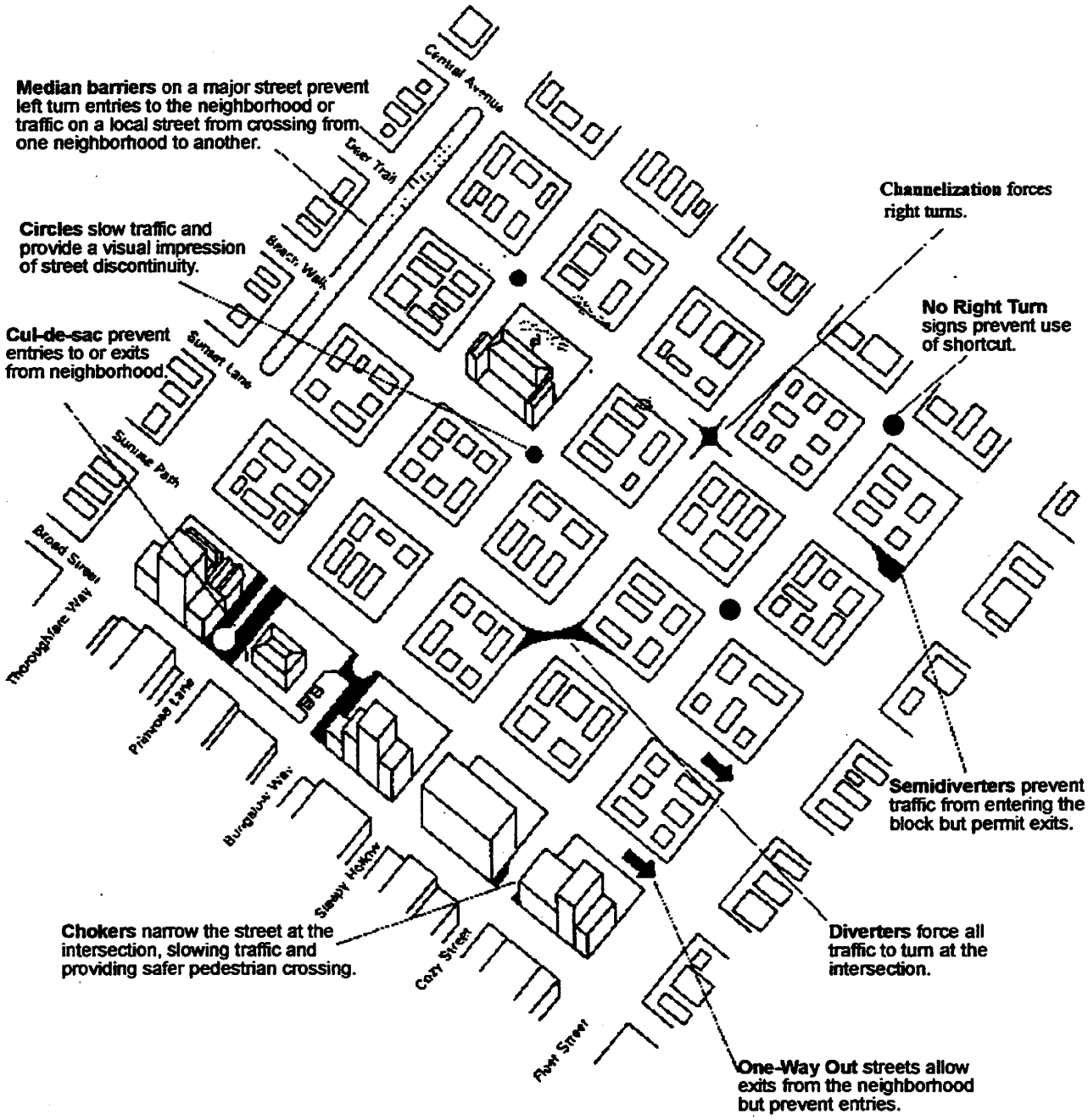
Residential traffic management reduces traffic speeds, vehicle noise, visual impacts and through traffic volumes in residential neighborhoods by physical, psychological, visual, social and legal (regulatory and enforcement) means. Table 2-1 highlights some of the common actions of RTM programs.





Adapted from State of The Art Report: Residential Traffic Management; Federal Highway Administration, 1980 .

Figure 2-1. Illustrative urban neighborhood and its traffic-related problems



Adapted from State of The Art Report: Residential Traffic Management; Federal Highway Administration, 1980

Figure 2-2. Illustrative residential traffic managmment program applied to problems in Figure 2-1.

RTM programs are defined largely by their goals and objectives, and the tools used to achieve them. Typical goals are seen in the City of Portland, Oregon's, program, "Reclaiming Our Streets" which are listed below:

Reducing	By	Examples
Through Volumes	Physical Means	Traffic circles, speed humps
Vehicle Noise	Psychological Means	Variable-spaced paint stripes
Visual Impacts	Visual Means	Landscaping to block through views
Traffic Speeds	Social Means	Neighborhood "Speed Watch" program
Accidents	Legal means	Strict speed enforcement

Table 2-1. RTM Activities

- Reduce traffic speeds and volumes on neighborhood streets to make them safer for pedestrians, bicyclists and residents, with special regard for children.
- Increase bicyclist and pedestrian safety, and encourage cycling and walking as transportation modes.
- Reduce deaths, injuries and property damage resulting from driving under the influence of intoxicants and from failure to use safety restraints.
- Increase the use of alternative transportation while decreasing auto use.

As summarized in Table 2-2, the tools for achieving these goals fall into four general categories:

Education, encouragement and enforcement programs such as "emphasis patrols" by local police to catch speeders, elementary school programs to teach and reinforce "defensive walking and biking habits" byschool children, or speed watch programs by residents.

Laws and ordinances - prohibiting through trucks in residential areas, posting speed limits in residential areas, on-street parking restrictions, etc.

Traffic control devices - ranging from turn prohibitions at key entry points to a succession of stop signs.

- ⇨ Education
- ⇨ Enforcement
- ⇨ Engineering
- ⇨ Enhancement

Table 2-2. The 4 E's of Residential Traffic Management

Geometric design features - physical restrictions to induce low speed travel such as narrow streets, traffic circles or speed humps, and even traffic diverters and street closures.

Most RTM programs have similar goals and techniques, but different results are often expected. For example, European and Japanese cities strive to restrain vehicle speeds in RTM areas to 6 to 12 mph, while many communities in the US want to hold average speeds to 25 mph on local streets.

History

Traffic engineers have only recently begun to look at vehicle movements in residential areas differently than traffic flows on urban arterials. On arterial streets, the focus is on maintaining mobility for vehicles, mostly in terms of speed and efficiency of movement. Residential streets require a much different approach, with a focus on safety and access instead of through movements.

Even though they have different purposes, most residential streets were not planned much differently than the rest of the urban street system. Most streets in residential neighborhoods are laid out in either a grid or a curvilinear pattern. While curving streets are less than a century old, the grid has been around since antiquity. In the United States, the grid is the most common street pattern found in urban areas, although in some areas the natural landscape made the roads more easily laid out than built. However, a regular grid offers a potentially endless variety of alternative travel routes.

Not surprisingly, some people living within a grid system did not always like having so little control over access to their neighborhood. Looking to reduce unwanted traffic and to establish a sense of exclusivity and community, some neighborhoods in Philadelphia, Boston and New York began to put up walls and large gated entrances to set their blocks apart.

As cities grew and spread, and auto ownership increased, unwanted through traffic became more of an issue. In the late 1940s and early 1950s, Montclair, New Jersey, and Grand Rapids, Michigan, began to put in traffic diverters, and convert neighborhood access streets into cul-de-sacs. Urban redevelopment projects in the 1960s also worked to alter the grid system, often by closing streets, by rebuilding existing neighborhoods and by creating huge "superblocks" of development with few through streets.

On the other hand, the curvilinear pattern used in many subdivisions and newer neighborhoods also was having problems. The patterns varied from division to division and offered few connections to main access routes, making trips circuitous. Transit and other alternative modes proved difficult to implement and use in these neighborhoods. Bicycle and pedestrian travel also became more difficult since interconnecting paths, sidewalks and trails were not mandated in local zoning ordinances.

The First Studies

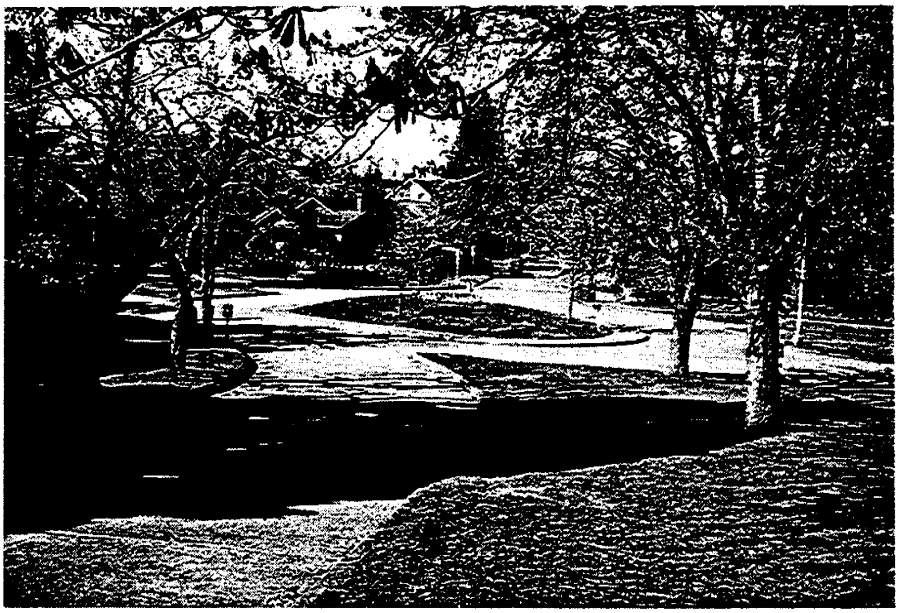
Planning guides and technical references specifically on the traffic problems of residential streets began first appearing in the early to mid 1960's. A seminal work, *Traffic in Towns*[2] by Colin Buchanan of the United Kingdom Ministry of Transport (1963), looked at the effect that suburban commuter traffic had on inner-city neighborhoods in England. Buchanan noted the threats to quality of life posed by greater congestion, air pollution, noise, and by the lower levels of safety and freedom of movement for local residents. Buchanan first introduced the concepts of "environmental traffic management" and the "environmental capacities" of residential streets.

By placing the traffic problems directly in the context of "life in the neighborhood," Buchanan pointed in the right direction. Later studies looked at the conflicts between urban mobility and neighborhood quality of life.

The Rise of Traffic Calming

"Traffic calming" for residential areas is a concept that seeks harmony between automobiles and people. Calming the traffic means to lower vehicle speeds and traffic volumes, usually through physical changes to the streets themselves and through laws on parking and speeds. With lower speeds and less through traffic, the street environment becomes more hospitable to residents, pedestrians, bicyclists and even playing children.

Traffic calming initially started out as a treatment for individual streets. However, the benefits of the managed traffic were limited mostly to those living on the affected street. Gradually, the concept was widened to include residential street networks and even main roads. Traffic calming has been applied the most in cities in Europe, and it is there that we find the broadest range of techniques.



The 1960's and 1970's saw the rise of a traffic calming movement in Europe. Germany closed streets in central areas and pedestrian areas covering many blocks in major cities and towns. Traffic calming was matched with urban development and urban renewal efforts. Numerous resident associations were formed to see that these policies were carried out by local governments. This "grass-roots" political pressure resulted in new 30 kph (20 mph) speed limits in built-up areas of many German cities and towns. A report by the German Research Society of Road and Transport[3] found that the traffic calming measures had reduced average speeds, reduced accident severity and reduced air and noise pollution in neighborhoods.

Woonereven

Cities in the Netherlands were the earliest and most aggressive proponents of programs that protected the residential environment from automobile traffic. In the early 1970's, the Dutch created a concept known as a "residential precinct" or "Woonerf," where cars were expected to adapt to pedestrians. Cars were not necessarily banned, but speeds were kept at walking pace. Access was limited, and cars were not allowed to park in rows. The entrance to woonereven were specifically marked by signs, so drivers were aware that they had entered a space where the rules of the road were different. The physical character of the road changed also through curb cuts, plants, street furniture, different pavements, and speed humps. However, the design concept always stressed high degrees of visibility – a driver's view should not be obstructed, but the path need not be necessarily straight.

The original woonerf concept called for makeovers of existing streets, with a large number of required design elements. The distinctions between pavement, sidewalk and landscape blurred and vehicles were expected to share the same space and move at the same speed as the pedestrian. While the concept proved effective, its construction and maintenance costs were high, and were found to be too expensive to be applied over large areas.

The Dutch then began experimenting with simpler, more economical approaches. One alternative changed the traffic circulation system by creating more one-way streets. Another sought to eliminate through traffic and to lower speeds through speed humps and parking rearrangements. The latter method proved to be a good middle ground by being a cost-effective way to reduce through traffic and accident rates. Unlike the woonerf neighborhood, the roads on such streets were not considered shared space for pedestrians – pedestrians and vehicles had separate rights of way.

In the later 1970's in West Germany, cities began to borrow some of the concepts of the woonerf and applied them across different neighborhoods and districts. West German cities created shared spaces, including "pedestrian-friendly squares" where cars were allowed at slow speeds. There were whole districts where speeds were lowered, speed-reducing devices were used, and parking plans were altered to narrow the roadway without reconstruction. By the mid 1980's, several state-sponsored research projects assessed the effect of these approaches throughout entire communities, and found them to be successful by a surprisingly large range of measures. The programs were affordable, they improved safety, and the streets were themselves more attractive and livable. Most importantly, they had wide public support.

Figure 2-3. Woonerf

With a 1977 amendment to its Road Traffic Act, Denmark carried the woonerf concept one step further by creating a category of residential roads where motor vehicles are required to yield to pedestrians and bicyclists. These "Section 40 areas" were established to give priority to non-motorized uses of the streets by its residents while at the same time providing adequate access to the homes and businesses along them. Speeds in such areas are posted at 15 kph (10 mph).

Silent Streets

Denmark adopted another class of roadways which become known as "silent streets." Such roads still give motor vehicles priority over pedestrians, but physical measures are used to restrict 95th-percentile vehicle speeds to 30 kph (20 mph). They have been very successful at reducing traffic speeds and injury/fatal accidents, as well as vehicle noise and intrusion (hence the name "silent streets").

Denmark also addressed the problems of through traffic impacts in small towns and commercial centers. This concept, termed "environmentally adapted through roads", uses traffic calming devices on arterial streets to slow traffic to 40 kph (25 mph) in heavy travelled pedestrian areas. As shown in Figure 2-4, this treatments uses a strong visual gateway and warning signs to alert motorists that they are approaching a special area.

"Ville plus sure, quartiers sans accidents"

This French program, translated as "Safer city, accident-free districts" was launched in 1984 with the concurrent goals of reducing traffic speeds and accidents, and increasing economic activity and livability. Although focused on major thoroughfares in smaller cities, the program employed traffic round-abouts, extensive visual treatments such as street trees and gateways, and variations in horizontal alignment which force lower travel speeds to achieve its goals.

The success of this program has been demonstrated by a 60 percent overall reduction in annual accidents in the districts where it has been applied. These areas have also seen increased pedestrian activity and building renovations, leading to economic revitalization and increased property values.

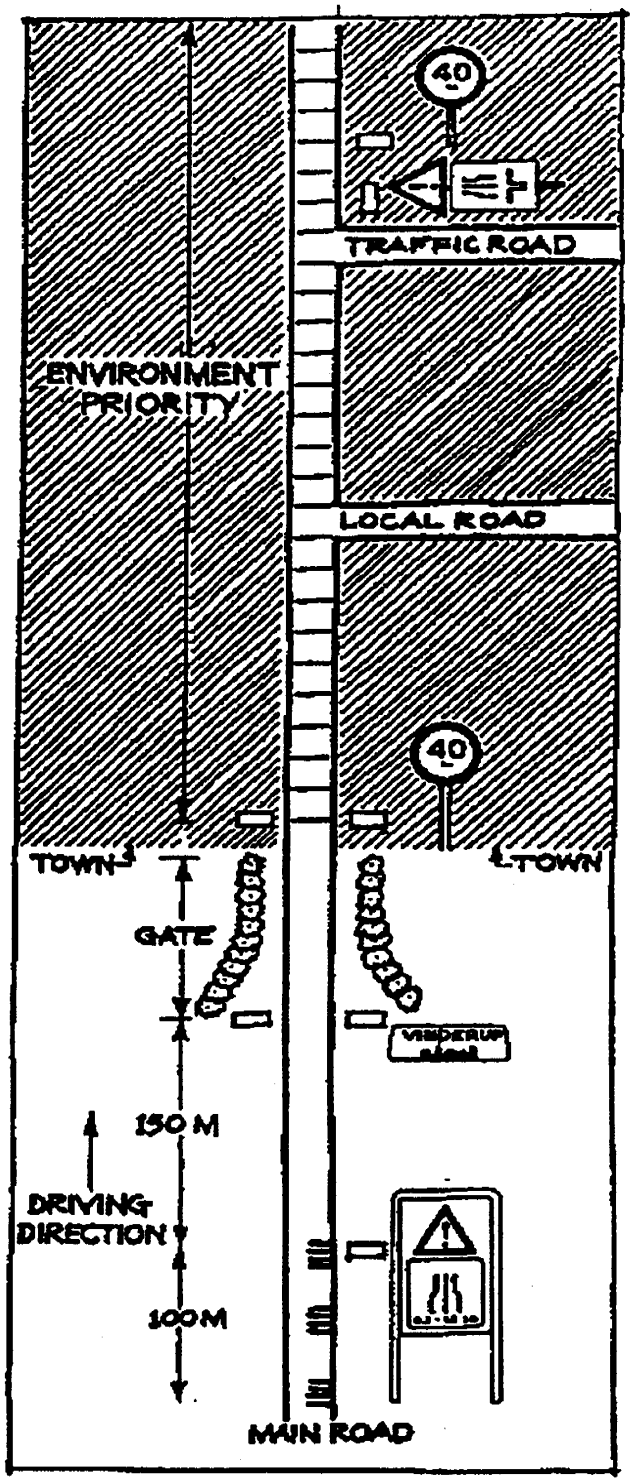


Figure 2-4. Environmentally Adopted Through Road

British experience

In Britain in the 1970's and 80's, a number of different approaches were used to manage traffic and preserve the residential environment, but with limited success One of the earliest steps was to reinforce and in some

cases recast the street hierarchy through roadway closures. Streets were sorted by their primary purpose, to carry traffic or give access, or some combination of these. As in West Germany and the Netherlands, the rearrangement of the street circulation patterns did not solve every residential traffic problem; it made some streets better, but it worsened conditions for people living on the busiest streets. Some open, shared roads and spaces were created, but mostly on a limited basis, and speed reducing devices were rarely applied. The British approach to managing traffic seemed to be based on the idea that drivers would slow down if their visibility was limited — and that did not appear to always be the case.

Local Area Traffic Management (LATM)

In Australia in the 1970's, Australian authorities began Local Area Traffic Management (LATM) schemes which applied now recognized techniques like narrowed streets, speed humps and circuitous routings to reduce speeds and volumes in residential areas. The National Association of Australian State Road Authorities (NAASRA) publishes nationally-accepted road design, construction and user standards. Part 10 of their *Traffic Engineering Practice* provides a standard guide on "Local Area Traffic Management."[4] This guide could be used as the "definitive" textbook on how to start an RTM program in the U.S., Canada or Great Britain.

One of the most influential and informative documents related to RTM was authored by a citizens group in Brisbane, Australia, who were opposing a freeway through their community. *Traffic Calming: a solution for Route 20 and a new vision for Brisbane*[5] gives a succinct explanation of traffic calming principles and makes compelling arguments for a multi-pronged approach to transportation planning focused on the needs of the community rather than the needs of its vehicles. It also discusses "eight myths of traditional traffic planning" which lay the foundation for its traffic calming alternatives.

Efforts in United States

A landmark study by Appleyard and Bartell[6] in 1972 looked at the environmental quality of city streets in San Francisco. Streets with different levels of traffic were studied, and the researchers found that residents on all streets were concerned with traffic safety, but the people living along the busiest streets were the most affected by other related problems like noise, vibration, fumes and soot. The residents on the busiest streets were much less likely to spend time in front of their homes, know their neighbors, or allow their children to play along the street.

Appleyard's work culminated in *Livable Streets* which has become a standard text on residential street design and traffic management. Both Buchanan and Appleyard concluded that residents' perceptions of the "capacity" of a street in a residential area was far below the physical capacity of the same street from the traditional traffic engineering perspective. Appleyard concluded, for example:

> The environmental capacity of most residential streets might therefore be reached in the 500 to 800 vehicles per day range. The speed of drivers must also be considered. Speed limits for the top 15 percent [of drivers] should be in the 15 to 20 mph range for children to be secure. (*Livable Streets*, page 272.)

Urban Design

The findings of the Appleyard study strongly influenced later principles of urban design. As a result of the study, the City of San Francisco changed its policy with a new urban design plan that sought to protect designated residential areas throughout the city. Where the city had previously emphasized mobility and speed of travel, its emphasis now shifted to improving public transit, concentrating traffic on major facilities, and making physical or cosmetic changes to minor streets to discourage through traffic. Throughout the 70's and 80's and into the 90's, other cities throughout the United States and abroad have taken similar steps. Correspondingly, the number of projects, methods, and the technical studies on the subject of neighborhood traffic control have grown dramatically.

Neo-traditional Neighborhoods

Although the focus of most RTM programs is on retrofitting existing streets to make them safer and more pleasant, neo-traditional neighborhood design (NTND)

aims to achieve these goals by building the streets right the first time. Like the concepts discussed above about the roles of the residential street, NTND holds that pedestrians, bicyclists, transit and cars must share the street in a balanced way and that the street-scape is an integral part of the neighborhood environment. NTND developments are characterized by:

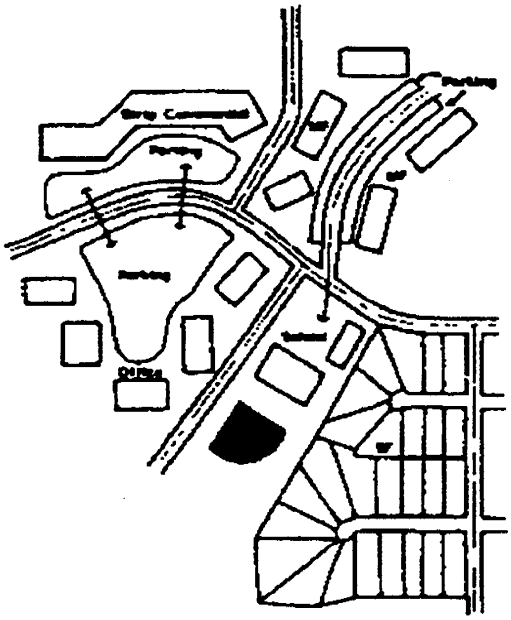
- Streets are laid out in regular, connect, geometric patterns so that there are alternate routes available to every destination.
- Streets are treated as complex public spaces, containing traffic and parking, and they are an integral part of the visual panorama consisting of the trees, sidewalks and buildings which front on them.
- The streets are relatively narrow within the street scape and are well-defined by the buildings along them.[7]

For residential traffic management, the most important neo-traditional design element is the low design speed of the residential streets. Street widths are kept narrow (less than 30 feet with parking); curb radii are limited to 20 feet or less; on-street parking is encouraged on both sides; superelevation is discouraged on curves; and pavement treatments such as undulations, special pavers and chokers are used along with extensive landscaping – all in an effort to assure that actual travel speeds do not exceed the 20 mph design speed. These neo-traditional design principles parallel those used in the most successful RTM programs.

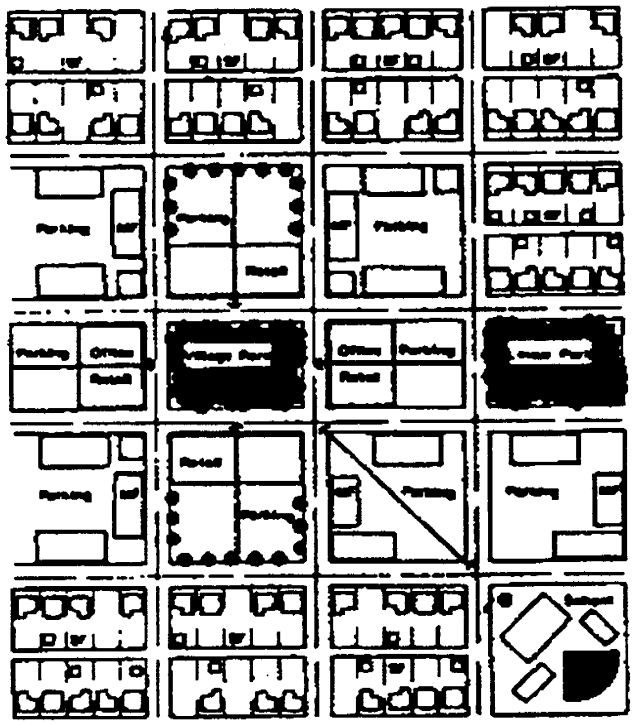
The Institute of Transportation Engineers has recently issued report on street design and traffic planning for NTND projects. *Traffic Engineering for Neo-Traditional Neighborhoods*[8] addresses a variety of design and operational topics where traditional traffic engineering practices conflict with the goals of NTND projects. It recognizes that the design of streets in NTND projects should give a higher priority to pedestrian uses than to automobile traffic flow.

Safety

The dangers of vehicle/pedestrian accidents have been clear since the early days of motor vehicles. The first recorded incident happened on August 17, 1896 in



Typical Subdivision Layout



Neo-traditional Street Pattern

Figure 2-5. Neo-traditional neighborhood design concepts

	Pedestrian	Cyclist	Moped	Auto
Pedestrian				
Toddlers	■	6 mph	X	X
Under 6	■	■	6 mph	6 mph
6 - 12	■	■	15 mph	15 mph
Adult	■	■	25 mph	25 mph
Elderly	■	■	15 mph	15 mph
Cyclist	■	■	15 mph	15 mph

Source: Vahl, H.G. and J Giske; *Traffic Calming Through Intergrated Urban Planning* (Amarcande, Paris, France, April 1990), page 18.

Table 2-3. Acceptable "confrontation speeds" in built-up areas

London when a car driven by one Arthur Edsal struck and killed a pedestrian, Bridget Driscoll, at the Crystall Palace. That same year, a bicyclist in New York City suffered broken bones in his run-in with a motor car.

Pedestrian accidents

In the last decade, collisions between motor vehicles and pedestrians or bicyclists were second leading cause of accidental death in Washington State for children between 5 and 14 years old; the greatest number of accidental deaths in this age group occurred while being an occupant in a motor vehicle. Studies show that most young pedestrians (under 15) who were killed or injured were crossing the road mid-block and not at an intersection. Most pedestrian accidents occur from 3 to 6 p.m., when children are most likely to be out.

Most pedestrian accidents can be prevented if drivers are going slow enough to stop quickly. Recognizing that setting acceptable speed limits is largely a political issue, Dutch researchers have developed a table of confrontation speeds, reproduced in Table 2-3, that provide some guidance on how slow is slow enough.

"Confrontation speeds" listed in Table 2-3 are based on drivers' reaction times and stopping distances, and the ability of pedestrians of various ages to recognize and respond to an approaching vehicle. The listed speeds apply on both residential and commercial streets in built-up areas. They are appropriate for areas with aggressive programs to "calm" traffic, and where streets are considered public space, rather than just a place for moving cars.

In the United States, the need for reduced speeds in residential areas is echoed in ITE's handbook on *Residential Street Design*:

> Moreover, research has shown that pedestrians are usually not seriously injured when hit by a car moving at a speed of less than 20 mph (30 km/h) at the time of impact. If impact speeds are between 20 and 35 mph (30 and 55 km/h), injuries are usually serious, while above 35 mph (55 km/h) they usually endanger life or are fatal.[9]

Traffic circles. Seattle has documented considerable success with its traffic circles. As early as 1982, Seattle reported reductions in intersection collisions of 77 to 91 percent as a result of installing traffic circles. (For example, see James Dare and Noel Schoneman, "Seattle's Neighborhood Traffic Control Program." *ITE Journal*, February 1982.) Large reductions in the number of accidents were found even when traffic volumes changed little from before the circle installation. Similar experience has occurred in recent years as well for new circle installations.

European experiences with RTM and pedestrian safety

According to a Danish study[10] by, the introduction of 30 km/h speed limits on residential streets in 1978 resulted in a significant reduction in pedestrian injuries and fatalities. For a sample consisting of 223 km of 30 km/h streets, Engel and Thomsen found a mean speed reduction of –11 km/h (before and after comparison). Over a three-year period there was a **24% decrease** in accidents and a **45% reduction** in casualties.

Similar research with 30 km/h speed limits in the Netherlands[10] found an overall average **reduction** in injury accidents of **25%** in 15 experimental areas over a six-year period. The initial results demonstrated a 40% reduction in injury accidents within the first three years of the street change. Accident levels subsequently rose to stabilize at an overall 20% to 25% decrease from the pre-30 km/h speed conditions.

Simply changing the speed limit alone is not enough to reduce accidents. In the Dutch experiment, locations without strong physical controls, such as signage only, showed little difference from the overall trend in

accidents in the surrounding area. However, streets where the 30 km/h speed limit was supported with speed humps, raised intersections, street narrowing, or traffic circles showed the greatest speed and accident reductions.

Follow-up studies on Denmark's "silent roads" found that fatalities dropped 72 percent and serious injuries declined by 78 percent on roads designated as "silent roads." Similar 30 kph roads in Holland, Germany and France experienced declines in accidents and injuries in the range of 27 to 60 percent over previous years.

The European experience demonstrates conclusively that RTM programs and devices can be successful in making streets safer for pedestrians, bicyclists and motorists.

For Further Reading

For those wishing to learn more details about RTM, this guidebook provides references aimed at two audiences: the local traffic engineer or city administrator responsible for setting up an RTM program, and the citizen or elected official interested in dealing with residential traffic problems. These references are listed in Table 2-4.

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Table 2-4. RTM References

Endnotes

[1] Donald Appleyard and Daniel T. Smith, Jr.; *State of the Art: Residential Traffic Management*, US Department of Transportation, Federal Highway Administration, Washington, D.C., December, 1980.

[2] Colin Buchanan; *Traffic in Towns: A Study of the Long-Term Problems of Traffic In Urban Areas,* Her Majesty's Stationery Office, London, England, 1963.

[3] *The Theory and Practice of Traffic Calming: Can Britain learn from the German Experience?*, Dr. Carmen Hass-Klau, Environmental and Transport Planning, Discussion Paper 10, January 1990, Brighton, England.

[4] National Association of Australian State Road Authorities (NAASRA); *Traffic Engineering Practice Part 10, "Local Area Traffic Management"*, Sydney, Australia, 1992.

[5] Citizens Against Route Twenty (CART), *Traffic Calming, The Solution To Route 20 And A New Vision For Brisbane*, Brisbane, Australia, 1989.

[6] Donald Appleyard; *Livable Streets*, University of California Press, Berkeley, CA, 1981.

[7] Eva Lerner-Lam, Stephen Cleniker, Gary Halbert, Chester Chellman and Sherry Ryan; "Neo-traditional Neighborhood Design and Its Implications for Traffic Engineering"; Institute of Transportation Engineers, *1991 Compendium of Technical Papers.*

[8] Frank Spielberg, et. al., *Traffic Engineering for Neo-Traditional Neighborhoods, An Informational Report*, ITE Technical Council Committee 5P-8, Institute of Transportation Engineers, March 1994.

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[10] Ulla Engel and Lars Thomsen, "Safety Effects of Speed Reducing Measures in Danish Residential Areas," *Accident Analysis and Prevention,* Vol. 24, No. 1, page 17-28, Pergamon Press, 1992.

[11] A.A. Vis, A. Dijkstra and M. Slop "Safety Effects of 30 Km/H Zones in the Netherlands," *Accident Analysis and Prevention*, Vol. 24, No. 1, page 75-86, Pergamon Press, 1992.

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Chapter 3.
Getting Started

Most people drive cars. Most people consider themselves experienced, "good," even skilled drivers. Getting drivers to change the habits of a lifetime takes a concerted effort.

Many people are also parents, concerned about the safety of their children in their neighborhoods. Parents know that safety education can only go so far in protecting children from being struck by cars. The skills and judgment required to safely interact with traffic can only be acquired by experience. More traffic and higher speeds on residential streets naturally make people concerned about the safety of their children and themselves. On the other hand, keeping children away from traffic prevents them from learning how to act safely around moving vehicles.

Aside from safety, residents are also concerned about the noise, pollution and visual impacts of cars, trucks and buses on their street. Such adverse impacts lead to discomfort and complaints by residents, reduced personal interactions among neighbors and an increase in non-owner-occupied housing as residents move, seeking a quieter place to live.

The hardest part of dealing with each of these valid concerns is getting started — taking the first step. This chapter shows what drivers and residents can do, in partnership with State and local traffic professionals, to make residential streets safer and more attractive.

Overview of the RTM Process

In almost all cases, a Residential Traffic Management (RTM) project begins with a complaint or concern voices by a resident, business person or elected official. Most successful RTM programs use with a three-step process to: (1) respond to the concern raised, provide information on possible solutions and solicit more data; (2) identify and implement low-cost solutions, termed ***Phase 1 Actions*** in this *Guidebook*, to quickly address the problem, and monitor their success; and (3) if necessary, proceed to identify and install more extensive RTM devices or other roadway modifications (***Phase 2 Actions)*** to reduce the adverse traffic impacts.

The flow chart in Figure 3-1 provides a good overview of the RTM process. The monitoring and reporting steps are very important, because they provide needed feedback for both staff and residents. Periodic follow-up checks for "permanent" installations (say every 5

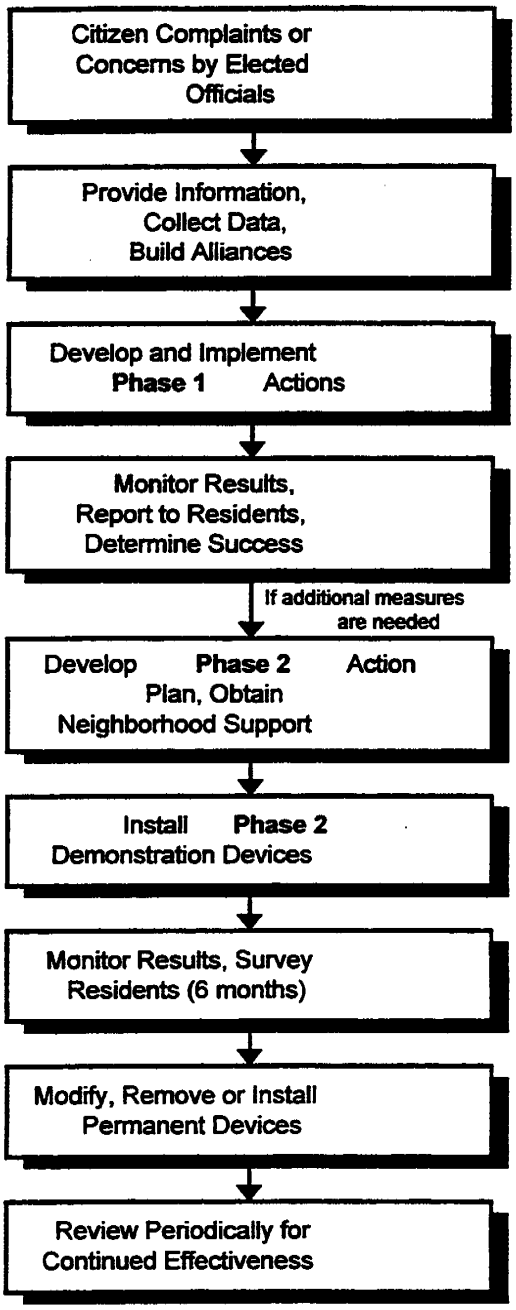

Figure 3-1. The RTM Process

years) are useful because neighborhoods and traffic patterns change over time, and today's solutions may no longer be needed ten years later.

The "Toolbox Approach" used in this *Guidebook* is a hands-on approach which stresses active involvement by staff and citizens in solving residential traffic problems. Solutions, or "tools" have been grouped into ***Phase 1*** and ***Phase 2*** categories in keeping with the step-wise approach shown in Figure 3-1.

The toolbox approach

This guidebook presents a range of tools that can help solve the most common traffic problems on residential streets. For these tools to work, however, they must be understood and supported by neighborhood residents, drivers and the local jurisdiction's engineers and planners. Getting this broad-based, active, informed and sustained support is a challenge, particularly at the neighborhood level.

Many communities have met this challenge and succeeded, often by using a progressive process: from trial and test, to another trial, then on to success. The City of Bellevue, Washington reports that eighty-five percent of the time their initial low cost and most easily implemented RTM measures work to the satisfaction of residents.

The actions and measures for dealing with residential traffic problems are organized here as a "toolbox." Some tools can be used for many situations while others have specific applications. For example, traffic control signs can be used alone or in conjunction with other RTM devices to warn, regulate or inform motorists; speed humps have speed reduction as their principal goal and would not be appropriate for areas where speeding traffic is not a major concern.

The toolbox approach, illustrated in Figure 3-2, provides a meaningful way to categorize and present related RTM actions. Users of this guide can go directly to the toolbox designed to remedy their particular problem without having to sift through a large number of actions and devices.

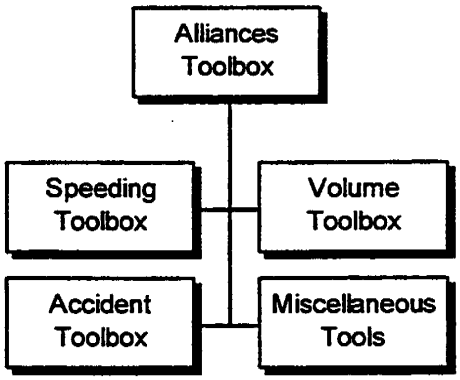

Figure 3-2. The RTM toolbox approach

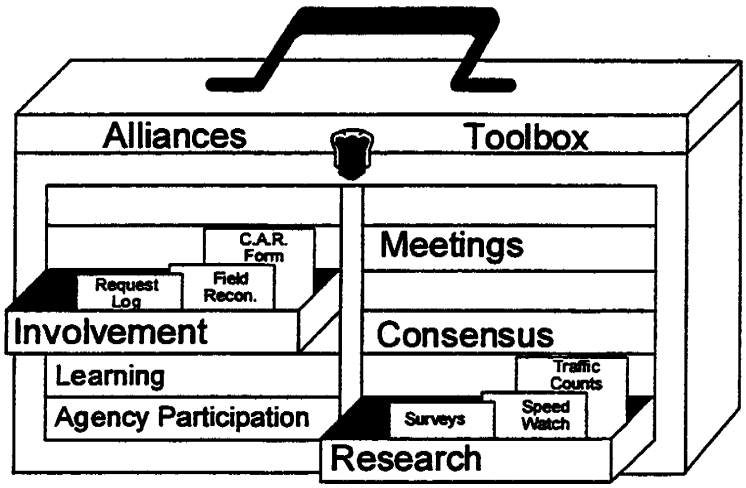

Figure 3-3. Alliances Toolbox

The Alliances Toolbox

The Alliances Toolbox is the first resource for the traffic professionals dealing with RTM problems in a community. It emphasizes involvement, learning and consensus building with the community.

The Alliances Toolbox recognizes that residents are necessary and equal partners when it comes to setting up and supporting on-going RTM programs. Citizens have the power to influence the type of traffic control measures on their street.

Involvement

Involving residents from the beginning garners their trust and cooperation, and leads to success. When a citizen calls in about a residential traffic problem, local staff have a chance to listen, inform and document, with an eye toward building a consensus on dealing with the problem.

In Bellevue, WA, for example, each person reporting a neighborhood traffic problem is asked to complete a "Citizen Action Request Form" (Figure 3-3). The form avoids forcing staff to make a "political" judgment on the validity of each request. Staff members **encourage** the person making the complaint to discuss the problem and possible solutions with their neighbors. A description of the city's RTM program and commonly used RTM devices are given out with the form. The information process begins with the first phone call, and continues throughout the interactions between city staff and residents.

With this approach, the citizen's concern is recognized and staff have a starting point for community involvement in the solution. At the same time, issues that are viewed as a problem by only a few people tend to be

CITIZEN ACTION REQUEST FORM

FOR THE FIRST PHASE IN NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

Contact Name: _____ Day Phone: _____
Address: _____ Today's Date: _____
Neighborhood: _____
Concerned Location: _____

What concerns have you identified at the above location?

_____

_____

What Phase I solutions do you feel would address your concerns? (Check one or more)

- ❑ Trimming Brushes
- ❑ Signing
- ❑ Enforcement
- ❑ Speed Humps
- ❑ Neighborhood Traffic Safety Campaign
- ❑ Other _____

_____

Thank you for taking the time to fill out the Citizen Action Form. After completing the form, fold it for mailing (address appears on the other side of this form). Don't forget to use first class postage. Once we receive the form, we will contact you to investigate traffic solutions.

FOR OFFICE USE ONLY

Date Received: _____ Project Number: _____
Field Investigated: _____
Accidents: ❑ Speeds: ❑ Volumes: ❑ Map: ❑
Neighborhood Contacted:
Traffic Improvement Plan Selected: _____

Figure 3-4. Citizen's Action Request Form

weeded out, since the responsibility for building support rests with the citizen.

Formal documentation with the Citizen Action Request Form is an important procedural step. By annually tallying the number of complaints and RTM projects, staff may not only track the quantity of their work, but also demonstrate their successes to the elected officials.

Learning

The learning step involves both staff and residents. Staff learn about the problem, and residents learn about possible options for dealing with it. Of course, residents are encouraged to offer their own solutions, and the dialog between staff and residents leads to solutions which have the greatest chance of success.

At this stage, staff may decide to collect data and conduct a detailed field review. A "Proposed Improvement Plan" may be prepared and reviewed with other city departments. Involved citizens are notified of the staff's actions, and another community meeting is scheduled to review the proposals.

The Learning process involves finding answers to two basic questions. The first:

- Is this problem really an RTM problem, or is the complaint really the result of some factors better dealt with by other city departments?

It is important to quickly channel complaints to the proper staff for action. Some common complaints which are not really RTM problems include:

- Restricted sight distance at intersections due to vegetation – this problem can be addressed by public works maintenance staff.
- Children crossing busy intersections on their way to and from school – the school district can examine the need for school crossing guards.
- Potholes and pavement deterioration – again, public works maintenance staff should deal with this problem.
- The "neighborhood feud" syndrome where one particular person/family/household is the problem – this is best dealt with in direct discussions with the offending party.

The second question is:

- Is RTM *really* the solution?

This question needs to be asked early on. A frank discussion about the likelihood of RTM success in those situations where it's not appropriate, and where to look for other solutions.

For example, if the real cause of traffic through the neighborhood is diversion from a parallel arterial, the best answer may lie with improving the arterial, not making it more difficult to cut through the neighborhood. However, RTM measures may be good remedial actions until more comprehensive solutions are implemented.

The Learning process results not only in informed residents, but also in better-informed staff members who can answer questions raised by managers and elected officials, who are often the first persons some residents call when they have a problem. Professional knowledge, objectivity, analytical skill and the willingness to experiment provide the real foundation for local staff in resolving neighborhood traffic problems.

Consensus

The consensus tool builds on the Involvement and Learning steps. It forges a partnership between staff

Figure 3-5. Neighborhood Speedwatch

and residents on the RTM program. Traffic personnel have dual roles to play in dealing with traffic control on residential streets. On the one hand, they must participate in consensus building so that neighborhood traffic programs are supported by residents/voters. On the other hand, they must function as objective fact gatherers and "neutral" dispensers of information.

The Consensus step deals with likely opposition to putting traffic restraints in the street by welcoming all views, especially strongly held ones, early in the program. Strongly held opinions and concerns move people to action, and they often reflect the problems residents encounter daily. When residents realize that others share their concerns, and that staff respects their views, consensus building begins.

Some alliances are short lived and are single issue oriented; and many local traffic issues can be resolved quickly through active discussion. Other times, a single issue may unite groups that oppose a particularly onerous "solution".

If staff act cooperatively and credibly in the learning process, common ground can be set for discussion the problem. Opposing groups can use, and then debate shifts from arguing about data and impacts to the fairness and values of various tactics. This process is important because those remedies that are universally perceived as being fair stand the best chance of working.

Local consensus among agencies is also needed. In successful RTM programs, traffic personnel work with police and fire services from the beginning so that needed services are not impaired. In this way, emergency services representatives become part of the RTM team rather than potential critics.

Each community has its own political dynamics, so a "cookie cutter" approach won't fit all cases. Traffic personnel alone cannot accumulate the support needed for instituting an RTM program in any community. Finding allies to support a program requires preparation, education and perseverance.

Research Tools

Residents and staff can cooperate in a variety of essential data collection and research activities to define/refine a problem. Information is needed to quantify the scope and magnitude of the problem, develop a range of alternative solutions, and to provide a baseline for a "before and after" evaluation of the chosen solution's effectiveness. The four types of needed information are:

- Traffic operational data,
- Organizational data,
- Social and attitudinal information, and
- Environmental factors.

Common types of data collection and research activities are listed in Table 3-1. This list is a starting point. Some problems will require just one or two of the activities, others may require steps not found in this list. The activities must reflect the situation, the jurisdiction's resources and the willingness of citizens to donate their time and talents.

Some measures, such as a speed study combined with a license plate survey to indicate where the vehicles are registered, allow the residents to participate in the field work and see the problems first hand. Such activities are very instructive, and allow staff to build teamwork with the residents. These joint activities foster consensus and form the partnerships that may be needed if restrictive physical measures become necessary to keep cut-through traffic out of the neighborhood.

Operational Data

- Traffic volume counts
- Traffic speeds
- Accident history
- Bus routes
- Characteristics of any major traffic generators in the area (schools, offices, industrial plants, shopping malls, etc.)
- Vicinity traffic flow patterns
- Parking availability and utilization surveys
- Bicycle and pedestrian routes and usage
- Roadway features and design characteristics (e.g., curbs, sidewalks, street width, curvature, etc.)
- Planned roadway improvements

Organizational data

- Local residential organizations (such as neighborhood associations or homeowners' associations) and other stakeholders
- Local interest associations and their leaders
- Area businesses
- Addresses, telephone numbers, meeting schedules, etc.
- Monitoring and reporting mechanics

Social/attitudinal data

- Population characteristics (age group)
- Perceptions of traffic impacts and needs
- Attitudes about RTM restraints
- Willingness to support neighborhood RTM program

Environmental data

- Physical land form characteristics
- Location of any sensitive environmental areas
- Noise measurements
- Land use and density information
- Planned changes in land use
- Emergency services facilities and access routes

Table 3-1. Examples of Initial Data Needs for RTM Program

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Chapter 4.
The RTM Toolboxes

The various traffic management techniques described in this chapter can be thought of as "tools" for "repairing" residential traffic problems. We have grouped these techniques into categories ("toolboxes") to assist users of this guide in their thinking about Residential Traffic Management (RTM). The choice of a specific tool in a given instance depends not only on the nature of the problem, but also upon the character of the neighborhood and the onerousness of the solution (tool). Some tools, if selected without the support of enough local residents along the affected streets, may alienate so many people that the solution is perceived as worse than the problem. Even when a majority agree on a specific remedy, often it's necessary to try out a series of tools before one works to the satisfaction of the majority of interests.

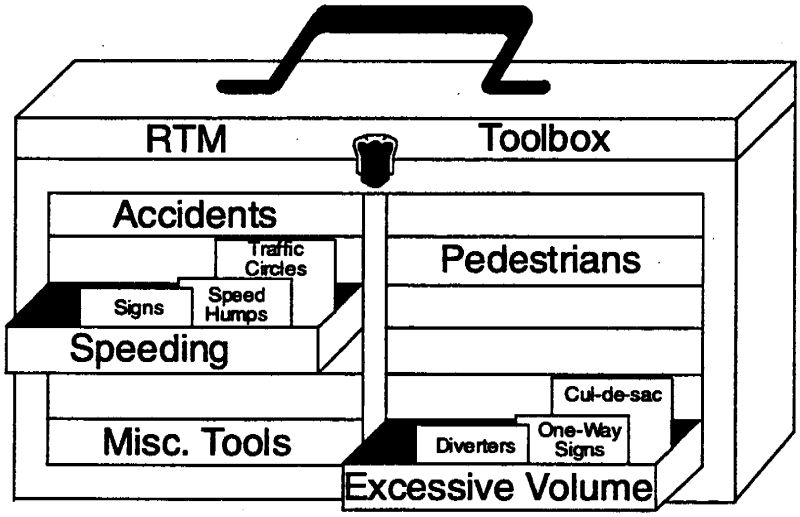

Figure 4-1. The RTM Toolbox Approach

A Catalog of RTM Tools

The research study identified published references to more than 80 individual traffic control devices or measures which have been used for residential traffic management. These devices ranged from speed humps and diagonal diverters to variable-spaced transverse pavement markings and odd speed limit signs (e.g., 16 mph). The reported levels of success and application feasibility varied greatly as well. Table 4-1 lists the principal characteristics of 26 devices or groupings of individual treatments which have been combined for ease of discussion.

The listing of RTM actions in Table 4-1 is divided into Phase I and Phase II categories. The Phase I actions are lower cost and less restrictive than Phase II options, and they can usually be implemented quickly. For example, the City of Bellevue, Washington, reported that 85 percent of their residential traffic complaints can be "solved" (i.e., the complaining neighbors are satisfied with the results) with Phase I responses.

The Toolboxes

In this guide, we have grouped the measures in four toolboxes:

- **Speeding**
- **Volumes**
- **Accidents**
- **Miscellaneous Tools**

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Device	Definition	Volume Reduction	Speed Reduction	Change in % trucks	Environment/Pollution Changes in conditions		Safety			Emergency/ Service Vehicle Access/Delay	Dependence on Police Enforcement	Level of Violation	Type/ Classification of Street			Impact on Adjacent Arterial	Use on Bus Route	Use with Driveways On Street	Use with Curbs & Gutters	Construct Cost/ Problems	Maintenanc Cost/ Proble	Aesthetics/ Landscapin Potential	Useful for Spot/Areawide Problems
							Vehicle Conflicts	Pedestrian	Bicyclist				Collector	Local Streets									
					Noise	Air							Commercial	Neighborhood Collector	Local Access								
Bicycle Lanes	Lanes reserved for bicycles	No	No	No	No change	No change	-	-	Improved	No effect	-	Low	Yes	Yes	Yes	No	Yes	Plan with care	-	Low	Low	-	Both
Crosswalks	Painted pedestrian crossing areas mid-block or at intersections	No	No	No	No change	No change	No change	No change	No change	-	-	Low	Yes	Yes	Yes	No	Yes	Yes	Yes	Low	Low	No	Both
Curb Extensions (Entry, Exit, Mid Block)	Extension of the curb into the roadway to create a narrower travel lane to protect parking strip or shorten pedetrian crossing distance	No	Slight	No	Slight Improvement	No change	No effect	Improved	Plan with care	No problems	-	-	Yes	Yes	Yes	No	No	Yes	Yes	Moderate	Low to Moderate	Yes	Both
Diagonal Diverters	Barrier placed diagonally across an intersection to force drivers to make a sharp turn but not allow other movements	Yes	Likely	Yes	Reduction	Improved	Improved	Varies	Varies	Minor Constraint	Self Enforcing	-	No	Avoid	Yes	Yes	Plan with care	Yes	Yes	Low	Moderate	Yes	Usually Areawide
Enforcement (Visible & active police presence)	Extensive traffic enforcement, "emphasis patrols,"	Not likely	Yes, temporary	Not likely	Possible reduction	No change	-	Improved	Improved	-	High	Low	Yes	Yes	Yes	Yes	Yes	Yes	-	-	Moderate	-	Both
Forced Turn Islands, Barriers, Channelization	Traffic islands or curbs specifically designed to prevent traffic from executing specific movements at an intersection	Yes	Likely	Yes	Reduction	No change	Improved	Improved	Varies	Minor constraints	-	Low	Yes	Yes	Yes	Yes	No Major Effect	Yes	Yes	Can be complex	Low	Optional, Depends upon priority	Both
Median Barriers	Barrier along the center line of a roadway to prohibit left turns or cross traffic	Yes	No	Possible	reduction	Decrease	Improved	Varies	Varies	Minor constraints	-	Low	Yes	Yes	Yes	No	Possible	Plan with care	Yes	Complex	Varies	Varies	Both
Median Entry/Exit Islands	Traffic islands used to create narrower roadway at entry/exit point	Possible	No	Possible	Possible reduction	Possible Decrease	Improved	Improved	Varies	Minor constraints	-	Low	Yes	Yes	Yes	No	No	Yes	Yes	Low	Varies	Yes	Both
Median Mid Block Islands	Traffic islands between intersections to create a narrower roadway or provide refuge for crossing pedestrians	No	Slight	Slight	No change	No change	Improved	Improved	Varies	Minor constraints	-	Low	Yes	Yes	Yes	No	Possible	Plan with care	Yes	Low	Low	Varies	Both
Mid-Block Slow points, Chicanes	Curbed islands or curb extensions protruding into the roadway, leaving a single-lane or narrow two-lane gap, often at an angle to the centerline	Yes	Yes	Likely	Reduction	Decrease	Improved	Improved	Questionable	Minor constraint	Self Enforcing	-	Yes	Yes	Yes	No	Yes	Avoid near driveways	Yes	Moderate	Moderate to High	Yes	Both
Neighborhood Traffic Safety/Campaign Program (Education)	Distribute safety information, special pedestrian safety clases for children	No	Not likely	Not likely	No change	No change	-	Possible Improvement	Possible Improvement	-	-	-	-	-	-	-	-	-	-	-	-	-	Both
Neotraditional Neighborhood Design	Integrated land use and transportation design to increase transit and non-motorized travel to non-residential destinations within the neighborhood	Likely	Likely	Likely	Likely reduction	Unknown	Improved	Improved	Improved	No constraint	-	Low	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Can be high	Varies	High	Area
Novelty signs	"Slow - Nudist Crossing", etc.	No	No	No	No change	No change	No change	No change	No change	-	-	High	No	No	Yes	-	-	-	-	Low	High	No	Spot
Odd speed limit signs	"13 MPH", etc.	No	No	No	No change	No change	No change	No change	No change	-	High	High	No	Yes	Yes	-	-	-	-	Low	High	No	Spot
One-Way Entry/Exit Chokers, Half closures, Semi-Diverters	A barrier to traffic in one direction of a street which permits traffic in the opposite direction to pass through	Possible	Yes	Not likely	Reduction	No change	Improved	Improved	Improved	Minor constraint	Initially high	Varies	Avoid	Avoid	Yes	Possible	Plan with care	Yes	Yes	Low	Moderate	Yes	Both
One-Way streets and signs	Restricted entry/exits to/from neighborhoods, one-way street patterns	Yes	Varies	Possible	Reduction	Improved	Improved	Improved	Improved	Plan with care	Low	Low	Yes	Yes	Yes	Yes	Plan with care	Yes	-	Low	Low	-	Usually Areawide
Parking Variants Class I (Zones, Signs, Striping, timed, resident restricted)	Parking areas create narrower roadways and increased activity leading to increased attention by drivers	Possible	Likely	Likely	Possible reduction	No change	Possible Improvement	Possible Improvement	-	No effect	Low	Varies	Yes	Yes	Yes	Yes	Yes	Yes	-	Low	Low	-	Both
Parking Variants, Class II (Shifting Traveled Way)	Alternating parking from one side of street to the other, parallel or diagonal	Possible	Likely	Not likely	Possible reduction	No change	Increased conflicts	Possible Improvement	Varies	No effect	-	-	Yes	Yes	Yes	No	No	Yes	Yes	Low	Low	Yes	Spot

Table 4-1. A Catalog of RTM Actions

Device	Definition	Volume Reduction	Speed Reduction	Change in % trucks	Environment/Pollution Changes in conditions		Safety			Emergency/ Service Vehicle Access/Delay	Dependence on Police Enforcement	Level of Violation	Type/ Classification of Street			Impact on Adjacent Arterial	Use on Bus Route	Use with Driveways On Street	Use with Curbs & Gutters	Construct Cost/ Problems	Maintenanc Cost/ Proble	Aesthetics/ Landscapin Potential	Useful for Spot/Areawide Problems
							Vehicle Conflicts	Pedestrian	Bicyclist				Collector	Local Streets									
					Noise	Air							Commercial	Neighborhood Collector	Local Access								
Pavement Treatment, Class II (Texture/Composition, Patterns, Color)	Special pavement compositions and markings to alert drivers of special conditions	Not likely	Possible	Possible	Possible reduction	No change	-	Possible Improvement	Varies	No constraint	-	-	Yes	Yes	Yes	No	Yes	Yes	-	Low	Low	-	Both
Pavement Treatments, Class I Marking and Striping & Color	Special pavement markings at entries, hazard locations or crosswalks to alert drivers of special conditions	No	Possible	Not likely	No change	No change	-	Possible Improvement	-	No effect	-	-	Yes	Yes	Yes	No	Yes	Yes	-	Low	Low	Yes	Both
Raised Crosswalks	Crosswalks raised transversely across the pavement	Possible	Yes	Not likely	No change	No change	-	Improved	Plan with care	Minor constraint	Self Enforcing	-	Plan with care	Yes	Yes	Yes	Plan with care	Yes	Yes	Moderate	Low to Moderate	Yes	Site
Speed Alert w/Warning	Residents use radar to clock speeds, record license plate numbers, police send notice to drivers	No	Varies	Not likely	Slight, temporary, reduction	No change	-	Slight, temporary, improvement	No change	-	High	-	Yes	Yes	Yes	No	Yes	Yes	-	-	Low	-	Both
Speed Bumps (about 3.5"h X 6")	Short strips of raised pavement, avoid using on public streets	Possible	Varies	Yes	Increased noise	Increase	Safety problem	Improved	Plan with care	Significant problems	Self Enforcing	-	No	No	No	-	No	-	-	Low	High	-	Spot
Speed Humps (about 2.75-4"h X 12')	Raised sections of pavement across the traveled way with curved transitions	Possible	Yes	Possible	No change	No change	-	Improved	Plan with care	Minor constraint	Self Enforcing	-	Plan with care	Yes	Yes	Yes	Yes	Yes	Yes	Low	Low to Moderate	Yes	Both
Speed limit signs	"25 MPH in residential areas", etc.	No	No	No	No change	No change	No change	No change	No change	-	High	High	Yes	Yes	Yes	No	-	-	-	Low	Low	No	Both
Speed Tables (3-4"h X 22')	Speed humps with a long flat section, often used as crosswalks	Possible	Yes	Possible	No change	No change	-	Improved	Plan with care	Minor constraint	Self Enforcing	-	Plan with care	Yes	Yes	Yes	Plan with care	Yes	Yes	Moderate	Low to Moderate	Yes	Both
Speed Watch	Illuminated display shows actual speed to passing drivers	No	Varies	Not likely	Slight, temporary, reduction	No change	-	Slight, temporary, improvement	No change	-	None	-	Yes	Yes	Yes	No	Yes	Yes	-	-	Low	-	Spot
Stop Signs	Stop signs, two way or four way, used to assign right-of-way at intersections.	Seldom	Varies	Not likely	Increased noise	Increase	Varies	Varies	Varies	No constraint	Low	Varies	Follow MUTCD guidelines	MUTCD guidelines	MUTCD guidelines	No	Yes	Yes	-	Low	Low	-	Both
Street Closures, Cul-De-Sacs	A complete barricade of a street at an intersection or a dead end street	Yes	Yes	Yes	Reduction	Improved	No	Improved	Improved	Significant constraints	-	-	No	No	Yes	Yes	No	Yes	-	Moderate	Moderate to High	Yes	Both
Traffic Circles	These geometric design features force traffic at intersections into circular maneuvers	Possible	Yes, near circle	Yes	No change	No change	Improved	Varies	Varies	Minor Constraint	Self Enforcing	-	Plan with care	Yes	Yes	Yes	Plan with care	Yes	Yes	Low	Moderate	Yes	Both
Traffic signals	Vehicle or pedestrian actuated	No	Possible	No	Increase	Increase	Improved	Improved	Improved	-	-	Low	Yes	Avoid	No	No	-	-	-	Moderate	Low	No	Both
Truck prohibitions	"No trucks over 10,000 lbs.", etc.	Minor	No	Yes	Likely reduction	Slightly improved	Improved	Improved	Improved	-	-	Low	No	Yes	Yes	Yes	-	-	-	Low	Low	No	Area
Turn Prohibition sign	Regulatory signs at intersections	Yes	Likely	Possible	Reduction	No change	Improved	Varies	Varies	No effect	Low	Varies	Yes	Yes	Yes	Yes	Yes	Yes	-	Low	Low	-	Both
Woonerf	Traffic calmed residential area where the street is an extension of the front yards and vehicles share street space with bikes and pedestrians	Yes	Yes	Yes	Significant reduction	Improved due to lower vol.	Improved	Improved	Improved	No constraint	-	Low	No	No	Yes	No	No	Yes	Yes	High	Varies	High	Spot

Table 4-1. A Catalog of RTM Actions

Each toolbox contains the actions most appropriate to address a specific problem, i.e., speeding traffic, high volumes in residential areas and high accident experience at a residential intersections, plus a "catch-all" for other ideas appropriate for special situations. Overlap among the tool boxes cannot be avoided, but this initial sorting can allow the user to first examine what has worked best in similar situations for his or her particular problem.

The tools have been arranged in a particular order. Common sense suggests that we start with the least onerous, often lowest cost solution first; then move to more restrictive ones as needed. However, frequently the first choice is enough to "solve" the problem; "solve" in the sense that residents benefit sufficiently from lower speeds, less noise, fewer cut-through drivers, etc. to stop complaining. Experience shows that these less onerous, but effective solutions can be used as tests, or thresholds, before the more expensive measures are employed. Further, in a number of cities with effective programs, these initial measures are bundled together to form a package of solutions that comprise Phase I (or year one) of a two-phased program. The more restrictive physical devices, e.g., speed humps, traffic circles, diverters, are normally used in the second phase after a lack of success has been demonstrated with the Phase I measures.

The following sections describe each toolbox and, separately, the tools themselves. The discussion about the toolboxes provides an overall approach to dealing with the various problem situations which arise in residential neighborhoods.

The effectiveness of these tools will vary from one instance to the next. For example, a 25 mph speed limit sign placed on a long, wide, downhill, straight street with few parked cars is probably not going to induce many drivers to drive at or below 25 mph. An *average speed* of 35 mph would not be uncommon on such a street. Often, 10 to 15 percent of the motorists will be going down the hill at more than 40 mph. We could even argue that the street was designed to induce speeds in excess of the 25 mph limit; certainly the effect of the design in this situation is undesired speeding.

In addition to speed limit signs, our Phase I speeding toolbox lists other eight potential actions. A "Speed Alert" or "Speed Watch" program is usually the first step in most jurisdictions for dealing with confirmed speeding problems on local streets. A major benefit to the Speed Watch action is that it directly involves local residents in gathering data on who the speeders really are. More often than not, the speeding drivers turn out to be their own neighbors, not just "outsiders" cutting through the neighborhood on their way to or from work. Documenting who is causing the problem can help achieve the desired result through peer pressure in some cases.

Stop signs are the most-often requested traffic control device in residential areas. Although the basic purpose of a stop sign is to assign right-of-way at an intersection, residents often believe that the installation of stop signs, or a series of stop signs, at previously uncontrolled intersections will reduce speeds and volumes of cut-through traffic. Unfortunately, experience has shown that this is not usually true[1]. A

The Speeding Problem Toolbox

Speeding is such a common problem that we will use it to illustrate in detail how the toolboxes are used in the RTM program. As shown in Table 4-2, the "Speeding" tool box contains measures of increasing severity or traffic restraint. They are also arranged in phases to separate those measures that can be implemented quickly at little expense from those actions which require more planning and a longer lead time.

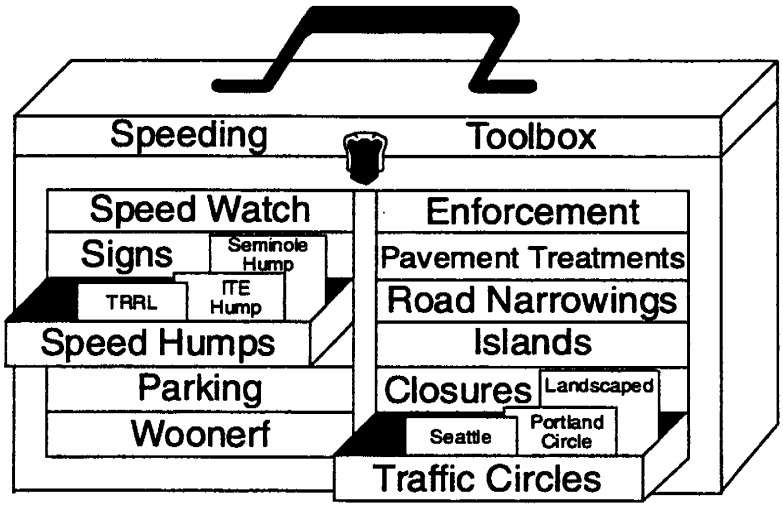


Figure 4-2. The Speeding Toolbox

Table 4-2
Speeding Tool Box
By Program Phase

Phase I Toolbox	Phase - II Toolbox (When Phase I Measures Fail)	
	Intersections & Entry Ways	**Along the Street/Street Section**
Warning, Caution Signs	Pavement pattern, texture, color variations (e.g. Cobblestone street section pseudo humps etc.)	Landscaping: foliated trees in planted strip, curb extensions, median islands. (shortens width, depth of view)
Speed limit, zone signs	Landscaping: foliated trees in circles, curb extensions, islands (Shortens width, depth of view)	Parking variants e.g. add parking, change parallel to diagonal, perpendicular, staggered, alternating
Pavement striping, marking, coloring	Raised street surface, e.g. Speed tables, thresholds of minor street	Curb extensions that don't alter number or width of lanes, e.g. protected parking
Rumble Strips	Chokers (half closures), using curb extensions to reduce turn/curb radii, lane width/number/access/egress	Median islands (lengths vary, may serve as turn barriers)
Speed Alert, (large, illuminated, roadside speed display in driver's view; shows driver's actual speed)	Traffic circles, rotaries, round-a-bouts	Raised Crosswalks
Police visibly present (enforcement)	Median islands, barriers, turn channeling	Speed humps,undulations, dips; speed tables/platforms
Speed watch/warning. Residents use radar, record license plate # of speeders, police send letter to alert/warn vehicle owners of observed vehicle speed, request compliance.	Diagonal diverters	Slow Points. Chokers, curb extensions that reduce number and or (less effectively) width of lanes; includes chicanes; are typically one lane two-way (Slow points may also be two lane two-way.)
Photo Radar. Police offsite, automatically issue tickets to owners of speeding vehicles. Photos contain pictures of license plate and occupants of the car.	Street closure	

more thorough discussion about using stop signs in an RTM program is presented in the section on "Paint, Buttons and Signs" later in this chapter.

The City of Portland, OR, developed a systematic approach for installing stop signs at uncontrolled intersections within a residential neighborhood. The Neighborhood Stop Plan[2] may be implemented on local access streets arranged in a grid pattern. Using a "Denver stop pattern," this application of stop signs establishes a pattern of stopping traffic on every other block throughout the entire neighborhood. Since there are no "through" streets in this pattern, it encourages an even distribution of traffic within the neighborhood. However, this program is not intended to reduce speeds or volumes, but rather to establish a rational traffic control plan in a residential area with grid streets.

Police enforcement is an effective short-term tool, but few police departments have the resources to respond to every neighborhood's complaint about speeding traffic. In addition, research has shown that speeds quickly creep back up once the police leave.

Photo radar is likely to be very effective at speed control, but it is equally controversial. Its use is not yet legally permissible in many states or local jurisdictions; although it has been used in some states on a trial basis, its legality has not been tested in the higher state courts. With photo radar, cameras are carefully positioned to take pictures of both drivers and license plate numbers of only those vehicles that are speeding. Film and data result in automatically issued tickets. Over time, selective use of photo radar might provide a very widespread and positive impact on driver behavior on residential streets. But, along with the many effective physical devices in the phase II speeding toolbox, it probably won't be used very long unless a majority of residents condone its.

More Restrictive Measures

If the actions in Phase I fail to abate speeds on the problem street(s), more restrictive measures may be applied.

In speed control, there is one primary rule: If you force the driver to make a significant side-to-side or up-and-

Figure 4-3. Speed reader board

Figure 4-4. A speed hump in action

down movement (lateral or vertical shift), almost everyone slows down. A second, though not so sure, rule is: If the width of the view ahead is narrowed, such as by foliated trees near the roadway, an actual narrowing of the lane widths (to 10 feet or less) or by buildings next to the sidewalk (i.e., buildings sited with little or no setbacks), a slowing effect may be realized.

The Australian Road Authorities sum up their experience by:

> Maximum vehicle speeds can only be reduced by deviation of the traveled path. Speed reduction can be achieved using devices which shift vehicle paths laterally (slow points, roundabouts, corners) or vertically (humps, platform intersections, platform pedestrian/school/bicycle crossings). Speed reduction can be helped by creating a visual environment conducive to lower speeds. This can be achieved by "segmenting" streets into relatively short lengths using street scapes or changes in alignment to create short sight lines. Pavement narrowing has only minor effects on average speeds, and usually little or no effect on maximum speeds.[3]

The Phase II portion of our speeding toolbox concentrates on actions which follow the above philosophy. Table 4-2 list actions which can be used at either intersections and entry ways, or along sections of the residential street. Physical devices such as speed humps, raised intersections, and "slow points" such as chokers or curb extensions to narrow the roadway, are the most successful means of controlling speeds on existing streets.

Pavement variations, parking variants and landscaping can be effective design tools for new or redeveloped streets. But they are not very useful by themselves in a retro-fit situation.

Traffic circles have found wide application in the Pacific Northwest to reduce travel speeds through neighborhoods. Portland, Oregon, and Seattle, Washington, have used circles extensively throughout their residential neighborhoods to control both speeds and accidents with good success.

Properly designed and installed speed humps are very effective in reducing speeds. Homburger *et al* report 85th-percentile speed reductions of 14 to 20 mph at the hump itself, and "substantial reductions" between devices.[4] Nicodemus reported a reduction in speeds above 30 mph from 34% before the hump was installed to only 8% after installation.[5] A study of 17 "road hump" installations in England found an average speed reduction of 11 mph.[6]

Research has shown that the application of several RTM tools in concert with one another provides the greatest benefit to speed control. Typical combinations include:

- a series of three speed humps spaced about 300 feet apart with advance warning signs and bold diagonal striping;
- speed tables (i.e., raised intersection areas) at key intersections with raised crosswalks between intersections; and
- narrow entryways with special pavement treatments and signing to signify residential areas, supplemented by lane narrowing and repeated pavement treatments throughout the neighborhood.

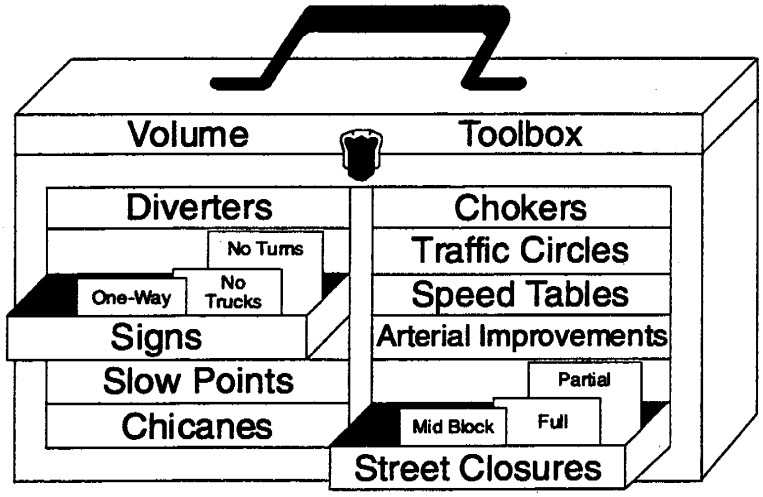


Figure 4-5. The Volume Toolbox

The Volume Problem Toolbox

Many residents complain about too much traffic on their local street. Some jurisdictions, such as the City of Seattle, have a policy of managing traffic in place to reduce speeds and accidents, but do not try and force drivers to use other routes. The reasoning behind this approach is that diverting traffic from one residential street simply shifts the problem elsewhere, and creates new adverse impacts in someone-else's neighborhood.

Cut-through traffic in residential areas often results from congestion on the nearby arterial streets. Drivers forced to wait through several signal cycles at major intersections try to avoid the bottlenecks by using local streets to avoid key intersections. As noted previously, the most effective actions in this case may be to improve traffic conditions on the arterials and attract drivers back to the through street.

The RTM alternative is to increase travel times through the residential neighborhoods, or preclude them altogether in radical cases. The tools listed in Table 4-3 can be highly effective in diverting cut-through traffic, but at the cost of inconvenience to residents as well. Many of the Phase I actions are the same as those in the Speeding Toolbox, because driving times are only shorter through the neighborhood if the drivers travel at 35 or 40 mph. These measures are only marginally effective, however, and would likely only result in a shift in traffic when viable alternative routes are available.

At some locations, a simple turn prohibition supplemented by strict enforcement or a physical barrier, can result in a major shift in traffic. The City of Bellevue, WA, reduced volumes on a section of 108th Avenue NE south of the central business district by prohibiting the southbound through movement at one key intersection and frequent, strict enforcement of the 25 mph speed limit.

One way streets have been applied in cut-through situations to restrict access into or out of a neighborhood at key points. Stop signs have not been included in Table 4-3 because although they can add travel time to a motorists trip, they are not effective in reducing volumes in most cases. (See also the discussion about stop signs under the Speeding Toolbox section above and the "Paint, Buttons and Signs" section below.)

Special treatments on the entryways into residential neighborhoods can be effective in communicating to the driver that he or she is entering a residential area. Narrowed lanes at the entry combined with special

Figure 4-6. Diagonal diverter

Table 4-3
Volume/Cut-Through Traffic Tool Box
By Program Phase

Phase I Toolbox	Phase - II Toolbox (When Phase I Measures Fail)	
	Intersections & Entry Ways	**Along the Street/Street Section**
No Through Traffic signs (Traffic volume reduction is possible only if alternate routes exist)		Parking variants e.g. add parking, change parallel to diagonal, perpendicular, staggered, alternating
One-way Signs (Caution: May also increase cut-through volumes and speeding)	Chokers (half closures), using curb extensions to reduce turn/curb radii, lane width/number/access/egress	Speed humps, undulations, dips; speed tables/platforms
Speed watch/warning (effective only if cut-through time savings are related to excessive travel speeds)	Traffic circles, rotaries, round-a-bouts	Slow Points. Chokers, curb extensions
Police visibly present (enforcement)	Diagonal diverters	
Photo Radar. Police offsite, automatically issue tickets to owners of speeding vehicles. Photos contain pictures of license plate and occupants of the car.	Forced turn channelization	Median Barriers
Turn Prohibition Signs	Full Street Closure, Cul-De-Sacs	

Table 4-3. RTM Volume / Cut-through Traffic Tools

pavement treatments of color or texture and landscaping convey the residential nature of the street and help discourage through traffic. These can be very effective if repeated at key locations such as mid-block crosswalks throughout the neighborhood.

Figure 4-8. Traffic circle (minimal type design)

Diverters

Physical measures to stop selected traffic movements are the best way to deal with unwanted traffic volumes and cut-through traffic. These include street closures (e.g., cul-de-sacs), half-closures to allow only one direction of travel into or out of a given approach at an intersection, or diagonal diverters at intersections which allow left or right turns, but prohibit through movements.

Street closures and diverters create problems for emergency services vehicles because they restrict access. Such measures should be implemented only after a thorough analysis of their benefits and impacts.

The Accident Problem Toolbox

Accidents are not usually a significant problem in residential areas. Most jurisdictions keep good accident records and take remedial actions in a timely manner through their normal traffic engineering processes. The Accident Toolbox, shown in Table 4-4, includes a limited number of RTM actions which may reduce accident rates at residential intersections. In addition, an extensive application of RTM measures in neighborhoods can result in significant reductions in accidents on local access streets.[7]

Often, as indicated under Phase I, the installation of stop or yield signs at key intersections to delineate the primary through movement can reduce right-angled accidents significantly. As noted in the Speeding Toolbox section, the City of Seattle has experienced good success with traffic circles in reducing accident rates in residential areas.

Stop signs, included in Table 4-4 as a possible Phase I measure, are usually an anathema to traffic engineers in residential neighborhoods. Few residential intersections meet current *MUTCD* warrants for stop signs.[8] However, a recent article by LaPlante and Kropidlowski[9] indicated considerable success in reducing accidents with four-way and two-way stops on residential streets in Chicago. Their study of 50 intersections between 1982 and 1988 found a 69 percent reduction in accident rates after stop signs were installed at previously uncontrolled intersections. Yield signs may also be appropriate in certain

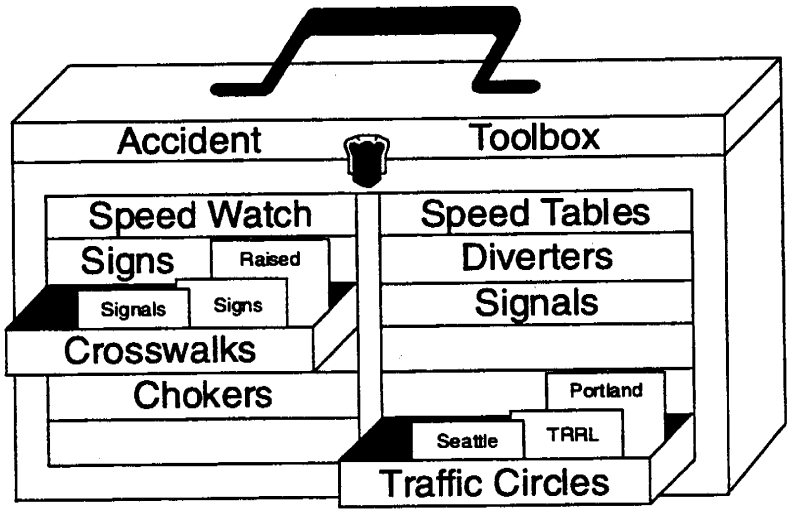


Figure 4-7. The Accident Toolbox

Table 4-4
Accident Problem Tool Box
By Program Phase

Phase I Toolbox	Phase - II Toolbox (When Phase I Measures Fail)	
	Intersections & Entry Ways	Along the Street/Street Section
Speed limit, zone signs	Raised street surface, e.g. Speed tables, thresholds of minor street	Raised and landscaped crosswalks for pedestrian accidents)
Speed watch/warning. Residents use radar, record license plate # of speeders, police send letter to alert/warn vehicle owners of observed vehicle speed, request compliance	Chokers (half closures), using curb extensions to reduce turn/curb radii, lane width/number/access/egress	Speed humps, bumps, undulations, dips; speed tables/platforms (effective where accidents are speed related)
Police visibly present (enforcement)	Traffic circles, rotaries, round-a-bouts	Slow Points. Chokers, curb extensions
Warning signs	Diagonal diverters	
Stop signs	Forced turn channelization	Median Barriers
Yield signs	Full Street Closure, Cul-De-Sacs	
Turn Prohibition Signs	Flashing beacons	

Table 4-4. RTM Accident Tools

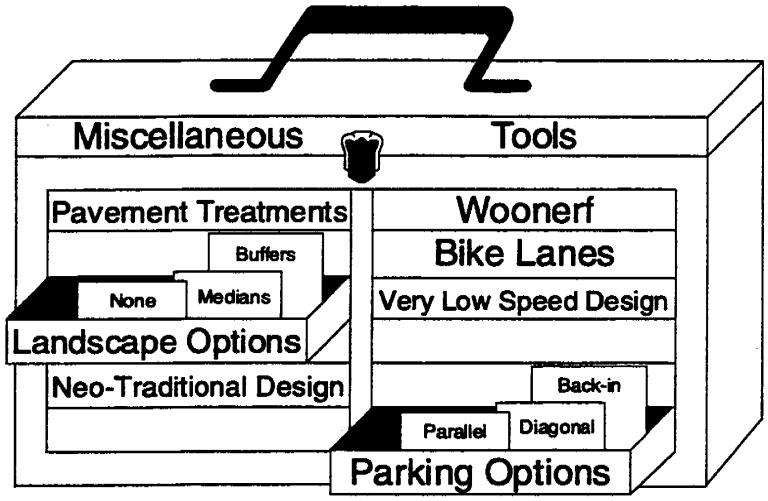


Figure 4-9. The Miscellaneous Toolbox

situations. In short, stop or yield signs may be the best device, and they should not be discarded out of hand.

Obviously, many accidents in residential areas are the direct result of excessive speed by drivers. Thus, all of the actions in the Speeding Toolbox may be applicable in a given accident situation.

Standard traffic engineering measures such as warning signs, proper illumination and pavement markings can be applied at high accident locations in residential areas. Sidewalks, paved shoulders and bike lanes can be used to provide separate traveled ways for pedestrians and bicyclists. The jurisdiction should be careful to maintain the low-speed residential character of the street, and not make it look like an arterial to the driver. The residential street should be made to look and feel as if it is shared transportation space (among residents, pedestrians, bicyclists and motor vehicles), not the exclusive domain of the motor vehicle.

At more serious accident locations, a site-specific study should be made to determine the causes of repeated accidents. At limited sight distance locations, advance warning signs or channelization may be needed even on low volume residential streets.

Miscellaneous Tools

The measures listed in Table 4-5 are mainly design techniques for residential streets rather than specific devices. The woonerf and neo-traditional street design concepts are described briefly in Chapter 1, and several references are listed for further research.[10]

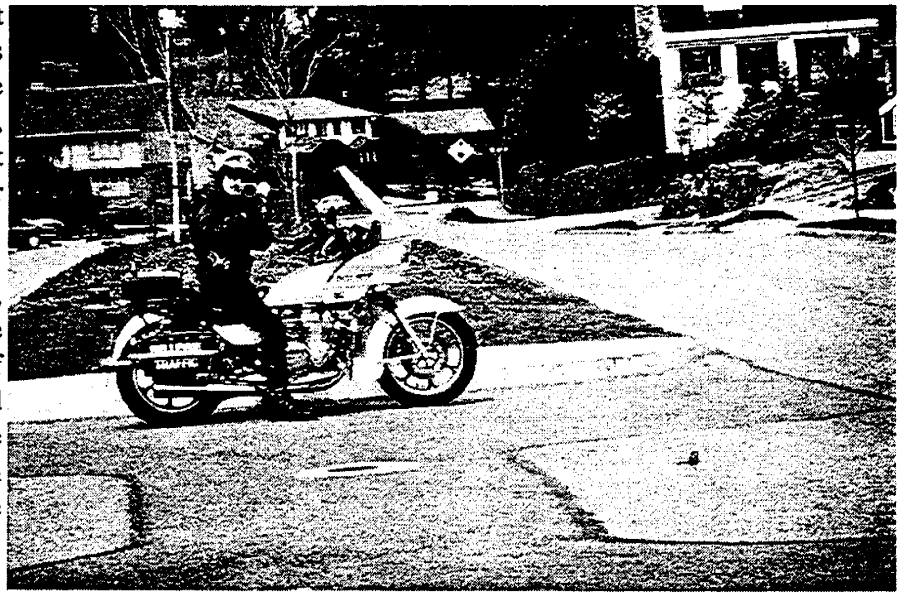
Landscaping is also discussed below, but should be used only as a supplement to other RTM measures such as chokers or entry treatments; landscaping is not a stand-alone measure.

Operational Measures

The following Phase I measures are largely operational, but they can be effective in many instances.

Speed Watch and its variations

Speed Watch is a public awareness program to observe and record vehicle speeds on residential streets, and to notify the owners of these vehicles when and where they were observed speeding. In many jurisdictions it is the first measure when complaints are received about speeding traffic on residential streets because: (1) it gets the neighbors involved in the solution, and (2) it provides valuable data on the severity of the problem.



Miscellaneous Measures	
Pavement treatments	Landscaping
Woonerf	Parking variants such as diagonal parking, back-in only parking
Low-speed design	Bike lanes
Neo-traditional street design	Sidewalks or paved shoulders

Table 4-5. RTM Miscellaneous Tools

Citizen volunteers are trained by city staff in the operation of a radar gun, and a suitable site is selected. Volunteers work in two-person shifts: one operates the radar unit while the other records the vehicle information (time, speed, license number and description) for all vehicles during a set time period. The jurisdiction takes the information and sends letters to the registered owners of all speeders. A cross-check is made before the letters are sent to make sure the license number matches the description of the vehicle.

A variation on this theme is the use of an unmanned radar unit with a reader board to display the speed of the approaching vehicle. It reminds drivers of their travel speed and reinforces their attention to slower speeds in residential areas.

Coupled with frequent police enforcement, this approach can be effective in neighborhoods with speeding problems on one or two through streets.

Enforcement

In specific instances, frequent police monitoring and enforcement of speed limits in residential areas can be effective. Particularly along commuter routes, the constant expectation of enforcement can reduce the travel speeds of frequent users of the street.

However, the limited resources of most police departments makes this option unattractive due to the inherently low-volume nature of the streets in question.

System Operations (one-way streets, etc.)

Some jurisdictions have implemented one-way streets or one-way entry or exit points for residential neighborhoods to reduce cut-through traffic. The degree of success varies with each location.

Two proto-typical one-way street systems for residential areas have been used in RTM programs. Both concepts have proved highly effective in eliminating cut-through traffic. The "one-way maze" concept forces drivers to take circuitous paths through the neighborhood, and the "limited entrance" scheme reduces the number of opportunities for penetrating the neighborhood.

One-way streets also inconvenience local residents and may impede emergency vehicle access. Therefore, their use should probably be limited to extreme situations where cutting through the neighborhood represents a significant time or distance advantage over the arterial routes.

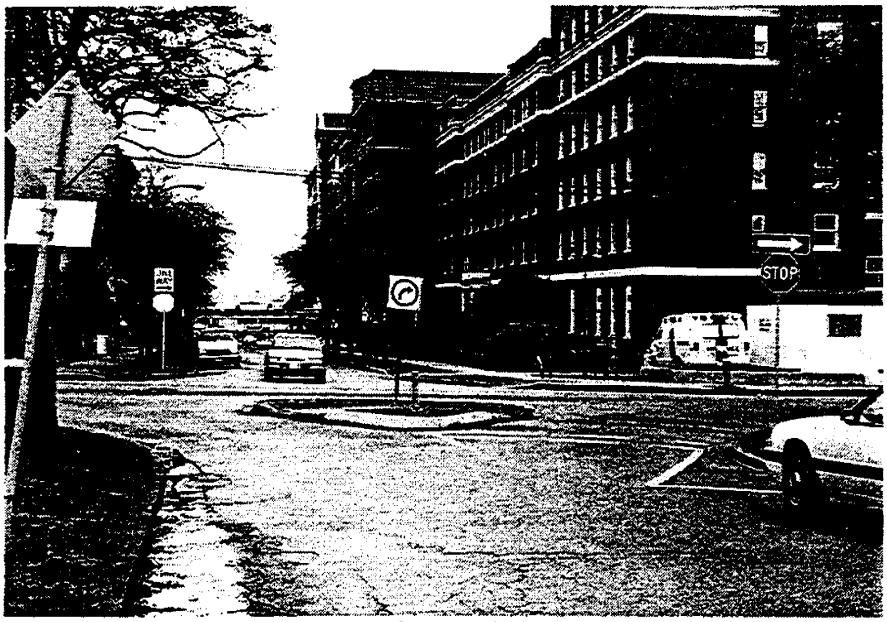


Figure 4-10. One-way Street Example

Paint, Buttons and Signs

This section discusses the traditional and innovative uses of paint, buttons and signs as RTM measures. Innovative applications include variable-width paint stripes (i.e., changing spacing and width to give drivers the illusion of speed), lane delineation with buttons (narrowing lane widths to encourage slower speeds), rumble strips between the traffic lane and ped/bike lane, and stop signs at low volume intersections.

Stop Signs

When traffic problems become noticeable in neighborhoods, stop signs are often the first measure requested by local residents to slow speeders or reduce cut-through traffic. However, numerous studies have indicated that stop signs are **not** effective devices to reduce either speeds or volumes.[11] Typical are the results obtained in a study of two-way stop sign installations at nine residential intersections in Portland, OR.[12] Before-and-after speed studies on all 36 legs of these intersections found that the 85th-percentile speeds remained the same on 19 legs (53%), increased by 2 mph or more on 4 legs (11%) and decreased by 2 mph or more on 13 legs (36%).

Portland, OR's, program to install stop signs on an alternating block basis in neighborhoods with a grid street pattern is an innovative approach to controlling traffic in residential areas. (See discussion under the "Speeding Toolbox" section above.)

Stop signs are traffic control devices used to assign the right-of-way at intersections with significant traffic volumes or accidents. The *MUTCD* lists warrants for stop signs that discourage their use on low volume residential streets, except in cases of "high speed, restricted view (or) serious accident record."

As mentioned before, LaPlante and Kropidlowski[13], found that stop signs in residential areas can have a beneficial safety effect. Their study found a 69 percent reduction in accident rates after stop signs were installed at unsigned intersections.

Therefore, stop signs should be considered as a safety measure on residential streets in urban areas, but should not be used to control speeds or volumes.

Yield Signs

Yield signs also assign right-of-way at intersections, but without requiring drivers to come to a complete stop. Like stop signs, yield signs should be used to address an identified traffic safety problem in a residential area and not for speed or volume control.

Speed Limit Signs and Restrictive Speed Zoning

European studies have shown significant beneficial effects on traffic speeds and pedestrian-related accidents in residential areas with very low speed limits of 15 to 30 km/hr (about 10 to 20 mph)[14]. When these areas are supported by physical RTM measures such as speed humps, traffic circles and roadway narrowings, speed reductions of 20 to 40 percent were observed. However, consistent with American experience, speed limit signing alone resulted in no measurable reductions in average or 85th-percentile speeds.[15]

Thus, it appears that speed limit signs alone will do little to reduce speeds in residential areas.

Figure 4-11. Multi-way stop on low volume residential street

Turn Prohibitions

The installation of "No Right Turn" or "No Left Turn" signs at key entry points to the neighborhood can significantly reduce cut-through traffic. However, their degree of success is directly related to strict and frequent enforcement. At problem locations, the signs should be augmented by channelization to discourage or prohibit these movements.

Pavement Markings

The City of Phoenix, Arizona, has experimented with variable-spaced, variable-width pavement markings in conjunction with speed humps. Their studies indicate a significant reduction in speeds over low humps when the pavement is marked with diagonal stripes that become narrower and more closely spaced as the driver approaches the speed hump. The spacing changes make it appear that the driver is approaching them faster than he or she actually is traveling, thus reinforcing the need to slow down.

Physical Control Devices

This section contains descriptions of some of the commonly used neighborhood traffic control devices. This list is not all inclusive. Other devices are available and may also be considered.

Temporary Installations

Many neighborhood traffic devices can be installed on a temporary basis by using traffic barricades, cones, traffic barrels, and pre-cast traffic barriers. Use the same engineering standard of care as with a permanent installation. Proper signing, channelization, and illumination by street lights or flashing construction warning lights are just as important for temporary installations as with permanent ones. The aesthetics of temporary devices are also important since they will affect the residents' and drivers' perceptions of a permanent device. Figure 4-13 shows a good example of a temporary installation. Residents may be shown illustrations of permanent RTM devices to offset any potentially adverse reactions to the temporary installation.

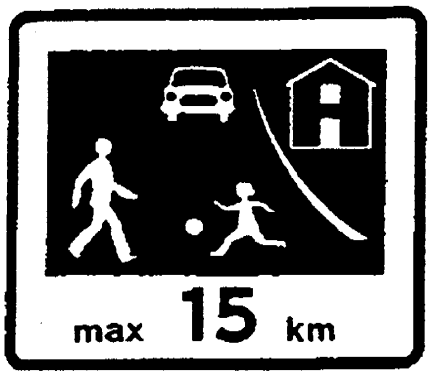


Figure 4-12. 15 Km/H Speed Limit

By installing temporary devices, public reaction can be obtained, traffic patterns reviewed, and changes made before significant amounts of money are spent on permanent revisions. Some cities have installed temporary measures only to discover that the solution was worse than the original problem. Modifying or removing a temporary device is much less expensive (and less embarrassing) than changing a permanent device.

When temporary devices are installed, emergency services personnel should drive through the area with

Figure 4-13. A temporary installation of a street closure

their vehicles and test their ability to navigate the obstacles. Based on their suggestions, be prepared to experiment with revisions to improve the permanent installation.

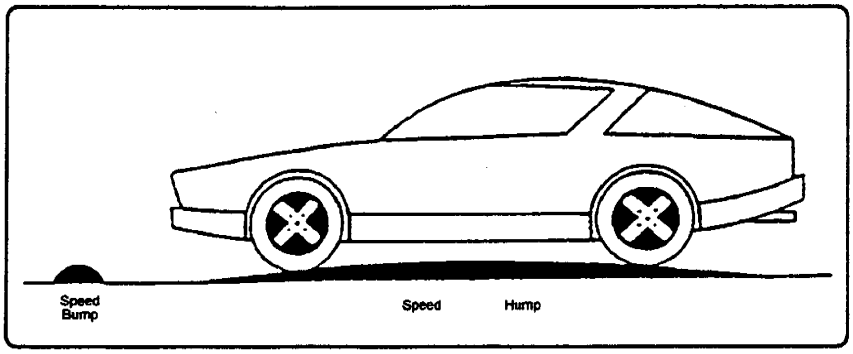


Figure 4-14. Speed hump vs. Speed bump

Speed Humps

A speed hump is differentiated from a speed bump as shown in Figure 4-14, although speed humps are signed as "speed bumps" in some jurisdictions. Speed humps normally have a maximum height of 3 to 4 inches with a travel length of about 12 feet. Speed bumps, commonly used in parking lots and on some private roadways are generally from 3 to 6 inches in height with a length of 1 to 3 feet. **Speed bumps should never be used on public roadways.**

From an operational standpoint, humps and bumps have critically different impacts on vehicles. Within typical residential speed ranges humps create a gentle vehicle rocking motion that causes some drive discomfort and results in most vehicles slowing to near 15 miles per hour at the hump and 20 to 25 miles per hour between property spaced humps in a system. At high speeds a hump acts as a bump and jolts the vehicle suspension and its occupants or cargo.

Numerous designs have been developed for speed humps, and they are the most common RTM device in place today throughout the world.[16] Seminole County, Florida, developed its own speed hump profile and has had good success with its application.[17] Illustrated in Figure 4-15, this profile consists of a segment of a circle with an approximate 72-foot radius, followed by a 3-inch high, ten foot long plateau, followed by a similar radius on the downstream end.

The Institute of Transportation Engineers has recommended a parabolic speed hump design which is based on a profile developed by the Transport and Road Research Laboratory (TRRL) in Great Britain. Shown in the top half of Figure 4-16, this TRRL design produces vehicle speeds near 15 mph at the hump and 20 to 25 mph between properly spaced humps. For contrast, the Australian flat-topped design is shown in the bottom half of this figure.

A recent Recommended Practice of the Institute of Transportation Engineers[18] incorporated the parabolic shape of the TRRL road hump design as its recommended standard for speed humps.

The City of Portland, Oregon, modified this design for use on arterial streets by changing the circular sections to smoother parabolic ones. The Portland design is illustrated in Figure 4-17.

There are no generally accepted standards for signing and marking speed humps. Advance warning signs should be installed upstream of speed humps (100 feet desirable). Figure 4-18 shows a typical signing and striping plan from the City of Bellevue, WA. The

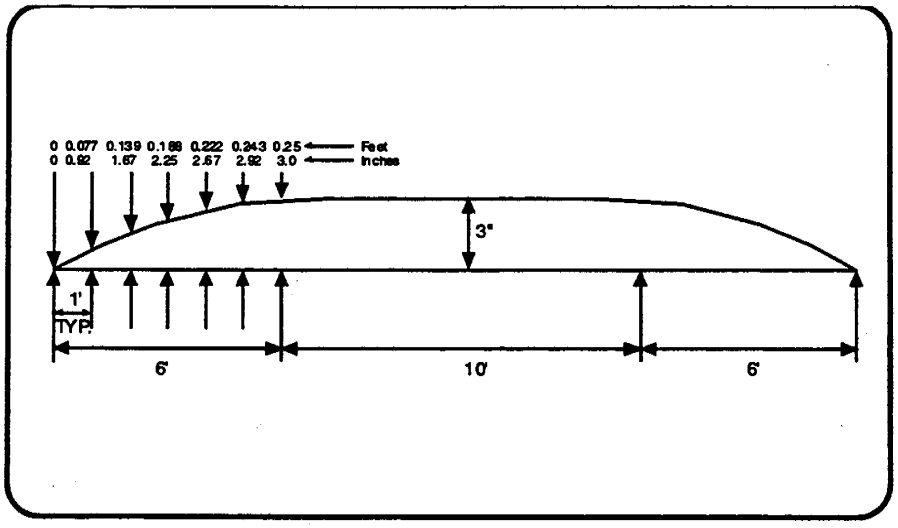


Figure 4-15. The Seminole hump

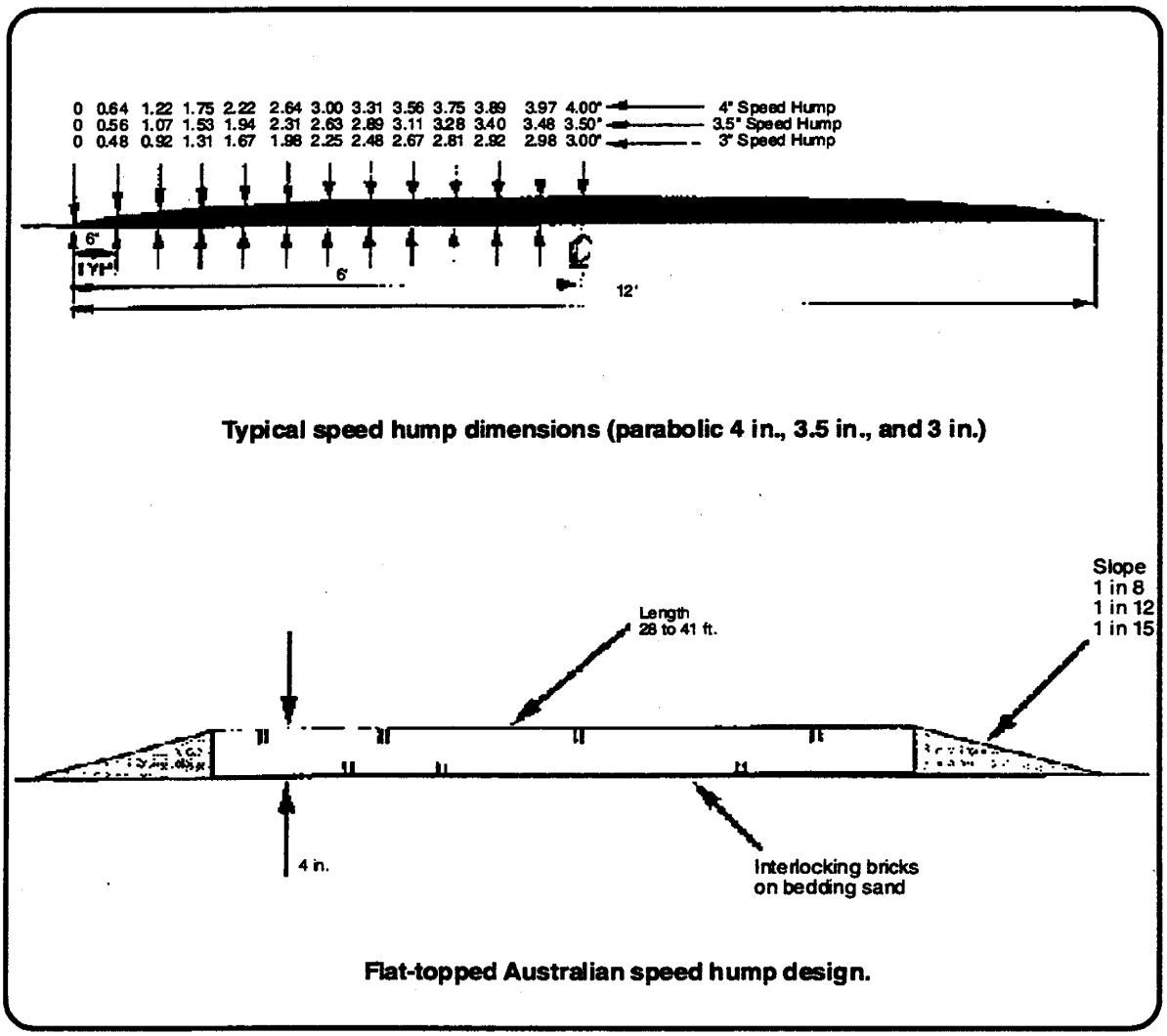


Figure 4-16. The TRRL and Australian road hump design

hump itself should have adequate pavement markings with reflectors or reflective paints so that drivers can clearly see the hump on a dark rainy night.

Repeated experience has shown that several humps in a row along a street are much more effective than a signal hump by itself. Typical spacing should be 400 to 550 feet apart, and they should be located at least 200 feet away from intersections or sharp horizontal or vertical curves which restrict sight lines.

The location of the hump within the street is important. There must be sufficient room on either side of the hump for bicycles to pass without conflicting with by parked cars. Adequate drainage provisions must be included in the hump design so that it does not block a gutter or other drainage way within the street.

The typical installation of a speed hump ranges between $1,500 and $2,000.

Speed humps can be by far the most cost-effective RTM measure for reducing speeds on existing residential streets. While they often generate considerable opposition from drivers, fire departments and service agencies, speed humps have repeatedly been shown to be effective in reducing travel speeds by 5 to 10 mph on residential streets, and they are relatively inexpensive to install and maintain.

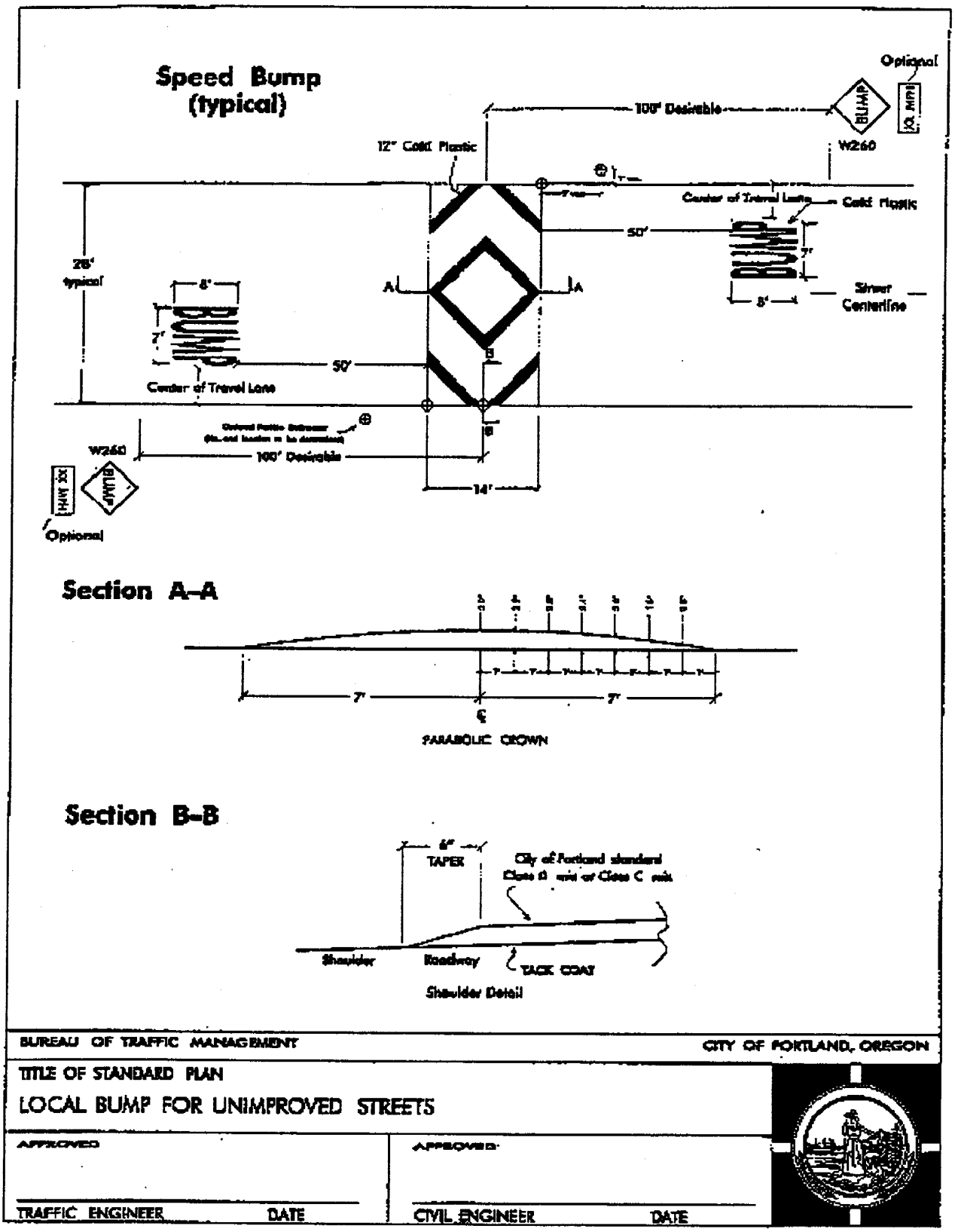


Figure 4-17. Portland's speed hump markings

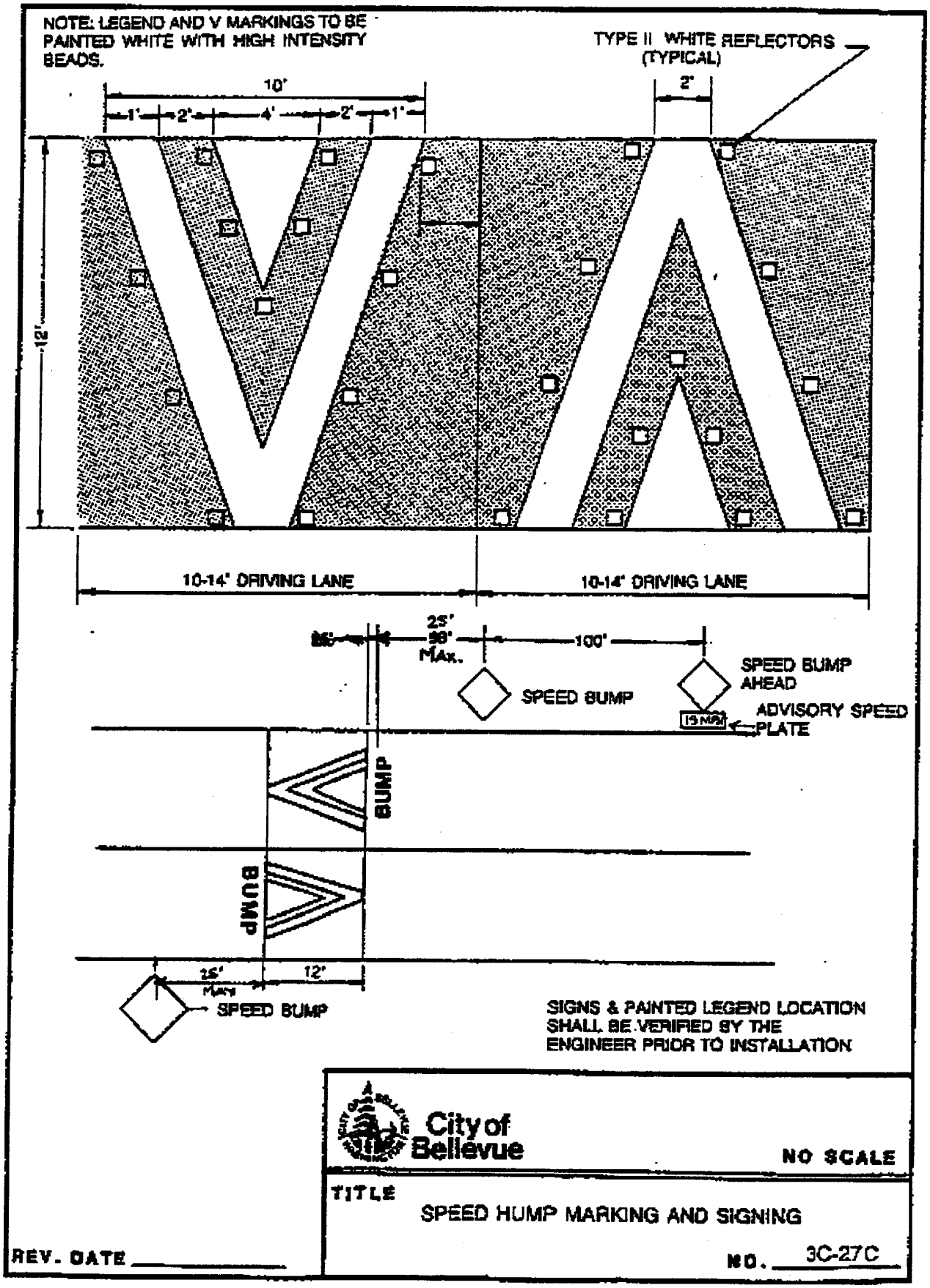


Figure 4-18. Typical signing and striping plan

Rumble Strips and Buttons

Rumble strips are patterned sections of rough pavement or row of traffic buttons placed across the driving lane used to alert drivers to a hazardous condition or the approach to another control device They have had some application for speed control in residential streets, although the noise generated by vehicles crossing the strips tends to create more resident protests than the speeding which they were intended to solve. Therefore, it is not recommended that rumble strips be used as a stand-alone device, but rather to call attention to some other device or warning sign.

Advance warning signs are often installed upstream of rumble strips. Additionally, a sign indicating the purpose of the rumble strip is placed adjacent to the rumble strip (i.e., stop ahead).

Rumble strips can be made from traffic buttons, grooved pavement, or brick paving blocks. Figure 4-19 shows a typical rumble strip made from traffic buttons. Rumble strips can be an effective attention-getting device in specific situations, particularly situations that exist all the time, such as a stop sign ahead, as opposed to school crossings which are in effect only during certain times of the day. Rumble strips are not generally effective at speed control or volume reduction.

Chokers

A choker is a constriction of the roadway at either an intersection or mid-block to constrain the width of the traveled path. Chokers have generally done little to effect traffic volume or speeds, but have been shown to improve pedestrian safety by shorting the length of crosswalks. Figure 4-20 shows a mid-block choker which is used as cross-walk.

Chokers also can be used to define the entrance of a neighborhood and to provide an opportunity for landscaping. Properly designed chokers look as though they have always been a part of the neighborhood's streetscape, rather than an "add-on" feature.

Visibility is a key design consideration and features such as advance warning signs, reflective channelization, reflectors on the curb, street lighting, and elevated landscaping should be used to improve visibility.

Figure 4-19. Rumble strips

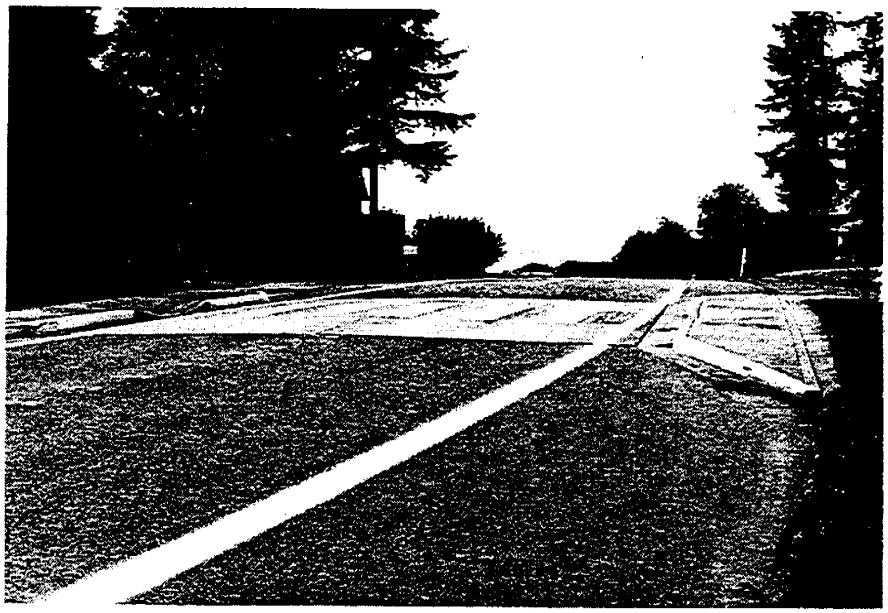


Figure 4-20. Mid-block choker

Curb Extensions

Curb extensions can be used at entry points to neighborhoods to alert motorists of the residential character of the upcoming streets. They are also used to enhance pedestrian crossings at intersections by reducing pedestrian travel time and distance across the roadway. By narrowing the roadway for a relatively short distance, they force drivers to slow down and pay closer attention to the edges of the traffic lanes.

Curb extensions are often used in conjunction with landscape treatments to create protected parking spaces or mid-block crosswalks.

Entry Treatments

There are a wide variety of special treatments for entry points into residential areas which can be used to provide visual and tactile cues to drivers about the residential character of the neighborhood. These treatments usually combine aspects of textured and colored pavements, curb extensions, raised crosswalks or speed tables, a landscape theme and entry signage. The effectiveness of such treatments is limited unless the key elements (street narrowing and landscaping) are repeated at key points in the neighborhood. An examples are shown in Figures 4-21 and 4-22.

Median Slow Point

The City of Portland has developed a design for a median slow point which can be used to reinforce entry treatments in residential areas. The design shown in Figure 4-22 is based on narrowing the traffic lane to 10 feet by constructing a mid-block median and a marked pedestrian crosswalk. The design includes a 5 foot bike lane. The landscape treatment are entry points should be reproduced at the slow point.

Raised Crosswalk or Speed Table

Many jurisdictions have successfully used raised crosswalks to increase pedestrian safety and reduce traffic speeds. These can be located at intersections or mid-block. Essentially, they form an extension of the sidewalk and must have a smooth transition for pedestrians.

Figure 4-21a. Surry Downs entry treatment, Bellevue, WA

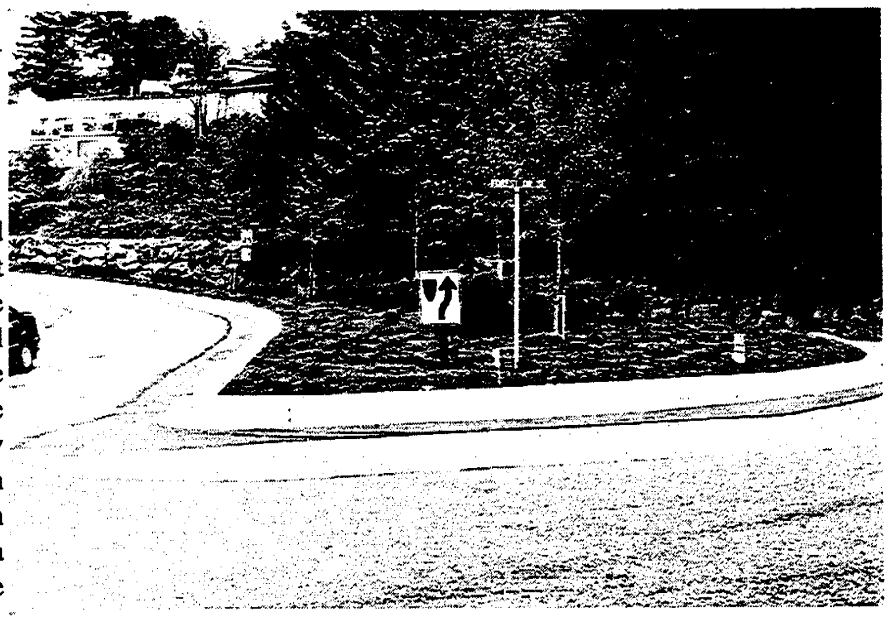


Figure 4-21b. Highland neighborhood, Portland, OR

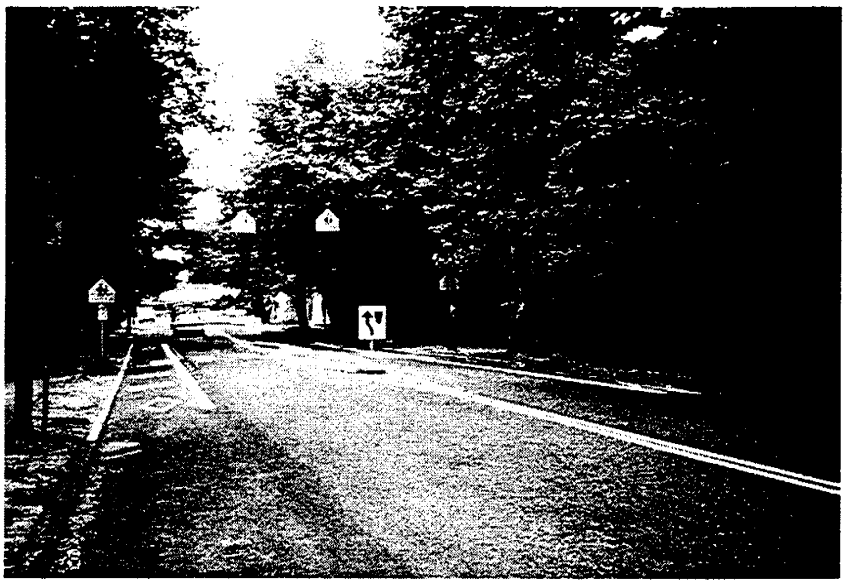


Figure 4-22. Median Slow Point

The raised crosswalk or speed table should have a six-foot parabolic approach transition raising the vehicles 3 to 4 inches above the nominal pavement. The flat section of the speed table should be 10 to 12 feet, and must be striped in accordance with *MUTCD* standards for crosswalks. Texture pavement may be used to further reinforce the speed table's effect on drivers perceptions, but the pedestrian area must be smooth enough to meet sidewalk pavement standards consistent with the Americans with Disabilities Act.

Chicanes or Serpentines

Chicanes or serpentines are devices that alter and slow the linear progression of a driver so that the automobile must shift to avoid an obstacle. Chicanes are generally staggered on opposite sides of the street at regular intervals. They are utilized often on long straight blocks. The devices used for construction may be curb extensions, planters, trees, barrels, fences or barricades (any device that is visible and imposing enough that vehicles will not drive over it). Parking areas are not considered chicanes, though they may have the same effect.

Chicanes are most effective when used in pairs of two or more sets placed 400 to 550 feet apart. This is illustrated in Figure 4-23 from the City of Seattle. As with other devices, visibility is a key design considerations and features such as advance warning signs, reflectors, arrow signs, street lighting, and elevated landscaping should be used to improve visibility.

Raised Intersection

In limited instances, it may be desirable to elevate the entire intersection above the street grade to reinforce the nature and character of the area. Again, texture pavement treatments may be used. This measure is more commonly found in commercial areas with high pedestrian volumes rather than in low volume residential areas, but it may be applicable in a re-development area with an emphasis on neo-traditional design.

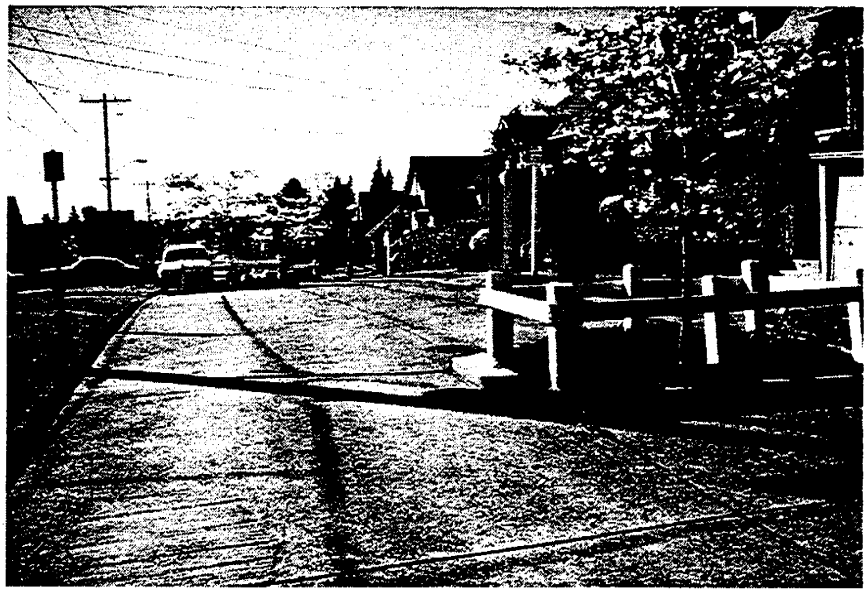


Figure 4-23. Chicane

Traffic Circles

Traffic circles or roundabouts are an effective and attractive technique for traffic restraint. They are round grade-separated areas placed in the center of an intersection. They are typically planted with shrubbery, flowers, or trees. Not only do they require traffic to slow down to get around them, but they also break the line of sight down a street so the driver cannot see any farther than the next traffic circle.

It is important to mark traffic circles well for night-time visibility with illumination, reflector buttons on the street surface, or reflectors on the sides of the concrete (if tall) or on low signs (if low circle). There is no generally accepted proper way to make a left turn at a circle; some jurisdictions allow left-turning vehicles to "short-cut" the intersection by turning in front of the circle, others, such as Boulder, Colorado, install a sign indicating that the vehicle is to drive around the circle to turn left. Cambridge, Great Britain, has marked the outer circle of its roundabouts with chevron tiles or blocks, which add both reflectivity at night and also point in the direction of travel.

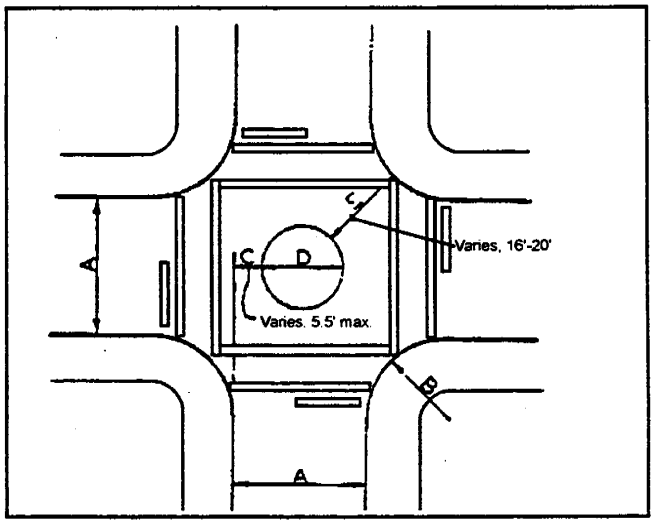
A well done traffic circle can be expensive to install; conversely they may be installed with very little cost. Some jurisdictions, especially when experimenting with them on a trial basis, may use tires, planters, sewer pipes (stood on end), guard rails, or wood barricades. Maintenance of the landscaping could be negotiated with the neighborhood residents, or adopted by a club. (See the following discussion on landscaping.)

The diameter of a traffic circle depends on the width of the intersection streets. The City of Seattle's design criteria are summarized below in conjunction with the schematic in Figure 4-24:

- The distance between a traffic circle and the street curb projection (off-set distance) shall be a maximum of 5-1/2 feet (dimension "C" in Figure 4-24).
- The width between a traffic circle and curb return shall be 16 to 20 feet ("E" in Figure 4-24).
- As the off-set distance decreases from the maximum 5-1/2 feet, the opening width shall increase from the minimum 16 feet.

The City of Portland, Oregon, has experience with two general types of traffic circles. Shown in Figure 4-25, the older type is a simple raised circular island. The new type of island, shown in Figure 4-26, consists of a slightly larger circular outer island "lip" with an additional concentric ring/curb. This new design also makes the middle of the island higher than the older design. Portland's experience with the older islands indicated that some drivers were not turning sharp enough and their vehicle's tires would rub into the island.

The purpose of the newer design is to make the island more conspicuous and make it more difficult for an errant vehicle to mount the traffic circle island. Instead, the larger initial curb/lip of the newer design helps drivers recognize the outer edge of the circle. Furthermore, if the curb of the traffic circle is struck, the newer design is better able to redirect the vehicle along its path and away from the center of the island.



Legend:

A	Street Width	D	Circle Diameter
B	Curb Return Radius	E	Opening Width
C	Off-Set Distance		

Optimum Criteria

Off-set Distance	Opening Width
5.5; max	16' min
5.0'	17' +/-
4.5'	18' +/-
4.0'	19' +/-
3.5' of less	20'

Figure 4-24. Traffic circle design criteria

In a report titled "Technical Evaluation Committee Final Report", prepared for the City of Portland's Neighborhood Traffic Management Program, dated January 1992, the following recommendations were made regarding Portland's traffic circles:

> Recommendations: As part of the City's periodic inspection of all traffic circle intersections, they should review the overall safety of their traffic operations including how vehicles go around the circles and if parked vehicles or fixed objects on the street curbs might constitute a significant hazard. In addition, an evaluation of sight distance for drivers on the minor street should be performed. Adjustments to the parking restrictions or removal/modification of objects that obstruct adequate sight distance should be made as appropriate.

Barriers/Restraints

Ranging from street closures and diagonal diverters, to chicanes and parking strip off-sets.

Street Closures

Street closures fall into two categories. Total closures using cul-de-sacs or half closures where traffic is limited to one direction usually outbound from a neighborhood, called semi-diverters. These devices can be installed temporarily by the use of barricades or guardrail or can be installed permanently with curb, gutter, sidewalk, and landscaping. Temporary closures allow the agency to test the design before permanent closures are constructed. The construction of permanent devices should generally follow the jurisdiction's design standards for residential streets in terms of curb, gutter, sidewalk, and landscaping. With adequate landscaping the street closure (full or partial) can look as if it were part of the initial street design rather than an added afterthought.

Street closures are most effective when added to a neighborhood in groups, in such a way to create a maze eliminating direct through travel. It is therefore important that proper signage be installed at the entrance to the street warning motorists that the street does not go through to the next intersection.

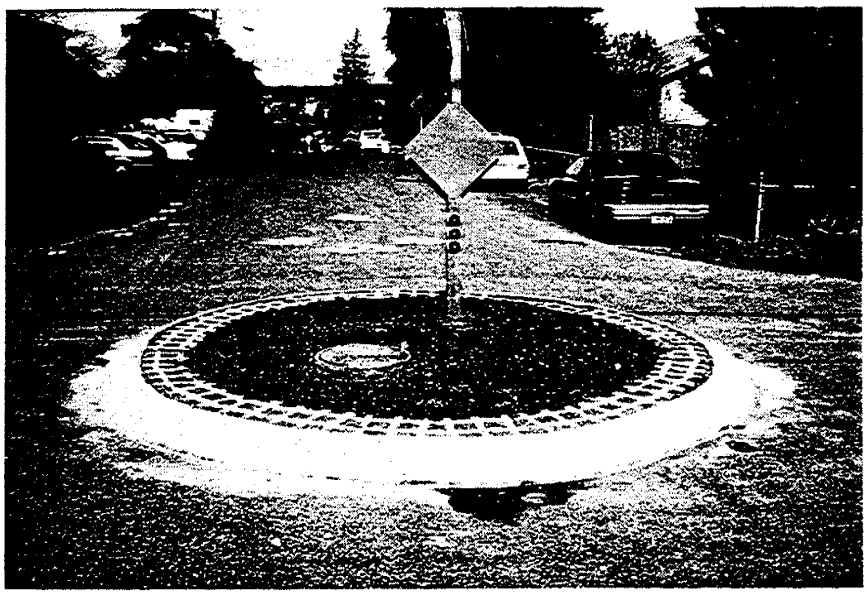


Figure 4-25. Portland's original traffic circle design

Figure 4-26. Portland's newer traffic circle design

A cul-de-sac provides closure of the roadway to through traffic in either direction. A cul-de-sac may be retrofitted to an existing street either at an intersection as shown in Figure 4-27 or at mid-block locations (Figure 4-28).

Figure 4-27. Cul-De-Sac *(Vancouver, BC)*

The primary fault with cul-de-sacs is the blockage of emergency and service vehicles and the inconvenience for neighborhood residents. It may be desirable to install bollards, mountable curbs, and traversable surfaces to allow emergency vehicle passage. The other challenge for the designer of a cul-de-sac is providing an adequate turn-around area; many existing residential streets do not have sufficient right-of-way to provide a 50-foot diameter circle for trucks to turn in.

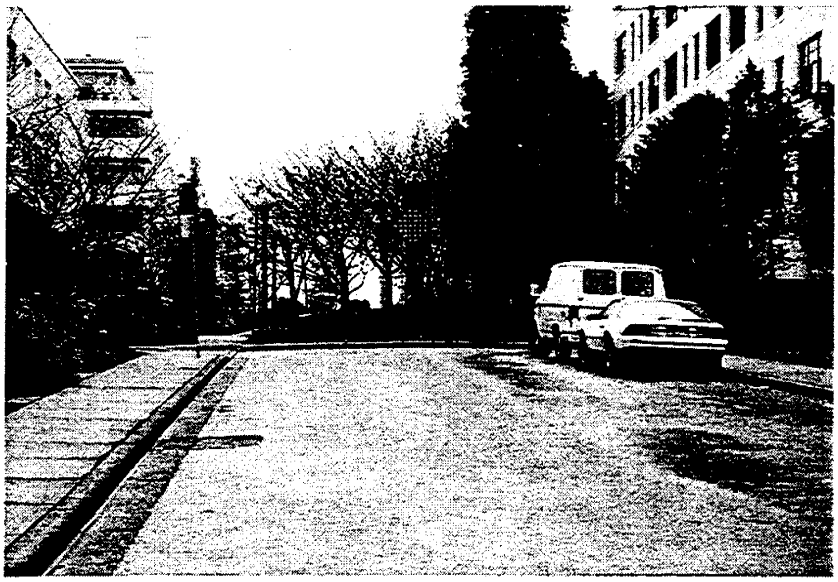


Figure 4-28. Mid-block street closure

Semi-Diverters

Semi-diverters are devices which bar traffic in one direction on a street while permitting travel in the other direction. In general, the roadway becomes one way at the semi-diverter while remaining two way for the remainder of the length.

Because semi-diverters block only half the street, they are easily evaded by motorists. This same property makes them a minimal impediment to emergency vehicles which can just go around the diverter in the wrong direction.

Semi-diverters can be constructed with curb and gutter, sidewalk, and landscaping as shown in Figure 4-29 or constructed of simple traffic barricades as shown in Figure 4-30. The temporary installation is a good way to test the effectiveness and acceptability of traffic diverters, but even the temporary device must be aesthetically pleasing and operationally safe.

Diagonal Diverters

A diagonal diverter is a barrier placed diagonally across an existing four-legged intersection. Its purpose is to convert the four-legged intersection into two unconnected streets, each making a sharp turn.

Diagonal diverters interrupt the continuity of a through street. Diagonal diverters are usually used in groups of two or more to create a maze within a neighborhood, eliminating cut-through traffic.

The radius of a diagonal should be consistent with the posted speed of the residential street and/or the speed

on the street reduced to accommodate the available turning radius. Advanced warning signs should be installed upstream (100 feet desirable) to alert the driver to the required turn.

Visibility is important and reflectors, directions arrow signs, street lighting or elevated landscaping should be added to improve visibility of diverters.

It may be desirable to install bollards, mountable curbs, and traversable surfaces to allow emergency vehicles passage across diagonal diverters.

Figure 4-29. Semi-diverter — permanent installation

Median Barriers

Median barriers made by simply installing traffic curb down the center of a roadway, or by constructing wide landscaped medians, are a standard traffic engineering device that can be employed to prevent left turn entries to local neighborhood streets or to prevent through traffic from crossing from one neighborhood to another across an arterial

Advanced warning signs along with "Right Turn Only" signage and channelization should be installed with median barriers.

Figure 4-30. Semi-diverter — temporary installation

Endnotes and References

[1] For example, see *Stop Sign Evaluation, Final Report,* Portland Bureau of Traffic Management, Portland, OR, June 1992.

[2] *System Stop Signs*; Portland Bureau of Traffic Management, Portland, OR, December, 1991.

[3] *Local Area Traffic Management, Guide to Traffic Engineering Practice*, National Association of Australian State Road Authorities, Sidney, 1988.

[4] Wolfgang S. Homburger, Elizabeth A. Deakin, Peter C. Bosselmann, Daniel T. Smith, Jr., and Bert Beukers, *Residential Street Design and Traffic Control*, Institute of Transportation Engineers, 1989, page 105.

[5] David A. Nicodemus, "Safe and Effective Roadway Humps: The Seminole County Profile," *ITE 1991 Compendium of Technical Papers.*

[6] Graham Crampton, "Cost Benefit Analysis Applied to Local Traffic Calming Schemes," University of Reading (England), Department of Economics, Discussion Papers in Urban and Regional Economics, Series C, Vol V (1992/93), May 1992. Crampton also found average volume reductions of 23% for a sample of 30 RTM schemes, including the 17 road hump applications noted in the text.

[7] See Werner Briton and Harald Blanke; "Extensive Traffic Calming: Results of the Accident Analysis in 6 Model Towns;" *1993 Compendium of Technical Papers*, ITE Annual Meeting, 1993; and various articles in the *Journal of Accident Analysis and Prevention*, Vol. 24, No. 1, page 75-86, Pergamon Press, 1992.

[8] Several jurisdictions have augmented the MUTCD's stop sign warrants to be more responsive to traffic accidents on low volume streets. For example, see the *Stop Sign Evaluation, Final Report*, in note 1, and "Guidelines for Traffic Controls at Minor Intersections," Gian Aggarwal, Traffic Engineer, City of Vacaville, CA in "To the Editor," *ITE Journal,* November 1993.

[9] John LaPlante and Chester Kropidlowski, "Stop Sign Warrants: Time for Change," *ITE Journal*, October, 1992.

[10] In "Impact of Residential Street Standards on Neo-Traditional Neighborhood Concepts," *ITE Journal*, July 1994, Gordon Shaw discusses the differences among four widely used standard references for residential street design: AASHTO's *A Policy on Geometric Design of Highways and Streets (1990), ITE's Guidelines for Residential Subdivision Street Design* (1990), *Residential Street Design and Traffic Control* by Homburger et al, and *Residential Streets* sponsored by ASCE, ULI and the National Association of Home Builders. Shaw concludes that "In general, Residential Streets appears to be more akin to the philosophy put forward by the Neo-Traditional Neighborhood Design movement than the other design documents. At the opposite end of the spectrum, Guidelines represents the strongest statement of the traditional traffic engineering focus of residential design."

Figure 4-31. Diagonal diverter

[11] For example, see the section on stop signs in *State of the Art Report: Residential Traffic Management*; USDOT/FHWA, December 1980, pages 63 – 65, for a thorough discussion of previous studies.

[12] See note 1.

[13] LaPlante and Kropidlowski, *op. cit.*

[14] For example, see "Safety Effects of 30 Km/H Zones in the Netherlands," A. A. Vis, A. Dukstra and M. Slop; "Safety in Urban Areas: the French Program "Safer City, Accident-Free Districts," Anne Faure and Andre de Neuville; and "Safety Effects of Speed Reducing Measures in Danish Residential Areas," Ulla Engel and Lars Thomsen; reported in Accident Analysis & Prevention, Volume 24, No. 1, Great Britain, 1992.

[15] See Vis, Dukstra and Slop, note 14.

[16] For example, see Teun de Wit, "Dutch Experiences with Speed Control Humps," 1993 *ITE Compendium of Technical Papers.*

[17] Nicodemus, note 1

[18] *Guidelines for the Design and Application of Speed Humps*, ITE Technical Council Task Force on Speed Humps, Institute of Transportation Engineers, 1993.

Figure 4-31. Median barrier

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Chapter 5.
Common Design Issues

Local jurisdictions face many common issues in selecting and designing of a Residential Traffic Management program or device.

A successful RTM program and its devices should be:

- Predictable: To ensure comparable types of traffic control devices over the entire transportation system.
- Based on Sound Engineering Standards: To ensure the safety of the public and limit the liability of the City.
- Equitable: To ensure a fair distribution of limited resources among the competing problems and among neighborhoods.
- Cost Effective: To get the greatest public benefit from the limited capital and maintenance dollars available to the City.
- Consistent: To ensure consistency with proven and accepted traffic engineering standards.
- Clear and concise: To be understood by the public, and easily administered by staff and officials.

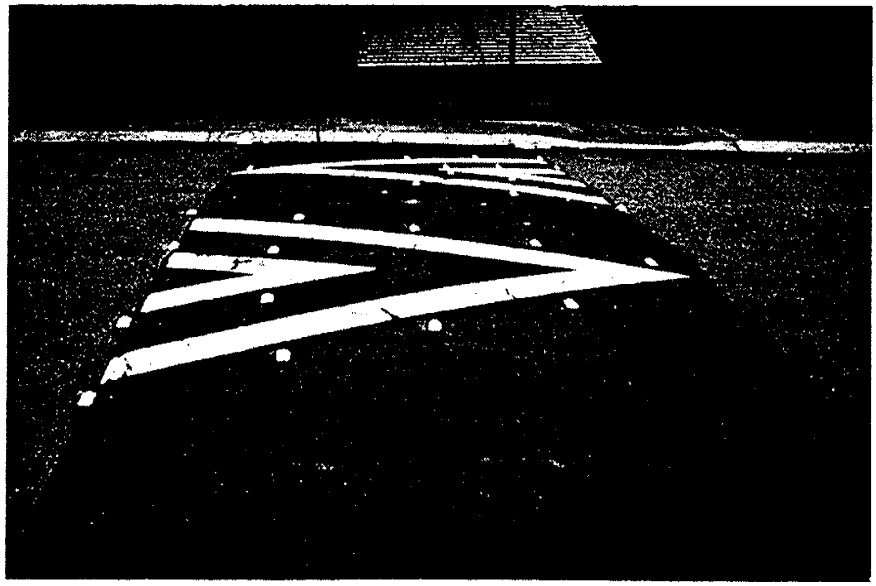

Figure 5-1a. Speed Hump Striping Pattern

Figure 5-1b. Speed Hump Edge Treatment

Guidelines

While efficiency and cost-effectiveness are important, safety is the overriding requirement in the design of local streets and RTM devices. The entire "streetscape" should create a safe environment for motorists, bicyclists, pedestrians and residents. The needs of each competing user group are balanced with the overall all goals for the street. Each element of the streetscape should contribute to the goal of maximizing personal safety, rather than the speed of car travel.

While many examples of successful RTM devices exist, a list of "off-the-shelf" devices and design standards will not produce a successful RTM program. Each situation is unique, and all design elements must be reviewed on a given street when considering RTM measures. As a minimum, the following items should be reviewed by the design professional for each RTM installation:

Geometrics

- Alignment
- Turning Radius
- Horizontal and Vertical Curves
- Superelevation
- Major geometric features such as sidewalks, curbs, etc.
- Lateral separation of modes
- Roadway Width
- Sight Distances

Safety

- Channelization
- Illumination
- Signing
- Safety Zone (clearance of obstructions from traveled roadway)
- Crosswalk Locations

Utilities

- Water and Sewer
- Franchise Utilities (such as gas, power, telephone, etc.)
- Storm Drainage
- Location of Fire Hydrants

Design vehicles

- Local emergency vehicle characteristics
- Minimum design vehicle - bus, single unit truck or passenger car
- Public transit and school bus stops and routes
- Bicycles, wheelchairs and other non-motorized devices

Other

- Landscaping
- Pedestrians and Bicycles
- Handicapped Access
- Parking
- Mail delivery routes
- Emergency Access

The requirements for these elements can be found in the design references listed in Table 5-1.

A Policy on Geometric Design of Highways and Streets, (commonly referred to as the AASHTO Green Book), American Association of State Highway and Transportation Officials.

Manual on Uniform Traffic Control Devices (MUTCD), Federal Highway Administration.

Washington State Department of Transportation:

- *Sign Fabrication Manual*
- *Standard Specifications for Road, Bridge, and Municipal Construction*
- *Standard Plans* for Road and Bridge Construction
- *Local Agency Guidelines*
- Local Supplements to the State's Standard Specifications and Standard Plans (varies by jurisdiction)

Table 5-1. RTM Design References

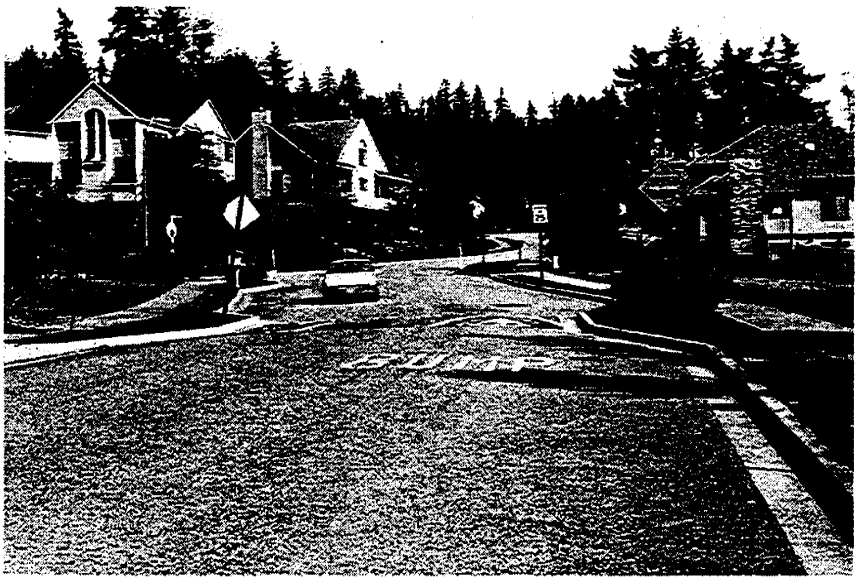

Figure 5-2 Visibility is a key design issue at an RTM device

to the extent possible. Some jurisdictions contract with the neighborhood to maintain plantings or simply eliminate planting and landscape in the absence of a willingness on the part of residents to participate.

- *Parking*. On-street parking in residential areas creates a sense of activity; some jursidictions encourage on-street parking for this reason. However, in some instances, on-street parking also creates sight line restrictions which may be unsafe for drivers who are going too fast. Diagonal parking in selected areas can be used to slow traffic flow, since motorists must be alert to cars backing out at any time. Examples of parking options are given in Figure 5-4.

Design Aspects of RTM Devices

This section discusses design issues related to specific RTM devices. Some common issues are:

- *Visibility*. Devices should be easily visible during day and night. Reflectors, buttons, highly reflective paint, or illumination should be used as appropriate to ensure visibility. Additionally, RTM devices should not be placed were drivers do not have adequate stopping sight distance for the desired deign speed.

- *Signage*. Advance signs should warn motorists of upcoming RTM devices and, to the extent possible, guide the motorists' response to such devices. For example, a curve sign should be placed upstream of diagonal diverters. A typical RTM warning sign is shown in Figure 5-3.

- *Streetscape*. RTM devices should blend naturally into the streetscape and enhance the appearance and "feel" of the street. They should alert drivers that they are in or entering a residential place.

- *Design vehicles*. RTM devices should be designed to accommodate emergency service and other large vehicles at an acceptable speed.

- *Maintenance*. As with any municipal project, the longer term maintenance needs should be anticipated in the design process and minimized

Figure 5-3. Advance warning sign

- *Speed control.* RTM devices should be located and designed to limit speeds in residential areas.

Landscaping

Neighborhood residents often insist on attractive landscaping as a component of RTM devices. Landscaping can enhance the effectiveness of traffic control devices and add to the living quality of the neighborhood. Figure 5-5 shows two approaches to landscaping traffic circles in the City of Seattle. The first, with a tree and well-established vegetation, contributes to the character of the neighborhood and reinforces the circle as an obstacle requiring low speeds to circumnavigate. The second, anchored by reflectors on a sign post, attracts little extra attention as evidenced by the dents in the guard rails and wheel marks on the curbing around the circle.

When planning landscaping, consider the following issues:

- Does the landscaping block vehicle and pedestrian sight lines?
- Does the landscaping hide pedestrians?
- Does the landscaping attract the driver's attention and induce the driver to negotiate the circle at low speed?
- Does the landscaping block illumination? The site should be visited at night to review the illumination and looking for shadows.
- How will the landscaping be maintained? Is irrigation required?

Many cities use a team approach where the neighborhood and city share the costs of installation and maintenance.

Figure 5-4a. Parallel parking on one side of the street

Figure 5-4b. Parallel parking on both sides of the street

Figure 5-4c. Diagonal parking on one side of the street.

Landscaping is usually handled in one of three ways:

1. The City buys, installs, and maintains the landscaping through the local parks department, street maintenance staff, or via contract with private landscape maintenance firm. King County, Washington, generally retains responsibility for maintaining their RTM devices.

2. The City buys and installs the landscaping, but the residents are responsible for maintenance. The City usually requires a maintenance agreement before the landscaping is installed. Often the City will train and advise the residents with this task. If the landscaping is not maintained as agreed, the City will remove it and pave or otherwise surface the area. This approach has been used extensively in the City of Seattle with good results.

3. The residents purchase, install, and maintain the landscaping through donations, a Local Improvement District (LID), or other community funding sources. Sometimes a local plant nursery or community club do this as a community service.

Figure 5-5a. Traffic circle with no landscaping

Figure 5-5b. Traffic circle with moderate landscaping

Figure 5-5c. Traffic circle with trees, shrubs and flowers

Concerns of Emergency and City Service Agencies

Any neighborhood traffic control plan should involve emergency and city service personnel from the very beginning. Police and fire departments are concerned about their response times to all parts of a neighborhood. City maintenance personnel are concerned with storm drainage, street

cleaning and repair, and snow plowing in colder areas. It is much more cost effective and politically acceptable to address these issues at the onset of any program, instead of solving a problem after it has happened.

Figure 5-6. Articulated Bus at Traffic Circle

Fire and EMS

The local Fire/EMS Departments will often oppose any physical methods of neighborhood traffic control. They are opposed to anything that slows, or is perceived to slow, their response time. Working with these departments early can often yield acceptable solutions. The Fire Department may prefer one physical device over another, or will identify a particular route that is heavily used and no devices should be placed on that route. By working closely and early with the Fire/EMS personnel, problems can be avoided, negative impacts be reduced, resulting in acceptable measures that are effective in remedying the original traffic complaint.

Figure 5-7. Speed hump test

The Portland, Oregon Fire Bureau uses a "pro-active" approach to working with the Portland Department of Transportation on traffic calming projects. First, they use their fire trucks to design standard templates for RTM devices to ensure acceptable design standards. For example, Portland is experimenting with longer, lower speed humps which can be negotiated by fire trucks at 25 to 38 mph. Second, the bureau developed maps of primary response routes, where the use of RTM devices are limited. The City participates in discussions with staff and elected officials about trade-offs between emergency response times and traffic control on such routes. Third, and perhaps most important, fire department staff visit each site proposed for RTM actions and assist the City in finding solutions which are acceptable to city departments and local residents.[1]

The City of Portland, OR, conducted a series of tests of the effects of speed humps on EMS vehicles.[2] The City's Bureau of Traffic Management has a video tape of these tests, clearly showing the reactions of the vehicles to traversing the humps at various speeds. Similar tests have been conducted by the City of Bellevue, WA; information can be obtained from the city's Public Works Department.[3]

Some of the concerns typically expressed by the fire departments:

Total Road Closure: Fire departments are concerned about situations where a fire truck might find itself on one side of a closure with the emergency on the other side and no way for the truck to reach it. For large fires, fire departments often approach the location from

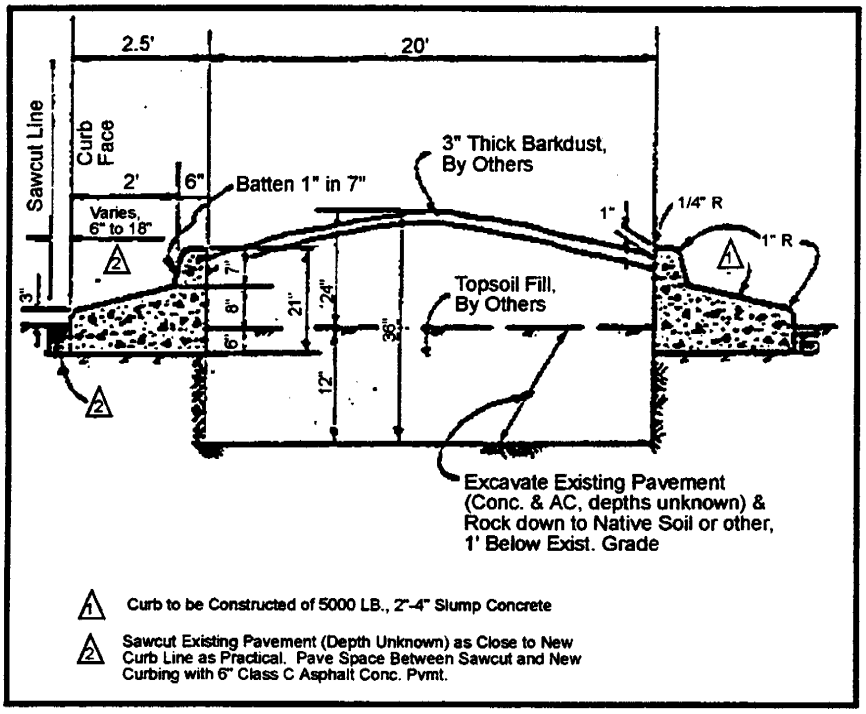

Figure 5-8. Portland's Traffic Circle Design

many directions. A total closure will prevent or hinder such an approach, although traversable barriers which allow for passage of emergency vehicles can often be an acceptable compromise.

Diagonal Diverters, Medians, and Forced Turn Channelization: Although these devices are not as restrictive as total closures, these devices pose some of the same problems for emergency vehicles. They may increase response times by forcing emergency vehicles to take a less direct route.

Semi-diverters, Chicanes, Curb Extensions and Chokers: Although these physical barriers do allow emergency vehicles to pass (in the case of semi-diverters, the emergency vehicle may enter in the wrong direction), they do slow the vehicle and increase response time.

Many fire department are concerned with getting their large trucks through tightly confined spaces. Waiting vehicles may cause the EMS vehicle to stop while the other vehicles clear the RTM device, thus increasing response time. Illegally parked cars, near these devices may also block the path of larger fire trucks.

EMS personnel say that the tight turns required to go through semi-diverters and chicanes can cause undo movement to critically injured patients and even cause additional injury.

Traffic Circles: Although properly designed traffic circles will let emergency vehicles pass at a relatively higher speed than other physical devices, they do slow response times. Additionally, vehicles parked illegally or too close to traffic circles can block larger emergency vehicles. Mountable curbs on the traffic circle will help the emergency vehicles get through a blockage, but to go over the curb will require very slow speeds, thus slowing response time.

The radius of a traffic circle, and the gap between the circle and the street curb, directly affect the speed and ease with which emergency vehicles can pass. Local emergency services personnel should be consulted to determine the best radius for their equipment. Temporary circles should be set up with cones, and the emergency response groups should conduct test drives to see how their vehicles react to the circles. Experiment to see what works best for both the neighborhood and the response teams.

Speed Humps, Raised Intersections and Special Pavement Treatments: Although these devices provide the greatest access to emergency vehicles, they force the vehicle to slow to about 5-15 mph for short distances. Fire departments say that speed humps at any speed tend to dislodge equipment on the trucks and may cause discomfort and/or injury to personnel riding the vehicles.

Portland, Oregon, has prepared a video tape of their different fire trucks and EMS vehicles going over various speed humps at different speeds. This video helped the City determine the best hump design and helped emergency personnel establish their safe travel speeds over the humps.

Fire departments also mention an increased maintenance costs due to damage caused by going over mountable curbs and speed humps, although no studies

have been performed to substantiate this claim. The fire chiefs interviewed for this guidebook have not experienced these added maintenance costs in their departments.

Also, EMS personnel say that the bump caused by speed humps might cause additional pain or injury to critically ill patients. However, there have not been any studies to document this affect.

Police

The local police department will also be concerned about how physical traffic control devices affect response time. Barriers to through traffic make it more difficult for police cars to patrol an area. At the same time, police departments are concerned about traffic safety and will support prudent measures to improve traffic flow and safety in neighborhoods.

Transit, Refuse Collection and Delivery Vehicles

RTM devices must allow reasonable passage of delivery and refuse collection vehicles of various sizes. This can be handled through proper design and attention to turning radiuses of various trucks. Public transit and school buses present less of a problem, since they mainly run on collector and arterial streets, but the potential location of RTM devices should be checked with the transit agency and school district in order to minimize interference with their routes. Access for delivery trucks and large moving van must be taken into account in the location and design of RTM devices as well.

Maintenance

Many of the traffic control devices may interfere with existing drainage patterns, hydrant locations, sewer manhole access, street cleaning, snow removal and other street maintenance functions. By working with the maintenance department, the design can be adjusted to minimize conflicts, and maintenance personnel can gain a better understanding of the devices and their purposes. Additionally, the cost to maintain the traffic control devices will need to be accounted for in the annual maintenance budget.

What the research says about RTM and EMS

A recent article by Zaidel, Hakkert and Pistiner in *Accident Analysis and Prevention Journal*[4] supports the trade-off of the benefits of RTM devices versus perceived impacts on emergency services. The authors conducted an extensive review of existing literature and an international survey of 23 respondents in 13 countries with years of experience on 100's of speed humps. For properly designed speed humps, such as the TRRL trapezoidal humps, they found no reported cases of damage, increased risk or operational difficulties associates with EMS in communities where humps were installed. "It seem that the objection of these services are a matter of policy and that they are quiescent after the humps are in place."[5]

The authors reported that potential objections on the basis of discomfort, damage, access or delay are more theoretical than real. More problems are caused by congestion, potholes and erratic drivers on high volume arterial streets than by speed humps on residential streets. To the extent that humps and other speed controlling measures reduce accidents, particularly serious pedestrian injuries, there will be a net gain to the EMS effectiveness overall, and the potential availability of EMS vehicles areawide.

Sharing the Road

Many people in the U.S. believe that streets belong to the drivers and their vehicles. The 36-foot wide typical suburban residential street with curbs and sidewalks says to motorists, "This is your space." In this environment, safety requires that cars and people be kept separated, even in residential areas.

The European *woonerf* concept[6] challenges this American perception by demanding that motorists in residential areas safely share the local street with its residents. *Woonerf* roughly translates as "living yard" and residents in such areas treat the street as a paved extension of their front yard. Drivers are cautioned through visual cues that they are in a residential space where they must share the space with bicycles and pedestrians.

Meandering streets, pedestrian activity and narrowed traveled ways also increase the drivers' attention levels in residential areas. Interrupted sight lines (to 300 feet), changes in pavement textures, angle parking and raised crosswalks force drivers to watch where they are going,

There is also a large body of research which suggests that increasing the safety of a car or road simply encourages the driver to take greater risks.

Drivers are willing to take a certain amount of risk in exchange for the benefit of faster speeds. This risk is added to safety limits of the car or road. **The new safety features also lull the driver into a new sense of security and vigilance, concentration and attentiveness are reduced.**[8]

and cause them to maintain lower speeds. Such streetscape actions force drivers to take responsibility for their actions, increases their attention levels and adds to the safety of the residential street environment.

This approach is reinforced by research findings in Australia.[7] Kenworthy argues that the most successful measures in reducing the road toll (fatalities) are those which "force a level of car use in a direction away from the available limits of the car and its driver." In other words, force drivers to drive at speeds and in a manner which are below the (ultimate performance) limits of the car and road.

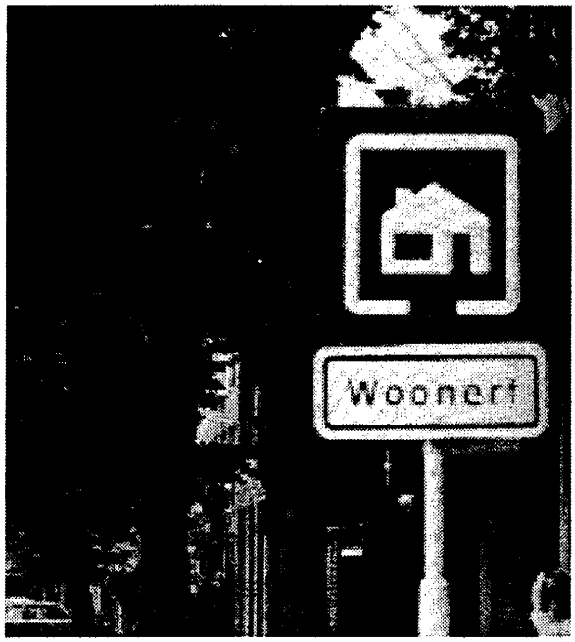

Figure 5-9. Woonerf sign

Do's and Don'ts of the Design Process

Do

☺ Install temporary traffic control devices and monitor them for a period of time before installing the permanent device.

☺ Have an organized program including public involvement with plans and policies approved and supported by the local city council/government.

☺ Involve the local service agencies, including fire, police, and emergency medical service personnel, from the start.

☺ Consult with fire department and EMS personnel to develop the preferred design, particularly with speed humps and traffic circles. Set up traffic circles with cones and have the fire trucks and other emergency vehicles drive around them; this will help determine what radius is best for the types of emergency vehicles found in different areas. The same process can be used in the design of speed humps.

☺ Review traffic patterns in the neighborhood as a whole. Avoid solving the problem on one neighborhood street by just shifting the traffic to another neighborhood street.

☺ Make certain that all signing and channelization is in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), the State's Sign Fabrication Manual, and the AASHTO Policy on Geometric Design of Highways and Streets.

☺ Check sight distances for vehicles, pedestrians, and bicyclists. Sight distance is to meet the requirements of AASHTO Policy on Geometric Design of Highways and Streets.

☺ Become familiar with RTM devices in other communities and assemble references so that residents can be directed where to see them.

☺ Decide on a safe design speed beforehand and in consultation with neighborhood residents.

☺ Check sight distances by visiting the site before and after installation. Do parked cars obstruct sight distances? Does landscaping or other features obstruct sight distance?

☺ Review the illumination at night. Are additional street lights needed? Does landscaping block the light? Is there a shadow on one side of a median or traffic circle that might hide pedestrians from view?

☺ Review the channelization during the day and night. Is it clear when approaching from all directions? Can it be seen at night? Watch the traffic, is the driving public confused by the signing and channelization? Make adjustments when needed.

☺ Review the site for utility conflicts. Is there a fire hydrant? Does it need to be moved? Are there existing utilities in the way?

☺ Check the storm water drainage. Will the storm drain system need to be moved or revised? Can the runoff get through or around the device?

☺ Review the on-street parking. Will parked cars block access of emergency vehicles through or around the proposed neighborhood traffic control devices? Add additional no parking zones where needed. Additional enforcement of parking restrictions may be required to keep the traveled path clear.

Don't

☹ Don't install neighborhood traffic control devices without a well-engineered program supported by the local governments and public.

☹ Don't install neighborhood traffic control devices on arterial streets. Typically, physical devices are not installed on streets with volumes greater than 3,000 vehicles per day, or with posted or prima-facie speeds of greater than 30 MPH.

☹ Don't install neighborhood traffic control devices on streets without curbs unless supplemental features are included to keep vehicles within the traveled way.

☹ Don't install neighborhood traffic control devices on streets with grades of greater than 10 percent.

☹ Don't install neighborhood traffic control devices on major truck routes.

Figure 5-10. Partial Street Closure (test installation)

☹ Don't install neighborhood traffic control devices on primary emergency routes. Contact local fire, emergency service agencies, and police departments to determine these routes. Secondary access routes should be considered on a case-by-case basis.

☹ Don't install neighborhood traffic control devices on curving, winding roads with limited sight distance unless reduced speed limits and adequate warning signs are used in conjunction with the device.

☹ Don't place neighborhood traffic control devices in front of driveways.

☹ Don't neglect to check for conflicting utilities.

☹ Don't install physical devices on adjacent parallel routes as this prevents or hinders emergency response. For example, Portland, OR, has a written policy against neighborhood traffic control devices on both of two adjacent parallel routes.

Endnotes and References

[1] The City of Bellevue Fire Chief has indicated that his department opposes any roadway restriction that left less than 22 feet clearance (two 11 foot lanes).

[2] See *Emergency Service*, A Technical Report compiled by City of Portland (OR) Bureau of Traffic Management, June 1991.

[3] Karen L Gonzalez, "Neighborhood Traffic Control: Bellevue's Approach," *ITE Journal*, May, 1993, p. 43-45.

[4] D. Zaidel, AS Hakkert and AH Pistiner; "The Use of Road Humps for Moderation of Speeds on Urban Streets," *Accident Analysis and Prevention Journal*, Vol. 24, No 1, p. 45-56, 1992.

[5] *Ibid.*, page 53.

[6] See Rodney Tolley, *Calming traffic* in residential areas, (Brefi Press, Tregaron, Dyfed, Great Britian, 1990) Chapter 4, for a good description of the woonerf concept.

[7] Reported in *Traffic Calming: The Solution to Route 20 and a New Vision for Brisbane*; Citizens Against Route Twenty; Ashgrove, Queensland, Australia, 1989, page 12.

[8] *Ibid.*

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Chapter 6.
Legal Issues

Legal concerns about residential traffic management (RTM) fall into two categories: authority and liability.

The question of authority deals with questions about a jurisdiction's right to impose restrictions on traffic flow on residential streets, or even closing a local access street to through traffic. Most challenges come from motorists who use neighborhood streets as a shortcut to their destination, or from businesses who believe their access has been damaged. However, the legal authority to impose residential traffic restrictions has been affirmed by both the Washington State and United States Supreme Courts.

Questions about potential liability arising from RTM devices often deal with the lack of uniformly accepted standards for installation and design. Since some RTM devices, such as traffic circles, are not included in standard design manuals or authoritative traffic engineering guides such as the *Manual on Uniform Traffic Control Devices* (*MUTCD*), jurisdictions are reluctant to implement "experimental" devices. The evolving nature of RTM device designs (witness the variety of speed hump profiles) can be worrisome to smaller jurisdictions which lack sufficient in-house expertise to develop their own design standards. Fortunately, the research for this project found no record of any successful liability cases involving any RTM device anywhere. This finding was confirmed through conversations with traffic professionals involved in RTM programs throughout the county.

Process is critical

The review of legal issues in this chapter reinforces a primary conclusion from this study:

Process is critical to the success of any RTM program.

Local jurisdictions can do much to assure that traffic control plans are legally sound by carrying out a thorough planning process and documenting findings carefully. These steps substantiate that the jurisdiction is acting reasonably and in accordance with applicable law. **The prudent and reasonable application of generally accepted traffic engineering principles provides a significant measure of insurance against liability claims.**

AUTHORITY

The legal problems related to residential traffic management programs usually arise out of conflicting interests. For instance, driver's right to use a public street may conflict with the residents' rights to enjoy their home and neighborhood. The safety of pedestrian and bicyclists may conflict with a driver's right to proceed at the legal speed of the roadway.

Local jurisdictions usually can demonstrate some basis of legal authority to implement traffic management actions. However, they may be challenged on the grounds that the actions are arbitrary, capricious, and unreasonable — and therefore not a legitimate exercise of the police power.

This section provides an overview of the legal basis for RTM programs under Washington state law. Laws, and their interpretation, vary considerably from state to state. Readers in other states should consult their attorneys about applicable statutes and case law applications in their jurisdiction.

"Police Power"

"Police power" means the general authority of local governments to protect and enhance the public health, safety, welfare, morals, and quality of life of its citizens. Conferred upon the state by the 10th amendment to the U.S. Constitution, such powers pass down to local jurisdictions. Traffic control planning and regulation are carried out through a variety of codes, ordinances, and regulations based on these police powers. This includes RTM programs.

The courts have given local authorities a great deal of latitude in the exercise of their police powers, and they are considered elastic and evolving in terms of accommodating changing community values and concerns. However, the use of police powers is constrained by constitutional principles of equal protection and due process, and frequent state legislative changes regarding the exercise of police powers. Table 6-1 lists some significant court decisions related to RTM programs and police powers.

A landmark case regarding the application of police power to land development regulation was *Village of Euclid v Amber Realty Company* (272 U.S. 365). In *Euclid*, the United States Supreme Court ruled that the local government had the right to restrict a property owner's development options through land use zoning. The Court also provided guidance about the evolving nature of such regulations and how they must change with the times:

> Regulations, the wisdom, necessity and validity of which, as applied to existing conditions, are so apparent that they are now uniformly sustained, a century ago, or even a half a century ago, probably would have been rejected as arbitrary and oppressive. ...while the meaning of constitutional guaranties never varies, the scope of their application must expand or contract to meet the new and different conditions which are constantly coming within the field of their operation. In a changing world, it is impossible that it should be otherwise. (*Euclid* at 386)

Although the main thrust of the *Euclid* case was the exclusion of industries and apartments from single family neighborhoods, the Court commented on the desire to keep residential areas free of "disturbing

Case	Citation	Major decision
Village of Euclid v Amber Realty Company	272 U.S. 365	Upheld the validity of land use and zoning regulations applied to private property. Specifically mentions the legitimate goal of a jurisdiction to keep residential areas free of the hazard of moving and parked automobiles.
Village of Belle Terre v Boraas	416 U.S. 1 [1974]	Recognized that residential areas have special needs that may be protected through regulations.
County Board of Arlington v Richards	434 U.S. 5 [1977]	Allowed Arlington County to place restrict parking in residential areas to preclude non-residents from parking on these streets.
City of Memphis v Greene	451 US 100, 67 L Ed 2d 769 [1981]	Upheld the City's right to close a street to through traffic in order to improve the safety of children living in a residential area and reduce "traffic pollution."
Mackie v Seattle	19 Wn.App. 464, 576 Pacific Reported 2d 414 [1978]	Washington State Appellate Court found that business owners have no right to compensation for a street closure unless their access has been completely denied by the action.

Table 6-1. Selected cases dealing with RTM applications

noises," "increased traffic," and the hazard of "moving and parked automobiles." The Court also noted these nuisances might deprive "children of the privilege of quiet and open spaces for play, enjoyed by those in more favored localities." (*Euclid* at 394)

In a related case, *Village of Belle Terre v. Boraas* (416 U.S. 1 [1974]), the US Supreme Court recognized that residential areas have special needs and a unique environment. The court held:

> A quiet place where yards are wide, people few, and motor vehicles restricted are legitimate guidelines in a land-use project addressed to family needs. This goal is a permissible one within *Berman v. Parker, supra.* The police power is not confined to elimination of filth, stench, and unhealthy places. It is ample to lay out zones where family, values, youth values, and the blessings of quiet seclusion and clean air make the area of a sanctuary for people. (*Belle Terre* at 9)

Even the dissent on *Belle Terre* by Mr. Justice Marshall concurred with the holding of broad police powers of a local authority:

> [L]ocal zoning authorities may properly act in furtherance of the objectives asserted to the served by the ordinance at issue here: restricting uncontrolled growth, solving traffic problems, keeping rental costs at a reasonable level and making the community attractive to families. The police power which provides the justification for zoning is not narrowly confined. And, it is appropriate that we afford zoning authorities considerable latitude in choosing the means by which to implement such purposes. [*Belle Terre* 416 U.S. 13, Marshall, J., dissenting)]

While not directly speaking on traffic control, these cases establish a local jurisdiction's right to implement specific regulations designed to enhance the special character of residential neighborhoods.

Case Law Related to RTM

One of the basic principles of RTM was established in 1978 by the Washington State Court of Appeals. In *Mackie v. Seattle* (19 Wn.App. 464, 576 Pacific Reporter 2d. 414 1978), a business owner sued the City of Seattle over the inconvenience and potential loss of customers caused by the City's closure of a through street which provided the most direct route to his place of business. However, the Court found that property owners have no ground for challenge or compensation unless their access has been completely denied. This landmark case has virtually precluded any subsequent successful challenges of local street closures in Washington state.

An early RTM challenge based on the equal protection clause of the U.S. Constitution (14th amendment) was rebuffed by the U.S. Supreme Court in 1977. (*County Board of Arlington v. Richards*, 1977. 434 United States Reporter 5) Upholding the right of the City of Arlington, Virginia to institute a residential parking permit program which precluded non-residents from parking on residential streets, the Court held:

> A community may also decide that restrictions on the flow of outside traffic into particular residential areas would enhance the quality of life, thereby reducing noise, traffic hazard and litter. By definition, discrimination against nonresidents would inhere in such restrictions [*County Board of Arlington v. Richards*, 1977. 434 United States Reporter 5].

In *City of Memphis v Greene* [451 US 100, 67 L Ed 2d 769, 1981], the US Supreme Court reached a conclusion similar to the Washington Court's findings in *Mackie v Seattle* (see above) regarding the authority of local jurisdictions to close streets. Residents of a predominately black neighborhood sued the City of Memphis over its closure of a street which connected the neighborhood to a predominately white residential community (Hein Park). The City cited as its reasons for closing the street were to reduce traffic flow through Hein Park, increase safety of children living in Hein Park and reduce "traffic pollution" in the residential area. The Court upheld the City because the decision to close the street was motivated by its interest in protecting the safety and tranquillity of a residential neighborhood and the procedures followed in making the decision were fair and were not affected by racial or other impermissible factors.

In addition, the Court found that the closing did not severely restrict access to the homes of the black residents and that their sole injury was simply the inconvenience of having to use one street rather than another for certain trips within the area. Citing *Arlington County Board v Richards* and *Village of Belle Terre v Boraas*, the Court concluded that "The residential interest in comparative tranquillity is also unquestionably legitimate. ...The interests motivating the city's action are thus sufficient to justify an adverse impact on motorists who are somewhat inconvenienced by the street closing." (*Memphis v. Greene* at 790)

The only adverse case found in our search was brought against the City of Berkeley in 1982 for installing diagonal diverters on certain residential streets. In *Rumford v the City of Berkeley* (31 Cal 3d 545, 645 P 2d. 183 Cal Reporter 73 [1982]), the California courts held that diverters were then illegal since they did not conform to the specifications for official traffic control devices in the California Vehicle Code. This ruling resulted in new state legislation which redefined official traffic control devices and gave local governments the authority to adopt regulations prohibiting entry to or exit from or both any street by means of islands, curbs, traffic barriers or the roadway design features.

Citing these cases and appropriate state law in a jurisdiction's RTM program prospectus could avoid many potential challenges to the local jurisdiction authority to implement RTM measures.

Washington State Law

General authority

Although there are no specific state statutes related to residential traffic management, the authority for RTM programs can be derived from the same statutes which allow jurisdictions to install and maintain other traffic control devices such as stop signs and traffic signals. Titles 46 and 47 of the Revised Code of Washington (RCW) contain the statutes dealing with motor vehicles, public highways and transportation in the state of Washington. The chapters and sections of the laws applicable to the residential traffic management are discussed below.

Section 46.90.010 of the RCW directs the Director of the Deaprtment of Licensing to adopt a model traffic ordinance containing a comprehensive set of uniform traffic laws for Washington communities. The model ordinance is codified in Chapter 308-300 of the Washington Administrative Code (WAC). Local jurisdictions are encouraged to adopt this model ordinance to provide motorists with common "rules of the road" throughout the state.

Under Washington state law, the basic authority for the installation and maintenance of traffic control devices rests with the "traffic engineer" for each local jurisdiction. WAC 308-330-260 (pursuant to RCW 46.90.010) establishes the office of traffic engineer and generally describes his or her duties. Absent a specific position of traffic engineer in a jurisdiction, the statutory duties of the traffic engineer may be carried out by the jurisdiction's engineer or other person appointed to carry them out.

The authority for specific acts by the traffic engineer is provided by WAC 308-330-265 (pursuant to RCW 46.90.010). The predecessor of this WAC regulation (formerely RCW 46.90.265) was cited by traffic engineers in Bellevue, King County and Seattle as the source of their authority for the RTM programs in these jurisdictions. Under RCW 46.90.010, the WAC regulation should have the same effect. For RTM, the following subsections of the WAC apply:

> WAC 308-330-265 (1). The traffic engineer is authorized to place and maintain official traffic control devices when and as required under the traffic ordinances or resolutions of the local authority to make effective the provisions of said ordinances or resolutions, and may place and maintain such additional official traffic control devices as he/she may deem necessary to regulate, warn, or guide traffic under the traffic ordinances or resolutions of the local authority;
>
> (4) To establish safety zones of such kind and character and at such places as he/she may deem necessary for the protection of pedestrians;
>
> (23) To test new or proposed traffic control devices under actual conditions of traffic.

Figure The latter section (23) establishes the authority of the traffic engineer to undertake demonstration projects involving traffic control devices under actual conditions of traffic. This section allows jurisdictions to test various RTM measures under the guidance of the local traffic engineer.

Speed Limits

Speeding traffic is a highly emotional issue. Since it is the major complaint leading to RTM measures, a discussion of state laws dealing with speed limits is appropriate. Many jurisdictions in the United States prescribe a 25 mph speed limit for their residential neighborhood streets. The basis for this common speed limit is documented by a field study[1] conducted in two middle income residential neighborhoods in Berkeley, California to answer the question 'how fast is too fast?'. Resident opinion as to whether speed is acceptable or unacceptable changed from almost total acceptance to almost total non-acceptance over a relatively narrow range of speeds – between 20 mph and 30 mph. The 25 mile per hour speed limit currently prevalent in most residential streets in the U.S. is central to this range.

Applicable Statutes. The basic speed limits for unposted streets in cities and towns is set at 25 mph by RCW 46.61.400(2). This rule is applicable to the vast majority of residential streets in cities and towns in Washington state. However, the basic rule of speed restrictions is more general and more applicable to RTM settings:

> **RCW 46.61.400 Basic Rule and maximum limits.** (1) No person shall drive a vehicle on a highway at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing. ...(emphasis added)

RCW 47.24.020 requires WSDOT approval for speed limits established by local authorities on city streets that are part of the state highway system.

Research from Europe and Australia indicates that a "reasonable and prudent" speed in residential areas may be much less than the standard 25 mph found on 80 percent of residential streets in the United States. These research findings could be used to justify both lower speed limits on designated residential streets when warranted by planning and engineering studies, and RTM devices to ensure compliance with those limits. (See the discussion under "Speeding Toolbox" and "Speed limit signs and speed zoning" in Chapter 4 for specific references.)

Statutory authority for lower speed limits in residential areas can be derived from RCW 46.61.415 (1) which allows local authorities to alter maximum limits "on the basis of an engineering and traffic investigation." However, this statute restricts the speed limit to "...not less than twenty miles per hour." [RCW 46.61.415

1. *Document need for action*
2. *Identify program objectives*
3. *State legal authority*
4. *Recognize inconvenience to traveling public and trade-offs for residents*
5. *Provide adequate public notice*
6. *Establish SEPA exemption*
7. *Mandate reasonable care and reference to engineering standards*
8. *Require follow-up and evaluation*
9. *Recognize trade-offs and risks*

Figure 6-2. RTM ordinance outline

(1)(c)] WSDOT publishes a public information pamphlet that provides a summary of the concepts used by traffic engineers to set appropriate speed limits.

RTM Ordinance

Our review revealed that many local jurisdictions in Washington, such as King County, Seattle, and Bellevue, do not have specific ordinances or resolutions dealing with the residential traffic management programs undertaken in their respective jurisdictions. The City of Portland however, has passed two resolutions pertaining to their Residential Traffic Management program.

Smaller jurisdictions may reduce legal challenges and minimize liability exposure by adopting an ordinance or resolution which creates a well-defined process to establish the program. Lacking a full-time traffic engineer, a small jurisdiction may need to initiate the program through an inter-local agreement with WSDOT or some other public agency, or hire a professional engineering consultant to help set up and monitor the program. In addition to legal issues, the formal ordinance or resolution process provides an initial opportunity for public input on the merits and goals of the RTM program.

Many examples of the requirements of a successful RTM program can be found in the references cited in this guidebook. A prototypical program outline is presented in Appendix E.

A General Outline

The following outline for an ordinance or resolution establishing an RTM program is designed to strengthen a jurisdiction's argument that the program is a "reasonable" exercise of its police power:

Document need for action. The need for a local jurisdiction's action related to its residential traffic management program could be based on speed studies, traffic accident records and traffic counts, noise and air pollution measurements or calculations, and on citizen concerns over issues related to traffic operations, safety, and pollution. General findings about traffic problems and successful RTM solutions documented in other jurisdictions could be used to help support the program, but they are not a substitute for thorough planning and engineering studies of each specific case.

Identify objectives of the residential traffic management plan. In general, the objectives include protection of residential areas, reduction of through traffic on residential streets, for enhanced safety, health, and welfare of the community. (see *County Board of Arlington v. Richards* and other cases above for hints on specific language in the ordinance).

State the authority for the RTM program. The jurisdiction needs to explicitly state the sources of its authority for an RTM program under Washington State law. [see RCW 46.90.005, 46.61.400 and 46.61.415]

Recognize inconvenience to traveling public. In *City of Memphis v Greene,* the court found that it was okay to inconvenience some drivers for the greater good of the residential neighborhood. However, specific recognition of the circuitry of alternate routes and increased travel times through the neighborhood helps demonstrate that the impacts of the RTM program were taken into consideration by the elected officials in making their decision. This is particularly true in dealing with emergency vehicle access issues.

Provide adequate public notice, comment and involvement with decision making process. Public involvement in the adoption of the general RTM program and the implementation of a specific RTM plan in a given neighborhood are critical to the legal and political success of the program.

Establish a SEPA exemption. To avoid lengthy and costly studies, delays, and challenges under the State Environmental Policy Act (SEPA), the jurisdiction could pursue categorically exempting RTM programs from the SEPA process by finding that they do not create any "significant" adverse environmental impacts.

Mandate reasonable care and reference to standard transportation engineering manuals, papers, reports, and texts. There is considerable variance in wording and intention of legislation across the country regarding the compliance with MUTCD. Many of the devices most commonly used in neighborhood traffic management schemes are not addressed in the MUTCD. Therefore, the ordinance (resolution) must direct that reasonable care be exercised in implementing RTM control schemes.

Require follow-up and evaluation. A jurisdiction implementing any RTM program should include a follow-up program to evaluate the effectiveness of the program. The results of the evaluation serve as good bench marks for future RTM programs of similar nature, and demonstrate the reasonableness of the program by requiring periodic monitoring of its effectiveness.

Recognize tradeoffs and risks. The ordinance (resolution) explicitly recognizes that the RTM program is a discretionary function, requiring the exercise of judgment in each individual case. The document may even state the basis for discretionary action by the jurisdiction and the criteria by which RTM measures are justified (or rejected) in specific cases.

LIABILITY

Design and installation of any traffic control device exposes a jurisdiction to some element of risk and liability for its actions. Personal injury resulting from accidents involving traffic control devices is usually the greatest concern. Tort claims are most commonly based on alleged negligence of the agency. It therefore follows that best defense is to be reasonable and prudent, and to exercise due care in the planning, design, installation and maintenance of RTM devices. Following adopted design and construction standards is also a key factor in reducing potential liability claims.[2]

Discretionary Functions

Courts have consistently held that discretionary acts can be immune from tort claims. Discretionary in this sense means the power and duty to choose among valid alternatives. This has been applied to the policy and planning functions of government, not to the implementation and operational duties required to carry out those policies. Examples are choosing to spend limited construction funds on one improvement versus another, or remedying a known safety hazard at one location instead of another. Courts have been reluctant to allow judges or juries to substitute their judgment for that of the responsible public official in making such choices. On the other hand, "ministerial" functions are those duties or actions which involve defined tasks with a minimum leeway for personal judgment. Examples include the construction of a roadway to established standards and the installation of a traffic signal in accord with recognized standards such as those contained in *MUTCD* and recognized national standard specifications.

The Utah Supreme Court summarized a commonly held view in *Andrus v State*, 541 P.2d 1117 (Utah, 1975):

> ...The decision to build the highway and specifying its general location were discretionary functions, but the preparing of plans and specifications and the supervision of the manner in which the work was carried out cannot be labeled discretionary functions.

In Washington State, discretionary governmental immunity is an extremely limited condition. Adopted in 1961, RCW 4.92.090 waivers the concept of sovereign immunity as applied to actions by the State and its jurisdictions:

> **4.92.020 Tortious conduct of state - Liability for damages.** The state of Washington, where acting in its governmental or proprietary capacity, shall be liable for damages arising out of its tortious conduct to the same extent as if it were a private person or corporation.

In *Evangelical United Brethren Church v State*, 67 Wn.2d 246, 407 P.2d 22 (1965), the State Supreme Court listed four basic questions which must be answered affirmatively for the act to be classified as discretionary and nontortious:

1. Does the challenged act, omission or decision necessarily involve a basic governmental policy, program or objective?
2. Is the questioned act, omission or decision essential to the realization or accomplishment of that policy, program or objective as opposed to one which would not change the course or direction of the policy, program or objective?
3. Does questioned act, omission or decision require the exercise of basic policy evaluation, judgment and expertise on the part of the governmental agency involved?
4. Does the governmental agency involved possess the requisite constitutional, statutory or lawful authority and duty to do or make the questioned act, omission or decision? (*Evangelical United Brethren Church v State* at 255)

The limits of discretionary immunity were refined in *King v Seattle*, 84 Wn.2d 239, 525 P.2d 228 (1974). Here the Court said that to be entitled to immunity the state must show that the subject action was a policy decision, consciously balancing risks and advantages, choosing among valid alternatives.

These issues were further clarified by the Court in *Stewart v State*, 92 Wn.2d 285, 597 P.2d 101 (1979). In a case involving an accident on I-5 on a bridge over the Snohomish River, trial court held that the design of the bridge and its lighting system was protected by discretionary governmental immunity. In reversing this broad finding, the Supreme Court stated:

> The State argues that adoption of a design necessarily involves a judgmental choice. The *King* test required more. There was no showing by the State that it considered the risks and advantages of these particular designs, that they were consciously balanced against alternatives, taking into account safety, economics, adopted standards, recognized engineering practices and whatever else was appropriate. The issues arising from the evidence as to negligent design should have been submitted to the jury. (*Steward v State* at 294)

The Duty of Ordinary Care

Given that actions related to residential traffic control would not likely be found to be immune from tort liability, are the risks associated with RTM programs and devices any greater or less than those associated with stop signs, traffic signals and other traffic control devices? The risks appear to be the same. States and local jurisdictions have a duty to provide reasonable care for the safety of motorists on streets and highways who are themselves exercising ordinary care and concern in their travel habits. *Steward v State* summarized this view:

> A governmental entity responsible for determining the details of a highway construction project and for its construction has an obligation to exercise due care in constructing and maintaining the highway in a reasonably safe condition after considering the various economic, engineering and safety factors which are applicable to the project. (*Steward v State* at 294)

References to standard engineering practices and design standards are necessary in implementing any RTM program. However, many agencies are concerned about installing RTM devices, such as traffic circles or speed humps, which are not included in the *MUTCD*. **Therefore, the jurisdiction should cite specific references to design practices and recommended standards for RTM devices in other standard traffic engineering references in the enabling ordinance. The jurisdiction should also prepare standard plans and specifications, and**

construction and installation procedures, for RTM devices and include them in their local street or roadway design manuals.

Process is Important

Procedural issues are becoming more important in tort cases. I.e., did the jurisdiction follow a reasonable process in erecting a given sign or signal? The choice of traffic control device, or even whether or not to install such device, has been held to be a discretionary or planning function immune from tort liability. Two cases demonstrate typical holdings by the courts.

In *Wainscott vs. State* (642 P.2d 1355, Alaska, 1982) concerning the state's decision to install a flashing red/yellow beacon rather than a full traffic signal at an intersection, the Alaska Supreme Court said: "The selection of a traffic control device for the...intersection was not a purely ministerial decision implementing a pre-existing policy, but rather a decision that called for policy judgment and the exercise of discretion."

In *City of Tell City v. Noble* [489 N.E.2d 958 (Ind. App.,1st Dist., 1986)] regarding the City's failure to install a stop sign, or any other form of traffic control device at an intersection, the Court held that the decision to install a stop sign was a discretionary one protected by the Indiana Tort Claims Act. In its decision, the Court stated that in passing the Tort Claims Act, "... it was not the intent of the legislature to permit a lay jury to second guess the acts of local authorities."

The discretionary exemption does not mean, however, that local authorities have latitude to make unreasonable decisions regarding traffic control measures. Courts have found that jurisdictions may be subject to tort claims in situations where the authority's decision was based on (a) inadequate study or (b) lacked a reasonable basis.[3] Note that the implied tests of an "adequate study" and a "reasonable basis" echo the need for "an engineering and traffic investigation" called for in Washington state statutes regarding traffic control and the need to show a "reasonable exercise of police power" cited in these section on program authority.

How to minimize liability in RTM applications

1. Clearly the best protection is a reasonable, logical and well thought out plan with prudent guidelines. While reasonableness is exercised in implementing any Residential Traffic Management program, tradeoffs and risks are recognized for any discretionary action.

2. As with any other traffic engineering activity or improvement, care must be taken to follow the guidelines suggested in standard manuals before installing any traffic control devices for RTM. Use of the standard references listed in Appendix C helps demonstrate this level of care and reasonableness.

3. All facts and engineering decisions are documented to minimize the possibility of lawsuits. Before any RTM action is implemented, written records are produced which documents the need, illustrates the alternatives considered and explains the basis for the recommended action. RTM measures in place should be monitored to evaluate their effectiveness in accomplishing the intended goal.

Legal References and Sources

The following is a short list of the literature related to legal aspects of the residential traffic management programs. Full citations for these references are given in Appendix B.

- Homburger, Wolfgang and Deakin, Elizabeth, et al.; *Residential Street Design and Traffic Control*; pages 120-124.

- Lewis, Russell M., *Practical Guidelines for Minimizing Tort Liability*, NCHRP Synthesis of Highway Practice No. 106, Transportation Research Board, Washington, D.C., December 1983.

- Smith, Daniel T. and Donald Appleyard; *Improving the Residential Street Environment*; Chapter 6.
- *Tort Liability and Risk Management*, Transportation Research Circular, No. 361, Transportation Research Board, Washington, D.C., July 1990.
- *Traffic Improvements – Legal Aspects and Liability*, Institute of Transportation Engineers.
- *Traffic Engineering Handbook*, Chapter 14.

Endnotes

[1]Transportation Research Board, NCHRP Report 174, *Highway Noise, A Design Guide for Prediction and Control, 1976.*

[2]For a summary of design standards and liability see, Lester Paff and Kathy Skinner, "The Issue of Standards and Tort Liability;" *AASHTO Quarterly*; American Association of State Highway and Transportation Officials, Washington, D. C.; April 1986.

[3] See *Alexander v Eldred, 1984, 63 N.Y. 2d 460, 483 N.Y.S.2d 168, 472 N.E.2d 996*, and *Weiss v Foote, 1960, 7N.Y.2d 579, 200 N.Y.S.2d 409, 167 N.E.2d 63.*

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Chapter 7.
The Politics of Residential Traffic Management

Not everyone embraces residential traffic management with open arms. Solving neighborhood traffic problems is as much a political process as it is a technical one. Residents and staff must be aware of the cooperation and compromise that are needed to make it work. Residential traffic problems and solutions must be considered in the context of all of the other issues facing the jurisdiction's elected officials. Establishing specific policies related to residential traffic management is a good starting point.

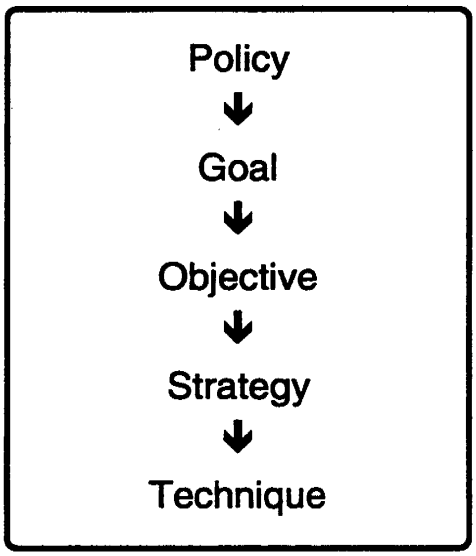

Figure 7-1. The Policy Chain

A Policy Basis for Action

Transportation policies are a jurisdiction's statement of its citizens' values. Such policies are usually found in the jurisdiction's comprehensive plan (such as those required under the State of Washington's 1990 Growth Management Act) or in a separate long range transportation plan.

The policies are a starting point for developing more specific goals and objectives. Then strategies and techniques which achieve the desired policies. This policy chain is illustrated in Figure 7-1.

Transportation policies are often generic and contain language stressing mobility, safety and efficiency of the transportation "system"; most often "system" means the road system and "efficiency" means the fast movement of cars from one place to another.

However, the advent of Growth Management in Washington State has increased the attention on those transportation policies which support a city's or a county's land use vision. The quality of life in a residential area can be just as important to the community's vision as moving cars through town at a rapid pace.

For residential traffic management to work, the policies should declare that a local residential street is a vital part of the neighborhood's living environment, and it must be shared by residents and motorists alike. If this concept is ***not accepted*** by the city's elected officials, then attempts to tame through traffic with a few traffic circles or speed humps will have only limited, short-term success. It may take the successful implementation of several demonstration projects to convince city officials that such policies are needed.

Several draft policy statements which would foster RTM practices are listed in Figure 7-2. These statements are only examples and must be modified to fit the needs of each community. In the absence of such specific statements, policy support may be drawn from existing policies regarding the safety of residents, pedestrians and motorists in the city's comprehensive plan.

Goals and objectives

Once the basic policies are agreed upon, goals and objectives can be developed to implement the policies. Goal statements describe ideal conditions in the long term, objectives are results-oriented statements of intended actions against which performance can be measured. RTM actions may be but one of many means to achieve the desired goals and objectives related to the living environment in a city's residential areas.

The adopted objectives lead to considerations of the strategies and techniques which would be used to achieve the objectives. Figure 7-3 illustrates the policy-goal-objective-strategy-technique chain relating to a safety goal. The primary purpose of this chain is to ensure that the RTM program is legitimately following the directions of the city's elected officials expressed in the city's transportation policies and goals.

Quick Response Kit

When the Mayor or Council member calls, the agency needs to respond quickly. Here's how.

Preparation is the key to quick response. The agency must have a well-documented procedure for dealing with residential traffic complaints, and the backing of the elected officials to do so. For smaller jurisdictions, a four-step process can quickly get the results.

Step 1: Send out information on residential traffic management and a Citizen Action Request Form to formally initiate the process. This step presupposes

- City streets are valuable public spaces and, as such, should be shared equitably by all users and may be altered to allow pedestrians, bicycles, children and residents to share the space with cars safely and without conflict.
- Local access streets in primarily residential areas are considered as extensions of the residents' yards. Priority is given to the safety of pedestrian and bicycle movements over the travel speeds of automobiles.
- The legal speed limit on local residential streets should be based on safe confrontation speeds between vehicles and pedestrians, not on the 85th-percentile speed of motorists now using the street.
- The city should protect residential neighborhoods from being used by through traffic, except under unique and unusual circumstances. To accomplish this goal, the city should ensure attractive alternate routes for through motorists and provide adequate collector and arterial streets.
- The city should use physical measures in support of legal and statutory regulations to hold vehicle speeds to acceptable levels on local residential streets.
- The welfare of the city requires that residential neighborhoods be protected from blighting influences. The use of residential local and collector streets by "unwanted" traffic can be such an influence. "Unwanted" traffic is defined as either: (a) traffic using a residential street as a shortcut or detour from arterial streets; (b) an excessive volume of traffic on a local residential street; (c) traffic operating at excessive speeds; or, (d) vehicles with an origin and destination outside the neighborhood.

Figure 7-2. Examples of RTM Policies

Policy	Local residential streets should maintain the highest environmental and living conditions for their residents.
Goal	Improve safety for road and non-road users of the local streets.
Objective	Reduce bicycle and pedestrian accidents to zero in residential areas.
Strategy	Reduce the speed difference between motor vehicles and bicycles or pedestrians by creating a street environment to contain vehicles speeds in residential areas below 20 mph.
Technique	Install landscaped slowing devices such as traffic circles or slow points at 500-foot intervals.

Figure 7-3. An RTM Policy Chain

that the agency has materials prepared in advance and can send them out with the next day's mail. This "Quick Response Kit" contains:

- A brochure describing the city's RTM program (11 x 17 folded) showing the phased approach to RTM and the process for individual RTM projects.
- A Citizen Action Request Form (shown previously in Figure 3-4) asking basic information about the perceived traffic problem and potential low-cost solutions.
- A one-page (8½ x 11, both sides) summary of RTM devices approved for use in the city's program, including diagrams and a matrix comparison.
- A list of names and telephone numbers of staff members for further information.

Examples of each of these items are provided in Appendix E. The agency responsible for RTM programs should modify these examples to fit their particular city's needs.

If the Citizen's Action Request Form is returned, staff should assign a project number and proceed to step 2.

Step 2: Visit the site and verify the basic information about the situation. Do this unobtrusively (i.e., not in a highly recognizable city vehicle) so that residents and drivers behave as they normally would, not as they do when they know some one is watching. If possible, talk to the residents about the complaint and try to observe the problem first hand. If the complaint appears to be a valid RTM problem, go to step 3.

If it's not valid in your opinion, look for a diplomatic way to respond through additional information or education. For example, the resident may be complaining about too much traffic on a minor arterial street. One can sympathize with the resident's feelings about the impacts of traffic, but at the same time inform them that the street has been designated as a major traffic street by the community, and the peaceful environment present on a low volume residential access street simply won't happen on the arterial.

Step 3: Distribute a survey form to all households, businesses and property owners that front on or are in the immediate vicinity of the subject street segment or intersection. The purpose of the survey is to determine the degree of local support for implementing an RTM project (even if it's just a speed watch). A sample survey form is given in Appendix E; it contains a brief description of the problem, asks for agreement or disagreement and asks whether or not the respondent wants something done about the problem. Second notices, or even personal visits, should be used to encourage a high rate of return.

If, after collecting the responses, there is a majority opinion that something should be done, the agency proceeds to the last step in the Quick Response Kit.

Step 1. Record complaint and send out information on RTM program.

Step 2. Visit the site and verify the complaint and available data.

Step 3. Distribute a survey form to all residents, or have residents initiate a petition, and analyze the results.

Step 4. Advertise and hold a neighborhood meeting to discuss the RTM program.

Figure 7-4. The Quick Response Steps

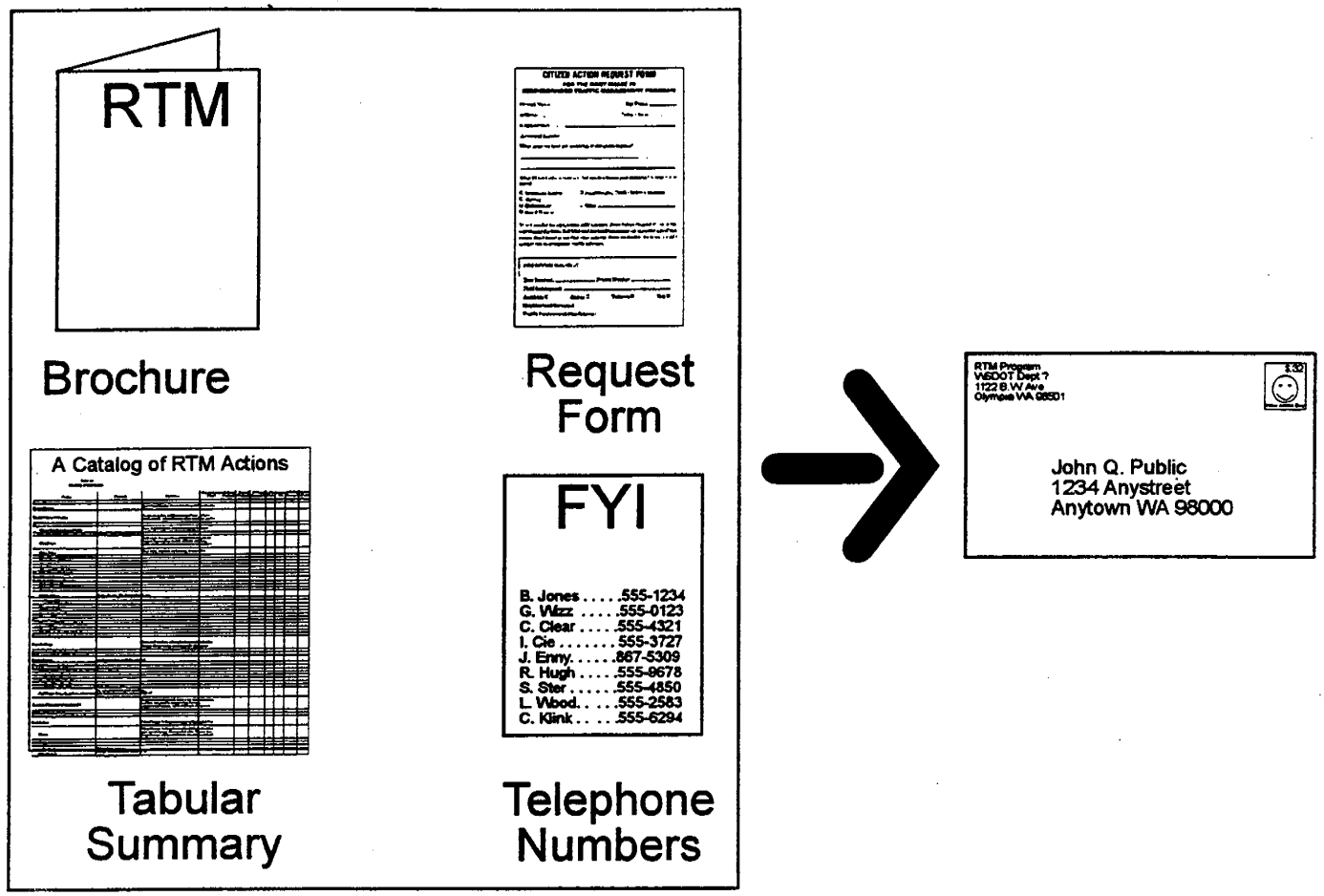

Figure 7-5. The Quick Response Kit

Requiring a petition signed by a majority of neighborhood residents is a popular alternative to the survey method. The person initiating the Action Request is given several blank petition forms and asked to collect the necessary signatures. This method puts the burden on the local residents to ask for help, and eliminates trivial complaints at an early stage. The political danger is that once a fully-executed petition is returned to the city, the entire neighborhood will be looking for quick action on their complaint, and staff may simply become too overloaded to handle all complaints in quick fashion. The survey method provides staff with more control of the process and schedule.

Step 4: Advertise and hold a public meeting in the neighborhood. The purpose of the meeting is to:

- provide an overview of the RTM program,
- give everyone the results of the survey (or petition),
- provide information collected by staff on traffic and street conditions,
- obtain feedback from the entire neighborhood about problems, issues and concerns, and
- recruit members for a neighborhood committee to work through the RTM process.

This public meeting provides an opportunity for public "outreach" by the city staff. It demonstrates the city's commitment to its residents, and also lets them know that the burden of solving the residential traffic problem falls largely on the residents themselves. If the initial complaint was funneled through an elected official, staff should advise that official of the upcoming meeting and give him/her a chance to attend if he/she wants.

Following step 4, the process goes through extensive data collection, evaluation, project selection, implementation and monitoring stages.

Detect and Defuse Potential Opposition

Coordinate RTM programs with all city departments. Publicize the program within the governmental structure and make a concerted effort to raise concerns of others as early as possible. In Portland, Oregon, the fire department has formalized its participation on RTM projects with the public works department through a review process which evolved over many years. In larger cities and counties, a formal committee process may be needed; in smaller jurisdictions, personal visits by the RTM staff member and one-on-one discussions with the fire chief, police chief, maintenance superintendent, etc. may be the most effective process.

The city attorney may oppose RTM devices because they are new. Point to the lack of successful cases involving claims against agencies for RTM devices.

Involvement of city staff from all city departments is critical to the success of the program. Encourage others to voice their concerns, raise issues, and resolve them cooperatively well before the project or program goes to the elected officials for adoption.

The Annual Report

It's important to publicize your successes to garner continued support and to record your failures so you can learn from them. An annual report is an excellent way to do both. It should be a brief listing of the highlights of the past year regarding RTM activities, and an overview of what's expected for the coming year. A sample outline is shown in Figure 7-6.

A good format for the annual report is one page (11" x 17" folded) with simple graphics and text. Photos of successful and attractive RTM installations make a big impression on readers, as do quotes from residents about them. The report can accompany the agency's annual budget request and provide justification for it.

The annual report should also be sent to the local newspaper, followed up with a telephone call to the editor/reporter who covers the city's happenings. Photos of installations and city staff can help promote the program. All installations should be photo-documented, with a series taken during construction, and after the landscaping (if any) is completed.

The Annual Report

I. Purpose statement about Residential Traffic Management
II. Description of the RTM Program
III. Activities during the past year
- Summary of inquiries and responses
- RTM projects initiated or installed
- Follow-up report on previous RTM projects

IV. Public safety and RTM
V. Next year's program highlights
VI. Budget
- Last year
- Proposed for next year
- Budget trends
- Grant applications

VII. What we learned about RTM in the past year

Figure 7-6. Annual Report Outline

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Chapter 8.
Concluding Thoughts

This guidebook has presented many ideas and resources for successfully implementing a residential traffic management (RTM) program in cities and counties. It is a "guide" book rather than a "cook" book because each jurisdiction's residential traffic problems and solutions will be unique. Readers are encouraged to consult the references listed herein for more detailed information about various issues. Staff members are encouraged to add to the knowledge about RTM by documenting and publishing their experiences with RTM programs and devices in their own communities.

Keys To Success

The keys to success for residential traffic management require hard work, patience and a willingness to talk with people. However, the need for a formal RTM program also depends upon the desires of the community. If the community's residents are not overly concerned about traffic problems in residential areas, then an RTM program is probably not needed now. If residents are not aware of potential RTM ideas, they may not express themselves clearly in traffic terms, but may complain about noise and intrusion. If they are concerned about such problems, the ideas listed in Figure 8-1 provide a good guide for a successful program.

The Keys to Success

- **Get Involved**
- **Detect and Defuse**
- **Try It and See**
- **Work the Politics**
- **Stay Informed**

Figure 8-1. Keys to success

Get Involved

At the onset, it is important to publicize the program and inform staff, citizens and elected officials about it. Some common techniques include the following activities.

- **Public Agency Coordination** – initiate contacts with other agencies and departments, and provide written information about the benefits and concerns of RTM programs and devices. This is also a good time to solicit input from all concerned city or county departments, especially emergency service agencies.
- **Outreach Programs** – Offer to make presentations on RTM to community groups, provide information in community newspapers and newsletters, etc. Make a formal briefing to the elected officials with a slide show or other presentation format.
- **Media Displays** – Set up display boards at city hall, in shopping malls, and in other community meeting places to inform and educate people about RTM. Hand out information sheets about the program at city-sponsored activities.

- **Citizens Groups** – When residents complain about traffic problems in their neighborhood, enlist their support in publicizing the program. The "Quick Response Kit" in Chapter 4 is a good starting point for RTM publicity.

Detect and Defuse

As mentioned in Chapter 7 and elsewhere, involving all interested parties in developing the program is crucial to its success. Scope out potential opponents and bring them into the process early. Initiate the contacts with police, fire department, utilities, etc. and invite their input; don't wait for them to hear about the project and then criticize it. Listen to their concerns and foster a spirit of cooperation among all concerned.

As the RTM program evolves in your community, be alert for criticisms and concerns. Respond quickly, and positively, either with information to counter the criticisms or with changes in the program to respond to valid concerns. Often, changes in wording, using a different approach or minor revisions to program elements at an early stage can avoid heated opposition later in the process. Be flexible in dealing with concerns but stick to the basic element of the program as outlined in this guidebook.

Try It and See

Successful RTM programs have: (1) a phased approach to implementing RTM beginning with the least restrictive action or device, and (2) a willingness to experiment with the layout, design and construction of RTM devices. Good engineering judgment and technical expertise are required for every application, but each RTM installation should be a learning experience for all.

Portland, Oregon, has an excellent program of continually re-evaluating its RTM elements in an effort to improve their overall quality, and an aggressive approach to addressing the concerns of city agencies about its program. Some ways that a small city or county can follow Portland's example are:

- **Demonstration Programs** – seek ISTEA funds or state safety grants to implement RTM actions on a demonstration basis with full funding of before and after evaluations.

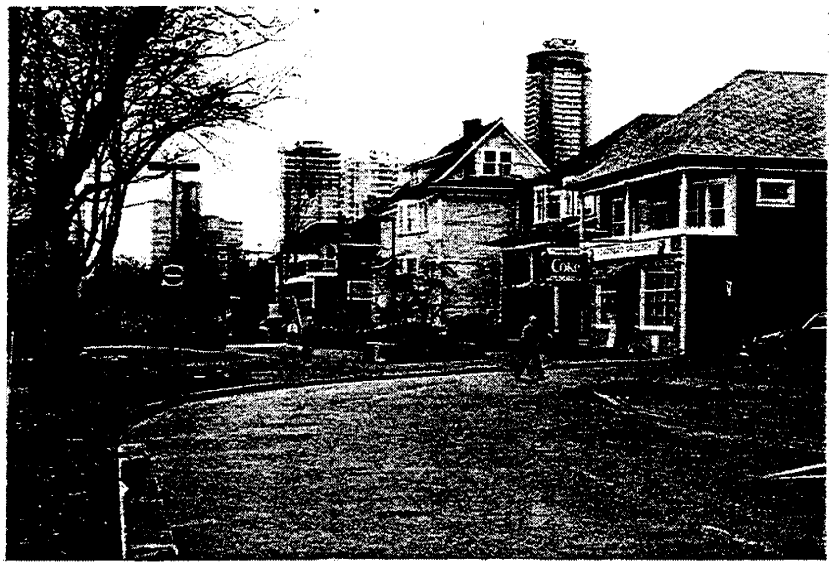
- **Temporary Devices** – In situations where the acceptance or effectiveness of a given RTM device is uncertain, try an attractive but low-cost temporary installation and monitor how it well it works.

- **Follow-Up Evaluations** – Every RTM project should have a written evaluation of each action taken. These evaluations should be summarized in the annual report, and ineffective actions/devices removed from the program. Follow-up and feedback are important steps in an RTM program.

- **Permanent Installations – The installed RTM device should look as good as, or better than, the jurisdiction's other traffic control devices. Speed humps should be signed and delineated with pavement markings that make it as easily recognizable as a school crosswalk or railroad crossing.** Landscaping can be a defining element of a traffic circle. Experiment with various plant materials to find those which are the most attractive at the least maintenance cost.

Work the Politics

Remember that residential traffic management is a political as well as an engineering and planning process, and stay in touch with the local politics of the situation. Keep your elected officials informed about the program, tell them about its successes, and alert them to potential "land mines" ahead of time. Build a constituency among satisfied customers (i.e., residents) and use them as spokespersons at council meetings to support the program.



Stay Informed

The art of residential traffic management is constantly evolving, and the responsible professional staff member must keep up to date with the state-of-the-art. The periodicals listed in the reference sections of this report provide the best chance of staying current: the *ITE Journal* and the APA's *Planning* magazine are the leading sources of transportation-related articles. Even as this *Guidebook* goes to press, articles in current issues of these magazines address RTM issues: "Modern Roundabouts for Maryland," and "Facing Up to a Street Closure Epidemic" in the October 1994 issue of the *ITE Journal*; and "Stroll Down the Boulevard" in the November 1994 issue of *Planning*.

Attending professional conferences and workshops on traffic safety issues helps develop a network of contacts in the traffic engineering field which you can draw on for advice on RTM matters. Informal discussions with other traffic professionals can yield valuable insights about how to best handle the day-to-day issues which arise with RTM programs.

Future Directions

Traffic impacts in residential neighborhoods will continue to be a problem into the foreseeable future. While new urban design approaches, such as neo-traditional neighborhoods, may alleviate potential car-pedestrian conflicts in some new communities, the current generation of suburban residential roads will be with us for many years. Thus, retro-fitting existing streets to slow speeding drivers and divert cut-through traffic will be an issue for some time.

The application of traffic calming techniques on collector streets and even minor arterials will be more prevelant as more and more "residential" streets are used for these purposes. At press time, the cities of Anchorage, Alaska, and Portland, Oregon, have issued separate requests for proposals for consulting services to develop traffic calming applications in roadway corridors carrying in excess of 18,000 average weekday traffic. Increased vehicle and pedestrian accidents, high speeds and neighbor's concerns about the safety of themselves and their children have generated these requests. As funding for new roadways becomes more and more difficult, the applications of RTM techniques to enhance pedestrian safety in such corridors will become more common.

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Appendix A.
Glossary of Terms

Bicycle lanes: Travel lanes designated for the exclusive use of bicycles. These could be on both sides or on just one side of the street. This technique is used to constrain the traveled width of the road and also to enhance the safety for bicyclists.

Chicane: An artificial 45-degree bend in a formerly straight street usually created by the placement of plantings or by alternating parking on one side of the road and then the other to force cars to negotiate the street in a snake-like fashion.

Choker: A narrowing of the street, either at an intersection or at midblock, to constrain the width of the traveled way.

Cul-de-sac: A dead end street; a cul-de-sac usually has a circular area at its end to allow vehicles to turn around without backing into a driveway.

Curb extensions, entry, exit, mid-block: Also known as chokers, these traffic management devices narrow the street by widening the landscape strip or sidewalk, usually at the intersection. They are used to make pedestrian crossing easier and to narrow the roadway, and provide a visual cue to motorists that they are entering a non-arterial street.

Diagonal diverters: A barrier placed diagonally across a four-legged intersection to, in effect, convert it into two unconnected streets, each making a sharp turn. By interrupting street continuity in a neighborhood, a system of diverters can prevent or significantly discourage through traffic. Its primary purpose is to reduce traffic volume and make through travel difficult in a neighborhood.

Environmentally adapted through road: A coordinated series of road modifications and traffic control devices to calm traffic on a main road through a community, in order to reduce the adverse environmental impacts of through traffic on the adjacent housing and other activities bordering the road. These RTM improvements were pioneered in Denmark.

Forced turn channelization: Ttraffic islands designed to prevent traffic from executing specific turning or through movements or to force it to execute others.

Median barriers: These are standard traffic engineering devices normally used to separate and improve flows on arterial streets. They can be employed to prevent left turn entries to local neighborhood streets from the arterials and to prevent through traffic flows on local streets from one neighborhood to another across an arterial.

Median entry/exit islands: A median, usually landscaped, which narrows and separates the incoming and exiting lanes at the entry to a residential neighborhood. These islands provide a visual cue to motorists that they are entering a residential area.

Median mid block islands: A median, often landscaped, which narrows and separates the traffic lanes on streets in a residential neighborhood. These islands provide a visual cue to motorists that they are driving in a residential area.

One way entry/exit chokers, half closures, semi diverters: A curb extension which narrows the street to one lane, allows only one direction of travel. These devices are used on the periphery of a neighborhood to control ingress and egress from the adjacent arterials.

One-way sign: The one way street designation can be used in several ways to protect a residential area. This could help divert the traffic from residential streets to the major streets. This approach could transfer the impacts to another local street or could lead to increased problems like speed increases on the subject street itself. Another technique is to create a maze of one-way streets so as to make through routes difficult to find.

Parking restrictions: Parking restrictions are usually employed to deter outsiders from abusing residential areas for parking. Variants include time restricted or resident restricted parking.

Pavement treatments: Several pavement treatments exist that have varying effect on the traffic characteristics. For instance, pavement striping, marking, and changes in the pavement pattern, texture, and color have desirable effect in slowing down the speeding vehicles.

Photo radar: A photo radar is mounted at a desirable location to take pictures of license plate and occupants of the speeding vehicles. Police retrieve the information offsite and issue tickets to the owners of the speeding vehicles.

Radburn layout: Housing and traffic arrangements, much adopted in post-war British estates, in which houses are clustered along short culs-de-sac or loop roads off the local distributor, with foot and cycle traffic segregated to paths between the houses.

Rumble strips: Patterned sections of rough pavement normally used to alert drivers to a hazardous condition or on approach to another control device. They have had some application for speed control in residential streets but are not generally effective.

Raised crosswalks: Pedestrian crosswalks which have been elevated above the normal pavement level to enhance pedestrian safety and to create a vertical pavement undulation to force motorists to slow down when traversing the crosswalk.

Semi-diverters: Devices which bar traffic in one direction on a street while permitting travel in the other direction.

Speed alert: Speed Alert comprises of a portable trailer equipped with a radar unit which detects the speed of passing vehicles and displays it on a digital reader board. The goal is to show drivers their "actual" speed vs. the posted speed limit and encourage their compliance. The device is usually placed in neighborhoods experiencing frequent speeding. However, other similar conditions may require its use.

Speed bumps: Raised bumps in the pavement surface extending across the traveled way to reduce traffic speed. Conventional speed bumps have generally been rejected in the U.S. for neighborhood traffic control applications because of potential failure to control speed and vehicle damage and safety hazards.

Speed control island: A device to interrupt a long straight section of a residential road. It is based on the maneuvering requirements of private cars but has mountable shoulders to allow larger vehicles to negotiate it.

Speed limit sign: These signs have generally been found to have little effect on traffic speed or residential streets, unless constantly enforced.

Speed humps: A raised hump in the roadway, short in length but extending across the road at right angles to the direction of flow. Cross-sections and materials may vary and there may be avoidance channels for cycles. Speed humps are the devices used primarily for reducing speed on residential streets. /Speed humps are pavement undulations with lengths of 8 to 12 feet that are more gradual than speed bumps which are usually less than 3 feet in length.

Speed tables: An elevated plateau in the roadway with a descending ramp on each side. Usually made from distinctive materials - such as paviours, tiles or setts - and often installed at gateways, crossing zones (raised crossings) and junctions (raised junctions). As the plateau has the effect of railing the roadway to the level of the bordering footway, it is also known as a raised pavement.

Speed watch/warning: Residents use radar, record license plate number of speeders. Police send letter to alert/warn vehicle owners of the observed vehicle speed and request their compliance.

Stop signs: Stop signs are used to assign right-of-way to the intersecting streets at an intersection. At a two-way stop controlled intersection, right of way is given to the vehicles on the major street and the vehicles on minor street have to stop at the stop sign. At four way stop controlled intersections, vehicles on all approaches have to stop. Stop signs are often requested by citizens with the expectation that they will control speed or reduce volume in residential neighborhoods. Studies however have shown that these goals are not always achieved.

Traffic circles: These devices, also called as rotaries or roundabouts, have several functions. Large circles or roundabouts are used for capacity improvements. They can replace intersections, changing direct conflicts of traffic streams into weaving maneuvers. Circles, 3 to 10 feet in diameter, are used to change right-of-way priorities at fairly busy intersections although they are being tried as speed control devices within the intersections of two local streets.

Turn prohibition sign: These involve the use of standard "No Right Turn" or "No Left Turn" signs, with or without peak hour limitations. These prevent turning movements onto residential streets, thereby reducing volume. Turn prohibition signs are used on major or collector streets to prevent undesired turning movements onto residential streets. They usually involve "No Right Turn" or "No Left Turn" signs, with or without peak hour limitations. If the cut-through traffic is limited to peak hours, the turns could be restricted during these periods so that residents have full accessibility during the rest of the day.

Woonerf: From the Dutch *woonerf* which means approximately "livings areas" or "living yard". Woonerf describes a residential street concept where the street is considered an extension of the residents' front yards, much like a paved courtyard. Cars, pedestrians and bicyclists share the public roadway at typical walking speeds (3 to 5 mph).

Appendix B
A Pictorial Glossary of RTM Devices

This appendix was prepared in draft form by the City of Everett's Department of Public Works and the Office of Neighborhoods. These pictures illustrate the many types of RTM devices which have been used in the Pacific Northwest. The locations of many of the devices are provided, so that persons interested in their application can visit the site in person and observe the device, its setting and how traffic reacts to it.

The Washington State Department of Transportation and KJS Associates, Inc. are grateful to the City of Everett for allowing these illustrations to be reproduced in this guidebook. The originals are in color and provide much greater clarity about the devices and their settings than the black-and-white reproductions in this appendix.

INTERACTIVE SPEED WATCH

RUMBLE STRIPS

TRAVERSIBLE RUBBER DELINEATOR

Location

Bellevue, Washington
Vancouver, B.C.

Setting

Varies

FIGURE 1 Interactive speed watch
Bellevue, Washington

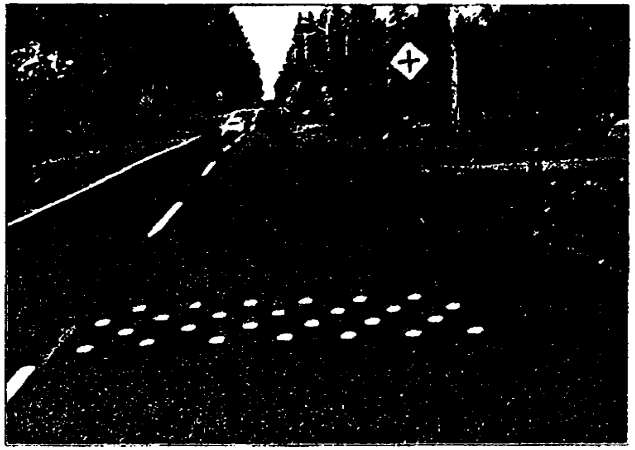


FIGURE 2 Rumble strip preceeding intersection
Bellevue, Washington

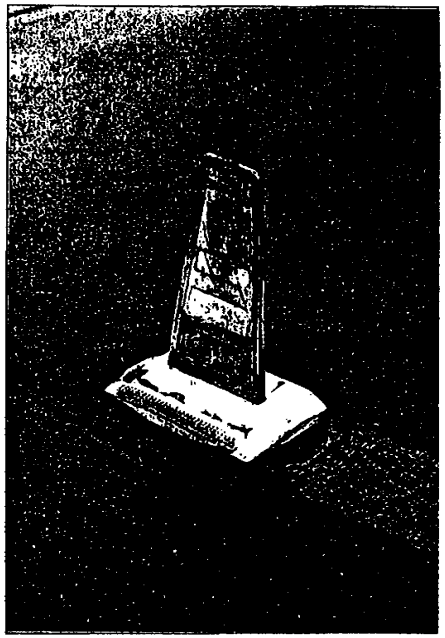


FIGURE 3 Rubber delineator on diagonal diverter
Vancouver, B.C.

TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Rumble Strips	Unlikely	Yes	Increase	Vehicles - Good Bicycles - Questionable	None	No Problems	Not Applicable	Low	Snowplow

ENTRY TREATMENT

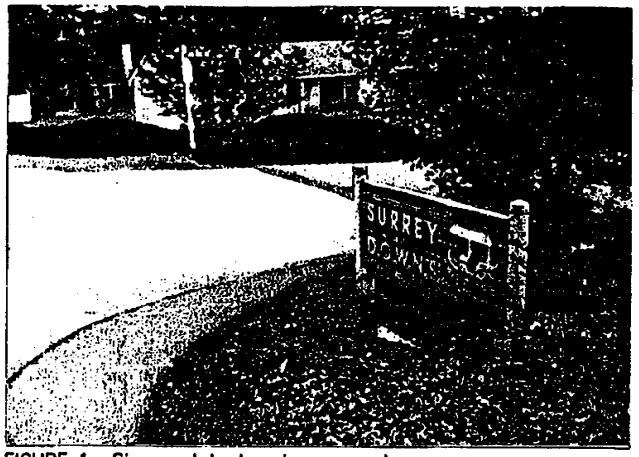


FIGURE 1 Sign and textured pavement
110th Ave. S.E. at Main St., Bellevue, Washington

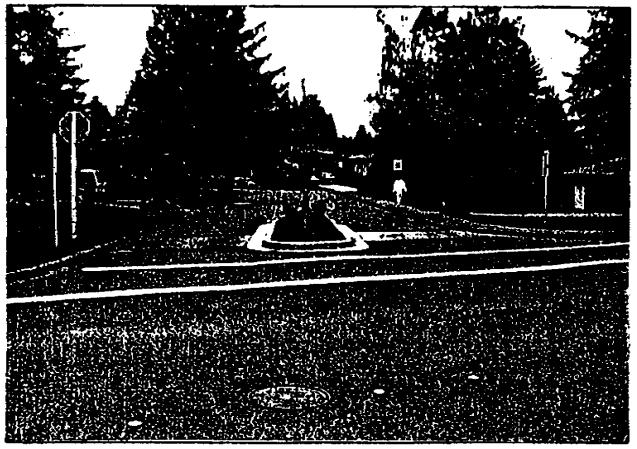


FIGURE 2 Median sign and textured pavement
S.E. 2nd Ave. at 100th Ave. S.E., Bellevue, Washington

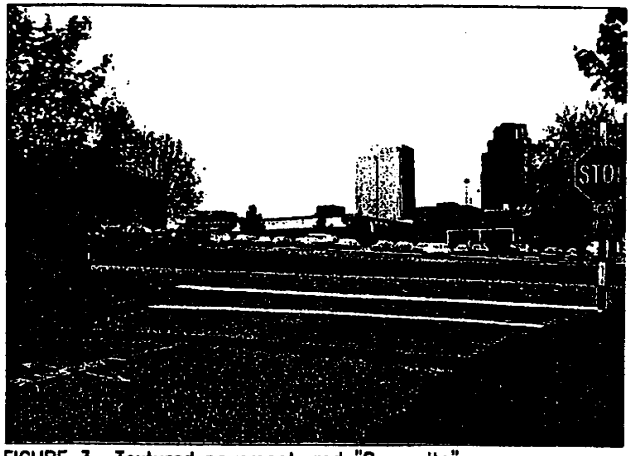


FIGURE 3 Textured pavement, red "Bomanite"
110th Ave. S.E. at Main St., Bellevue, Washington

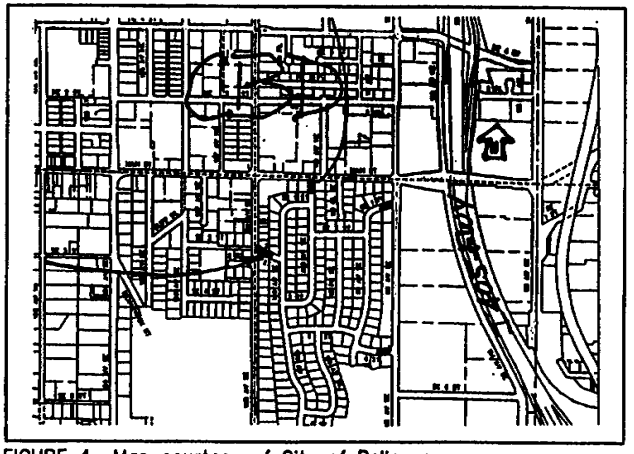


FIGURE 4 Map courtesy of City of Bellevue

Location

Surrey Downs Neighborhood
Bellevue, Washington

Setting

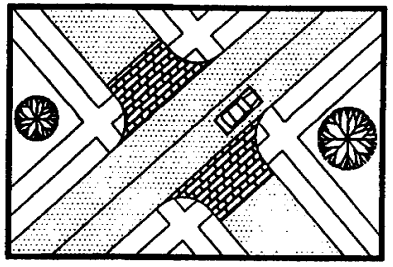
Fully developed, single family residential area, adjacent to downtown Bellevue.

Situation

Cut-thru traffic and excessive speeds. Neighbors seek to affect driver behavior by emphasizing that they are entering a "special" place.

Features

Textured, colored pavement, neighborhood identification sign, median, drought-resistant landscaping.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Entry Treatment Surface & Median	Possible	Slight	No/Minor Change	Possibly Improved	None	No Problem	Not Applicable	Low to Moderate	Low to Moderate / Possible Vandalism

TRAFFIC CIRCLE

FIGURE 1 Circle sign indicates direction of travel
Vancouver, B.C.

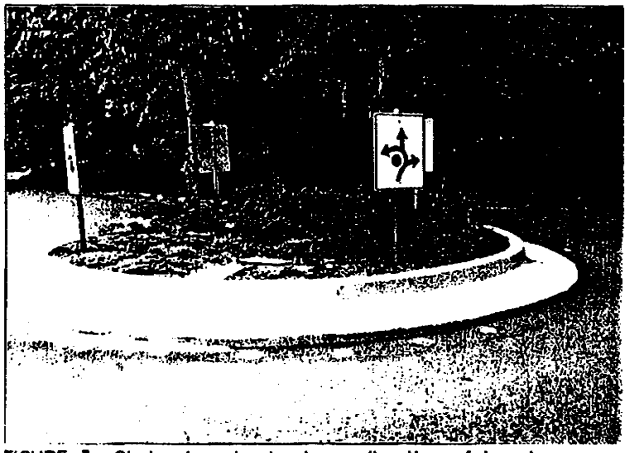


FIGURE 3 Circle sign clearly shows direction of travel
N.E. area, Portland, Oregon

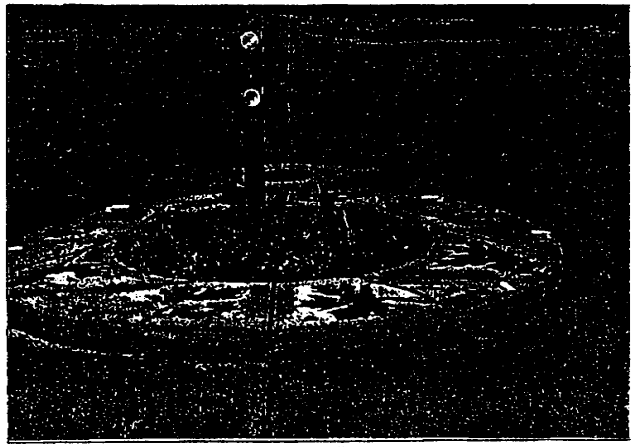


FIGURE 2 Circle detail "Mapleleaf" pavement design
Mapleleaf Neighborhood, Seattle, Washington

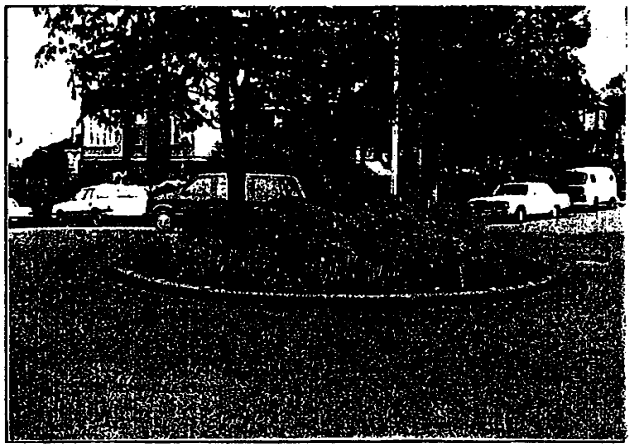


FIGURE 4 Circle visibility maintained with thoughtful landscaping,
E. Highland Dr. at 16th St., Seattle, Washington

Location

Figure 1 Vancouver, B.C.
Figure 2,4 Seattle, Washington
Figure 3 Portland, Oregon

Setting

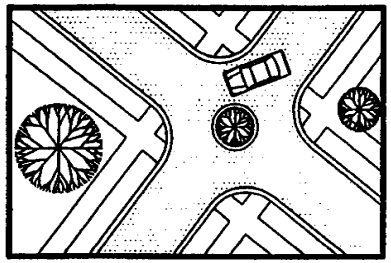
Fully developed residential areas in three Pacific Northwest cities.

Situation

All circles at intersections of local streets.
Diameter of circles varies to provide clearance.

Features

Portland and Vancouver both provide signs to indicate the desired direction of travel. Seattle does not do this on local streets, but does sign for direction when circles are located on intersections of local and arterial/collector streets.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Traffic Circle	Possible	Likely	No Change	Improved	None	Some Constraint	Low	Low	Vandalism

TRAFFIC CIRCLES

In Three Cities

FIGURE 1 18th Ave. E. at E. Roy St.
Capitol Hill, Seattle, Washington

FIGURE 2 E. Roanoke at 25th Ave. E. Eastbound
Mountlake District, Seattle, Washington

FIGURE 3 Haro and Jervis
Vancouver, B.C., Canada

FIGURE 4 N.E. 24th Ave. at N.E. Tillamook
Portland, Oregon

Location

Seattle, Washington
Portland, Oregon
Vancouver, B.C., Canada

Setting

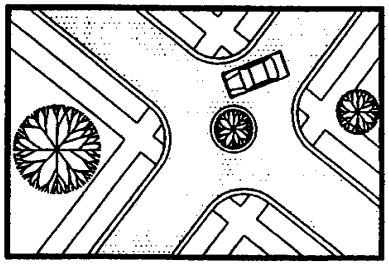
Figure 1 Old single family area near church and school; circle installed mid 1970's; Seattle, Washington
Figure 2 Affluent, single family area near Univ. of Washington and Lake Washington. Circle newly installed.
Figure 3 High density, high rise near downtown Vancouver, B.C.
Figure 4 Mature, well-kept single family area; Portland, Oregon

Situation

The same problem in each city: speeding, cut-thru traffic, accidents. The circles are one of a number of devices and measures put in together to provide an area-wide remedy They are not "spot" improvements in these case

Features

All examples very well landscaped with both shrubs and trees.
Notice variation in signage, curb design, striping and use of reflectors. See how shrubs are kept low and trees are pruned high to assure pedestrians and driver/auto visibility.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Traffic Circle	Possible	Yes Near Circle	No Change	Improved	None	Some Constraint	Self Enforcing	Moderate to High	Moderate / Possible Vandalism

ROTARY

Moderate Size

FIGURE 1 Rotary N.E. Naomi at 17th Ave. and 63rd St. Looking east, Seattle, Washington

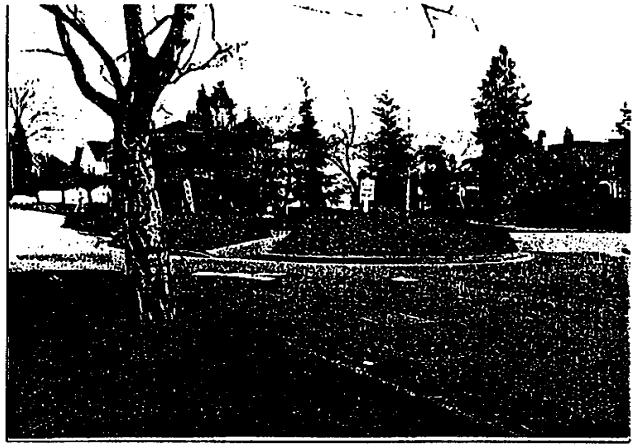


FIGURE 2 Rotary, N.E. Naomi at 17th Ave. and 63rd St. Seattle, Washington

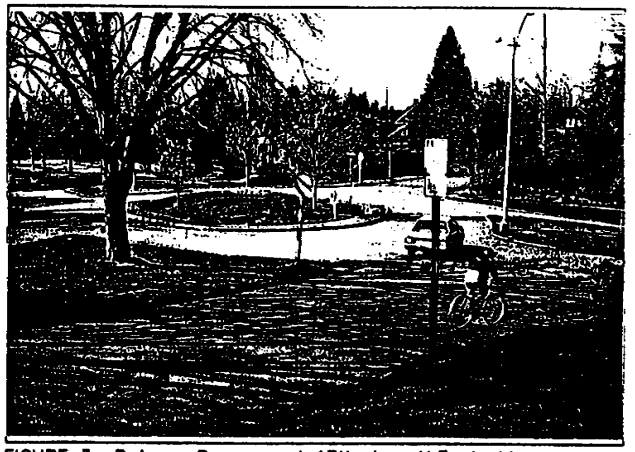


FIGURE 3 Rotary Ravenna at 17th Ave. N.E., looking north Seattle, Washington

FIGURE 4

Location

University neighborhood north of the University of Washington, Seattle, Washington.

Setting

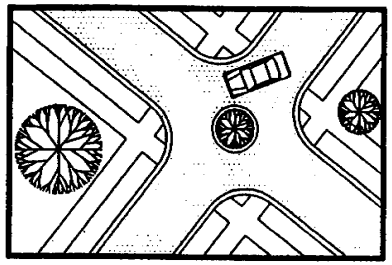
Fully developed, mature single family areas, N. Seattle.
Figure 2 Classic rotary in heavily landscaped boulevard of historic Olmsted design.

Situation

Rotaries reduce head on conflicts by encouraging traffic to merge, flow in the same direction, and exit smoothly. Pedestrians must be alert to find gaps in which to cross if traffic volumes are high.

Features

Figure 1,2 Odd-shaped, landscaped rotary with walkways cutting across to accomodate pedestrians.
Figure 3 has a circumferential sidewalk. It and the nearby median islands are wide and tastefully landscaped.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Traffic Rotary	No	No	Mixed Results	Mixed Results	None	No Constraint	Low	High	Moderate / Possible to High Vandalism

• Rotaries are very large circles. They often substitute for traffic signals on major arterials if there is enough space available. In these neighborhood examples, however, some of the entering streets have stop signs; in many instances, rotaries function quite well without stop controls. Unfamiliar drivers discover that they take some getting used to.

FORCED TURN CHANNELIZATION

Right Turn In
Right Turn Out
Diverter

FIGURE 1 Barkley at Thurlow Looking west
Vancouver, B.C.

FIGURE 3 Barkley at Thurlow Looking east
Vancouver, B.C.

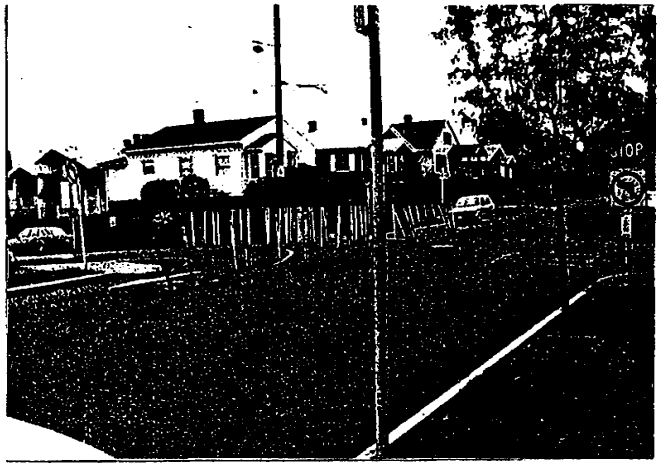


FIGURE 2 Test: Right turn in, right turn out island
N.E. Schulyer at E. 8th Ave, looking S.W.
Portland, Oregon

FIGURE 4 Test: Right turn in, right turn out island
N.E. Schulyer at E. 8th Ave., looking north
Portland, Oregon

Location

Westend area, Vancouver, B.C.
Northeast area, Portland, Oregon

Setting

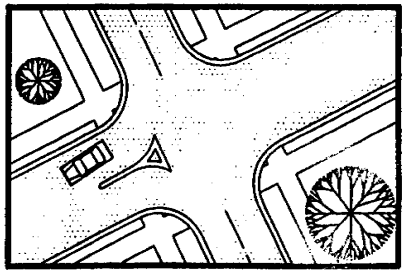
Two residential neighborhoods in two Pacific Northwest cities. In Vancouver, B.C., high population density in high and low rise buildings adjacent to downtown. In Portland, Oregon, mature urban single family area near major shopping center.

Situation

Vancouver, B.C.: High volume of cut-thru speeding traffic, often to/from hospital complex to east.
Portland, Oregon: Cut-thru, speeding traffic mostly to/from shopping complex to south.

Features

Figure 1,3 raised island diverter with curb cuts, no landscaping, functional but unattractive.
Figure 2,4 Test case. Lack of bulk contributes to unappealing appearance.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Forced Turn Channelization	Yes	Likely	Decrease	Improved	Some, No Left Turn	Minor Constraint	N/A	Potentially High	Vandalism

SPEED HUMP (BUMP)

ROAD UNDULATIONS
3 Humps In Series
With Curb Extensions

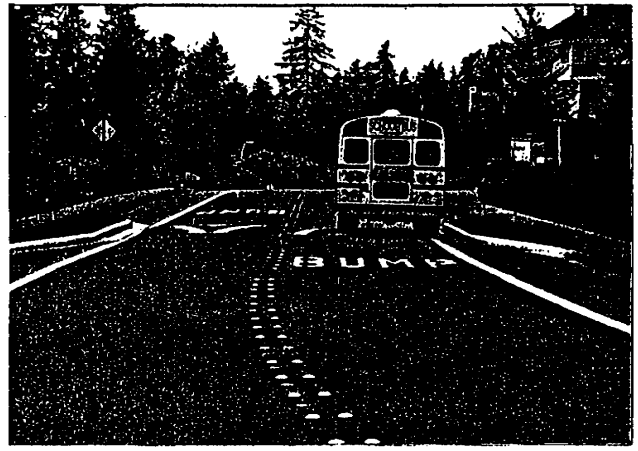


FIGURE 1 Speed hump with curb extensions
111th Ave. N.E. looking N.W., Bellevue, Washington

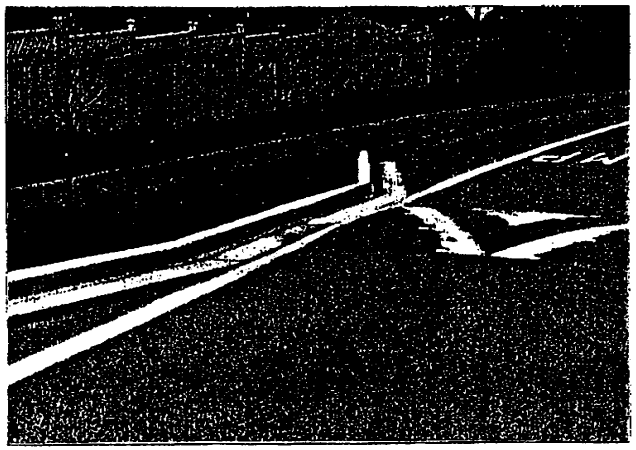


FIGURE 2 Detail curb extension to physically reduce traveled way. See tire marks on curb face.
111th Ave. N.E., Bellevue, Washington

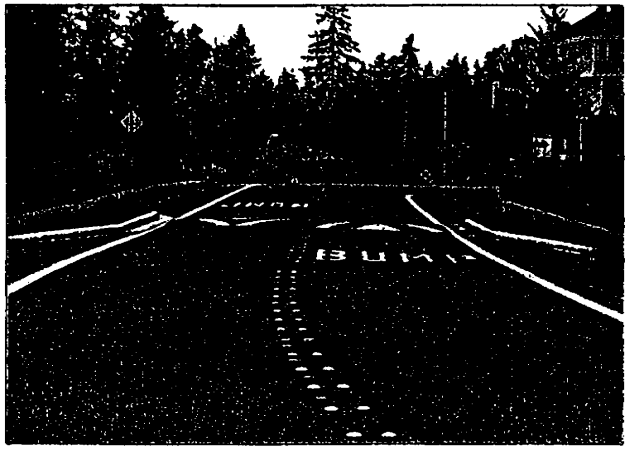


FIGURE 3 Speed hump with curb extensions
111th Ave. N.E. looking N.W., Bellevue, Washington

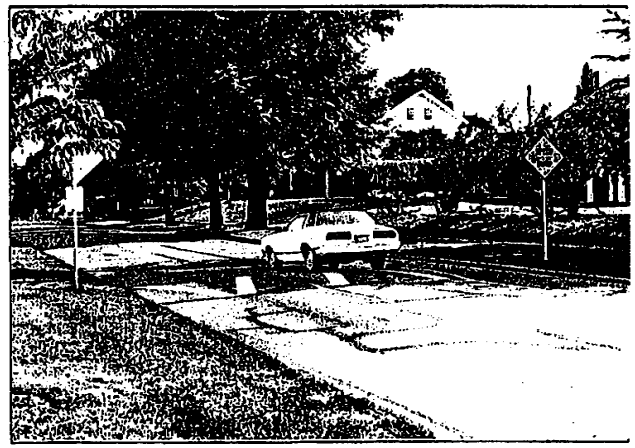


FIGURE 4 Grand Ave., Everett, Washington

Location

Yarrow Bay Development
Bellevue, Washington;
Grand Ave., Everett, Washington

Setting

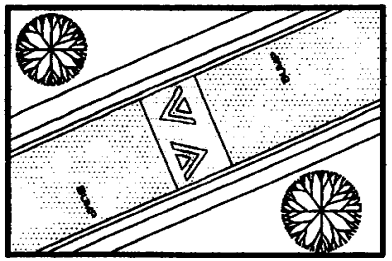
Newly developed, single family area. Condos and other multi-family dwellings along easterly portion of 111th Ave. N.E.

Situation

Cut-thru traffic, speeding
Wide street width and sweeping curves invited speeding. Rolling terrain and curves limit sight distance. Wide curb-to-curb places crossing pedestrians and school children at risk.
Speed reduced

Features

Extensive use of striping, reflectors, and buttons. Landscaped curb extensions include deciduous trees. Drought tolerant plantings maintained by neighbors. Pedestrian crossing distance effectively reduced with striping.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Speed Humps/ Undulations	Possible	Yes	No Change	Improved	None	Minor Constraint	Self Enforcing	Moderate	Low to / Possible Moderate Vandalism

ENTRY ISLANDS AND MID BLOCK SLOW POINT

FIGURE 1 Mid block slow point, one lane/two way
Dorffel Dr., Seattle, Washington

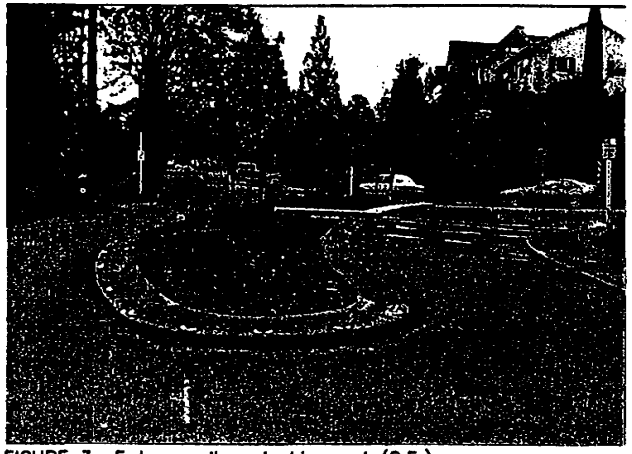


FIGURE 3 Entry median looking out (S.E.)
Dorffel Dr. at E. John and Maiden Lane, Seattle, Washington

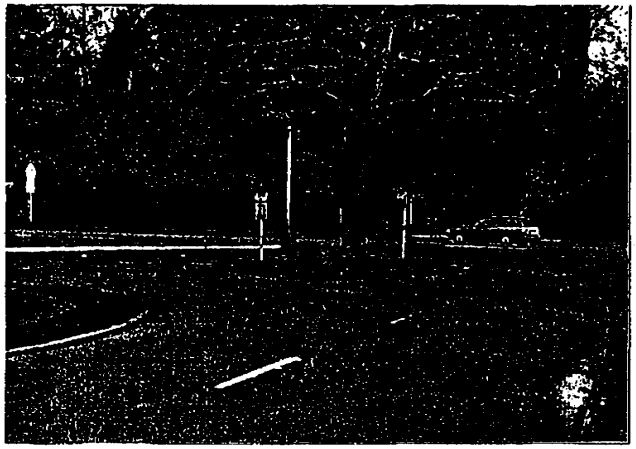


FIGURE 2 Intersection island neighborhood entry
Lake Washington Blvd. at Dorffel Dr.

FIGURE 4

Location

Lakeview Park area
Seattle, Washington

Setting

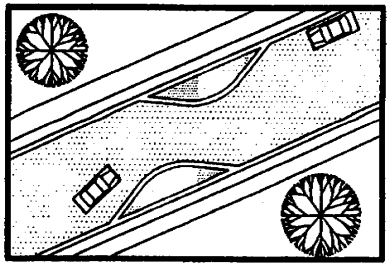
Fully developed, mature and single family residential neighborhood near Lake Washington.

Situation

Cut-thru traffic and excessive speed; Neighbors requested slow point to allow passage of only one car at a time, and the median at southeast entry to lessen collisions by slowing and guiding traffic flow.

Features

Offset slow point and entry islands, all landscaped.
Slow point and island have irrigation system.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS

CHICANE

Alternating Barriers

Reduce 2 Lane, 2 Way to 1 Lane, 2 Way

FIGURE 1 Approaching vehicle, requires driver decision. Who is to give way? 70th Ave., westbound

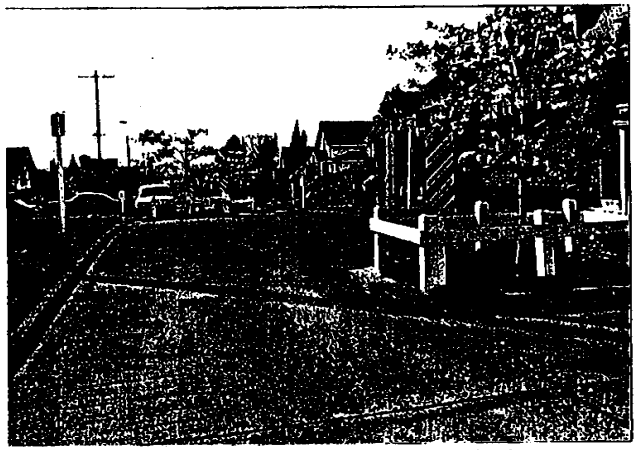


FIGURE 2 Open lane ahead; N.E. 70th St. west of 15th Ave. N.E., westbound

FIGURE 3 N.E. 70th St. at 15th Ave. N.E.; Looking west

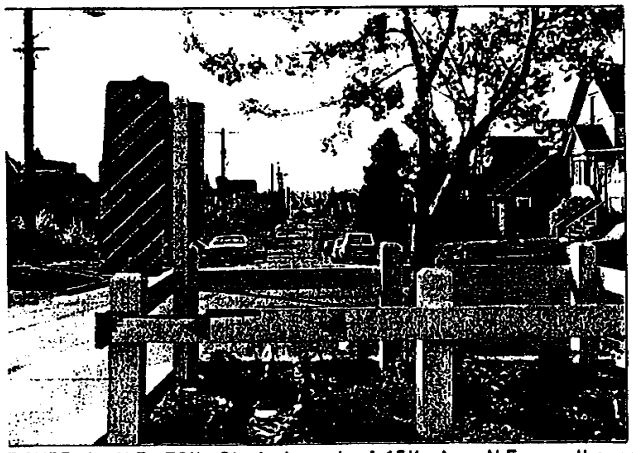


FIGURE 4 N.E. 70th St. just west of 15th Ave. N.E., westbound

Location

North of the Univ. of Washington, east of I-5 freeway and the Green Lake area of Seattle, Washington.

Setting

Fully developed, urban area in corridor serving heavily traveled freeway.

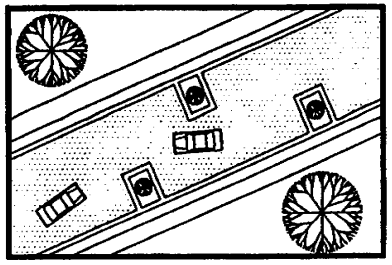
Situation

Three chicanes on 70th St. N.E. just west of 15th Ave. and another three farther down the street just east of 12th Ave. have been very effective in reducing cut-thru traffic volumes. Speeding has also diminished.

70th Ave. to the west provides one of several I-5 freeway crossings in the vicinity. It is fed by an I-5 off-ramp serving south, west, and eastbound freeway exits.

Features

Basic landscaping and fencing (6x6 posts, 2x6 laterals), provided by the city is maintained by neighbors (who also painted fence). The solid appearance and use of reflectors and signs has proven effective, safe and popular with residents along the street. Boisterous negotiations between drivers going in opposing directions have been reported.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Chicane (Fort)	Yes	Yes	Decrease	Mixed Results	None	Minor Constraint	Not Applicable	Moderate to High	Moderate / Possible Vandalism to High

CHOKERS
LANE REDUCTION

Passage For One Vehicle At A Time

FIGURE 1 Interlaken Blvd. east of 24th Ave. E. Bridge reduced to one lane

FIGURE 2 Interlaken Blvd. near 24th Ave. E., when southeast bound, entering series of choke points.

FIGURE 3 Interlaken Blvd. near 24th Ave. E., when northwest bound, exiting series of choke points

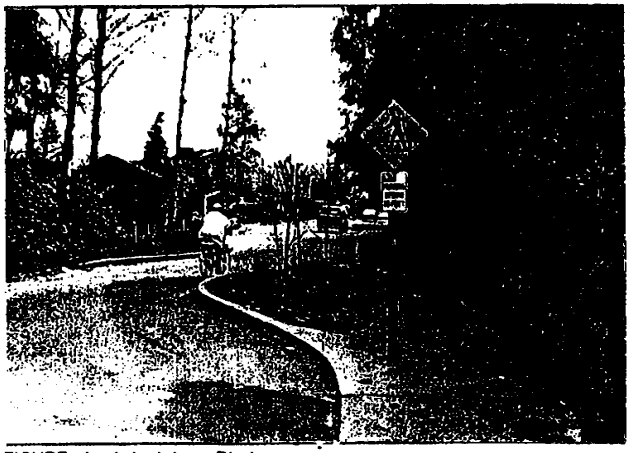


FIGURE 4 Interlaken Blvd.

Location

West of Washington Park
Seattle, Washington

Setting

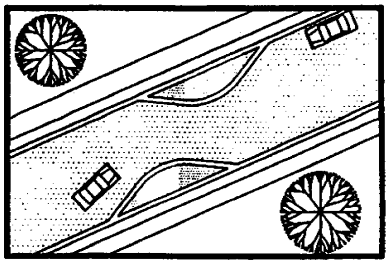
Fully developed, mature single family area, Houses abut linear parkway

Situation

Congestion on the few alternative routes attracted commuter cut-thru traffic.
Series of chokers effectively reduced speed and volume of traffic. Strenuous opposition is slowly abating (1991), but drivers often "honk" (day and night) to warn opposing vehicles approaching single lane bridge. Honking upsets neighbors.
"Perfect" solution yet to be achieved.

Features

Landscaping on chokers and bridge approaches retains flavor of original "Olmstead" boulevard design.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Choker Lane Reduction	Possible	Yes	Decrease	Improved for Pedestrians	None	No Problems	Initially High Now Routine	Moderate to High	Possible Vandalism Moderate

HALF CLOSURE

Test Exit Only
Semi-Diverter/Choker

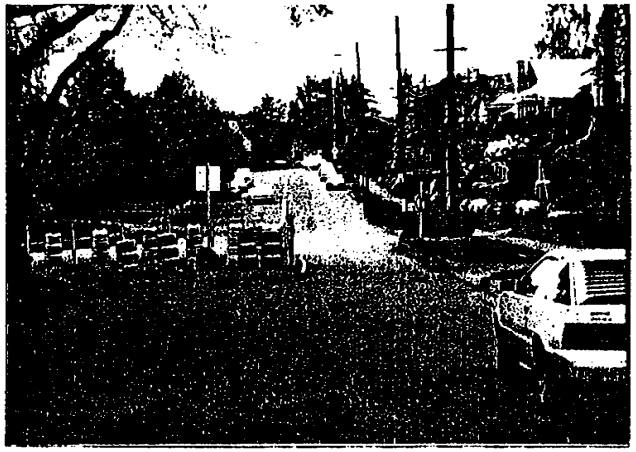


FIGURE 1 Test N.E. Wistaria and 42nd Ave., looking west

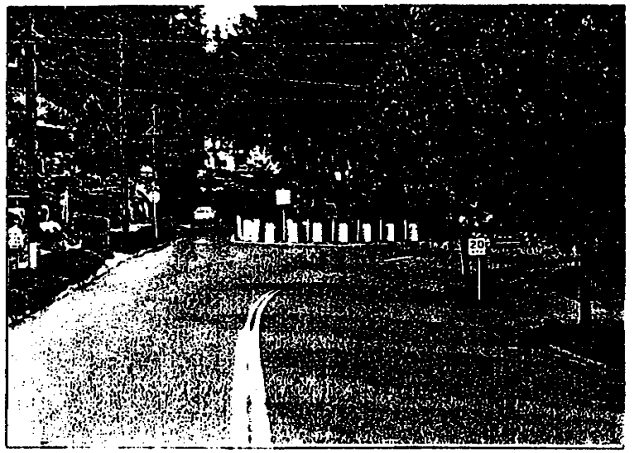


FIGURE 3 Test N.E. Wistaria and 42nd Ave., looking east

FIGURE 2 Test N.E. Knott at 42nd Ave., looking east

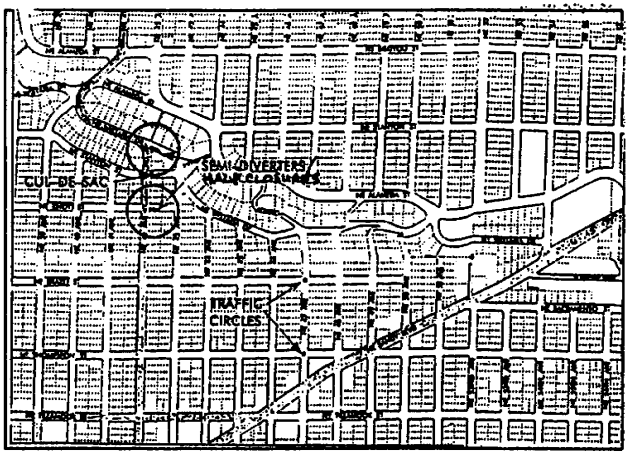


FIGURE 4 Map courtesy of City of Portland, revised

Location

Northeast Portland, Oregon

Setting

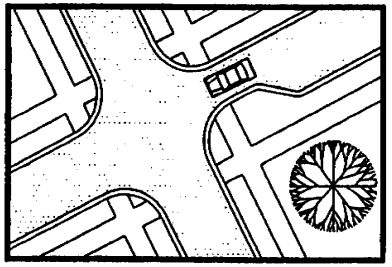
Fully developed, well maintained, single family residential area

Situation

Cut-thru traffic uses local streets.
Two half closures and one full closure/ cul-de-sac have been temporarily installed to assess their deterrent effect.

Features

Highly visible, well signed barriers are successful in appearing both massive and temporary.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Half Closure (Semi-diverter)	Yes	Likely	Decrease	Improved	Restricted One Direction	Minor Constraint	Potentially High	Moderate	Low to Moderate / Possible Vandalism

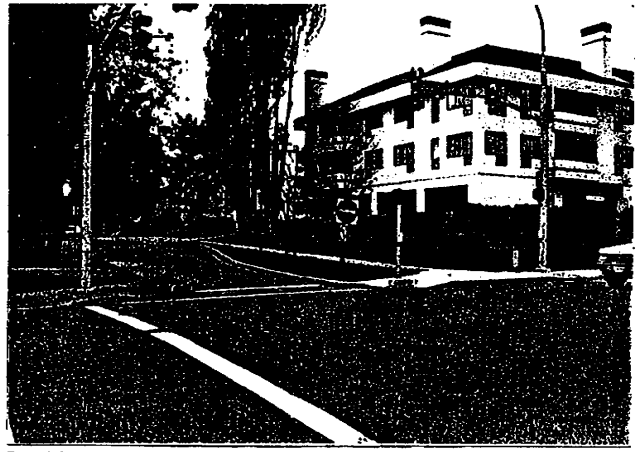


FIGURE 1 Half closure, 4th St. at 100th Ave. N.E., looking northwest, Bellevue, Washington

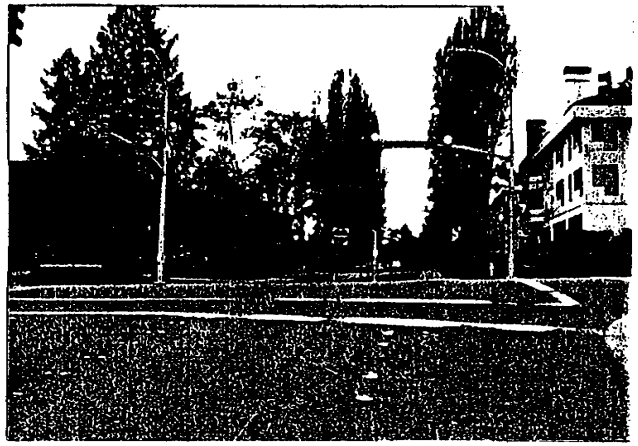


FIGURE 2 Same location as figures 1 and 4, looking west

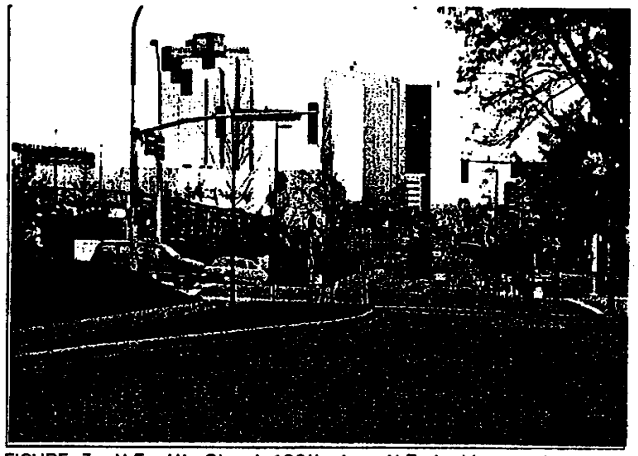


FIGURE 3 N.E. 4th St. at 100th Ave. N.E. looking east Bellevue, Washington

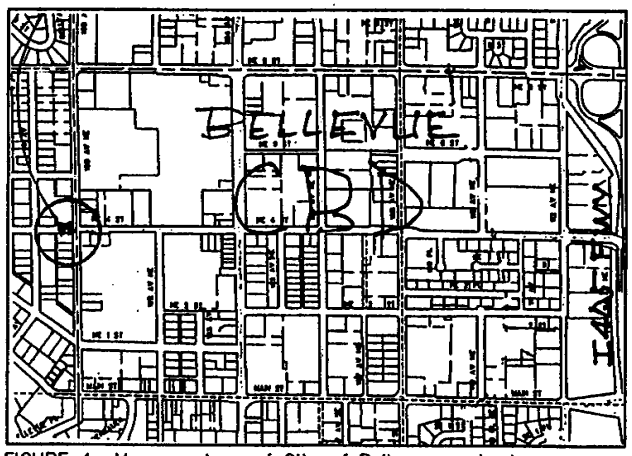


FIGURE 4 Map courtesy of City of Bellevue, revised

HALF CLOSURE

EXIT ONLY
Semi-Diverter
/Choker

Location

West of downtown
Bellevue, Washington

Setting

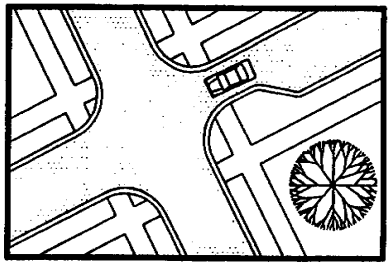
Transition block, senior housing condominiums and apartments between downtown Bellevue and single family area to west

Situation

Heavy two-directional traffic to and through neighborhood. Pedestrians at risk.
Exit-only half closure installed
Reduced volume; shifted and split entering traffic among alternative routes nearby.
Pedestrians also benefit from reduced crossing distance on west side of 100th Ave.

Features

Curb extended to close off entry lane.
Irrigated landscaping, ample signage, pedestrian activated signal



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Half Closure/ Semi-Diverter	Yes	Likely	Decrease	Improved	Restricted to One Direction	Minor Constraint	Potentially High	Low to Moderate / Possible Vandalism	Moderate

SEMI-DIVERTER PARTIAL CLOSURE

Intersection Re-Design

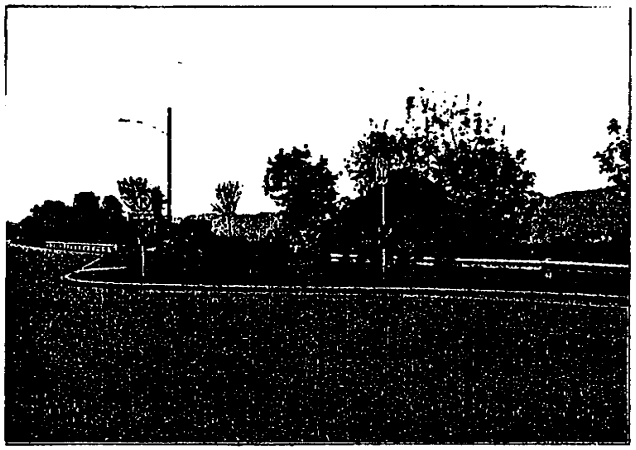


Figure 1 N. Willamette Blvd. at N. Portland Blvd. Looking southwest

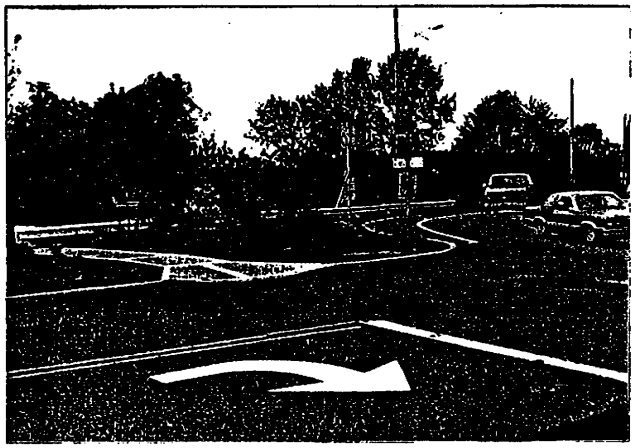


Figure 2 N. Willamette Blvd. at N. Portland Blvd. Looking northwest

Figure 3 N. Willamette Blvd. at N. Portland Blvd. Looking south

Figure 4

Location

Along bluff east of and above Swan Island Industrial Park and the Willamette River in the north area of Portland, Oregon

Setting

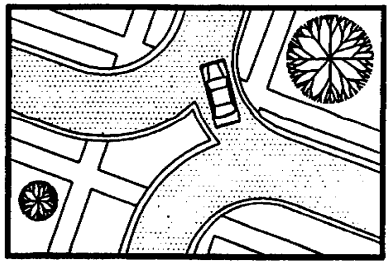
Mature, fully developed, mostly single family residential area. Residences are on bluff on east side of street facing westerly view over the street toward Forest Park on the west Portland hills across the Willamette River below.

Situation

Cut-thru and speeding traffic caused neighbors to south to seek remedy.
The semi-diverter forces south bound traffic originating from the north to flow eastward toward the Portland Blvd. interchange with the I-5 freeway.

Features

Dense, yet tasteful landscaping reinforces change of direction.
Curb cut walkway accesses blufftop trails.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Semi Diverter	Yes	Likely	Decrease	Improved	Restricted	No Problems	Moderate	Potentially High	Vandalism

DIAGONAL DIVERTER

FIGURE 1 Diagonal diverter at Gilford and Pendrell, looking east

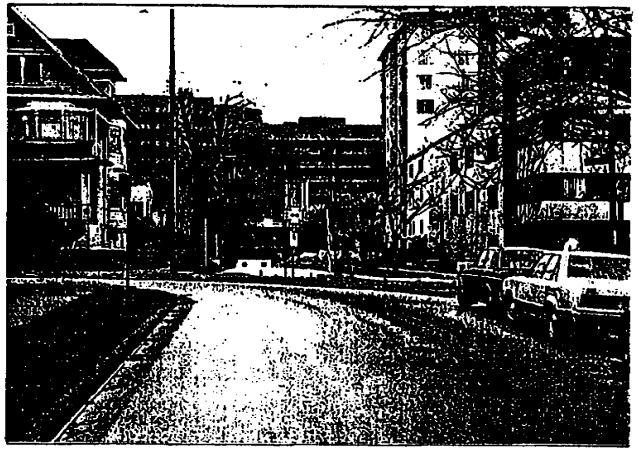


FIGURE 2 Diagonal diverter at Bute and Pendrell, looking south on Bute

FIGURE 3 Diagonal diverter at Gilford and Pendrell, looking west

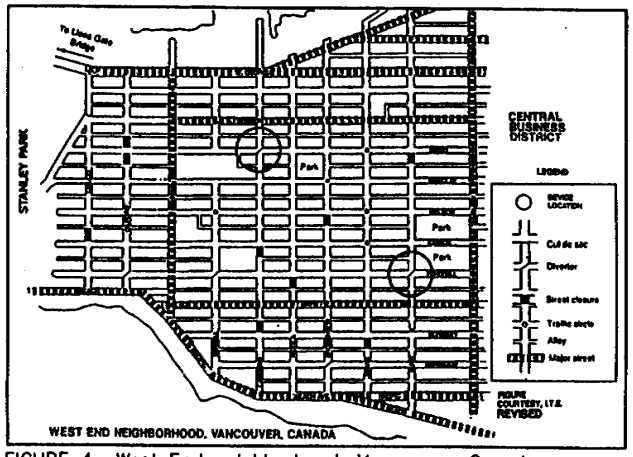


FIGURE 4 West End neighborhood, Vancouver, Canada (Courtesy of I.T.E.)

Location

West End Neighborhood
(Near Stanley Park)
Vancouver, B.C., Canada

Setting

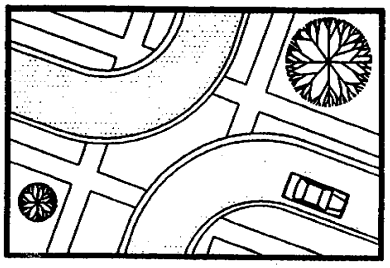
Fully developed, dense urban area mostly residential with high and low rise buildings.
Between downtown and major regional scale park.

Situation

High volumes of cut-thru traffic, speeding accidents.
Diagonal diverters one of several devices used to mitigate negative traffic impacts in this area.

Features

Very desirable, close-in living and working environment. Tasteful landscaping and surface treatment.
Sparse appearance due to seasonal loss of leaves by deciduous trees.
Traversable curbs allow passage of emergency vehicles.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Diagonal Diverters	Yes	Likely	Decrease	Improved	Left or Right Turn Only	Some Constraint	Moderate	Potentially High	Vandalism

DIAGONAL DIVERTERS

Full and Partial

See Opening For Right Turns
(Figure 3 only)

FIGURE 1 Diagonal diverter, E. Prospect at 18th Ave., Seattle, Washington

FIGURE 2 Diagonal diverter, E. 17th Ave. at Republican St., Seattle, Washington

FIGURE 3 Turn lane cut into partial diagonal diverter E. Highland Ave. at 18th Ave., Seattle, Washington

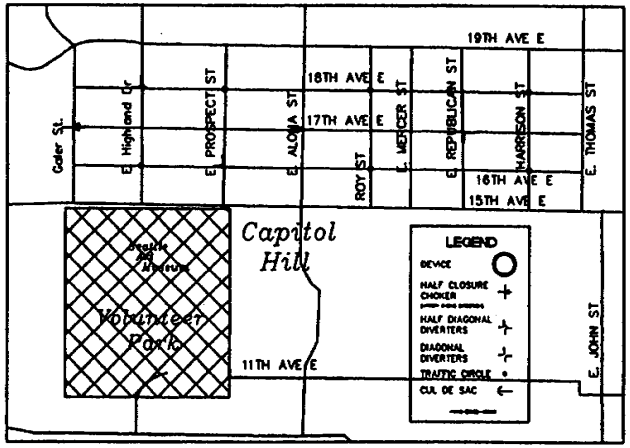


FIGURE 4 Capitol Hill area, Seattle, Washington

Location

Capitol Hill Area
Seattle, Washington

Setting

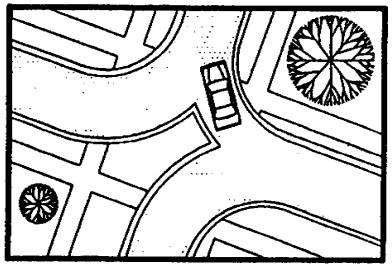
Fully developed, older residential area of large, single family and apartment houses.

Situation

Cut-thru traffic, numerous accidents at local street intersections.
System of diverters, half closures, and circles lessened cut-thru volume and greatly reduced accidents.

Features

Figure 1 diverter is cut to ease traffic access to elementary school on adjacent block. All diverters heavily landscaped. Autos parked along diverter further slow traffic.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Full Diagonal Diverters	Yes	Likely	Decrease	Reduces Accidents	Left or Right Turn Only	Some Constraint	Low, Depends on Features	Moderate to High	Moderate / Possible Vandalism
Partial Diagonal Diverters	Yes	Likely	Decrease	Reduces Accidents (Less so than Full Diverter)	Left or Right Turn Only (Except at opening)	Some Constraint	Low, Depends on Features	Moderate to High	Moderate / Possible Vandalism

DIAGONAL DIVERTER

FIGURE 1 Diagonal diverter at Cadero and Haro, Vancouver, B.C.

FIGURE 2 Diagonal diverter at Bute and Pendrell, Vancouver, B.C.

FIGURE 3 Diagonal diverter at Cadero and Haro, Vancouver, B.C.

FIGURE 4 West End neighborhood, Vancouver, Canada
Figure courtesy of I.T.E.

Location

West End Neighborhood
(Near Stanley Park)
Vancouver, B.C., Canada

Setting

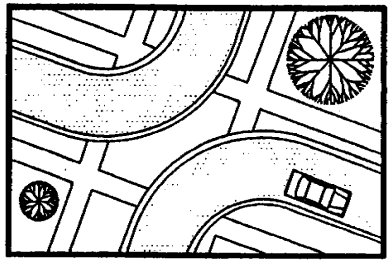
Fully developed, dense urban area mostly residential with high and low rise buildings.
Between downtown and major regional scale park.

Situation

High volumes of cut-thru traffic, speeding accidents.
Diagonal diverters one of several devices used to mitigate negative traffic impacts in this area.

Features

Very desirable, close-in living and working environment. Tasteful landscaping and surface treatment.
Sparse appearance due to seasonal loss of leaves by deciduous trees.
Traversable curbs allow passage of emergency vehicles.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Diagonal Diverters	Yes	Likely	Decrease	Reduces Accidents	Left or Right Turn Only	Some Constraint	Low to High Depends on Features	Moderate to High	Possible Vandalism

DIAGONAL DIVERTER

FIGURE 1 Diagonal diverter at 15th Ave. and E. Prospect St.

FIGURE 2 Diagonal diverter at 15th Ave. and E. Prospect St., looking south

FIGURE 3 Diagonal diverter at 16th Ave. and E. Prospect St.

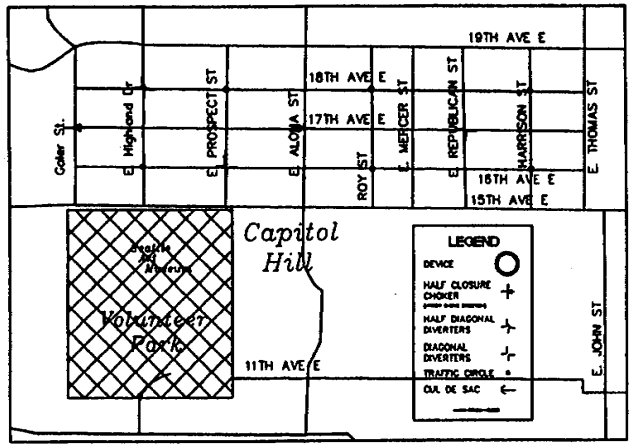


FIGURE 4 Capitol Hill area, Seattle, Washington

Location

Stevens neighborhood
(Capitol Hill)
Seattle, Washington

Setting

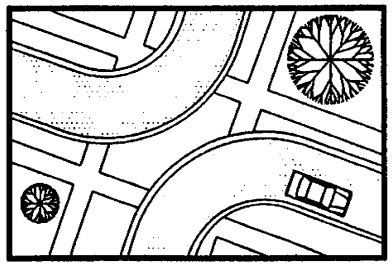
Fully developed, mature, single family residential neighborhood.
Some conversions to apartments.

Situation

This diverter is one of a network of six devices put in place in 1974 following a test period. (See map, figure 4) Thru traffic and accidents were reduced and have remained low since the devices were installed.

Features

Seattle installs street lights, hydrants, on each side of diagonal diverters. Landscaped with trees and shrubs. Community bulletin board, stone bench, rock obstacles,and curb cuts.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Diagonal Diverters	Yes	Likely	Decrease	Reduces Accidents	Left or Right Turn Only	Some Constraint	Low, Self Enforcing	Moderate to High	Moderate / Vandalism

HALF CLOSURE

Median Barriers
Turn Channelization

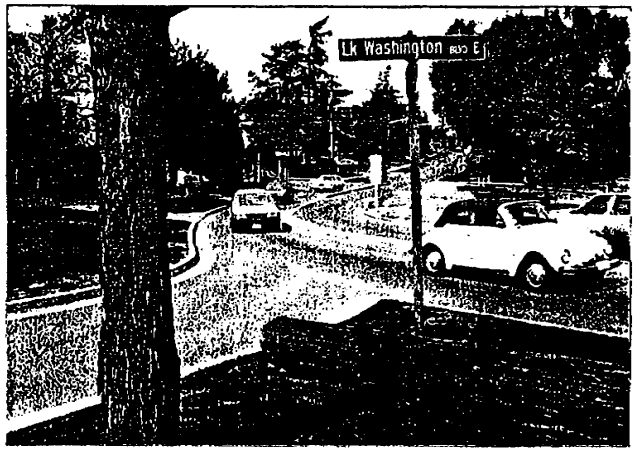


FIGURE 1 Two median barriers on Lake Washington Blvd. prohibit left turns into neighborhood.

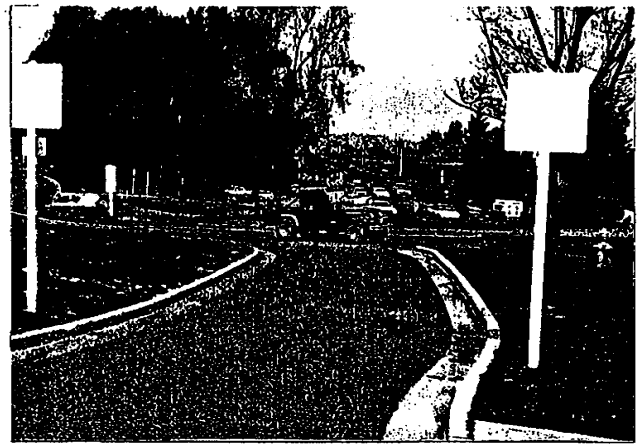


FIGURE 2 No exit from neighborhood, 26th Ave.; right turn entry only. See SR520 off-ramp to Lake Washington Blvd. in background.

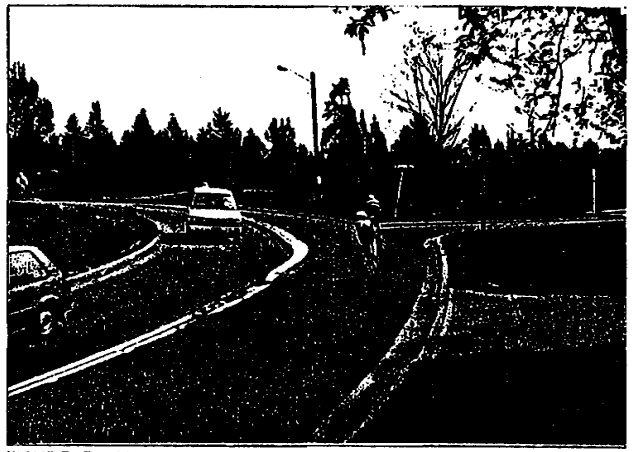


FIGURE 3 Median barrier prohibits left turns into residential area; no exit from 26th Ave.
Lake Washington Blvd. at 26th Ave., Seattle, Washington

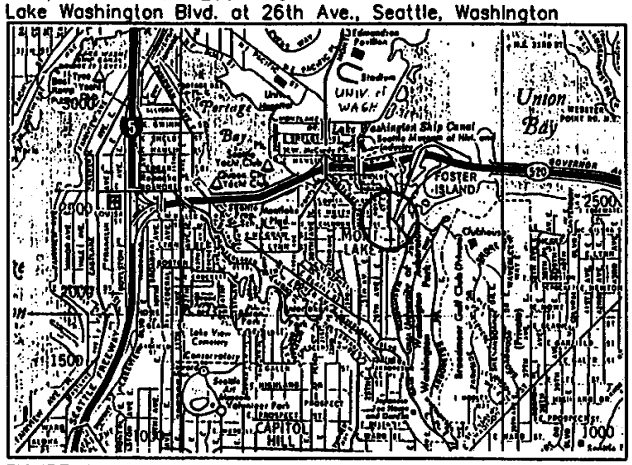


FIGURE 4 Montlake area, Seattle, Washington
Map courtesy of H.M. Gousha, Barrington, Ill.,revised

Location

Mountlake Neighborhood
Seattle, Washington

Setting

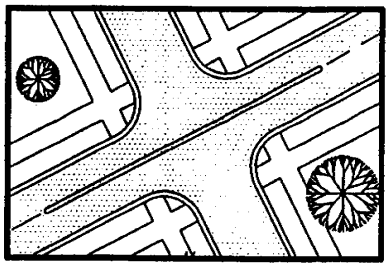
Urban, fully developed, single family area adjacent but separated from major lakeside park by Lake Washington Blvd.

Situation

Lake Washington Blvd. provides route to and from park, Univ. of Washington, I-5, and SR520 bridge. System of turn prohibitors, half closure, and traffic circles reduced cut-thru traffic volumes and reduced speed on local streets.

Features

Lawn and tree landscaping blends half closure into park and adjacent residential area. Unattractive and very narrow median barriers are products of hard fought compromises. Barriers have many reflectors and are illuminated by street lights.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Forced Turn Channelization Snake	Yes	Likely	Decrease	Improved	Some, No Left Turn	Minor Constraint	Potentially High	Low to Moderate	Vandalism
Half Closure Semi Diverter	Yes	Likely	Decrease	Improved	Restricted One Direction	Minor Constraint	Low	Moderate	Vandalism

STREET CLOSURE

Half Block
Full Closure

FIGURE 1 Half block, full closure; looking northeast along Gilford toward alley and Haro.

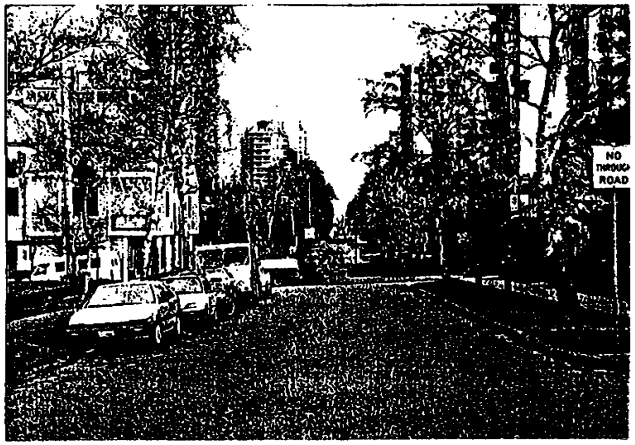


FIGURE 2 Alley adjacent to half block, full closure on Gilford north of Haro.

FIGURE 3 Half block, full closure; Haro and Gilford, looking southwest along Gilford.

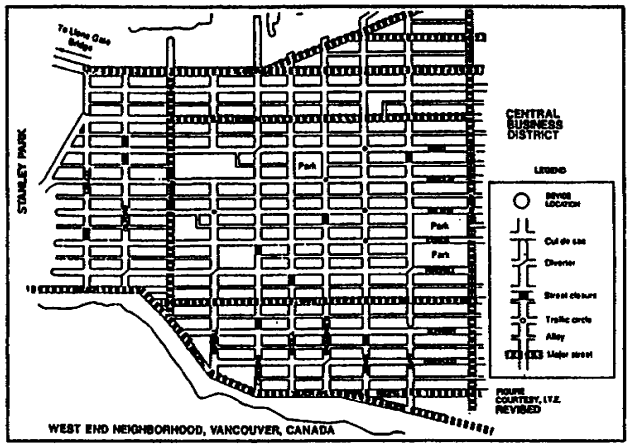


FIGURE 4 Courtesy of I.T.E., revised

Location

West End Neighborhood
(Near Stanley Park, west of downtown)
Vancouver, B.C., Canada

Setting

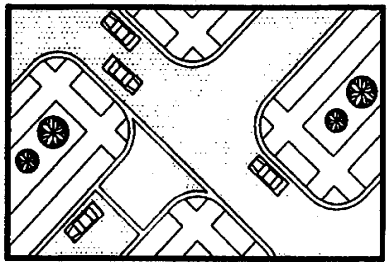
Fully developed dense urban area; mostly residential with high and low rise buildings just east of Stanley Park.

Situation

Full closure one of a variety of traffic control devices located to discourage thru and speeding traffic; reduce accidents. Devices are within residential areas bounded by major streets.

Features

Very desirable, close in living near downtown and regional scale park. Tasteful landscaping, attractive street furniture, permanent appearance and design.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Full Closure	Yes	Yes	Decrease	Improved	Yes	Some Constraint	Low	High/Moderate to High	Moderate/Possible to High Vandalism

STREET CLOSURE

Half Block
Full Closure

FIGURE 1 Half block, full closure
Cardero and alley south of Comox

FIGURE 3 Half block, full closure
Comox and Chilco, looking northeast along Chilco

FIGURE 2 Half block, full closure
Looking northeast along Broughton from Comox

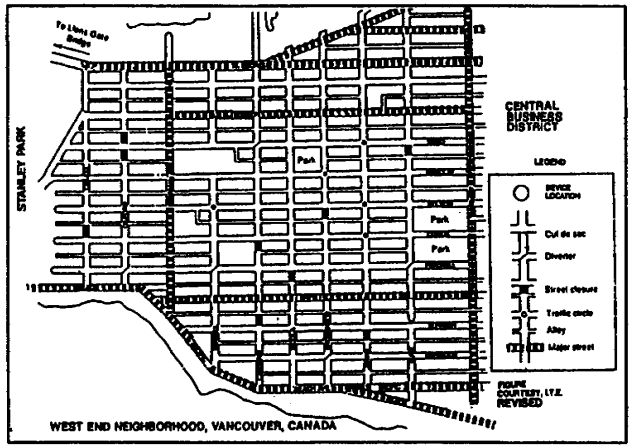


FIGURE 4

Location

West End Neighborhood
(Near Stanley Park)
Vancouver, B.C., Canada

Setting

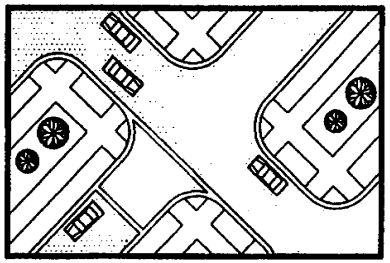
Fully developed, dense urban area
Mostly residential with high and low rise buildings.
Adjacent to downtown

Situation

High volumes of cut thru traffic, speeding, accidents; full closures just one of several types of control devices used in this area to control traffic.

Features

Very desirable, close-in living, tasteful landscaping, planters, street furniture and surface treatments.
Permanent appearance and design
See mountable curb for emergency vehicle access.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Full Closure	Yes	Likely	Reduced	Improved	Yes	Some Constraint	Low	Low	Vandalism

FULL CLOSURE

Cul-de-Sac
Diverter
Combination

FIGURE 1 Chilco St. cul-de-sac looking southwest toward the intersection of Chilco, Robson, and Lagoon Dr.

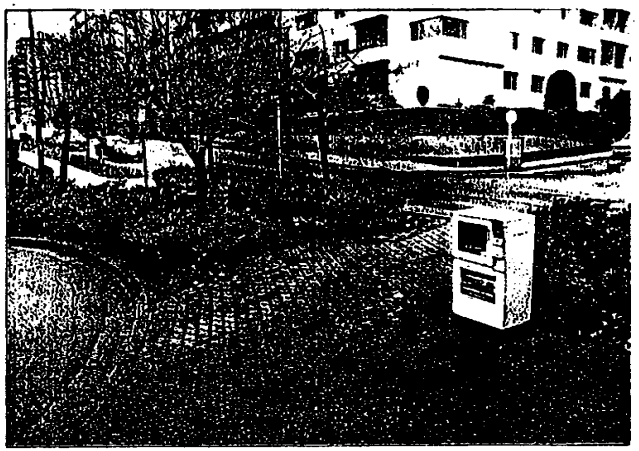


FIGURE 2 Chilco St. cul-de-sac looking toward Robson.

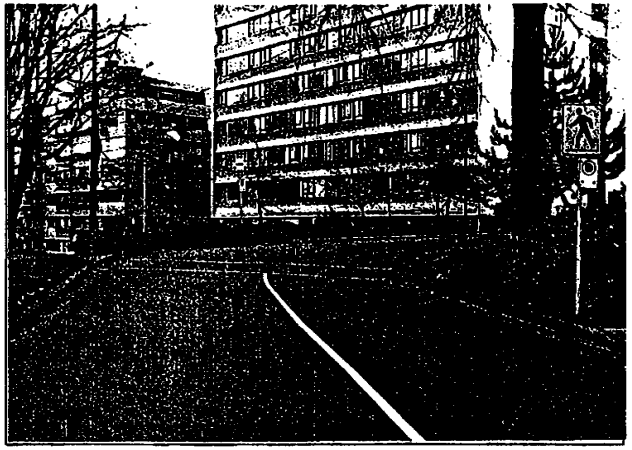


FIGURE 3 Lagoon Dr. looking east toward diverter; rear of cul-de-sac on Chilco.

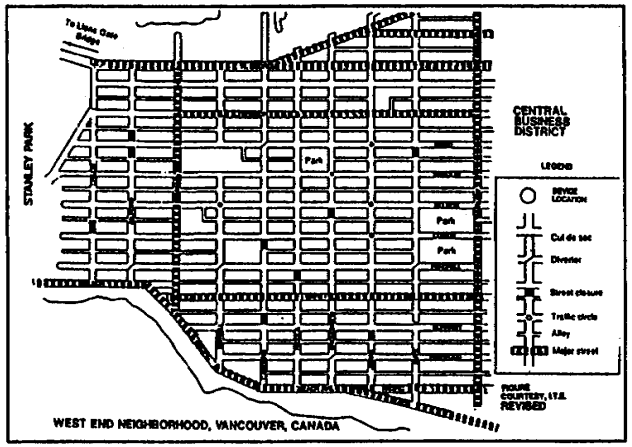


FIGURE 4 Courtesy of I.T.E., revised

Location

West End Neighborhood
(Near Stanley Park)
Vancouver, B.C., Canada

Setting

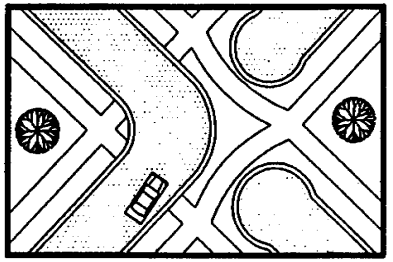
Fully Developed
Dense Urban Area
Mostly residential with high and low rise buildings.

Situation

Adjacent to downtown
Very desirable, close in living
Tasteful landscaping
Permanent appearance and design

Features

Very desirable, close in living near downtown and regional park.
Tasteful landscaping



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Diagonal Diverters	Yes	Likely	Decrease	Improved	Left or right turn only	Some Constraint	Low	Moderate to High	Moderate to High / Possible Vandalism
Cul-de-Sac	Yes	Yes	Decrease	Improved	Total	Some Constraint	Low		Moderate to High / Possible Vandalism

FULL CLOSURES TEST

Cul-de-Sac or Hammerhead

Depending upon design at street terminus

FIGURE 1 Test, Full Closure, looking west
N.E. Halsey St. at 28th Ave., Portland, Oregon

FIGURE 3 Full Closure/Cul-de-Sac test
N.E. 28th Ave. at Wasco St., Portland, Oregon

FIGURE 2 Test Full Closure looking west
N.E. Stanton at N.E. 42nd Ave., Portland, Oregon

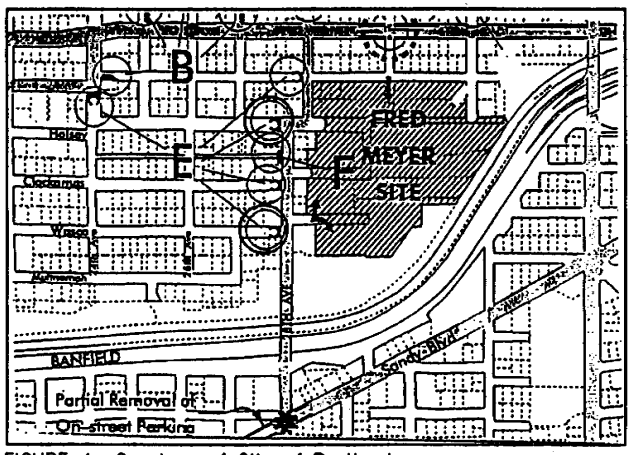


FIGURE 4 Courtesy of City of Portland

Location

Northeast area of Portland, Oregon

Setting

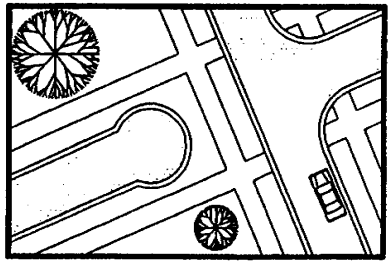
Two different residential neighborhoods both fully developed.
Figure 1 and 3 mixed multiple and single family near large (Fred Meyer) shopping center.
Figure 2 single family area

Situation

Excessive cut thru traffic.
See "E" and "F" in figure 4 for series of five test closures near shopping center.
Figure 2 reverts to play street. One of three locations in test case.

Features

Obvious temporary appearance; well signed, many reflectors.
Three to six month test period precedes decisions on suitability/acceptance.
CAUTION: Concrete "Jersey" barriers are unforgiving if struck. Use in test requires careful and liberal use of reflectors, warning and control signs.



TRAFFIC MANAGEMENT DEVICE	VOLUME REDUCTION	SPEED REDUCTION	NOISE AND POLLUTION	SAFETY	ACCESS RESTRICTIONS	EMERGENCY VEHICLE ACCESS	DEPENDENCE ON POLICE ENFORCEMENT	CONSTRUCTABILITY COST/ COMPLEXITY	MAINTENANCE COST/PROBLEMS
Cul de Sac	Yes	Yes	Decrease	Improved	Total	Some Constraint	Low	Low to High (R.O.W. acquisition and landscaping)	Low to Moderate Possible Vandalism if landscaped

Appendix C
Annotated Bibliography

Appleyard, Donald; *Livable Streets*; University of California Press; Berkeley, CA, 1981. The "bible" of traffic calming and residential traffic management in the United States, Appleyard's study of traffic and its effects on various neighborhoods in San Francisco is a classic. The book is an exhaustive sociological study of traffic in residential areas and how it affects the everyday lives of the residents. Filled with anecdotes, illustrations and facts, the book presents clear and understandable images of the problems it discusses, and provides comprehensive recommendations on policies and practices to create "livable" streets. It also presents a brief history of traffic management in Great Britain after Buchanan's *Traffic in Towns* study, and how Buchanan's recommendations were actually applied in several cities. Although the book is long (317 pages of text, two appendices, a bibliography and 14 page index), it is very readable by the lay person interested in RTM, and provides the traffic engineer with a thorough discussion of the community planning and urban design aspects of residential streets and RTM. This book should be read by all engineers and administrators responsible for RTM programs in local communities.

Appleyard, Donald, et al; *Livable Urban Streets: Managing Auto Traffic in Neighborhoods*; U.S. Department of Transportation; Washington, D. C., 1976. The precursor the *Livable Streets*, this federally funded study of traffic on three residential streets in San Francisco provided a wealth of data about the impacts of traffic on the lives of the residents along the street front. Appleyard provides some quantitative data on people's reactions to traffic which reinforce the "anecdotal" evidence presented in many other references to the negative impacts of increased traffic volumes.

Accident Analysis and Prevention Journal; Vol. 24, No. 1, Pergamon Press; London, January, 1992. This journal issue is entirely devoted to traffic calming, and contains articles which present the results of detailed studies of RTM measures in Europe and Australia. Although the articles are technically oriented, they present a wealth of solid factual data on the real-world benefits of RTM measures such as speed humps, traffic circles, areawide traffic calming schemes, and 30 km/h (20 mph) speed zones. This information can be very useful in demonstrating the likely benefits of selected RTM applications in North American cities and towns as well. The most relevant articles are:

> A.A. Vis, A. Dijkstra and M. Slop "Safety Effects of 30 Km/H Zones in the Netherlands," pages 75-86.
>
> Ulla Engel and Lars Thomsen, "Safety Effects of Speed Reducing Measures in Danish Residential Areas," pages 17-28.
>
> Ray Brindle, "Local Street Speed Management In Australia — Is It 'Traffic Calming?", pages 29-38.

Buchanan, Colin; *Traffic in Towns: A Study of the Long-Term Problems of Traffic in Urban Areas;* the United Kingdom Ministry of Transport, Her Majesty's Stationery Office, London, 1963. This seminal work in urban transport planning was one of the first to specifically address the impacts of traffic on residential access streets. Buchanan introduced the concept of the "environmental capacity" of residential streets which related traffic volumes to the ability of residents to enjoy their home environment. Buchanan's work also presaged

the current movement towards neo-traditional neighborhood design with his "environmental areas" which severely limited extraneous traffic in residential area and emphasized pedestrians and bicyclists over automobiles.

Citizens Advisory Committee; *Arterial Traffic Calming Program – Report and Recommendations*; City of Portland (OR), Bureau of Traffic Management, April, 1993. A detailed guide to Portland's RTM program for collector streets in residential areas. It contains detailed discussions of many policy issues and objectives for RTM on collector streets.

Citizens Against Route Twenty (CART); *Traffic Calming, The Solution To Route 20 And A New Vision For Brisbane*; CART, Ashgrove, Queensland, Australia, 1989. (USA distributor: Sensible Transportation Options for People (STOP), 154 SW 116th Avenue, #202B, Tigard, OR 97224) A thoroughly-researched and professionally-produced booklet offering a traffic calming alternative to the government's proposed construction of a Western Arterial Bypass (route 20) in Brisbane, Australia. Topics include : the eight myths of traditional traffic planning; a citizen's guide to the theory, practice and benefits of large-scale traffic calming programs; up-to-date research on traffic calming programs; a recommended traffic calming program for the route 20 corridor; and a comprehensive implementation scheme for the recommended program.

Guidelines for the Design and Application of Speed Humps, ITE Technical Council Task Force on Speed Humps, Institute of Transportation Engineers, 1993. This publication presents the recommended traffic engineering practices in the design, application and construction of speed humps. It contains detailed design guidelines for both parabolic speed humps and flat-topped speed tables, and recommended signing and striping plans. The guidelines highlight virtually all of the issues involved with speed humps, although most are presented in a highly abbreviated form. There is also an extensive bibliography for further reading. This publication is a "must" reference for any jurisdiction considering speed humps as part of its RTM program.

Grava, Sigurd; "Traffic Calming — Can It Be Done in America?" in *Transportation Quarterly*, Volume 47, No. 4, October 1993; Eno Transportation Foundation, Inc.; Lansdowne, VA. This article provides a good summary of current traffic calming practices in Europe and offers the author's opinions on how they may be applied in the U.S. It uses examples of planned or inadvertent traffic calming devices in New York City to illustrate some of the key points about residential traffic management.

Hass-Klau, Carmen; *An Illustrated Guide to Traffic Calming*; Environmental and Transport Planning and Friends of the Earth; London, 1989. A photographic survey of traffic calming, or residential traffic management, schemes in European (mostly German) cities. The report presents many high-quality before and after pictures of streets and intersections, supplemented by informative and easy-to-read narratives. This book clearly illustrates the benefits of traffic calming from an urban design point of view.

Hass-Klau, Carmen; *The Theory and Practice of Traffic Calming: Can Britain learn from the German Experience?*, Environmental and Transport Planning, Discussion Paper 10, January 1990; Brighton, England. This discussion paper surveys traffic calming and residential traffic management in Germany, and provides ideas on how the German experience can be implemented in Great Britain. This paper provides an excellent overview of the history of traffic calming in Germany, with references to other European countries.

Homburger, Wolfgang and Deakin, Elizabeth, et al.; *Residential Street Design and Traffic Control*; Institute of Traffic Engineers, Washington, D.C., 1989. This book presents the current "state-of-the-art" in residential street traffic management as viewed by the traffic engineering profession. It is a standard reference for all types of RTM devices and programs, and is an integral part of the references needed to support an RTM program in a local community.

Local Area Traffic Management, Guide to Traffic Engineering Practice; National Association of Australian State Road Authorities; Sidney, 1988. A detailed traffic engineering guide to residential traffic management practices and programs in Australia. It is more detailed and succinct than ITE's *Residential Street Design and Traffic Control* by Homburger, et al, and is directly aimed at the traffic professional.

Manual on Uniform Traffic Control Devices (MUTCD), U.S. Department of Transportation, Federal Highway Administration, Washington, D. C., 1988 and supplements. This is the federal government's official recommendations on the design, application and installation of all traffic control devices. All 50 states have adopted the *MUTCD*, with relatively minor modifications or refinements, as the legal guideline for traffic control devices, and many traffic engineering professionals are reluctant to install devices, such as RTM measures, which are not specifically described in the *MUTCD*.

Moudon, Anne V.. editor; *Public Streets for Public Use*; Van Nostrand Reinhold Company Inc., New York, 1987. A collection of technical papers which grew out of a 1982 conference at the University of Washington on "Streets as Public Property: Opportunities for Public/Private Interaction in Planning and Design." The book deals mainly with urban design issues related to urban streets in both residential and commercial areas. Going well beyond traffic calming ideas, this book includes chapters on "A Successful Street Design Process," "Streets as Playgrounds," auto-free communities in Alaska, "Redesigning Residential Streets," and the influences of natural light on urban street design.

Neighborhood Traffic Management Program, Technical Evaluation Committee – Final Report; City of Portland (OR) Bureau of Traffic Management, January 1992. This compendium of 11 discussion papers and recommendations addresses in detail various issues dealing with residential traffic management. The issues include: traffic circle effectiveness and engineering – a peer review; Stop-sign evaluation; neighborhood stop signs; traffic impact thresholds for RTM measures; speed bumps, other RTM devices; scoring and selection criteria for RTM projects; emergency service considerations; street improvements; transit service considerations; and landscape maintenance issues. The papers, and the overall recommendations, deal with many of the "nuts and bolts" of an RTM program, and provide a good source of practical information for starting up an RTM program.

Pivnik, Sheldon et al; *Traffic Improvements – Legal Aspects and Liability*; Institute of Transportation Engineers; 1980. A basic overview of legal aspects and liability related to traffic control devices for state and local traffic engineers. Provides basic principles and background on legal issues, and a glossary of legal terms.

A Policy on Geometric Design of Highways and Streets, (commonly referred to as the AASHTO Green Book); American Association of State Highway and Transportation Officials; Washington, D. C., 1990. This is the standard reference on the geometric design of arterial roads and streets in the United States.

Reclaiming Our Streets – Traffic Solutions, Safer Streets, More Livable Neighborhoods; City of Portland, Bureau of Traffic Management, February 1993. Subtitled "A community action plan to calm neighborhood traffic," this booklet describes an extensive policy, engineering regulatory and legislative action program to implement RTM techniques in Portland, OR. It provides a model framework for a similar action program in any community, large or small, and contains many good examples of policies which could be adopted (with minor refinements) by a city council or county commission desiring to implement an RTM program.

Residential Streets, Second Edition; ASCE, National Association of Homebuilders and the Urban Land Institute; Washington, D.C., 1990. A highly readable book illustrating various approaches to residential street layout and design in new developments.

Smith, Daniel T. and Donald Appleyard; *Improving the Residential Street Environment*; U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., May 1981. A follow-on to the *State of the Art Report* by the same authors, this report contains summarizes the key findings from the previous report, discusses research and implementation experiences with road humps, highlights findings from studies of speed and volume on residential streets, and addresses legal issues in neighborhood traffic management.

Smith, Daniel T., Donald Appleyard, et al; *State of the Art Report: Residential Traffic Management*; U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 1980. This report summarizes research and operating experience with various residential traffic restrain measures including diagonal diverters, cul-de-sacs, median barriers, speed bumps and pavement undulations, stop signs, rumble

strips and other devices. It also covers techniques for developing and implementing RTM plans including community involvement and technical evaluation elements.

Traffic Engineering Handbook, 4th Edition; Institute of Transportation Engineers; Prentice-Hall, 1992. A standard traffic engineering reference, its 15 chapters summarize all aspects of traffic engineering. Individual chapters are written by experts in the specific topic. Chapter 11 deals with elements of residential traffic maangement.

Tolly, Rodney; *Calming Traffic in Residential Areas*; Brefi Press, Tregaron, Wales, Great Britain, 1990. An extensively illustrated guide to traffic calming in Britain and Europe. In addition to a detailed history of traffic calming and its relationship to town planning in Britain and Germany, Tolley presents more than 180 photographs and illustrations on traffic calming and RTM devices in current use throughout Europe and Britain. Although the book deals entirely with European experiences, it can be used to illustrate how a extensive program of RTM devices can change and enhance the character of an urban residential neighborhood.

A Toolbox for Alleviating Traffic Congestion; Institute of Transportation Engineers; Washington, D. C., 1989. As the name implies, this report presents a "toolbox" of solutions for urban traffic congestion, and is written for elected officials and interested citizens, as well as traffic professionals. For RTM programs, it presents a variety of way to enhance traffic flows on the arterial street network, thus reducing the impetus for cutting-through residential neighborhoods to avoid congested streets and intersections.

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Uniform Vehicle Code, and *Model Traffic Ordinance* (combined publication), National Committee on Uniform Traffic Laws and Ordinances, Washington, D. C., 1991. A guideline to promote uniformity among states for traffic control devices, rules of the road and basic traffic laws. It provides a model framework for traffic regulations at the state and local level.

Vahl, H.G., and J Giske; *Traffic Calming Through Integrated Urban Planning;* Amarcande, Paris, France, April, 1990. A short summary of traffic calming experiences in France and the Netherlands. The book's examples deal mainly with retro-fitting main thoroughfares and downtown streets to make them pedestrian friendly in commercial and high-density residential areas. The book introduces the concept of acceptable confrontation speeds between motorized and pedestrian and bicycle modes of travel, and how RTM devices can be used to restrain motor vehicle speeds to acceptable levels..

Articles from the *ITE Journal* (J) and the *ITE Compendium of Technical Papers* (C):

Aggarwal, Gian; "To the Editor: Stop Sign Warrants;" (J) November 1993.

Brilon, Werner and Harald Blanke; "Extensive Traffic Calming: Results of the accident analyses in 6 model towns;" (C) 1993.

Craus, Joseph, et al; "Geometric Aspects of Traffic Calming in Shared Streets;" (C) 1993.

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Elizer, R. Marshall, Jr. and Nazir Lalani; "Facing Up to a Street Closure Epidemic;" (J) October 1994.

Ewing, Reid; "Residential Street Design – Do the British and Australians know something we Americans don't?;" (C) 1993.

LaPlante, John and Chester Kropidlowski; "Stop Sign Warrants: Time for Change" (J) October, 1992.

Lerner-Lam, Eva, Stephen Cleniker, Gary Halbert, Chester Chellman and Sherry Ryan; "Neo-traditional Neighborhood Design and Its Implications for Traffic Engineering;" (C) 1991.

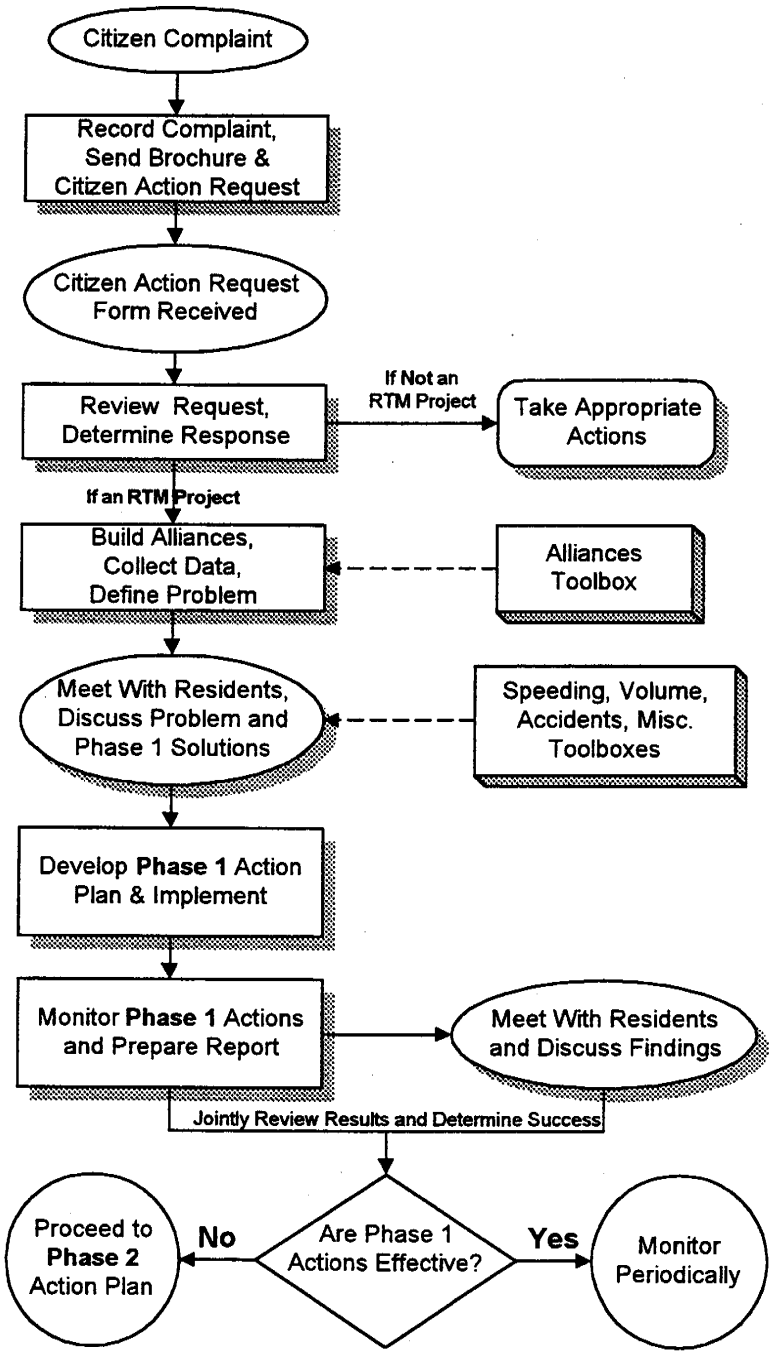
Meyers, Edward; Modern Roundabouts for Maryland;" October 1994.

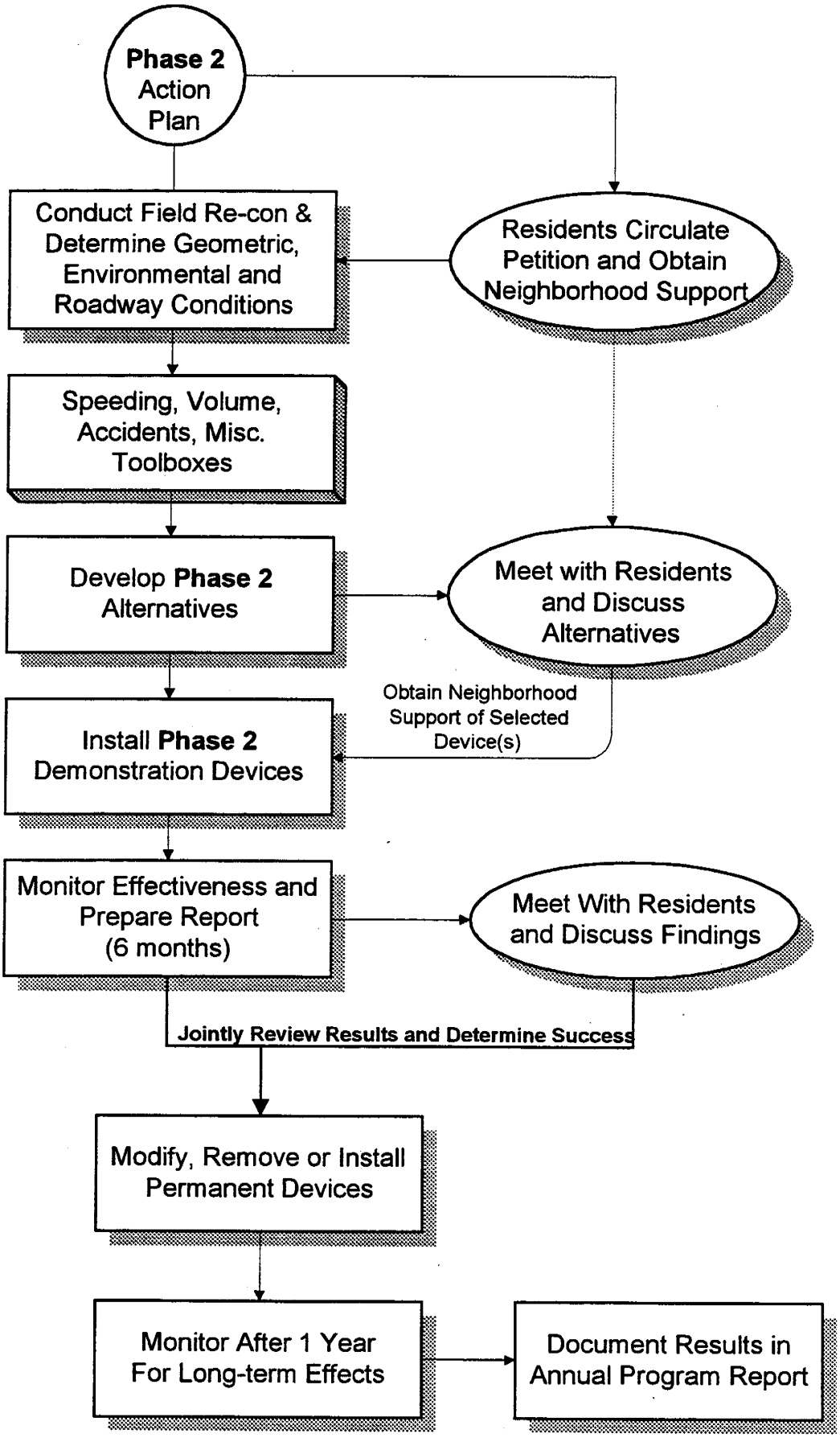
Sanchez, Susan, "Bellevue's NTC Program";

Van Leusden, George and Michele J. Coemet; "Dynamic Traffic Management in the Netherlands;" (J) July 1993.

Womble, Joseph; "Neighborhood Speed Watch;" (J) February 1990.

Appendix D
RTM Program Flow Chart




Phase 2 Action Plan
Conduct Field Re-con & Determine Geometric, Environmental and Roadway Conditions
Residents Circulate Petition and Obtain Neighborhood Support
Speeding, Volume, Accidents, Misc. Toolboxes
Develop Phase 2 Alternatives
Meet with Residents and Discuss Alternatives
Obtain Neighborhood Support of Selected Device(s)
Install Phase 2 Demonstration Devices
Monitor Effectiveness and Prepare Report (6 months)
Meet With Residents and Discuss Findings
Jointly Review Results and Determine Success
Modify, Remove or Install Permanent Devices
Monitor After 1 Year For Long-term Effects
Document Results in Annual Program Report

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Appendix E
Setting Up A Self Managed Program in Small Communities

Often times local agencies are confronted with complaints from citizen groups, and or individuals regarding traffic problems pertaining to their respective neighborhoods. Typical complaints involve speeding, cut-through traffic, high traffic volumes, accidents, noise, pollution, sight distance, safety of children, pedestrians, and bicyclists, etc. The local agencies also have to respond to the complaints of this nature received by a mayor or a City Council person. What should a local agency do and what steps should it follow in order to address these complaints? This section provides an overview of everything that a local agency needs to know about setting up a RTM program that has guidelines to deal with problems of this nature.

Authority to undertake RTM programs

Before setting up a RTM program, a local agency would want to know the authority it has in implementing any such program. Although there are no specific state statutes related to residential traffic management, the authority for RTM programs can be derived from the same statutes which allow jurisdictions to install and maintain other traffic control devices such as stop signs and traffic signals. Titles 46 and 47 of the Revised Code of Washington (RCW) contain the statutes dealing with motor vehicles, public highways and transportation in the state of Washington. The chapters and sections of the laws applicable to the residential traffic management are discussed below.

Section 46.90.010 of the RCW directs the Director of the Deaprtment of Licensing to adopt a model traffic ordinance containing a comprehensive set of uniform traffic laws for Washington communities. The model ordinance is codified in Chapter 308-300 of the Washington Administrative Code (WAC).

The basic authority for the installation and maintenance of traffic control devices rests with the "traffic engineer" for each local jurisdiction. WAC 308-330-260 (pursuant to RCW 46.90.010) establishes the office of "traffic engineer" and generally describes his or her duties. Absent a specific position of traffic engineer in a jurisdiction, the statutory duties of the traffic engineer may be carried out by the jurisdiction's engineer or other person appointed to carry them out.

The authority for specific acts by the traffic engineer is provided by WAC 308-330-265. The predecessor of this WAC regulation (formerely RCW 46.90.265) was cited by traffic engineers in Bellevue, King County and Seattle as the source of their authority for the RTM programs in these jurisdictions. Under the more recent RCW 46.90.010, the WAC regulation should have the same effect.

For RTM programs, the following subsections of the WAC apply:

> WAC 308-330-265 (1). The traffic engineer is authorized to place and maintain official traffic control devices when and as required under the traffic ordinances or resolutions of the local authority to make effective the provisions of said ordinances or resolutions, and may place and maintain such additional official traffic control devices as he/she may deem necessary to regulate, warn, or guide traffic under the traffic ordinances or resolutions of the local authority;
>
> (4) To establish safety zones of such kind and character and at such places as he/she may deem necessary for the protection of pedestrians;
>
> (23) To test new or proposed traffic control devices under actual conditions of traffic.

The latter section (23) establishes the authority of the traffic engineer to undertake demonstration projects involving traffic control devices under actual conditions of traffic. This section allows jurisdictions to test various RTM measures under the guidance of the local traffic engineer.

Speed Limits. The basic speed limits for unposted streets in cities and towns in Washington is set at 25 mph by RCW 46.61.400(2). The basic rule of speed restrictions is more applicable to RTM settings:

> **RCW 46.61.400 Basic Rule and maximum limits.** (1) No person shall drive a vehicle on a highway at a speed greater than is **reasonable and prudent** under the conditions and having regard to the **actual and potential hazards** then existing. ...(emphasis added)

RCW 47.24.020 requires WSDOT approval for speed limits established by local authorities on city streets that are part of the state highway system.

Goals and Objectives

The goals selected for RTM program should be consistent with local needs, desires and resources, should be non-conflicting and accepted and easily understood by local officials. The primary goal could be the improvement of living and environmental conditions in residential streets.

The objectives must be clear, concise, and unambiguous, should be consistent with goals and priorities. The objectives could be improvements in safety, and reduction in noise and air pollution.

Identification of the Needs

Growing public awareness of the neighborhood traffic problems and related issues mounted to increasing pressure on the local agencies in dealing with the problems. These problems range from high speeds, high traffic volumes to excessive non-resident parking, to poor geometrics and pavement surface. The issues range from safety to pollution, to inconvenience. The local agencies use two approaches to identify and address the problems and issues associated with residential traffic management.

Based on Complaints

In most cities, neighborhood traffic problems are identified primarily through the complaints they receive from the residents. Some cities have established standard procedures for assessing a complaint and dealing with it. Usually, they require citizens to document their problems in a standard format (e.g., the Citizens' Action Request Form in this appendix). If the complaint is from an individual, the problem is confirmed either by conducting interviews with the residents of the neighborhood or by requiring the individual to obtain problem confirming signatures from other residents in the neighborhood. Before undertaking a detailed assessment, based on a complaint, of the nature and the gravity of a neighborhood traffic problem, it is important to ascertain whether it is a widely experienced problem or the one that is perceived by one or two individuals of the neighborhood. A written complaint with signatures corroborating the problem provides the local agency with enough justification to address the problem.

Based on Inventory Information

Some cities periodically update inventory of the conditions of local streets. Typically, the inventory updates are done for traffic volume, speed, accident, and composition data, pavement condition data, data on traffic control devices, signs, and markings, and other pertinent information. These cities use either locally developed standards or state standards or guidelines from other established sources, to identify conditions of streets in need of attention.

Assessment of the Problem

Once it is confirmed that there exists a problem in a neighborhood, the local agency should undertake field studies to understand the nature of the problem, its complexity, magnitude, and origin. In general, the field studies are conducted for information on traffic volume counts, speed, accidents, traffic operations, parking patterns, traffic composition, design features and geometrics of the roadway, and land use. Analysis of all these factors and other pertinent factors would help reveal the real cause(s) of the problem. Sometimes,

contrary to the beliefs of the residents, the real cause of the problem may be lying within the neighborhood . For instance, on-street parking shortages in certain neighborhoods have been found to be the result not only of commuter use of the spaces, but partly due to residential off-street parking standards being below the level needed to handle resident's cars.

Development of Alternatives

Community involvement plays a crucial role in the development of alternatives for alleviating neighborhood traffic problems. In developing alternative plans, all affected groups should be invited for a open discussion of the problem and possible solutions. Transportation professionals should educate the community groups, emergency service personnel, and other affected parties of various possible ways in which a problem may be addressed. It is equally important to listen to the solutions that the affected groups might have in dealing with a particular problem. The communities should be informed of both long and short term solutions, although they usually prefer a quick fix solution to their respective neighborhood problems. Usually a combination of short-term and long-term solutions may be in the best interest of the community. For example, a short-term solution to excessive non-resident parking on local streets might be to implement resident permit parking. Longer-term solution would include developing a commute-reduction program to reduce the percentage of non-residents arriving by auto, improving the management of available commercial parking facilities, and constructing additional parking facilities for non-residents' use.

While preparing alternative schemes, some of the important factors to be considered are the access restrictions to emergency vehicles, safety issues, traffic operational impacts, and environmental impacts.

Evaluation of Alternatives

A detailed assessment of the selected alternatives should be conducted in order to determine their feasibility of implementation of an alternative and likelihood of its success in mitigating a neighborhood traffic problem. The impacts to be assessed include:

Access restrictions to the emergency vehicles, school and transit buses, other service vehicles because of the alternatives

- Safety issues associated with the alternatives
- Impacts of the alternatives on the adjacent neighborhoods
- Other Traffic and parking operational impacts
- Land use impacts
- Environmental impacts including noise pollution, air pollution, and fuel consumption
- Impacts on the aesthetics of the neighborhood

Besides these issues, financial and economic feasibility, socio-political impacts, and legal implications of the alternatives should also be studied in detail. Lastly and most importantly, legal aspects of the traffic control devices involved in the alternatives should be given due consideration.

Selection of an Alternative

The alternatives should be compared in a matrix format in relation to the factors and issues listed in the above section. Using the matrix, transportation professionals can help the decision makers in their choice by identifying the merits and demerits of various alternatives and by recommending some of them. The final selection of an alternative is usually the responsibility of elected officials. Neighborhood groups also have considerable influence in the selection process. However, it is the duty of transportation professionals to inform the decision makers of all possible consequences of the alternatives.

Implementation

The implementation of a neighborhood traffic control plan involves several issues including public notice and involvement, enforcement, the choice of temporary and permanent installations, financing implementation, incremental versus one step implementation, timing of various phases of installation. Besides, care should be taken to see that the plan satisfies all the legal requirements. If the traffic control plan involves installation of any devices, standard manuals, and texts should be referred to for guidelines.

Public notice, citizen involvement, and police enforcement

Public and motorists should be informed of the implementation plan so that they are fully aware of the changes about to take place. The information can be passed to the affected interests by distributing notices, posters, and flyers. Also, emergency services including police, fire, paramedics, and other services such as public transit, school buses, and delivery services should be made fully aware of the implementation schedule and the changes.

Since the enforcement is the key for the successful implementation of any program, it is important to apprise the enforcement personnel of the plan, of the laws related to new controls, and expected construction schedule.

Also, local magistrates should be informed of the purpose of the program, the planning process involved, the legal basis for the devices, and the planned enforcement program. This could be useful in case of any future legal entanglements.

Temporary versus permanent devices

The choice between temporary and permanent devices involves substantial trade-offs. Temporary devices are easy to modify, and cost effective for installation in several locations. They can be used as experimental devices, modified or upgraded if proved to be successful,

dismantled otherwise, without involving huge losses. On the negative side, they may create technical, legal, aesthetic, and political problems. Vandalism and disobedience is also a possibility with these devices.

Permanent devices on the other hand are aesthetically pleasing, command better obedience and respect. However it is financially risky to install them if their effectiveness is subject to question.

Financing and Implementation

The costs of a neighborhood traffic control scheme vary depending upon the type and the extent to which the devices are used. The funds for financing these schemes are obtained from general funds in most states of the U.S. However in some states, fuel taxes, motor vehicle taxes, parking revenues, and other transportation funds are utilized for funding these schemes. Occasionally, commercial developments contributing to the neighborhood problems fund these schemes while community development funds or other grants are used in certain lower income neighborhoods to help pay for traffic control schemes.

Incremental Vs One-Step Implementation

Incremental approach is followed when the resources are limited, and the implementation plan is large. This approach allows for careful evaluation of the impacts associated with individual installations and provides room for rectifying the mistakes in later installations. However, series of changes in traffic operations spread over a longer period of time could lead to adverse public reactions. Controversies may raise over which neighborhood was chosen for early implementation of the plan over others.

One-Step implementation on the other hand avoids issues of favoritism and repeated changes in the traffic operations. However, one time-large scale changes in traffic conditions could lead to complicated traffic flow and control problems and could become a target for political opposition.

Timing of Installations

Ideally, installation of any traffic devices should be done when least number of drivers and residents are around. e.g. Summer time in a university town. In the communities where such situation is not likely to occur, effort should be made to avoid implementation of the programs in peak traffic seasons like Christmas shopping season near downtown etc.

Evaluation

Evaluation process of any RTM traffic control program is the most critical process since it forms the basis for any future program of similar nature. It helps determine how well the scheme performed and how effective it was in achieving the intended objectives. Before conducting the evaluation process, a waiting period of three to six months should be given to allow for the residents and traffic to adjust to the new program.

A "before-after" traffic study should be a part of the evaluation process to study the impacts of the scheme on various factors such as traffic volumes, vehicle composition, trip diversion, accidents, speeds, aesthetics, safety. Residents' perceptions on these factors and input from the personnel of emergency services, public transit, and school buses regarding their experiences with the program could be very valuable in the evaluation process.

Public Participation

In all the steps listed above, it could be noticed that public participation had a prominent role to play in shaping any RTM program. Public involvement in all steps of the program builds the trust of citizens in their governing bodies, and increases the chances of success of a program. Also, it is very crucial to a city committed to improving the living conditions, welfare, and safety of its citizens and the neighborhoods they live in.

Program Monitoring and record keeping

Successful programs should be monitored constantly and records should be kept on the problems and issues associated with them. These records could be very beneficial for similar programs of the future.

Where (and When) to Get Help?

In case of any ambiguity concerning any issue related to RTM, the small communities could consult the following sources.

1. Experienced staff of the cities where successful RTM programs exist (e.g. City of Portland, City of Bellevue, City of Seattle, etc.)
2. Private traffic consultant
3. WSDOT and the Northwest Technology Transfer Center
4. References listed in this report (Public libraries could be encouraged to have them)

Common sense, reasonableness and liability exposure

Clearly best protection is a reasonable, logical and well thought out plan with good guidelines. While reasonableness should be exercised in implementing any Residential Traffic Management program, tradeoffs and risks should be recognized in case of any discretionary action.

As in the case of any other traffic engineering activity or improvement, care should be taken to follow the guidelines suggested in standard manuals before installing any traffic control devices for RTM.

All facts and engineering decisions should be documented to minimize the possibility of lawsuits. Residential Traffic Management programs in place should be followed upon to evaluate their effectiveness in neighborhood traffic control.

CITIZEN ACTION REQUEST FORM

FOR THE FIRST PHASE IN NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

Contact Name: _____ Day Phone: _____

Address: _____ Today's Date: _____

Neighborhood: _____

Concerned Location: _____

What concerns have you identified at the above location?

_____

_____

What Phase I solutions do you feel would address your concerns? (Check one or more)

- ☐ Trimming Bushes
- ☐ Signing
- ☐ Enforcement
- ☐ Speed Humps
- ☐ Neighborhood Traffic Safety Campaign
- ☐ Other _____

_____

Thank you for taking the time to fill out the Citizen Action Request Form. After completing the form, fold it for mailing (address appears on the other side of this form). *Don't forget to use first class postage.* Once we receive the form, we will contact you to investigate traffic solutions.

FOR OFFICE USE ONLY

Date Received: _____ Project Number: _____

Field Investigated: _____

Accidents ☐ Speeds ☐ Volumes ☐ Map ☐

Neighborhood Contacted: _____

Traffic Improvement Plan Selected: _____

NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

City of Phoenix
STREET TRANSPORTATION DEPARTMENT

NEIGHBORHOOD TRAFFIC MANAGEMENT DEVICES

Traffic Management Device	Traffic Reduction	Speed Reduction	Noise and Pollution	Safety	Traffic Access Restrictions	Emergency Vehicle Access	Maintenance Problems	Level of Violation	Cost
Speed Humps	Possible	Limited	Increase Noise	No Documented Problems	None	Minor Problems	None	Not Applicable	Low
STOP Signs*	Unlikely	None	Increase	Unclear	None	No Problems	None	Potentially High	Low
NO LEFT/RIGHT TURN Signs	Yes	None	Decrease	Improved	No Turn(s)	No Problems	Vandalism	Potentially High	Low
One-Way Street	Yes	None	Decrease	Improved	One Direction	One Direction	None	Low	Low**
Chokers	Unlikely	Minor	No Change	Improved For Pedestrians	None	No Problems	Trucks Hit Curbs	Not Applicable	Moderate
Traffic Circle	Possible	Likely	No Change	Unclear	None	Some Constraint	Vandalism	Low	Moderate
Median Barrier	Yes	None	Decrease	Improved	Right Turn Only	Minor Constraint	None	Low	Moderate
Forced Turn Channelization	Yes	Possible	Decrease	Improved	Some	Minor Constraint	Vandalism	Potentially High	Moderate
Semi-Diverter	Yes	Likely	Decrease	Improved	One Direction	Minor Constraint	Vandalism	Potentially High	Moderate
Diagonal Diverters	Yes	Likely	Decrease	Improved	Thru Traffic	Some Constraint	Vandalism	Low	Moderate
Cul-de-Sac	Yes	Likely	Decrease	Improved	Total	Some Constraint	Vandalism	Low	High

*Must meet legal requirements for installation.
**May result in high roadway user costs.

Source: City of Phoenix
Street Transportation Department

WHAT IS THE NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM?

The Neighborhood Traffic Management Program was created in 1989 by the Phoenix City Council and is operated by the Street Transportation Department. Since that time the program has been addressing neighborhood traffic safety concerns by enabling citizens and/or community groups to become involved with the improvement process.

In this way, the Street Transportation Department and the neighborhood community work together to create a pleasant and safe environment in which to live.

WHY WOULD OUR NEIGHBORHOOD BECOME INVOLVED?

There could be many reasons. Some major ones include:

•

Vehicles travelling faster than the posted speed limit.

•

Non-local traffic using the neighborhood as a short cut.

•

High number of traffic accidents.

•

Pedestrian safety.

HOW DOES THE PROGRAM WORK?

The program involves a two-phase process. Depending on the nature of the problem, some solutions can be resolved and action taken immediately, while others may take longer.

PHASE I

The first phase measures the extent of the problem and focuses on using effective but less restrictive measures first. Doing so allows the opportunity to change driver behaviors and correct the problem *without* imposing severe and drastic changes.

- Citizen request from Home Owners' Association or by petition
- Traffic Engineering Reviews... **1-2 months**
- Organize neighborhood and develop traffic management plan..... **1-3 months**
- If approved by the neighborhood and Phoenix City Council, work is completed.... **1 month**

PHASE II

The second phase focuses on physical measures. These are *only necessary or desirable, if the first phase improvements are ineffective.*

- Review 1st Phase Improvements .. **1 month**
- *If necessary*, modify or develop additional traffic control measures ..... **1 month**
- A petition is circulated by neighborhood with at least a 70% majority..... **1-2 months**
- Public Hearing ..... **1-2 months**
- If approved by the neighborhood and the City Council, work is completed..... **1-3 months**

HOW DOES OUR NEIGHBORHOOD BEGIN THE PROCESS?

1. Identify the PROBLEMS in your neighborhood. For example:
   - Limited visibility or sight distance.
   - Unusually high traffic volumes.
   - Speeding vehicles.
   - Unsafe walking routes.

2. Discuss the types of SOLUTIONS with your neighbors. Possible solutions may be as follows:

   Trimming Bushes
   Trim bushes either by the homeowners or City crews to provide better sight distance.

   Signing
   Install appropriate traffic control signs. These may include speed limit, parking restrictions, turn restrictions, etc.

   Target Enforcement
   Increased enforcement of the speed limit by the Phoenix Police Department. Police cannot be at all places at all times. However, with neighborhood assistance they can target their efforts to those times when speeding is most prevalent and through their presence increase driver awareness.

   Speed Humps
   The installation of 3" asphalt humps placed across the street to slow motorists down. Residents may elect to use one hump or a series of humps along a street to control speeds.

3. FILL OUT the Citizen Action Request Form enclosed.
   Please note: Each project will be evaluated and prioritized on a first come, first serve basis, and the ability of the neighborhood to show concensus for a traffic management plan.

IS THE PROGRAM SUCCESSFUL?

The success of the program is reflected by the positive comments and results achieved in neighborhoods throughout Phoenix. The most successful efforts occur where the neighborhood establishes traffic safety as a community priority and becomes actively involved. By working as a community, you have taken the first step toward a more pleasant and safer neighborhood in which to live.

A Public Awareness Program
Sponsored by the City of Phoenix
Street Transportation Department