This chapter presents a framework for understanding problems of the residential street environment and the role of the neighborhood traffic management in solving them. As presented herein, the nature of residential streets is defined; problems and their causes are identified; goals for neighborhood traffic management are established; and the major strategies and devices for achieving the goals are outlined.

The residential street

A residential street serves many different kinds of people and many different purposes. The sketches which follow highlight some of the more important purposes of residential streets and the activities which take place along them. If the traffic service function of a residential street is overemphasized or motorist's behavior is insufficiently controlled, these other activities or qualities may suffer.
A residential street is . . .

trees and landscape . . .
a place where neighbors meet . . .
houses . . .
views . . .
sidewalks, crosswalks...

a place to drive...

a place to park...

front yards...
The problem

The fact that traffic is a widespread problem in residential neighborhoods is perhaps best documented by the U.S. Annual Housing census of 1973. Of the 56,000 people sampled, 45 percent complained of undesirable “street noise” and 29 percent complained of “heavy traffic” on their streets. These were the most widespread neighborhood problems reported.

Behind the statistics, several specific problems caused by traffic in neighborhoods can be identified:

- **Traffic Accidents** — The occurrence of accidents, and frequently the fear or expectation that accidents may occur, is a significant problem. Much citizen anger and reaction to traffic stems from a desire for safer streets.

- **Noise, Vibration and Air Pollution** — These are aspects affecting the quality of life of neighborhood residents. At their extremes, they can affect the physical condition of structures. At less extreme levels, they represent at least a nuisance within a neighborhood.

- **Traffic Speed**. Speed is a subject of frequent resident complaint. In some cases the speed of all vehicles is a problem; in others, a few hot rodders or shortcutters are the culprits. The negative reaction to speed is often a translation of concern over high levels of noise and fear of safety problems. In other cases, the single high speeding vehicle is seen as an insult by thoughtless drivers to the peace and quiet of the neighborhood.

- **Traffic Volume**. The total amount of traffic is a major cause of complaint. Effects of volume change are perceived most accurately in the middle and lower ranges (under 2000-3000 ADT). As with speed, complaints about high volume are often a reflection of previously cited problems: safety, noise, vibration and air pollution. Complaints about high volumes are also a positive indicator that some of these other problems are perceived to exist.

- **Traffic Composition**. In most cases, it is through traffic that residents complain of, though quite often the problem lies with neighborhood residents. Certain types of traffic are also a prime cause of annoyance, especially trucks, buses and motorcycles which create more noise, fumes, vibrations and perceived hazard than the regular automobile.

- **Appearance, Identity, and Maintenance** — Traffic, by its mere presence, detracts from the appearance of a neighborhood, be the vehicles parked or moving. The presence of traffic can detract from more positive features of a neighborhood, aiding if not causing a reduction in neighborhood identity and cohesion, and reducing the incentive to maintain the neighborhood’s appearance.

- **Reduction of Street Activities and “Neighboring”** — These are effects of traffic which are problems of communities as much as problems of individuals. When traffic noise is high, the desire to meet and converse on the street is reduced; where volumes are high, the ability of children to use the streets as play areas — often the only feasible location — is reduced. Other physical activities, such as walking and jogging, are also affected.

- **Impact on Land Use and Social Stability** — The presence of traffic can discourage residential land uses and encourage commercial activity; it can also lead to rapid population turnover and neighborhood instability, though this is not always the case. There is also some evidence that streets with greater auto accessibility may be more susceptible to residential crime (e.g., burglaries). Some of the more typical and specific neighborhood problems are shown in Figure 1.

As this listing indicates, the traffic problem can be viewed microscopically, affecting individuals, and macroscopically, affecting communities and eventually regions. While the most vocal statements of the problem will usually involve impacts on individuals, those aspects affecting the community as a whole cannot be overlooked.
Causes of the problem

Causes of the problem can be classified as either psychological or physical; as will be shown in other parts of the report, the solutions can also be divided in this way.

Psychological Causes

The psychological causes relate to the ingrained expectations of both motorists and residents. Many motorists simply regard any street in any location as, first and foremost, a place to drive. Further, they have certain expectations as to how a street system should operate, and if the street designed to serve their through trip becomes congested beyond their tolerance level, they will seek other paths. Other motorists, also using any street available, use their vehicles as instruments for thrills and pleasure, and have no concern for the effects of the noise they generate.

Neighborhood residents, on the other hand, usually desire a quiet, pleasant and safe place to live. Clearly the conflict of expectations and the psychology of each group is a major cause of the neighborhood traffic problem.

This is a typical neighborhood. The regular grid pattern permits through traffic to flow freely onto local residential streets. If traffic is congested on the bounding arterials (Central Avenue, Thoroughfare Way, Broad and Fleet Streets) or the traffic signal system provides poor progression along them, drivers will speed through a street meant to furnish access to local residences only. Some of the problems this can cause are noted on the schematic neighborhood plan on the right.

Figure 1. Typical neighborhood with traffic related problems
Physical Causes

Physical causes of the problem relate to the way cities have been designed, the way in which traffic demand has grown. The pattern of the street system, street geometries, location of major traffic generators, traffic congestion on major streets and nuances of traffic control can all contribute to neighborhood traffic problems. Gridiron street systems allow traffic to diffuse in all directions on every street. Although city grids as a rule have clearly defined hierarchies of arterial, collector and local streets, often the streets designed to carry high volumes of through traffic are overloaded. In some of the older city grids, there is often little physical difference from a motorist's standpoint between the designated arterials and collectors and purely residential streets. If an arterial or collector is congested, the adjacent residential street in the grid, a parallel path of virtually equal distance, is an inviting shortcut. Area-wide conditions of this nature are one aspect of the physical problem.

Other problems are more site specific and can occur with or without the grid system. A single congested intersection can lead to shortcutting. Often traffic control devices designed to move traffic on an arterial, such as left turn prohibitions, can force traffic onto residential streets. Or the presence of high volume traffic generators within or at the borders of a neighborhood can lead traffic through it.

Street design is another physical aspect of the problem. Suburban residential streets have been constructed to generous standards of width and geometric alignment. Streets which are both wide and contain long straight stretches are most inviting to speeders. Such streets look like traffic channels rather than places where people live. Features which make streets amenable and identifiable as residential places are frequently overlooked in design.

Many residential area problems are caused by location of land use activities which encourages or requires traffic to pass through residential neighborhoods. Where neighborhoods border on significant traffic generators, or where such generators are actually located within the neighborhood, complaints of traffic
problems are most intense. Downtowns, shopping centers, hospitals, industrial sites, freeway off-ramps, and transit stations can be the source of problem traffic. At rush hours and occasionally other times, the traffic centered on these places spills over from the major streets into the residential areas. On a smaller scale, streets close to major intersections or neighborhood shopping centers often suffer from shortcutting traffic and those searching for a parking space.

Another problem stemming from poor planning is when arterials and collectors are constructed with residential uses fronting on them. These streets are often specifically intended to serve more traffic and faster traffic than is consistent with an attractive residential environment. Occasionally the same end result occurs when suburban areas grow. A street originally built for access to abutting residences is extended branched and ends up linking cul-de-sacs, loop streets and other local access roads to the main street network.

Finally, devices traditionally used to control traffic in neighborhoods are not effective in reducing traffic volume or in slowing traffic down except temporarily. Part of this problem is due to the fact that traffic management rather than traffic facilitation is still a relatively new concept in traffic engineering.

In summary, the problems of traffic on residential streets can be traced to a conflict between desires of drivers on the street and the expectations of residents along it. Beyond this, the problems can be traced to numerous design deficiencies and operational policies which either fail to take the residential environment into consideration, or which fail to value it as highly as the need to move traffic.

The basic focus of this report, as well as the research that will follow it, is on effective techniques which can help to swing the balance of this conflict in favor of the neighborhoods. As such, the report is concerned more with "retrofitting" existing neighborhoods rather than with proper design for new neighborhoods. Many of the goals and principles contained herein are applicable to new residential developments, but the reader concerned with that problem is better advised to consult current manuals of residential neighborhood design.
Goals of street improvement and traffic management

The goals of street improvement and traffic management can be structured in different levels. The primary goal is the improvement of living and environmental conditions on residential streets. This is the goal of most schemes. However, another set of goals relating needs of motorists and needs of people living on other streets often emerges during the planning process. These may be called secondary goals which often impose constraints on the primary goal. Finally, there is the "political" goal of public officials — to give some indication of response and degree of satisfaction to any expressing concern for traffic issues.

Primary Goal

To significantly improve the environmental conditions of as many residents as possible, especially those most vulnerable to traffic impacts. The concepts of significant improvement, numbers of residents affected and vulnerability of those affected are particularly important aspects of this goal. Implicit are positive changes large enough to be meaningful accruing to as many people as possible, particularly those elements of the population most sensitive to traffic effects and negative impacts limited in degree of severity and numbers of people affected and falling on those least sensitive to traffic effects.

Since traffic has many impacts, the primary goal can lead to a number of subgoals:

To reduce traffic accidents and fear of traffic on neighborhood streets. This goal relates to vehicle accidents as well as subsuming the two more specific goals immediately below.

To maintain reasonably safe access and convenience for local residents, pedestrians, cyclists, and wheelchair users. Adequate and reasonably convenient parking, fairly direct routes, separation of different kinds of traffic in clearly marked zones, reduction of intersection conflicts, the encouragement of predictable behavior, and the provision of optimum information to road users can serve this goal.

To provide adequate and safe open space for children’s play and other recreational activities. The street space comprises a substantial percentage (often about 25 percent) of urban land and in the inner city it is sometimes the only available public open space. Use solely by automobiles when traffic flows are light can be seriously questioned. Multiple use possibilities have been demonstrated in the increasingly well known Dutch Woonerven, "residential yards" and in U.S. "play street" applications.

To eliminate unwanted noise, vibration, and air pollution. Peaceful, quiet streets and neighborhoods should be the environmental right of every urban dweller. To the extent that residential uses often take place on streets designated to have a major role in moving traffic (arterials and collectors), this goal must be somewhat compromised. But on purely residential streets, its achievement should take precedence over movement of traffic.

To improve the appearance of the residential street environment and encourage its maintenance by the residents and public agencies. The appearance of a residential street is usually improved when it is treated as a residential place, with thoughtful planting and details that are pleasant and designed for pedestrian use rather than driver use (walking surfaces, seating places, domestic scale signs, and street furniture, etc.). The intrusion of cars and traffic signs on the residential character of the place should be minimized. Good maintenance by residents can be encouraged by creating spaces for which they feel personally responsible, with clearly defined territories.

To encourage neighborhood revitalization and neighborhood stability. The overall purpose of street improvement is neighborhood improvement or at least prevention from deterioration. Traffic restraint may be related to rehabilitation in a number of ways: it may lead to it by improving environmental conditions; it may result from the efforts of residents to revitalize their neighborhood; or it may have no relation (in some cases revitalization takes place despite heavy traffic, in other cases neighborhoods without traffic decline for other reasons).
To reduce crime, particularly street crime and burglaries. No direct connections between traffic and crime have been established. However, studies in Hartford, Connecticut and St. Paul, Minnesota demonstrate that incidence of street crimes tends to be less in neighborhoods with complex and confining street patterns than in ones with open, easily perceived street grids and that traffic management plans which create complex and confining street patterns can reduce the crime rate. Hence, reduction of crime is a goal of traffic management and street improvements.

Secondary Goals

To maintain reasonable access for emergency, transit and delivery services. In cases of emergency, there must be ways in which these services can reach every house in the neighborhood within reasonable time. Transit should be accessible from residences and delivery services should have reasonably direct routes through the neighborhood.

To maintain reasonable access for automobiles with destinations in the neighborhood. Access to each residence should not involve excessively indirect or incomprehensible access routes. Slow but easy movement should be the rule.

To maintain reasonable access for non-residential uses. Local merchants need access, visibility and adequate parking as do local institutions, transit stations, industry, and other highly used facilities. Maintaining access from the major arterial system while protecting the surrounding residences is a means of achieving this goal. Special considerations are needed when non-residential uses are located within a neighborhood.

To mitigate conditions or compensate those on residential streets which must carry heavy traffic. By controlling speeds and traffic composition, making traffic behavior predictable, creating safe and visible pedestrian crossings, controlling omission, building protective barriers, or increasing setbacks, and providing compensating improvements such as street trees, better maintenance, police control, and substitute open space, the lowered quality of these streets can be ameliorated. In some situations financial compensation may be considered.

Political Goals

To relieve political pressure and respond to citizen concerns. This common goal is much more pragmatic and political than those given above. It is to respond, at least in a minimal way, to citizen concerns about traffic on their streets. It may motivate actions which genuinely satisfy citizen's needs or perfunctory measures designed simply to get the residents off the officials' backs.

All the goals listed above appear obvious and reasonable, but achieving acceptable levels of satisfaction for all or most of them is often difficult for there are inherent conflicts between many of them. The most obvious conflict is between the primary goals of livability and the secondary goals of mobility. Even among the livability goals there can be conflicts. Families with children may desire measures extensive enough to make streets safe as play spaces while just reduction of heavy truck traffic and traffic noise may be enough to satisfy other residents on the street. Residents with auto-oriented lifestyles place more value on accessibility than do others. Sometimes the conflicts lie within the individual residents themselves. Residents espouse livability goals for their own block of their own street, but when driving behave as though mobility goals were of prime importance to them. Hence, the crux of planning for neighborhood traffic management lies in finding trade-offs and compromises which allow achievement of an acceptable level of satisfaction over a broad range of livability and mobility goals.

Neighborhood traffic management

Traffic management is only one of a number of strategies that can help meet the above goals and improve environmental conditions in residential neighborhoods. Rehabilitation of housing, creation of new open space and recreation areas, planting trees, and townscaping are non-traffic strategies that may well be used to help
meet most of the primary goals.

There are also strategies which like traffic management attempt to improve environmental conditions by reducing traffic impacts in neighborhoods. Increasing the capacity of arterial streets, the encouragement of transit use, better land use planning, even the building of freeways could relieve the traffic load on residential streets. Design changes to vehicles, particularly trucks and motorcycles, to reduce their noise and air impacts would also benefit the neighborhood environment. However, traffic management is one of the most immediate, forceful and low-cost ways of improving a street's environment.

There are a considerable number of traffic management devices which may solve specific neighborhood traffic problems. These devices normally aim to control the volume and composition of traffic on residential streets and the behavior of the driver, particularly with regard to speed, direction, care and predictability. Devices range from physical controls which actually change the street configuration or otherwise physically affect the vehicle, to passive controls which induce drivers to act in a desired fashion as the result of perceptual or cognitive reaction to the device. As an introduction to the subject, Figure 2 presents a sampling of the devices and their primary control effects. As a fur-
ther introduction, Figure 3 presents an illustrated glossary of typical neighborhood protection devices.

Each of these devices has different effects and different reasons for its use. These effects and usage considerations are far more complex than the simplistic notations shown on Figure 2. In assessing these effects and selecting a control device for a specific situation, the analysts should be aware that these complexities are not limited to the direct effects on traffic. Secondary effects of the devices may be as useful or influential as direct traffic control impacts. For instance, on a street where traffic speed is the primary traffic control problem but where children’s play space or landscape features are also lacking, a device (like a cul-de-sac) which creates play space or landscape opportunity might be favored over one which simply controls traffic speed (such as an undulation). Details on the full range of traffic control device effects and considerations in their selection are presented in the following chapters.

Traditional versus New Devices

Many of the devices listed in this report are traditional controls that have been used, mainly on arterial streets, for years. Channelization, median barriers, one-way streets, and stop signs are devices which have been used long enough that they are generally accepted and usually obeyed by the traveling public. Other devices, notably cul-de-sacs and diagonal diverters, are adaptations of features routinely designed into new residential subdivisions. In these cases, while the control may be familiar, the specific applications of the device itself may be new. Still other devices, such as speed humps and traffic circles, represent relatively new approaches. Experience has shown that often, simply because a device is new or unfamiliar, it is represented both by drivers and residents as yet another effort by the government to control their lives. The degree to which this reaction may occur is largely a local phenomenon to be evaluated: if it can be predicted, use of more traditional devices which solve at least part of a problem may be preferable over the theoretically better “new” solution that creates an uproar.

Positive physical controls

Cul-de-Sac  Semi-Diverter  Diagonal Diverter

Figure 3. Glossary of neighborhood traffic management devices
Passive controls

STOP Signs  
Traffic Circle  
Speed Bump

Psychological controls

Lateral Striping  
Warning Signs  
"Gimmick" Signs

Figure 3. Glossary of neighborhood traffic management devices (continued)
The need for an organized planning process and community involvement

The complex nature of the residential street, the variety of users and their often conflicting goals, the complexity of control device effects on traffic and the secondary effects of these devices, make it imperative that neighborhood traffic management actions be a well-organized planning process. Such a process should include these basic steps:

- **Problem Identification** — An exploration of the specific nature of the problem or problems, and the issues and individuals involved.
- **Alternative Plans Generation** — Definition of the full range of plausible responses to the identified problems.
- **Plan Selection** — Estimating the likely effects of each alternative and how many people and whom would benefit or not from these effects, and choosing an option which has the most acceptable balance of positive and negative impacts.
- **Implementation** — Preparing the public for what is to take place; then actually constructing or putting into effect the planned traffic control changes.
- **Evaluation** — Observing and measuring how the traffic management system actually operates and identifying features requiring change or fine tuning.
- **Modification** — Adjustments to repair minor functional difficulties or to improve upon the initial planning concept or a larger-scale reconsideration of alternatives — a recycling of the planning process — where the initial scheme has proven unacceptable or ineffective.

The planning process should not be onerous or intimidating. Nor should its details be so overemphasized that the fundamental objectives of the program, traffic management and environmental improvement, are suppressed and the planning process becomes the objective of itself.
Its formality and the extensiveness of activity should be scaled to the needs of the individual situation. But the essential tasks at each step should be accomplished. Observations in the State-of-the-Art review reinforce this point. Where traffic management had severe difficulties, the difficulty was frequently attributable to lack of an organized planning process or to missing an essential element of it rather than to a technical error or to the inherent properties of the control devices and systems utilized.

At the outset, it must be emphasized that solving the neighborhood traffic problem is as much a political problem as it is a technical problem. Many sorry experiences have shown that a neighborhood traffic management plan may or may not succeed if the technical work is not perfect, but it will almost never succeed unless effective and thorough programs of planning and community relations are developed and carried on from the very beginning. Too often, well-meaning engineers have listened to a small group from a community, prepared and implemented a plan, only to face resentment from citizens previously unaware or uncommunicative on the subject. This aspect of the problem has been considered so important that many agencies will undertake a project only if a substantial majority of the affected neighborhood signs a petition requesting or agreeing to the plan. The planning process must provide a structure for effectively integrating community inputs with technical work.

Because the planning process and citizen involvement are critical, Chapter 4 of this report extensively documents the steps in planning for neighborhood traffic management and techniques for citizen involvement which have been successfully used.

Summary — a note on the State-of-the-Art

From the foregoing discussion, it should be clear that while the causes of the neighborhood traffic problem are fairly clear, the planning process, both political and technical, can become quite complex. Because the solutions often benefit some people while creating new problems for others, there is often a tendency on the part of political agencies to do nothing for fear of merely adding to their problems.

The most encouraging discovery in the State-of-the-Art research conducted in the preparation of this document is that there are a number of means, both technical and political, of solving the neighborhood traffic problem. Where failures have occurred, more often than not their cause can be traced to a lack of knowledge about the effects of particular devices, about how to involve the public in planning traffic management schemes or about the techniques for communicating what is known to the public.

This document represents the first step in the gathering together of current knowledge and its dissemination. As will become clear from further reading of this report, the State-of-the-Art is still incomplete. There is much still to be learned. However, the devices and techniques described in the following chapters should provide planning agencies with sufficient knowledge to make a positive beginning toward solving their problems. Hopefully it will suffice until the further research to be conducted in this study can fill in some of the gaps in knowledge in the way in which people, as drivers and residents, and the devices interact.