TOWN OF PLAINFIELD

PLAINFIELD

SPEED LIMIT SURVEY REPORT

INTRODUCTION

As a result of a 2013 speed limit survey, the Town has elected to update its approach to establishing posted speed limits on its roadway system. Past history has created a system that can be described as generally suitable in pockets but overly inconsistent through similar roadway classification comparisons.

PURPOSE

The purpose of this document is to offer a summary of the findings of the survey, discuss some approaches that may be considered to address any concerns, offer some general and technical insight into speed limits, propose a procedure for making adjustments to speed limits in the future, and finally, provide some recommended steps that may be taken to create a more consistent and effective system of speed limits and speed control measures within the Town's entire roadway system.

SURVEY RESULTS

'Exhibit A' is a map of posted speed limits, identified by existing sign locations, across the Town. Key insights from the survey include:

- Several collector roadways that include safety features such as roadside curbing, street lighting, and turning lane accommodations have posted speed limits of 30mph.
- Intersections of like roadway classifications with similar safety features can exhibit up to a 15 mph difference.
- Local streets vary regularly from one neighborhood to the next, including abrupt posted speed limit reductions of 10mph.

Given that it is desirable to offer a consistent system of speed limits and speed control measures, the Town is prepared to consider a series of systematic changes that would offer residents a better and safer experience when utilizing the public right of ways for travel.

ROADWAY CLASSIFICATIONS

To accomplish creating a more complete, thorough, and consistent approach in defining appropriate posted speed limits, the Town hereby establishes these speed limit guidelines in accordance with IAC and the roadway classifications as set forth in the Town's most recently adopted comprehensive plan.

Classification Types	Examples	Description	Speed Limit Range * (mph)
Divided Primary Arterials	Quaker Boulevard	Limited to zero direct access drives	45 - 55
Primary Arterials	Saratoga, Ronald Reagan	Carry traffic through region	35 - 45
Secondary Arterials	Dan Jones, Stafford	Interconnect Primary Arterials	35 - 40
Collector	Vestal, Carr	Connect local streets to thoroughfare system and businesses	30 - 40
Local	Neighborhood Streets	Continual personal drive access	25 - 30

** Lower limits recommended where pedestrian and non-motorized traffic are serviced.*

Though each particular portion of the roadway system can be viewed independently for specific hazards that may warrant deviation from these guidelines, the value of meeting driver expectations by providing consistent speed limits for similar roadway classifications shall be viewed in good favor as it relates to offering a consistent system.

INFO ON SPEED LIMITS

Facts for Posted Speed Limits

- The Indiana Code and Indiana Manual on Uniform Traffic Control Devices (Indiana MUTCD) provide standards for determining the posted speed limits.
- Only designated school zones and park zones can be posted at 20 MPH as per the Indiana Code.
- Only designated alleyways can be posted at 15 MPH or lower as per the Indiana Code.
- Posted speed limits should be indicative of the roadway characteristics (# of lanes, lane widths, curvature, etc.) and functionality (local road, collector, arterial) as per the Indiana MUTCD.
- Revising the posted speed limit to a speed other than 25 or 30 MPH requires a speed study to determine the 85th percentile speed as per the Indiana Code and Indiana MUTCD.

Misconceptions for Revising Posted Speed Limit

- Revising the posted speed limit in of itself does not necessarily improve safety (e.g. reduce crashes).
- Drivers do not always drive 5 to 10 MPH over the posted speed limit, especially for lower speed roadways such as 25 MPH or 30 MPH.

Possible Improvements for Improving Safety other than Revised Posted Speed Limit

- Improved pavement markings and warning signs.
- Improved roadway lighting.
- Increased police enforcement.
- Traffic calming measures (reduced lane widths via bump-outs, raised crosswalks, etc.)

With specific consideration of Local of low volume Collector roadway classifications, other means of speed control measures such as traffic calming are expected to be more effective than speed limit adjustments. A report titled 'Speed Control in Residential Areas' provides quality insight into the challenges of implementing various traffic and speed control measures. For convenience, a copy of this report is included as Appendix 'B'. For lack of its own adopted policies, this document may serve the Town as reference for implementation of speed control measures beyond the changing of posted speed limits.

GUIDELINE FOR POSTED SPEED LIMIT CHANGE REQUESTS

A request to change the posted speed limit is typically made with the intent for improving safety. However, lowering the posted speed limit may not necessarily be the appropriate course of action depending on the circumstances. Other measures may be needed instead such as increased police enforcement, improving other signage or pavement markings, implement traffic calming measures, or improving the roadway characteristics. Raising speed limits may also come into consideration as traffic volumes increase. Generally, increasing speed limits should also be accompanied with improved safety measures and may represent the need for a more involved project.

The Town has developed a guideline for addressing speed limit revision requests (Appendix A). The guideline consists of a two-phased approach:

- Phase 1: Preliminary Engineering Assessment
- Phase 2: Engineering and Traffic Investigation (aka Speed Study, if needed)

Phase 1 (preliminary assessment) will be performed by the Town's engineering staff to first determine if revising the posted speed limit is the correct course of action for improving safety. If so, then Phase 2 (speed study) will be performed in accordance with state statute.

RECOMMENDATIONS

The 2013 speed limit survey has made evident several concerns and inconsistencies surrounding the Town's roadway system. To improve the system to be more consistent, effective, and efficient, the following steps are recommended to be considered as future actions:

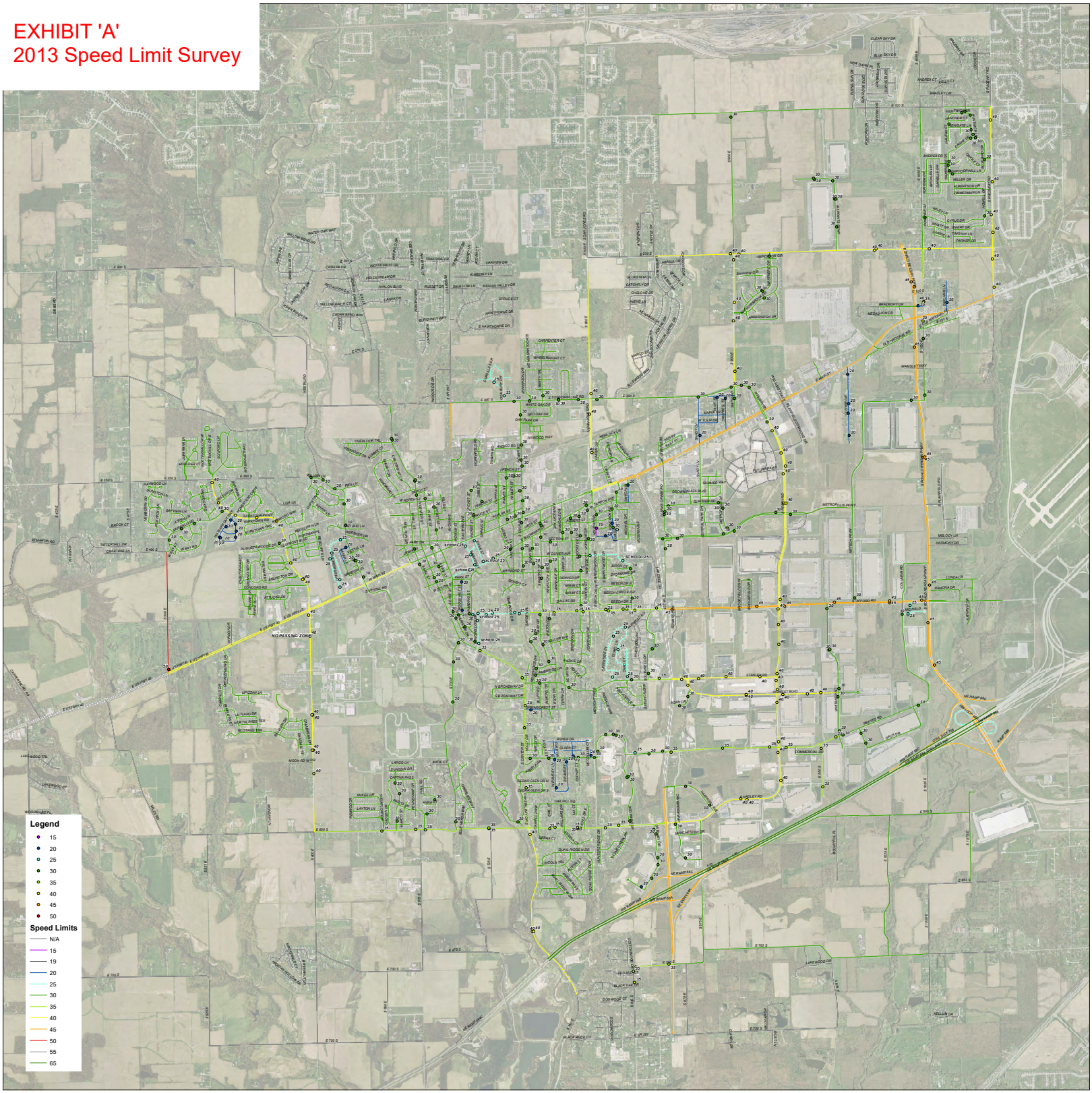
- Perform an Engineering and Traffic Investigation study on select Collector and Arterial Roadways to determine the actual travel speeds and make appropriate adjustments to the posted speed limits.

- Draft and adopt an ordinance to establish a 25mph speed limit for all Local roadway classifications except those areas of schools, parks, and alleyways as specifically identified within the Indiana Code. To avoid an immediate cost burden being placed on the Town, consideration should be given for a gradual implementation of this change.

- Draft and adopt a resolution to approve the use of the Guidelines for Posted Speed Limit Revision Requests to offer better direction for Town residents desiring to enhance safety through reduced speed limits in their neighborhoods. Note that with the adoption of the 25mph limit of Local roadway classifications, these requests would be effectively limited to Collector and Arterial roadways.

- Consider the development of additional guidelines for the strategic implementation of alternative speed control (i.e. traffic calming) measures.

EXHIBIT 'A'
2013 Speed Limit Survey



TOWN OF PLAINFIELD

GUIDELINE FOR POSTED SPEED LIMIT CHANGE REQUESTS

Introduction

The following represents the Town's guideline for addressing requests to revise posted speed limits. This guideline will be interpreted as needed based on the most recent version of the Indiana Code[i] and the Indiana Manual on Uniform Traffic Control Devices for Streets and Highways (Indiana MUTCD)[ii].

Definition of Posted Speed Limit

A posted speed limit sign is the regulatory sign (black and white sign) that posts the maximum speed for the roadway. This does not include any speed warning signs (yellow and black signs) that post a reduced warning speed (such as those at sharp roadway curves).

Steps for Speed Limit Revision Requests

A request to revise the posted speed limit should be made with documented support of the local HOA, or in the case where no governing HOA exists, a fairly representative list of affected residents who support the request. Any request should be made with the intent for improving safety. However, lowering the posted speed limit may not necessarily be the appropriate course of action depending on the circumstances. Where increased speed limits are being considered, additional roadway features are likely to be required as part of an overall improvement project. In any case, consideration for other measures may be needed instead such as increased police enforcement, improving other signage or pavement markings, implement traffic calming measures, or improving the roadway characteristics.

The following pages provide a stepwise procedure for addressing speed limit revision requests in order to best improve safety for each specific situation. The steps have been grouped into the following phases:

- Phase 1: Preliminary Engineering Assessment
- Phase 2: Engineering and Traffic Investigation (aka Speed Study)

The purpose of the Preliminary Engineering Assessment phase is to first determine if revising the posted speed limit is the most appropriate course of action for improving safety. If so, then

an Engineering and Traffic Investigation may be needed to recommend the revised posted speed. If not, then the course of action recommended by the Preliminary Engineering Assessment should be implemented.

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Phase 1: Preliminary Engineering Assessment

1. The Town's engineering staff will perform a Preliminary Engineering Assessment to determine if revising the posted speed limit is the most appropriate course of action for improving safety.

   Discussions may be made with the residents and the Town's emergency responders during the preliminary assessment. Readily available resources and data will be reviewed such as:

   a. The Indiana Code and Indiana MUTCD.

   b. The existing posted speed limit, other traffic signage, pavement markings, traffic control, and roadway lighting.

   c. Existing roadway characteristics such as lane widths, curvature, grade, driveway spacing, traffic calming measures, and sight distance.

   d. Traffic volume data.

   e. Crash history data.

2. An initial recommendation will be made by the Preliminary Engineering Assessment to improve safety which may include one or more of the following:

   a. No improvements are necessary.

   b. Revise the posted speed limit without the requirement of performing an Engineering and Traffic Investigation (Phase 2) as per the Indiana Code. Example situations that do not require an Engineering and Traffic Investigation include posted speed limits of 25 miles per hour (mph) or 30 mph within an urban district and 20 mph zones for schools and parks.

   c. Revise the posted speed limit with the requirement of performing an Engineering and Traffic Investigation (Phase 2) as per the Indiana Code.

   d. Increased police enforcement as agreed upon by the Town's police department.

   e. A roadway improvement project to improve traffic signage, pavement markings, traffic control, roadway lighting, roadway grade, curvature, driveway spacing, traffic calming measures, and / or sight distance.

Phase 2: Engineering and Traffic Investigation (aka Speed Study)

1. An Engineering and Traffic Investigation will be performed by the Town's engineering staff (or designated consultant) to determine the appropriate revised posted speed limit if recommended by the Preliminary Engineering Assessment (Phase 1).

   The Indiana MUTCD provides standards and guidelines for performing an Engineering and Traffic Investigation. Some of the data may have already been collected during the Preliminary Engineering Assessment or may need to be expanded upon such as:

   a. Speed distribution data (aka collect speed data via pneumatic tubes).
   b. Pace speed (most frequently occurring 10 mph range of speeds).
   c. Roadway characteristics such as grade, alignment, roadway curves, sight distance, etc.
   d. Roadside development and environment.
   e. Parking practices and pedestrian activity.
   f. Reported crash experience for 12 month period.
   g. Additional data recommended by the Preliminary Engineering Assessment.

2. A final recommendation will be made by the Engineering and Traffic Investigation to improve safety which may include one or more of the following:

   a. Revise the posted speed limit with the recommended speed.
   b. A roadway improvement project to improve traffic signage, pavement markings, traffic control, roadway lighting, roadway grade, curvature, driveway spacing, traffic calming measures, and / or sight distance.
   c. No improvements are necessary.

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[i] *Indiana Code,* Indiana General Assembly, 2015 Session.

[ii] *Indiana Manual on Uniform Traffic Control Devices (Indiana MUTCD) for Streets and Highways*, Indiana Department of Transportation (INDOT), 2011 Edition with Revisions 1 and 2.

SPEED CONTROL IN RESIDENTIAL AREAS

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DRIVE MICHIGAN SAFELY

FORWARD

This document is a revision of the "Speed Control in Residential Areas" booklet original written by the Residential Area Speed Control Ad-Hoc Committee. This revision represents the latest information and findings of the Institute of Transportation Engineers (ITE) Michigan Section's Technical Project Committee. The makeup of the Technical Project Committee is as follows:

Lori Swanson, Chair	Hubbell, Roth & Clark, Inc.
John Abraham	City of Troy
Matthew Smith	McNamee, Porter & Seeley, Inc.
Mshadoni Smith	Hubbell, Roth & Clark, Inc.
Eric Tripi	Barton-Aschman Associates, Inc. of Michigan

The information presented in this document represents the findings of the authors and does not necessarily reflect the views of the Michigan Office of Highway Safety Planning.

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Interesting summary of issues and residents mind-set.

I. INTRODUCTION

The perception of speeding on local streets is probably the most persistent problem facing residents and traffic officials, alike. Although local or residential streets carry the lowest traffic volumes and suffer the fewest traffic crashes, they are the single largest consumer of a traffic engineer's time and energy. Residents observe vehicles being driven at speeds they perceive are too fast and conclude that the speeds would decrease if stop signs were installed. Speeds considered excessive by residents are considered reasonable by these same persons when they are driving in another neighborhood. Every traffic engineer has been shaken by these same residents who announce "if something is not done about the traffic problem on my street, someone is going to be killed and it will be your fault." This is usually followed by a demand for various traffic control measures and often backed up with petitions from residents. Traffic officials then must focus their attention on responding to these pressures, often diverting resources that could be dedicated to solving major capacity and traffic crash problems on other streets.

Residents' complaints are usually accompanied by a proposed solution to the speeding problem...stop signs. Traffic officials respond that stop signs installed to control speeding: (a) don't work, (b) are frequently violated, (c) are detrimental to safety, (d) are not warranted in the Manual* and, (e) actually increase speeds between stop signs. When residents are told that stop signs are not the answer to the speeding problem, they feel they must fight city hall to get them installed. A confrontational relationship is established between residents and traffic officials and the stop sign becomes a "trophy" which is awarded to the winner of the confrontation. Solving the speeding problem becomes secondary to winning the "trophy". The end results of this process are: (1) unhappy citizens, (2) continued complaints and requests for more stop signs, (3) increased political pressure and, (4) often, approval of stop sign installations to bring the controversy, temporarily, to an end. However, experience shows the

* The "Manual" refers to the *Michigan Manual of Uniform Traffic Control Devices* (MMUTCD that specifically states that stop signs should not be used for speed control).

speeding problem is usually not solved. Before and after studies show that stop signs usually increase mid-block speeds and create violators of the stop controls.

This booklet introduces traffic engineers, law enforcement officers, elected officials and community leaders to the concept of traffic calming which may help alleviate speeding in residential areas. Traffic calming is the combination of physical controls and community support to reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized users. Some objectives of traffic calming include: reducing speeds for motor vehicles, reducing crash frequency and severity, increasing safety, reducing the need for police enforcement, and reducing cut-through motor vehicle traffic.

Traffic calming measures are typically installed as part of an area wide traffic management scheme rather than on a single street to avoid shifting the problem from one street to another. A successful traffic calming program must include enforcement, education, engineering and community involvement. Community support and participation is an integral part of a successful traffic calming program. This booklet will give guidance on how to set up a successful traffic calming program in your community.

This booklet provides alternatives that may help decrease speeds on residential streets. It discusses the advantages and disadvantages of each alternative. It points out that there is no single, simple solution to all speeding problems that satisfies residents, is effective, and meets good engineering practices and standards. It also stresses that there may not be a tool to reduce speeds. Regardless of the approach used, there are certain criteria that should be followed:

- All devices must meet Michigan Manual of Uniform Traffic Control Devices requirements.

- The integrity of streets classified as Major under the provisions of Public Act 51 must be preserved.

- Permanent traffic control devices should be used to the minimum extent required to achieve the objectives.

- Access to all properties must be accommodated.
- Access from the nearest arterial to the destination should be as direct as practical.
- Local access to neighborhood facilities must be accommodated.
- All permanently installed devices must be designed to allow emergency vehicle access.
- Consideration must be given to circulation, parking and needs of customers and business owners.
- Consideration should be given to the access needs of essential commercial services such as garbage pickup, snow plowing, student busing, etc.
- Changes must not unduly impact adjacent areas.

It states that residents and local officials must work together with a full understanding of each other's problems, limitations and concerns for the common goal of safety on residential streets. One of the best ways to accomplish this is to have citizens involved in standing or ad hoc community traffic safety committees.

This booklet is intended to be used as a traffic safety tool by traffic engineers, law enforcement officers, elected officials, and community leaders in their day-to-day traffic control responsibilities.

References: 40, 41, 42

II. COMMUNITY INVOLVEMENT

An important component of any traffic calming program is community involvement. If citizens are involved, the chance for problem resolution and a successful traffic calming program is greatly improved. Often the problem cited is one of perception and not fact, and the solution proposed could be ineffective or even counter-productive. One way to avoid the knee-jerk approach to traffic engineering is to develop a process that involves the community. While there are many ways to accomplish public involvement, this section will describe two that have been successful.

Approaches to Citizen Involvement

Standing Committee

Some communities have successfully employed a standing committee, normally referred to as the "Citizen Traffic Committee," to deal with traffic control issues. The makeup, function and authority of the committee are described below:

a. The committee is appointed by the mayor or council. It should consist of an odd number of members who serve staggered terms.

b. Non-voting staff experts (police and engineers) are available to prepare agendas, collect data, provide input and send recommendations to the city council.

c. Efforts should be undertaken to make committee members as knowledgeable as possible about traffic engineering and enforcement principles. This can be realized by providing technical materials and training for committee members.

d. The Committee reviews citizen requests for traffic control devices and staff analysis of those requests, and makes recommendations to the city council.

The Committee should hold monthly, evening meetings. The standing committee offers several advantages; acts as a buffer between the council and citizens; lessens the pressure to install unwarranted devices; may be perceived as more objective than staff; provides technical and citizen input to the council; and dampens the adversary relationship that often develops between citizens and staff. On the other hand, there are some drawbacks: the committee can become politically motivated; one strong member can have too much influence; it can slow the process; and it requires some staff time.

Ad hoc committee

In this approach, an *ad hoc* or advisory committee is formed when a community seeks help in dealing with a specific traffic control problem. While the governmental agency has the ultimate responsibility, it is highly desirable that the committee and agency work through the process and arrive at a consensus. This process works as follows:

a. A working committee of neighborhood residents should be selected to represent different parts of the neighborhood. If the neighborhood has an organized association it should be asked to assist with the appointments; otherwise, volunteers are sought.

b. Committee members should identify the problem brought to their attention.

c. Staff collects the appropriate data and presents it to the committee. The committee sets goals which are quantifiable, e.g., reduce the average speed by a certain percentage, etc.

d. Options should be identified and alternatives presented, listing the pros, cons, cost, etc. of each.

e. Committee and staff reach agreement on the alternative to be recommended.

f. Committee with staff support presents the plan to the larger community through a large meeting or several small meet-

ings. One large meeting is enough if the plan is not controversial; the number of meetings should be directly related to the complexity of the plan. The purpose of the meetings is to obtain community support.

g. Once community support is achieved the plan is implemented. If possible, it is best to install temporary measures to determine the impact. This allows for adjustments and even removal if it is obvious that the measures will not produce the desired results.

The advantages of using advisory committees are that they will help develop neighborhood concerns and determine what, if anything, should be done; it builds a relationship between staff and residents to work through future problems; and the process creates a better understanding of traffic engineering and enforcement principles among lay people. Conversely, this process consumes considerable time and effort of staff. If consensus is not reached, the neighborhood can become divided. If not handled deftly by staff, the process can become unwieldy.

References: 19, 25, 28

III. PROBLEM IDENTIFICATION

The first step in a traffic calming program is to identify the problem. When a resident contacts their City, Village or County, a complaint is recorded. The resident will be directed to discuss their concerns with the other residents or an established traffic advisory committee. If an advisory committee has not been established, the public agency will give guidance on how to start one. Residents will assist the public agency in the identification of the problem.

These residents will also assist the public agency in the collection of data. Speed studies, traffic volume studies and license plate surveys, depending on need, will be performed at locations identified by the residents. The data collected will be analyzed to determine if there is a problem. If a problem is not identified, a letter with the supporting data will be sent to the residents explaining the findings and that no further action is required. If a problem is identified, then the public agency will move to the next steps of the program which include enforcement and education.

References: 42

IV. EDUCATION AND ENFORCEMENT

Once a speeding problem has been identified, the next steps in a traffic calming program is to initiate education and enforcement campaigns. Both of these steps should be conducted at the same time since many times a speeding problem can be reduced through effectively enforcing the traffic ordinances and educating the residents. From past enforcement activities, the City of Farmington Hills, Michigan found that most traffic violators within a residential area were the residents who live in the area. Therefore, it is critical to educate the residents of an area where a traffic problem is occurring.

Reference: 42

A. EDUCATION

1. Public Information And Education

An effective way to educate residents is through public information and education campaigns. Public information and education campaigns should be carried out through the mass media by law enforcement members of safety oriented groups. These campaigns "spread the word" about current enforcement emphasis and encourage voluntary compliance with the law. The perception that violators will be apprehended is essential to develop compliance with the law. Selecting the right media for your message is important. Clearly define the reason for the change; i.e., to reduce traffic crash casualties. The size of the audience and project will be a controlling factor in the media you select. An enforcement effort must be coordinated with the information and education campaign.

Reference: 5

2. Neighborhood Speed Watch Program

Another educational tool is the Neighborhood Speed Watch Program whereby residents can help control speeds with minimal police support.

A Neighborhood Speed Watch Program must involve law enforcement personnel and residents working as a team. Law enforcement's role is to provide the educational material and, if necessary traffic law enforcement. An effective tool used for education is speed radar trailers. The trailers are unmanned and equipped with radar equipment to detect the speed of vehicles. The trailer clocks the speed of an approaching vehicle and displays the speed on a display board that is visible to the motorist. This shows the motorist the actual speed at which they are traveling.

The neighbors must educate each other, establish their goals, and police themselves. Neighbors identify the speeders, the police make personal contact for the purpose of educating the speeder, and involve law enforcement as a last resort.

This program has the benefit of bonding the neighborhood together. The off-shoots of this are invaluable. The reduction of negative contacts with law enforcement enhances its image. The time involvement will depend on the individual's role and the size of neighborhood or community that is targeted. The media relationship involvement relates to the target area.

Neighborhood Speed Watch Programs rely on peer pressure and community spirit to increase awareness in a subdivision that may experience speeding traffic. It considers the fact that in a self-contained subdivision, the drivers involved are neighbors and friends of the people complaining of speeding. Neighborhood Speed Watch Programs have little or no effect on "through" traffic problems.

Typically, to be included in a Neighborhood Speed Watch Program, a street must (1) be a local street, (2) experience 85th percentile speeds in excess of 10 MPH greater than the posted speed, and (3) receive support from most of the households.

Once established, the following actions are taken:

a) A personal letter is sent to all households explaining the Program.

b) Neighborhood Speed Watch Program signs are posted.

c) Committee members call each household in the specific area to explain the program and appeal for cooperation.

d) Radar speed observations are made by local traffic personnel and personal letter are sent by the Chief of Police to drivers or owners of vehicles observed speeding.

e) Periodic speed studies are made to determine the Program's effectiveness.

f) Neighborhood organizations are involved as necessary.

Reference: 9, 42

B. ENFORCEMENT

1. Surveillance/Enforcement

Selective traffic law enforcement is the process of assigning police officers to a specific area at specific times to enforce traffic laws relating to a specific problem. The allocation of officers to the area is usually for a limited period.

When a police agency becomes aware of a particular traffic safety problem, officers can be assigned to the problem area to enforce related laws. Decisions must be made as to enforcement strategy, number of officers, time of day or any combination thereof, depending on the variables related to the location, type of violations, available officers, etc.

This type of activity tends to only solve the problem in the presence of the officer. The more officers assigned, the more effective this method. This is a costly process especially when it involves overtime or diverting officers from other assignments.

2. Automated Speed Enforcement Device

The newest tool in speed enforcement is the Automated Speed Enforcement Device, which is currently being tested at selected locations throughout the U.S. This device consists of a speed radar device and a 35 mm camera interfaced through a computer. It is located in an unmarked vehicle parked on the side of a road. As each vehicle comes within radar range its speed is determined. If that speed is over the preset threshold speed, the camera takes a photograph of the vehicle and its license plate.

The owner of the vehicle is then informed by either a warning letter or ticket of the date, time location, posted speed and travel speed of the vehicle. Currently, Michigan law does not permit the issuance of a ticket.

V. ENGINEERING

When the education and enforcement campaigns prove to be ineffective, the location qualifies for further analysis to determine what traffic engineering measure, if any at all, should be installed to effectively reduce speeds. In certain situations, vehicle speeds can only be effectively reduced by physical diversion of the traffic on the travelway. The application of traffic control devices, such as signs, alone normally are not effective in reducing vehicle speeds through residential neighborhoods. However, when used in conjunction with traffic calming devices, the proper use of traffic control signs can be an effective traffic management tool.

A. TRAFFIC CONTROL DEVICES

1. Stop Signs

The basic purpose of stop signs is to assign right-of-way to vehicles at intersections. There are Stop Sign Warrants outlined in the MMUTCD which must be satisfied before a stop sign can be installed. Stop signs are requested by residents more than any other traffic control device for the reduction of vehicle speeds and traffic volumes. Unfortunately, studies have shown that stop signs are largely ineffective in meeting the residents' requests for speed control.

a. Two-Way Stop

This is used to assign right-of-way to traffic on one of two intersecting streets by requiring traffic on one street to come to a complete stop. It is suitable where:

- one street is a major street;
- sight distances approaching the intersection are substandard, and traffic approaching under the general rules for uncontrolled intersections would run a strong risk of being involved in collisions;

- there is a history of a crash pattern that could be corrected by right-of-way controls, yet conditions do not require traffic on both streets to stop.

b. Four-Way Stop

This type of intersection control is intended primarily where two collector or major streets intersect and do not warrant a traffic signal. Its purpose is to assign right-of-way to traffic on both intersecting streets by requiring all approaching vehicles to come to a complete stop.

c. Effect on Traffic Volumes

When local streets offer significant savings in time over congested parallel major and collector routes, or allow avoidance of congestion points, traffic control devices, including stop signs, will do little to reduce traffic volumes. However, when the local streets offer only a slight savings in travel time over other routes, the time lost at stop signs may be enough to keep traffic off of local residential streets.

Stop signs may be installed at uncontrolled intersections in residential neighborhoods with a street network arranged in a grid pattern. Traffic would be stopped on every other block throughout the entire residential neighborhood. With no continuous "through" streets in the neighborhood, an even distribution of traffic would be encouraged.

d. Effect on Traffic Speed

Numerous studies have shown that stop signs are relatively ineffective as a speed control measure, except within 150 feet of the intersection. At the point of installation, speeds are reduced, but the effect on traffic approaching or leaving the stop-controlled intersection is negligible. In fact, some motorists actually increase their speed to make up for the "inconvenience" of stopping or disregard the stop signs. Studies show that more than 50% do not stop.

A study conducted in Boulder, Colorado, demonstrated that the 85th percentile speed and mean speeds on 25 mph and 35 mph roads were greater in areas that were controlled by stop signs.

Studies in various California cities showed a slight increase, or no change, in vehicle speeds after the installation of stop signs.

While the request for stop sign installation leads all resident requests for speed control measures, it must be emphasized that studies have proven there is little or no effect on vehicle speeds in residential road networks after installation.

e. Warrants/Compliance

Warrants for stop sign installations are included in the Michigan Manual of Uniform Traffic Control Devices (MMUTCD). These warrants relate to right-of-way assignment and respond to site safety consideration.

A stop sign observance study of unwarranted four-way stops in Troy, Michigan, found that the percentage of "no" or "roll" stops to be significant after installation of unwarranted stop signs, while there was no significant change in 85th percentile speeds.

Many studies have been conducted to determine the degree to which stop signs are obeyed. When not required to stop by cross street traffic, only 5 to 20 percent of all drivers come to a complete stop; 40 to 60 percent will come to a "rolling" stop below 5 MPH, and 20 to 40 percent will pass through at higher speeds. High-volume, four way stop-controlled intersections have demonstrated the highest compliance levels, while three-way stop controlled intersections have shown the lowest.

In Star City, West Virginia, before and after studies showed an increase in "no-stops" from 14.1% to 25.1% when two-way stop intersections were converted every summer to four-way stops for pedestrian safety. Mean Speed was not significantly affected by the presence of the four-way stops. The recommendation of this particular study was to end the practice of using four-way stops for speed control.

Studies have shown that when a driver does not believe that a stop sign appropriately reflects the actual traffic conditions, the driver often disregards it. The use of unwarranted stop signs not only decreases the compliance levels of motorists, but has the unintended effect of decreasing compliance at intersections where stop signs have been installed for warranted operation and collision reduction.

f. Effect on Traffic Safety

While no study has proven the effectiveness of stop signs as traffic safety measures, general engineering belief is that the unwarranted use of stop signs increases the safety hazard at the intersection. This is shown in the studies of the compliance rates at stop-controlled intersections. In addition, motorists disregard for unwarranted stop signs presents a significant hazard to crossing pedestrians.

Effects of unwarranted stop signs on driver behavior and safety at stop signs throughout a community are difficult to substantiate. Evidence to date on the safety effects of individual stop signs placed for volume and speed reduction purposes is mixed. At some intersections where a degradation in safety was measured, placement of the signs in poor visibility positions and lack of supplementary markings may account for the crash experience. Cases where safety experience was reportedly improved may include instances where traditional warrants for stop sign installation were actually met, or were close to being met.

g. Environmental Effects

Stop signs affect the environment around the intersection, and the use of unwarranted stops signs could unnecessarily add to this problem. Stopping and idling at intersections increases the amount of automobile exhaust in the area. In addition, tire noise and engine noise increase with the braking and acceleration associated with stop signs. Automobile fuel consumption is increased with the stopping, accelerating, and idling of vehicles at stop-controlled intersections.

h. Community Reaction

Residents often see stop signs as a solution to "near miss", as well as actual crashes. They are also viewed as being effective at controlling vehicle speeds. Suggestions that unwarranted stop signs have very poor compliance and that they might be detrimental to safety are generally discounted by residents. Residents also dismiss concerns over a community's exposure to tort liability for unwarranted use of traffic control devices. By disregarding the warrants presented in the MMUTCD, this presents potential liability concerns for the responsible jurisdiction. If a stop sign installation could be considered irresponsible or in clear contradiction to accepted standards, liability suits could result.

Objections to stop signs come mainly from residents at the intersections who are subjected to additional noise and pollution which come from decelerating and accelerating vehicles, and from motorists who think they are being stopped needlessly.

It should be the goal of the traffic engineer and local policy makers to explain to the public why unwarranted stop signs are ineffective at controlling vehicle speeds. Special attention should be given to explaining the adverse effects on the environment, motorist safety, and pedestrian safety.

A community's policy of installing 4-way stops at school crossings should be reviewed in light of the above items. Stops at these locations are only useful about 2% of the time. Therefore, 98% of the time, they can be serious traffic safety hazards.

References: 1, 2, 3, 4, 36, 37, 38, 39, 40

2. Speed Limit Signs

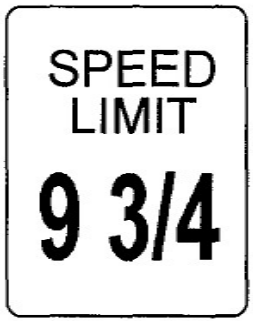
a. Speed Limit Signs/Speed Zoning

The speed limit sign is a regulatory device that informs drivers of the speed limit imposed by the governing agency. Some signs merely remind drivers of the limits applicable to the type of highway and area. Where the speed

limit is not applicable to specific sites because of special hazards, a deviation from that limit is shown by posting advisory speed signs. A new speed limit is determined by an engineering and traffic study of the street section involved. Special attention is given to the character of the street (sidewalks, driveways, and sight obstructions), horizontal and vertical alignment, pedestrian activities, and hazards which may not be easily detected by drivers. If no unusual safety problems are detected, the 85th percentile speed of traffic on a street is usually taken as an indication of the speed limit which could be implemented.

Studies that tested the effect of speed limit signs on speeds have been largely confined to major streets and expressways. Performance on these highways is not considered relevant to the local street situation. Studies have shown that speed limit signs have very little impact on drivers' speeds on major streets. Motorists drive at speeds that they consider reasonable, comfortable, convenient and safe under existing conditions. Drivers appear not to operate their vehicles by the speedometer, but by roadway conditions.

Speed limit signs, other than the standard 5 MPH increment (i.e., 28 MPH), are not standard and may be illegal. The desired effect of posting a non-standard speed limit sign is to gain compliance by capturing the driver's attention with a unique number. If drivers are consciously aware of the speed limit, they are more likely to comply with it. While the signs are inexpensive, they do not conform to the MMUTCD. Initially, the signs would be noticed and make drivers aware of their speed. Once drivers became used to the signs, they have no further effect on drivers' speeds.



If posted speed limits are significantly lower than prevailing traffic speed, residents normally place some hope in them or in subsequent enforcement. However, if the posted limits are within a few miles per hour of the previously prevailing traffic speed, they are not addressing the residents' problem.

b. Speed Limit Signs With Other Devices

Speed limit signs with flashing beacons have been shown to have a minor effect in reducing vehicular speeds. Such signs have been shown to be most effective in school zones. Other traffic activated signs with variable messages and warnings may also have minor effectiveness in reducing speeds.

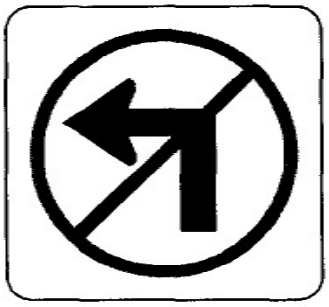
One such device is a trailer-mounted variable message sign with a radar speed gun which displays the posted speed limit and the approaching driver's speed. The intent is to increase the motorists' awareness of both posted speed limit and their own travel speed.

Observations show that most motorists reduce their speed when they see the device. In addition to reducing motorists' speeds, other advantages of the equipment include the creation of positive public relations, better acceptance of speeding tickets, and its ability to act as a teaching device. The disadvantages include potential vandalism to the equipment if left unattended, and it may encourage speeding by those who wish to "test" it. Its speed reduction effectiveness is isolated to the immediate area and time of its use, and this likely will diminish over time. However, effectiveness can be improved with the use of visible speed enforcement.

References: 5, 6, 7

3. Turn Prohibitions

Turn prohibitions will reduce traffic volumes, noise, and, in some cases, speeds on streets where they are applied. They may also improve traffic safety on streets to which they are applied. However, volumes, noise and speeds will increase on alternate routes. They are difficult to enforce, and reduce access for residents. In some cases, speeds may increase, and traffic safety may decrease, when motorists are forced to take alternate routes.



Turn prohibitions can be used to reduce traffic volumes on local streets by installing them on major/collector streets to prevent traffic from entering local streets. Such controls are usually in effect during peak traffic volume hours, when motorists are seeking less congested, alternate routes.

Although turn prohibitions have been in use for some time, very little quantitative research was found, and it was related to the number of violations. Violations in the range of 10% to 15% of the original turning volume can be expected.

Reference: 8

4. One-Way Streets

The use of one-way streets has mixed results. They are not useful in reducing speeds on local streets. In fact, the use of one-way signs may increase speeds in the permitted direction, and may increase the amount of cut-through traffic on other residential streets.

One-way streets can be used to make travel through a neighborhood difficult by creating a maze effect in the internal street pattern, which may discourage through traffic. However, the amount of traffic on other residential streets may be increased.

Reference: 8

5. Commercial Vehicle Prohibitions

It is a common practice in communities to prohibit commercial vehicles from most, if not all, local streets in residential areas. This is done to protect the pavements and eliminate nuisances. However, commercial vehicles are normally allowed to travel on any street when engaged in pickup and delivery. Such regulations are unlikely to affect vehicle speeds, but they will reduce truck traffic volume and noise.

Reference: 8

6. Special Warning Signs

Special warning signs such as "Children at Play", "Watch for Children", or others that warn of normal conditions are not effective in reducing speeds in residential areas. It is also likely that such signs encourage parents to believe that there is an added degree of protection, which is not the case. These signs suggest that it is acceptable for children to play in the street. The Michigan Vehicle Code prohibits the use of signs not deemed standard by the MMUTCD.

The MMUTCD provides standards for signs warning drivers that they are approaching recreational facilities such as parks and playgrounds. However, there is not enough evidence to determine the effect of these warning signs on vehicle speeds.

Reference: 40

7. Portable Signs

One growing trend in many communities is the use of portable stop signs placed in the street between crosswalks, to protect pedestrians. This has actually turned out to be a very controversial issue in many areas.

Municipalities feel that these signs are very effective in forcing traffic to stop for pedestrians in crosswalks. However, some state departments of transportation have banned the use of these portable signs, citing reports that the signs, when hit by vehicles, have caused injuries to nearby pedestrians. The MMUTCD states "As noted herein or for emergency purposes, portable or part-time STOP signs shall not be used". The exceptions refer to hand-held STOP signs used by construction flaggers and school crossing guards.

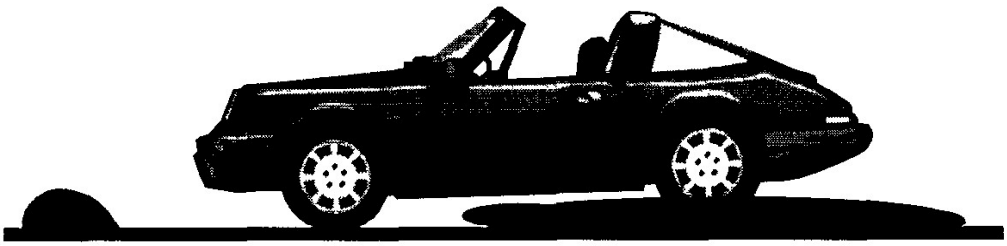
B. TRAFFIC CALMING DEVICES

1. Speed Humps and Bumps

The speed hump is generally 3 to 4 inches high, rounded section of pavement, approximately 12 feet in length. A speed bump is approximately 12" to 18" long, causing a more severe "bump" to be felt by the driver.

The speed hump was developed in the Transportation Road Research Laboratories (TRRL) in Great Britain and has been tested in closed test areas and on public roads. Tests in the United States and in various countries around the world, have shown speed humps to be effective in controlling vehicle speeds and in reducing traffic volumes in the immediate area of the hump or bump.

Studies in Australia, the United Kingdom, and the United States have shown reductions in 85th percentile speeds ranging from 3 MPH to 14 MPH between speed humps and from 6 MPH to 27 MPH at the speed hump location. Recent experience in a Michigan community indicated a 5 mph reduction in the 85th percentile speed. Volumes were found to be reduced from 1 to 55 percent.



SPEED BUMP **SPEED HUMP**

Another type of speed hump is the flat top hump or speed table. These humps are typically 22 inches long with a 10 foot flat

section and can be used on collector roads with more than 12,000 vehicles per day. This type of speed hump can serve as pedestrian crossings. Studies have shown these humps not only greatly reduce the 85th percentile speed of mainstream traffic but also have shown that, unlike speed humps, the speed between the humps and at the humps are essentially the same as before hump or bump installation.

Some of the negative effects of speed humps are an increase in noise level from individual vehicles near the humps caused by braking and acceleration, but not due to the sound of vehicles striking the humps. Studies have shown that speed humps have a more severe impact on longer wheel base vehicles and should not be used on neighborhood collectors, major fire and ambulance routes, or on routes frequently used by large trucks or buses. They are a major hindrance to snowplowing efforts.

Often the implementation of such traffic calming measures bring up liability issues. A recent survey of a number of communities using different traffic calming devices found that most had no legal problems at all while the remainder had mostly experienced threats and no action. As more and more traffic calming devices are installed, the question of the legality of these measures are becoming irrelevant.

The reports on speed humps have shown that both the design and location/spacing of speed humps are critical. For typical residential streets the most widely used design is the circular, parabolic speed hump. A series of speed humps is more effective than a single installation. The spacing of speed humps ranges from 200 feet to 750 feet, depending upon the desired 85th percentile speed between speed humps. Formulas have been developed to determine the optimal spacing of humps, depending on the use of either a 3 inch or a 4 inch high hump. Adequate pavement markings and traffic signs are important to warn drivers of speed humps. Speed humps can be installed on roadways carrying 3,000-8,000 vehicles per day. The cross-section design of humps or bumps is critical to their effectiveness.

The speed hump should not be confused with the speed bump that is 3 to 5 inches in height and 1 to 1 ½ feet in length. Because speed bumps are abrupt, they are considered to be potentially hazardous for motor vehicles. The main use of the speed bump

has been in private parking lots and on private roads. They are generally considered to be inappropriate by traffic engineers because they are not included in design guides.

As of September 10, 1997, The Institute of Transportation Engineers (ITE) plans to publish the recommended practices for Guidelines for the Design and Application of Speed Humps.

References: 10, 11, 12, 13, 14, 15, 16, 32, 33

2. Rumble Strips

Rumble strips are a series of either bumps or depressions in the pavement. They are intended to alert drivers of a special situation, such as a speed reduction or stop ahead condition. They are typically ½ to 1 ½ inches high or deep, 3 to 4 inches wide and placed 90° to traffic flow.

Rumble strips produce both an audible rumble and a vibration that creates an awareness of a condition for which a driver must react. They are used most frequently on shoulders of high-speed roadways to alert drivers that they are not driving in the travel lanes of a road. They are also commonly used to alert drivers in rural or high speed areas of an unexpected stop-ahead condition.

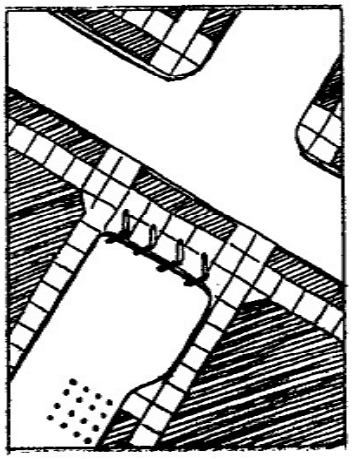
Many states now use 'portable' rumble strips, which are basically high density rubber sheets with a series of undulations. Though these are popularly used near construction zones, these may be used as a temporary measure in residential areas before installing permanent rumble strips.

Little research has been performed in residential areas for their use as a speed control device. A study in the City of Rochester Hills showed speed reductions of up to 2 MPH, whereas another study showed reductions of up to 15 MPH. Rumble strips can produce an annoying noise, cause vibration in nearby homes and be snow removal obstructions. One study suggests they should not be used where there is significant bus or truck activity or where traffic volumes exceed 2,500 vehicles per day. Due to the adverse effects, their installation must be carefully considered.

References: 4, 17, 18

3. Street Closures

The primary effect of street closures is to eliminate through traffic rather than to reduce speed. There may be some speed reduction because higher speed through traffic is discouraged from using the neighborhood streets. This is true particularly where a pattern of closures is carefully designed to accomplish this end. Street closures can be constructed at an intersection or at midblock. The midblock application can be effectively used where it is desired to restrict traffic in a residential section while allowing access to a high traffic generator adjacent to the residential area. Generally, whenever a street closure is used, a cul-de-sacs should be constructed so as not to "trap" a vehicle. Cul-de-sacs often require the purchase of right-of-way and often are constructed in a resident's front yard.



Among the disadvantages of street closures are:

- Restricted access to the neighborhood by service and emergency vehicles.
- Problems with vandalism and maintenance.
- Traffic is often transferred to neighboring streets, generating new problems and complaints.

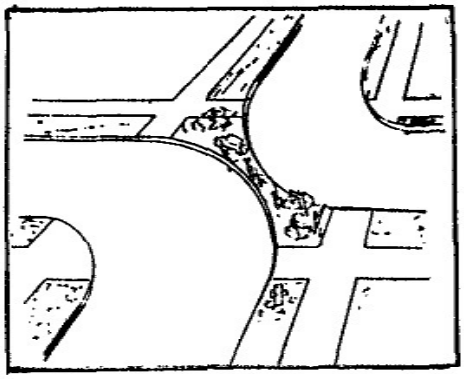
Street closures are difficult to apply to existing roadways and are better suited for newly developing subdivisions.

When cul-de-sacs are used, adequate turnaround areas must be provided at the end of the street. Proper signs must be installed to warn drivers of the end of the street.

Reference: 8, 28

4. Traffic Diverters

a. Diagonal Diverters



Diagonal diverters are barriers placed diagonally across an intersection. This converts a normal four-legged intersection into two separate roadways, each with a 90° turn. The purpose is to discourage "through" traffic by requiring it to take a circuitous route through the neighborhood.

Speeds of vehicles are only affected in the immediate vicinity of the diverter because drivers must make a 90° turn. Diverters may discourage drivers from using the street as a short-cut route. However, some drivers will simply move to another residential street, thus moving the problem. Since they create formidable barriers in the intersection, they must be marked similar to one-way streets and have appropriate lights so they can be seen at night.

References: 8, 9, 19

b. Semi-Diverters

A semi-diverter is a barrier placed transverse to traffic at the beginning of a block. It prohibits traffic from entering the block, but allows two-way traffic within the block. Since they create formidable barriers in the intersection, they must be marked similar to one-way streets and have appropriate lights so they can be seen at night.

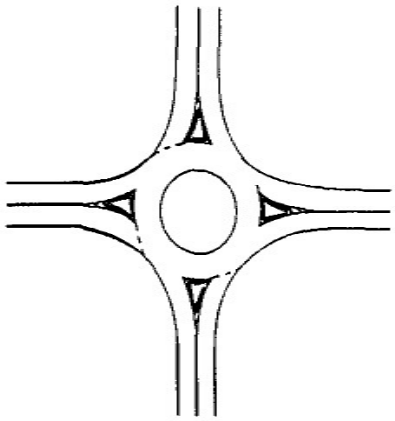
Semi-diverters have no effect on speeds other than in the immediate vicinity of the barrier. They can reduce traffic volumes, but only at the end of the block at which they are placed. The violation incidence can be quite high.

Reference: 8, 19

5. Traffic Islands

a. Traffic Roundabout

Modern roundabouts are different from traditional traffic circles, in that all approaching traffic yields right of way to circulating traffic. This is reinforced through the use of yield signs on the approaches. Other characteristics of roundabouts include deflection and flared approaches. Use of deflection helps slow entering vehicles, leading to safer merges with the circulating traffic stream. The use of splitter islands helps drivers perceive a change in the roadway geometry and enter the roundabout safely. Benefits of roundabouts realized in the states of California, Florida, Maryland and others include slowing of traffic, reducing delay and emissions when compared to stop/signal controlled intersections, improving safety and aesthetics.



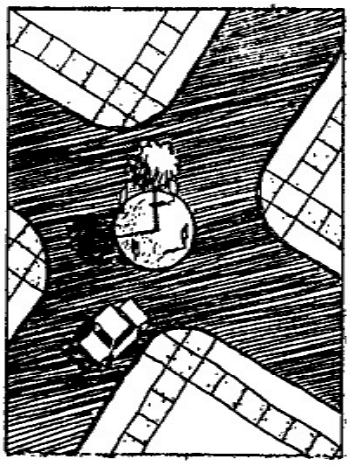
Its primary use is to reduce crash frequency at residential intersections. These roundabouts also have an effect on traffic volume and speeds.

At ten study locations, average speeds were reduced 4 MPH (from 27.5 MPH to 23.3 MPH) downstream from the circles, but only for short distances. Speed reductions can be even more significant near the circle, similar to speeds near stop signs.

One study shows a significant 77% decrease in crashes. Traffic volumes on the higher volume street at twenty study locations decreased an insignificant 2%. The construction cost of a roundabout is quite high ($10,000 - $30,000).

References: 4, 8, 19, 20, 30

b. Traffic Islands



A traffic island is a defined area, painted or raised, included in highway design for the primary purposes of controlling and directing traffic movements. They also provide refuge for pedestrians, reduce excessive pavement areas, and can be used to indicate proper use of an intersection or to locate traffic control devices.

Painted/striped islands do not affect speeds significantly; raised islands reduce vehicle speeds in some instances, mostly in combination with narrow lanes, which can create hazards.

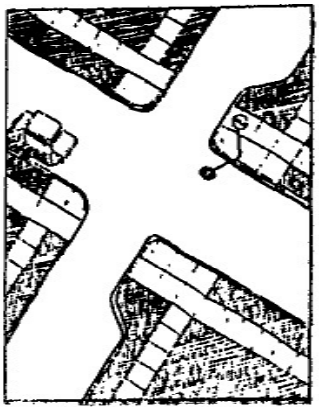
Improper islands make roadways unsafe. If an island is not large enough to command attention, motorists will drive over it. Curbed islands are sometimes difficult to see at night due to oncoming headlights or other light sources, thus causing crashes.

Islands do not reduce traffic volume by any significant amount, but can be an effective treatment for traffic movement and safety. If a traffic island is used, it might be beneficial to plan an island initially, then observe the effect and change the layout arrangement accordingly. The same process can be repeated until an optimum arrangement is established and a permanent raised island can be installed.

6. Chokers and Road Narrowing

Chokers are narrowed roadway widths using landscaped areas between the sidewalk and street. The pavement width between chokers can be constructed for one or two lanes of traffic. The choker can be constructed parallel to the traveled way or twisted to the direction of travel.

Road narrowing is a method used mostly in residential areas to control vehicle speeds and reduce traffic volume to improve safety. Another road narrowing technique can be found by the use of medians. In one community in Maryland, medians 20 to 50 feet or more in length have been constructed in advance of intersections. It was found to effectively reduce speeds though, it was necessary to construct bulb-outs to force drivers to shift over inconveniently. Once implemented, the 85th percentile speeds were reduced by 2-5 mph.



Chokers and road narrowing can control the speeds of vehicles efficiently and can increase safety and reduce traffic flow if properly installed. However, they should not be used on high volume streets, and sudden road narrowing should always be avoided. Curbside parking may have to be sacrificed to implement these methods. Proper signs should be installed to warn drivers of the chokers.

Reference: 4, 32

7. <u>On-Street Parking</u>

On-street parking is parking that is allowed on a street in the curb lane and is commonly permitted in residential areas.

Drivers of through vehicles generally reduce their speed in anticipation of conflict situations with parked vehicles or pedestrians. A study was done in Dallas where parking was removed in four central business districts. A 60-day study showed an increase of 26.7% in vehicle speed. In another study, only peak period prohibitions were reported which increased average speeds by 27%.

A clear relationship exists between crashes and vehicles parked on-street. One study in a community of 65,000 people found that 43% of all local and collector-street crashes involved on-street parking.

The angle of on-street parking has an affect on safety. Although angle parking allows for more parking spaces per unit of curb length than parallel parking, it requires more space for maneuvering, increases the amount of time a car is exposed to oncoming traffic, and can create a visibility problem for drivers when backing out into traffic. Therefore, angle parking has a substantially higher crash rate than parallel parking. Many studies have found that eliminating angle parking and replacing it with parallel parking reduces crashes 19 to 63 percent. A study in Maine found that parallel parking had a crash rate 12 percent lower than angle parking. A study in Nebraska concluded that parking should be of parallel rather than angle type to improve safety by reducing traffic crashes.

Several studies have been conducted that show the safety concerns of on-street parking. Primary hazards are:

1. Parked vehicles make the road width narrower and significantly restrict the flow of traffic. Parked vehicles can easily increase rear-end or side-swipe crashes due to hazardous maneuvers by drivers avoiding parked vehicles or drivers entering or leaving parking stalls.

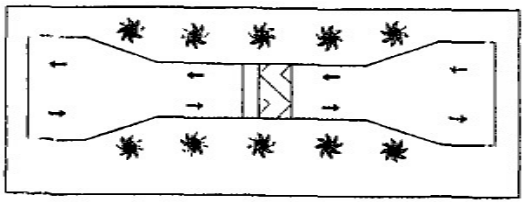
2. Drivers or rear-seat passengers getting out of parked vehicles on the side street present an added obstacle in the roadway. This produces both rear-end and side-swipe collisions.

3. Reduced sight distances involving pedestrians, especially children, attempting to cross the street from between parked vehicles or at intersections.

It is advisable to avoid on-street parking especially on residential streets because of the crash hazard, traffic volume/capacity/flow reduction, etc. It does, however, reduce speeds by restricting sight distances.

References; 21, 22, 23, 24, 34, 35

8. Combination of Physical Control Measures



Various combinations of traffic control and traffic calming measures can be used to enhance effectiveness. The combinations are governed by the major objectives or purpose for which the installation is planned. For example, the objective of reducing speeds and cut through traffic may be achieved by using a combination of a speed hump and street narrowing. The illustration presents such a combination. This combines the installation of a speed hump as well as street narrowing within the vicinity of the speed hump. The street narrowing helps to reduce speeds over a longer distance than a conventional speed hump.

References: 31

C. ROADWAY MARKINGS

1. Transverse Markings

Transverse pavement markings consist of a series of painted lines placed across the road. The spacing between the lines gradually decreases as the hazard is approached. The paint pattern is intended to give the illusion of high speed and causes drivers to reduce their speeds. In Maine, transverse pavement markings used in conjunction with standard speed limit signs, when entering a small town, increased the number of vehicles traveling below the speed limit by 10 percent. In Scotland, similar

success occurred when yellow transverse markings were applied in advance of a traffic circle. Initial results showed a 30 percent reduction in 85th percentile speeds. which were later reduced to 16 percent after one year. Crashes were reduced at the Scotland site from 14 crashes in the year prior to the installation to only 2 crashes in the 16 months following the installation.

A study in Great Britain showed that speeds were influenced by the existence or non-existence of a hazard following the transverse markings. If no hazard exists at the first location with transverse markings, the driver would not slow down at the second location even if a hazard existed.

It appears from the various studies that if transverse markings are used at locations in advance of potentially hazardous locations or in addition to normal speed limit signing when entering small towns, that speed reductions will occur at both types of locations and crashes will be reduced at the hazardous locations. However, it does not appear from the literature reviewed that reductions in speeds should be anticipated by applying transverse pavement markings in the middle of a typical residential area.

Reference: 27

2. Longitudinal Markings

Longitudinal pavement markings for speed control is intended to give drivers the impression of a narrow lane through which the vehicle must be guided. One study involved the striping of two residential streets to nine foot wide lanes. It was found that speeds changed in a range of a decrease of 1.4 MPH to an increase of 3.2 MPH. It was theorized that the narrowing by striping was ineffective because it actually made the drivers task of tracking the roadway easier.

3. Crosswalks

The use of painted crosswalks is to provide improved pedestrian safety by guiding them across the street and to notify drivers of the possibility of the presence of pedestrians. When painted

crosswalks are used, sidewalks on both sides of the road should also be provided. There is no indication in the literature that crosswalks result in lower vehicular speeds.

Reference: 16

D. PLANNING-RELATED ALTERNATIVES

1. Adequate Arterial Capacity

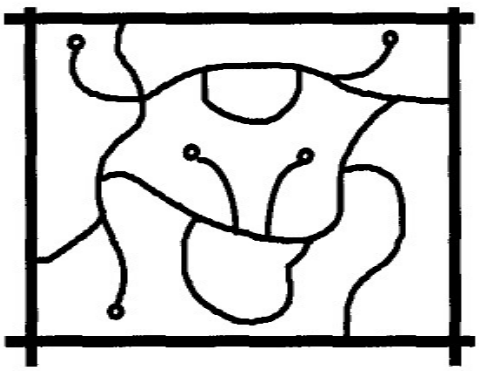
By providing adequate capacity on the surrounding major street network, the amount of through traffic using residential streets can be reduced. Although not specifically a speed regulating method, reducing the traffic volume can decrease the number of speed complaints on residential streets and can improve safety.

Though this is a costly means of reducing residential speeding complaints, improved traffic flow and crash reduction can be realized on residential streets.

Reference: 26

2. Subdivision Planning

Residential street design can influence the speed of vehicles through a neighborhood. Designs that feature curvilinear alignment, a narrow cross-section, short block length, reduced building setback and roadside tree planting can create a feeling of restriction and result in a speed reduction and may increase traffic crashes. Conversely, local streets built to high standards, in an attempt to improve safety, create an environment that allows increased vehicle speeds.



New subdivision streets can be designed to discourage cut-through traffic, which will reduce speeding complaints.

Care must be taken in the design process to ensure adequate sight distances along the roadway and at intersections, to provide the highest level of safety possible.

Reference: 26, 29

VI. CONCLUSIONS

An effective traffic calming program can be implemented by following the guidelines in this booklet. The key to a successful program is **community involvement**. Local officials and residents must work together for the common goal of improving safety on residential streets. This booklet provides alternatives that may help decrease speeds and/or reduce through traffic on residential streets. It also gives direction for developing a traffic calming program in those communities that currently use only traffic law enforcement to control speeds.

Whenever traffic calming devices are used, special care must be taken to advise drivers of the device by installing adequate warning signs and/or permanent markings.

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