

*The
City
of
West Palm Beach*



"The Capital City of the Palm Beaches"

AUDIT COMMITTEE

"A Committee of the City Commission"

P.O. Box 3366
West Palm Beach, Florida 33402
Tel: 561/659-8099
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TO: Honorable Mayor
and
Members of the City Commission

FROM: Commissioner James L. Exline, Audit Committee Chairperson

DATE: July 26, 2002

**SUBJECT: Transmittal of Internal Audit Report No. 2002-001
AUDIT OF TRAFFIC CALMING**

Attached is the report on **AUDIT OF TRAFFIC CALMING** approved by the Audit Committee at its regular meeting held today.

The report includes several recommendations for improving the City's traffic calming program. The City Administrator's responses to those recommendations were favorable and time schedules for implementation were provided.

The audit included a survey of neighborhood residents' opinions of the traffic calming measures implemented within their respective neighborhoods. While the majority of responses to the survey favored traffic calming, a concern about ongoing maintenance was voiced.

James L. Exline, Commissioner, Audit Committee Chairperson

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AUDIT OF TRAFFIC CALMING

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“The Capital City of the Palm Beaches”

INTERNAL AUDITOR’S OFFICE

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TO: Mayor Joel T. Daves

FROM: Imogene Isaacs, CIA, CGFM, Internal Auditor

DATE: July 26, 2002

**SUBJECT: REPORT NO. 2002-001
AUDIT OF TRAFFIC CALMING**

INTRODUCTION

This audit was initiated at the request of the Audit Committee following a formal inquiry by two concerned citizens on the “effective and efficient use of City finances for traffic calming.” We set the objectives for the audit to determine if:

1. For the traffic calming program, the City:
 - A. has established a traffic calming definition and
 - B. has set goals and objectives for traffic calming.
2. Traffic calming projects were :
 - A. prioritized based on a needs assessment using established criteria,
 - B. planned and budgeted including future maintenance,
 - C. based on selection practices established to ensure uniform benefit to all residents, and
 - D. implemented using standard criteria for appearance and landscaping.
3. Traffic calming measures that were selected for implementation were:
 - A. in compliance with the DOT specifications and State Uniform Traffic Control standards,
 - B. tested for effectiveness and durability,
 - C. the most cost effective,
 - D. designed to accommodate emergency vehicle traffic,
 - E. designed to accommodate the sanitation functions of hauling solid waste and street cleaning, and
 - F. based on accepted and proven construction methods

4. Calming measures were properly procured and vendors complied with the construction agreements and specifications.
5. Input was received from appropriate City departments and residents, including documentation of the residents' views.
6. The traffic calming measures that were selected and implemented:
 - G. met the defined goals and objectives,
 - H. met criteria established through department and resident input, and
 - I. were implemented only after other more traditional measures were unsuccessful.

CONCLUSIONS AND SUMMARY OF FINDINGS

The City's traffic calming measures can be characterized as experiments with a variety of designs, construction methods and techniques, and materials. There is no documented evidence that the results of these experiments solved the purported problems, such as speeding, cut-through traffic, conditions unsafe to street users, etc. Furthermore, there is no documented evidence that the purported problems were verified to exist prior to implementing the measures. There are no formal procedures for establishing the need for traffic calming measures and setting priorities. Additionally, the City has not adequately addressed issues relating to safety and ongoing maintenance costs of traffic calming measures. The City's traffic calming initiatives need to be reviewed and evaluated with the objective of establishing a formal traffic calming program for the future.

Residents of neighborhoods where traffic calming measures have been or are being implemented generally favor traffic calming. In response to our survey, the majority perceived benefits from:

- reduced speeding,
- safer streets,
- improved neighborhood appearance, and
- increased real estate values.

Our survey received 204 responses to the 608 survey questionnaires mailed to six neighborhoods. Five of the six neighborhoods surveyed had traffic calming devices installed prior to the survey and one was having devices installed at the time of the survey.

The main concerns mentioned by survey respondents and identified by us during the audit are the design and safety of traffic calming devices and the need for ongoing maintenance. We observed numerous traffic calming devices included in most of the traffic-calmed neighborhoods that had seriously deteriorated or been noticeably

damaged in a relatively short period of time. Planning for the future costs involved with maintaining traffic calming measures needs to be part of the overall program. As with all municipal infrastructures (i.e. sewer pipes, pavement, sidewalks, etc.), implementation is only the start of the cost cycle that necessarily results.

The audit objectives, as stated above, revealed a number of problems with the methods and practices for implementing the traffic calming measures. Goals and objectives have been defined for traffic calming measures but are not always considered or adhered to. Written standard practices for selecting, planning and setting priorities of traffic calming projects have not been adopted. Plans and budgets for the ongoing maintenance of traffic calming devices have not been established. Standards have not been developed to ensure uniform benefits to residents of traffic calmed areas, particularly with regard to landscaping practices. Signs and street markings are not in conformance with Federal and State standards. The City does not test traffic calming devices for effectiveness and durability. Traffic calming measures are not evaluated based on cost effectiveness. Contractors have not always complied with drawing requirements when constructing speed humps. Impact of traffic calming devices on emergency response vehicles, sanitation vehicles and buses is not effectively managed. Effective coordination of traffic calming measures with affected entities has not regularly occurred. The City needs to clearly define its comprehensive traffic calming plan and to develop a formal, documented traffic calming program.

The following summarizes our findings that are discussed in detail along with our recommendations for improvements and management's responses under the **Findings, Recommendations and Responses** section below.

Finding No. 1: Effective Program Management over the City's Traffic Calming Activities Can Focus the Program, Add Efficiency and Improve Results brings out that after the departure of Mr. Ian Lockwood, former City Transportation Planner, responsibilities for the traffic calming activities became fragmented. As a result, there is a need to establish a central authority to plan, direct and coordinate the City's traffic calming program.

Finding No. 2: A Comprehensive Traffic Calming Plan is Needed to Establish Strategic Direction, Set Priorities and Define the Program points out that no comprehensive master plan and written procedures for the implementation of traffic calming measures exist. There is no documented methodology used in setting priorities for implementation of traffic calming measures. The traffic calming devices selected are largely at the discretion of the various neighborhood groups and the City's staff. Measurable criteria for determining the need for the physical measures selected are not utilized. No written policies or plans exist for ongoing maintenance of the measures implemented.

Finding No. 3: Unsafe Conditions Need Attention and A Traffic Engineer is Needed to Assure Regulatory Compliance of Traffic Calming Measures shows

how overgrown vegetation in numerous traffic calming devices impaired driver visibility and nullified the visibility triangle requirements specified in the City's Zoning Code. Markings and signs for traffic calming devices are inconsistently utilized within the City and do not conform with provisions of the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) adopted by the Florida Department of Transportation for State and local governments.

Finding No. 4: Better Coordination of the Traffic Calming Program Among City Staff and the Greater Community is Essential for Success of the Program identifies that coordination among City departments and between the City and the greater community has been frequently ineffective. The specific needs of staff and citizens have often been ignored in the interest of expediency.

Finding No. 5: Pre- and Post-Implementation Studies Can Verify the Need and Justify the Cost of Traffic Calming Measures identifies a serious shortfall in the process for implementing traffic calming measures. Historically, if residents asked for traffic calming measures and the City was amenable, pre-implementation studies were not performed. Post-implementation studies have not been done. Effective planning practices dictate measuring conditions and establishing criteria to verify the need for and justify the cost of traffic calming devices before implementation, and post-implementation testing can determine if the outcome is effective and beneficial.

Finding No. 6: Attention to Ongoing Maintenance and Upkeep of Traffic Calming Devices and Landscaping is Needed shows that the responsibility for maintaining traffic calming measures has not been designated and the ongoing costs have not been identified and separately accounted for. Street Maintenance employees performed repairs to damaged devices but costs were not charged to traffic calming. Similarly, Grounds Maintenance has provided some landscaping replacements or care without tying the costs to traffic calming.

City Administration responded positively to our recommendations for addressing the findings. The complete written responses appear at the back of the report and are summarized in the **Findings, Recommendations and Responses** section.

We thank Tim Stillings, City Transportation Planner; Richard Pittman, City Engineer; John Alford, Utilities O&M Superintendent of Street Maintenance; Police Sergeant Robert Olsen, Traffic Section Supervisor; and Ben Couden, Senior Accountant, Finance Department, for the cooperation and assistance they afforded us throughout the audit. Additionally, we thank Greg Meyer, Public Information Officer, and the staff of Channel 79, for assistance in developing a video recording of the various traffic calming devices used in the City.

This audit was conducted by Ken Nielson, CPA, CIA, and Scott Craig, CIA, Assistant Internal Auditors. Dennis Prewitt, CCP, SPHR, Management Analyst, developed and conducted the survey and analyzed the results.

SCOPE AND METHODOLOGY

The audit included all traffic calming activities from 1994 (when the initial traffic calming resolution was passed) through 6/30/01. This covered the establishment of the program, formal definitions and goals, planning and budgeting, implementation and evaluation of the program's effectiveness.

The audit was performed in accordance with generally accepted government auditing standards and included such audit methods that we deemed necessary. Our methods included:

- Searching literature on the state of the practice of traffic calming;
- Reviewing City Commission resolutions and ordinances pertaining to traffic calming;
- Comparing funds allocated to traffic calming projects to funds spent;
- Reviewing the bidding and awarding process for work contracted;
- Inspecting contractors' invoices for work performed;
- Making inquiries to the Transportation Planner about plans for future development of traffic calming measures and ongoing maintenance of existing traffic calming devices;
- Reviewing drawings and specifications for traffic calming devices;
- Examining traffic calming devices for compliance with standards and physical condition;
- Developing estimates of ongoing maintenance costs for traffic calming devices;
- Making inquiries of Police, Fire, Public Utilities, and County organizations affected by traffic calming;
- Analyzing documented phone calls to the Mayor's Office in response to traffic calming measures; and
- Surveying residents in neighborhoods where traffic calming is used.

BACKGROUND AND PERTINENT INFORMATION

BACKGROUND

The Transportation Division of the Planning Department is responsible for planning street modifications in the City, including traffic calming. Authorized staffing is a City Transportation Planner and a Senior Transportation Planner.

Traffic calming projects have been planned or begun throughout several of the older sections of the City but costs are increasing at such a rate that there is concern regarding continued funding in the amounts needed. All of the measures thus far have been street modifications or done in conjunction with street replacement or repair. No projects have been planned for west of Military Trail and the new western

developments may have no need for such measures since the majority are gated communities with private rather than public streets.

Traditional traffic calming is designed to reduce speeding and accidents and discourage "cut-through" traffic on neighborhood streets. Several measures have been developed to accomplish this; speed humps, chokers, bulbouts (a narrowing of intersections), chicanes (twisted chokers that shift traffic from side to side), roundabouts, entryways or gatehouses, and partial or complete road closures.

In most municipalities, a need is identified by citizen request or by measurement of traffic volume/speed and accident frequency. Limited resources usually require a ranking of potential projects.

Speed reduction or elimination of cut-through traffic are cited as the primary reasons for traffic calming measures with beautification a secondary consideration. It should be noted that traffic engineers throughout the country use the normal driver's speed as a guide in setting speed limits since most drivers tend to regulate their own speed according to traffic, road and weather conditions. For a speed limit to be effective, at least 85 percent of the drivers must voluntarily comply with the law. According to a FDOT Speed Zoning publication "Unreasonably low speeds are commonly violated by a majority of motorists, making enforcement difficult, with resultant operating speeds sometimes higher than would exist with proper, realistic speed limits." When posted speed limits do not achieve the desired results, other traffic calming measures are employed.

The stated purpose of traffic calming is to alter driver behavior and improve conditions for non-motorized street users. In part, this is accomplished by forcing drivers to slow down due to the obstacles introduced by the altered design of the roadway.

POLICY

Authority

City Code Chapter 19, Motor Vehicles and Traffic, Division 3. Traffic Engineer, Sec. 19-56 vests the powers and duties of the Traffic Engineer, a qualified traffic engineer, to "plan and determine the installation and proper timing and maintenance of traffic-control devices; to plan and direct the operation of traffic on the streets of this city, including parking areas; to conduct investigations of traffic conditions; to cooperate with other municipal and state officials and make recommendations for the improvement of traffic movement and conditions, including improvements in streets and parking areas...". If the traffic engineer is absent or incapable of performing his duties, the duties and powers shall be vested in 1) a duly appointed acting traffic engineer or 2) the director of engineering.

City Code Chapter 22, Planning, Article II., Planning Department, Sec. 22-18, Transportation Planning Division vests the Transportation Planner, a qualified traffic engineer or planner, with "...the powers and duties as set forth in Chapter 19 of the City Code and other transportation related ordinances of the City. The Transportation Planner shall have the responsibility for transportation planning and shall develop, maintain, and promote the City's transportation vision by working with organizations and departments within and outside of the City; effect street modifications and other changes to the City to be in keeping with the transportation vision, keep current on transportation issues..."

Definitions

The Institute of Transportation Engineers (ITE) definition of Traffic Engineering is "that phase of engineering which deals with the planning, geometric design and traffic operations of roads, streets and highways--their networks, terminals, abutting lands and relationships with other modes of transportation--for the achievement of safe, efficient and convenient movement of persons and goods."

ITE is recognized as an authority on Traffic Calming and has adopted the definition written by Ian Lockwood, former City Transportation Planner, which defines traffic calming as "...the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users."

Original Traffic Calming Program (Resolution No. 155-94)

On June 20, 1994, the City passed Resolution No. 155-94 establishing the "Neighborhood Traffic Calming Program" to "fund the planning, demonstration and installation of neighborhood traffic calming devices on residential streets." Criteria for award of competitive program funds included:

- 60% written support from residents and business owners having frontage along the intersecting streets within 400 feet of the intersection or location in which the proposed device is to be located.
- petitions submitted by March 31 of each year for consideration for funding in the next fiscal year, **provided such funding is approved by the City Commission.**
- petitions ranked based on accident history, traffic volume and traffic speeds to determine the priority for construction of the neighborhood calming device.

The Director of Engineering and Public Works (now Public Utilities Director) would:

1. notify residents that a neighborhood had been approved for a trial project.
2. conduct a traffic and emergency vehicle access analysis.
3. install a demonstration device for a trial period (generally about 180 days).

4. after the trial period, evaluate recommendation for permanent installation based upon resident feedback and actual impacts of the device on traffic movement, emergency access, and other relevant factors.
5. approve permanent installation if no more than 40% of residents in the petition area object, and there is no unreasonable impact on emergency vehicle access, traffic movement, or other relevant factors.
6. upon approval, the device would be made permanent and landscaped.

If landscaping of calming devices is feasible and desired by the neighborhood, the neighborhood shall donate the landscaping materials that shall be installed by the City. The benefited neighborhood shall be responsible for maintaining landscaping and shall be required to enter into a landscape maintenance agreement. If the neighborhood fails to fulfill its maintenance responsibility or the Director of Engineering and Public Works determines that the landscaping obstructs the view of traffic, or creates other traffic hazard, the Director of Engineering and Public Works shall have the authority to remove the landscaping.

The Traffic Engineer position in the City became vacant in April 1993 and has not been filled. In 1996, former Mayor Nancy Graham hired Ian Lockwood, created the position of Transportation Planner, and assigned responsibility for planning and guiding the City's traffic calming projects to the Transportation Planner.

New Traffic Calming Program (Resolution No. 230-98)

The old program did not fit with the philosophy of the Transportation Division and New Urbanism principles and was considered by many in the City as cumbersome and inflexible. On September 21, 1998, Resolution No. 230-98 repealed Resolution No. 155-94 and the Neighborhood Traffic Calming Program. The new program eliminated the requirement for analysis to determine if traffic calming was warranted and considered traffic calming normal practice rather than an exception. The policy does not limit traffic calming to residential areas or streets.

Resolution No. 230-98, the new traffic calming resolution, provides that:

- traffic calming projects shall be planned and developed by the Transportation Division, employing the process that is in the best interest of the City.
- traffic calming projects need not be requested by residents or businesses along the affected frontage but may be initiated by any of the following:
 1. residents
 2. neighborhoods
 3. neighborhood associations
 4. business owners
 5. business associations

6. City staff
 7. City Administration
 8. City Commission
 9. any other persons that are entitled to services provided by the City
- traffic calming shall be done in conjunction with, and as part of, any other street modification or related work which requires the street to be replaced or repaired in order to reduce the cost of the traffic calming portion. Streets shall not be reconstructed to their previous configuration without written consent from the City's Transportation Division.
 - priority of traffic calming projects shall be directed by the Mayor and/or City Administration, unless otherwise directed by the City Commission.

The new traffic calming policy, unlike its predecessor, does not address responsibility for landscape maintenance of traffic calming devices but notes that traffic calming is most successful when done in conjunction with streetscaping. The new policy does not address funding for maintenance, nor does it address the funding process for the projects themselves.

FUNDING

Total funding allocated for traffic calming projects through fiscal year 2000-2001 was as follows:

1998 Public Service Tax Bond	\$3,400,000
Local Gas Tax Revenue Fund	283,952
Capital Projects Fund FY 00/01	<u>400,000</u>
	<u>\$4,083,952</u>

Of the \$3,400,000 from the Public Service Tax Bond proceeds, \$1,350,000 was allocated for 15 initial projects and the remaining \$2,050,000 was subsequently allocated to 26 additional projects. The \$283,952 from Gas Tax Revenues was allocated to other traffic calming projects and activities and the \$400,000 from the Capital Projects Fund was later allocated to create a City traffic calming crew in the Street Maintenance Division of the Public Utilities Department.

The original allocations for the 41 projects were based on early estimates that were revised after design work commenced and initial bids for construction came in. The new estimate for completion of the 15 initial projects is \$3,157,366 and for the 26 additional projects is \$5,932,000. This results in an additional \$5,405,414 to be funded for completion of all the projects.

The total number of projects has been reduced to 40 and some of these will be completed as part of stormwater sewer projects. Those remaining are to be done by the City's traffic calming crew as their annual funding allows.

Separate from the above 41 projects, the City was authorized \$11.25 million Federal money in TEA-21, the reauthorization of the Inter-modal Surface Transportation Efficiency Act (ISTEA - pronounced "Ice Tea") for traffic calming projects. These projects are FDOT projects on state roads with City input on how to use the traffic calming monies.

The total amount actually spent or encumbered by the City for all traffic calming projects since traffic calming activities commenced was not readily determinable since project accounting was not always used and some projects such as Clematis Street and Northwood Road were called streetscape improvements initially and embraced as traffic calming later. Additionally, \$207,525 was spent from the gas tax fund for traffic calming from fiscal years 1997/98 through 1999/2000 that was not associated with a particular project.

For traffic calming activities that were tracked separately, \$2,926,015 was spent or encumbered through June 30, 2001 from the following funding sources:

Gas Tax Revenue Fund (no project)	\$ 207,525
1998 Public Service Tax Bond Fund	2,434,537
Gas Tax Revenue Fund (2 projects)	273,371
General Fund (Northboro/Spruce)	<u>10,582</u>
	<u>\$2,926,015</u>

LEVELS OF SERVICE

Level of Service (LOS) is defined as "a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers." Six levels of service range from "A" (best) to "F" (worst).

LOS "A" represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

LOS "B" is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS "A". The level of comfort and convenience provided is somewhat less than at LOS "A", because the presence of others in the traffic stream begins to affect individual behavior.

LOS "C" is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users become significantly affected by

interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

LOS "D" represents high density, but stable flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

LOS "E" represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high.

LOS "F" is used to define forced or breakdown flow. This condition exists whenever the amount of traffic approaching a point exceeds the amount that can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop and go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in cyclic fashion. LOS "F" is used to describe the operating conditions within the queue, as well as the point of the breakdown.

The City's LOS standard for motor vehicle users was changed from LOS "D", the standard for State and County maintained streets, to LOS "E". The City's Transportation Planning Division embraces "...the concept of transportation choice..." and believes a lower level of service "...helps change people's modal choice, making non-automobile modes more competitive." However, since most of the streets and highways within the City's boundaries that are affected by LOS limitations are State and County roadways, the revised LOS has little consequence. Furthermore, most of the City's streets meet the LOS "D" standard.

TCEA and CRALLS

Lower levels of service are allowed in Transportation Concurrency Exception Areas (TCEA) or on Constrained Roadway At a Lower Level of Service (CRALLS).

The City has designated a TCEA for the purposes of downtown revitalization and urban redevelopment. It is bounded to the north by Palm Beach Lakes Boulevard, to the east by the Intracoastal Waterway, to the south by Okeechobee Boulevard including Howard Park and the CityPlace Development, and to the west by the CSX Railroad between Palm Beach Lakes Boulevard and Banyan Boulevard, and by Australian Avenue between Banyan Boulevard and Okeechobee Boulevard. Within the area, there are no transportation concurrency requirements for future development.

The City has requested CRALLS designation for Palm Beach Lakes Boulevard between Tamarind Avenue and Village Boulevard. It has taken effect but not at the level originally requested. This designation enables the street to operate at a lower level of service than normally adopted by the County to allow infill or other development to continue without usual concurrency requirements. It is anticipated to support redevelopment of the Palm Beach Mall and the surrounding properties. The County is also initiating a CRALLS along 45th Street for the Don King redevelopment project at the jai-alai fronton property.

CITIZEN INPUT

The issue of traffic calming in the City of West Palm Beach is one that has galvanized the citizenry and other users of City streets. Both proponents and opponents fervently espouse their views.

TELEPHONE CALLS

We reviewed the Mayor's Response Team (MRT) telephone call reports. The MRT recorded 141 telephone calls on traffic calming between February 24, 1999 and May 15, 2001.

- Fifty-five (55) were favorable or requesting traffic calming for their street or neighborhood. Four were repeat calls.
- Thirty (30) were unfavorable; most objected to devices blocking access to their driveways or complained of increased traffic on their street diverted from a traffic calmed street. Four were repeat calls.
- Forty-three (43) were problem calls regarding landscaping maintenance or type, location (placement) of devices, building delays and construction problems.
- Thirteen did not fit the other classifications and were mainly requests for additional information or were about the cost of the program.

For the callers that gave their addresses, the distribution of favorable and unfavorable telephone calls was compiled by streets and segmented by neighborhoods. These statistics are shown in the following table:

Since telephone calls would typically be made only by the more zealous on either side of the issue or as part of an organized drive to advocate points of view, we conducted a citizen survey to obtain a broader perspective on traffic calming. Our survey focused on neighborhoods that have been or are in the process of being traffic calmed. We surveyed residents and businesses of traffic calmed and adjacent streets within the neighborhoods to obtain the opinions of a wider cross section of those impacted.

CITIZEN SURVEY

Methodology

<u>Street</u>	<u>Neighborhood</u>	<u>For Calming Measures</u>	<u>Against Calming Measures</u>
Arlington Road	Southside Neighborhood Association	3	2
Churchill Road – 300 block	Southside Neighborhood Association	4	1
Gregory Place	Southside Neighborhood Association	1	2
Gregory Road	Southside Neighborhood Association	4	3
Malvern Road	Southside Neighborhood Association	1	1
Nottingham Boulevard	Southside Neighborhood Association	3	1
Pilgrim Road	Southside Neighborhood Association	9	0
Avila Road	El Cid, Prospect Park, Southland Park Homeowners Association	1	1
Monroe Drive	El Cid, Prospect Park, Southland Park Homeowners Association	3	2
Eastview Avenue	Northwood Hills Neighborhood Association	0	4
Westview Avenue	Northwood Hills Neighborhood Association	1	3
Granada Road	El Cid Historic Neighborhood Association	0	1
Valencia Road	El Cid Historic Neighborhood Association	0	3
N. Mangonia Drive	Lake Mangonia Neighborhood Association	1	1
TOTAL		<u>31</u>	<u>25</u>

A questionnaire was designed to address the broad topics of traffic control, safety, value, and responsibility for the costs of installing and maintaining traffic calming measures. Six areas were selected to represent traffic calmed neighborhoods, and questionnaires along with a postage-paid return envelope were mailed to each address within the six areas. The selected areas were in the Flamingo Park, Northwood, Northwood Hills, Northboro Park, Sunshine Park, and Vedado Park neighborhoods. The questionnaires were coded to allow identification of returned questionnaires by area and as a control against duplication.

Of the 608 questionnaires that were mailed a total of 204 completed questionnaires were returned by residents. Fifty-one were returned marked “undeliverable” for various reasons. The resultant return rate was approximately 34%.

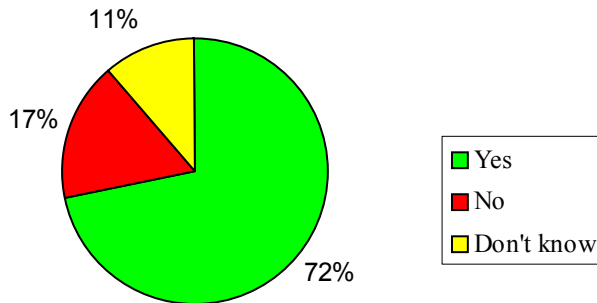
Summary Of Survey Results

Significant results compiled from the Traffic Calming Survey are shown in the charts that follow. The term “resident” includes any owners who responded to the survey that are not actual occupants.

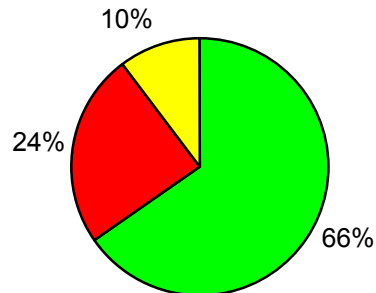
Traffic Control – Almost three-fourths (72%) of the responding residents reported that speeding was a problem in their neighborhoods, and well more than half (66%)

thought that their traffic calming measures were effective in reducing speeds.

Was speeding a problem?

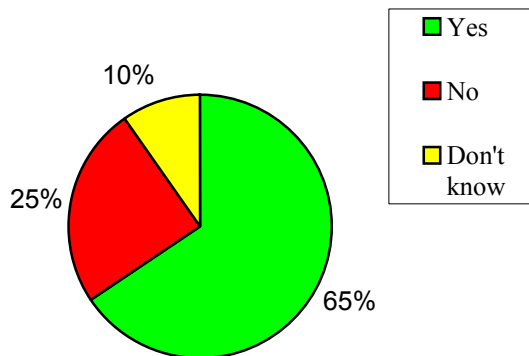


Did measures reduce speeding?

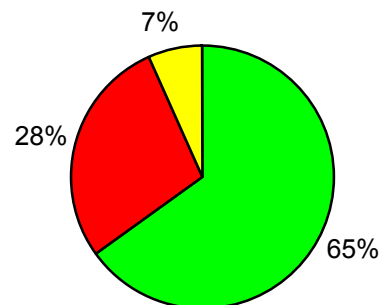


Safety – Most responding residents believed that the measures made it safer for pedestrians and children in their neighborhoods (65%), and were also safe for vehicles and their drivers (65%).

Did measures make streets safer for pedestrians and children?

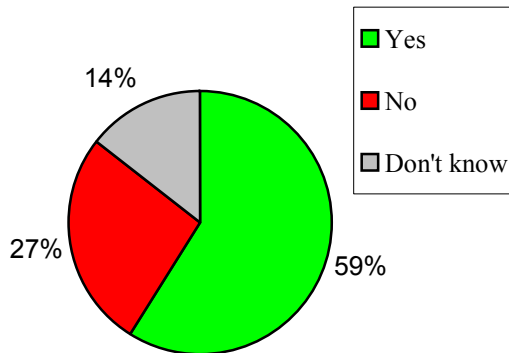


Are measures safe for cars and drivers?

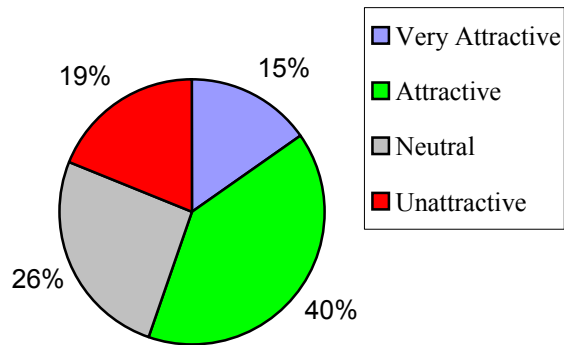


Value – More than one-half of the responding residents (59%) thought that the traffic calming measures added value to their neighborhoods and that they were attractive (55%).

Did traffic calming add value?

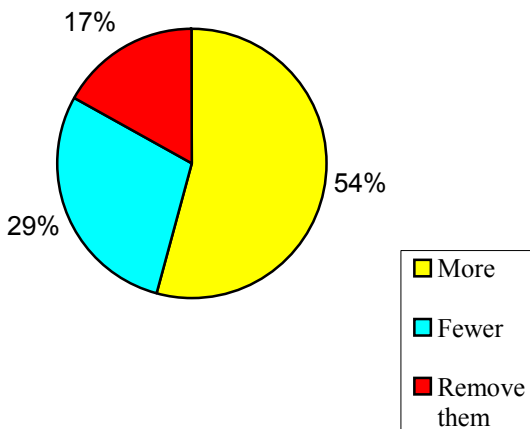


Visual appeal?

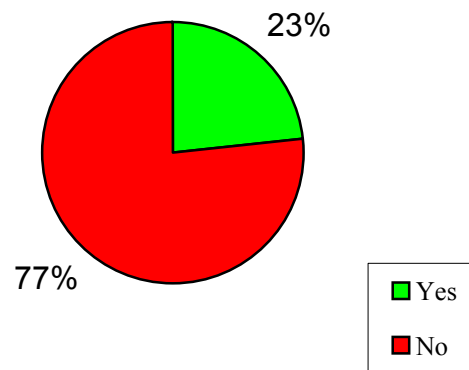


Responsibility for Installation Costs – While the majority (54%) of responding residents wanted more traffic calming measures for their neighborhoods, a strong majority (77%) stated that they were not willing to share in the cost of new measures.

Are more measures needed?

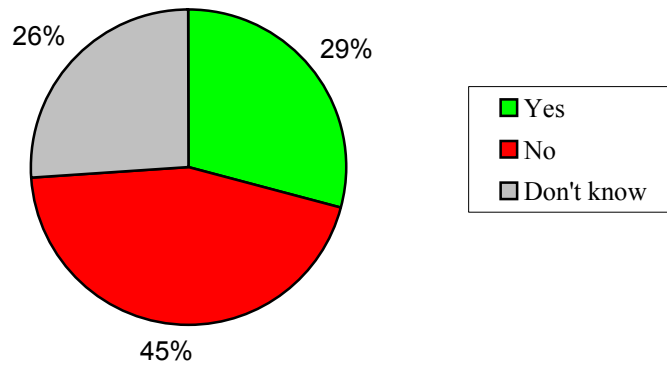


Share cost of new measures?

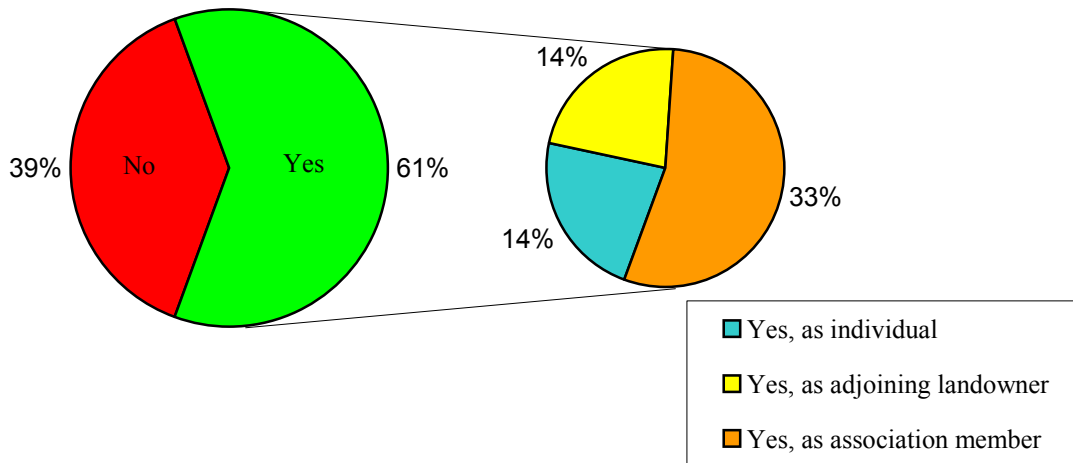


Maintenance Responsibility – A significant number of responding residents (45%) reported that landscaping associated with their measures was not being adequately maintained, but most (61%) indicated that they would be willing to assist in providing this maintenance as either an individual (14%), abutting property owner (14%), or neighborhood association member (33%).

Are measures being maintained?



Would you maintain landscaping?



Detailed Survey Results

Residents' responses to individual questions on the Traffic Calming Survey are indicated below as a percentage of the total number of responses to each question.

1. Was speeding a problem in your neighborhood before the traffic calming measures were installed?
Yes 72% No 17% Don't know 11%
2. Is there sufficient traffic enforcement by City Police Officers in your neighborhood?
Yes 35% No 44% Don't know 21%
3. Do you believe that these traffic calming measures reduce speeding in your neighborhood?
Yes 66% No 24% Don't know 10%
4. Do you believe that the amount of traffic has decreased or increased in your neighborhood since the installation of the traffic calming measures?
Decreased 45% Increased 9% Don't know 46%
5. Do you believe that the traffic calming measures made it safer for pedestrians and children in your neighborhood?
Yes 65% No 25% Don't know 10%
6. Do you believe that the traffic calming measures in your neighborhood are safe for drivers and vehicles?
Yes 65% No 28% Don't know 7%
7. How would you rate the visual appeal of the traffic calming measures?
Very attractive 15% Attractive 40% Neutral 26% Unattractive 19%
8. Do you think that the traffic calming measures add value to your neighborhood?
Yes 59% No 27% Don't know 14%
9. Were you asked for your input or invited to a planning meeting before the traffic calming was installed?
Yes 42% No 39% Don't know 18%
10. Did you attend any meetings on traffic calming in your neighborhood?
Yes 34% No 66% If Yes, how many? **Most indicated 1 (many residents who answered "yes" did not give the number of meetings that they attended)**

11. Do you think your neighborhood needs more or fewer traffic calming measures?
More 54% Fewer 29% Remove them all 17% **(a total of 12 residents added in comments that the correct number of traffic measures have been installed)**
12. Are the traffic calming measures that include landscaping being maintained adequately in your neighborhood?
Yes 29% No 45% Don't know 26%
13. Would you be willing to maintain landscaping that is part of a traffic calming measure?
Yes 61% No 39% If Yes: As an individual 14% As an abutting property owner 14% As part of a Neighborhood Association 33%
14. Would you be willing to share in the cost of new traffic calming measures for your neighborhood?
Yes 23% No 77% **(several residents added in the comment that they already were paying for traffic measures via their taxes)**

Resident Comments

An extraordinary number of residents (136) submitted additional comments with their questionnaire responses. Following are some of the most emphatic pro and con comments:

“Before traffic calming was installed in my neighborhood, it was a miserable place to live. Now there is peace.”

“You people don't care how you spend the taxpayers money. About 40 years we had circles for traffic calming and you took them out. Now you are putting them back. You widen the streets and then you want to make them back the way they were. I'm upset with the things you're doing.”

“Traffic calming has been a good idea, good for neighborhoods, good for pedestrians.”

“I think it to be exceedingly foolish to have spent money to widen streets...only to reduce them by this ego run amuck project. That money should have gone to the repair of aging sewers.”

“I like everything that you are doing - keep up the good work.”

“Our family hates the idiot traffic calming devices for these reasons (condensed): they inhibit rescue providers, they are a driving hazard, they do

not slow the traffic, and the cost is embarrassing considering the more pressing needs of our community.”

“The traffic calming measures have improved the aesthetics of the area. I fully support them.”

“I expect a car to become airborne (on a speed bump) and hit a neighborhood car at any time...but we like the free tools flying off the trucks.”

“Before calming – Greenwood Ave was a high speed drug link between Riviera and West Palm Beach. It is now safe to walk outside again. Thank you.”

“Money better spent on police patrol. Those who want to live in a suburban-like gated community need to move west. Our community is an inner city community. Traffic is part of our reality.”

“We love the effect of the traffic calming measures in our neighborhood...”

“I find the speed bumps very irritating. If I have to go over one, I put two wheels in the gutter and go over with the others.”

“The traffic calmed right down, and we like them. I think they beautify the place.”

“Traffic calmers are an ugly, unnecessary, wasteful and absurd program needlessly inflicted on us by the City of West Palm Beach.”

“We appreciate the traffic calming, and feel it makes our neighborhood nicer and safer. Thank you.”

“Don’t like them, can’t stand them, take them out please.”

Aside from general pro and con statements, the most frequent subject of comment was the design of traffic calming devices. More than 30 residents criticized the placement, size, marking or overall design of the devices, particularly as related to safety. Several residents provided sketches to emphasize particular problems and made suggestions for improvement. All comments that included a request for action or were related to a safety issue were forwarded to the City Transportation Planner and Public Utilities Director.

FINDINGS, RECOMMENDATIONS AND RESPONSES

The order in which the following findings appear reflects a logical progression for implementing the overall recommendations. In order of importance, we would

certainly give top priority to addressing all safety issues and correcting noncompliance with regulatory requirements.

FINDING NO. 1: Effective Program Management over the City's Traffic Calming Activities Can Focus the Program, Add Efficiency and Improve Results

After the departure of Mr. Ian Lockwood, former City Transportation Planner, responsibilities for the traffic calming activities became fragmented. Before his departure, Mr. Lockwood had overall design and oversight responsibility for traffic calming measures. He worked directly with the City Engineer and the neighborhood groups in defining the kinds of traffic calming measures to be used and where they were to be located and monitored results.

City Code Chapter 19 **MOTOR VEHICLES AND TRAFFIC**, Sec. 19-56 (a) states: "The office of city traffic engineer is hereby established. The city traffic engineer shall be a qualified traffic engineer and shall be appointed by the city manager [mayor]." Chapter 19 assigns the office of traffic engineer broad authority for overseeing the City's traffic management responsibilities.

The City had a traffic engineer until April 1993 when he was laid off and the position has not been filled since.

Mr. Ian Lockwood was hired as Transportation Planner on September 2, 1996. Ordinance No. 3068-97 created the Transportation Planning Division after the third reading on January 12, 1998. The Ordinance designated the Transportation Planner as the Transportation Planning Division head and further states:

"The Transportation Planner shall be a qualified transportation engineer or planner. He or she shall exercise the powers and duties as set forth in Chapter 19 of the City Code and other transportation related ordinances of the City."

In effect, the Transportation Planner was assigned the "powers and duties" of the City Traffic Engineer. Additionally, Ordinance No. 3068-97 states:

"The Transportation Planner shall have responsibility for transportation planning and shall develop, maintain, and promote the City's transportation vision by working with organizations and departments within and outside the City; effect street modifications and other changes to the City to be in keeping with the transportation vision; keep current on transportation issues; and carry out the additional powers and duties imposed by Chapter 19 of the City Code and other ordinances of the City."

Clearly, the Transportation Planner was empowered to direct and coordinate the City's overall transportation initiative (i.e. "Transportation Element"), including the traffic calming program.

Mr. Lockwood, the City's Transportation Planner, left the City on January 19, 2001. Mr. Tim Stillings was made the City's Acting Transportation Planner when Mr. Lockwood left and recently was appointed City Transportation Planner. Mr. Stillings commented that his role and responsibilities with respect to the City's traffic calming initiatives have not been formally communicated.

Since Mr. Lockwood's departure, responsibilities for traffic calming activities have been assigned independently to three individuals. Mr. Pittman stated that he takes direction from the Mayor with respect to priorities over the different neighborhood traffic calming projects appearing on the list of 41 projects approved by the City Commission. Mr. Stillings also directs implementation of some traffic calming projects on the list when requested by the Mayor. Additionally, Mr. John Alford directs implementation of other traffic calming projects not on the list. Mr. Alford stated he occasionally receives direction from his immediate management or Mr. Pittman, but mostly from the Mayor. Since the departure of Mr. Lockwood, there has been no one individual under the Mayor that has accepted overall responsibility for the traffic calming program. As a result, no one can provide the complete picture of the City's overall traffic calming program.

We observed some variations among the types of traffic calming measures implemented by Messrs. Pittman, Stillings and Alford. Mr. Pittman mentioned his projects generally do not include planters with speed humps while Mr. Stillings' do. And, in both cases, the projects are normally designed with speed humps made from brick pavers. For new projects directed by Mr. Alford, the speed humps are made from stamped asphalt and site specific drawings are not prepared.

We asked for a complete listing of locations and a set of drawings for existing traffic calming devices within the City. Neither the Transportation Planning Division nor the Public Utilities Department could produce a complete listing of locations or an accurate set of drawings for the existing devices. The City's ability to insure proper monitoring and maintenance of all its traffic calming devices is dependent on knowing what they look like and where they are. Additionally, in the future, for the City to comply with GASB 34 reporting requirements, a complete inventory of traffic calming devices will be needed.

The variations in project designs and materials and problems noted with incomplete record keeping for projects result from ineffective program management. Project responsibilities being spread among individuals in different organizations with no individual having overall program responsibility contributes to inconsistent results and inefficiencies.

The City needs to establish a central authority (hereinafter referred to as “program manager”) to plan, direct and coordinate the City’s traffic calming program. In assignment of this authority, strong consideration must be given to the importance of achieving a strong team effort among City staff and solid participation from neighborhood groups.

RECOMMENDATIONS:

We recommend the City Administrator implement the City Code provisions that define the City Transportation Planner’s responsibilities for transportation planning and the powers and duties imposed by Chapter 19 which includes the overall duties for planning, directing and coordinating all traffic calming activities. If the City Transportation Planner is not to be given these responsibilities, the Code needs to be revised accordingly. Furthermore, the responsibilities, as assigned, need to be clearly communicated in writing to all affected staff.

RESPONSE:

City Administration agreed to review the City Code provisions and to provide recommendations for revisions to the City Commission within six months.

FINDING NO. 2: A Comprehensive Traffic Calming Plan is Needed to Establish Strategic Direction, Set Priorities and Define the Program

The City has no comprehensive master plan to guide its traffic calming initiatives. Traffic calming priorities are not defined and critical performance parameters are not formalized in a comprehensive written plan. The City has gained valuable experience in experimenting with various traffic calming measures since starting traffic calming and should use this knowledge in formulating the comprehensive plan. In developing the plan, it is vital that it be a coordinated effort involving all affected parties.

There is no documented methodology used in setting priorities for implementation or in selecting traffic calming measures. Resolution No. 230-98 of the City Commission authorizes the Mayor and/or City Administrator to direct priorities for traffic calming projects unless the City Commission otherwise directs them. The traffic calming measures employed are mostly at the discretion of the various neighborhood groups and City staff. Coordination among affected groups and individuals is seriously lacking. Measurable criteria for determining the need for and effectiveness of traffic measures are not employed. No formal plans or written policies exist for ongoing maintenance of the measures being implemented.

We asked Mr. Stillings if the City had a master plan for implementation of traffic calming measures. He stated that goals and objectives had been defined but that there

was no comprehensive master plan covering traffic calming for the City. Furthermore, he confirmed the City has no formal traffic calming program.

When we asked City Engineer Richard Pittman if he knew of any master plan, he stated there was a list created at the time funds from the sale of the 1998 Public Service Tax Bonds were allocated identifying neighborhoods for traffic calming projects. He indicated the list as the only “plan” for identifying future traffic calming projects.

One of the City’s stated goals for traffic calming is: “Incorporating preferences and requirements of people using the area (e.g., working, playing, residing), in, on, or along street(s) to be traffic calmed.” Mr. Stillings mentioned two general problems involving neighborhood input: (1) some neighborhoods have no neighborhood association and (2) residents are not knowledgeable about traffic calming techniques. Residents focused more on appearance than functionality. Some neighborhoods insisted on brick pavers rather than stamped asphalt for speed humps due to the preferred appearance of brick over painted asphalt. The City has offered some neighborhoods the choice between brick and asphalt as long as the overall cost of the project did not exceed the amount budgeted. We observed a wide variation in the types and appearances of traffic calming measures around the City. Standards for traffic calming measures need to be documented and followed to avoid the appearance of favoritism to select neighborhoods.

The City needs to have a comprehensive master plan for traffic calming that formalizes the program. The plan should define the strategy for achieving the goals and objectives adopted by the City Commission as set forth in Resolution No. 230-98. Specifically, the plan should include the following:

- the scope and purpose of the City’s traffic calming program,
- the goals and objectives,
- tasks necessary to achieve the goals and objectives,
- a timeframe for accomplishing tasks that are not ongoing,
- design standards for all approved traffic calming devices,
- standards for trees, shrubs and other types of plants suitable for use in traffic calming applications,
- procedures for requesting traffic calming measures,
- criteria for approving the use of traffic calming measures, and

- a generic project plan, including the following items:
 1. a definition of the proposed project,
 2. the physical resources (i.e. people and equipment) required to complete the project plan,
 3. monetary resources required and proposed sources,
 4. progress and performance measures,
 5. documentation and change management procedures, and
 6. all projected future costs to maintain devices after implementation.

In developing a comprehensive plan, the program manager should gather input from the various groups and individuals affected as well as plans from other municipalities that have formalized their traffic calming programs. We have provided Mr. Stillings with a number of formal plans established by other cities that are leaders in implementing traffic calming.

RECOMMENDATIONS:

We recommend the City Administrator direct the program manager to develop a comprehensive master plan for the City's traffic calming program.

RESPONSE:

The Engineering Department will develop Engineering Standards on Traffic Calming for City Administration's review by October 31, 2002.

FINDING NO. 3: Unsafe Conditions Need Attention and A Traffic Engineer is Needed to Assure Regulatory Compliance of Traffic Calming Measures

Overgrown vegetation in numerous traffic calming devices impair driver visibility and nullify the purpose of the visibility triangle requirements specified in the City's Zoning Code. Markings and signs for traffic calming devices are inconsistently utilized within the City and do not conform to requirements and recommendations of the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD) which was adopted by the Florida Department of Transportation for State and local governments, effective January 17, 2001. The ITE Traffic Calming: State of

the Practice report, August 1999, mentions that the 4-inch maximum height for 12-foot speed humps is too harsh for most applications; yet some speed humps in the City exceed the four (4) inch height limit.

We observed that neckdowns used on 36th Street and Northwood Road were planted with vegetation that grew out of control on a regular basis. This overgrowth impaired pedestrian traffic on sidewalks and created an obstruction to vehicle drivers' views of cross traffic. Also, it would obscure a driver's view of a small child entering the crosswalk. This condition was particularly notable at chokers installed on Northwood Road. See photos that follow.



Overgrowth at 36th Street and Spruce Avenue



Overgrowth at crosswalk on Northwood Road

In the second photo, note the adult pedestrian at the crosswalk who is almost totally obscured by the vegetation.

We observed a number of intersections with neckdowns where vegetation growing in the traffic calming planters exceeded the 18 inches allowed under the City's Zoning Code. Exhibit 1 at the back of the report shows the City Zoning Code's visibility triangle requirements. We asked a code enforcement officer about citing this violation and were told that citations are not issued against the City. Consequently, code officers are reluctant to cite nearby property owners with like violations on their property or abutting swales.

Some varieties of plants used in the plantings naturally exceed the 18-inch limit and cannot be suitably trimmed below that height. Some of the trees used have a natural tendency to bush out resulting in an obstructed view for drivers. More care in the selection of plants and trees for the plantings would improve safety. The pictures that follow show some of the visibility problems observed during the audit.



View of Traffic Obscured from 36th Street
at Poinsettia Avenue



Stop Sign Obscured on Spruce Avenue
Approaching 36th Street



Stop Sign Obscured on New York Street
Approaching Georgia Avenue



View of Traffic Obscured from New York
Street at Georgia Avenue

To ensure the safety of pedestrians, drivers and all street users, standards for types of vegetation and controlling or limiting growth need to be established.

Some of the City's speed humps have neither signs nor street markings to provide advance warnings to drivers of vehicles; others we observed had advance markings but they were not the same at all locations. The MUTCD states if markings are used they must be in accordance with the standard. See the following photographs showing different methods used in the City of giving advance warning of speed humps to drivers.



Nonstandard Chevron-Style Advance Speed Hump
Markings on Northwood Road
(Chevrons are normally placed directly

on the hump incline rather than in front of it.)

Advance Speed
(Note that there
for 4 stripes.)



Nonstandard Bar Pattern
Hump
Markings on 47th Street
are 3 stripes shown
whereas the City's standard calls



No Advance Warning for Speed Hump on Gregory
Road (In theory, the lane restriction due to the
planter should slow the driver.)

Speed humps installed on Gregory Road, Arlington Road and Greenwood Avenue were built with bulbouts or planters to effect street narrowing. See previous photograph showing planter on Gregory Road. It was conjectured that the street narrowing would cause drivers to naturally slow down on approaching the speed humps. We noted two trees in planters on Greenwood Avenue and one on Gregory Road that had been struck by vehicles. Furthermore, we noted that the planters were poorly marked and the vegetation in the planters blended into the background making it difficult for drivers to easily recognize the extension of the planters into the street or the restricted street condition. At night, recognizing this irregularity in the roadway is even more difficult due to poorer visibility. If drivers cannot readily recognize the changed condition in the roadway, a hazard to motorists is created. Street markings and signs should clearly indicate to drivers the approaching speed hump and the necking down of the street width.

In December 2000, the MUTCD (Millennium Edition) incorporated sections on markings for traffic calming devices that included two “standards” for speed hump

markings. The new MUTCD was adopted by Federal Highway Administration (FHWA) and the Florida Department of Transportation (FDOT), effective January 17, 2001. The standards mandate:

1. If “speed hump markings” are used, one of the three specified options for speed hump markings must be used.
2. If “advance speed hump markings” are used, one of the two specified options for advance speed hump markings must be used.

See Exhibit 2 for MUTCD options for mandatory markings.

In May 2001, the City designed its own advance warning markings that are noticeably different from the options allowed in the MUTCD. The advance speed hump markings specified in the MUTCD are a bar pattern with the shortest length bar located farthest from the hump and with the bar lengths increasing as they come closer to the hump. The City’s bar pattern is the opposite configuration with the longest length bar farthest from the hump and the shortest length bar closest to the hump. The City’s unique designs were not approved by the FHWA as required in the MUTCD. Furthermore, these unique markings are counter to the intent of establishing uniform markings on a nationwide basis that are recognizable to all drivers and are in conflict with Florida Statute §316.007 which provides for statewide uniformity. And, the City is in violation of its own Code Section 19-83 Manual and specifications for traffic-control devices that states: “In all respects, all traffic control signs, signals and devices shall conform to the manual and specifications as approved by the state department of transportation.” The City should conform to the uniform markings specified by the FHWA and adopted by FDOT to enhance safety by giving drivers recognizable warnings when speed humps are used.

The street markings used as advanced warnings for the City’s older speed humps do not meet the new MUTCD requirements shown in Exhibit 2. The new requirement is for the markings to be placed on the speed hump rather than preceding it as in the photographs shown earlier.

The City does not apply uniform standards for signing traffic calmed areas. Signs posting “Speed Limits” and advisory speeds in traffic calmed areas vary by location. The MUTCD specifies that white signs with black lettering shall be used to indicate mandatory requirements to drivers while yellow signs with black lettering are advisory to drivers. The following photographs show variations in the City’s practices.



Mandatory Speed Limit Sign on
Northwood Road



Advisory Speed Sign on
36th Street

City Ordinance No. 3338-00 provides for a “Reduced speed limit: As posted for traffic calmed streets by the Engineering Services Division.” However, Florida Statute Chapter 316.189 (1) states “MUNICIPAL SPEED.--The maximum speed within any municipality is 30 miles per hour. With respect to residence districts, a municipality may set a maximum speed limit of 20 or 25 miles per hour on local streets and highways after an investigation determines that such a limit is reasonable.” Posting a mandatory speed limit of less than 20 mph conflicts with Chapter 316.189 (1). Posting an advisory speed would avoid this conflict while still advising drivers of a safe speed for going over the speed humps.

Furthermore, the City Code Section 19-83 states: “All signs and signals required and permitted by this chapter [19] shall be uniform as to type and location throughout the city.”

The City’s standard for speed humps is a 4-inch maximum height for a 12-foot long hump. We measured four humps on Gregory Road and noted a variance in the height from side-to-side of up to 2 inches with three having a maximum height of 5 inches and one having a maximum height of 6 inches. The ITE and FHWA reported in August 1999 that: “The 4-inch height has fallen out of favor in the United States, being too harsh for most applications. The 3- and 3.5-inch profiles are still in common use.” We observed the hump on Gregory Road that measured 6 inches was severely gouged due to scraping by vehicles as was the pavement on the down-traffic side of the hump. We also observed one driver pulling into the swale to avoid a speed

hump on Gregory Road. The purpose of using speed humps is not to cause damage to vehicles or result in unsafe driver behavior.

Another unsafe driver response to traffic calming devices that we observed was turning onto roundabouts into the oncoming lane to make a left turn without going around the circle. This hazard could be mitigated by using street markings or dividers on the approaches to the roundabouts. See Exhibit 2, Figure 3B-26.

We observed traffic calming projects in various stages of construction and noted a number of unsafe conditions; some as shown in the following pictures.



Conflicting Regulatory Signs on Opposite Sides of the Street



Conflicting Regulatory Signs on the Same Side of the Street



Vehicle is Forced to Drive in Crosswalk due to Roundabout



Vehicle is Forced to Drive into Opposite Lane by Neckdown

We were advised that the conflicting signs were the result of the contractor not removing the old signs when new signs were posted. The condition was subsequently corrected. The project coordinator advised that the yellow striping at the neckdown was also the fault of the contractor. The condition was corrected after we advised the Police Department to request the responsible Public Utilities Department personnel to take action.

Crosswalks located less than the width of standard-size vehicle from roundabouts were noted at several locations in the City and at least one was at a completed project. The new MUTCD provides guidance for markings at intersections with roundabouts. This guidance states that: “Where crosswalk markings are used, these markings should be located a minimum of 7.6 m (25 ft) upstream from the yield line or, if none, from the dotted line.” See Exhibit 2 for an illustration of markings for roundabouts.

We also reviewed engineering drawings for several of the City’s traffic calming projects and noted that the drawings had not been signed, sealed and certified by a professional engineer duly licensed in the State of Florida. We asked Mr. Mark Wilson, Deputy State Traffic Operations Engineer, if signing, sealing and certifying of drawings by a professional engineer was required. He advised that these are requirements for any drawings related to construction jobs and engineering documents for “public view.” Not complying with State regulations could result in negative consequences to the City.

One of the traffic calming goals adopted in Resolution No. 230-98 is: “Creating safe and attractive streets.” Safety should be the foremost consideration when planning, designing, engineering and constructing traffic calming devices. Regulatory compliance and complying with the City’s own laws should be a high priority to the City as well. City Code Section 19-3, Obedience to chapter, states: “It is unlawful for any person to do any act forbidden or fail to perform any act required in this chapter [19].”

A qualified traffic engineer, being disciplined in the field of traffic safety and regulatory compliance, can provide sound, reliable advice to the City’s planners and other staff involved in implementing the City’s “Transportation Element.”

RECOMMENDATIONS:

We recommend the City Administrator:

1. Direct the City Engineer to inspect all speed humps in the City to identify any that do not comply with the City’s specifications and to take action to timely bring them into compliance.
2. Direct Planning and Public Utilities to inspect City streets for speed hump markings and speed limit signs that do not comply with FDOT and MUTCD requirements and to correct any deficiencies.
3. Take action to hire or contract for the services of a qualified traffic engineer who is a professional engineer licensed in Florida. In addition to responsibility for assuring the City’s compliance with all traffic safety and regulatory requirements, the traffic engineer should be assigned the following responsibilities:

- analyzing traffic problems, finding solutions and testing results using pre- and post-implementation studies;
- performing value analyses;
- recommending improvements;
- reviewing and approving all designs for traffic calming devices;
- signing, sealing and certifying engineering documents prior to construction; and
- inspecting and approving completed projects.

RESPONSE:

City Administration will direct staff to inspect existing traffic calming devices and repair all deficiencies deemed to be significant liabilities. Additionally, a qualified traffic engineering consultant will be retained to provide advice, recommendations and guidance for the Traffic Calming Program.

FINDING NO. 4: Better Coordination of the Traffic Calming Program Among City Staff and the Greater Community is Essential for Success of the Program

Coordination among City departments and between the City and the greater community has been frequently ineffective. The specific needs of staff and citizens have often been ignored in the interest of expediency.

As mentioned earlier, Ordinance No. 3068-97 states:

“The Transportation Planner shall ... promote the City’s transportation vision by working with organizations and departments within and outside the City...”

Coordination among involved City departments is also not always achieved. The Transportation Planning Division was responsible for the original design concept for the circular planters located at the centers of intersections on Pinewood Avenue. Peter Spatara, Assistant Director of Public Utilities, advised that the planters, while under construction, were struck by vehicles and damaged in three different incidents. Concerned that the design could represent a hazard to motorists, the Public Utilities Department redesigned the device and directed the contractor to change all like devices that had been built for the project. Tim Stillings advised that the Transportation Planning Division was not notified in advance about the changes or consulted with on the redesign.

We reviewed the Pinewood Avenue project a short time after one of the crashes and noted the device had been rebuilt to the original design, but then shortly after that we observed that the device was rebuilt according a redesigned configuration. We also reviewed the police report of the crash and noted that: 1) the time of the crash was 1:22 a.m. and 2) the driver stated he did not see the planter because he was not familiar with the area. The police officer estimated the driver's speed at 40 mph when the posted speed limit was 35 mph. No injuries were reported and the driver was cited for careless driving.

The redesign of the circular planters on Pinewood Avenue should have been a coordinated effort between Public Utilities Department and the Transportation Planning Division, and a qualified traffic engineer should have been consulted.

We asked Sergeant Robert Olsen, the Police Department's Traffic Section Supervisor, if he had been asked for input regarding accidents or traffic enforcement statistics in neighborhoods where traffic calming measures were planned and he said that he had not.

We spoke with Chief Fire Prevention Officer Robert Prusiecki regarding the Fire Departments input on traffic calming measures. Chief Prusiecki stated that Fire was originally involved in reviewing plans for traffic calming but after raising concerns about some traffic calming devices Fire was no longer asked to review plans.

Johnny Thomas, Sanitation Superintendent, advised that it was very difficult for sanitation trucks to navigate the narrowed intersections, as extensive backing was required. He said the only way the drivers can navigate the roundabouts is to go over them so that's what they do. Some bulbouts are such that street sweepers cannot provide complete cleaning. The following photographs show the results of street sweepers not being able to perform effectively near bulb outs.

Street Sweeping Problems Caused
By Bulbouts
(Note the drainage channel is obstructed.)



We spoke with representatives of Palm Beach County School District and the Palm Beach County Palm Tran regarding the City's initiatives in coordinating traffic calming measures with them. The School District's Assistant Director of Operations for the Transportation Department advised that they were not conferred with or notified about traffic calming in advance of traffic calming devices being constructed. Additionally, the Assistant Director stated traffic calming measures had not necessitated rerouting school buses but that the drivers find it necessary to drive over some of the traffic calming devices that cannot be navigated around due to their design.

The person we spoke with in the Palm Tran Planning Department stated that the first notice they receive of traffic calming measures is when their bus drivers see the orange paint on the streets indicating where devices are to be located. She stated that traffic calming devices cause problems for buses equipped with wheel chair lifts due to clearance limitations. The Palm Tran Customer Service Supervisor advised that three routes had to be changed as the result of traffic calming devices being implemented. Some elderly and disabled riders complained to the Supervisor about the change to one of the routes.

One of the "traffic calming principles" stated in Resolution No. 230-98 as minimum criteria is:

"Traffic calming must improve the safety of street users, particularly vulnerable users including children, disabled, elderly, pedestrians, and cyclists."

Not coordinating with street users, like school and public transportation services, on traffic calming initiatives is clearly at odds with these minimum criteria.

Prior to installation, the location of the proposed traffic calming measures were outlined on the streets with orange marking paint so affected residents could see the size and proximity of the devices before construction. Residents frequently requested the traffic calming devices be relocated to minimize the effects on parking or driveway access, for appearance reasons, and for personal convenience. In some instances, changes added costs. For example, R.C.T. Engineering, Inc., the City's engineering consultant, submitted a change order and billed the City an additional \$3,733.50 for extra work on the Arlington/Gregory traffic calming project due mostly to "...the revisions required for relocating the traffic calming measures. RCT initially prepared drawings according to their locations based on the drawings issued by Mr. Ian Lockwood for the project. However, 12 of the 17 locations had to be revised because of one problem or another, such as blocking a driveway or homeowner complaint." Better planning and coordination with the residents and then with the consultant might have avoided the additional cost.

Another result from lack of coordination is the incomplete listing of locations and set of drawings for existing traffic calming devices, as mentioned under Finding No. 1. This missing information hampers efforts to maintain the devices in good condition and compromises the integrity of the City's Geographic Information System (GIS) which is vital to managing the City's street network.

A function of the program manager should be to coordinate all traffic calming implementation activities within the City. Furthermore, all designs and design changes for traffic calming devices should be coordinated by the program manager to effect proper approval. Also, the program manager should be responsible for proper approval of designs and design changes by a qualified traffic engineer and for the development of a written plan for ongoing maintenance of traffic calming measures.

RECOMMENDATIONS:

We recommend the City Administrator direct the program manager to coordinate all traffic calming activities "...with organizations and departments within and outside the City..." as prescribed by Ordinance No. 3068-97. Additionally, the program manager should be directed to coordinate the establishment of a central repository of data on all traffic calming devices in the City to include as-built drawings, construction contracts with change orders, and a database showing the locations of all installed traffic calming devices that can support the GIS.

RESPONSE:

City Administration intends to include the actions recommended here in the plans mentioned earlier to address the recommendations in Finding No. 1.

FINDING NO. 5: Pre- and Post-Implementation Studies Can Verify the Need and Justify the Cost of Traffic Calming Measures

The City does not perform pre- and post-implementation studies as a part of its traffic calming initiative. We were advised by Messrs. Stillings, Pittman, and Alford that pre-implementation studies of traffic conditions were not required to establish the need for traffic calming measures and were not performed. Subsequent to adoption of Resolution 230-98, if residents asked for traffic calming measures and the City was amenable, pre-implementation studies were not performed. We asked for post-implementation studies and none could be produced. Effective project planning should include: 1) measuring traffic conditions and establishing criteria to verify the need for and justify the cost of traffic calming devices before implementation, and 2) post-implementation testing to determine effectiveness.

We conducted a series of tests using the Police Department's Stealth Stat Recorder on streets already slated for traffic calming measures. Exhibit 3 at the back of the report is an example of the data generated from the Stealth Stat Recorder.

We selected five streets for pre-implementation studies of speeding and traffic volume as an indicator of pass-through traffic. The traffic calming devices for these streets had already been selected based on neighborhood requests and the streets had been marked with paint showing the placement and outline of the devices selected. The devices selected were speed humps with and without planters and roundabouts. The test data collected on the speed of vehicles over a 24-hour period are summarized in the following table.

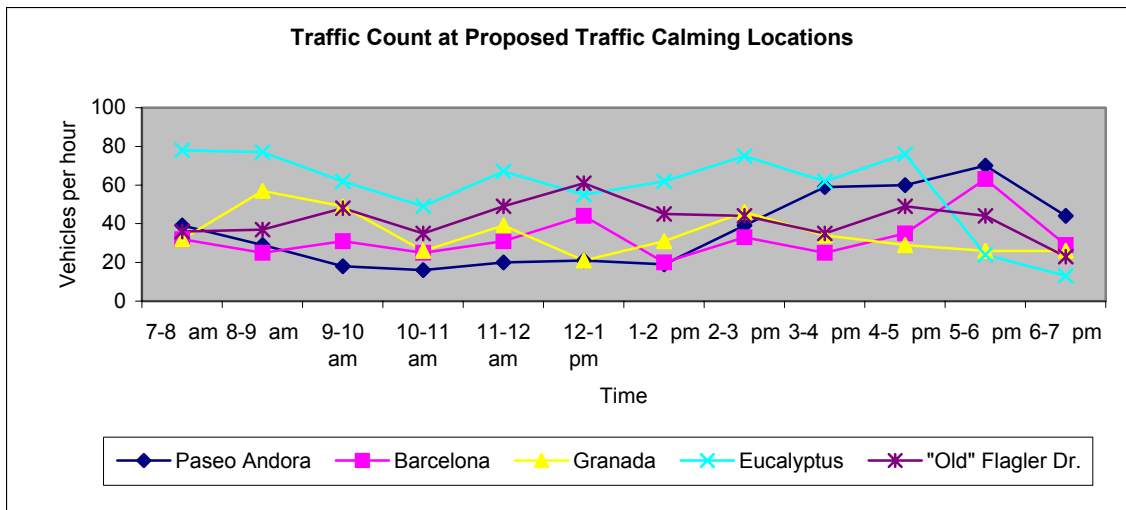
Neighborhood	Street Name	Total Vehicles	Posted Speed (mph)	Vehicles Exceeding 30 mph	Average Speed (mph)	Speed Driven by 85 th Percentile (mph)	Highest Speed Clocked (mph)
Vedado	Paseo Andora	583	30	1 (0.2%)	15.85	21	35
El Cid	Barcelona	472	15	5 (1.1%)	18.79	24	38
El Cid	Granada	457	15	5 (1.1%)	17.67	23	36
Providencia	Eucalyptus	819	30	1 (0.1%)	14.61	19	35
Providencia	"Old" Flagler Dr.	581	30	35 (6%)	20.87	27	40

As shown in the table for the five streets tested over 24-hour periods:

two streets had one vehicle exceed 30 mph,
two streets had five vehicles exceed 30 mph and
one street had 35 vehicles exceed 30 mph.

Average speeds shown in the table for the five streets tested ranged from 14.61 to 20.87 over the nominal 24-hour periods with the 85th percentile speeds ranging from 19 to 27 mph. The 85th percentile is a standard measurement recommended by the Florida Department of Transportation for establishing maximum speed limit and is defined as the speed that 85% of the vehicles travel at or less than when recorded over a 24-hour period.

Next, we graphed the traffic-flow volume over a 12-hour period, from 7:00 a.m. to 7:00 p.m. for each street, as follows:



From the graph we observed a significant increase in vehicle-flow volume between the hours of 3:00 p.m. and 6:00 p.m. on Paseo Andora in the Vedado Park neighborhood. The City Engineer had advised that cut-through traffic was observed on Paseo Andora. After studying the surroundings, we noted the close proximity of the City’s recreation facility at Vedado Park and inquired about afternoon programs at the facility. Ms. Tracy Merrill, Recreation Program Coordinator at the facility, advised that the City ran an after-school daycare program for 65 children who were picked up in the City van at two schools after 2:00 p.m. and brought to the facility, after which they were picked up in private vehicles between the hours of 3:00 p.m. and 6:00 p.m. Ms. Merrill confirmed that many of the drivers picking up children most likely traveled on Paseo Andora.

Pre-implementation engineering studies of traffic conditions in the Vedado Park neighborhood would have disclosed the low level of speeding violations and amount of cut-through traffic due to the daycare program and questioned whether two speed humps and a circle within a two-block distance were justified or appropriate for addressing the real problem.

Also from the graph, we noted traffic-flow volume on Eucalyptus Street was significantly higher between 7:00 a.m. and 9:00 a.m. and moderately higher between 4:00 p.m. and 6:00 p.m. This is likely, in part, related to drivers going to Rosarian Academy, where Eucalyptus Street ends, to drop off/pick up children or to work. We confirmed with a Rosarian staff person that Eucalyptus Street is used by staff and drivers transporting students. The Academy’s classes begin at 8:00 a.m. and end at 3:30 p.m. with some sporting activities ending later.

We noted only one residential structure on Eucalyptus Street, a multi-family unit. When we inquired as to why the speed hump (with planter) was being placed there, the City Transportation Planner advised that the neighborhood association had requested it. From our test data and observations, we did not see justification for the type of device selected or its planned location.

Again, an engineering study could have determined if speeding was a serious problem and the reasons for cut-through traffic and if a speed hump served the best interests of the neighborhood and addressed the problem.

An interesting observation about the graphs of Granada Road and Barcelona Road, which are two parallel streets, two blocks apart in El Cid neighborhood, is that the traffic-flow peaked on Granada between 8:00 a.m. and 9:00 a.m. while the traffic-flow peaked on Barcelona between 5:00 p.m. and 6:00 p.m. This inverse pattern in the traffic-flow peaks may be the result of commuters cutting through the neighborhood on one of the streets when heading in one direction and cutting through the other street when returning in the opposite direction to avoid delays at different intersections. We were unable to confirm this hypothesis from our test data. Further study to determine the cause and effects of this condition might identify a more cost effective alternative to the five planned speed humps.

Installing traffic calming measures to discourage drivers from cutting through neighborhoods is at odds with the City's need to allow access to recreation and school facilities that provide vital community services in those neighborhoods. Furthermore, less intrusive, lower cost, solutions such as signage or rerouting should be considered first.

Since the City has no established criteria for justifying the need and cost of implementing traffic calming measures such as the number of vehicles exceeding the speed limit, the average speed of vehicles, the volume of traffic, and number of collisions per year, we can only conclude that these attributes are not being objectively evaluated when determining traffic calming needs. As noted from our research, a number of local governments have established criteria using these attributes when determining a neighborhood's eligibility for traffic calming. Studying the root causes of traffic problems can effectively lead to identifying the best measures to correct these conditions. Furthermore, it is wasteful of taxpayers' money to build traffic calming devices where there is not an established need.

RECOMMENDATIONS:

We recommend the City Administrator take action to establish criteria for justifying the need and cost of implementing traffic calming measures, require pre- and post-implementation studies of traffic conditions to identify the core problem(s) and root causes, implement the most effective method of correcting the problem(s) and evaluate the outcome of changes implemented.

RESPONSE:

City Administration believes these recommendations will be addressed by the actions identified in the Responses to Findings No. 1 and No. 2.

FINDING NO. 6: Attention to Ongoing Maintenance and Upkeep of Traffic Calming Devices and Landscaping is Needed

Responsibility for ongoing maintenance of traffic calming measures has not been formally assigned within the City and the costs have not been separately accounted for. Street Maintenance employees perform repairs to damaged measures but costs were not charged to traffic calming. Similarly, Grounds Maintenance provides some landscaping replacement or care. Again, costs were not charged to traffic calming.

We visited several traffic calmed areas and poor conditions, to a greater or lesser degree, were observed in nearly every area.

Deterioration results primarily from inadequate maintenance practices and physical abuse. The following photographs exemplify some of the observed conditions.



Damaged Bollard at Golf and 7th Street



Damaged Crosswalk on Northwood Road



Broken Planter Curb on 39th Street



Vehicle-Caused Damage on Greenwood



Weeds and Litter in Circular Planter at Florida Avenue and Ardmore Road



Dying Shrubbery and Grass on Greenwood Avenue

Generally, conditions deteriorate over a relatively short period of time with many older measures in dire need of attention. In a letter dated April 4, 2001, regarding needed repairs to traffic calming measures, the Vice Chair of the Northboro Park Historic Neighborhood Association wrote:

“Northboro Park was the **first** neighborhood to embrace Traffic Calming implemented by Ian Lockwood. We are proud to have been pioneers for the City in this endeavor. We were the test case. From the onset there has been a need for the City to come back and correct these items. We have waited, while all other neighborhoods had traffic calming implemented which incorporated improvements learned from our first test case. There has (sic) been over ten major incidents of destruction to our Bulb Outs, Roundabouts and front yards within the last 2 years. (Located in the 500 Block of 38th close to Broadway / 38th and Spruce / East & West side of Spruce between 38th and 39th / and in the 500 Block of 39th close to Broadway.)

Please take this time to review our maintenance needs and incorporate the needed dollars into the budget, which will complete and improve the first (1st) Traffic Calmed Neighborhood in the City of West Palm Beach.”

The City assumes responsibility for repairing physical damage to traffic calming devices that is caused by vehicular impact, wear, tear and aging. If an accident report results from vehicular incident, the City may recover some cost from insurance claims. John Alford advised that the practice has been to charge costs of repairs to general street maintenance and that he was unable to estimate what amount to budget for repair of traffic calming devices in the future based on the limited experience to date.

Responsibility for maintenance of vegetation in traffic calming devices (i.e. planters) throughout the City has not been clearly established or acknowledged. The City viewed it as the neighborhoods’ responsibility while most residents viewed it as the City’s responsibility. As a result, several traffic calming measures have become

eyesores due to overgrown weeds, litter or plants that died due to lack of water. Notwithstanding the fact that last year's drought brought added stress to foliage, the condition of many plants were evidence of a complete lack of care. Additionally, the City has no written standards regarding the type of vegetation used for landscaping; instead, neighborhood associations or residents decide what should be planted. Many plants and trees selected require extensive maintenance, cannot tolerate drought conditions, and grow too large for this application. The City has employees skilled in these areas whose expertise is not regularly utilized. On staff are a Landscape Architect, a Horticulturist, an Arborist and an employee with a business degree specialty in plants management.

The City assumed that neighborhood associations, desirous of the beautification provided by streetscaping used for traffic calming measures, would provide the required care for the vegetation. As a result some neighborhoods are better maintained while others have been allowed to deteriorate. We obtained copies of two letters indicating neighborhoods would maintain the landscaping, but written agreements were not executed between the City and the associations. The Flamingo Park Neighborhood Association committed to maintenance of the landscaped planters and/or roundabouts and contracted on an annual basis with a landscape service to perform the work. The Sunshine Park Neighborhood Association committed to provide, install and maintain the landscaping. Landscaping in Flamingo Park is still, for the most part, attractive but that in Sunshine Park is neglected.

Other cities (notably Seattle and Portland) have experienced similar difficulties in relying on association volunteers to maintain landscaping. When Seattle has an association renege on the agreement to maintain landscaping, it threatens to pave over the planters with asphalt (similar to the treatment of Tamarind Avenue). While they have never had to carry out the threat, the quality of landscaping remains uneven throughout the city. Portland chose to assume complete responsibility for landscape maintenance to avoid a poor reflection on the city and to avoid potential liability.¹

For more recent projects, maintenance agreements were not sought but neighborhood participation was invited. For example, the Commission Memorandum for the traffic calming of Nottingham and Pine Terrace stated, "The Southside Neighborhood Association will encourage adjacent property owners to maintain the landscaping. In the event the adjacent property owners fail to adequately maintain the landscaping, the City's Grounds Operations Manager has established the annual landscaping cost to be \$3,589."

Former City Attorney Pat Brown advised that if the City entered into formal agreements with neighborhood associations that the associations would be expected to carry adequate insurance coverage. He believes most neighborhood associations would not want to purchase the insurance. Mr. Brown suggested that the most

¹ Traffic Calming: State of Practice by Reid Ewing

workable plan for maintaining traffic calming devices would be for the City to assume that obligation and to budget for it.

The Utilities O&M Superintendent responsible for Grounds Maintenance told us they had replaced about 8-10 palm trees (that had either died or been run over) in the past year. They have not been tracking the time they have spent on maintenance of landscaping for traffic calming measures, but if his group was given the assignment to maintain all traffic calming devices in the City, including watering, fertilizing, trimming and litter removal, he estimates 7-8 additional staff and associated vehicles and equipment would be required.

Budgetary control needs to be established over the ongoing repair and maintenance costs for traffic calming devices. This will enable tracking of and accountability and planning for traffic calming related costs that are now being combined with general street maintenance and grounds maintenance. Cost of repair and maintenance of devices and foliage were estimated by Engineering to approximate 10% of original cost annually. At this time that would be about \$300,000 annually based on all identified project cost to date. The amount would need to grow by an estimated 10% of the capital costs of traffic calming measures in each future year.

In addition to the above, the City has entered into a FDOT Roadway Transfer agreement and a Highway Beautification and Maintenance Agreement wherein the City gains ownership and all responsibility for operation and maintenance of Dixie Highway and Olive Avenue between the West Palm Beach Canal and Palm Beach Lakes Boulevard. The Beautification and Maintenance Agreement provides that the State will install or cause to install landscape projects for an amount not to exceed \$1,484,000 and that the City will be responsible for maintenance of all the landscaped areas. This maintenance includes trimming, cutting, mowing, fertilizing, litter pickup and necessary replanting and the City's responsibility for maintenance shall include all landscape/turf areas and areas covered with interlocking pavers or similar type surfacing (hardscape).

Streetscaping, while improving the City's appearance, has, in effect, created a multitude of mini-parks that require regular care. To date, streetscaped areas have received only limited care from the City's maintenance crews since this work was not anticipated when planning the staffing and scheduling of Grounds Maintenance and has been picked up as an additional task. If the City hopes to maintain the attractive appearance of the traffic calming measures it has invested in, it needs to establish a plan and budget for ongoing maintenance. Additionally, the repair of damaged devices must be provided for as well.

RECOMMENDATIONS:

We recommend the City Administrator:

1. Direct the program manager to:

- A. establish standards for the type of vegetation acceptable for streetscaping related to traffic calming measures used in the City using the expertise and knowledge of City staff trained in landscape architecture, horticulture, arboriculture, and plant care and management; and
 - B. set standards for maintaining the condition of vegetation in traffic calming devices at an acceptable level.
2. Define the City's role and participation in maintaining traffic calming measures on an ongoing basis, and if the City is to assume the responsibility.
 3. If appropriate, direct the Public Utilities Director to develop a plan and estimate resources required for ongoing maintenance of traffic calming devices and to budget accordingly in Grounds Maintenance and Street Maintenance.

RESPONSE:

City Administration will include standards for landscaping in the Engineering Standards discussed in the Response to Finding No. 2. An inventory will be taken of all the existing traffic calming related landscaping and compared to the standards to determine the cost of bringing all traffic calming related landscaping into compliance. The cost to the City for maintenance of all traffic calming measures within the City will be included in the proposed budget for FY 2003-04.

EXHIBIT 1: Excerpt from City of West Palm Beach Zoning Code

Visibility at Intersections. At any road intersections, visibility shall not be obscured by the construction, placement, or maintenance of a structure wall, sign, fence, berm, plant material, shrubs, or any similar item between eighteen (18) inches or eight (8) feet in height within a triangle beginning at the point where property lines meet at the corner, then twenty (20) feet along the front property line, thence diagonally to a point along the side property line twenty (20) feet from the point of beginning, and thence to the point of beginning. In the event the corner of an intersection is rounded, the measurement shall begin at the point the property lines would meet without rounding. (See Figure X-1)

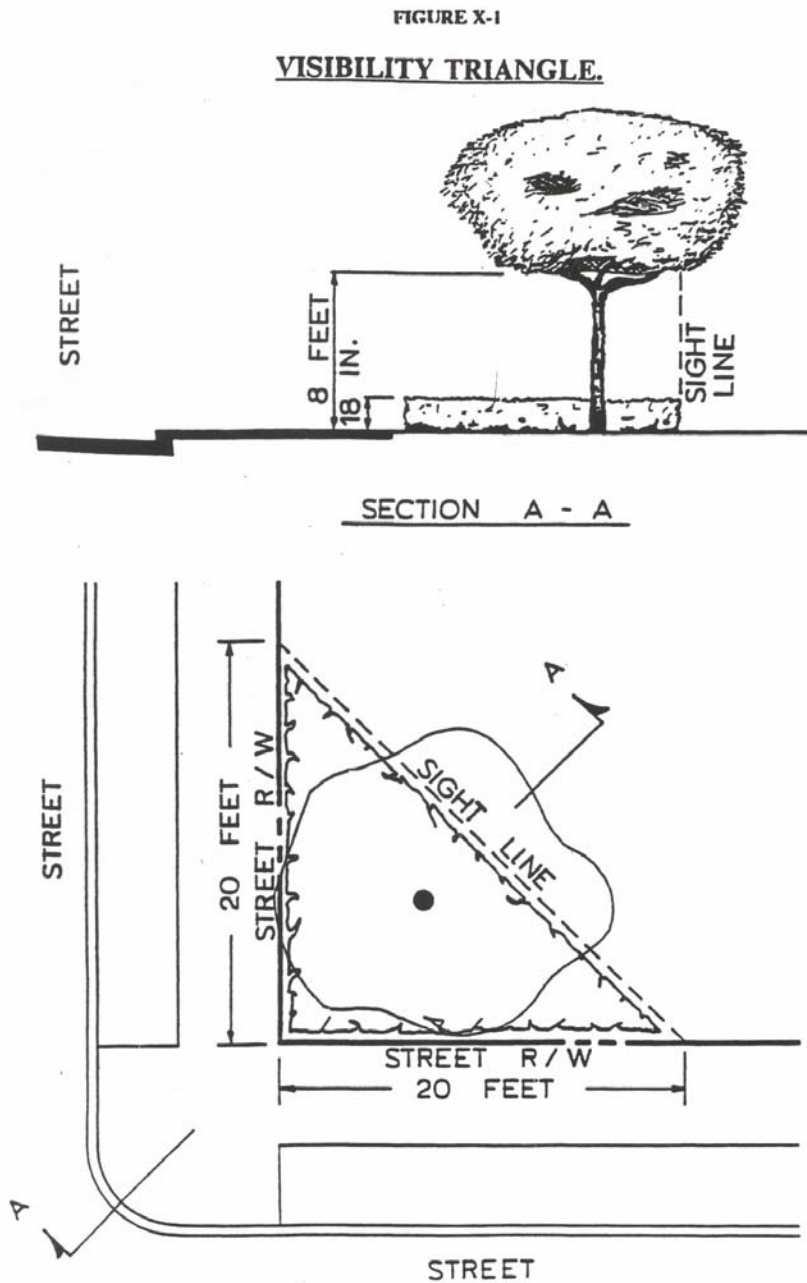


EXHIBIT 2: Excerpts from: Manual on Uniform Traffic Control Devices (MUTCD), December 2000

Section 3B.24 Markings for Roundabouts

Support:

Roundabouts are distinctive circular roadways that have the following three critical characteristics:

- A. A requirement to yield at entry which gives a vehicle on the circular roadway the right-of-way; and
- B. A deflection of the approaching vehicle around the central island; and
- C. A flare or widening of the approach to match the width of the circular roadway.

Typical markings for roundabouts are shown in Figure 3B-26.

Option:

A yellow edge line may be placed around the inner (left) edge of the circular roadway.

Guidance:

A white line should be used on the outer (right) side of the circular roadway as follows: a solid line along the splitter island and a dotted line across the lane(s) entering the roundabout.

Edge line extensions should not be placed across the exits from the circular roadway.

Where crosswalk markings are used, these markings should be located a minimum of 7.6 m (25 ft) upstream from the yield line, or, if none, from the dotted white line.

Option:

Lane lines may be used on the circular roadway if there is more than one lane.

Section 3B.25 Markings for Other Circular Intersections

Support:

Other circular intersections include but are not limited to rotaries, traffic circles, and residential traffic calming designs.

EXHIBIT 2: Excerpts from: Manual on Uniform Traffic Control Devices (MUTCD), December 2000 - Continued

Option:

The markings shown in Figure 3B-26 may be used at other circular intersections when engineering judgment indicates that their presence will benefit drivers or pedestrians.

Section 3B.26 Speed Hump Markings

Standard:

If used, speed hump markings shall be a series of white markings placed on a speed hump to identify its location.

Option:

Speed humps, except those used for crosswalks, may be marked in accordance with Figure 3B-28. The markings shown in Figure 3B-29 may be used where the speed hump also functions as a crosswalk or speed table.

Section 3B.27 Advance Speed Hump Markings

Standard:

If used, advance speed hump markings shall be a special white marking placed in advance of speed humps or other engineered vertical roadway deflections such as dips.

Option:

Advance speed hump markings may be used in advance of an engineered vertical roadway deflection where added visibility is desired or where such deflection is not expected (see Figure 3B-30).

Advance pavement wording such as BUMP or HUMP (see Section 3B.19, not included here) may be used on the approach to a speed hump either alone or in conjunction with advance speed hump markings.

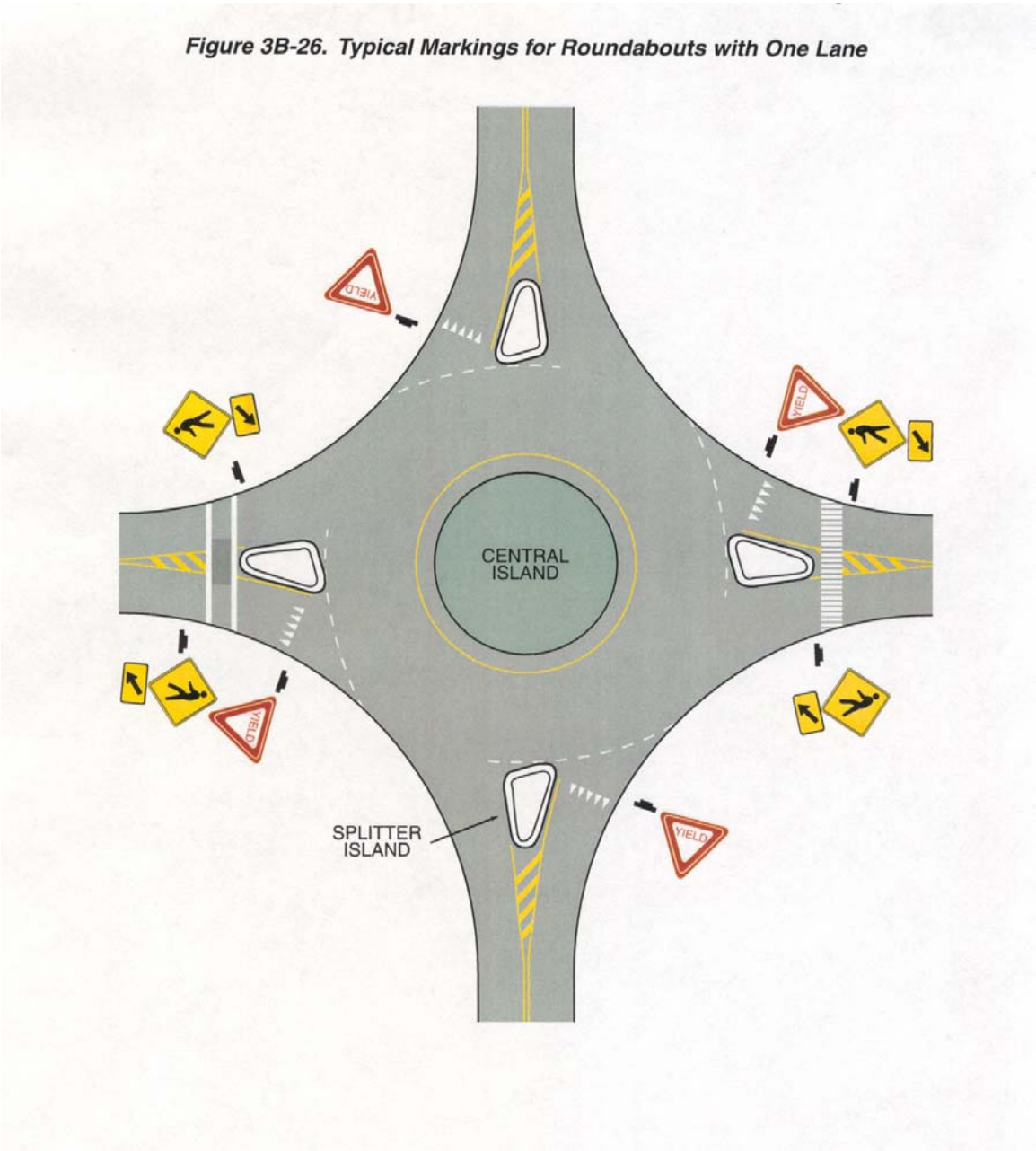
Appropriate advance warning signs may be used in conformance with Section 2C.22 (not included here).

Guidance:

If used, advance speed hump markings should be installed in each approach lane.

EXHIBIT 2: Excerpts from: Manual on Uniform Traffic Control Devices (MUTCD), December 2000 - Continued

Figure 3B-26. Typical Markings for Roundabouts with One Lane



Note: Figure 3B-27 is not shown because it is not applicable.

EXHIBIT 2: Excerpts from: Manual on Uniform Traffic Control Devices (MUTCD), December 2000 - Continued

Figure 3B-28. Typical Pavement Markings for Speed Humps

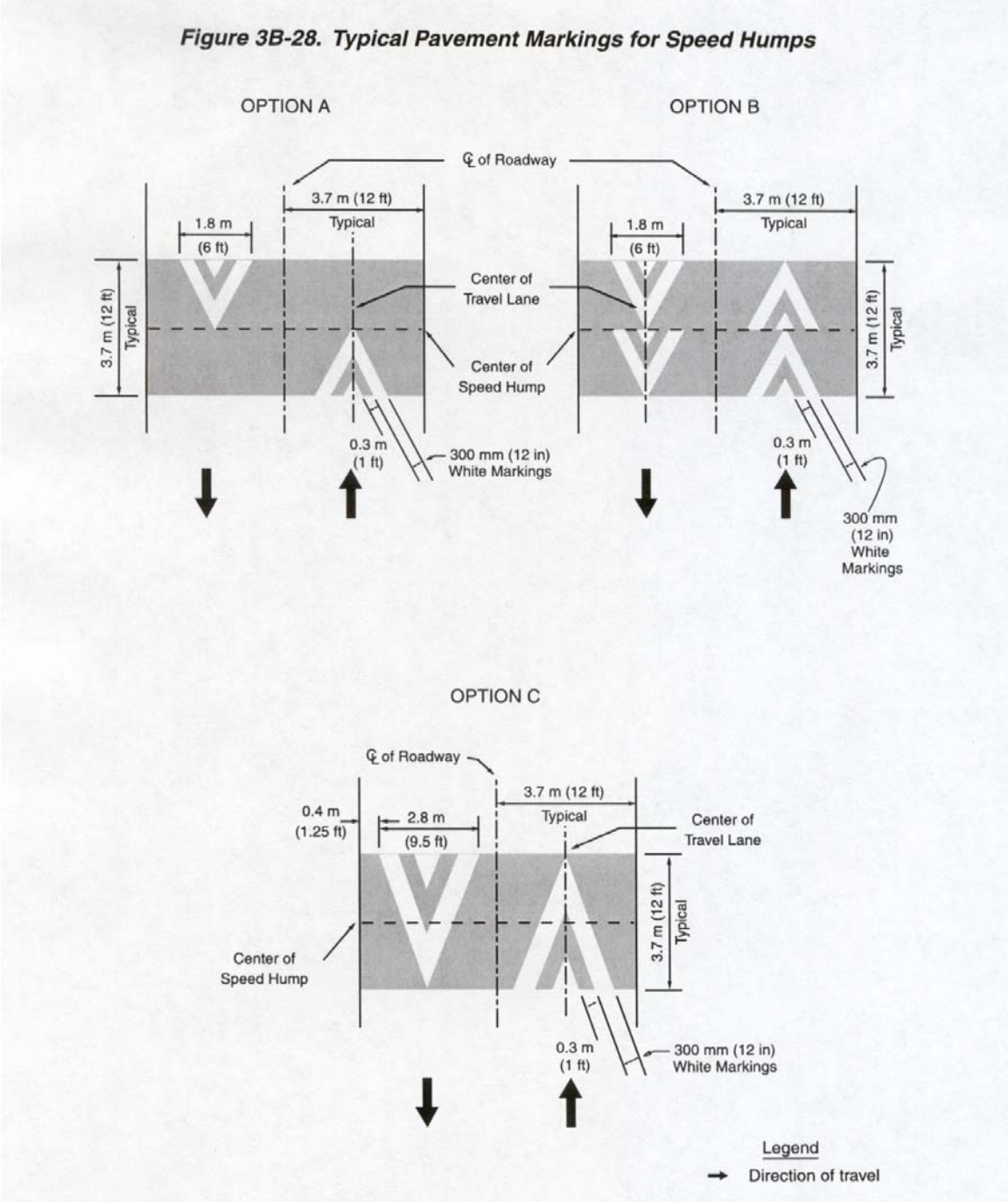


EXHIBIT 2: Excerpts from: Manual on Uniform Traffic Control Devices (MUTCD), December 2000 - Continued

Figure 3B-29. Typical Pavement Markings for Speed Tables or Speed Humps with Crosswalks

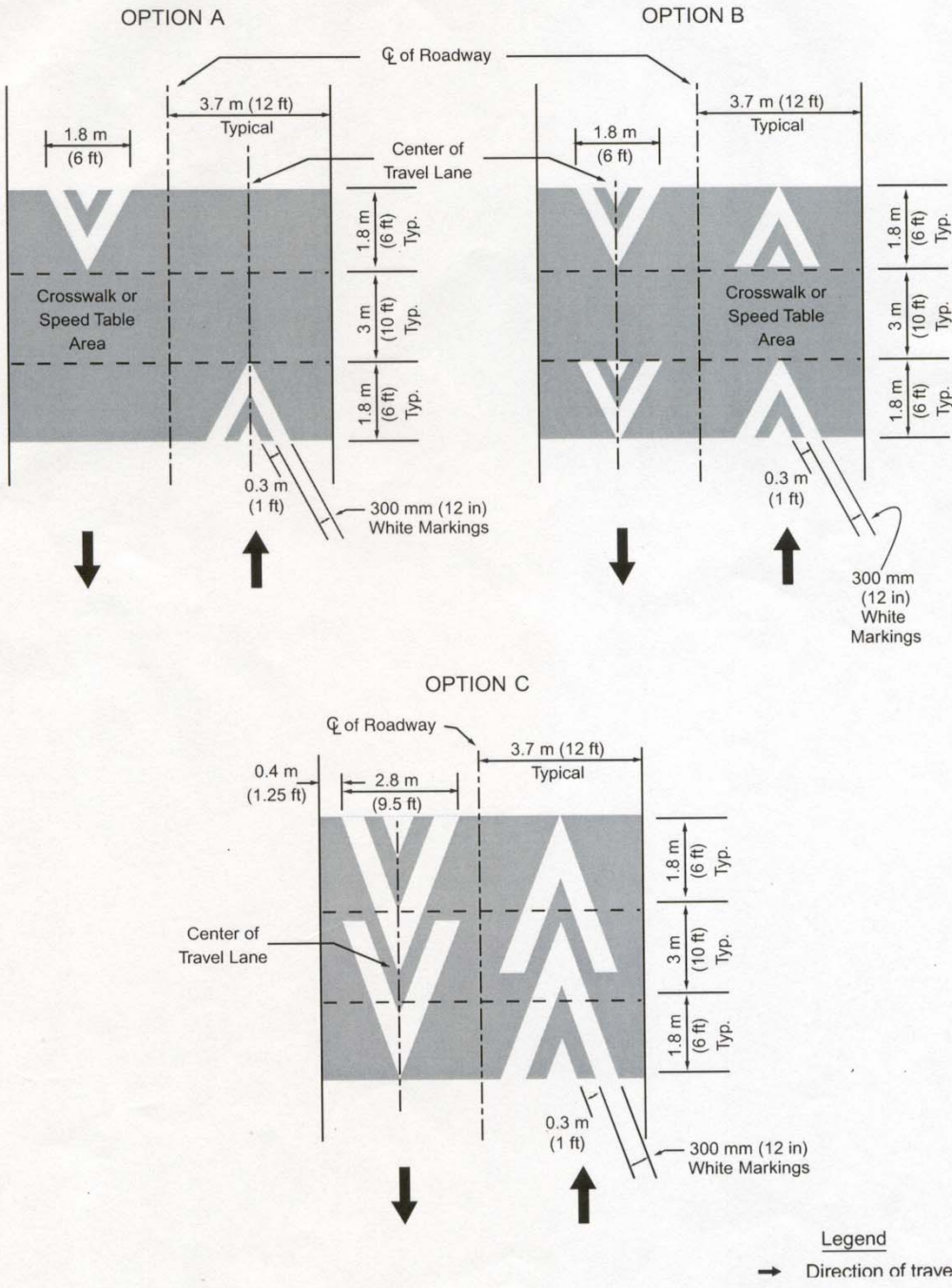
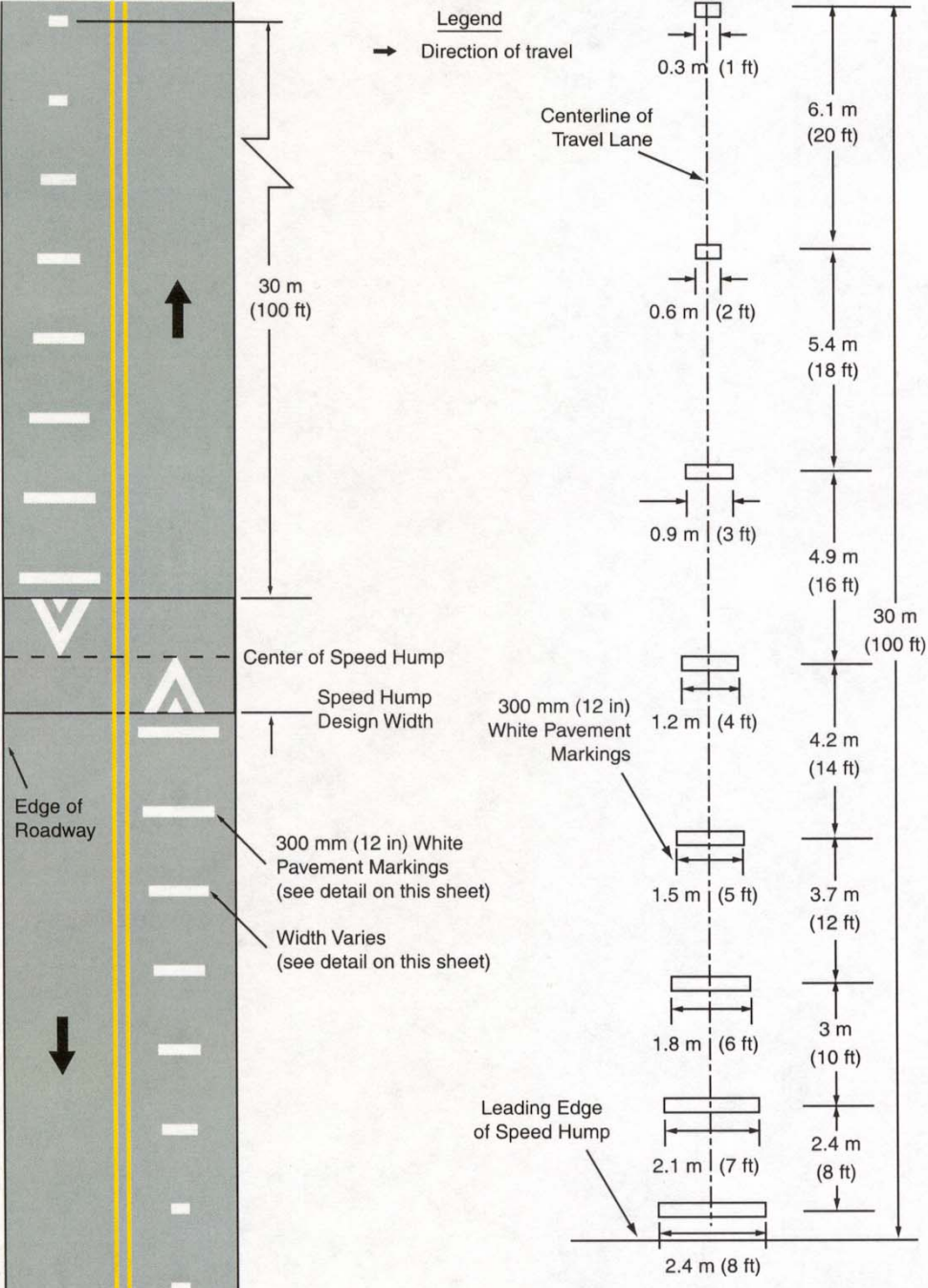


EXHIBIT 2: Excerpts from: Manual on Uniform Traffic Control Devices (MUTCD), December 2000 - Continued

Figure 3B-30. Typical Advance Warning Markings for Speed Humps



DETAIL—SPEED HUMP ADVANCE WARNING MARKINGS

EXHIBIT 3: Example of Stealth Stat Data

<300 blk eculyptus st <clear>	TIME	06:30	06:45	07:00	07:15	07:30	07:45	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45
	VEH.	4	1	2	8	21	29	20	30	14	12	21	16	7	17	22	11	12	16
	AVG.	17.3	11.0	16.5	16.0	14.7	14.5	16.4	14.6	16.6	13.4	13.2	14.3	12.7	13.5	14.5	12.6	14.1	14.8
POSTED SPEED LIMIT SURVEY STARTED: < MIN SPEED ALLOWE	TIME	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:15	13:30	13:45	14:00	14:15	14:30	14:45	15:00	15:15
	VEH.	10	13	18	21	15	11	10	10	24	18	12	15	17	12	12	25	26	20
	AVG.	14.3	13.9	15.2	14.7	15.5	14.7	14.0	13.3	14.2	15.3	13.9	15.8	14.4	15.7	14.4	13.9	15.3	15.5
TOTAL VEHICLES =	TIME	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45	19:00	19:15	19:30	19:45
	VEH.	11	17	14	14	7	28	27	9	7	6	2	3	2	5	3	1	0	2
	AVG.	16.4	14.2	14.9	13.6	15.0	15.9	13.7	15.9	12.7	14.7	14.0	19.0	22.0	15.4	12.0	24.0	0.0	15.5
AVERAGE SPEED =	TIME	20:00	20:15	20:30	20:45	21:00	21:15	21:30	21:45	22:00	22:15	22:30	22:45	23:00	23:15	23:30	23:45	00:00	00:15
	VEH.	1	0	1	2	0	3	3	0	0	0	1	0	0	1	0	0	0	0
	AVG.	12.0	0.0	22.0	12.0	0.0	13.0	11.7	0.0	0.0	0.0	12.0	0.0	0.0	18.0	0.0	0.0	0.0	0.0
TEN MILE PACE = 10	TIME	00:30	00:45	01:00	01:15	01:30	01:45	02:00	02:15	02:30	02:45	03:00	03:15	03:30	03:45	04:00	04:15	04:30	04:45
	VEH.	0	0	0	1	0	1	1	0	1	0	0	1	0	2	0	1	5	0
	AVG.	0.0	0.0	0.0	15.0	0.0	12.0	12.0	0.0	19.0	0.0	0.0	10.0	0.0	17.0	0.0	12.0	12.2	0.0
SURVEY COMPLETE,	TIME	05:00	05:15	05:30	05:45	06:00	06:15	06:30	06:45	07:00	07:15	07:30	07:45	08:00	08:15				
	VEH.	0	1	1	2	0	2	0	3	5	17	16	28	8	1				
	AVG.	0.0	15.0	15.0	11.5	0.0	12.0	0.0	17.0	14.6	15.2	13.2	14.5	14.1	12.0				

EXHIBIT 3: Example of Stealth Stat Data - Continued

Cars vs. Speed

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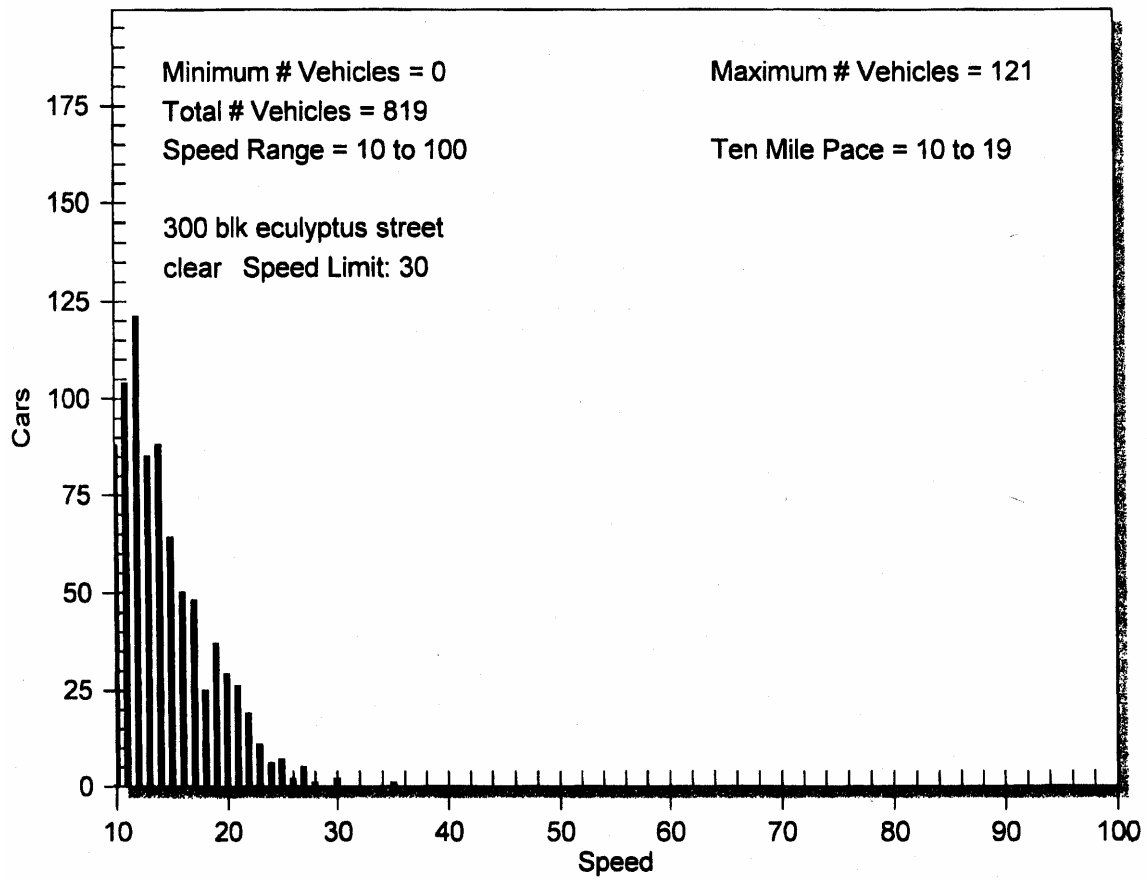


EXHIBIT 3: Example of Stealth Stat Data - Continued

Cars vs. Time

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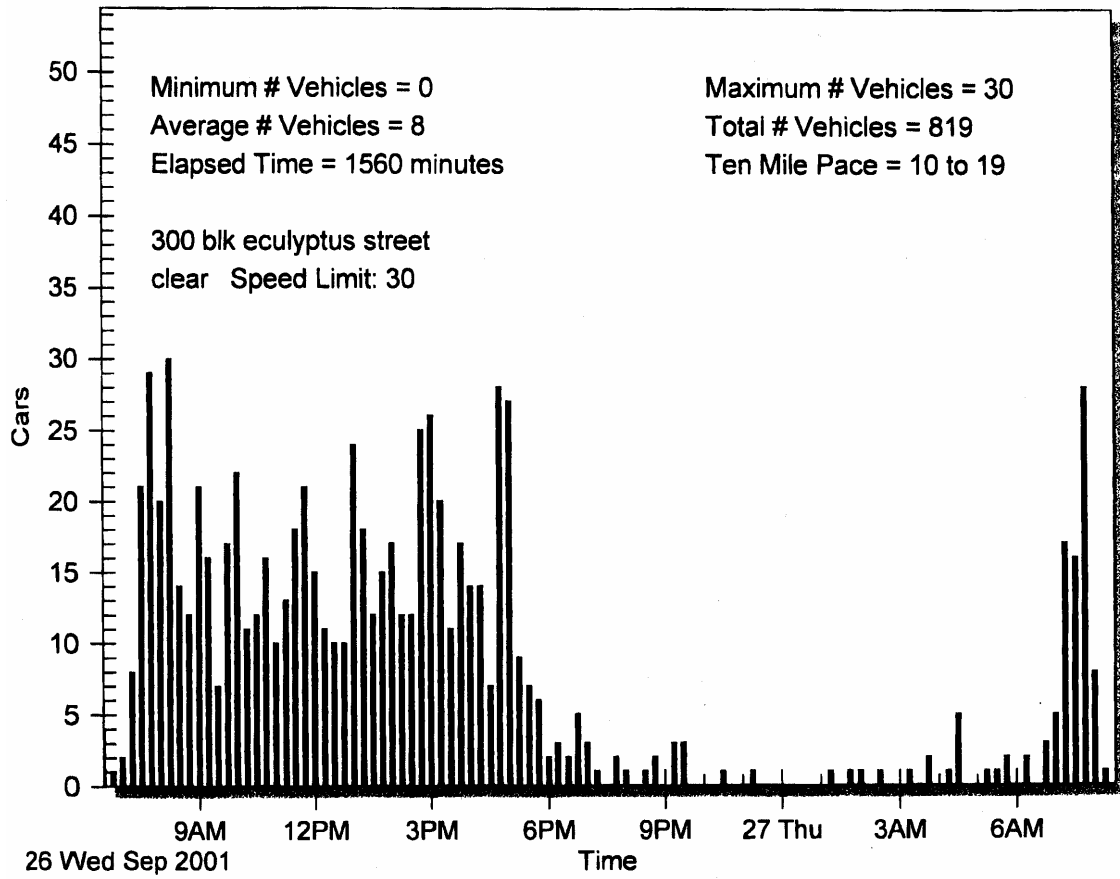


EXHIBIT 3: Example of Stealth Stat Data - Continued

