Topic #750-010-002

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SPEED ZONING

For

HIGHWAYS, ROADS & STREETS

In

FLORIDA

FDOT
TRAFFIC ENGINEERING &
OPERATIONS OFFICE
TALLAHASSEE, FLORIDA

TABLE OF CONTENTS

1. MANUAL ADOPTION PROCEDURE 1-3

1.1 PURPOSE 1-3
1.2 AUTHORITY 1-3
1.3 SCOPE 1-3
1.4 REFERENCE 1-3
1.5 DISTRIBUTION 1-3
1.6 AVAILABILITY 1-3
1.7 REGISTRATION 1-3
1.8 REVISIONS AND ADDITIONS 1-4
1.9 TRAINING 1-4
1.10 FORMS 1-4

2. INTENT OF SPEED ZONING 2-1

3. DRIVER BEHAVIOR 3-1

4. TRAFFIC ENGINEERING INVESTIGATIONS 4-1

4.1 BASIC INVESTIGATIONS 4-1

5. EQUIPMENT, CONDITIONS, AND DATA COLLECTION SITES 5-1

5.1 GENERAL INFORMATION 5-1
5.2 UNCOORDINATED, CLOSELY SPACED TRAFFIC SIGNAL ROADWAY SEGMENTS 5-3
5.3 CLOSELY SPACED 4-WAY STOP CONTROLLED INTERSECTIONS 5-3

6. WHEN TO MAKE STUDIES 6-1

6.1 GENERAL NOTES 6-1
6.2 EXCEPTIONS 6-1
6.3 OTHER APPROACHES 6-2

7. SPOT SPEED SAMPLE SIZE 7-1

8. CALCULATING 85TH PERCENTILE SPEED 8-1

8.1 EXAMPLE OF SPEED CALCULATION 8-1

9. DETERMINING THE SPEED LIMIT 9-1

9.1 TRAFFIC CRASHES 9-1

10. SPEED ZONE SIGNS 10-1

10.1 VARIABLE SPEED LIMIT SIGNS 10-1

11. LENGTH OF GRADUATED SPEED ZONES 11-1

12. AREA WIDE “BLANKET” SPEED RESTRICTIONS 12-1

13. UNIFORM SPEED ZONING AND ENFORCEMENT 13-1

14. SPEED ZONE LOCATIONS 14-1

14.1 SUBDIVISION STREETS 14-1
14.2 DESIGN SPEED 14-2
14.3 STATE PARKS 14-3
14.4 WORK ZONES 14-4
14.5 REST AREAS 14-5
14.6 ENVIRONMENTAL SENSITIVE AREAS 14-5

15. OTHER SPEED SIGNS AND TERMS 15-1

15.1 TIME PERIOD SPEED (REGULATORY) 15-1
15.2 ADVISORY SPEED (WARNING) 15-1
15.3 ROAD OR BRIDGE SPECIAL RESTRICTIONS (REGULATORY) 15-3
15.4 ELECTRONIC FEEDBACK SPEED (REGULATORY) 15-3

16. SPEED ZONE ESTABLISHMENT AND RECORDS 16-1

16.1 RECORD KEEPING AND CONTINUITY 16-2

TABLE OF FIGURES

FIGURE 4-1. SPEED FREQUENCY AND CUMULATIVE FREQUENCY DISTRIBUTION CURVES 4-2
FIGURE 7-1. VEHICLE SPOT SPEED STUDY 7-2
FIGURE 10-1. VARIABLE SPEED LIMIT SIGN 10-3
FIGURE 14-1. TYPICAL SUBDIVISION 14-1
FIGURE 16-1A. STRAIGHT LINE DIAGRAM 16-1
FIGURE 16-1B. STRAIGHT LINE DIAGRAM 16-2
FIGURE 16-2. SPOT SPEED STUDY SUMMARY 16-5
FIGURE 16-3. SPEED ZONE REGULATIONS 16-6

SPEED ZONING FOR HIGHWAYS, ROADS, AND STREETS IN FLORIDA

1. MANUAL ADOPTION PROCEDURE

1.1 PURPOSE

To provide guidelines and recommended procedures for establishing uniform speed zones on State, Municipal, and County roadways throughout the State of Florida.

1.2 AUTHORITY

Chapter 316, Florida Statutes (F.S.)
Sections 187 and 189, Florida Statues (F.S.)
Rule 14-15.012, F.A.C.
Rule 14-15.010, F.A.C., Manual on Uniform Traffic Control Devices (MUTCD)

1.3 SCOPE

This ***Manual*** affects the State Traffic Engineering and Operations Office, District Traffic Operations Offices, Florida Counties and Municipalities and anyone else affected by speed limits establishment.

1.4 REFERENCE

Topic No. 025-020-002-i, Standard Operating System.

1.5 DISTRIBUTION

The official recipient of this manual will be the District Traffic Operations Engineers and their employees, and the State Traffic Engineering and Operations Office managers and staff.

1.6 AVAILABILITY

This ***Manual*** is available free of charge at the Department's State Traffic Engineering and Operations Office website:

http://www.dot.state.fl.us/TrafficOperations/speedzone/Speed_Zone_Manual.shtm

1.7 REGISTRATION

Users of this ***Manual*** interested in receiving automatic notifications of revisions to the manual by e-mail may subscribe from the web site. As required by ***Section 283.55,***

F.S., by March 1 of each odd-numbered year, we will survey e-mail addresses from our current registration list and purge any outdated registrations.

1.8 REVISIONS AND ADDITIONS

1.8.1 The District Traffic Operations Engineers, the Traffic Systems Studies Group and the State Traffic Operations Engineer will constitute the Manual Review Team.

1.8.2 Items warranting immediate change will be made with the approval of the State Traffic Operations Engineer (after a majority vote of the Manual Review Team and consultation with any other affected parties).

1.8.3 All revisions will be coordinated through the Forms and Procedures Office prior to implementation.

1.9 TRAINING

None required.

1.10 FORMS

The Vehicle Spot Speed Study Form (Form 750-01-003) is incorporated by reference into ***Rule 14-15.012 Florida Administrative Code (F.A.C)***, and any revisions, additions, or updates to this form must be coordinated with the Office of General Counsel for Administrative Code update. This form is available from the Forms Library:

http://formserver.dot.state.fl.us/MiscRepository/forms/75001003.pdf

2. INTENT OF SPEED ZONING

The primary intent for establishing a speed zone is to improve vehicular and pedestrian safety by reducing the probability and severity of crashes. A speed limit sign notifies the driver of the maximum and/or minimum operating speed that is considered reasonably safe in optimum weather and visibility conditions. It is intended to establish the standard speed limits within which a normally prudent driver can perceive and react safely to driving problems encountered on the roadway.

Speed limit signs are neither costly nor complicated traffic control devices, but more than any other message-conveying sign, they are responsible for communicating a basic element of uniform safe driving advice to the driver. Uniform traffic flow and corresponding safe roadway speed is an important parameter describing the state of a traffic stream and can only be achieved through consistent methods of establishing speed zones, uniform sign design and placement and an effective speed zone enforcement approach. This ***Manual*** seeks to fulfill a large measure of this need by explaining the principles, philosophies, and procedures of realistic speed zoning.

The "statutory" or allowable speed limits mandated by state statutes prevail on the types of roads and/or locations identified within state, municipalities and county jurisdictions. Such speed limits may be altered upward or downward by speed zoning thus creating specific or altered speed limits or restrictions for prescribed segments of highways, roads and residential streets. Statutory limitations however, establish maximum speed limits for state, county, and city road systems. According to Section ***316.187 (b), F.S.***, "the maximum allowable speed on any other highway which is outside an urban area of 5,000 or more persons and which has at least four lanes divided by a median strip, is 65 mph. The maximum speed on city and county roadways is defined in Section ***316.189, F.S.***, with a maximum of 60 mph for County roads and varies for residential and/or business districts within city municipalities not to exceed 60 mph.

Any alteration and posting of speed limits on municipal or county streets and roads, as set forth in Section ***316.189, F.S.***, must be based on an engineering and traffic investigation that determines such a change is reasonable and in conformity to criteria promulgated by Florida Department of Transportation (FDOT). Altered speed limits established solely on the basis of opinion are considered contrary to the intent of the statute.

This ***Manual*** includes guidelines and procedures for performing traffic engineering investigations related to speed zoning in addition to information on the philosophy of speed zoning and the identification of some of the factors to be considered in establishing realistic, safe, and effective speed zones to which meaningful enforcement can be applied.

Throughout this and many other sources on vehicular speed, the term speed zone, speed limit, and speed restriction are used interchangeably.

Spot speed studies historically showed that the 85th and 15th percentile observed speeds generally describes the high and low speeds observed by most reasonable drivers. It is generally thought that the upper and lower 15% of the observed speeds are too fast or too slow for existing conditions. It is for these out of range operating speeds that the practice of speed zoning strives to achieve its objective of providing realistic speed restrictions to which meaningful enforcement can be applied.

Research[1] has shown that higher traveling speeds are not necessarily associated with an increased risk of being involved in a crash. When drivers travel at the same speed in the same direction, even at high speeds, as on interstates, they are not passing one another and cannot collide as long as they maintain the same travelling speed. Conversely, when drivers travel at different rates of speed, the frequency of crashes increases, especially crashes involving more than one vehicle. The key factor is speed variance. The greater the speed variance or the distribution of speeds the greater the number of interactions among vehicles. Thus, drivers attempting passing maneuvers due to speed variance increase the risk of having collisions.

1 Analyzing Crash Risk Using Automatic Traffic Recorder Speed Data (TRB, Iowa State University 2005)

http://ntlsearch.bts.gov/tris/record/tris/01004340.html

3. DRIVER BEHAVIOR

There are many factors that influence a driver's choice for comfortably selecting an operating speed. The presence and density of adjacent vehicles, weather, road conditions, road geometry, adjacent land use and other factors are examined in this ***Manual***. A driver's choice of speed is a balance between experience and safety and is often a subconscious reaction to the ambient surroundings.

Human beings are complex and have a wide range of characteristics that can and do influence the driving task. Examples of these characteristics are the visual acuity factor, the reaction process, hearing and physical strength. One of the most important factors is the personality and psychology of the driver. This, however, is not easily quantified for speed zoning purposes and is dealt with primarily through enforcement and licensing procedures that attempt to remove or restrict drivers who periodically display inappropriate tendencies, as indicated by crash and violation experience. Drivers tend to pay less attention to speed limit signs, which they consider unreasonable unless there is an inordinate degree of enforcement. On the other hand, unreasonably low posted speed limits are commonly violated by drivers essentially making enforcement difficult and operating speeds higher than what would exist with proper realistic posted speed limits.

Most drivers on a road segment select a reasonably safe speed based on their conscious and subconscious reaction to many factors as previously mentioned. By obtaining a true measure or profile of the observed range of speeds, a realistic speed can be determined in terms of providing a posted speed limit beyond which enforcement can be applied. As an oversimplification of the procedure, it can be said that drivers, without knowing it, determine their own speed limit. Some motorists persistently drive fast (faster than what would be considered normal for the given conditions), while others drive persistently slow. Although both are disruptive to safe traffic operations, the former is the condition intended to be corrected by the implementation of speed zoning. The following factors have been found to influence a driver's choice of speed:

1. Time of day
2. Length of trip
3. Purpose of trip
4. Number of passengers
5. Type of vehicle
6. Presence and/or history of enforcement (personnel or officially marked vehicle)
7. The interval since witnessing a crash or results of a crash
8. Driver skill
9. Emotional condition of driver
10. Lane width

11. Speed of other vehicles
12. Adjacent land use and intensity
13. Pavement wetness (including standing and running water)
14. Pavement type and condition
15. Traffic volume
16. Pedestrians, especially children
17. Presence and location of cyclists
18. Ambient light
19. Type of passengers
20. Weather
21. Familiarity of driver with road
22. Condition of vehicle
23. Urgency of trip
24. Running speed for previous 5 or 10 miles of travel
25. Personality of drive
26. Vehicle parking
27. Recent traffic violation and points earned
28. Shoulder width and condition
29. Restrictive lateral clearance
30. Snow, ice, mud, and sand on pavement
31. Pavement roughness
32. Alcohol and/or other drugs
33. Personal schedule of driver (Late or on time)

Although the cause and effect of all these factors may not be exclusively covered in this ***Manual***, they should be recognized as factors which clearly influence the speed at which a driver travels at any given time.

4. TRAFFIC ENGINEERING INVESTIGATIONS

Florida Statutes require an engineering and traffic investigation to be conducted for any alteration of speed limits, mandated in Sections ***316.187*** and ***316.189 F.S.*** These investigations would include, but are not limited to, the measurements of vehicular speed and other traffic engineering evaluations contained in this ***Manual***. As an alternative, ***Section 5, (Equipment, conditions, and Data Collection)*** and ***Section 14, (Speed Zone Locations)*** of this ***Manual*** give an explanation for exceptions to the practice of collecting and analyzing speed data.

4.1 BASIC INVESTIGATIONS

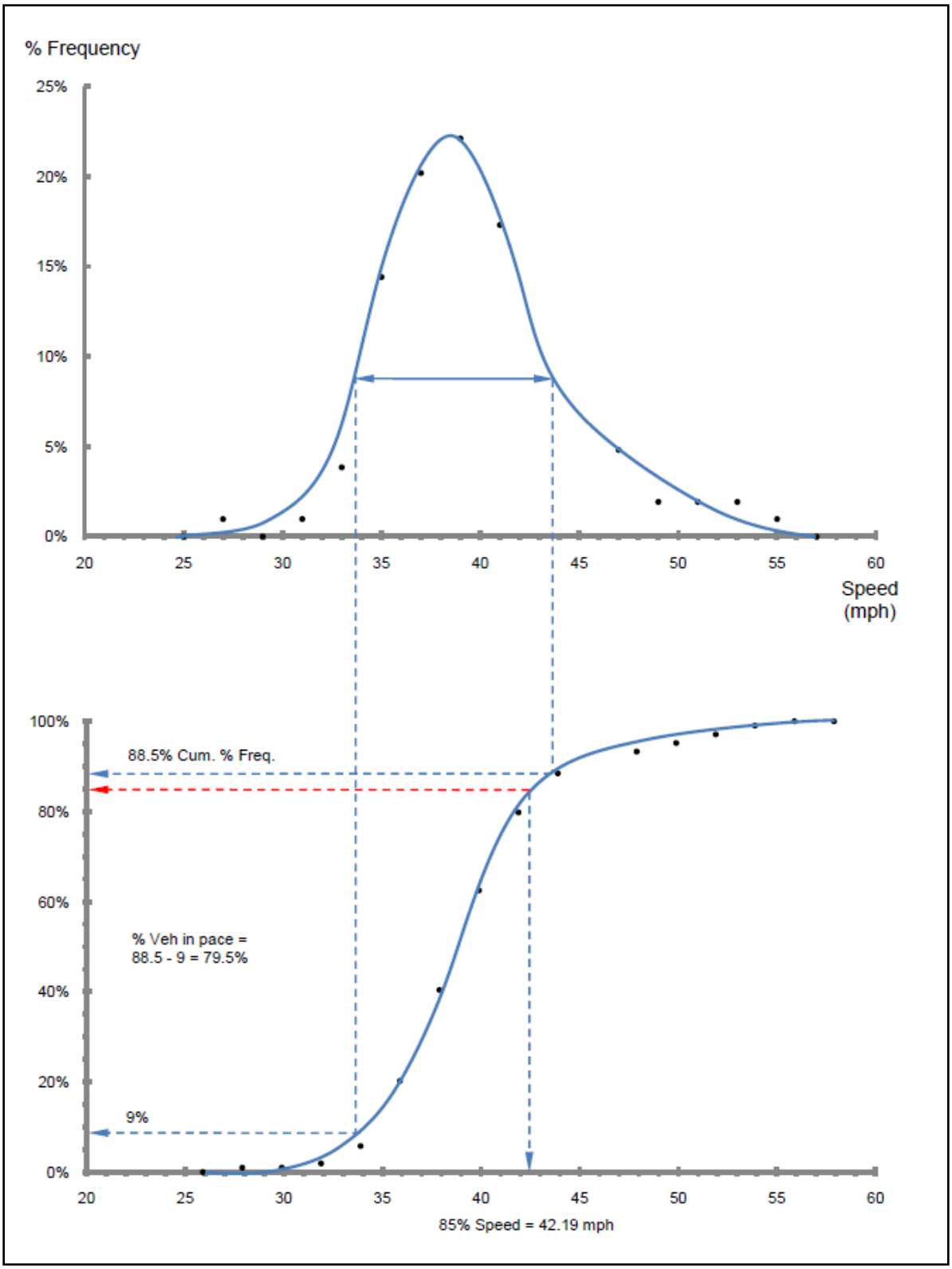
The measurement of prevailing speeds of free-flowing traffic during good weather and roadway conditions is the prime requisite for an investigation and the establishment of a speed limit for any roadway segment. There are three types of common descriptive statistical measures utilized in determining the prevailing speed: ***85th*** percentile speed, upper limit of ***10 mph pace*** and average test run speed. The first two measures are determined from raw speed data collected at the investigation site called either a speed check or spot speed study, ***(See Manual of Uniform Traffic Studies (MUTS), Chapter 13)***. The third measure is from the average speed of a test run vehicle which is driven through the site a number of times.

The ***85th*** percentile speed is defined as the speed at or below which 85 percent of the observed free-flowing vehicles are traveling. The ***10 mph pace*** is defined as the 10 mph range containing the highest number of such vehicles contained in the study sample data. The average test run speed is measured using agency vehicles and is usually unnecessary to obtain unless the roadway segment observed has low volumes where a sufficiently large number of vehicles cannot be observed in a reasonable period of time.

The speed frequency and cumulative frequency distribution curves ***(Figure 4-1)*** in addition to the field data collection sheet ***(Figure 7-1)*** reveal important information about the observed speed along a roadway segment. The less variation in vehicular speed at a particular location, the safer the conditions would be. If all vehicles would travel at or near the same speed, there would not be a reason for passing on a two-lane road and much less reason for lane changing on multi-lane roadways. This would result in lower rear-end, head-on, and sideswipe traffic crashes.

Experience has shown that realistic speed limits developed by procedures as outlined in this ***Manual*** will reduce the variance of speeds even though the average, mean, or 85th percentile speed may not change appreciably. This reduced range will result in a higher percentage of vehicles within the 10 mph pace as illustrated by a narrow width bell shaped curve shown in ***Figure 4-1***, and a more sloping, almost vertical, appearance of the center (straight) portion of the S-curve below.

Figure 4-1. Speed Frequency and Cumulative Frequency Distribution Curves



5. EQUIPMENT, CONDITIONS, AND DATA COLLECTION SITES

5.1 GENERAL INFORMATION

Spot speeds are generally measured using one of two methods:

(a) Measurement of travel times as vehicles traverse a short predetermined distance along a roadway segment.

(b) The use of hand-held or fixed-mounted radar or other electromagnetic wave detection devices.

In the early days of vehicular speed enforcement, the primary technique used by police was to place two pneumatic round tubes across a travel lane separated a short distance apart, using a meter to measure the time between successive actuations to determine speed. The short distance between the two road tubes was called a “trap”. This is the origin of the common word “speed trap” used today to describe any police speed monitoring location.

For traffic engineering investigations, the simplest and cheapest techniques involve manual use of stopwatches to time vehicles as they traverse an easily recognized trap. This method, however, has been determined to have inherent random systematic errors called “parallax” created by human observation of the trap travel times. An improved and more accurate method to collect speed data today involves automatic time-stamp microprocessor traffic data recorders. These data collectors use the same trap methodology to detect speed, volume and vehicular classification utilizing road tubes placed at predefined spacing with advanced data storage and retrieval capabilities. Other technologies utilizing the trap method include low power infrared scanning and light beam interrupt.

The second speed measuring and data collection method involves the use of hand-held or fixed-mounted devices. Presently, there are three distinct categories that utilize these types of remote sensing technologies, the Doppler-Shift, the Field Magnetic Interrupt and the Vehicular Acoustic Energy detection. Examples of the doppler-shift technologies are the hand-held or fixed-mounted radar units, pole-mounted microwave units and the fixed-mounted ultrasound units. The field magnetic interrupt technology applies to in-roadway inductive loops such as the permanent counting stations operated by the FDOT Transportation Statistics Office that have traffic classifiers capable of providing reliable speed data information. Currently there is only one source for Acoustic Energy detection device used for speed sensing, however, as modern technology evolves, so will the type and method of speed data collection improve.

Regardless of the method used, every effort must be made to disguise or conceal the fact that speeds are being recorded on any roadway segment, otherwise distorted data will be collected, the analysis of which can lead to unrealistically low speed limits due primarily to the driver’s reaction to a perceived speed trap. A speed survey should be

made at times of the day when it is possible to measure a true free flowing traffic, but these conditions do not usually occur during peak traffic hours. An exception would be low volume facilities. Even in light traffic, vehicle platoons may form. In platoon flow, only the first vehicle should be recorded unless all are free flowing. Free flowing traffic is defined as a condition when drivers have relative freedom to choose a traveling speed without interference from other traffic or ambient weather.

Judgment is extremely important when selecting a spot speed study location. Obviously, a semi rural area with unchanging lanes, roadway width and character does not require more than one spot speed study. Conversely, more than one sample will need to be taken in areas where drivers are expected to accelerate or decelerate such as in horizontal curves, steep grades, lane merges, etc.

As the land use urbanizes, traffic volumes increase, roadway character changes, other regulations change (such as curb parking restrictions), or there is a frequency of interchanges or intersections, the need increases for carefully selecting spot speed sites sometimes as close as one block intervals. This is done to capture the real changes in conditions that affect drivers speed, and in turn, through the speed zone process, provide speed limits that are reasonable.

The proximity to the following types of conditions should be avoided when selecting spot speed study sites because their effect on drivers will give a distorted or biased speed sample:

- Stop signs
- School crossing
- Railroad crossing
- Traffic signal
- Bump or dip in roadway
- Congested traffic
- Steep grade
- Construction activity on adjacent road
- Horizontal curve
- Poor sight distance
- Diverge and merging areas
- Narrow bridge
- Rest Areas
- Proximity of Limited Access Interchanges

There are other situations involving the conditions in **Section 5.1** that are sometimes unavoidable and preclude the use of spot speed studies. The following sections describe roadway characteristic conditions that may prove helpful when speed zone alterations are being considered. Other prohibitive locations such as variable speed limit segments and curving subdivision streets are addressed in detail under ***Section 14, (Speed Zone Locations).***

5.2 UNCOORDINATED, CLOSELY SPACED TRAFFIC SIGNAL ROADWAY SEGMENTS

Due to the random side street demand and the mainline roadway cycling relationship of uncoordinated signals, there may be times when all signals will be green for a driver. The infrequency of this makes speed data collection a time consuming and tedious procedure and, at best, of questionable value. Considering the types of streets having traffic signals, it is uncommon to have a speed limit less than the legislative blanket speed of 30 mph; however, by implementing speed zoning, higher speed limits may result.

Selecting a speed limit for these conditions requires traffic engineering knowledge focused on understanding the purpose and function of speed zoning in the interest of safety and traffic operations. In some cases, it is desirable to conduct studies during low volume periods to obtain free flow conditions.

Whenever traffic signals are interconnected for progression, it is advisable to establish a speed limit equal to or higher than the progression speed otherwise drivers may be lured into exceeding the lawful limit.

5.3 CLOSELY SPACED 4-WAY STOP CONTROLLED INTERSECTIONS

As with the condition in the previous section, spot speed studies conducted at closely spaced stop sign controlled intersections are of little value. A more valuable engineering investigation is to re-evaluate some or all of these intersections to determine if they truly meet 4-way stop control conditions ***(See Section 2B.05 of the MUTCD)***. Use of realistic speed zones ***(regulatory)*** and advisory speed ***(warning)*** as outlined in ***Section 15 (Other Speed Signs and Terms)*** is an important way to develop proper credibility and respect for implementing speed zoning.

6. WHEN TO MAKE STUDIES

6.1 GENERAL NOTES

There are certain time-periods that will need to be considered to capture ideal spot speed data typical of the conditions that should govern realistic speed limits. Studies in Florida have shown wide fluctuations in traffic volumes by time-periods, which may help determine when, and when not to make speed studies:

- Hour of day
- Day vs. night
- Weekdays vs. weekends
- Season of year
- Day of week

For example, the measured speed of bumper to bumper, congested traffic is only an indication of an overburdened roadway and its ability to handle a limited capacity at a failing level of service. As traffic demand lessens, the speed begins to increase up to a point when an isolated driver is seldom influenced by any other vehicles. Care must be taken with identifying an appropriate time for the free flowing speed of vehicles whose drivers have a reasonable freedom of choice to travel at speeds predominately set, not by other drivers, but by unconstrained roadway conditions.

Data collection for speed zoning should not occur in the vicinity of intensive enforcement activity or for a few days thereafter. However, data collected before, immediately after, and a week or two later, may prove useful information on the effectiveness of the enforcement. Concealment of survey equipment, observers, and vehicles is more critical than usual because of drivers' sensitivity to enforcement activities.

6.2 EXCEPTIONS

There are time periods other than the normal AM, Noon and PM peak hour traffic fluctuations where exceptions to the rule may be helpful in understanding speed zoning.

6.2.1 DAY VS. NIGHT

Many years ago, the practice of setting the night speed of 5 mph lower than the day speeds was common practice. While this is no longer necessary with improved vehicle capabilities, conditions may exist on individual roadways where this may be a desirable practice. Examples include coastal areas where combinations of climate consistently produce night time fog.

6.2.2 SEASONS

Although this ***Manual*** repeatedly cautions against making speed studies when high traffic volumes preclude a free flowing condition, there are some locations in Florida (particularly beach areas) having hourly volumes during peak seasons at such high levels throughout most of the day that congestion becomes the norm and free flowing data is collectable only during the early morning hours.

6.3 OTHER APPROACHES

By accepting the fact that speed limits are a maximum speed for ideal conditions, collecting data during off peak hours and establishing the speed limit in accordance with ***Section 9 (Determining the Speed Limit)*** should be implemented. Another approach is to provide seasonal speed limits or other time period speed limits such as described in ***Section 15 (Other Speed Signs and Terms)***. Whether on a seasonal or daily basis, speed signs can be changed in accordance with the regulations legally established.

For shorter time periods, manual, electromechanical, or matrix signs can display speed limits; however, for enforcement and litigation purposes, a record must be maintained on the day, hour, and minute a change is made, unless the sign message is changed on a predetermined schedule.

7. SPOT SPEED SAMPLE SIZE

At a minimum, spot speeds of 100 vehicles in each direction should be recorded; or, if traffic volumes are low, all free flowing vehicles during a two-hour time period should be the minimum sample size. The **FDOT** has developed the following form to facilitate consistent and uniform field data collection methods ***Form No. 750-010-03***, ***Vehicle Spot Speed Study (Figure 7-1)***. This form is also available in spreadsheet format with built-in macros for automatic data reduction and calculation. Other computer generated reports are commercially available that produce similar outputs and are generally associated with the automatic data collection equipment listed in **Section 5 (*Equipment, Conditions, and Data Collection Sites*)** of this manual.

On some low volume roads and streets, a two hour study may contain a small number of measured speeds (up to 50 mph in both directions). It is with this limited data that special consideration should be given to the following:

- The best traffic engineering judgment is exercised.
- The analyst must be assured that the observer, equipment, and vehicle were sufficiently concealed to take a true, unbiased sample, and;
- The need of individual test runs to add depth to the limited data, by driving the road not as a technician, analyst, or engineer, but as a typical driver reacting to perceived conditions.

A minimum of three test runs in each direction should be made and, if in an area where one end of the anticipated zone is adjacent to a higher speed zones, a substantially long running start should be given to acclimate the driver to the roadway environment. A short approach run, particularly from a stopped position, does not represent a normal situation.

Measuring speeds by vehicle classification (cars, trucks, buses, etc) is not necessary unless the specific speed of such vehicle is of concern.

Figure 7-1. Vehicle Spot Speed Study

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

VEHICLE SPOT SPEED STUDY

FORM 750-010-03
TRAFFIC ENGINEERING
07/2009 ASE

LOCATION ID: Douglas Rd. - C.R. 949	SECTION: ----------
LOCATION: 137 Miles East of Northfork Cr.	MP : 28.83
POSTED SPEED (mph): 55 MPH	COUNTY: Bedford
DATE: 6/4/2008	PAVEMENT CONDITION: Dry, Good
OBSERVER: K. Matthews	TIME FROM: 9:00 AM TIME TO: 11:00 AM
REMARKS: Concealment Quite Difficult	

NUMBER OF VEHICLES BOUND						SPEED	NUMBER OF VEHICLES E BOUND						BOTH DIRECTIONS	
CUM. TOTAL	TOTAL	20	15	10	5	BIN (mph)	5	10	15	20	TOTAL	CUM. TOTAL	TOTAL	CUM. TOTAL
						≥ 80								
						78 - 79.9								
						76 - 77.9								
						74 - 75.9								
						72 - 73.9								
						70 - 71.9								
						68 - 69.9								
						66 - 67.9								
						64 - 65.9								
						62 - 63.9								
						60 - 61.9								
						58 - 59.9								
						56 - 57.9								
						54 - 55.9								
						52 - 53.9					1	104		
						50 - 51.9					2	103		
						48 - 49.9					2	101		
						46 - 47.9					2	99		
						44 - 45.9					5	97		
						42 - 43.9					9	92		
						40 - 41.9					18	83		
						38 - 39.9					23	65		
						36 - 37.9					21	42		
						34 - 35.9					15	21		
						32 - 33.9					4	6		
						30 - 31.9					1	2		
						28 - 29.9						1		
						26 - 27.9					1	1		
						24 - 25.9								
						22 - 23.9								
						20 - 21.9								
						18 - 19.9								
						16 - 17.9								
						14 - 15.9								
						12 - 13.9								
						10 - 11.9								
						≤ 10								
		TOTALS								TOTALS				

SPEED DATA SUMMARY	EAST BOUND			ENGINEER: B. Traffic
85th PERCENTILE SPEED	42			DATE: 7/6/2008
10 mph PACE	33 - 43			

8. CALCULATING 85th PERCENTILE SPEED

To calculate the 85th percentile speed, multiply the total number of vehicles whose speed has been measured and recorded on the form (sample size) by 0.85 which gives the 85th percentile point in the Cumulative (Cum) Total column of the Vehicle Spot Speed Study ***(Figure 7-1)***. Next, mark that point between the two cumulative speed numbers bins where this value falls. If it is one of the bin numbers, take the middle value as the 85th percentile speed and no further calculations are necessary. Otherwise, the 85th percentile speed is determined by graph or interpolating the nearby data points as illustrated in the following example.

8.1 EXAMPLE OF SPEED CALCULATION

Given the data shown in ***Figure 7-1***,

Sample Size = 104 vehicles

85th percentile point is: 104 X 0.85 = 88.4 vehicles

The 85 percentile point falls between (40 – 41.9) Bin and (42 – 43.9) Bin corresponding to 83 and 92 of the CUM TOTAL Column.

Using the middle value of the Bin column,

$$\frac{88.4 - 92}{92 - 83} = \frac{x - 43}{43 - 41}$$

85th % Speed = x = 42.20 mph.

The upper limit of the ***10 mph pace*** is determined from the same study sheet. This often can be estimated visually without calculations by looking at the pattern of tally marks. Another way to select the pace, or to verify the visual method, is to scan the data for the highest total number of vehicles within any 10 mph range.
In ***Figure 7-1*** this pace is obvious, and runs from 4 in the (32 – 33.9) mph line to 9 in the (42 – 43.9) mph line. Again, by using the middle value of the bin numbers, the upper limit of this 10 mph pace is 43 mph. The number of vehicles within the 10 mph pace is 90 and the percentage of vehicles within the pace is 79.5%.

A blank copy of the Vehicle Spot Speed Study, ***FDOT Form No. 750-010-03***, is provided in the appendix, and is also available through the forms library website.

9. DETERMINING THE SPEED LIMIT

According to ***Section 2B-13 of the MUTCD***, *"After an engineering study has been made in accordance with established traffic engineering practices, the Speed Limit (R2-1) sign (see Figure 2B-1) shall display the limit established by law, ordinance, regulation, or as adopted by the authorized agency. The speed limits shown shall be in multiples of 10 km/h or 5 mph."*

Any alteration and posting of speed limits on municipal or county streets and roads, as set forth in ***Section 316.189 F.S***., must be based upon an engineering and traffic investigation as promulgated herein by the FDOT.

Altered speed limits established solely on the basis of individual or group opinions are considered contrary to the intent of the statute.

A speed limit should not differ from the **85th** percentile speed or upper limit of the **10-mph pace** by more than **3 mph** and it shall not be less than **8 mph**. A speed limit of 4 to 8 mph less than the **85th** percentile speed shall be supported by a supplemental investigation, which identifies the following:

- There are road or roadside features not readily obvious to the normally prudent driver, such as length of section, alignment, roadway width, surface condition, sight distance, traffic volume, crash experience, maximum comfortable speed in curves, side friction (roadside development), signal progression, etc., or;

- Other standard signs and markings have been tried but found ineffective

Example:

A measured **85th** percentile speed of 42 mph would result in a 40 or 45 mph speed limit unless supplemental investigation conditions are met. The 40 or 45 mph limit then could be lowered 5 mph, thus producing a 35 or 40 mph speed limit (minimum potential speed limit). The maximum potential speed would be 45 mph unless the upper limit of the **10-mph pace** were greater than 42.

Extreme care must be taken to assure that the condition upon which the 5 mph reduction is based on is not one that a driver may have taken into account either consciously or subconsciously. Otherwise, it will be given double weight and result in an unrealistically low speed limit.

9.1 TRAFFIC CRASHES

It is not possible within the scope of this manual to give details on the evaluation and statistical analysis of traffic crash information. Before and after crash studies are a valid means of measuring degrees of success or failure of any traffic control device or physical change on a given roadway. However, caution must be exercised or false

conclusions can be reached if the magnitude, time span or actual number of crashes (including personal injuries, deaths, and property damage) is not statistically significant to provide valid conclusions. In addition, crash and fatality rates should be computed to avoid comparison of crash information under different traffic volume conditions, whether it is two different years or months, or simply daytime versus nighttime crashes during the same time period. Crash experience on a section of road (unless a newly constructed or reconstructed road) should definitely be considered; but the fact that crashes have been known to increase on some roads and decrease on others after a speed limit is lowered, should be considered when applying crash data toward the choice of the numerical speed limit. Generally, a higher number of crashes occur when the speed differential is greatest. Individual speeds at the **85th** percentile level are by definition the safest speed for travel.

10. SPEED ZONE SIGNS

All speed zones and related roadway signs must be in compliance with requirements set forth in the **MUTCD** as adopted by the State of Florida, ***Rule 14-15.010, F.A.C***. On one-way streets and on divided roads with ample median space, placement of a pair of speed signs on the left and right sides of the one-way roadway improves communication with drivers. Dual signs are especially important at locations where the speed limit is lowered or varied due to downstream roadway conditions.
.
The speed sign tabulation sheet in ***Section 16* (*Speed Zone Establishment and Records)***, lists only those signs essential to providing information to drivers of the change in numerical speed limits. Unless speed zones are short, additional signs should be placed to give reaffirming information to drivers, as well as the new information to drivers turning onto the road from a side street.

The location of speed limit signs shall be in accordance with ***Section 2B-18 of the MUTCD*** which states, *"Speed limit (R2-1) signs, indicating speed limits for which posting is required by law, shall be located at the points of change from one speed limit to another. At the end of the section to which a speed limit applies, a Speed Limit sign showing the next speed limit shall be installed. Additional Speed Limit signs shall be installed beyond major intersections and at other locations where it is necessary to remind road users of the speed limit that is applicable. Speed Limit signs indicating the statutory speed limits shall be installed at entrances to the State and at jurisdictional boundaries of metropolitan areas."*

Speed reduction warning signs shall be in accordance with ***Section 2-C-30 of the MUTCD*** which states: *"A speed Reduction (W305 or W3-5a) sign should be used to inform road users of a reduced speed zone when engineering judgment indicates the need for advance notice to comply with the posted speed limit ahead.""Standard:*

If used, Speed Reduction signs shall be followed by a Speed Limit (R2-1) sign installed at the beginning of the zone where the speed limit applies.

The speed limit displayed on the Speed Reduction sign shall be identical to the speed limit displayed on the subsequent Speed Limit sign."

Extreme care must be exercised in placing the additional signs, with emphasis on locations where such reminder signs should not be placed; e.g., in proximity to a horizontal curve, railroad track, school zone, traffic signal, stop sign, narrow bridge, or any other type of roadway characteristic that may overload a driver's ability to process information and react accordingly.

10.1 VARIABLE SPEED LIMIT SIGNS

The traditional static maximum speed limit signs are posted based on ideal roadway and weather conditions. Such signs fail to assist drivers with the challenge of determining a proper maximum safe driving speed under non-ideal conditions. Furthermore, law enforcement agencies are required to make a subjective

determination when citing a motorist driving unsafely and too fast for peril roadway conditions. Variable speed limit (VSL) systems are utilized to alleviate these situations and provide safe driving speed information based on prevailing upstream roadway conditions.

VSL systems are a type of Intelligent Transportation System (ITS) that utilizes real-time traffic speed and volume detection, weather information, accident and congestion information, and road surface condition technology to determine optimal and appropriate speeds at which drivers should be traveling through the variable speed limit zone. FDOT mandates that any automated system capable of adjusting or displaying posted speed limits on electronic signs require a human operator to review and accept system-generated speed limits prior to posting them on roadside signs.

Deployed with success in other States and in Europe, VSL is intended to regulate the flow of traffic, reduce traffic shockwave propagation and thereby improving efficiency and safety. VSL operates under the same premise as rice grains passing through a funnel: Depositing a bag of rice grains all at once will clog the funnel, whereas gradually pouring the grains enables them to pass quickly. VSL's goals are to:

- Increase traffic flow by integrating vehicles gradually
- Reduce abrupt traffic stoppage, resulting in fewer rear-end/side-swipe crashes
- Make work zones safer for construction workers and motorists
- Empower motorists with actionable information about real-time traffic conditions, enabling them to modify travel times, routes or modes

In the event FDOT determines, based upon an engineering and traffic study, that the safe and orderly movement of traffic on any State Highway System will be facilitated by the establishment of variable speed limits, the Department may erect, regulate, and control signs on the State Highway System, or any portion thereof, which signs shall be designated as to permit display of different speed limits at various times of the day or night. The Speed Limit within the established variable speed limit zone at a particular time and place shall be that which is then and there displayed upon such sign.

10.1.1 VSL OPERATION AND SIGNAGE

In the event of a VSL system warning initiation notifying Traffic Management Center personnel of an adverse roadway conditions and a recommended system generated reduced speed limit has been evaluated and accepted, the electronic roadside posting procedure within the VSL speed limit zone shall be as follows:

1. Reduce numeric speed limit by 5 mph from the maximum, unconditioned, posted speed limit and initiate yellow flashing beacon.

2. Re-evaluate and observe traffic flow for optimal and safe performance.

3. Reduce numeric speed limit by an additional 5 mph if necessary, however, and under no circumstances shall the reduced posted speed limit be more than 20 mph below the unconditioned maximum posted speed limit.

4. Once the VSL system warnings have returned to normal operation and adverse roadway conditions have been alleviated, return posted speed limit to maximum unconditioned numeric value and turn off yellow flashing beacon.

Figure 10-1. Variable Speed Limit Sign

11. LENGTH OF GRADUATED SPEED ZONES

A specific speed zone may be only a short segment of a graduated speed zone or may extend for many miles without changing.

The State of Florida has no minimum required length for speed zones, but traffic engineering judgment should be applied for zones that are short to the extent that require a driver to apply brakes to comply with the posted speed imit. Although deceleration rates vary with vehicle type and transmission, a minimum zone length, if the graduation of measured speeds is somewhat abrupt, should be based on normal engine and un-breaked deceleration. When spot speed studies show abrupt drops in the **85th** percentile speed, the 10 mph elements may be the better choice to increase the running length of zones.

Exceeding a 10 mph change in speed from one zone to the next is discouraged and violates the purpose of providing smooth transitions in realistic graduated speed restrictions.

Section 11-804(e) of the Uniform Vehicle Code and Model Traffic Ordinance (1992) which was developed by the National Committee on Uniform Traffic Laws and Ordinances, states the following regarding the number of alteration of speed restriction. “Not more than six such alterations as herein authorized shall be made per one mile along a street or highway, except in the case of reduced limits at intersections, and the difference between adjacent limits shall not be more than 10 miles per hour.”

12. AREA WIDE "BLANKET" SPEED RESTRICTIONS

Notwithstanding the declaration in ***Section 316.006(2), (3), F.S.*** that chartered municipalities and counties shall have original jurisdiction over all streets and highways located within their respective boundaries, except for state roads. Counties and municipalities may also exercise jurisdiction over any private road or roads, or over any limited access road or roads owned or controlled by a special district, located within its boundaries if the county/municipality and party or parties owning or controlling such road or roads provide, by written agreement approved by the governing body of the municipality, for municipal traffic control jurisdiction over the road or roads encompassed by such agreement.

Section 316.189, F.S. stipulates that the maximum speed within any municipality or county is 30 mph. Within residential districts, a municipality may set a maximum speed limit of 20 or 25 mph on local streets and highways after an investigation determines that such a limit is reasonable. Municipalities and counties may set speed zones altering such speeds, both as to maximum and minimum, after investigation determines such a change is reasonable and in conformity to criteria promulgated by the FDOT, except that no such speed zone shall permit a speed of more than 60 miles per hour.

Although ***Section 316.003, F.S.*** provides definitions for business and residential districts, the identification of such districts should not be left to driver judgment; rather, speed limit signs should be located at frequent intervals to inform drivers, particularly in areas that marginally meet the requirements in the definitions and where no alteration has been made by speed zoning methods described in this manual.

The word Municipal implies a domestic community or urban setting and, hence slower speed limits are State law. However, there are many municipalities that have rural or semi-rural conditions where the speed limit according to ***Section 316.189(1), F.S.***, is 30 mph. To alter these speed limits to a more realistic level, the methods and guidelines set forth in this manual must be used.

Section 316.003, F.S., defines Business and Residence as follows:
Section 316.003(4), F.S., Business District: "The territory contiguous to, and including, a highway when 50 percent or more of the frontage thereon, for a distance of 300 feet or more, is occupied by buildings in use for business."

Section 316.003(38), F.S., Residence District: "The territory contiguous to, and including, a highway, not comprising a business district, when the property on such highway, for a distance of 300 feet or more, is, in the main, improved with residences or residences and buildings in use for business."

This manual sets forth the FDOT criteria to establish specific speed zones and in no way provides a means whereby a blanket speed limit, such as 25 mph, can be enacted by local ordinance (often with signs placed at city limits declaring, 25 mph, UNLESS POSTED). To do so is contrary to the intent of the statutory 30 mph Blanket Speed

Limit, which only can be altered upward or downward on a location basis by the traffic engineering procedures described herein.

13. UNIFORM SPEED ZONING AND ENFORCEMENT

The quest for uniform traffic control devices (signs, signals, and markings) has been underway for more than 50 years in this country. Progress is on-going due to an excellent working relationship between the FDOT and the Federal Highway Administration (FHWA).

Uniform traffic control devices do not bring uniform traffic control unless uniform enforcement and uniform traffic laws and ordinances are perceived to be reasonable when applied to these devices and to driver performance. The State of Florida ranks very high in compliance to the Uniform Vehicle Code and the Model Traffic Ordinance developed by the National Committee on Uniform Traffic Laws and Ordinances www.ncutlo.org. Developing uniform speed zoning methods throughout all of Florida's local jurisdictions would be of questionable value if the enforcement of these and other restrictions were not applied uniformly.

While speed enforcement tolerances are rightfully the authority of law enforcement agencies and not traffic engineering, hopefully this activity is openly discussed and is a subject of concern for uniformity among law enforcement agencies statewide. Furthermore, the tolerances an enforcement agency expects to apply to speed zones must not affect the process of selecting the numeric speed zone limit; otherwise uniformity will not result.

The primary purpose of speed zoning is not intended to be a revenue producing program, contrary to the belief of some drivers and, unfortunately, to a few local jurisdictions.

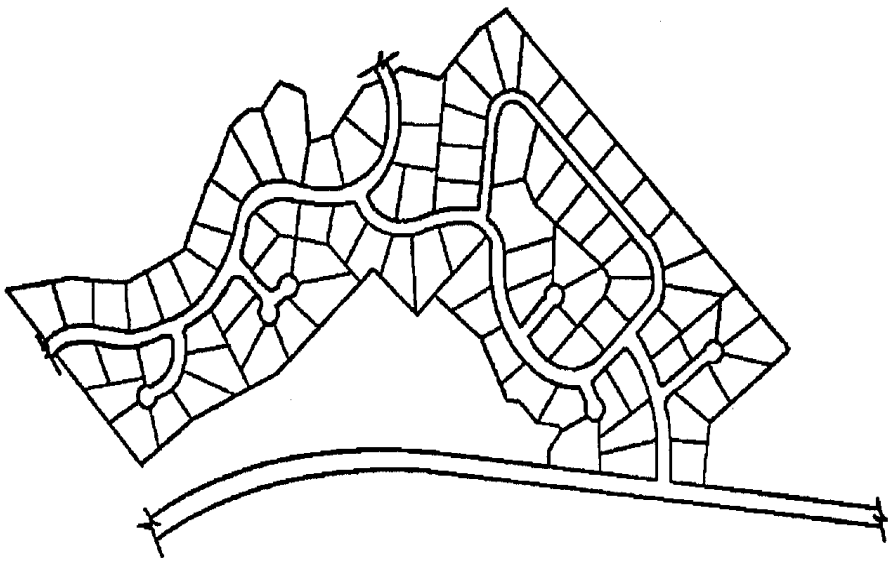
The FDOT encourages uniform speed signs, uniform development of numerical speed limits, uniform practice of enforcement to achieve its goals and objectives of better highway safety, higher respect for traffic control devices and laws, improved credibility between enforcement agencies, traffic engineering practice, with the driver, and ultimately the ability to actually influence vehicle speed when desired to bring about a reduction due to a condition ahead not readily evident to the driver.

14. SPEED ZONE LOCATIONS

14.1 SUBDIVISION STREETS

Street systems in older platted subdivisions are like the grid patterns common to urban areas, but many newer subdivisions are designed with streets that provide almost continuous horizontal curvature. In addition to their aesthetics, such winding streets discourage both higher driving speeds and through traffic. A typical subdivision pattern is illustrated in ***Figure 14-1***.

Figure 14-1. Typical Subdivision



Depending upon the design speed of the curves, the posting of speed regulatory signs with the blanket speed limit of 30 mph as provided in ***Section 316.189, F.S.***, may be inappropriate except that on tangent roadway sections with sufficient length that drivers would not be influenced by alignment curvature. ***Section 5 (Equipment, Conditions, and Data Collection Sites)***, cautions against making speed checks within horizontal curves and ***Section 15 (Other Speed Signs and Terms)***, refers to a method of arriving at an advisory speed for posting at horizontal curves. For continuous or near continuous curving roads of subdivisions streets, the use of spot speed studies, through data collection and computation of the **85th** percentile speed, is inappropriate for determining the posted speed.

If a subdivision is not completed, an engineering decision can be made on an appropriate posted speed based on anticipated driving speeds on winding, curving street alignments.

If the subdivision streets were completed, the third type of basic traffic investigation listed in ***Section 4 (Traffic Engineering Investigations)***, would apply. Test run speeds are used in lieu of data from the measured speed of many vehicles in order to arrive at a realistic speed limit.

- Except in rare cases, drivers' choice of speed is based on many factors, as outlined in ***Section 3.1 (Driver Behavior)***, of which speed signs are only one, and often a minor one.

- For speed limits to be of traffic safety value, they must be realistic and acceptable to most drivers. Use of realistic speed limits still results in 10 to 20 percent violation rate, which is as much as enforcement personnel can handle.

- Use of unrealistically low speed limits usually results in high violation rates and large variance in speed, which negates speed zoning.

- High violation rates far exceed a practical citation rate unless a mass, concentrated enforcement effort is applied, usually without measurable residual effect.

- Design speed has the greatest impact on actual operating speed in and adjacent to horizontal curves, where the driver/vehicle/roadway relationship dramatically affects the driver physically by centrifugal force.

14.2 DESIGN SPEED

AASHTO defines a roadway's design speed as "the maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern". This is the maximum speed prudent drivers would choose when ambient conditions are very good and traffic volumes are light. However, the assumption that a posted speed limit should not exceed a roadway's design speed is not all conclusive. There will be some instances where the observed **85th** percentile speed measures more than the actual roadway design speed. As an example, four or six lane long-tangent urban arterials with traffic signals spaced ½ mile or more and with ample sight distance may exhibit operating speeds of 50 to 60 mph in a 45 mph design speed zone. In this situation, posting a speed limit higher than the roadway design speed is permissible. Careful engineering judgment should be exercised to determine the speed zoning under investigation and if consistency in design speed along these highways have been implemented.

Any modification of posted speed limits after the construction of a State roadway project has been completed is a decision made under the authority of the District Traffic

Operations Engineer (DTOE), ***(Topic No. 750-010-011)***. This is based on the **85th** percentile speed determined through engineering and traffic investigations described in this ***Manual***. The DTOE typically conducts a speed investigation within one year after a new construction or reconstruction project is completed. When it is determined from this speed study that a posted speed higher than the original design speed is warranted, the DTOE working with the District Design Engineer (DDE) must process Design Exceptions or Variations for those design elements that do not meet the criteria for the higher speed. When agreement between the DDE and DTOE cannot be reached, the DDE and DTOE will forward the matter to the District Director of Transportation Development and District Director of Transportation Operations for final resolution.

For subdivision streets where adjacent development is anticipated within a reasonable time, design decisions should be based on traffic speed expected to occur from such development (residential home construction). Such design decisions would include cross section, degree of curvature, super elevation (if any), treatment of fixed objects, and/or tree removal.

An engineer cannot assume that a residential land use with a well designed road, particularly a main road fed by a network of other streets and/or carrying traffic through the subdivision, will operate at 30 mph. It is not uncommon for such streets to become semi-arterial and posted with 25 or 30 mph signs plus one of the many version of non-authorized CHILDREN PLAYING or PLAYGROUND **(W15-1)** signs which have no measurable benefits on traffic and may even have a negative safety effect by appeasing residents' concern about safety for children. Traffic safety would be improved if residential lots on such roads had substantial building setbacks to lessen the likelihood of; (1) children playing in the streets, and (2) residents' vehicles being parked on or parallel to the street.

14.3 STATE PARKS

The street system within State Parks presents a unique situation of determining the appropriate speed to be posted. State Park roadways are intended for leisurely driving and recreation, contrary to the purpose of all other highways.

Section 316.187(2) (c), F.S. authorizes the FDOT to set maximum and minimum speed limits for travel over other roadways under it's' authority as it deems safe and advisable (not to exceed a maximum limit of 60 mph). Since the intent of State parks roadways is to produce an attitude of relaxation and leisure, the posted speed limit shall be 25 mph. However, at more congested centers and near park buildings, beaches, picnic, campground, and play areas, the appropriate posted speed limit is 15 mph. These speeds, 15 and 25 mph, are based on engineering judgment due to the types of activities that are expected within their respective zones. An engineering and traffic investigation is still necessary in order to determine the limits of each speed zone. Speed limits with state Parks, other than 15 or 25 mph, shall not be posted unless and until such speed is deemed appropriate on the basis of an engineering study.

14.4 WORK ZONES

The goal of traffic control for construction, maintenance, and utility operation within Temporary Traffic Control (TTC) work zones, is to route traffic through such areas in a manner as closely and safely comparable to normal roadway conditions. ***Section 6A.01 of the MUTCD*** states the following:" TTC plans and devices shall be the responsibility of the authority of a public body or official having jurisdiction for guiding road users. There shall be adequate statutory authority for the implementation and enforcement of needed road user regulations, parking controls, speed zoning, and the management of traffic incidents. Such statutes shall provide sufficient flexibility in the application of TTC to meet the needs of changing conditions in the TTC zone."

Section 337.11(13) F.S. states "Each contract let by the department for performance of road or bridge construction or maintenance work must contain a traffic maintenance plan which shows the appropriate regulatory speed signs and traffic control devices for the work zone area as defined in s. 316.003."

Regulatory speed establishment or change thereof must be made on the basis of an engineering and traffic investigation as required by ***Section 316.187, F.S.*** Preparing and documenting the engineering and traffic investigation for work zones is significantly different than for the establishment of normal regulatory speeds. This is due to the changing phases of work zones and that it is neither appropriate nor feasible to establish regulatory speeds in work zones based on the **85th** percentile criteria. Regulatory speeds through work zones must be established on existing or anticipated field conditions using engineering judgment. The field conditions that should be considered are:

- Traffic volumes
- Construction phasing,
- Lane restrictions
- Type of construction
- Proximity of construction workers
- Use of concrete barriers
- Type of equipment
- Flagger usage
- Pedestrian activity and volume
- Detour geometry.

Other conditions may need to be addressed on a project by project basis. The design engineer of record will conduct an engineering and traffic investigation of the work zone project and maintain engineering records consisting of the design and the Maintenance of Traffic control plans as a subset of the approved construction plans. If a roadway condition under construction warrants a change in the posted regulatory speed limit, the field engineer recommending the change must provide a signed and sealed engineering and traffic investigation report addressing the conditions requiring the proposed change in the existing regulatory posted speed limit.

Regulatory speed signs should be used on all construction, maintenance, and utility operations, whenever practical, in lieu of advisory speed plates. There may be circumstances when advisory speeds are posted until such time as regulatory speeds can be justified and installed. Such circumstances may include roadway emergencies where maintenance personnel must respond immediately or for unforeseen circumstances in a construction work zone which may warrant speed reduction.

Generally, speed should not be reduced more than 10 mph below the posted regulatory speed except in emergency situations or extremely unusual conditions. When reductions exceed 10 mph, the reduction should be accomplished in 10 mph increments. When establishing the appropriate regulatory speed for each phase of the maintenance of traffic, the engineer should generally establish one speed for the entire phase and avoid instances that would require multiple changes of regulatory speeds within each phase.

The engineer should also consider the guidelines included in the ***FDOT's Plans Preparation Manual*** when determining the need for speed restrictions.

In no case, should the speed limit be reduced below the minimum regulatory speed established by Florida Statute for that class of facility.

14.5 REST AREAS

Advisory exit, ramp and curve speed signs are covered in ***Section 2C.36 of the MUTCD***. However, the appropriate regulatory speed limits within the rest area itself are not addressed.

Determining speed limits in the rest area through traffic observation studies is generally not feasible. Since there are numerous parking maneuvers and uncontrolled pedestrian movements, the engineer's experience and judgment will play an important part in establishing a reasonably safe speed limit through this area.

Posted speeds of 15 mph for congested portions of the rest area and 25 mph in the other portions are generally appropriate.

14.6 ENVIRONMENTAL SENSITIVE AREAS

Department coordination will be required between the District Traffic Operations office and the District Environmental Management Office when speed limits are to be established or increased on facilities which pass through, or are adjacent to, public lands being managed for wildlife protection.

Coordination shall include, but not be limited to,

(a) A joint evaluation of the history of transportation related wildlife mortality along the proposed area, when needed.

(b) Updated statewide maps and/or lists that show environmentally sensitive areas.

It will be the responsibility of the applicable FDOT District Environmental Office to coordinate with the Office of Environmental Services of the Florida Wildlife Commission (FWC) and any other local, state, or federal agency having management responsibilities over the adjacent land. Lands to be considered as those “managed for wildlife values” shall be all state and federal wildlife refuges, management areas, forests, parks, and lands owned by the water management districts. Also included shall be those privately owned lands which have been previously identified by the FWC as areas of a high incidence of transportation related wildlife mortality.

15. OTHER SPEED SIGNS AND TERMS

In addition to the speed zoning procedures and speed signs discussed in this manual, there are several other speed signs that merit inclusion and acknowledgement. They fall into four main categories; Time Period Speed (Regulatory), Advisory Speed (Warning), Road or Bridge Special Temporary Speed Restrictions (Regulatory), and Electronic Feedback Speed (Regulatory).

15.1 TIME PERIOD SPEED (REGULATORY)

Most commonly used at school zones, a special lowered speed limit during specific time periods is based on considerations other than the **85th** percentile speed. The speed limit selection decision depends on such things as:

- Age of children
- Normal approach speed of traffic
- Sight distance
- Number of vehicles
- Width of street
- Presence of other traffic control devices
- Use of adult and/or school children crossing guards, etc.

Establishment of lowered speed zones for schools shall be in accordance to ***Section 316.1895, F.S.*** School zone traffic signs and pavement markings are described in Part ***7*** of the ***MUTCD***, and are referred in ***Section 316.189, F.S.***

Electronic Feedback Speed signs (see **Section 15.4**) may be used in conjunction with the school zone time period speed signs provided they meet the guidelines set forth in ***MUTCD*** and this ***Manual***.

15.2 ADVISORY SPEED (WARNING)

Advisory speed signs are warning signs and are intended to display recommended maximum comfortable and safe speed rather than the maximum legal speed as displayed on regulatory signs used for speed zoning. Hence, their colors are black legend on yellow background (black legend on orange background for work site application) rather than black legend on white background. The ***MUTCD*** illustrates two types of these signs in ***Section 2C.30***.

The Advisory Speed (W13-1) plaque may be used to supplement any warning sign to indicate the advisory speed for a condition. According to ***MUTCD***, “The Advisory Speed plaque shall be used where an engineering study indicates a need to advise road users of the advisory speed for a condition. If used, the Advisory Speed plaque shall carry the message XX km/h (XX MPH). The speed shown shall be a multiple of 10 km/h or 5 mph except in emergencies or when the condition is temporary, an Advisory Speed plaque

shall not be installed until the advisory speed has been determined by an engineering study."

Advisory speed signs are not meant to show a speed beyond which a vehicle will spin out (if on a horizontal curve) or bottom out (if used for a dip or hump in the roadway). Rather, they allow for a comfortable margin of safety because of variations in vehicle and pavement characteristics.

Road user surveys have indicated a lack of faith in the numerical values posted on horizontal curve speed signs. This is understandable and due primarily to the common misunderstanding of many drivers and practitioners responsible for their installation as to their true purpose and meaning. As experienced with realistic speed limit signs, advisory speed warning signs can gain driver confidence and credibility and become effective tools only when uniformly is used to communicate important information in the interest of traffic safety.

Advisory speed warning signs are not to be used as enforceable speeds, although a violation of them is sometimes used by enforcement officers in support of other traffic violation charges.

Electronic Feedback Speed signs, see ***Section 15.4***, may be used in conjunction with advisory signs or plaques provided that they meet the following guidelines: ***Section 2B.13 of the MUTCD*** "If a changeable message sign displaying approach speeds is installed, the legend YOUR SPEED XX km/h (MPH) or such similar legend should be shown. The color of the changeable message legend should be a yellow legend on a black background or the reverse of these colors".

The displayed advisory warning speed:

- Is approximately 75 percent of the maximum safe speed for an average passenger car;
- Is the speed at which driver discomfort begins;
- Is the speed beyond which loose items may shift in a vehicle;
- Is based on an average passenger car, typically loaded;
- May be too high for a top-heavy truck;
- May be too low for a sports car;
- May not be too low with loose gravel, sand, or ice on the road.

A special type of spot speed study is conducted to determine the maximum speed at which a horizontal curve can be negotiated comfortably. The equipment includes a driver, and a test car with ball bank indicator. For more detail on the study techniques refer to ***Chapter 13 (Vehicle Spot Speed Study) of the*** **MUTS**. The **MUTS** Manual is available online at the following web site:

http://www.dot.state.fl.us/trafficoperations/Operations/Studies/MUTS/MUTS.shtm

For information on the availability of equipment and more detail on study techniques for advisory speeds, you may contact one of the FDOT District Offices listed in the Appendix.

Advisory speed signs used to supplement warning signs such as DIP (W8-2), BUMP (W8-1), HUMPBACK BRIDGE, etc., are based on test runs using an average passenger car and traffic engineering judgment.

This test run method in addition to the ball-bank indicator is also applicable to spiral curve ramps which are not equal tangent circular curves or broken back curves (two or more consecutive curves with short tangents between them).

The need for advanced mainline signing of advisory ramp or exit speeds increases proportionately to the difference between the mainline speed and the advisory speed. The greater the difference, the greater the need for more advance signing. However, ***Section 2E-10 of the MUTCD*** cautions that mainline warning signs when placed on an overhead sign structure or on its support, must be considered as one of the maximum of three signs which can be displayed. Furthermore, advisory Exit Speed signs are not recommended for typical diamond interchange ramps. Signs for these straighter, higher speed exit ramps should be STOP AHEAD (W3-1) or SIGNAL AHEAD (W3-3) as symbols or an optional message sign, whichever is appropriate.

15.3 ROAD OR BRIDGE SPECIAL RESTRICTIONS (REGULATORY)

Due to the physical deterioration or damage to road pavements, sub grades, or bridge structures, it may be necessary to reduce the speed limits and/or vehicle load limits temporarily until reconstruction and/or repair work can be scheduled and completed. Usually, the speed reduction would apply to heavier vehicles, but in the interest of public safety, as well as minimizing further road or bridge damage, a regulatory speed for passenger cars also may become necessary.

The engineering choice of speed limits for this purpose is not addressed by this manual, but the procedures for locating signs, identifying the zones, etc., is covered.

15.4 ELECTRONIC FEEDBACK SPEED (REGULATORY)

An Electronic Feedback Speed sign (also called a driver feedback sign, changeable message sign, or variable message sign) is an interactive sign, generally constructed of a series of LEDs that displays vehicle speed as drivers approach. The purpose of this new type of regulatory signs is to reduce vehicle speed by making drivers aware of their approaching speed relative to the posted speed limit. ***Section 2B.13 of the MUTCD*** permits the use as follows: “A changeable message sign that displays to approaching drivers the speed at which they are traveling may be installed in conjunction with a Speed Limit sign”.

16. SPEED ZONE ESTABLISHMENT AND RECORDS

Although Florida Statutes prescribe certain procedures to gain official approval for speed zone alterations on the State Highway System, once the studies and recommendations have been made, such procedures are not prescribed for county and city roads and streets.

Section 335.10, F.S., as amended, requires the FDOT to prescribe regulations (including speed zones) for vehicles operating on the State Highway System. The ***FDOT Topic Number 750-010-11, Traffic Regulation Approval Process*** complies with this statutory requirement. Notice of speed zoning changes are provided in writing by certified mail, return receipt requested, to each local governmental entity where the regulation will apply, at least 14 days prior to implementation. Formal documentation of such notices is maintained in the FDOT District Offices.

Any speed zone alteration on county or city roads or streets should be approved by action of a council or commission and entered into the records for that body, unless that agency authorizes and delegates an officer or person (by title) to determine and maintain a record system on speed zoning as determined by that office or person in accordance with the methods outlined in this manual.

Records typically should contain a Speed Zone Map or Straight Line Diagram as shown in **(Figure 16-1A and 16-1B)**. A Spot Speed Study summary **(Figure 16-2)**, the Speed Zone Regulation including the date approved, from-to mileposts, the numerical limits and physical locations **(Figure 16-3)**; and finally, the locations and dates of Speed Regulation Sign Installations.

It may seem excessively precise to carry milepost values to three decimal places, but each 0.001 mile is 5.28 feet. Descriptions of sign locations sometimes require even more than 5.28 feet accuracy, such as a sign to be located on a lot line between two residences or in a critical location to avoid driveways, other signs, and obstructions which might block it from view. So even with milepost, a State Plane Coordinate node or a specific physical description may be crucial

Changes in street characteristics and adjacent land use conditions commonly require a re-examination of speed limits. Although the most common numerical change is downward (assuming the existing limits are realistically established by the methods outlined in this manual), it is not uncommon for a speed limit to rise, particularly when major construction changes to the roadway and improvements to traffic control devices (signs, signals, lighting, and markings) cause traffic operational efficiency and safety to increase

It is advisable to change from one numerical speed zone to another just upstream and downstream from an intersection such as 35 mph, from 12th Street South to Frederick Street (Traffic Signals 99, 100, 101 and 61, **Figure 16-1B**), because this leaves no doubt as to the speed limit within the intersections where crashes are most likely to occur.

16.1 RECORD KEEPING AND CONTINUITY

Officials are sometimes asked to provide records showing the official approval of speed zone alterations in litigation proceedings on some traffic crash or speed citation cases. Litigants may ask for the date the signs were put up, along with work order completion forms signed by the person doing the sign installation, or his supervisor. Maintaining such detailed records as this may seem unnecessary, but if done on a routine basis, is neither difficult nor time consuming. Such records provide more accurate evidence in court for proper adjudication of traffic crash and speed citation cases.

It would seem obvious that a speed zone once begun must end and, unless the road ends, must co-terminate with another speed zone. It is not uncommon on rural roads to find a realistic speed become unrealistic, simply because it isn't explicitly terminated. Without any additional speed signs for miles beyond, this practice must puzzle both drivers and enforcement officers.

Care also must be exercised to assure a speed zone does not change simply because the road or street enters another agency's jurisdiction. Coordination of speed zoning between the two agencies and use of the methodology in this manual will provide the highest degree of uniformity and safety.

Figure 16-1A. Straight Line Diagram

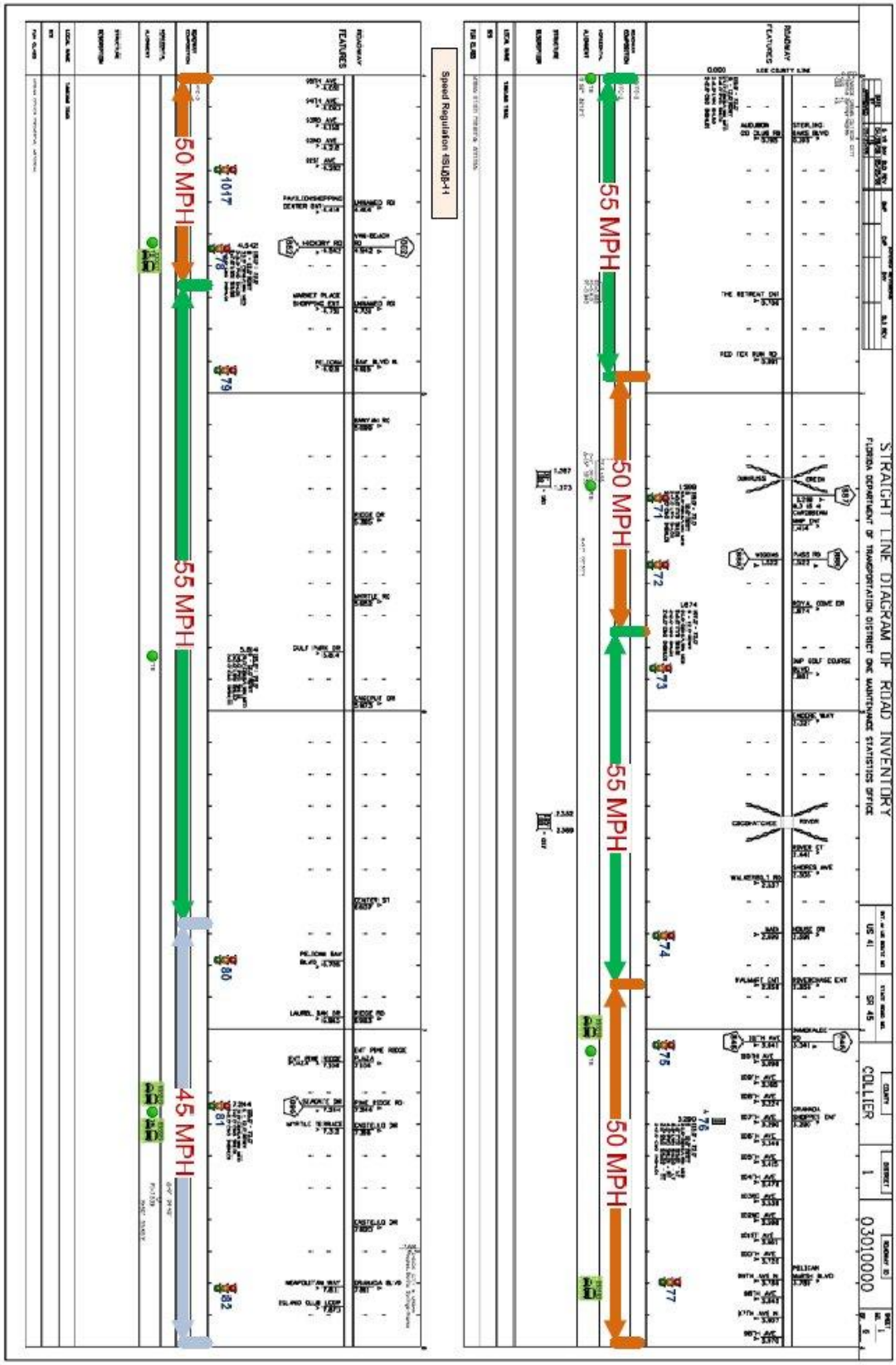


Figure 16-1B. Straight Line Diagram

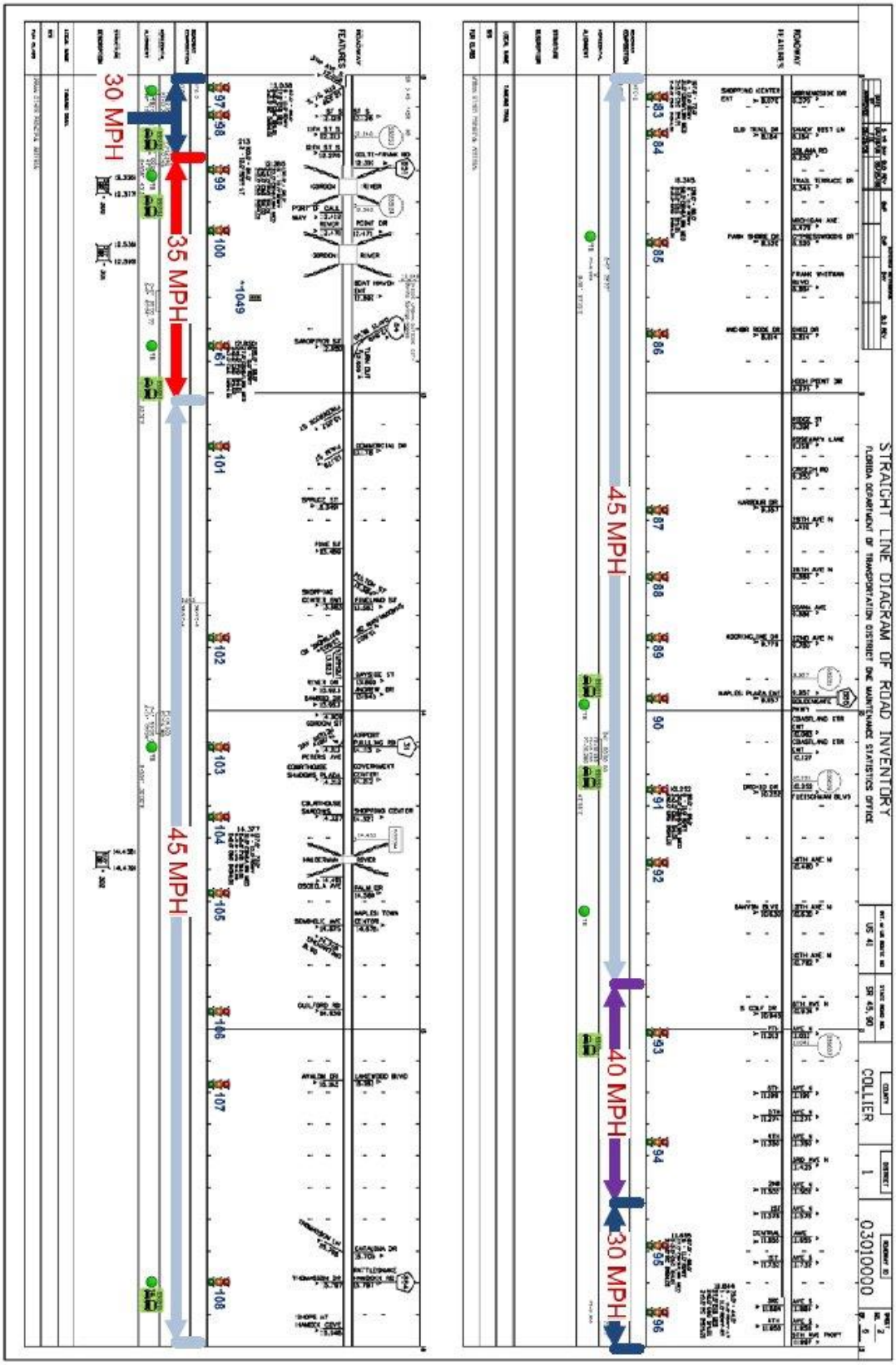


Figure 16-2. Spot Speed Study Summary

SPOT SPEED STUDIES							
State Road No. 45		**Roadway ID:**	03010000	**District:**	1	**County:**	Collier
Study	**Date**	**Direction**	**85th %**	**MilePost**		**Study Location**	
1	05/22/06	NB	54	0.564		750 ‘ N. of The Retreat Entrance	
		SB	56				
2	05/22/06	NB	49	1.200		523’ N. of Old US 41	
		SB	50				
3	05/22/06	NB	55	2.80		449’ N of Riverchace Entrance	
		SB	57				
4	05/22/06	NB	48	3.538		Corner of 103rd Ave.	
		SB	51				
5	05/23/06	NB	52	5.514		100’ N. of Gulf Park Drive	
		SB	55				
6	05/23/06	NB	42	7.791		100’ N. of Neapolitan Way	
		SB	48				
7	05/23/06	NB	43	9.233		100’ N. Creech Road	
		SB	47				
8	05/23/06	NB	25	11.844		200’ N. of 3rd Avenue	
		SB	24				
9	04/18/08	NB	46	13.783		100’ N. of Shadowlawn Drive	
		SB	42				
10	04/18/08	NB	51	15.372		1000’ S. of Avalon Drive	
		SB	51				

Figure 16-3. Speed Zone Regulation

SPEED ZONE REGULATION						
Traffic Regulation Number 1SL08-11			**Date Approved: 11/24/2008**			
State Road No. 45	**Roadway ID:**	03010000	**District:**	1	**County:**	Collier
Milepost From	**Milepost To**	**Speed (MPH)**	**Length (Mi)**		**Location**	
0.000	0.964	55	0.964		From County line to 1,760' North of C.R. 887.	
0.964	1.735	50	0.771		From 1,760' North of C.R. 887 to 1,125' South of C.R. 888.	
1.735	2.862	55	1.127		From 1,125' South of C.R. 888 to 945' South of C.R. 846.	
2.862	4.666	50	1.804		From 945' South of C.R. 846 to 650' South of C.R. 862	
4.666	6.685	55	2.019		From 650' South of C.R. 862 to 530' North of Pelican Bay Boulevard.	
6.685	10.816	45	4.131		From 530' North of Pelican Bay Boulevard to 690' North of S. Golf Drive.	
10.816	11.566	40	0.750		From 690' North of S. Golf Drive to 60' North of 1st Avenue North.	
11.566	12.265	30	0.699		From 60' North of 1st Avenue North to 230' North of Goodlette Frank Road.	
12.265	13.037	35	0.7.22		From 230' North of Goodlette Frank Road to 79' North of Frederick Street.	
13.037	16.224	45	3.187		From 79' North of Frederick Street to 980' South of Valleystreem Drive.	
16.224	19.883	55	3.659		From 980' South of Valleystreem Drive to 240' North of Price Street/Triangle Boulevard.	

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

VEHICLE SPOT SPEED STUDY

FORM 750-010-03
TRAFFIC ENGINEERING
03/2010 ASE

LOCATION ID:	SECTION:
LOCATION:	MP :
POSTED SPEED (mph):	COUNTY:
DATE:	PAVEMENT CONDITION:
OBSERVER:	TIME FROM: TIME TO:
REMARKS:	

NUMBER OF VEHICLES		BOUND				SPEED	NUMBER OF VEHICLES				BOUND		BOTH DIRECTIONS	
CUM. TOTAL	TOTAL	20	15	10	5	BIN (mph)	5	10	15	20	TOTAL	CUM. TOTAL	TOTAL	CUM. TOTAL
						≥ 80								
						78 - 79.9								
						76 - 77.9								
						74 - 75.9								
						72 - 73.9								
						70 - 71.9								
						68 - 69.9								
						66 - 67.9								
						64 - 65.9								
						62 - 63.9								
						60 - 61.9								
						58 - 59.9								
						56 - 57.9								
						54 - 55.9								
						52 - 53.9								
						50 - 51.9								
						48 - 49.9								
						46 - 47.9								
						44 - 45.9								
						42 - 43.9								
						40 - 41.9								
						38 - 39.9								
						36 - 37.9								
						34 - 35.9								
						32 - 33.9								
						30 - 31.9								
						28 - 29.9								
						26 - 27.9								
						24 - 25.9								
						22 - 23.9								
						20 - 21.9								
						18 - 19.9								
						16 - 17.9								
						14 - 15.9								
						12 - 13.9								
						10 - 11.9								
						≤ 10								
		TOTALS									TOTALS			

SPEED DATA SUMMARY			
85th PERCENTILE SPEED			
10 mph PACE			