**FLORIDA TECHNOLOGY TRANSFER**

**TRAFFIC INFORMATION PROGRAM SERIES (TIPS)**

**From the Florida Section (**District 10) of the

Institute of Transportation Engineers

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The Florida Section (District 10) of the Institute of Transportation Engineers has produced a series of information and fact sheets that address common questions relating to transportation. The Traffic Information Program Series (TIPS) answer frequently asked questions about many aspects of transportation planning, traffic operations and traffic control. The TIPS are written in lay language so they serve as an information source not only for transportation professionals, but for the general public as well.

The TIPS are produced as a public service by the Florida Section of the Institute of Transportation Engineers, John T. Izzo, P.E., editor. The TIPS are published in the Florida Section Institute of Transportation Engineers newsletter, FSITE, and are reprinted by the Florida Technology Transfer (T2) Center at the University of Florida.



If you have a hot TIP you'd like to share with others, contact the T2 Center and we'll put you in touch with the TIPS coordinator.

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## WON'T A 'TRAFFIC SIGNAL' REDUCE CRASHES AT OUR INTERSECTION?

Traffic signals don't always prevent crashes. In many instances, the total number of crashes and injuries increase after they're installed.

Where signals are used unnecessarily, the most common results are a reduction in right-angle collisions but an increase in total crashes, especially the rear-end type collision. In addition, pedestrians are often lulled into a false sense of security.

In deciding whether a traffic signal will be an asset and not a liability, traffic engineers evaluate the following criteria:

1. Does the number of vehicles on intersecting streets create confusion or congestion?
2. Is traffic on the main street so heavy that drivers on the side street will try to cross when it is unsafe?

3. Does the number of pedestrians trying to cross a busy main street create confusion, congestion or hazardous conditions?

4. Does the number of school children crossing a street require special controls for their protection? If so, is a traffic signal the best solution?

5. Will the installation of a signal allow for continuous, uniform traffic flow with a minimum number of vehicle stops?

6. Does an intersection's crash history indicate that a signal will reduce the possibility of a collision?

Traffic engineers compare the existing conditions against nationally accepted minimum standards established after many years of studies throughout the country. At intersections where standards have been met, the signals generally operate effectively with good public compliance. Where not met, compliance is generally reduced resulting in additional hazards.

While a properly placed traffic signal improves the flow and decreases crashes, an unnecessary one can be a source of danger and annoyance to all who use an intersection: pedestrians, cyclists and drivers.

## WON'T A 'STOP SIGN' SLOW TRAFFIC ON OUR STREET?

Stop signs installed in the wrong places for the wrong purposes usually create more problems than they solve.

One common misuse of stop signs is to arbitrarily interrupt traffic, either by causing it to stop or by causing such an inconvenience that motorists are forced to use other routes. Studies made in many parts of the country show that there is a high incidence of intentional violations where stop signs are installed as "nuisances" or "speed breakers". These studies showed that speed was reduced in the immediate vicinity of the "nuisance" stop signs. But, speeds were actually higher between intersections than they would have been if these signs hadn't been installed.

At the right place and under the right conditions, a stop sign tells drivers and pedestrians who has the right of way. Nationally recognized standards have been established to determine when stop signs should be used. These standards, or "warrants", take into consideration, among other things, traffic speed and volume, sight distance and the frequency of traffic "gaps" which will allow safe vehicle entry or pedestrian crossing.

Most drivers are reasonable and prudent. But, when confronted with unreasonable restrictions, they frequently violate them and develop a general contempt for all traffic controls--often with tragic results.

## WHY NOT 'LOWER THE SPEED LIMIT' TO REDUCE HAZARDS IN OUR AREA?

An unrealistically low speed limit can actually lead to crashes. Here's why:

First, many studies conducted over several decades in all parts of the country have shown that a driver's speed is influenced more by the appearance of the roadway and the prevailing traffic conditions than it is by the posted speed limit.

Second, some drivers will obey the lower posted speed while others will feel it's unreasonable and simply ignore it. This disrupts the uniform traffic flow and increases crash potential between the faster and the slower drivers.

Third, when traffic is traveling at different speeds, the number of breaks in traffic to permit safe crossing is reduced. Pedestrians also have greater difficulty in judging the speed of approaching vehicles.

Florida Statutes, Chapter 316.183 deals with unlawful speed. This law states that "No person shall drive a vehicle on a highway at a speed greater than is reasonable and prudent under the conditions, and having regard to the actual and potential hazards, then existing."

Florida Statutes, Chapter 316.187 authorizes the Florida Department of Transportation (FDOT) to set maximum and minimum speed limits for travel over these roadways under its authority as it deems safe and advisable, not to exceed 55 miles per hour.

Florida Statutes, Chapter 316.189 presents the authority for establishment of municipal and County speed zones on roads maintained by these agencies. This section indicates that the maximum speed on any municipal or County-maintained road is 30 miles per hour. However, the municipality or County may set speed zones altering such speeds, both as to maximum and minimum after investigation determines such a change is reasonable and in conformity with Florida Department of Transportation criteria.

## WON'T A 'CHILDREN AT PLAY' SIGN HELP PROTECT OUR KIDS?

At first consideration, it might seem that this sign would provide protection for youngsters playing in a neighborhood. It doesn't.

Studies made in cities where such signs were widely posted in residential areas show no evidence of having reduced pedestrian crashes, vehicle speed or legal liability. In fact, many types of signs which were installed to warn of normal conditions in residential areas failed to achieve the desired safety benefits. Further, if signs encourage parents with children to believe they have an added degree of protection--which the signs do not and cannot provide--a great disservice results.

Obviously, children should not be encouraged to play in the roadway. The "children at play" sign is a direct and open suggestion that it is acceptable to do so.

Federal standards discourage the use of "children at play" signs.

Specific warnings for schools, playgrounds, parks and other recreational facilities are available for use where clearly justified.

## WHY CAN'T WE USE 'SPEED BUMPS' ON OUR BLOCK?

The speed bump is an increased hazard to the unwary ... a challenge to the daredevil ... a disruption of the movement of emergency vehicles ... and the cause of an undesirable increase in noise.

Courts have held public agencies liable for personal injuries resulting from faulty design. Because speed bumps have considerable potential for liability suits, many officials have rejected them as a standard traffic control device on public streets.

In addition, tests of various experimental designs have demonstrated the physical inability of a speed bump to successfully control all types of light-weight and heavy-weight vehicles. The driver of a softsprung sedan is actually encouraged to increase speed for a better ride over a bump that may cause other motorists to lose control.

The control of speeding in residential neighborhoods is a widespread concern which requires persistent law enforcement efforts ... not speed bumps.

## HOW CAN WE GET 'BIKEWAYS' IN OUR NEIGHBORHOOD?

Bikeways have created a lot of interest in recent years. Some agencies have built separate off-road bike paths, while many more have painted bike lanes on streets. Other communities have installed green "Bike Route" signs in neighborhoods and park systems without the special lanes. Different types of bike

facilities meet the needs of different types (classes) of bicyclists.

Experienced adult bicyclists prefer to ride on the road with the flow or traffic, with bike lanes to separate them from motor vehicles. Novice or child bicyclists prefer off-road bike paths.

The cost of building and maintaining bikeways can be a deterrent to may bike programs. Initial cost can range from a few dollars to paint a lane, to a small fortune to build a separate path including special bridges and railings where needed. Funding may be available from ISTEA or "Roadway Enhancement" funds. Such projects must be submitted through an established procedure.

An overall bicycle safety program should include: enforcement of traffic laws: bike safety training in the schools at an early age: follow-up training every year in the schools and involvement of the parents of minor children who violate traffic laws or exhibit dangerous riding habits.

The bike program for a community should include three principal features:

Education in safety riding practices

Enforcement of rules of the road

Development of well-engineered bike lanes and bike paths

This will involve the active participation of:

School Officials

Law Enforcement Officials

Traffic Engineers and of course, you, the citizen

REMEMBER: AT NIGHT, FLORIDA LAW REQUIRES LIGHTS ON BOTH THE FRONT AND REAR OF ALL BICYCLES. (Over 60% of Florida bike fatalities occur at night.)

(Revised 12/95)

## ARE 'TRAFFIC CONTROL DEVICES' ON PRIVATE PROPERTY REQUIRED TO MEET STATE STANDARDS?

State law requires traffic control devices, including those signs and pavement markings on private property where the public is invited, to meet State standards adopted by the Florida Department of Transportation. Florida Statutes, Section 316.0747 state: "It is unlawful for any nongovernmental entity to use any traffic control device at any place where the general public is invited, unless such device conforms to the uniform system of traffic control devices adopted by the Department of Transportation pursuant to this Chapter."

The "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD) published by the U.S. Department of Transportation is the national standard for Traffic Control Devices. The Florida Department of Transportation has adopted the MUTCD as the State standard by Rule 14-15.10.

The "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" may be purchased for $44.00 plus $5.00 shipping and handling from: Institute of Transportation Engineers, 525 School Street, S.W., Suite 410, Washington D.C. 20024-2729. Phone: (202) 554-8050.

The MUTCD states that: Parking space striping must be white (Sec. 3B-19).

Lane Lines between traffic lanes in the same direction, must be white (Sec. 3B-2).

Centerlines between traffic in opposing direction, must be yellow (Sec. 3B-1).

Arrows on the pavement must be white (Sec. 3B-20).

Crosswalks and Crosswalk lines must be white (Sec. 3B-18).

Stop Lines (Stop Bars) must be white (Sec. 3B-17).

Street Name Signs must have 4" high lettering and should be reflectorized (Sec. 2D-39).

SIGN INSTALLATION: In business, commercial or residential districts where parking and/or pedestrian movement is likely, the clearance to the bottom of a sign shall be at least 7 feet above the edge of the pavement. In rural areas, the clearance to the bottom of a sign shall be at least 5 feet above the edge of the pavement (Sec. 2A-23).

Lateral clearance for regulatory and warning signs or small directional signs should be 6 to 12 feet from the edge of the pavement or traveled way in rural areas. In urban areas, signs generally are mounted alongside the roadway in the space between the curb and the sidewalk. Although 2 feet is recommended as a working urban minimum, a clearance of 1 foot from the curb face is permissible where sidewalk width is limited (Sec. 2A-24).

STANDARD SIZES, (SHAPES) AND ORDER CODES OF SIGNS:

STOP: 30" (OCTAGON), ORDER CODE R1-1

YIELD: 36" (EQUILATERAL TRIANGLE), ORDER CODE R1-2

NO TURN (SYMBOL): 24"x24" (SQUARE), ORDER CODE R3-1R, R3-2L OR R3-3

DO NOT ENTER: 30"x30" (SQUARE), ORDER CODE R5-1

REGULATORY (SPEED LIMIT, KEEP RIGHT): 24"x30" (RECTANGLE), ORDER CODE R2-1, R4-7

WARNING (RIGHT OR LEFT CURVE, NO OUTLET...): 30"x30" OR 36"x36" (DIAMOND)

STREET NAME: 6" HIGH WITH/4" HIGH LETTERING (RECTANGLE), ORDER CODE D3-X

HANDICAPPED PARKING: 12"x18" (RECTANGLE), ORDER CODE R7-8

ONE WAY: 36"x12" OR 18"x24" (RECTANGLE), ORDER CODE R6-2R (OR L); R6-1R (OR L)

## HAVE YOU THOUGHT ABOUT THE IMPACT OF 'HIGHWAY SIGNS' ON TRAFFIC SAFETY?

As a motorist or pedestrian, have you noticed changes in traffic signs you see along the roadways? New colors, shapes, symbols and messages are now helping you as the result of many years of worldwide research and engineering development by Transportation Engineers.

The MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) gives Transportation Engineers the uniform standards to safely assist motorists as they travel. It defines a series of uniform signs which are clear in their messages as applied on the nation's roadway system.

Symbols have replaced word messages whenever appropriate. The MUTCD has adopted standard sign and pavement marking colors and shapes to help today's motorists to better understand the rules of the road.

The use of specific colors is designed to promote instant recognition of sign and pavement markings messages.

The color RED, is used exclusively to indicate a stop or prohibition. The red "STOP" and "DO NOT ENTER"

signs are examples of a "Stop message", while red on white parking signs indicate that parking is not allowed.

GREEN is the color which indicates a "Go" condition, or gives the motorist directional guidance. Virtually all guide signs on the Interstate System have a green background and local roadways are following suit. A parking regulation sign with green text indicates that parking is allowed.

BLUE is a sign color which directs motorists to services that are available. The "H" hospital sign, the telephone symbol sign, as well as food-gas-lodging signs which are located at many highway interchanges are examples of this use.

YELLOW is used for warning signs which alert the motorist to a changing condition in the roadway ahead. "SIGNAL AHEAD", "SCHOOL CROSSING", "LOW CLEARANCE", and "NO PASSING" zone signs are examples.

A BLACK LEGEND ON A WHITE BACKGROUND indicates a regulation. "LEFT LANE MUST TURN LEFT" and "SPEED LIMIT 55" are typical examples.

ORANGE signs indicate that a motorist is approaching a construction and/or maintenance area.

BROWN is the background color for information about public parks and recreational areas.

Transportation Engineers have also reserved the shape of traffic control signs for specific types of messages. With only a quick glance, a motorist can tell the type of message by the shape of the sign.

The DIAMOND shaped sign is always used to issue a warning to the motorist. This diamond sign can warn of a pedestrian crossing, traffic signals, slippery pavement or curve in the roadway.

A RECTANGULAR sign with its longer side vertical signifies a traffic regulation. "KEEP RIGHT", "DO NOT PASS" and "NO U TURN" signs are examples.

RECTANGULAR SIGNS with the longer dimension horizontal are intended to give guidance information. "BIKE ROUTE", "FOOD-PHONE-GAS-LODGING", and directional signs fall into this category.

An OCTAGON is only used for a "STOP" sign and has no other legal use relative to traffic control devices.

An INVERTED TRIANGLE is the only way the Transportation Engineer signifies a "YIELD" condition.

A PENNANT shaped sign indicates that "NO PASSING" is allowed.

A PENTAGON sign is restricted to school zones. A pentagon sign with the silhouette of children walking signifies the beginning of school property while the same sign, with the addition of a crosswalk shown on it, indicates the school crossing point.

A CIRCULAR sign is used only at railroad crossings.

Strict criteria have been developed by the Florida Department of Transportation to control the use of traffic generator signs such as those used to guide traffic to business establishments.

Transportation Engineers attempt to minimize the amount of time a motorist's eyes must be diverted from the roadway to perceive sign messages. The next time you take a ride through your area, take a good look at the highway signs. They are examples of how Transportation Engineering research works to make your driving safer.

## HAVE YOU THOUGHT ABOUT THE IMPACT OF HIGHWAY 'PAVEMENT MARKINGS' ON TRAFFIC SAFETY?

Pavement markings have definite and important functions to perform in the area of traffic control. They may be used to supplement the regulations or warnings of other devices, such as the use of stop bars in

conjunction with traffic signs or signals. They may be used alone to produce results that cannot be obtained by any other device, such as guidance on winding roads and around fixed objects near the highway.

The Federal Highway Administration adopted the "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" to provide a standard for traffic control devices. This manual has been adopted by most states including Florida.

Pavement markings are generally yellow or white in color. Yellow lines delineate the separation of traffic flows in opposing directions or mark the left boundary of the travel path at locations of particular hazard. White lines delineate the separation of traffic flows in the same direction.

Solid lines are restrictive, with double lines indicating maximum restriction. Broken lines are permissive. Line width also has importance, indicating the degree of emphasis with which the local traffic authorities are placing on traffic control. Some of the more common markings are:

A solid yellow line delineates the left edge of a travel path. It indicates a restriction against passing on the left or delineates the left edge of pavement on a divided street or highway, where there is inadequate clearance to the left of the line for making emergency stops. A double line consisting of two solid yellow lines delineates the separation between travel paths in opposite directions where passing is prohibited in both directions. Crossing this marking with care is permitted only as part of a left-turn maneuver.

A broken yellow line is used to delineate the left edge of a travel path where travel on the other side of the line is in the opposite direction. The usual application is as the center line of a two-lane, two-way roadway where overtaking and passing is permitted.

A double line consisting of a broken yellow line and a solid yellow line delineates a separation between travel paths in opposite directions where overtaking and passing is permitted for traffic adjacent to the broken line and is prohibited for traffic adjacent to the solid line. It is used on two-way, two and three-lane roadways to regulate passing.

A broken white line is used to delineate the edge of a travel path where travel is permitted in the same direction on both sides of the line. Its most frequent application is as a lane line.

A solid white line is used to delineate the edge of a travel path where travel in the same direction is permitted on both sides of the line but crossing the line is discouraged. The solid white line is also used as a pavement edge marking. A wide solid white line is used for emphasis where the crossing requires unusual care. It is often used as a line to delineate left or right turn lanes.

A double solid white line is used to delineate a travel path where travel in the same direction is permitted on both sides of the line, but crossing the line is prohibited. It is used as a channelizing line in advance of obstructions which may be passed on either side.

On occasion, a broken line is used to delineate the extension of a line through an intersection or interchange area. It has the same color as the line it extends.

Raised Reflective Pavement Markings (RPM's) have been found to be very effective in marking roadway centerlines and lane lines especially at night and during periods of rain.

Circumstances sometimes require more unusual treatments. Reversible lanes, inbound in the morning and outbound at night, and the reservation of a left-turn only lane in the center of a highway are examples of such conditions. A double broken yellow line delineates the edge of a lane in which the direction of travel is changed from time to time. In "left turn only" lanes, yellow markings are placed with solid lines on the outside and broken lines on the inside of the lane. Traffic adjacent to the solid line may cross this marking only as part of a left-turn maneuver.

Pavement markings such as shoulder markings, word and symbol markings, stop lines, crosswalk lines and parking space markings are white with the following two exceptions:

1. Transverse median markings are yellow.

2. Line, word and symbol markings visible only to traffic proceeding in the wrong direction on a one-way roadway are red. This type of marking is found on exit ramps or high speed, limited access roadways.

## ARE THERE GUIDELINES FOR THE PROPER INSTALLATION OF MAILBOXES AND NEWSPAPER DELIVERY BOXES?

Each year, 70 to 100 people are killed in crashes involving rural mailboxes. Many victims that are not killed are often blinded and disfigured for life because mailboxes and their supports penetrate the windshield and hit the victim in the face.

Mailbox owners are limited only by their imagination. Steel tractor wheels, water pumps, milk cans filled with concrete, chains and massive I-beams are a few devices used to support mailboxes. Although such supports may be artistic to some, most are serious roadside hazards to motorists.

In a publication entitled "The Law and Roadside Hazards" Sponsored by the Insurance Institute for Highway Safety, it is stated that "Private individuals and corporations, as well as governmental entities, may be liable for their roles in creating or maintaining highway hazards."

The use of massive rigid mailbox supports such as bricks around the mailbox, heavy metal posts, concrete posts, and items of farm equipment, such as milk cans filled with concrete must not be used.

In Florida, uniform minimum standards and criteria for the design construction and maintenance of all public streets, is presented in the "Manual on Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways." This publication, referred to as the "Green Book", developed by the Florida Department of Transportation, states that guidelines for the location of mailboxes and the types of support are given in the AASHTO publication "A Guide for Erecting Mailboxes on Highways - 1984". The FDOT "Green Book" also states that Geometric Design Objective #6 is to: "Provide a hazard-free environment that is "forgiving" to a vehicle that has badly deviated from the travel path or is out of control."

The following support and location standards for mailboxes and newspaper delivery boxes are from the AASHTO to publication entitled "A Guide for Erecting Mailboxes on Highways" (5-24-84):

### TYPE OF SUPPORTS

WOOD POSTS: 4" diameter if round; 4 x 4" if rectangular

METAL PIPES: 2" inside diameter (maximum) standard steel, or aluminum.

NUMBER OF SUPPORTS: Use only 1 support for 1 box or group boxes.

Supports Should:

1. Yield or collapse if struck.

2. Bend or fall away from vehicle.

3. Not create severe deceleration.

4. Not be fitted with an anchor plate (metal post).

5. Not be embedded over 24" into the ground.

6. Not be set in concrete.

LOCATION OF MAILBOXES OR NEWSPAPER DELIVERY BOXES

1. Should be on right side of road in direction of delivery travel.

2. Servicing vehicle should be removed from roadway.

3. Mailbox face should be no closer than edge of shoulder (8'from roadway).

4. Mailbox should not block sight distance.

5. Mailbox should be behind existing guardrail if possible.

6. Should be mounted 3' to 4' above the mail stop surface.

## WHAT CAN A CITIZEN DO TO HELP REDUCE TRAFFIC CRASHES?

In Florida, over 250,000 traffic crashes each year account for approximately 2,900 fatalities, 217,000 nonfatal injuries and $600 million dollars in property damage.

Citizens can do their part to help reduce the high cost of traffic crashes by taking the following actions:

DRIVE CAREFULLY - Concentrate on driving and use seat belts; do not speed or drink and drive.

DON'T TAKE CHANCES - Play it safe. Drivers should not try to "beat the light" or "beat the train" at railroad crossings. Drive defensively at all times.

REPORT ROADWAY HAZARDS as soon as possible to city, county or state officials responsible for road maintenance and safety. Roadway hazards that should be reported are:

1. Traffic signs obstructed by vegetation.
2. Traffic signal malfunctions.
3. Traffic signs down or damaged.
4. Obstructions, potholes, bumps or dips in roadway.
5. Shoulder washouts.
6. Water ponding on roadway.

PROPERTY OWNERS SHOULD KEEP VEGETATION TRIMMED to insure that good intersection and driveway sight distance is provided and that traffic control signs are visible.

REPORT ACTS OF VANDALISM to law enforcement, traffic engineering and maintenance officials.

SUPPORT TRAFFIC SAFETY OFFICIALS to insure that they have adequate budgets for staff, equipment and supplies to do their job properly.

TURN ON VEHICLE HEADLIGHTS between dusk and dawn and anytime visibility is reduced by rain, smoke, fog, etc.

KEEP VEHICLES IN GOOD MECHANICAL CONDITION by regularly checking brakes, tires, wipers and other

safety equipment.

OBEY TRAFFIC CONTROL DEVICES such as signs, signals and pavement markings. These devices were installed to enhance safety.

## WHY DO THEY HAVE TO REMOVE THOSE NICE TREES NEXT TO MY ROADWAY?

In Florida, during 1985, crashes involving trees accounted for 230 fatalities and 7,905 non-fatal injuries. Trees must sometimes be removed near a roadway in order to improve the sight distance, which is the length of road ahead visible to the driver.

Many traffic crashes involving trees occur when vehicles run off roadways with little or no roadside clear zone. The roadside clear zone has been defined by the Florida Department of Transportation (FDOT) as "that area outside the traveled way available for use by errant vehicles." Vehicles frequently leave the traveled way during avoidance maneuvers, due to loss of control by the driver or due to collisions with other vehicles. Common circumstances that may cause a driver to run off the roadway can be driver or environment related. Driver related contributing circumstances which may cause a vehicle to stray off the roadway include: improper passing, alcohol or drug involvement, falling asleep, driver inattention, or driver distraction. Environment related contributing circumstances which may cause a vehicle to run off the roadway include: debris in roadway, glare, holes or ruts in roadway, slippery surface, water ponding or animal in path of the vehicle.

A manual was developed by the FDOT to provide uniform minimum standards and criteria for the design, construction and maintenance of all public streets. The manual often referred to as the "FDOT Greenbook," is entitled "Manual of Uniform Minimum Standards for Design, Construction and Maintenance of Streets and Highways." The standards presented in the manual are intended to provide the basic guidelines for developing and maintaining a highway system. Objective #6 of the manual is to "Provide a hazard-free environment that is forgiving" to a vehicle that has badly deviated from the travel path or is out of control." Page III-35 of the manual states that "the width of the roadside clear zone should be made as wide as is practicable. The minimum permitted widths are given in Table III-12. These are minimum values only and should be increased wherever feasible."

The FDOT standards require a minimum width of roadway clear zone in accordance with the design speed of the roadway and the type of area, rural or urban.

In rural areas, with a roadway design speed below 35 MPH, a minimum clear zone width of 6 feet is required. For a design speed of 35, 40 and 45 MPH, a minimum clear zone width of 8, 11 and 14 feet respectively, is required. For a design speed of 50 MPH and above, a minimum clear zone width of 30 feet is required. In urban areas, with a roadway design speed of 45 MPH or less, a minimum clear zone width of 4 feet is required. The 4 foot minimum required clearance area applies to the placement of trees behind curbed islands and roadway edge. For a design speed of 50 MPH and above, a minimum clear zone width of 14 feet is required.

In summary, trees in the roadside clear zone can be harmful in two ways: Trees can prevent vehicle recovery to the roadway and increase injury severity and property damage when crashes do occur. Good traffic engineering practice and state standards require that an adequate roadside clear zone be provided on all new road construction projects. This requires that the roadside clear zone to be clear of trees and other fixed objects.

## WHY ARE THOSE ORANGE SIGNS AROUND ROAD CONSTRUCTION SITES?

Whenever work is done on or near the roadway, drivers are faced with changing and unexpected traffic conditions. These changes may be hazardous for drivers, workers and pedestrians unless protective measures are taken.

Drivers and pedestrians should take special care to observe signs, signals, pavement markings and flagmen, near roadway construction sites. These traffic control devices are installed to assist and safely guide and protect motorists, pedestrians and workers in a traffic control zone.

Most traffic control zones are divided into the following areas:

Advance Warning Area - tells traffic what to expect.

Transition Area - moves traffic out of its normal area.

Buffer Space - provides protection for traffic and workers.

Work Area

Termination Area - lets traffic resume normal driving.

Regulatory Signs are typically rectangular in shape with the long dimension vertical. The standard color scheme is black lettering on a white background. A red circle with a diagonal slash may be used in conjunction with a black diagram to indicate a prohibited maneuver. Red is used as a predominant color for STOP, YIELD, DO NOT ENTER and WRONG WAY signs.

Warning Signs are used to give notice of conditions that are potentially hazardous to traffic. These signs are used particularly when the danger is not obvious or cannot be seen by the motorist. Warning signs are typically diamond-shaped with one diagonal vertical. Permanent warning signs have a black legend on a yellow background. Construction and maintenance warning signs are a special series with the black legend on an orange background. The orange color is used to indicate the temporary nature of the condition and the additional potential hazard of the worksite. Traditionally, work activities have included construction, maintenance, and utility operations. However, orange color warning signs may have application for all work activities within the right of way such as survey crews or temporary weighing stations.

Guide Signs show destinations, directions, distances, services, points of interest and other geographical information. Directional signs and street name signs, when used with detour routing, may have a black legend on an orange background. Special information signs relating to the work being done shall have a black message on an orange background.

## HOW DO 'TRAFFIC SIGNALS' WORK?

When installed under conditions that justify its use, a traffic signal is a valuable device for traffic control. However, an ill-advised or poorly designed signal is not only annoying, but can be dangerous to pedestrians, cyclists and drivers. Therefore, it is essential that, before traffic signals are installed, engineering studies be made by qualified personnel.

A traffic signal provides alternate right-of-way for different traffic movements at an intersection. It provides a degree of control that is second only to physical barriers. A good general guide is to use the least traffic control required to provide for the safe and efficient movement of vehicles and pedestrians. Specifications for signals and their placement as well as warrants for their use are contained in a publication entitled "Manual on Uniform Traffic Control Devices" published by the U.S. Department of Transportation.

A signal that minimizes vehicle stops and delay also cuts fuel consumption and emissions. The signal controller switches the signal indications on and off to assign right-of-way correctly and safely. Two basic kinds of controllers are used: pretimed (also known as fixed-time) and traffic-actuated.

Pretimed controllers operate on a predetermined, regularly repeated sequence of signal indications. They are used frequently where traffic volumes are predictable and stable.

Traffic-actuated controllers differ from pretimed controllers in that their signal indications are not of fixed length, but change in response to variations in traffic demand. They are frequently used where traffic volumes fluctuate widely or irregularly, or where interruptions to major-street flow must be minimized.

Signal Timing is the division of the cycle into seconds for each of the phases. It assigns right-of-way to alternate traffic movements in order to reduce traffic delay and crash-producing conflicts. Signal timing is constrained by the cycle length - the time for one complete sequence of the signal indications. Cycle lengths usually fall between 45 and 120 seconds.

There are three common techniques for coordinating traffic signals to operate as a system. This is done to improve the progressive flow of traffic along an arterial street or in a network, any of which can work with either pretimed or actuated controllers.

The simplest system is the basic programmed system in which a master controller simply sends a periodic pulse to all intersections to instruct the local controllers that this is the system reference point.

The second method, called "time based coordinators," replaces the central controller and the interconnecting communications completely and places a very accurate timer directly at each location.

The third system uses a sophisticated central computer control that exerts more external control on the individual controllers.

## WHY ARE THOSE STOP SIGNS SO HIGH?

Traffic engineers have received calls from concerned citizens asking "Aren't those new STOP signs rather high?

In Florida, as in most states, the standard for signs, signals and pavement markings is the "Manual on Uniform Traffic Control Devices" (MUTCD). This publication by the U.S. Department of Transportation, serves as the standard for the installation of all traffic control devices.

The MUTCD indicates that "in business, commercial and residential districts where parking and/or pedestrian movement is likely to occur or where there are other obstructions to view, the clearance to the bottom of the sign shall be at least 7 feet." "Signs erected at the side of the road in rural districts shall be mounted at a height of at least 5 feet, measured from the bottom of the sign to the near edge of the pavement."

"Why must signs be so high?" One major reason is the improved visibility that results. In urban areas, parked cars and other obstructions often obscure signs that are too low. Also, pedestrians are not likely to collide with properly mounted signs under conditions of reduced visibility (darkness). In rural areas, bushes and even weeds can block signs that are installed too low.

Another reason for installing signs high enough is the improved condition and life of the sign. A sign 7 feet above the ground is less susceptible to vandalism. It is also less likely to be sprayed with dirt from passing cars. And finally, signs mounted at their correct height have been found to command more respect than those that are too low.

Another concern of citizens is the lateral placement of STOP signs from the roadway.

The MUTCD states that "signs should have the maximum practical lateral clearance from the edge of the traveled way for the safety of motorists who may leave the roadway and strike the sign support." It is further stated that "Normally, signs should not be closer than 6 feet from the edge of the shoulder, or if none, 12 feet from the edge of the traveled way. In urban areas, a lesser clearance may be used where necessary. Although 2 feet is recommended as a working urban minimum, a clearance of 1 foot from the curb face is permissible where sidewalk width is limited or where existing poles are close to the curb."

## WHY ARE 'TWO-WAY LEFT-TURN LANES' USED?

The two-way left-turn lane, a device for increasing capacity and safety, is being more frequently used throughout Florida and other states. As its name implies, this is a marked lane that is used for left turns by traffic going in both directions on a street. A significant benefit can result when it is used on streets that are lined with commercial development and many driveways.

Despite the initial apprehension which a driver may have, the safety record of these lanes appears to be good. One study showed that where no median was previously provided, the installation of continuous two-way left-turn lanes reduced total crashes by about 33% with reductions of 45% and 62% for head-on and rear-end type crashes, respectively.

Another study reported that the "head-on collision," which has been a primary concern among those considering the installation of a continuous two-way left-turn lane, has proved to be an uncommon occurrence and of negligible concern.

Drivers use the two-way turn lane by entering only when they are making the left turn. They do not drive in the lane and therefore do not create a significant potential for head-on collisions. However, by pulling into the left-turn lane when making a turn into a driveway, the driver removes himself from the through lane and this eliminates potential rear-end, side-swipe and lane-changing crashes. These turn-lanes also increase the capacity of the street.

Both Federal and State manuals on traffic control devices specifically provide for the two-way left-turn lane. The markings for the two-way left-turn lanes are yellow and consist of a dashed line and a solid barrier line on each side of the lane. The solid line is on the outside of the two-way left-turn lane and the dashed line is on the inside. This marking tells the driver in the through lane that he cannot cross the line for the purpose of passing another moving car, although he can cross into the lane for the purpose of turning left.

A two-way left-turn lane can change into a single direction left-turn lane at major intersections through a change in marking. The lane markings on the right side change from the yellow solid-dashed combination into a standard white lane line used to separate traffic moving in the same direction. The lane markings on the left would change into a double yellow, the standard used to prohibit passing in either direction.

White pavement arrows may be used in addition to the lane and barrier markings to remind drivers that left turns are made in both directions from the lane. Signs must also be used to supplement the pavement markings.

The use of this relatively new traffic control treatment will increase as more officials become familiar with it. The two-way left-turn lane is not a cure-all. However, it is another one of the devices being used by Traffic Engineers to increase the capacity as well as the safety of our existing street system.

## WHY LIMIT THE NUMBER OF DRIVEWAYS?

The fewer driveways on an urban or rural roadway, the more effectively it will serve its primary function. As traffic volume and roadside development increase, increasing numbers of driveways cause crash rates to gradually increase. It has been estimated that about 12% of crashes on major urban routes are related to commercial driveways.

One accident study showed that as the number of driveways per mile increased, the crash rate increased:

| Driveways Per Mile | Crashes Per Million Vehicle Miles |
|---|---|
| .2 | 1.25 |

| | |
|---|---|
| 2.0 | 2.70 |
| 20.0 | 17.80 |

Access control on highways would include strict criteria for the spacing of median openings on divided roadways. Typical median crossovers are spaced 330' apart in urban areas and 660' apart in rural areas. Access to highways from residential, commercial and public property should be equitably managed to achieve both highway safety and reasonable access.

Traffic engineers recognize that elimination of unexpected events and the separation of decision points simplifies the driving task. Access control reduces the variety and spacing of events to which the driver must respond. Controlled access has resulted in improved traffic operations and reduced crashes.

Based on an analysis of data from 30 states, a report to the U.S. Congress concluded that full control of access has been the most important single design factor ever developed for crash reduction.

The effect of control of access on crashes and fatalities in urban and rural areas is shown below:

Crash Rate Per Million Vehicle Miles

| | Urban | | Rural | |
|---|---|---|---|---|
| Access Control | Total | Fatal | Total | Fatal |
| Full | 1.86 | 0.02 | 1.51 | 0.03 |
| Partial | 4.96 | 0.05 | 2.11 | 0.06 |
| None | 5.26 | 0.04 | 3.32 | 0.09 |

The above study indicates that crash and fatality rates on facilities with full control of access were about one-half on rural highways and one-third on urban locations when compared to facilities without access control.

## WHY ARE 'TURN LANES' USED?

Turn lanes at intersections are designed primarily to separate turning traffic from through traffic. With turn lanes, through traffic is not delayed by vehicles waiting to turn. By removing the turning vehicles from a through lane, traffic flow and safety are improved. Turn lanes may also be used to decelerate vehicles leaving the major street.

Studies have shown that channelization of intersections, with turn lanes, produced an average of 32.4 percent reduction in all types of crashes. Crashes involving personal injuries decreased by over 50 percent. One study showed that intersection channelization projects had produced an average benefit/

cost ratio of 2.31. Turn lanes at major driveways can also improve efficiency and safety especially on high volume or high speed roadways. Studies have shown a 52% decrease in rear end crashes as well as 6% decrease in left turn crashes.

One of the most significant features affecting an intersection's operation is the treatment of left-turning vehicles. Accommodation of left turns can be one of the most critical design factors since safety and the level of service are greatly influenced.

A left turning vehicle can conflict with: a) Opposing through traffic; b) Crossing traffic; c) Through traffic in the same direction.

The major crash types involved with left turning vehicles are rear end, angle and sideswipe crashes in the same direction. The capacity of a roadway may be greatly influenced by how left turning vehicles are handled. Studies have shown the effect of left-turn lanes on crash rates at intersections. The results of one study is shown below:

| Intersection Type | Crashes Per Million Entering Vehicles |
|---|---|
| Unsignalized - without left turn lanes | 4.3 |
| Unsignalized - with left turn lanes | 1.1 |
| Signalized - without left turn lanes | 2.5 |
| Signalized - with left turn lanes | 1.6 |

Crash types associated with right-turning vehicles are rear-end, side-swipe and pedestrian. An accident study of driveway crash types related to turning movement is shown below:

| Movement | Number of Crashes | % of Total |
|---|---|---|
| Entering driveway by left turn | 246 | 43 |
| Entering driveway by right turn | 26 | 15 |
| Leaving driveway by left turn | 65 | 27 |
| Leaving driveway by right turn | 35 | 15 |

The use of right-turn lanes at intersections can significantly affect operations. At signalized intersectons, an increase in the level of service can be provided by an addition of a separate right-turn lane. At unsignalized intersections, right-turn lanes can serve to safely remove turning vehicles that are decelerating from the through traffic.

In general, the treatment of right-turning vehicles is less critical than left-turning vehicles due to the higher right-turning vehicle speeds and the uninterrupted nature of the right-turn maneuver.

## WHY ALL THE FUSS ABOUT DRUNK DRIVING?

In Florida during 1985, there were 250,412 traffic crashes - 35,745 (14%) were alcohol related crashes that accounted for 1,294 fatalities. Alcohol related fatalities represent 45% of all fatalities. The amount of alcohol in the bloodstream is called the "Blood Alcohol Concentration (BAC)" In Florida, a person is legally drunk when the BAC is .10% or more. However, a person's driving is impaired starting at about .05% BAC. The body can burn off only about one ounce of alcohol, about one drink, per hour. The BAC is affected by a person's body weight, loss of sleep, amount of food in the stomach and other physical and emotional factors.

If a law officer has reason to suspect a person is driving under the influence, the person may be requested to submit to: A breath alcohol test, a urine test for controlled substances and a blood test for blood alcohol or for controlled substances. If a person refuses a required breath, urine or blood test, it will result in loss of a person's driver's license and prosecution for Driving Under the Influence (DUI).

On July 1, 1982, one of the nation's toughest laws on drunken driving took effect in Florida. This law provided for strict penalties if convicted of drunken driving. First Convictions provided for:

Fines of at least $250 (with up to $500)

Jail Term up to 6 months

Driver's License revoked at least 6 months (with up to 1 year)

Community service of 50 hours is required

DUI school is required - paid for by the person convicted

Repeated Convictions can provide for: Fines of up to $2,500, jail term of up to 1 year, Driver's license revoked up to 10 years and DUI school can require further treatment without court approval

Paying the Toll for DUI can be a sobering experience:

| ITEM | APPROX. COST |
|---|---|
| Vehicle Towing | $30-50 |
| Bond release from jail | $250 |
| Attorney's fees if you plead guilty | $350-700 |
| Attorney's fees if you plead not guilty | $750-2,000 |
| Witness fees | $200-300 |
| Fine for 1st conviction | $250-500 |
| Court Costs | $26-50 |
| Probation costs | $120-300 |

| | |
|---|---|
| Alcohol Safety Educational School | $50-125 |
| Driver's license reinstatement fee | $35 |
| Approximate annual insurance rate increase for 3 years | $1,000 |

DRIVERS SHOULD REMEMBER TO STOP DRINKING BEFORE REACHING THE LIMIT. Once you know your limit, stick to it when you plan on driving. If you do exceed your limit, don't risk driving. Be responsible and stay where you are until you can drive safely, or have a sober person drive. Or take a cab - it's worth the wait. Protect your friends, too - don't let them drive drunk. Help friends when they have had too much. If it's at a party, offer friends a non-alcoholic beverage. Let friends stay at your home until they are able to drive. Give friends a ride, or call a cab. The body burns off about one ounce (one drink) of alcohol per hour. It takes about four hours to cancel the effects of four drinks. Nothing will speed this up--not exercise, not food, not even a cold shower.

## WHAT IS FLORIDA LAW IN REGARD TO SCHOOL SPEED ZONES AND SCHOOL BUSES?

The approach of a new school year brings out old questions on school zones and school buses.

In Florida, school zones are governed by the Florida Traffic Laws, Florida Statutes, Section 316.1895. This Statute states that "No school zone speed limit shall be less than 15 miles per hour except by local regulation. Such speed limit shall be in force only during those times 30 minutes before and 30 minutes after the times necessary and corresponding to the periods of time when pupils are arriving at and leaving regularly scheduled school sessions."

The Statute also states that "Permanent signs designating school zones and school zone speed limits shall be uniform in size and color, and shall display the times during which the restrictive speed limit is enforced clearly designated thereon. The Department of Transportation shall establish adequate standards for the signs."

Different types of speed limit signs are used for school zones in Florida. Some have flashers which serve the purpose of advising motorists when the school zones are in effect. When these flashers are set and used properly, they are very effective. They alert the motorist to the need for caution and slower driving when the appropriate conditions exist. A school speed limit sign without flashers, while not as helpful to the motorist, is just as legally binding as the flasher sign. Drivers are reminded to be especially alert during those hours when children are on the streets.

Chapter 316.172 of the Florida Statutes indicates that traffic must stop for school buses. This law states that:

(1) "Any person using, operating, or driving a vehicle on or over the roads or highways of this State shall, upon approaching any school bus used in transporting school pupils to or from school which is properly identified in substantial accordance with the provisions of Florida Statute 234.051 and which displays a stop signal, bring such vehicle to a full stop while the bus is stopped, and the vehicle shall not pass the school bus until the signal has been withdrawn."

(2) "The driver of a vehicle upon a divided highway where the one-way roadways are separated by an intervening unpaved space at least 5 feet or physical barrier, need not stop upon meeting or passing a

school bus which is on a different roadway."

## WHAT ARE THE DRIVERS' RESPONSIBILITIES WHEN A TRAFFIC CRASH OCCURS?

1. Stop.

If you are in a crash while driving, you must stop. If anyone is hurt you must get help.

2. Report The Crash.

If the crash causes injury, death, or property damage of $100.00 or more, it must be reported. Call the local police or the Florida Highway Patrol. If the crash involves a charge of driving while impaired (DWI), results in death or injury, or involves a vehicle rendered inoperative, an officer will fill out a report.

If no report is written by an officer, you must report the crash to the Department of Highway Safety and Motor Vehicles within 5 days. The officer will provide you with a crash form, or you may use the form in the back of the Florida Drivers Handbook. Keep a copy of the form for your records.

3. Move Your Car If It Is Blocking Traffic.

If your car is blocking the flow of traffic, you must move it. If you cannot move it yourself, you must get help or call a tow truck. This is true anytime your vehicle is blocking the flow of traffic, whether it has been involved in a crash or not.

4. Appear In Court.

If you are involved in a crash, you will probably have to go to court. The officer who comes to the scene of the crash will file charges against any driver who broke a traffic law.

Anyone who is charged will have a chance to explain to the court what happened. The court will then decide what the penalty will be. Anyone who is not charged with breaking a law will usually have to come to court as a witness.

A driver leaving the scene of a crash involving death or personal injury will have his or her license revoked. The driver can also receive a jail sentence.

If while driving, you hit a vehicle with no one in it or if you damage any object that belongs to someone else, you must tell the owner. Give the owner your name and address in person or in a note attached to the object that was hit.

## WHAT ARE THE RULES FOR HANDICAPPED PARKING?

Florida Statute (F.S.) 316.1955, presents the State standard for parking spaces provided by governmental agencies for certain disabled persons. This section requires each State agency and political subdivision having jurisdiction over street parking or publicly owned and operated parking facilities to provide a minimum number of specially designed and marked motor vehicle parking spaces for the exclusive use of those severely physically disabled individuals who have permanent mobility problems and who have been issued an "exemption entitlement parking permit." This section requires the minimum number of handicapped parking spaces as shown below:

| Total Parking Spaces in Lot | Required # of Handicapped Parking Spaces | Total Parking Spaces in Lot | Required # of Handicapped Parking Spaces |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Up to 25 | 1 | 201 to 300 | 7 |
| 26 to 50 | 2 | 301 to 400 | 8 |
| 51 to 75 | 3 | 401 to 500 | 9 |
| 76 to 100 | 4 | 501 to 1000 | 2% of total |
| 101 to 150 | 5 | Over 1000 | 20% plus 1 for each 100 over 1000 |
| 151 to 200 | 6 | | |

This law further requires that "Diagonal or perpendicular parking spaces shall be a minimum of 12 feet wide" and "Each such parking space shall be prominently outlined with paint and posted with a permanent above- grade sign of a color and design approved by the Department of Transportation, bearing the international symbol of accessibility and the caption 'PARKING BY DISABLED PERMIT ONLY'." An approved FDOT sign is 12" wide by 18" high, designated FTO-25 in accordance with FDOT Standard Index 17355. Design requirements for this reflective sign are: 1" Series "C" letters on blue background with white legend and border on top, and a bottom portion of white background with black opaque legend and border.

State Law now requires all handicapped parking spaces to be "conspicuously outlined in blue paint" in addition to the above-grade signing. FDOT standards require the blue outline to be a 4" wide blue stripe to be 2" inside of the standard 4" white stripe as shown in FDOT Standard Index 17358. This standard states "USE OF THE PAVEMENT SYMBOL IN HANDICAPPED PARKING SPACES IS OPTIONAL. WHEN USED, THE SYMBOL SHALL BE 3 TO 5 FT. HIGH AND WHITE IN COLOR." The blue stripes should match Shade 15180 of Federal Standard 595A.

F.S. 316 also states: "It is unlawful for any person to stop, stand, or park a vehicle within any such specifically designated and marked parking space provided in accordance with this section, unless such vehicle displays a parking permit issued pursuant to s. 316.1958 or s. 320.0848, and such vehicle is transporting a person eligible for the parking permit." Florida Law provides for handicapped parking enforcement by stating: "The provisions of handicapped parking shall be enforced by state, county, and municipal authorities in their respective jurisdictions whether on public or private property in the same manner as is used to enforce other parking laws and ordinances by said agencies." F.S. 316.008 provides for a fine up to $250.00 for drivers who illegally park in designated handicapped parking spaces.

F.S. 316.1956 presents the State Law in regard to parking spaces provided by nongovernmental entities for certain disabled persons. This section states "Any business firm, or other person licensed to do business with the public may provide specially designed and marked motor vehicle parking spaces for the exclusive use of physically disabled persons who have been issued parking permits pursuant to s.316.1958(2)(c)."

An "Application for Disabled Person Parking Permit by Disabled Person" (Form HSMV 83039) and "Disabled

Person's Parking Permit Physician's Statement of Certification" (Form HSMV 83006) may be obtained through the Florida Department of Highway Safety and Motor Vehicles, Division of Motor Vehicles, Neil Kirkman Building, Tallahassee, Florida 32301, or at local tag office.

Some Counties, including Volusia County, require developers to provide for handicapped parking in accordance with the Standard Building Code. This code requires the same size and number of spaces as presented in F.S. 316.1955.

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## WHY ARE 'FIRE LANES' NEEDED?

A "Fire Lane," also called an "Emergency Access Lane" is a driving lane adjacent to a commercial development that is reserved to provide for emergency access. Parking or standing in a Fire Lane is prohibited.

The Standard Building Code, Section 602.6, provides the standard for Fire Lanes. The Code states "Every building hereafter constructed shall be accessible to fire department apparatus by way of access roadways with all-weather driving surface not less than 20 ft. of unobstructed width, with adequate roadway turning radius capable of supporting the imposed loads of fire apparatus and having a minimum vertical clearance of 13 ft-6 in." The Fire Prevention Code also states that "The required width of access roadways shall not be obstructed in any manner, including the parking of vehicles.

Installation of "NO PARKING" signs or other appropriate notice, or of approved obstructions inhibiting parking, may be required and if installed, shall be maintained. The owner (or his representative) of a building which is adjacent to the fire lane shall be responsible for keeping the fire lane free of obstructions."

The primary purpose of a Fire Lane is to allow emergency personnel and equipment easy access to a facility.

A secondary benefit of providing a "Fire Lane" or "Emergency Access Lane" is to improve both pedestrian safety and traffic circulation.

Pedestrian Safety is improved because pedestrians are more visible to drivers since parked cars do not obstruct the view of the driver.

Traffic Circulation will be greatly improved through the use of a "Fire Lane" on the main roadway adjacent to a commercial development. No parking or standing in a "Fire Lane" will decrease the interruption of traffic and will increase the roadway capacity.

No national standard for Fire Lane signing or marking has been developed; however, many jurisdictions have developed local standards. A typical standard for signing and marking Fire Lanes is presented below:

Signing shall be with 12" x 18" "NO PARKING - FIRE LANE" signs with red lettering on a white background. These signs shall be similar to the "Manual on Uniform Traffic Control Devices" (MUTCD) R7 Sign Code Series and shall be installed at a spacing of 50' to 100', along the Fire Lane and shall be plainly visible to motorists.

Pavement markings for Fire Lanes shall be installed with beaded paint 15 mils minimum thickness or thermoplastic 90 mils minimum thickness and shall include a yellow curb throughout the limits of the Fire Lane. The pavement marking legend shall be "NO PARKING - FIRE LANE" spaced at a maximum of 100' apart. Pavement marking lettering must be 8' high with 6" strokes in accordance with the MUTCD.

## WHAT IS MEANT BY 'HIGHWAY CAPACITY' AND 'LEVEL OF SERVICE'?

Capacity of a highway is defined in the 1985 Highway Capacity Manual (HCM), by the Transportation Research Board, as "the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic and control conditions." The HCM defines "Level of Service" (LOS) as "a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers."

Six Levels of Service for each facility type 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" 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 it 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 wherever the amount of traffic approaching a point exceeds the amount which 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.

For each type of facility, LOS is based on one or more operational parameters which best describe operating quality for the subject facility type. The parameters selected to define LOS for each facility type are called "Measures Of Effectiveness" (MOE). For a 2 lane highway, the MOEs are "percent time delay (%)" and "average travel speed (mph)". For a multilane highway, the MOE is "Density (passenger cars/mile/lane)". For a signalized intersection, the MOE is "average individual stopped delay (seconds/vehicle)." For unsignalized intersections, the MOE is "Reserve capacity (passenger cars/hour)."

For planning purposes, some engineers use the following uninterrupted flow capacity (vehicles/day/lane) for the LOS indicated: "A" (2,500); "B" (4,000); "C" (6,000); "D" (7,500); "E" (12,000).

To determine the operational capacity of a highway, engineers must obtain detailed data based on the characteristics of a roadway. For a 2 lane highway, the data needed for an operational capacity analysis is: terrain, lane width, shoulder width, "No Passing" zone, % Trucks, % RVs, % Buses and directional distribution. For a multilane highway, the data needed for an operational capacity analysis is: terrain,

number of lanes, lane width, lateral clearance, obstruction on 1 or 2 sides, highway type (divided or undivided), suburban or rural, design speed, % Trucks, % RVs, % Buses and driver population factor (based on regular users or non- regular users). Signalized intersection analysis must consider the following prevailing conditions: the amount and distribution of traffic movements, traffic composition, geometric characteristics and the details of intersection signalization. Unsignalized intersection analysis must consider the number and use of lanes, channelization, % grade, curb radii and approach angle, sight distance and average running speed on major roadway.

## WHAT CAN A PEDESTRIAN DO TO REDUCE PEDESTRIAN CRASHES?

Each year for the last five years, there were more than 600 pedestrian fatalities and over 7000 pedestrian injuries in Florida. 1985 Statistics indicate a pedestrian fatality rate of 5.71 per 1000 population. Florida ranked second in the nation for pedestrian fatalities with 655. California with 843 pedestrian fatalities was highest for that year. The major crash types most often associated with pedestrian crashes are: Mid-block dartouts; Intersection dash; Vehicle Turn/Merge; Multiple lanes crossing; Bus stop related; Vendor--Ice Cream Truck and Backing Up .

Walk Defensively - Be prepared for the unexpected--don't let cars surprise you even if a motorist does something wrong like running a stop sign or making a sudden turn.

Walk Facing Oncoming Traffic - When there are no sidewalks, walk near the curb, or off the road, if necessary.

Cross Streets at Intersections Whenever Possible - Look in all directions before entering the street. Be especially alert to vehicles that may be turning right on a red signal. If there are crosswalks, use them but don't assume you are completely safe in a crosswalk. Don't cross at mid-block because "jaywalking" is dangerous and against the law.

At Intersections, Look for the Signs or Signals - They will help to cross safely. Use the push-buttons for crossing protection at signalized intersections that have pedestrian indications. The lighted "Walk" and "Don't Walk" signals are meant for the pedestrian. If the "Don't Walk" light is blinking while you are in the street, continue quickly and carefully. If there are no walk signals, watch the traffic signals. When there are only STOP or YIELD signs, look in all directions and cross when traffic has cleared.

Be Careful in Parking Lots - Pedestrians are supposed to have the right of way but many drivers don't wait for pedestrians. Parking lots can be as dangerous as streets. On streets, the direction of cars is usually known but in parking lots, cars might be moving in all directions, including backwards.

Avoid Dangerous Moves - Any movement a pedestrian makes that drivers aren't expecting, could be dangerous. When leaving a school bus, wait a second before crossing. Drivers don't always stop for unloading school buses; so stop, look both ways and then cross. Don't step into traffic from between parked cars since this is a sure way of surprising drivers.

Keep Your View of Traffic Clear at All Times - A pedestrian needs to be able to see cars around him. Don't block your view with packages, umbrellas or other objects.

After Dark, Wear Light Colored or White Clothes - Drivers can see you better if you wear light colored or white clothes. Carry a lighted flashlight and swing it back and forth to improve your chances of being seen by drivers. In spite of the relatively small percentage of pedestrian travel during darkness, more than one-third of pedestrian crashes occur during dark conditions.

Following all these tips while you are a pedestrian will greatly improve your chances of safely walking your estimated lifetime average of 75,000 miles.

## WHAT IS 'TRAFFIC ENGINEERING'?

The Institute of Transportation Engineers, an international professional organization, defines traffic engineering as "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."

When roads and streets were built many years ago, the biggest task facing the road builder was to keep them passable in all types of weather. The problem of moving large numbers of cars and parking them was not significant.

As the number of cars increases, taxing the capacity of our streets and highways, the field of traffic engineering has become increasingly prominent. Each year more people own and operate cars. Urban growth has increased the need for public transportation, for improved movement of goods, for new shopping and industrial centers, and for transportation terminals. Funding for new roads has decreased, due partly to environmental concerns. This has resulted in an increased emphasis on improving the existing road system as much as possible. Traffic Engineering is helping to meet these challenges.

Traffic Engineering extends beyond the local level. It plays a vital role in the functional design and traffic operations of the Interstate Highway System. The Traffic Engineer must formulate recommendations for the integration of freeways, shopping centers, and industrial complexes into communities which will serve the population and benefit future development. Traffic Engineers design and operate highway control and communication systems and devise ways to expand capacity and improve safety of existing roads and streets.

Traffic Engineering involves two major areas of activity:

(1) team decision making about new streets, highways and other transportation

matters;

(2) responsibility for the efficient, convenient, and safe use of existing

transportation facilities.

The Traffic Engineer is concerned with groups and individuals and their needs, desires, actions, characteristics, capabilities and limitations as related to the roadway system. His decisions affect drivers, passengers, and pedestrians.

One of the tasks of traffic engineering is long-range transportation planning. Working with sophisticated, computer-aided techniques, engineers and planners determine future transportation needs.

## HOW ARE 'SPEED LIMITS' ESTABLISHED?

In Florida, speed limits are set by Florida Statutes, Chapter 316, which deals with the "State Uniform Traffic Control".

Florida Statutes Chapter 316.187, authorizes the Florida Department of Transportation (FDOT) to set maximum and minimum speed limits for travel on the roadways under its authority as it deems safe and advisable, not to exceed 55 miles per hour, 65 mph on certain designated segments of interstate highways.

Florida Statutes, Chapter 316.189, presents the authority for establishment of municipal and County speed zones maintained by these agencies. This section indicates that the maximum speed on any Municipal or County maintained road is 30 mph. However, the Municipality or County may set speed zones altering such speeds, both as to maximum and minimum after investigation determines such a change is reasonable and in conformity with the criteria established by the FDOT.

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. It is important to remember that the speed regulation informs the driver of the limits in which one can safely operate a vehicle under normal circumstances and within which the driver can be expected to react safely. Setting speed limits at appropriate levels will create a reasonable uniform flow of traffic, discourage violation of the law and help keep streets and highways safe.

The FDOT criteria for setting speed zones are presented in the publication entitled "Speed Zoning for Highways, Roads and Streets in Florida for Compliance with the Florida Statutes, Chapter 316." This publication indicates "The 85th percentile speed is the speed at or below which 85 percent of the observed free flow vehicles are traveling." It also states that a speed limit should not differ from the 85th percentile speed by more than 3 mph and it shall not be more than 8 mph less.

The following excerpts were also taken from the FDOT Speed Zoning publication:

"It is common traffic engineering knowledge that most drivers (about 85%) travel at a reasonably safe speed for the various roadway conditions encountered regardless of speed limit signs, but it is for those drivers who don't that the practice of speed zoning does take place for the purpose of providing realistic speed restrictions to which meaningful enforcement can be applied."

"The vehicle speed chosen by a driver is influenced by many factors: the presence of other vehicles, weather, road conditions, road geometrics, adjacent land use, and other factors tabulated in this report. A driver's choice of speed is a balance between expediency and safety, and is often a subconscious reaction to environment."

"Motorists tend to pay little attention to speed regulations which they consider unreasonable unless there is an inordinate degree of enforcement."

"Unreasonably low speed limits 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."

## HOW MUCH TRAFFIC WILL THAT NEW DEVELOPMENT GENERATE?

Many variables affecting traffic generation make it difficult to predict the precise amount of traffic to be generated by a project. However, transportation studies have quantified, in general terms, the volume generated for different types of land use. The Institute of Transportation Engineers (ITE) has compiled a listing of trip generation rates for various land uses. These rates were developed from studies conducted throughout the country. Trip Generation Rates for residential land uses are usually expressed as average weekday vehicle Trip Ends per Dwelling Unit (TE/DU) while those for commercial developments are typically expressed as average weekday vehicle trip ends per 1,000 Gross Square Feet of Leasable Area (KGSFLA), per 1,000 Square Feet of Gross Floor Area (KSFGFA), per 1,000 Square Feet of Building Area (KSFBA) or per 1,000 Gross Square Feet (KGSF). A "Trip End" is defined as a single or one-direction vehicle movement, in or out of the site. The table below is a summary of trip generation rates presented in the 1991 ITE publication entitled "Trip Generation - 5th Edition."

SUMMARY OF ITE TRIP GENERATION RATES BY LAND USE AND DEVELOPMENT TYPE

| LAND USE/BUILDING TYPE (ITE CODE) | AVERAGE WEEKDAY VEHICLE TRIP ENDS | | NO. OF |
|---|---|---|---|
| | AVERAGE | RANGE | STUDIES |

RESIDENTIAL

| | | | |
|---|---|---|---|
| Single Family Detached (210) | 9.55 TE/DU | 4.31-21.85 | 348 |
| Apartment - General (220) | 6.47 TE/DU | 2.00-11.81 | 109 |
| Low Rise Apartment (221) | 6.59 TE/DU | 5.10-9.24 | 22 |
| High Rise Apartment (222) | 4.20 TE/DU | 3.00-6.45 | 9 |
| Residential Condominium (230) | 5.86 TE/DU | 1.83-11.79 | 53 |
| Mobile Home Park (240) | 4.81 TE/DU | 2.29-10.42 | 37 |
| Recreational Home (260) | 3.16 TE/DU | 3.00-3.24 | 2 |
| Residential Planned Unit Development (270) | 7.44 TE/DU | 5.79-14.38 | 12 |

RETAIL

Shopping Center (820):

| | | |
|---|---|---|
| 10 KGSF | 167.59 TE/KGSFLA | --- |
| 50 KGSF | 91.65 TE/KGSFLA | --- |
| 100 KGSF | 70.67 TE/KGSFLA | --- |
| 200 KGSF | 54.50 TE/KGSFLA | --- |
| 300 KGSF | 46.81 TE/KGSFLA | --- |
| 400 KGSF | 42.02 TE/KGSFLA | --- |
| 500 KGSF | 38.65 TE/KGSFLA | --- |

| | | | |
|---|---|---|---|
| Specialty Retail Center (814) | 40.67 TE/KGSFLA | 21.30-50.94 | 3 |
| Discount Store (815) | 70.13 TE/KGSFLA | 25.53-363.16 | 7 |

| | | | |
|---|---|---|---|
| Restaurant-Quality (831) | 2.86 TE/SEAT | 1.77-5.50 | 12 |
| Restaurant-Quality (831) | 96.51 TE/KSFGFA | 48.56-139.33 | 12 |
| Restaurant-High Turnover Sit Down (832) | 205.36 TE/KSFGFA | 112.00-363.16 | 4 |
| Restaurant-Fast Food w/Drive Thru (834) | 632.12 TE/KSFGFA | 284.00-1359.50 | 8 |
| Convenience Market - 24 Hr Open (851) | 737.99 TE/KGSF | 330.00-1,438.00 | 8 |

OFFICE

| | | | |
|---|---|---|---|
| General Office 10 KGSF (710) | 24.60 TE/KGSF | | --- |
| General Office 50 KGSF (710) | 16.58 TE/KGSF | | --- |
| General Office 100 KGSF (710) | 14.03 TE/KGSF | | --- |
| Medical Office Building (720) | 34.17 TE/KGSF | 23.16-42.55 | 6 |
| Government Office Building (730) | 68.93 TE/KGSF | -------- | 1 |
| U.S. Post Office (732) | 87.12 TE/KSFGFA | 35.57-352.42 | 6 |
| Office Park (750) | 11.42 TE/KSFGFA | 7.56-30.30 | 12 |

SERVICE

| | | | |
|---|---|---|---|
| Bank (Walk-In) (911) | 140.61 TE/KGSF | 134.60-156.48 | 2 |
| Bank (Drive-In) (912) | 265.21 TE/KGSF | 150.86-817.00 | 14 |
| Savings & Loan (Walk-In) (913) | 61.00 TE/KGSF | -------- | 1 |
| Savings & Loan (Drive-In) (914) | 74.17 TE/KGSF | -------- | 1 |

LODGING

| | | | |
|---|---|---|---|
| Hotel (310) | 8.70 TE/Room | 5.31-9.58 | 7 |

| | | | |
|---|---|---|---|
| Motel (320) | 10.19 TE/Occu.Rm | 4.67-14.64 | 13 |
| MEDICAL | | | |
| Hospital (610) | 11.77 TE/Bed | 3.00-32.83 | 20 |
| Hospital (610) | 16.78 TE/KGSFA | 11.40-45.14 | 14 |
| Nursing Home (620) | 2.60 TE/Bed | 1.88-3.97 | 18 |
| Clinic (630) | 23.79 TE/KGSFA | -------- | 1 |
| INDUSTRIAL | | | |
| General Light Industrial (110) | 6.97 TE/KGSF | 1.58-16.88 | 18 |
| General Heavy Industrial (120) | 1.50 TE/KGSF | 0.58-1.84 | 3 |
| Industrial Park (130) | 6.97 TE/KGSFBA | 0.91-36.97 | 48 |
| Manufacturing (140) | 3.85 TE/KGSF | 0.50-52.05 | 60 |
| Warehousing (150) | 4.88 TE/KGSF | 1.51-17.00 | 15 |

## WHY CAN'T WE HAVE A 4-WAY STOP TO REDUCE CRASHES?

Many people believe that installing STOP signs on all approaches to an intersection will result in fewer crashes. This is not always the case, however. Although the crash severity may be lessened, drivers are penalized by the additional delay and higher vehicle operating costs (fuel, brakes, etc.). There is no real evidence to indicate that STOP signs decrease the speed of traffic. Impatient drivers view the additional delay caused by unwarranted STOP signs as "lost time" to be made up by driving at higher speeds between STOP signs. Unwarranted STOP signs breed disrespect by motorists who tend to ignore them or slow down without stopping. This can sometimes lead to tragic consequences.

State Law requires the installation of all traffic control devices, including STOP signs to meet State standards adopted by the Florida Department of Transportation (FDOT). Florida Statutes, Section 316.0745, state: "The Department of Transportation shall adopt a uniform system of traffic control devices for use on the streets and highways of the State." The Statutes also state: "All official traffic control signals or official traffic control devices purchased and installed in this State by any public body or official shall conform with the manual and specifications published by the Department of Transportation ...."

The Manual on Uniform Traffic Control Devices (MUTCD) published by the U.S. Department of

Transportation is the national standard for Traffic Control Devices. The FDOT has adopted the MUTCD as the State standard.

The installation of a multiway stop condition must first meet the warrants as set forth in the MUTCD. Any of the following conditions may warrant a STOP sign installation (sec. 2B-5):

1. Where traffic signals are warranted and urgently needed, the multiway STOP is an interim measure that can be installed quickly to control traffic while arrangements are being made for the signal installation.

2. A crash problem, as indicated by five or more reported crashes of a type susceptible to correction by a multiway STOP installation in a 12-month period. Such crashes include right and left-turn collisions as well as right-angle collisions.

3. Minimum traffic volumes:

(a) The total vehicular volume entering the intersection from all approaches must average at least 500 vehicles per hour for any 8 hours of an average day, and

(b) The combined vehicular and pedestrian volume from the minor street or highway must average at least 200 units per hour for the same 8 hours, with an average delay to minor street vehicular traffic of at least 30 seconds per vehicle during the maximum hour, but

(c) When the 85-percentile approach speed of the major street traffic exceeds 40 miles per hour, the minimum vehicular volume warrant is 70 percent of the above requirements.

STOP signs should not be viewed as a cure-all for solving all safety problems but, when properly located, can be useful traffic control devices to enhance safety for all roadway users.

## WHAT IS A DRI?

In 1972, the Florida Legislature enacted Chapter 380.06 of the Florida Statutes. This law identified large developments for extensive review. These Developments are called Developments of Regional Impact (DRI). Chapter 380.06 states that a project is considered to have a regional impact and designated a DRI if because of its character, magnitude or location, it would have a substantial effect on the health, safety or welfare of citizens of more than one county. The law further specifies thresholds for different land use types that will vary with the size of the county. The following list is a summary of thresholds for various facilities:

AIRPORTS - Any new airport with paved runways, new passenger terminal or existing runway or terminal expansion by 25% or more.

ATTRACTIONS & RECREATION FACILITIES - Any of the following facilities:

1. Sports, entertainment, amusement or recreation facility which provides for:

(a) a single performance with over 2,500 parking spaces or more than 10,000 permanent seats;

(b) a serial performance with over 1,000 parking spaces or more than 4,000 permanent seats.

2. Construction of a new pari-mutuel facility or an existing facility that has a 10% increase in parking spaces.

HOSPITALS

1. A proposed hospital which has a design capacity of more than 600 beds, or

2. A new facility that serves two or more counties.

INDUSTRIAL PLANTS & INDUSTRIAL PARKS

1. Any new facility with over 2,500 parking spaces, or

2. A new facility that occupies a site greater than 320 acres.

MINING OPERATIONS

1. A facility with removal or disturbance of over 100 acres per year of solid minerals or overburden, or

2. A facility with a water consumption of over 3,000,000 gallons per day.

OFFICE DEVELOPMENTS

1. A new facility that occupies over 30 acres of land, or

2. A facility with over 300,000 square feet of gross floor area.

3. A facility with over 600,000 square feet of gross floor area in counties over 500,000 population.

PETROLEUM STORAGE FACILITIES

1. A new facility within 1,000 feet of navigable water and storing over 50,000 barrels, or

2. A new facility with a storage capacity of over 200,000 barrels.

PORT FACILITIES

1. Wet storage or mooring of over 100 watercraft used exclusively for sport, pleasure or commercial fishing.

2. Dry storage of more than 150 watercraft used for sport, pleasure or commercial fishing.

3. Wet or dry storage or mooring of more the 300 watercraft used exclusively for sport, pleasure or commercial fishing in an area in the state marina siting plan as suitable for a marina.

4. Dry storage of over 300 watercraft used exclusively for sport, pleasure or commercial fishing at a marina constructed prior to 7-1-85.

RESIDENTIAL DEVELOPMENTS - Any proposed residential development to be over the following dwelling units:

a) Counties with a population of less than 25,000, threshold = 250 welling Units (DU's).

b) Counties with 25,000 to 50,000 population, threshold = 500 DU's.

c) Counties with population of 50,001 to 100,000, threshold = 750 DU's.

d) Counties with population of 100,001 to 250,000, threshold = 1,000 DU's.

e) Counties with population of 250,001 to 500,000, threshold = 2,000 DU's.

f) Counties with population of of over 500,000, threshold = 3,000 DU's.

SCHOOLS

1. A new school with over 3,000 full-time equivalent students, or

2. The expansion of a facility by at least 20% of the design population.

SHOPPING CENTERS - Any proposed retail or wholesale business that

1. Occupies more than 40 acres of land, or

2. Encompasses more than 400,000 square feet of gross floor area, or

3. Provides parking spaces for more than 2,500 cars.

HOTEL OR MOTELS -

1. Any proposed hotel or motel development that is planned to create or accommodate 350 or more units, or

2. Any proposed hotel or motel development over 750 units in counties with over 500,000 population.

RECREATIONAL VEHICLE DEVELOPMENTS - Proposed recreational vehicle development with 500 or more spaces.

MIXED USE DEVELOPMENTS

Any proposed development with two or more land uses if the sum of the threshold percentages is more than 130%.

The developer of any project exceeding 120% of these thresholds must file an application for Development Approval with the State Department of Community Affairs, the Regional Planning Council and the unit of local government having jurisdiction. This application must include:

- Maps and a project description.

- Environmental information that covers air, land, water, wetlands, flood plains, vegetation and wildlife.

- Historical and Archaeological sites.

- Employment and Economic Characteristics.

- Public Facilities including wastewater management, drainage, water supply, solid waste, energy, education, recreation and open space, health care, police and fire protection and public transportation.

- Housing.

If a development is between 80% and 120% of the above thresholds, the developer may need to prove that it is not a DRI by preparing a "Binding Letter Application" (BLA). The BLA, much simpler than a DRI, is a short form impact assessment which is intended to show whether the developer's project has any significant regional impact.

## WHAT IS A LOCAL GOVERNMENT COMPREHENSIVE PLAN?

State and local governments have become aware of the costs of uncontrolled growth. Inadequately managed development imposes costs in terms of additional public facility and service needs, adverse environmental impacts, and a lot of the qualities which make a community special. Florida's citizens and local officials are beginning to recognize that properly managed growth can benefit their communities in several ways. Potential benefits include a broader range of job opportunities, protection of natural resources, affordable housing, the elimination of sprawl and a more compact development pattern which

is capable of being served by existing and planned public facilities.

In response to this awareness, the Florida Legislature, during the past fifteen years, has enacted a series of laws requiring state, regional and local government agencies to prepare plans to manage Florida's rapid growth. A 1972 Act directed the Governor's Office to prepare a State Comprehensive Plan for adoption by the Legislature and directed the eleven regional planning councils to prepare and adopt comprehensive regional policy plans, all within specified deadlines.

Local governments, which were required by a 1975 act to prepare and adopt comprehensive plans, were directed by the 1985 and 1986 revisions of that act (the Local Government Comprehensive Planning and Land Development Regulation Act) to ensure that their plans were consistent with the State Comprehensive Plan and appropriate regional plans. The result of this legislation is a statewide framework for coordinated planning.

Because both the State Comprehensive Plan, adopted by state statute, and local plans, which must be adopted by ordinance, have the force of law, this framework does more than require the production of government documents. To ensure that local plans are implemented, the local planning act directed the state land planning agency (the Florida Department of Community Affairs) to adopt by rule minimum criteria for determining plan compliance with the act and required local plans to contain measurable objectives and specific policies to ensure implementation. It also required local governments to adopt, within one year after submitting their plan for state compliance review, specific land development regulations consistent with their plan and to only allow development where sufficient services are available or are committed to be available at the same time as the development's impacts.

Regardless of where a local government chooses to begin planning, an initial vision, subject to refinement later, can help guide other important planning activities. These activities include the collection and analysis of data related to locally perceived needs, the development of goals, objectives and policies to achieve the desired future growth pattern and way of life, and the ongoing evaluation of the plan's effectiveness in meeting local needs and achieving desired results.

The Local Government Comprehensive Plan consists of the following elements:

Future Land Use; Traffic Circulation; Mass Transit; Port, Aviation and Related Facilities; Housing; Sanitary Sewer, Solid Waste, Drainage, Potable Water, and Natural Groundwater Aquifer Recharge; Coastal Management; Conservation; Recreation and Open Space; Intergovernmental Coordination; and Capital Improvements.

## WHAT IS THE FUNCTIONALLY CLASSIFIED ROAD SYSTEM?

In 1977, the Florida Legislature enacted Chapter 77-165 which provided for the establishment of the functional classification of public roads in Florida. The law defined the various road classifications, established public road systems based on these classifications and provided a mechanism for a continuing evaluation of each classified road. The law also required that functional evaluations performed after 1982 utilize a quantitative criteria developed by the Florida Department of Transportation (FDOT).

Florida Statutes, Chapter 334.03, defines Functional Classification as "The assignment of roads into systems according to the character of service they provide in relation to the total road network. Basic functional categories include arterial roads, collector roads and local roads which may be subdivided into principal, major, or minor levels. Those levels may be additionally divided into rural and urban categories." Functional classifications designated by the FDOT include:

State Rural Principal Arterial

State Urban Extension Principal Arterial

County Urban Extension Major Collector

County Rural Minor Collector

| | |
|---|---|
| State Intra Urban Principal Arterial | County Urban Extension Minor Collector |
| State Rural Minor Arterial | County Intra Urban Collector |
| State Urban Extension Minor Arterial | County Local Road |
| State Intra Urban Minor Arterial | Municipal Intra Urban Collector |
| County Intra Urban Minor Arterial | Municipal Urban Collector |
| County Rural Major Collector | Municipal Local Road |

The quantitative criteria developed by the FDOT, known as System Attribute Score (SAS) is based upon two system classification theories. The first classification theory is based on the concept that a road has certain road attributes which define its functional service. These road attributes are physical and operational characteristics such as:

Average Daily Traffic (ADT); Length of Road (Miles); Trucks (Number of);

Access Factor (ADT/access points per mile); Intersections/Interchanges (Number of);

Mobility (Number of Counties road is in); Speed (MPH); Traffic Signals; Lanes; Divided/Undivided

The second classification theory is based on the concept that the whole road network is comprised of system elements (routes) that interconnect and link together the end points of transportation service. System elements are each defined in terms of their operation within a hierarchal order of service connections. A few typical relationships between road linkage and functional classification are shown below:

| LINKAGE | FUNCTIONAL CLASSIFICATION |
|---|---|
| Urbanized to Urbanized w/Arterial Termini | Principal Arterial |
| Bypass Around Urban Area w/Minor Arterial Termini | Minor Arterial |
| Community-to-Other Community, or to Urbanized/Urban | Major Collector |
| Rural-to-Urbanized/Urban or Community/Not Arterial-to-Arterial | Minor Collector |
| Within Community | Local |

Based on these functional classifications, agencies have the responsibility for the maintenance and improvements along roadways under their jurisdiction. Cities and Counties are allotted funds by the State

to carry out these duties on their assigned roads while the FDOT is responsible for State roads, interstates and other limited access roads.

## HOW ARE TRANSPORTATION PROJECTS FUNDED?

Due to the rapid growth throughout Florida, many agencies must depend on several funding methods to provide for new road projects. Revenue sources that are being used by various agencies include the following:

A. DISCRETIONARY TAXES

1. Ad Valorem (Property) Tax - While allowing local governments to use the ad valorem tax, the Constitution limits the millage rate to 10 mills for County purposes, 10 mills for Municipal purposes and 10 mills for school districts. Although additional ad valorem millage for debt service and operating purposes for a maximum of two years is allowed, this additional millage is subject to voter approval.

2. Municipal Utility Tax - This tax is available to municipalities up to a maximum of 10%, with other statutory limitations depending upon the type of utility being taxed.

3. Occupational License Taxes - Cities and Counties can use this tax.

B. NON-DISCRETIONARY TAXES

1. Sales Taxes for Mass Transit - At up to 1% rate, these taxes are available to Broward, Dade, Duval, Sarasota and Volusia Counties.

2. Motor Fuel Tax - The 5th, 6th and 7th cent of the State motor fuel tax is paid directly to Florida's 67 counties. Distribution is based on 25% County area, 25% population and 50% motor fuel tax collection to the total State. The 5th and 6th cent must be used for road construction and maintenance and the 7th cent must be used for maintenance of County roads and bridges.

A Local Option Motor Fuel Tax of up to 6 per gallon, earmarked for transportation needs, can be levied without voter approval by all Counties and an additional Voted motor fuel tax of 1 per gallon is allowed with voter approval.

The Optional 6 per gallon Motor Fuel Tax that a County can assess must be used for "transportation expenditures" including (a) Public transportation operations and maintenance; (b) Roadway and right of way maintenance and equipment; (c) Roadway and right of way drainage; (d) Streetlighting; (e) Traffic signs, traffic engineering, signalization and pavement markings; (f) Bridge maintenance and operation; (g) Debt service and current expenditures for transportation capital projections in the foregoing program areas including construction or reconstruction of roads.

The voted 1 per gallon tax pays the costs of land acquisition, construction, reconstruction and maintenance of roads and streets.

3. Municipal/State Revenue Sharing is unit-based (i.e., cigarettes and 8th cent motor fuel tax).

4. County/State Revenue Sharing is largely based on the intangible tax. Intangible tax is based on personal property such as stocks, bonds, mutual funds and other obligations for payment of money.

5. User Fees are direct charges for products or services such as toll roads.

6. Special Assessments may be used by counties, municipalities and special districts for indirect service charges. The service must provide a real and substantial benefit to real property. Special assessments differ in type or degree from the benefits provided to the community as a whole.

7. Impact Fees fall under the category of an indirect charge for services. Impact fees rely on the police

power of the jurisdiction, not on any taxing authority. They cannot be used for improvements to, or extensions of, existing facilities unrelated to the needs created by new development, nor can they be used for operation, maintenance or replacement of existing facilities. They can only be used for those capital facility capacity needs necessitated by new growth.

All existing Federal, State and local funds for roads have specific uses or system limitations. Consequently, it becomes necessary to determine which system receives improvements. With the estimate of funds by category, a financial plan can be refined from the needed roadway improvements. By using the functional classification program, certain roads are identified by ownership and are eligible for funding on a priority basis.

Revised: March 23, 1990

## WHAT IS A TRANSPORTATION MODEL?

A computer model is simply a representation of a real object or process. Physical models are used to represent objects or structures. Mathematical models are used to represent established relationships which evolve from some process such as the interaction between speed, flow, and density in a traffic stream. Computer models are mathematical rather than physical in nature. The use of a mathematical model does not necessarily require a computer; however, models that describe complex relationships or multiple operations are usually easier to incorporate into a computer program than to calculate manually.

There are two general approaches to numerical problem solving in engineering.

1. The first is the experimental or empirical approach in which answers to engineering questions are by actual measurement rather than by calculations. For example, the traffic carrying capacity of a roadway has been addressed experimentally to determine the effect of such factors as roadway width, parking, etc. The results have been incorporated into the "Highway Capacity Manual". The main advantage of the experimental approach is the credHOWibility resulting from making direct measurements of a specific process under specific conditions. There is no need to rely on assumptions, approximations or other factors that may reduce confidence in the validity of the solution to a given problem.

2. The modeling approach, on the other hand, makes use of available information on the process being studied to generate additional information, generally in the form of specific answers to specific questions. Compared to the direct measurement approach, computer modeling offers some important benefits in certain areas, especially when applied to complex problems which do not lend themselves to simple experimental solutions. Specific advantages include:

(a) Cost: it is usually possible to model a complex situation such as a moon landing at much lower expense,

(b) Safety: computer specialists are seldom injured in the course of their duties,

(c) Speed: many processes such as weather patterns can be simulated at many times their actual speed,

(d) Scope: it is possible using computer modeling to examine hypothetical problems such as a proposed road or to develop future traffic volumes,

(e) Controllability: it is usually easier to constrain the parameters of a model; consequently, the effects of each parameter may be independently controlled.

All of these advantages are of some interest to the traffic engineer who is concerned with systems that are costly to install, which experience safety problems, and which require data analysis over long periods often under hypothetical conditions.

A few popular transportation models are:

SOAP (Signal Operations Analysis Package)

PASSER (Progression Analysis and Signal System Evaluation Routine)

TRANSYT-7F (TRAffic Network StudY Tool)

NETSIM (NETwork SIMulation Model)

FSUTMS (Florida Standard Urban Transportation Model Structure)

## WHAT IS THE 'FSUTMS'?

FSUTMS stands for the Florida Standard Urban Transportation Model Structure. This standard model has been under development by the Florida Department of Transportation (FDOT) since 1975.

The FSUTMS model structure consists of standardized computer software; urban area data formats and operating procedures. These standards common to all urban studies in Florida, have been developed for the primary purpose of reducing the time and effort required to produce long-range travel demand forecasts. Under such standardization, FDOT is able to efficiently provide software updates, procedural manuals, and technical support to district and local planning agencies.

The FSUTMS model is available in micro, mini and mainframe versions that use the same input data. In Florida at least 22 urban study areas have been modeled using FSUTMS.

The following 6 basic program steps are identified in the Florida Standard Model:

1. The External Trips Step data parameters include:

- Base Year external to external (EE) trip interchanges

- Growth Rates for each External station

- Ratio of through (EE) trips to internal-external (IE) trips at each external station

2. The Trip Generation Step data parameters are:

- Trip Production and Attraction Rates

- Land Use Social Economic Variables

3A. The Highway Network Step data parameters include: 3B. The Transit Network Step data parameters include:

- Coordinates (for distance calculations) - Transit Headway

- Toll Information - Transit Layover Time

- Number of Lanes - Transit Routes and Modes

- Area Type and Facility Type - Transit Operating Costs

- Speed and Capacity - Passenger Car Equivalents

- Traffic Counts

4. The Distribution Step data parameters include:

- Friction Factors

- Terminal and Intrazonal Times (Terminal times represent the trip time utilized in traveling from the doorway at the trip origin to the vehicle at its parked location. Intrazonal times account for travel time within a zone.)

- Transit Captivity Factor and Utility Constants

5. The Mode Step (computes Mode Split, convert auto person trips to auto vehicle trips)

- Mode Split Parameters

- Occupancy Rates

6. The Assignment Step data parameters include:

- Number of Iterations (should be set to maximize accuracy and minimize computer time) full peak hour to 24 hours

- CONFAC factor (to convert hourly capacities to daily capacities)

- Speed change curve for capacity restraint

7. The Evaluation Step data parameters include:

- Crash rates

- Noise rates

- Emission rates

- Energy usage

- Capital Improvement Costs

- Maintenance Costs

- Travel Time Costs

- Crash Costs

Revised: April 1, 1989

## WHAT ARE THE 'WARRANTS' FOR TRAFFIC SIGNALS?

In order to assure traffic signals are installed only where necessary, a series of 11 warrants have been developed and accepted by traffic engineers throughout the country.

Traffic signal warrants are contained in a manual developed by the U.S. Department of Transportation, entitled "Manual on Uniform Traffic Control Devices" (MUTCD).

For State approval, a signal must meet at least one of the warrants presented in the MUTCD.

A summary of the 11 Warrants for Traffic Signals is presented in the following table.

| | BOTH APPROACHES OF HIGHER VOLUME APPROACH |
|---|---|

| WARRANT | MAJOR STREET (1) (vehicles/hr for 8 hrs) | OF MINOR STREET (1) (vehicles/hr for 8 hrs) |
|---|---|---|
| 1. Minimum Vehicular Volume (depends on number of lanes) | 500 to 600 | 150 to 200 |
| 2. Interruption of Continuous Traffic (depends on number of lanes) | 750 to 900 | 75 to 100 |
| 3. Minimum Pedestrian Volume | 600 or more plus 150 or more pedestrians crossing streets | -- |
| 4. School Crossing | insufficient number of adequate gaps to allow children to cross | -- |
| 5. Progressive Movement | to maintain proper vehicle grouping between successive signals | -- |
| 6. Crash Experience | five or more crashes susceptible to correction by signal control within a 12 month period | -- |

| | | |
|---|---|---|
| 7. Systems - two major streets | 800 | -- |
| 8. Combination of Warrants | 80 percent of two of the first three warrants | -- |
| 9. Four Hour Volumes | see MUTCD graph | see MUTCD graph |
| 10. Peak Hour Delay | see MUTCD graph | see MUTCD graph |
| 11. Peak Hour Volume | see MUTCD graph | see MUTCD graph |

(1) Need not be eight consecutive hours, but must represent the same hours for the major and minor streets.

SOURCE: Adapted from Manual on Uniform Traffic Control Devices, (MUTCD) 1978 by the U.S. Department of Transportation.

## WHAT IS THE 'FDOT GREENBOOK'?

The "FDOT Greenbook" was developed by the Florida Department of Transportation (FDOT) and is entitled "Manual of Uniform Minimum Standards for Design, Construction and Maintenance of Streets and Highways."

The purpose of the FDOT Greenbook is to provide uniform minimum standards and criteria for the design, construction and maintenance of all public streets, roads, highways, bridges, sidewalks, curbs and curb ramps, crosswalks where feasible, bicycle paths, underpasses and overpasses used by the public for vehicular and pedestrian traffic as directed by Section 335.075 Florida Statutes.

The FDOT standards are intended to provide the basic guidelines for developing and maintaining a highway system with reasonable operating characteristics and a minimum number of hazards.

The standards established by the FDOT Greenbook are intended for use on all new construction projects. It is understood that the FDOT standards cannot be applied completely to all reconstruction projects, however, the standards should be applied to the extent that economic and environmental considerations and existing development will allow.

When the FDOT Greenbook refers to guidelines and design standards given by current American Association of State Highway and Transportation Officials (formerly AASHTO) publications, these guidelines and standards should generally be considered as minimum criteria.

The criteria and standards set forth in other Manuals which have been included by reference shall be considered as requirements within the authority of this Manual.

Listed below is a brief outline of the FDOT Greenbook.

I. PLANNING

A. Introduction

B. Conflicting Criteria

C. Highway Function and Classification

D. Operation

II. LAND DEVELOPMENT

A. Introduction

B. Objectives

C. Principles and Guidelines

D. Conflict and Coordination

E. Control Techniques

F. Reconstruction

G. Maintenance

V. PAVEMENT DESIGN, CONSTRUCTION & MAINTENANCE

A. Pavement Design

B. Pavement Construction

C. Shoulder Treatment

D. Pavement Maintenance

VI. ROADWAY LIGHTING

A. Introduction

B. Objectives

C. Warranting Conditions

D. Level of Illumination

E. Uniformity of Illumination

F. Underpasses

G. Maintenance

IX. BICYCLE FACILITIES

X. MAINTENANCE

A. Introduction

B. Objectives

C. Policy

D. Identification of Needs

E. Establishment of Priorities

F. Establishment of Procedures

G. Maintenance Program

III. GEOMETRIC DESIGN

A. Introduction

B. Objectives

C. Design Elements

B. Objectives and

IV. ROADSIDE DESIGN

A. Introduction

B. Policy

C. Objectives

D. Roadside Design

E. Protective Devices

H. Light Poles

A. Introduction

VII. RAIL-HIGHWAY GRADE CROSSING

A. Introduction

B. Objectives

C. Policy

D. Planning of Operations

C. Design and Grade Crossings

D. Maintenance and Reconstruction

VIII. PEDESTRIAN TRAFFIC

A. Introduction

B. Policy and Objectives

C. Conflict Elimination & Reduction

D. Protection

XI. WORK SITE SAFETY

A. Introduction

B. Objectives

C. Policy

D. Planning of Operations

E. Work Site Operations

F. Evaluation of Program

## WHAT IS CONCURRENCY?

Concurrency means that the necessary public facilities and services to maintain the adopted level of service standards are available or will be in place when the impacts of the development occur.

The "Local Government Comprehensive Planning and Land Development Regulation Act", commonly referred to as the 1985 Growth Management Act (GMA), prohibits the issuance of building permits to developments which would reduce the level of public services impacted by the development to below the Level of Service (LOS) required by a Local Government's Comprehensive Plan (LGCP).

Some have referred to the "Concurrency Doctrine" as the "Doomsday Clause" in the Growth Management Act since it could severely limit or stop growth in parts of the State.

Florida Statutes Section 163.3177(10)h(1987) state: "It is the intent of the Legislature that public facilities and services needed to support development shall be available concurrent with the impacts of

such development. In meeting this intent, public facility and service availability shall be deemed sufficient if the public facilities and services for a development are phased, or the development is phased, so that the public facilities and those related services which are deemed necessary by the local government to operate the facilities necessitated by that development are available concurrent with the impacts of the development. The public facilities and services, unless already available, are to be consistent with the capital improvement element of the local comprehensive plan..."

The Act requires that each local government prepare a comprehensive plan and submit its plan to Florida's State land planning agency, the Department of Community Affairs (DCA), on designated dates between July 1, 1988 and July 1, 1991.

Florida Statutes, Section 163.3202(1)-(2)g(1987) require that: "(1) Within 1 year after submission of its...comprehensive plan (all local governments) in this state shall adopt or amend and enforce land development regulations that are consistent with and implement their adopted comprehensive plan...(2) Local land development regulations shall contain specific and detailed provisions necessary or desirable to implement the adopted comprehensive plan and shall as a minimum: (g) Provide that public facilities and services meet or exceed the standards established in the capital improvements element required (under this Act) and are available when needed for the development, or that development orders and permits are conditioned on the availability of these public facilities and services necessary to serve the proposed development. Not later than 1 year after its due date established by the state...a local government shall not issue a development order or permit which results in a reduction in the level of services for the affected public facilities below the level of services provided in the comprehensive plan of the local government."

DCA's secretary, Thomas Pelham, has indicated the following will satisfy the concurrency requirement: "(1) The necessary facilities are in place at the time a development permit is issued or development permit is issued subject to the condition that the necessary facilities will be in place when the impacts of the development occur; (2) The necessary facilities are under construction at the time a permit is issued; (3) The necessary facilities are the subject of a binding contract executed for the construction of those facilities at the time a development permit is issued; or (4) The necessary facilities have been included in the local government's budget at the time a development permit is issued even though the facilities are not yet the subject of a binding contract for their construction."

Florida Statutes, Section 163.3215 (1987) provides that any aggrieved or adversely affected party has the right to maintain action for injunctive or other relief against any local government to prevent the local government from taking any action on a development order that is not consistent with its adopted comprehensive plan.

## WHAT ARE 'PASSER-BY' TRIPS?

Land use activities generate traffic to and from a particular site. Many types of commercial activities such as Service Stations, Fast Food Restaurants, Convenience Stores, Supermarkets, Banks and Shopping Centers generate a portion of the traffic that is already on the adjacent street that merely stop at the establishment in passing by (i.e. passer-by traffic).

Passer-by factors are used to recognize and reduce the estimated additional total daily traffic to the street(s) serving a proposed development. They are not applied directly to reduce trip generation and turning movement volume at driveways serving a development.

There are three categories of trips: Primary Shopping Trips, Diverted Linked Trips and Passer-by Trips.

A Primary Shopping Trip to a retail facility is one in which the purpose of the trip is shopping and the trip pattern is generally home-to-shopping-to-home.

A Diverted Linked Trip or a Passer-by Trip is one in which the shopping destination is a secondary part of the primary trip such as work-to-shopping-to-home. The diverted linked trip involves a route diversion

from one roadway to another.

The Passer-by Trip comes directly from the traffic stream passing the facility on the adjacent street system and does not require a diversion from another roadway. Two ITE publications, the Trip Generation Manual, 5th Edition (1991), and the Transportation and Land Development Manual (1988), present the following data related to passer-by trip rates:

| GENERATOR | % PASSER-BY TRIPS (% OF SITE TRAFFIC) |
|---|---|
| Service Station | 58% |
| Fast-Food Restaurant | 45% |
| Convenience Store | 16-45% |
| Supermarket | 28% |
| Banks w/Drive Thru Window | 14% |
| Hardware Store | 8% |

Shopping Center:

$$\text{Ln (Pass-By Trip \%)} = -0.341 \text{ Ln } \left(\frac{\text{GLA}}{1000}\right)$$

(Use with caution - See Manual)

| | | |
|---|---|---|
| 50,000 | SFGLA | 56.94% |
| 100,000 | SFGLA | 44.95% |
| 150,000 | SFGLA | 39.15% |
| 200,000 | SFGLA | 35.49% |
| 250,000 | SFGLA | 32.89% |

% Passer-by for Shopping Centers = 45.1 - 0.0225 X SFGLA/1000

## WHAT IS MEANT BY A DESIGN VEHICLE?

The Florida Department of Transportation (FDOT) "Manual of Uniform Minimum Standards For Design, Construction and Maintenance For Streets and Highways" defines a "design vehicle" as a selected motor vehicle whose weight, dimensions and operating characteristics are used to establish highway design controls to accommodate vehicles of a designated type. For the purpose of geometric design, the design vehicle should be one with dimensions and minimum turning radii larger than those of almost all vehicles in its class. One or more of these vehicles should be used as a control in the selection of geometric design elements. In certain industrial (or other) areas, special service vehicles may have to be considered in the design. Fire equipment and emergency vehicles should have reasonable access to all areas.

If a significant number or percentage (5 percent of all the total traffic) of vehicles of those classes larger than passenger vehicles are likely to use a particular street or highway, that class should be used as a design control. The design of major arterial streets and highways should normally be adequate to accommodate all design vehicles. The decision as to which of the design vehicles (or other special vehicles) should be used as a control is complex and requires careful study. Each situation must be evaluated individually to arrive at a reasonable estimate of the type and volume of expected traffic.

Design criteria that are significantly affected by the type of vehicle include: horizontal and vertical clearances, alignments, lane widening on curves, shoulder width requirements, turning roadway and intersection radii, intersection sight distance and acceleration criteria. Particular care should be taken in establishing the radii at intersections so that vehicles may enter the street or highway without encroaching upon adjacent travel lanes or leaving the pavement.

The American Association of State and Highway Transportation Officials (AASHTO) manual entitled "A Policy On Geometric Design Of Highways and Streets" indicates that the boundaries of the turning paths of ten selected design vehicles when making the sharpest turns are established by the outer trace of the front overhang and the path of the inner rear wheel. This turn assumes that the outer front wheel follows the circular arc defining the minimum turning radius as determined by the vehicle steering mechanism.

Geometric design requirements for trucks and buses are much more severe than they are for passenger vehicles. Trucks and buses are wider and have longer wheelbases and greater minimum turning radii. These are the principal characteristic dimensions affecting horizontal highway design. The longer single-unit trucks and buses require greater minimum turning radii than most vehicle combinations, but because of their greater offtracking, the longer vehicle combinations also require greater widths of turning paths.

The minimum turning radii of the outside and inside wheel paths shown are for turns at less than 10 mph. Higher speeds require larger radii than the minimums.

(Note: The design table is on the next page.)

## WHAT CAN BE DONE TO DEVELOP A SAFE AND EFFICIENT TRANSPORTATION SYSTEM?

Traffic Engineers are striving to provide roadway conditions that contribute to smooth and efficient traffic flow. Experience has shown that safety is enhanced by smooth traffic flow. Disrupting the smooth flow of traffic increases the probability of crashes.

Erratic traffic operation may be caused by vehicles stopping or slowing in the roadway, passing and weaving maneuvers, unwarranted traffic signals, the lack of street name signs and unreasonably low speed limits. In addition, too many commercial signs may cause driver confusion and indecision. Slower speed does not insure safer traffic operation. The chances of a driver becoming involved in a crash are least when he is traveling at the average speed of traffic. The population growth in many areas poses great challenges for Traffic Engineers. These engineers are utilizing many traffic management techniques to control traffic within the development review process. These management techniques should:

Limit the number of driveways from new developments.

Increase spacing between driveways.

Limit indiscriminate access to major roads by requiring connecting drives between adjacent shopping centers.

Require developers to direct traffic into signalized access points.

Require developers to provide a good turning radius at driveways to allow drivers to enter and exit roads easily.

Require developers to provide tapers or turn lanes when needed.

Require developers to provide traffic control devices such as signs, pavement markings and signals.

In addition, Traffic Engineers can improve traffic safety and congestion by the following techniques:

Install computerized signal systems to improve traffic flow.

Install turn lanes at existing or proposed intersections and along sections of roadways where there are frequent turning movements.

Install bikeways and sidewalks where needed.

Promote mass transit where feasible.

Promote ride share programs.

Direct benefits to the public can be improved safety and air quality and reduced travel cost and travel time. Safety can be enhanced by improving the uniformity of traffic flow and reducing the vehicles on the roadway. Air Quality can be improved by reducing the number of stops and motorized vehicles on the road. Delay in Travel Time can be reduced especially at signalized intersections. Travel Cost can be reduced by minimizing delays at traffic signals and in heavy traffic congestion.

## HOW CAN I OBTAIN THE PUBLICATIONS USED BY TRAFFIC ENGINEERS?

Some of the Publications used by Traffic Engineers are listed below:

"Manual Of Uniform Minimum Standards For Design, Construction, and Maintenance For Streets and Highways" (FDOT Green Book) 1994 Edition by Florida Department of Transportation

Cost $10.00 + tax:

Florida Department of Transportation

Maps and Publications Section

Haydon Burns Building

605 Suwannee Street, MS-12

Tallahassee, Florida 32399-0450, Phone: (904) 488-9220 SUNCOM 278-9220

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"Manual On Uniform Traffic Control Devices For Streets and Highways" (MUTCD) 1988 by the U.S. Department of Transportation. Publication Code LP-140

Cost $44.00 + 10% for Shipping & Handling with a $5 Minimum

Institute of Transportation Engineers

525 School Street, S.W.Suite 410

Washington, D.C. 20024-2729, Phone: (202) 554-805 * now a two book set *

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"A Policy On Geometric Design Of Highways and Streets, 1994" (includes metric) (AASHTO Green Book) Publications Code GDHS

Cost $50.00 includes S/H:

American Association of State Highway and Transportation Officials

444 North Capitol Street N.W., Suite 249

Washington, D.C. 20001, Phone: (202) 624-5800

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"Highway Capacity Manual (Special Report 209), 1985" w/updated chapters By Transportation Research Board. Publication Code LP-102

Cost $80.00 + 10% for Shipping & Handling with a $5 Minimum:

Institute of Transportation Engineers

525 School Street, S.W., Suite 410

Washington, D.C. 20024-2729, Phone: (202) 554-8050

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"Trip Generation Manual (5th Ed)" 1991 by Institute of Transportation Engineers. Publication Code IR-016A

Cost $150.00 ($130.00 to ITE Members) + 10% for Shipping & Handling:

Institute of Transportation Engineers

525 School Street, S.W., Suite 410

Washington, D.C. 20024-2729, Phone: (202) 554-8050

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"Florida Traffic Laws - Florida Statutes 1987 - Chapter 316 State Uniform Traffic Control" No Charge from: $10.60 prepaid, includes S/H

Department of State

Bureau of Administrative Code

401 S. Monroe St.

Elliot Bldg.

Tallahassee, FL 32399-0250

## WHAT IS A CLOSED LOOP SYSTEM?

A "closed loop system" is a system of communication between individual signalized intersections within an arterial or a network of arterial roadways, and the Traffic Engineer.

A closed loop system basically consists of sampling detectors at intersections, local controllers, one or more on-street master controllers and a central microcomputer.

The system is called "closed loop" because two-way communication can be maintained between the street controllers and the user. "Open loop" systems maintain only one-way communication "up" from the sampling detectors to the on-street master to the local controllers, but no feedback is received from the local controller or the master. The addition of the central microcomputer "closed the loop" in the system's communications. Data is transferred from the sampling detectors to the master via the local controllers; the sampling detectors report to the central microcomputer via the master; and the central microcomputer transmits information to the master and to the local controllers via the master.

ta Loading

The following data is entered by the microcomputer user via a keyboard:

Controller settings such as minimum and maximum GREEN, YELLOW, and RED times

System timing parameters such as cycle lengths, offsets, splits and permissive periods

Traffic responsive computation information such as sampling detector ththreshold values, detector assignments and weighting factors

Time clock information (at the master and local controllers) and Time Of Day (TOD) and Day Of Week (DOW) schedule entries

The microcomputer "downloads" the above data to the master controller and to each local controller via the master.

System Monitoring and Reports

The central microcomputer can receive from the master the following information:

Mode of operation (TOD/DOW, traffic responsive, free, etc.) for the current time and/or previous 24 hour period.

Timing plan in effect for the current time and the previous 24 hour period.

Status of local controllers (flash, preemption, failures, etc.) for the previous 24 hours.

Status of sampling detectors (in/out service, failures) including all volume and occupancy data for the previous 24 hours.

## WHAT GIVES THE COUNTY THE RIGHT TO DIG UP MY FRONT YARD?

Increasing urbanization has made necessary many roadway reconstruction projects in built-up areas. Some residents do not understand that the public right of way extends into what they consider to be their private property.

The Florida Department of Transportation (FDOT) publication entitled "Manual of Uniform Minimum Standards For Design, Construction and Maintenance For Streets and Highways" (Green Book) includes the following definition of the term "right of way": "A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to transportation purposes. More specifically, land in which the State, the Department, a County or a municipality owns the fee, or has an easement devoted to or required for use as a public road."

During roadway construction projects, many public agency officials or contractors are mistakenly blamed for trespassing onto private property. Even if the public agency does not own actual fee simple title to property, it may acquire the right to the property when the public agency has maintained a roadway for a period of at least four (4) years. This type of right of way is known as prescriptive right of way.

Florida Statutes, Section 95.361, presents information on when roads are presumed to be dedicated through the prescriptive right concept. This section states: "When a road, constructed by a County, a municipality, or the Division of Road Operations has been maintained or repaired continuously and without interruption for 4 years by the County, municipality, or Division of Road Operations, jointly or severally, the road shall be deemed to be dedicated to the public to the extent in width that has been actually maintained for the prescribed period, whether the road has been formally established as a public highway or not."

Most public agencies such as Volusia County require a permit for any work within the County right of way. This includes driveway connections and culvert/utility installations. The reason for controlling work within the public right of way is to insure that hazardous objects are not installed too close to the roadway. Also, the maintaining agency officials must insure that installations in the right of way do not obstruct the view of drivers.

The area of public right of way for roads usually varies from 50 feet for a local road with curb and gutter to 300 feet for an interstate highway. To determine the right of way width for a road, a citizen may contact the Engineering Department (Right of Way Section) of the maintaining agency of the roadway.

## WHAT IS GIS?

The term "GIS" is used to refer to Geographic Information System. The computerized GIS is used to automate everything from simple mapping functions to complex land use analysis, site selection and network modeling.

GIS has created a new dimension in map making which allows an enhanced ability to manage our cities, natural resources, parcels of land and utility systems.

Using GIS, public officials can quickly evaluate the impact of proposed facilities. For example, public works engineers can assess the impact of a pollution spill on all areas along a water distribution path and fire and police departments can dispatch vehicles based on a detailed analysis of the quickest path between two points. Tasks that once took months can now be accomplished in a few minutes, using GIS.

Through GIS, geographic information from maps, aerial photographs and batches of descriptive records are fed into computers as overlays representing property parcels, political and man-made boundaries, utility distribution networks, natural land base features, land use patterns, demographic data, etc. This information is tied to these graphic pictures by the numerous records that describe them. For example, the dimensions and ownership data associated with each land parcel, or the height, diameter, material, number and other information associated with a utility pole. An urban planner could quickly find all industrially zoned land that meets minimum acreage criteria and is within 100 yards of a major transportation feeder. GIS provides the means to point to a parcel on a display screen and have instant access to all publicly available information about that address.

A technology similar to GIS, is called AM/FM which is an acronym for Automated Mapping/Facilities Management. GIS is used within a planning, natural resources and land records management environment AM/FM is used more often by the utility environment. The AM/FM stems from an evolution of computer-aided drafting technology.

The basic hardware components of a GIS include:

Central Processing Unit (CPU) is where the information processing tasks are performed and software commands executed.

Disk Drives are the storage medium for the GIS database. Tape drives are the medium for loading data from other systems, backing up and storing GIS data.

Output Devices include printers, plotters and copiers.

Digitizing Device is the mechanism for electronically tracing manually produced maps to produce a digital version of the information.

Workstation includes a graphics display screen and a keyboard used for data input, editing and manipulation.

## WHERE SHOULD A 'STOP BAR' (LINE) AND 'STOP SIGN'

## BE PLACED AT AN INTERSECTION?

In Florida, as in most states, the standard for signs, signals and pavement markings is the "Manual On Uniform Traffic Control Devices" (MUTCD). This publication by the U.S. Department of Transportation serves as the standard for the installation of all traffic control devices.

The MUTCD indicates that a stop bar (line) is a solid white line, normally 12 to 24 inches wide, extending across all approach lanes to a STOP sign or traffic signal. A stop bar should be placed parallel to the centerline of the intersecting street. A stop bar should be used in both rural and urban areas where it is important to indicate the point, behind which vehicles are required to stop, in compliance with a STOP sign, traffic signal, officer's direction, or other legal requirement.

A stop bar, when used, should ordinarily be placed 4 feet in advance of and parallel to the nearest crosswalk line. In the absence of a marked crosswalk, the stop bar should be placed at the desired stopping point and no case more than 30 feet or less than 4 feet from the nearest edge of the

intersecting roadway.

When a stop bar is used in conjunction with a STOP sign, it should be placed in line with the STOP sign. However, if the STOP sign cannot be located exactly where vehicles are expected to stop, the stop bar should be placed at the desired stopping point.

In general, a STOP sign should be located to optimize nighttime visibility and minimize mud splatter. In addition,a STOP sign should be located so that it is not obscured by other signs or hidden from view by roadside objects and vegetation.

In order to provide adequate lateral clearance for the motorists who may leave the roadway in rural areas and strike the sign support, a STOP sign should be located at least 6 feet from the edge of the shoulder or, if there is no shoulder, 12 feet, with a maximum of 14 feet from the edge of the travelled way. The height to the bottom of the STOP sign in rural areas should not be less than 5 feet or more than 8 feet above the edge of the roadway.

In urban areas a lesser lateral clearance may be used where necessary. Although 2 feet is recommended as a working minimum, a clearance of 1 foot from the curb face is permissible where sidewalk width is limited or where existing poles are close to the curb. The height to the bottom of a STOP sign in urban areas should not be less than 7 feet or more than 8 feet above the top of the curb.

## HOW D0 YOU KNOW HOW MUCH TRAFFIC IS GOING TO BE ON A ROAD IN 10 YEARS?

The following factors must be considered by Traffic Engineers and Planners in order to develop traffic projections.

Historic traffic volumes

Historic and projected population growth rates

Future land uses, to include average expected development as well as

high impact developments (DRIs)

To determine future traffic projections, Engineers and Planners must:

Use data from an area transportation model, or

Use historic traffic counts and land use information to develop a

growth curve, or

Use historic traffic counts and a compound linear rate table to

determine a growth factor that is adjusted by changes in land

development.

Projection of future traffic volumes expected on the area roadways can be accomplished using several methodologies, depending upon what data is available.

The use of an area transportation model, such as FSUTMS, is the most desirable method. It assigns traffic to the roadway links based on a comprehensive and complex series of vehicle trip assignments derived from information on future population, economic conditions, land use and system operations information.

An alternative analysis involves the use of growth trends developed from historic traffic count information and land uses, both existing and planned, for the area. This information, plotted over time,

will form a curve which is then extended to project future traffic volumes. Typically, the curves will show a linear or non-linear relationship that should correlate with the area's growth trends, i.e. high growth, slow but steady, increment, etc., each of which should exhibit a different curve. Extension of the curve, consistent with the expected growth trend, will provide future traffic volumes expected on the roadways. This may be done by physically graphing the data or through the use of computerized curve-fitting analysis programs. Knowledge of the area, professional judgment, and economic conditions form important elements in determining the rational basis for traffic projections.

Another methodology involves the use of growth factors referenced through compound linear rate tables. This involves the determination of a rate of growth from the ratio of the most recent and earliest count volumes, which is then located on compound linear rate tables according to the number of years between the counts. From this table, a growth factor is determined for the desired number of years into the future, which is then applied to existing traffic volumes to produce the expected traffic volume for the desired year. Any anticipated major changes in land use could be used to alter the projection.

## WHAT ARE THE "WARRANTS" FOR MULTIWAY STOP SIGNS?

In order to insure multiway stop signs are installed only where necessary, warrants have been developed by the U.S. Department of Transportation and accepted by traffic engineers throughout the country.

The "Manual on Uniform Traffic Control Devices" (MUTCD) describes the conditions that may warrant a multiway stop sign installation. Multiway stop signs should only be used when traffic volumes on intersecting roads are approximately equal.

ALL APPROACHES MINOR STREET

Average Vehicles/ Vehicles/Hr. +

Hr. for the Pedestrians/Hr.

WARRANT Highest 8 Hrs. during same

8 hours

1. At intersections where - -

traffic signals are

already warranted prior

to actual signal

installation

2. 5 or more crashes - -

(Right turn, left turn,

right angle) in a

12 month period

3. Minimum traffic volumes 500 200 + 30 sec./

vehicle delay

during maximum

hour

4. When 85 percentile speeds 350 140 + 30 sec./

exceed 40 MPH the minimum vehicle delay

traffic volume warrant is during maximum

70% of the normal warrant hour

Source: Adapted from Manual on Uniform Traffic Control Devices, (MUTCD) 1988 by U.S. Department of Transportation.

## WHAT IS THE "ACCESSIBILITY REQUIREMENTS MANUAL?"

The "Accessibility Requirements Manual" is a public document that was published in January 1990 by the Department of Community Affairs (DCA), Florida Board of Building Codes and Standards.

The 1989 Florida Legislature passed a bill which mandated many changes to the requirements for accessibility for the physically handicapped. The bill also stipulated that the Department of Community Affairs (DCA) be required to prepare a manual which fully explains the relationship and requirements of the American National Standards Institute standard and Part V of Chapter 553, Florida Statutes relating to handicapped accessibility.

This manual was published by the Department of Community Affairs in association with the Florida Agricultural and Mechanical University's Institute for Building Sciences, School of Architecture, who illustrated the drawings and cover.

Many different groups throughout the state including building departments, design professionals, builders and handicapped advocates will use this publication to determine the minimum requirements for providing accessibility. Included in the manual are the requirements of Part V, Chapter 553, Florida Statutes; the mandatory portions of A117.1, 1986; definitions; interpretive illustrations; special notes; and an appendix of legislation relating to issues that affect the disabled. The text is laid out in concert with the interpretive illustrations so that a verbal and graphic representation of the subject matter is presented together. It should be noted that the interpretive illustrations are often construed as the code itself.

The code and manual address accessibility features designed for the physically handicapped adult. It does not address the special needs of the physically handicapped child; however, the Florida Department of Education is currently developing a standard that identifies the special design requirements needed to provide accessibility for physically handicapped children.

Accessibility features of buildings and facilities provide the opportunity for handicapped persons in the community to become more self reliant and independent. Barrier free design can help to enable a person with disabilities to achieve his or her potential for contributions to our society.

The new DCA "Accessibility Requirements Manual" includes the following topics:

Basic Components Windows Lavatories, Sinks, & Mirrors Signage

Space Allowances & Reach Ranges Doors Bathtubs Telephones

Accessible Route Entrances Shower Stalls Food & Liquor Service

Walkways Drinking Fountains Toilet Rooms, Bathrooms, Bathing Establishments

Protruding Objects & Water Coolers Facilities & Shower Rooms Seating, Tables &

Ground & Floor Surfaces Restroom Vestibules Changing Rooms Work Surfaces

Parking Spaces & Passenger Restroom & Toilet Storage Areas Auditorium & Assembly

Curb Ramps Grab Bars, & Tub & Loading Zones Room Clear Passage

Ramps Shower Seats Controls & Operating Mechanisms Residential

Stairs Water Closets Alarms Occupancies

Elevators Toilet Stalls Detectable Warnings Modifications &

Exceptions From Accessibility Urinals Enforcement & Date Waivers

Requirements

A copy of the DCA "Accessibility Requirements Manual" may be obtained from the:

Department of Community Affairs

Florida Board of Building Codes & Standards

2740 Centerview Drive

Tallahassee, Florida 32399-2100

Phone: (904) 487-1824 SUNCOM 277-1824

## WHAT IS THE RADIUS FOR A TRAFFIC IMPACT STUDY?

When doing a traffic impact study, there is always the question as to how far the study area should reasonably go from the site. The purpose of this TIPS is to provide a general guidance for the study area radii for a particular type of development.

These suggested study area radii require the consideration of two variables. One of these is the type of land use, and the second is the magnitude of that land use. The table below for suggested impact study area radii is based upon the average trip length for various types of land uses. Generally, one quarter of this average trip length is utilized as the significant impact area for the largest developments for each type of land use and the study area decreases in size with smaller projects. In rural areas the study area radii may be extended to cover the nearest major intersections.

### SUGGESTED IMPACT STUDY AREA RADII (MILES)

| | **Average Trip Length (Miles)** | **Over 1000 Units** | **500 - 1000 Units** | **250 - 499 Units** | **0 - 249 Units** |
|---|---|---|---|---|---|
| Residential | 6 - 8 | 2.0 | 1.5 | 1.0 | 0.5 |
| Hotel/Motel | 2 - 3 | 1.5 | 1.0 | 0.5 | 0.25 |
| | | **Over 200,000 GBA** | **100,000 - 199,000** | **0 - 99,000** | |
| Office | 5 - 6 | 1.5 | 1.0 | 0.5 | |
| | | **Over** | **200,000 -** | **100,000 -** | **50,000 - 0 - 49,000** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | **400,000 GBA** | **399,000** | **199,000** | **99,000** | |
| Shopping Center | 1 - 5 | 1.5 | 1.0 | 0.75 | 0.5 | 0.25 |
| | | **All Sizes** | | | | |
| Quality/Sit Down Restaurant | 1 - 1.5 | 0.25 | | | | |
| Fast Food | 0.5 - 1.0 | 0.25 | | | | |
| Convenience Store | 0.5 - 1.0 | 0.25 | | | | |
| Drive - In Bank | 1.5 - 2.0 | 0.25 | | | | |
| Day Care Center | 1.5 - 2.0 | 0.25 | | | | |
| Building Materials | 3.4 | 0.75 | | | | |
| | | **Over 1,000,000 GBA** | **500,000 - 1,000,000** | **250,000 - 499,000** | **0 - 250,000** | |
| Industrial/ Manufacturing | 6 - 8 | 2 | 1.5 | 1 | 0.5 | |

## WHAT IS THE HARM OF INSTALLING AN UNWARRANTED TRAFFIC CONTROL DEVICE?

Traffic Control Devices (TCD's) such as Traffic Signals, Stop Signs and Speed Limit Signs are installed to regulate traffic flow and improve safety. The installation of these TCD's should be based on the professional judgement of Traffic Engineers after careful study of the location to be controlled. The study should consider such factors as crash frequency and type, vehicle speeds and traffic volumes.

On occasion, an elected official, with a true "politician's" zeal to please everyone, influences the installation of a traffic control device against the advice of the Traffic Engineer. The elected official's motivation is often an angry or persistent citizen rather than the objective professional judgement of the Traffic Engineer.

Many elected officials do not realize that there are National guidelines for the installation of Traffic Control Devices. The Manual On Uniform Traffic Control Devices (MUTCD) gives Transportation Engineers the uniform standards to safely assist motorists as they travel. It defines a series of uniform Traffic Control Devices (Signals, Signs and Pavement Markings) which are clear in their messages as applied on the nation's roadway system.

The March 1990 issue of "Public Roads" magazine, published by the U.S. Department of Transportation, contained an article on "Motorist Compliance With Standard Traffic Control Devices." The article examined the following forms of motorist noncompliance:

Speeding

Not coming to a full stop at STOP signs

Failing to yield right of way to pedestrians

Ignoring active railroad crossing devices

Making illegal turns

Using lanes improperly

Violating traffic signal indications

Driving too fast through work zones

Encroaching on centerlines

Violating passing zone restrictions

The behavioral studies collected compliance and other data at a large number of typical sites over extended periods of time. In the process, hundreds of thousands of motorists were observed. The clear conclusion was that motorist noncompliance does take place.

One of the recommendations in the US DOT article was: "To ensure that the motoring public maintains a healthy respect for TCD's, traffic professionals must use them prudently. Through concerted efforts of the nature outlined above (Engineering, Enforcement and Education), the safety and efficiency of our streets and highways can be maximized."

Another recommendation was to "Apply TCD's consistently to ensure they command respect."

## WHY IS LANDSCAPE DESIGN & MAINTENANCE IMPORTANT IN PRIVATE PARKING LOTS?

Landscape design is important because it can contribute greatly to safe ingress and egress of any busy parking lot.

The problem begins long before the sight obstruction becomes noticeable to the motorist. It starts when the architect and site planners are preparing building plans and parking lot layouts. Many times the architect or site plan designer will try to take advantage of the end island treatment of parking aisles to meet landscaping requirements of the municipalities. Unfortunately, the type of planting selected is not always functional from a traffic or pedestrian safety perspective. When plants are allowed to grow to a height that makes it difficult for a motorist to see oncoming vehicles or pedestrians, it creates a traffic safety hazard.

Property owners, site managers and ground maintenance personnel should be trained to identify poorly maintained plantings and correct hazardous conditions. Property owners who invite the public onto their property should come under the same scrutiny as the public sector.

Traffic crashes caused by sight distance problems in parking lots of shopping center, office complexes or other private commercial sites are just as harmful as traffic crashes on public residential streets. There could be more pedestrians crossing in a neighborhood shopping center than on a typical residential street.

Many traffic crashes on private sites go unreported because they are minor in nature and many police departments do not respond to private property crashes unless there is an injury. Pedestrian crashes from either public or private sites are usually reported. Police agencies have very little enforcement authority within private parking areas.

Because there is little documented traffic data on private property, traffic analysts rely on judgment and experience when reviewing site plans from a traffic safety perspective.

Municipalities have corner clearance ordinances regulating the height of fences and hedges at the intersection of public roads. These restrictions are generally enforced when the obstruction becomes a traffic safety problem. However, there are few municipalities which have regulations or inspect sight triangle or corner clearance obstructions in parking areas.

Good landscaping treatment that would improve safety and reduce crashes should use the following guidelines:

1. Trees, at maturity, should not have a trunk diameter larger than 4 inches.

2. Trees should require very little trimming or other maintenance and should not have branches lower than 6 feet.

3. Hedges should be avoided. Plants and vegetation should be no higher than 18 inches.

4. A clear zone between 18 inches and 6 feet above the ground should be left open.

These few guidelines could go a long way toward reducing crashes within private property parking areas. People bruise, bleed and break bones the same way on public or private property - the ownership of the property does not lessen the pain of the injured.

## WHAT IS THE ROADSIDE CLEAR ZONE?

The Florida Department of Transportation states "The roadside clear zone is that area outside the traveled way, available for use by errant vehicles." The roadside clear zone is an area in the median or on the side of the road, off the pavement, that is kept clear of fixed objects. If vehicles drive off the road, for whatever reason, the drivers have leeway to regain control of the vehicle and steer back onto the road. The clear zone also permits disabled vehicles to pull off the roadway. Clear zones are established to provide an extra margin of safety for travelers.

Minimum clear zone standards have been specified by the Florida Department of Transportation for the design of roadways. New highways always include clear zones when they are built. The width of the clear zone depends upon the type of roadway, the speed of vehicles traveling on the roadway, and several other criteria. Rural Interstate highways, with heavy traffic and high speeds, should have a clear zone at least 30 feet wide. A city street with curbs and a 35 mph speed limit requires a minimum 2 feet of clear zone behind each curb. Other clear zone widths are specified for each different type of road. Clear zones should be wider along the outside edge of curves, since out-of-control vehicles are more likely to run off that side of the road.

Other elements considered when specifying clear zone width include the slope of the shoulder, the depth of roadside ditches, railroad crossing equipment, and existing structures or buildings that may be very difficult to relocate when a road is widened. Objects that cannot be removed from the clear zone need protective devices like crash cushions or guardrail installed to protect drivers and passengers.

Clear zones can be enhanced with some innovative techniques. Using selected plant species, landscaping can provide a natural crash cushion of thick shrubbery or bushes. Placing electric and telephone lines underground will eliminate concrete poles along the side of the road. Billboards and other large signs can be built using supports that angle away from the roadway. Smaller signs can use special breakaway supports. Street lights can bolt to low-profile concrete foundations. Stormwater drains and culverts can be designed for vehicles to drive over them rather than crash into them.

Trees, business signs, or local landmarks are sometimes identified for relocation during a road widening project in order to provide an adequate clear zone. It is often difficult for residents to accept the need for relocating such objects to accommodate a larger road, but highway designers are responsible to the public for developing the safest practical roadway design.

When you see damaged light poles, heavily scarred tree trunks, or guardrail installed around a chipped concrete foundation and think about the events that caused the damage, you will understand why engineers insist on adequate roadside clear zones.

For more information:

1. Florida DOT: Minimum Standards for Design, Construction and Maintenance for Streets and Highways, 1994; Chapter 3

2. Florida DOT: 1994 Roadway and Traffic Design Standards; Index Number 700

3. Wright and Paquette: Highway Engineering, 4th Edition, 1979; Chapter 11

4. American Association of State Highway and Transportation Officials: A Policy on Geometric Design of Highways and Streets, 1990.

## WHAT ARE THE TYPICAL DESIGN STANDARDS FOR BIKE PATHS?

Bike Path standards are presented in a publication entitled "Bicycle Facilities Planning and Design Manual" published by the Florida Department of Transportation. This Manual contains the information necessary to plan, locate, select, and design bicycle facilities.

The FDOT Manual defines Bicycle Path as "a bikeway which is physically separated from motorized vehicle traffic by an open space or barrier and which is either within the highway right of way or within an independent right of way. Crossflows with motorized traffic are minimized."

A copy of the FDOT Bicycle Facilities Planning & Design Manual may be obtained from the FDOT Maps and Publications Section, 605 Suwannee Street, Tallahassee, Florida 32301-8064, Phone: (904) 488-9220, SUNCOM 278-9220.

A summary of the minimum FDOT Bicycle Path standards for planning purposes are:

| ELEMENT | RECOMMENDED | ALLOWABLE |
|---|---|---|
| WIDTH (FT) | 10' | 8' |
| DESIGN SPEED (MPH) | 20 MPH OR HIGHER | 20 MPH |
| VERTICAL CLEARANCE (FT) OVERHEAD | 10' | 8.2' |

| | | |
|---|---|---|
| STOPPING SIGHT DISTANCE (FT) FOR 20 MPH DESIGN SPEED | 130' AT 0% GRADE<br>140' AT 5% GRADE | 130' AT 0% GRADE<br>140' AT 5% GRADE |
| MINIMUM RADIUS (FT) FOR 20 MPH DESIGN SPEED | 95' OR MORE | 95'AT 2% SUPERELEVATION |
| SUPERELEVATION (%) | 2% TO 5% | 2% TO 5% |
| MAXIMUM GRADE (%) | 2% | 4% TO 5% |
| MINIMUM CROSS SLOPE (%) FOR DRAINAGE | 2% TO 3% | 2% TO 3% |
| SEPARATION FROM TREES, POLES, WALLS, FENCES, GUARDRAILS (FT) | 3' OR MORE | 2' |
| SEPARATION FROM CANALS, BARRIER | WIDE SEPARATION | 7' OR USE POSITIVE |

| | | |
|---|---|---|
| DITCHES, ETC. (FT) (Should be a graded area with no greater than a 5% slope) | | SUCH AS DENSE SHRUBBERY OR CHAIN LINK FENCE AT LEAST 4.5' HIGH. |
| SEPARATION FROM ROADWAY (FT) | WIDE SEPARATION | 5' OR USE PHYSICAL DIVIDER SUCH AS A FENCE, DENSE SHRUBS OR OTHER. DIVIDER SHALL BE A MINIMUM OF 4.5' HIGH. |
| MINIMUM HEIGHT OF BARRIERS (FT) | | 4.5' |
| DRAINAGE GRATE LOCATION | KEEP OUT OF BICYCLISTS EXPECTED PATH. | KEEP OUT OF BICYCLISTS EXPECTED PATH. |
| RAILROAD CROSSINGS ANGLE (DEGREES) | PATH SHOULD CROSS AT RIGHT ANGLE (90) TO THE RAIL. | 45 |
| PAVEMENT STRUCTURAL SECTION | 4"-6" PORTLAND CEMENT CONCRETE | 1"-2" ASPHALTIC |

| | | |
|---|---|---|
| | CONCRETE SURFACE | SURFACE 3-4" STABILIZED |
| | ON COMPACTED SUBGRADE. | LIMEROCK BASE ON COMPACTED |

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| | | |
|---|---|---|
| SIGN CLEARANCE TO BOTTOM (FT) | 7' | 7' |

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## WHAT IS 'TRANSPORTATION DEMAND MANAGEMENT'?

Transportation Demand Management (TDM) focuses on ways of influencing the amount and the time of the demand on transportation. It encourages alternatives to the single-occupant automobile and more efficient use of the transportation system by altering the demand characteristics. When properly used, TDM actions can promote the use of public transportation, increase the people moving capacity of the transportation system and allow the transportation system to support a higher development density.

TDM TECHNIQUES are divided into the following three categories:

1. Promote alternatives to the automobile by encouraging persons to switch to other modes of travel such as transit, bicycles, or walking. The following techniques can be used:

a) Park-and-Ride service

b) Shuttle Systems

c) Pedestrian Systems

d) Employer Transit Subsidies

e) Bicycling

2. Encourage more efficient use of automobiles and roads by use of Ride Sharing and Alternative Work Hours. The following techniques can be used:

a) High-Occupancy Vehicle (HOV) Lanes

b) Ride Sharing

c) Alternative Work Hours

d) Truck Traffic Restrictions

3. Discourage the use of automobiles by making their use more costly or more difficult. The following techniques can be used:

a) Limiting on-Street Parking.

b) Limiting off-Street Public Parking

c) Allowing developers to provide fewer than the standard number of parking spaces in exchange for promoting other TDM activities, such as ride sharing and variable work hours.

d) Requiring Parking Permits for Residential Areas adjacent to business districts.

e) Increasing Long-Term (commuter) Parking Rates.

The above three TDM techniques can be used together to reduce peak-hour traffic by five (5) to fifteen (15) percent (%).

TDM is a part of the activities of Transportation System Management (TSM). In addition to the types of actions included in TDM, TSM includes:

Traffic Signal Timing Improvement

Turn Lane Additions

Transit Scheduling Improvement

Other Improvements related to Increased Operating Efficiency of the Existing Transportation System.

## WHAT ARE THE FACTS ABOUT FLORIDA'S DUI LAW?

In 1989, there were 36,312 alcohol related crashes and Florida's new DUI Law is a serious effort to reduce the number of alcohol related vehicular deaths which totaled 1,492 in 1989.

The new law requires police to immediately suspend the license of any driver who has a Blood-Alcohol Content (BAC) of .10% or higher or who refuses to take a breathalyzer test or provide a urine sample upon request of the arresting officer. In cases of crashes with injuries or fatalities, blood tests may not be refused without loss of license for up to 18 months. Four DUI convictions require a lifetime revocation of a Florida driver's license. The table below summarizes the penalties for the convicted drunk driver:

| Penalty | 1st Conviction | 2nd Conviction | 3rd Conviction |
|---|---|---|---|
| License Revocation | Mandatory 180 days, up to 1 year. | Minimum 5 yrs., if within 5 yrs. of 1st conviction. | Minimum 10 yrs., if within 10 yrs. of 1st conviction. |
| Fine (See note below) | Mandatory $250. up to $500. | Mandatory $500. Up to $1,000. | Mandatory $1,000. Up to $2,500. |

| | | | | |
|---|---|---|---|---|
| Imprisonment | Up to 6 Mos. optional. | 10 days mandatory, if within 3 yrs. of 1st conviction. Up to 9 mos. | 30 days mandatory, if within 5 yrs. of prior conviction. Up to 1 yr. | optional. |
| Probation | Mandatory - Up to 1 Year with fee paid by offender. | | | |
| Community Service | At least 50 hours with costs paid by offender. | | | |
| Education | Required substance abuse course with fee paid by offender. Further treatment of the defendant may be | | | |

required by the

school.

Note: Minimum fine will be doubled if convicted with blood alcohol of .20 (double legal limit) or above.

SOURCE: AAA World Magazine, January/February 1991, American Automobile Association

**"WHAT ARE FLORIDA'S NEW ACCESS MANAGEMENT AND DRIVEWAY CONNECTION STANDARDS?"**

On February 13, 1991, the Florida Department of Transportation passed one of the nation's most far reaching access management regulations. The regulation is called Administrative Rule Chapter 14-97 Access Management Classification System and Standards. This rule institutes minimum spacing standards for driveway connections, median openings, and traffic signals on the State Highway System.

By July 1992, the entire State Highway System should be categorized into seven Access Management Classifications, each with its own minimum standard for access management. See Exhibit 1 for the classification system for arterials.

INTERIM STANDARDS

Until highways are classified, minimum spacing standards for driveway connections, median openings, and signals will be handled by Interim Standards found in Rule Chapter 14-97. These Interim Standards will be based primarily on the posted speed limit of the highway. See Exhibit 2 for the Interim Standards.

THE MEASUREMENTS

With the institution of this new Administrative Rule, the Department of Transportation will also be measuring distances between connections and corner clearance in a new fashion. Previously, this distance was measured from the point of tangency to the point of curvature, but now it will be measured from the edge of the pavement to the edge of the pavement of the other connection or nearest intersecting road (Please see Exhibit 4). Corner clearance standards and the connections spacing standards will be the same. This means that if the connection spacing standard is 330 feet, the corner clearance standard will also be 330 feet except where exempted specifically within this Rule.

THE IMPORTANT EXEMPTIONS

There are exemptions to this Rule such as small single family residential and where "reasonable access" would be denied, such as a small landlocked parcel with no alternate access. In this case, a single driveway would be allowed.

THE TREATMENT OF MULTIPLE PROPERTIES UNDER SINGLE OWNERSHIP

Multiple neighboring properties under single ownership will be treated as if they were one parcel. Exemptions to this are leasehold interests in existence before February 13, 1991, and bonafide contracts for sale anytime. Minimum corner clearance measurements may be used where there are small corner properties that are landlocked from having reasonable access either through a side street or their neighbor. Where such properties exist, they may be allowed to have driveways closer to the intersections than are called for within the standards. Under these portions of the regulations, they will usually be required to have restrictive driveway connections such as right-in/right-out. Exhibit 4 is the table of the minimum corner clearance distances.

This summary is not intended to be a substitute for complete knowledge of Rule Chapter 14-97, but is

intended as an overview. We highly recommend that you get a copy of Rule Chapter 14-97, available at Florida Department of Transportation Media Center, Maps and Publications Sale at 605 Suwannee Street, M.S. 12, Tallahassee, Florida 32399-0450, telephone (904)488-9220. The cost of this document is $7.00.

## WHAT IS AN INTELLIGENT TRANSPORTATION SYSTEM?

Since 1956, road travel has more than tripled to nearly 1.9 trillion vehicle-miles. At the same time, road and street mileage has seen only modest growth: from 1970 to 1985, vehicle population grew 63 percent while road mileage increased 5 percent. In 1987, drivers experienced 2 billion vehicle-hours of delay on urban freeways, a 60% increase from 1984. Studies of the top U.S. cities estimate total economic losses due to congestion at approximately $42 billion per year. Two-thirds of all urban interstate traffic is experiencing severe congestion (defined as travel under 35 mph).

Studies estimate that travel will double to 3.8 trillion vehicle-miles by 2020. If no major improvements are made, there will be about 10 billion vehicle-hours of delay by 2005. The driving population is aging. Today, 1 in 8 drivers is older than 65. By 2020, 1 in 5 drivers (20% of the driving population) will be over 65.

Engineers need to look for ways to increase driver mobility while increasing safety. The National Transportation Policy recognizes these issues by including four strategies to address future surface transportation needs: Build New Capacity; Manage Travel Demand; Increase Operational Efficiency; and Advance New Technologies. One strategy with the potential to effectively provide for increased mobility and safety is advancing new technologies. Collectively, these technologies are known as Intelligent Transportation Systems (ITS), or smart cars and smart highways.

IVHS represents the marriage of the vehicle, the driver and the highway to improve system efficiency and driver safety. There are four elements of ITS:

- Advanced Traffic Management System (ATMS) - Commercial Vehicle Operations (CVO)

- Advanced Traveler Information System (ATIS) - Advanced Vehicle Control System (AVCS)

IVHS shows promise for increased safety: by 2010, they could save an estimated 11,500 lives and prevent 442,000 injuries annually.

Advanced Traffic Management Systems

Much like air traffic controllers at an airport, these systems are intended to monitor, control and manage traffic. ATMS will:

- Work in real-time

- Use algorithms to predict congestion and implement countermeasures

- Use area-wide surveillance and detection to develop optimal solutions

- Coordinate control of freeways and arterials

- Provide rapid response to incidents

- Provide information to individual vehicles

- Be able to cover multiple jurisdictions

ATMS should substantially reduce congestion by reducing delays an estimated 10 to 35 percent. The greatest potential for reduced delay is through improved incident management strategies - one minute saved in clearing an incident reduces the duration of congestion by at least 4 to 5 minutes. ATMS also

helps reduce crashes by improving traffic conditions. (Source: Public Roads, U.S. DOT - FHWA, December 1990)

**"WHAT ARE THE TECHNIQUES TO IMPROVE TRAFFIC FLOW IN URBAN AREAS?"**

Improve Land Use Planning

- Reduce trip generation rate per acre

- Increase number and width of corridors set aside for roads

- Require increased investment by investors

Add or Improve Mass Transit (Extremely expensive)

Build New Roads (Extremely expensive)

Increase Capacity of Existing Roads

- Widen roads (Very expensive)

- Widen intersections only (Expensive)

- Set up ONE-WAY street pairs or networks (Operational complications)

- Upgrade roads by: a. new striping

b. curb and gutter

c. reduce access points

d. reduce other side friction

- Upgrade traffic signals by: a. re-phasing signals (Comparatively inexpensive)

b. re-timing signals (Very high benefit/cost ratio)

- Add new signals - carefully or capacity may be reduced

- Remove unwarranted signals (Inexpensive)

- Re-evaluate use of ALL-STOP, STOP, and YIELD signs

- Implement a reversible lane control system (Operational complications)

Improve Incident Management

- Repair signals and signs more expeditiously (Comparatively inexpensive)

- Set up detours if needed more expeditiously

- Advise drivers to avoid individual incidents by: a. public radio broadcasts

b. variable message signs

c. CCTV monitoring of major intersections and corridors

- Remove/tow debris more expeditiously

- Prevent incidents from being visible by: a. creating visual barriers in freeway medians

b. curtaining off individual incidents

- Move violators away from other traffic for ticketing

Modify Drive Behavior

- Educate drivers: a. driving school

b. license test

c. public service broadcasts

d. newspaper articles

- Ticket violators

- Encourage car-pooling

- Stagger working hours

- Encourage use of mass transit

- Encourage use of alternate private transport: a. walking

b. bicycling

c. motorbiking

- Encourage living closer to work

- Encourage businesses to locate near residences

## "HOW DO 'PEDESTRIAN' SIGNALS WORK?"

A pedestrian signal allows a safe way for pedestrians to cross the street at signalized intersections. The pedestrian signal, when activated, provides time for the pedestrian to enter the street on the steady "WALK" signal and finish crossing the street on the flashing "DONT WALK" SIGNAL. The pedestrian signal is activated by a pedestrian detector push-button, which causes the controller to operate a pre-programmed timed sequence of steady "WALK" and flashing "DONT WALK" indications.

Pedestrian signal indications consist of "WALK" and "DONT WALK" signals or international symbols displaying a person walking for the "WALK" indication and a hand for the "DONT WALK" indication. The "WALK" or person walking symbol is displayed in white and the "DONT WALK" or hand symbol is displayed in Portland orange.

The pedestrian signal sequence begins when the "WALK" indication is illuminated. This sequence should be at least 4 to 7 seconds long and allow enough time to leave the curb and begin crossing the street before the clearance interval begins. At locations where large numbers of pedestrians are crossing, a longer "WALK" interval may be warranted.

The pedestrian clearance interval consists of a flashing "DONT WALK" indication. During this interval the pedestrian should complete his crossing, however; he should not begin crossing on the flashing "DONT WALK" signal. The clearance interval timing is based on the street width divided by 4 feet per second

walking time. If elderly pedestrians are using the crossing it is recommended that the walk speed be reduced to 3.5 feet per second. The distance is measured across the street: from the curb on the near side to the center of the last lane on the far side of the street.

The "DONT WALK" indication, steadily illuminated, means that a pedestrian should not enter the street in the direction of the pedestrian signal.

The design requirements for a pedestrian signal require that a pedestrian signal be mounted at least 8 feet, but no higher than 10 feet, above the sidewalk. The pedestrian signal shall be so positioned and adjusted as to provide maximum visibility to the pedestrian. The pedestrian detector push-button is usually found on the pole under the pedestrian signal head that faces the crossing direction. A sign shall be mounted above the detector unit explaining its purpose and the positioning of the push-button should clearly indicate which crosswalk signal is activated by each push-button.

**WARNING**-Both pedestrians and drivers must be particularly alert while pedestrians are crossing, especially when "Right turn on Red" movements are allowed.

## WHAT ARE TRAFFIC ENGINEERS DOING TO HELP OLDER DRIVERS?

### BACKGROUND

The increasing needs of older road users are becoming more apparent as a greater proportion of our nation's motorists fall into the 65 or older age group. The natural aging process results in a steady decrease in the abilities needed to perform the driving task. The effect of aging upon vision, hearing, coordination, range of movement, strength, attentiveness and response time have been well documented through research.

Concern over how these limitations affect motorists ultimately resulted in the preparation of the Transportation Research Board's Special Report 218, "Transportation in an Aging Society," in 1988. This report summarizes mobility concerns, the problems older drivers have with vehicle operation, and current highway design deficiencies related to older driver abilities. The report presents recommendations for corrective improvements in the following areas:

1. Roadway design and operation.

2. Traffic control devices (signs, signals and markings).

3. Vehicle safety.

4. Driver screening and licensing.

5. Vision screening.

6. Alternative means of transportation.

Implementation of these recommendations would improve the mobility and safety of older persons, and most of the improvements would benefit all age groups.

### FHWA FOLLOW-UP

The Federal Highway Administration supported the TRB's recommendations and developed an action plan to implement the highway-related recommendations of the report. Their "Action Plan for Older Persons," dated February 1989, presented strategies for the following:

1. Highway safety data needs.

2. Traffic control device improvements.

3. Roadway design improvements.

4. Pedestrian improvements.

5. Older person awareness training.

RECOMMENDATIONS

The Florida Department of Transportation (FDOT) will prepare recommendations on specific engineering enhancements to meet the requirements of the older road-user. Concurrent with this effort, the FDOT will be identifying locations and facility types on which to use these enhancements.

Specific design improvements to benefit the older road-user may include:

Improved signing - Increased letter size, retroreflectivity, better placement, multiple and mid-block signing, trailblazing and use of symbols.

Improved pavement marking and delineation - Size of markings, use of edge and centerlines on low volume roads, improved maintenance and inspection, more pavement arrows and words.

Improvements to traffic signals - Larger signal faces, better located within field of view, longer walk phase for pedestrian signals, improved maintenance.

Improved sight distance - For stopping, decision making, intersections, and clear sight line.

Improved intersection configurations - Simplify designs, provide protected left turns, grade separations for very high volumes with confusing movements.

Improved roadway designs - For better channelization, increase use of medians, minimize hazards and unexpected obstacles, eliminate grade crossings.

Improved pedestrian crossings - Provide refuge islands, utilize high visibility crossing pavement markings, re-evaluate pedestrian walk speeds.

Improved roadway lighting - Reduce headlight glare with glare screens and open graded asphalt at pedestrian crossings, interchanges, intersections and mainlines.

These representative design improvements have been proven to benefit the older road-user. The FDOT also recommends that the Department of Highway Safety and Motor Vehicles periodically test all road users on traffic control devices since technology and regulations can and do change.

## WHAT ARE THE DISTINCTIONS AMONG

## ARTERIAL, COLLECTOR AND LOCAL ROADS?

Travellers have two basic needs for roadways: (1) to travel efficiently from origin to destination, and (2) for access to the roadway system. Accordingly, roadways have two primary functions: (1) to carry heavy volumes of traffic at high rates of speed, and (2) to provide access to land. The corresponding facilities are known as arterial roads, and local roads, respectively. Since traffic volumes on arterial roads are normally heavy, the main function of an arterial road is to serve an efficient network supporting high-speed travel and provide capacity to maintain adequate travel speeds.

These two functions, traffic service and land access, are incompatible. A roadway that serves one function cannot serve the other function effectively. Heavy volumes and high-speed traffic on local roads disrupt residential settings, subject pedestrians and pedalcyclists to hazards, and conflict with the safety and ease of land access. These effects counteract the purpose of local roads. Similarly, slow traffic

operations caused by points of land access disrupt the traffic flow, reduce arterial speeds, increase crash potential, and reduce traffic-carrying capabilities. These effects degrade traffic service, increase congestion, and counteract the purpose of arterial roads. Also, degradation of arterial function can cause traffic to seek short-cuts on local streets by speeding through neighborhoods; defeating the purpose of local roads.

Since the two primary functions of roadways are incompatible, a third class of roadway is needed to serve as an interface between the local and arterial. These are collector roads, which collect traffic from the local roads and intercept the arterial roads at locations spaced to minimize disruptions.

A leading consideration associated with functionally classified roadways is to overcome the popular misconception that any roadway can serve multiple functions. Multiple functions result in wasteful consumption of energy, transport time, and in allowing concessions that are irreversible. Because of these functional incompatibilities, it is essential to recognize and preserve the functional integrity of arterial, collector and local roads, not just for now, but also for future generations.

## WHAT IS ISTEA?

The term ISTEA (pronounced Ice Tea) refers to the "Intermodal Surface Transportation Efficiency Act of 1991. This law was signed by President Bush on December 18, 1991. This important bill provides for the renewal of our surface transportation programs to address the changing needs for America's future. It will create jobs, reduce congestion and rebuild our infrastructure.

ISTEA will provide $155 billion for highways, highway safety and mass transportation for the next 6 years (FY 1992-1997). The purpose of the Act is given in its statement of policy: "To develop a National Intermodal Transportation System that is economically efficient, environmentally sound, provides the foundation for the Nation to compete in the global economy and will move people and goods in an energy efficient manner."

Some of the major features include:

* A National Highway System (NHS), consisting primarily of existing Interstate routes. A portion of the Primary System is established to focus Federal resources on roads that are the most important to interstate travel and national defense, roads that connect with other modes of transportation, and are essential for international commerce.

* State and local governments are given more flexibility in determining transportation solutions, whether transit or highways. This will provide the tools for enhanced planning and management systems to guide them in making the best choices.

* New technologies, such as Intelligent Transportation System (ITS) and prototype magnetic levitation systems (MAGLEV) are funded to push the Nation forward into thinking of new approaches in providing 21st Century transportation.

* The private sector is tapped as a source for funding transportation improvements. Restrictions on the use of Federal funds for toll roads have been relaxed and private entities may even own such facilities.

* The Act continues discretionary and formula funds for mass transit.

* Highway funds are available for activities that enhance the environment, such as wetland banking, mitigation of damage to wildlife habitat, historic sites, activities that contribute to meeting air quality standards, a wide range of bicycle and pedestrian projects, and highway beautification.

* Highway safety is further enhanced by a new program to encourage the use of safety belts and motorcycle helmets.

* State uniformity in vehicle registration and fuel tax reporting is required. This will ease the record keeping and reporting burden on businesses and contribute substantially to increased productivity of the

truck and bus industry.

## WHAT BENEFITS DO TRANSPORTATION ENGINEERS RECEIVE FROM WORKSHOPS AND PROFESSIONAL MEETINGS?

The transportation profession has been in a state of change, especially since the introduction of microcomputers. Transportation analysis techniques are continuously being refined and improved as more studies and data become available. The following manuals, handbooks and related software, used by transportation professionals, undergo frequent updating:

- Highway Capacity Manual (HCM) and Software by the Transportation Research Board

- Manual On Uniform Traffic Control Devices (MUTCD) by the U.S. Department of Transportation

- Trip Generation Manual and Related Software by the Institute of Transportation Engineers

- Parking Generation Manual by the Institute of Transportation Engineers

- Manual Of Uniform Minimum Standards for Design, Construction and Maintenance of Streets and Highways (Green Book) by the Florida Department of Transportation

- A Policy On Geometric Design of Highways and Streets by the American Association of State Highway and Transportation Officials (AASHTO)

- Level Of Service Manual by the Florida Department of Transportation

- Bikeway Facilities Planning and Design Manual by the Florida Department of Transportation

Workshops provide transportation professionals with updates of analysis techniques. Meetings such as those held by the Institute of Transportation Engineers provide a forum for engineers and planners to exchange information. The Institute of Transportation Engineers (ITE) is made up of more than 11,000 transportation engineers and planners in over 70 countries. These transportation professionals are responsible for the safe and efficient movement of people and goods on streets, highways and transit systems. Since 1930 the Institute has been providing transportation professionals with programs and resources to help them meet those responsibilities. Institute programs and resources include professional development seminars; technical reports; a monthly journal; local, regional and international meetings; and other forums for the exchange of opinion, ideas, techniques, and research.

Members of the Florida Section of ITE meet three times each year to share and discuss information on various transportation topics. Technical committees include:

Access Management

Growth Management

Residential Traffic Control

Traffic Information Program Series (TIPS)

## WHAT IS THE JUSTIFICATION FOR A LEFT TURN ARROW?

LEFT TURN SIGNAL PHASING

Left turn signal phases facilitate left turning traffic and usually improve the safety of the intersection for left turning vehicles. However, this is done at the expense of the amount of green time available for through traffic and will usually reduce the capacity of the intersection. Left turn arrows also result in

longer cycle lengths which will in turn have a detrimental effect by increasing stops and delays. Pedestrian delays may be increased and due to the increased delay, pedestrians may elect to ignore the pedestrian signal.

While phases for protected left turning vehicles are the most popular and most often added phases, other methods of handling left turn conflicts should be considered first. Potential solutions include prohibited left turns and geometric improvements.

LEFT TURN PHASE CRITERIA

The left turn phase criteria suggested below are a combination of left turning phasing used in several States in the United States and the result of considerable research and study. These warrants are not mandated by the Manual on Uniform Traffic Control Devices (MUTCD) and are provided for information purposes only. Suggested warrants are as follows:

Volumes - Consider left turn phasing when the product of left turning and opposing volumes during peak hours exceed 100,000 on a four lane street, or 50,000 on a two lane street (1 approach lane). Also, the left turn volume for 2 or more approach lanes should be greater than 2 vehicles per cycle during the peak hour period. Volumes meeting these levels indicate that a left turn phase may be justified and further study of the intersection is recommended.

Delay - Consider installing left turn phasing if a left turn total delay of 2 vehicle hours or more occur in a peak hour on a critical approach. Also, there should be a minimum left turn volume of greater than 2 vehicles per cycle during peak hour, and the average delay for left turning vehicle should be at least 35 seconds.

Crash Experience - Install left turn phasing if the critical number of left turn crashes has occurred. For one approach, the critical number is 4 left turn crashes in one year, or 6 in two years. For both approaches, the critical number is 6 left turn crashes in one year, or 10 in 2 years.

PROTECTED/PERMITTED LEFT TURN PHASING

Protected/permitted left turn phasing is a left turn movement of traffic at a signalized intersection having a separate left turn phase in the signal cycle to provide a protected green arrow interval, as well as nonprotected circular green interval. Use of the protected/permitted left turn phasing technique is based on the assumption that the need for a protected left turn interval has been established. One of the basic precepts of the protected/permitted left turn phasing, is that the protected green arrow is displayed only when needed in a traffic demand condition. It is therefore emphasized that the protected/permitted left turn phasing technique is an efficient concept as opposed to a crash reduction concept although it will probably offer safer operation than permissive only operation.

PROTECTED ONLY LEFT TURN PHASING

When a separate interval is provided to accommodate a left turn without conflicting traffic, and left turns are prohibited during the rest of the cycle, protected only left turn phasing occurs.

Although the MUTCD provides no left turn phasing warrants, the traffic control device handbook offers suggested guidelines for separate left turn phasing.

UNPROTECTED LEFT TURN PHASING

Unprotected left turn phasing occurs when an exclusive phase is not provided for left turn vehicles. Left turns are permitted to occur through gaps in the opposing traffic flow. Separate left turn lanes may or may not be provided.

## WHAT IS METRICATION?

Metrication is the process of conversion to the metric system. This process has begun in the U.S. and will be totally established by 1996. The conversion applies to all FHWA manuals, documents, publications, reporting and construction contracts. All programs authorized under titles 23 and 49, U.S.Code, and related highway acts shall be converted to metric. The conversion will be mandatory, not voluntary as in the past, for all procurements, grants and other business-related activities, except to the extent that such conversion is impractical or is likely to cause significant inefficiencies or loss of markets to U.S. firms.

| Measurement | Multiply By | To Obtain |
|---|---|---|
| Acres (Area) | 0.4047 | Hectares |
| Acres (Area) | 4047.0000 | Square Meters |
| Centigrade (Temperature) | (oCx9/5)+32 | Fahrenheit |
| Centimeters (Length) | 10.0000 | Millimeters |
| Centimeters (Length) | 0.3937 | Inches |
| Cubic Feet (Volume) | 0.02832 | Cubic Meters |
| Cubic Meters (Volume) | 35.314 | Cubic Feet |
| Cubic Yards (Volume) | 0.7646 | Cubic Meters |
| Cubic Meters (Volume) | 1.3079 | Cubic Yards |
| Fahrenheit (Temperature) | (oF-32)x1.8 | Centigrade |
| Feet (Length) | 0.3048 | Meters |
| Feet (Length) | 30.4800 | Centimeters |
| Gallons (U.S.) (Volume) | 3.785 | Liters |
| Grams (Weight) | 0.03527 | Ounces |
| Grams (Weight) | 453.5900 | Pounds |
| Hectares (Area) | 2.571 | Acres |

| | | |
|---|---|---|
| Inches (Length) | 25.40 | Millimeters |
| Inches (Length) | 2.540 | Centimeters |
| Inches (Length) | 0.2540 | Meters |
| Kilograms (Weight) | 2.2046 | Pounds |
| Kilograms (Weight) | 35.2736 | Ounces |
| Kilometers (Length) | 0.6214 | Miles |
| Kilometers Per Hour (Speed) | 0.6214 | Miles Per Hour |
| Kilometers Per Hour (Speed) | 0.9113 | Feet Per Second |
| Liters (Volume) | 1.0567 | Quarts |
| Liters (Volume) | 0.2642 | Gallons (U.S) |
| Meters (Length) | 100.0000 | Centimeters |
| Meters (Length) | 1000.0000 | Millimeters |
| Meters (Length) | 3.2808 | Feet |
| Meters (Length) | 1.0936 | Yards |
| Metric Tons (Weight) | 0.98421 | English Tons |
| Miles (Length) | 1.6094 | Kilometers |
| Miles Per Hour (Speed) | 1.6093 | Kilometers Per Hour |
| Milligrams (Weight) | 0.0010 | Grams |
| Millimeters (Length) | 0.1000 | Centimeters |

| | | |
|---|---|---|
| Millimeters (Length) | 0.0010 | Meters |
| Ounces (Weight) | 28.35 | Grams |
| Pounds (Weight) | 0.4536 | Kilograms |
| Square Meters (Area) | 10.764 | Square Feet |
| Square Miles (Area) | 2.590 | Square Kilometers |
| Yards (Length) | 91.44 | Centimeters |
| Yards (Length) | 0.9144 | Meters |

## WHAT ACRONYMS ARE USED FOR INTELLIGENT TRANSPORTATION SYSTEM (ITS)?

ADIS ADVANCED DRIVER INFORMATION SYSTEMS, RENAMED AS ADVANCED TRAVELER INFORMATION SYSTEMS.

AHAR AUTOMATIC HIGHWAY ADVISORY RADIO.

AI ARTIFICIAL INTELLIGENCE.

AMTICS ADVANCED MOBILE TRAFFIC INFORMATION AND COMMUNICATION SYSTEM.

API AUTOMATIC PERSONAL IDENTIFICATION.

APTS ADVANCED PUBLIC TRANSPORTATION SYSTEMS.

ATIS ADVANCED TRAVELER INFORMATION SYSTEMS.

ATMS ADVANCED TRAFFIC MANAGEMENT SYSTEMS.

ATSAC AUTOMATED TRAFFIC SURVEILLANCE AND CONTROL SYSTEM (LOS ANGELES).

AVC AUTOMATIC VEHICLE CLASSIFICATION.

AVCS ADVANCED VEHICLE CONTROL SYSTEMS.

AVI AUTOMATIC VEHICLE IDENTIFICATION.

AVL AUTOMATIC VEHICLE LOCATION.

AVM AUTOMATIC VEHICLE MONITORING.

CARIN CAR INFORMATION AND NAVIGATION SYSTEM.

CB CITIZEN BAND.

CCTV CLOSED CIRCUIT TELEVISION.

CMS CHANGEABLE MESSAGE SIGNS (ALSO VARIABLE MESSAGE SIGNS, VMS).

COM-TV COMMUTER-TV SYSTEM.

CVI COMMERCIAL VEHICLE IDENTIFICATION.

CVO COMMERCIAL VEHICLE OPERATIONS.

EMS EMERGENCY MANAGEMENT SYSTEM.

ETTM ELECTRONIC TOLL AND TRAFFIC MANAGEMENT.

FLAMINGO FLORIDA MOTORISTS INFORMATION NETWORK FOR GUIDANCE AND OPERATIONS (MIAMI).

FSS FIXED SATELLITE SERVICE.

HAR HIGHWAY ADVISORY RADIO.

HELP HEAVY VEHICLE ELECTRONIC LICENSE PLATE PROGRAM.

HOV(S) HIGH OCCUPANCY VEHICLE(S).

HUD HEAD-UP DISPLAY.

HVCO HEAVY VEHICLE & COMMERCIAL OPERATIONS.

ICS INTELLIGENT CORRIDOR SYSTEM.

ILD INDUCTIVE LOOP DETECTORS.

IMS INCIDENT MANAGEMENT SYSTEM.

INFORM INFORMATION FOR MOTORISTS.

IRTE INTEGRATED ROAD TRANSPORT ENVIRONMENT.

ITS INTELLIGENT TRANSPORTATION SYSTEMS.

IVSAWS IN-VEHICLE SAFETY ADVISORY AND WARNING SYSTEMS.

LCD LIQUID CRYSTAL DISPLAY.

LED LIGHT EMITTING DIODE.

OBC ON-BOARD COMPUTERS.

PATH PROGRAM ON ADVANCED TECHNOLOGY FOR THE HIGHWAY (CALIFORNIA).

PGI PARKING GUIDANCE AND INFORMATION.

PIN PERSONAL IDENTIFICATION NUMBER.

PROMETHEUS PROGRAM FOR EUROPEAN TRAFFIC WITH HIGHEST EFFICIENCY AND UNPRECEDENTED SAFETY.

RACS ROAD AUTOMOBILE COMMUNICATION SYSTEM (JAPAN).

RDS RADIO DETERMINATION SATELLITE SERVICES.

RTI ROAD TRANSPORT INFORMATICS (EUROPEAN TERM FOR IVHS).

TARDIS TRAFFIC AND ROADS - DRIVE INTEGRATED SYSTEM.

TMC TRAFFIC MANAGEMENT CENTER.

VMS VARIABLE MESSAGE SIGNS (ALSO CHANGEABLE MESSAGE SIGNS).

## WHAT DO THOSE TRANSPORTATION AGENCY AND ORGANIZATION ACRONYMS MEAN?

AAA AMERICAN AUTOMOBILE ASSOCIATION

AASHTO AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS

APA AMERICAN PLANNING ASSOCIATION

APTA AMERICAN PUBLIC TRANSIT ASSOCIATION

APWA AMERICAN PUBLIC WORKS ASSOCIATION

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

CAC CITIZENS ADVISORY COMMITTEE

CALTRANS CALIFORNIA DEPARTMENT OF TRANSPORTATION

CEC COMMISSION OF THE EUROPEAN COMMUNITY

CUTR CENTER FOR URBAN TRANSPORTATION RESEARCH (UNIVERSITY OF S. FLORIDA)

DCA DEPARTMENT OF COMMUNITY AFFAIRS (FLORIDA)

DHS&MV DEPARTMENT OF HIGHWAY SAFETY & MOTOR VEHICLES (FLORIDA)

DOT DEPARTMENT OF TRANSPORTATION (U.S. OR FLORIDA)

ECFRPC EAST CENTRAL FLORIDA REGIONAL PLANNING COUNCIL

FAA FEDERAL AVIATION ADMINISTRATION (U.S. D.O.T.)

FAPA FLORIDA CHAPTER - AMERICAN PLANNING ASSOCIATION

FBT FLORIDIANS FOR BETTER TRANSPORTAITON

FDOT FLORIDA DEPARTMENT OF TRANSPORTATION

FES FLORIDA ENGINEERING SOCIETY

FHP FLORIDA HIGHWAY PATROL (DHS&MV)

FHWA FEDERAL HIGHWAY ADMINISTRATION (U.S. D.O.T.)

FPZA FLORIDA PLANNING & ZONING ASSOCIATION

FRA FEDERAL RAILROAD ADMINISTRATION (U.S. D.O.T.)

FSITE FLORIDA SECTION - INSTITUTE OF TRANSPORTATION ENGINEERS

FSU FLORIDA STATE UNIVERSITY

FTA FEDERAL TRANSIT ADMINISTRATION (FORMALLY UMTA) U.S. D.O.T.

IIHS INSURANCE INSTITUTE FOR HIGHWAY SAFETY

ITE INSTITUTE OF TRANSPORTATION ENGINEERS

McTRANS MICROCOMPUTERS IN TRANSPORTATION (UNIVERSITY OF FLORIDA)

MPO METROPOLITAN PLANNING ORGANIZATION (LOCAL)

NHTSA NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (U.S. D.O.T.)

NRC NATIONAL RESEARCH COUNCIL

NSC NATIONAL SAFETY COUNCIL

SWFRPC SOUTHWEST FLORIDA REGIONAL PLANNING COUNCIL

TAC TECHNICAL ADVISORY COMMITTEE

T2 TECHNOLOGY TRANSFER (EACH STATE)

TRB TRANSPORTATION RESEARCH BOARD (NATIONALA RESEARCH COUNCIL)

TRC TRANSPORTATION RESEARCH CENTER (U. OF F.)

TTI TEXAS TRANSPORTATION INSTITUTE

UCF UNIVERSITY OF CENTRAL FLORIDA

UF UNIVERSITY OF FLORIDA

UMTA URBAN MASS TRANSIT ASSOCIATION (CHANGED TO FTA)

U.S. D.O.T. UNITED STATES DEPARTMENT OF TRANSPORTATION

USF UNIVERSITY OF SOUTH FLORIDA

UTEC URBAN TRAFFIC ENGINEERS COUNCIL (ITE)

## WHY ARE TRAFFIC ENGINEERS RELUCTANT

## TO INSTALL "DEAF CHILD" OR "BLIND CHILD" WARNING SIGNS?

Traffic Engineers are reluctant to install "Deaf Child" or "Blind Child" Warning Signs for individuals for the following reasons:

- A "Deaf Child" or "Blind Child" Sign does not describe to the motorists where the child might be. Most streets within a residential area have children who react in the same way, and each driver must be aware of all children in a neighborhood environment.

- Special signs such as "Deaf Child" or "Blind Child" signs provide parents and children with a false sense of security that their children are safe when playing on or near the street, when playing in the street is actually an unsafe practice.

Many attempts to attract the driver's attention through the use of unique and unusual signs have been made. Some examples include messages warning of children at play, of domestic animals crossing, of special speed limit enforcement, and odd-value advisory safe speed signs. Usually, these unique signs are installed as a result of emotional and political pressure.

Unfortunately, the novelty effect wears off quickly and the signs no longer attract the attention of regular passers-by. They are a target for vandals and souvenir hunters and have a high replacement cost. Unique message signs have no legal meaning or established precedent for use in basic traffic engineering references; their use is discouraged because of both the lack of proven effectiveness and undesirable liability exposure.

Many Traffic Engineers feel that special warning signs are warranted at a location adjacent to a school for the deaf or for the blind and have considerably more merit than those at a location where a deaf or blind person may only cross occasionally.

## DO BICYCLE RIDERS HAVE TO FOLLOW THE SAME RULES AS VEHICLE DRIVERS?

Florida Law treats bicycle riders of all ages the same as motor vehicle drivers, except for licensing requirements and laws which by their nature can have no application to bicycles. The law imposes additional requirements on bicyclists, most of which are contained in Section 316.2065, Florida Statutes. The major requirements are summarized below.

When operated on a street, a bicycle is subject to the same rules which apply to all vehicles. A bicyclist must travel in the same direction as other traffic and obey all traffic control signs and signals (stop signs, traffic lights, etc.). Bicyclists also are required to use hand signals when turning or stopping. Except when turning left or passing, bicycles must be kept as close as practicable to the right side of the road (or left if on a one-way street).

Unless signs are posted prohibiting access, Florida law permits bicycles to be ridden on all streets and highways other than interstates, Florida's Turnpike, and similar limited-access roads. Bicycles also are permitted on sidewalks except where prohibited by local ordinance.

Bicycles may not be ridden more than two abreast. When ridden two abreast, bicycles may not impede the normal flow of traffic and must occupy only a single lane.

When on a sidewalk or crosswalk, a bicyclist has the same rights and responsibilities as a pedestrian. However, a bicyclist must yield the right-of-way to a pedestrian and must give an audible signal before overtaking and passing a pedestrian.

When operated between dusk and dawn, a bicycle must be equipped with a headlamp exhibiting a white light visible from at least 500 feet and both a lamp and a reflector on the rear, each exhibiting a red light visible from at least 600 feet. Additional lights and reflectors, both on the bicycle and on the rider, are permitted and encouraged when riding at night in order to increase the visibility of the bicycle for drivers of other vehicles.

All bicycles must be equipped with brakes. The brakes must be capable of stopping a bicycle going 10 miles per hour within 25 feet on dry, level, clear pavement.

The driver of a bicycle must be on a permanent seat and keep at least one hand on the handlebars at all times. Bicyclist may not attach themselves or their bicycles to other vehicles.

The number of people allowed to ride on a bicycle is limited to the number for which the bicycle is designed or equipped. Passengers may not be carried on the handlebars or frame of the bicycle. However, an adult may carry a child in a sling or a backpack while riding a bicycle (this is not recommended for very young infants). Trailers may be attached to bicycles for carrying cargo.

For children under 15 years old, the fine for a violation of a traffic law when operating a bicycle is $17.

Bicyclists 15 and older receive the same fines as motor vehicle drivers, but are not assessed points against their driver licenses. Parents or legal guardians may be cited for a non-moving traffic violation for knowingly allowing their minor children to operate a bicycle in violation of the special bicycle regulations contained in Section 316.2065, Florida Statutes.

Source:Traffic Crash Facts

Special Report: Bicycle Crashes In Florida by the Florida Department of Highway Safety and Motor Vehicles, June 1993

## WHAT IS PARTNERING?

DEFINITION

Partnering is a structured process through which companies identify the barriers which prevent them from working together most effectively and then develop specific action plans to address those barriers. It is designed to reduce conflict, eliminate claims, improve communication and provide timely resolution of problems.

BACKGROUND

The partnering concept began in the late 1980s with the Army Corps of Engineers in Washington State. Adversarial relationships and increased litigation were key factors which revealed the need for a change in contractor owner relationships. The partnering process was developed to improve this deteriorating relationship. Partnering usually begins with a one or two day workshop for a particular project.

CONCEPT

The basic intent is to bring key managers of the project together to open channels of communication, set common goals and foster a climate in which issues can be openly raised, discussed and jointly settled at the lowest practical level of responsibility. Team members or stakeholders are encouraged to candidly discuss their respective interests in the project and to explore areas of potential conflict and possible ways to resolve them. Workshops are held to create a cooperative team spirit, trust between team members, and a step-by-step joint issue identification and resolution process to minimize the number and extent of disputes.

Partnering is a way of doing business with both the contracting agency and the contractor recognizing that they have common goals which can be achieved through cooperation and open communication. Partnering benefits the construction industry in four areas: quality, cost, time and profit. Past partnering efforts in both the public and private sectors have produced significant accomplishments including cost underruns, crash reduction, reduction of rework, reduction of construction errors, and a high level of personal satisfaction which the contracting parties receive from working together.

The partnering concept places an emphasis on cooperation rather than confrontation. The foundation of partnering is teamwork. Both the owner and the contractor's organizations share a common vision and responsibility to build the highest quality product on schedule, safely and within budget.

TEAM COMPOSITION

The composition of the team should include people from each company/entity involved with the project. This should include: (1) the contractor and his major sub-contractors and suppliers, (2) the owner or contracting agency's management, project level inspectors, designers, maintenance, etc., (3) utility company representatives: management and field level, (4) city or county engineers, and (5) any other group or person who has a stake in the outcome of the project.

PARTNERING IN FLORIDA'S DEPARTMENT OF TRANSPORTATION

The Florida Department of Transportation adopted the partnering process in March, 1992. Since then, more than 60 workshops have been held on construction projects. It is at these workshops that the planning, communicating and coordinating begin to happen. This is where project level relationships are established and key concerns and issues first get addressed. At these workshops, names and faces come together. Ideas, and the people proposing them, become real and tangible. The spirit of teamwork and trust begins to develop.

Source: Greg Xanders, P.E., Partnering Coordinator, Florida Department of Transportation, Tallahassee, Florida

## WHAT ARE THE VERTICAL CLEARANCE STANDARDS FOR ROADWAYS?

The "Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways" (the Greenbook) by the Florida Department of Transportation (FDOT) provides minimum standards for vertical clearances over roadways. The FDOT manual states:

Vertical clearances should be adequate for the type of expected traffic. Freeways and major arterials shall have a vertical clearance of at least 16 feet. Other streets and highways should have a clearance of 16 feet unless the provision of a reduced clearance is fully justified by a specific analysis of the situation. Provision for additional clearance (3 to 6 inches) is recommended to allow for future resurfacing.

The FDOT Greenbook, Table III-2 presents the height of various types of design vehicles as shown below:

| Design Vehicle | Height |
|---|---|
| Passenger Car | 4.25 feet |
| Single Unit Truck | 13.5 feet |
| Single Unit Bus | 13.5 feet |
| Articulated Bus | 10.5 feet |
| Semi-Trailer | 13.5 feet |

The "Manual on Uniform Traffic Control Devices (MUTCD) by the U.S. Department of Transportation provides information related to the placement of "Low Clearance Signs" (W12-2). The MUTCD states:

The Low Clearance sign is used to warn vehicle operators of clearance less than the maximum vehicle height permitted plus 12 inches. If a sign is placed on the structure, it may be a rectangular shape with the legend (12) ft (6) in.

The actual clearance is normally shown on the sign to the nearest inch not exceeding the actual clearance. However, in areas that experience changes in temperature causing frost action, an allowance, not exceeding 3 inches, for this condition, is recommended.

Where the clearance is less than the legal limit, a sign to that effect should be placed at the nearest intersecting road or wide point in the road at which a vehicle can detour or turn around.

In the case of an arch or other structure under which the clearance varies greatly, two or more signs should be used as necessary on the structure itself, to give information as to the clearance over the

entire roadway.

Clearances should be checked periodically, particularly in areas where resurfacing operations have taken place.

The FDOT Roadway and Traffic Design Standards for Design, Construction, Maintenance and Utility Operations (the Standard Index) No. 17727, 2 of 2, provides standards for traffic signal head clearance. The document states signal heads must have a "vertical clearance of not less than 17 feet and not more than 19 feet, measured under the most critical signal assembly (with regard to clearance) for that span."

## WHAT ARE THE PEDESTRIAN RIGHTS AND

## RESPONSIBILITIES WHEN WALKING ON OR CROSSING A STREET?

The Florida Traffic Laws as presented in the Florida Statutes, Chapter 316.130, indicate pedestrians must follow traffic control devices and traffic regulations as follows:

1. A pedestrian shall obey the instructions of any official traffic control device specifically applicable to him unless otherwise directed by a police officer.

2. Pedestrians shall be subject to traffic control signals at intersections as provided in S. 316.075, but at all other places pedestrians shall be accorded the privileges and be subject to the restrictions stated in this chapter.

3. Where sidewalks are provided, no pedestrian shall, unless required by other circumstances, walk along and upon the portion of a roadway paved for vehicular traffic.

4. Where sidewalks are not provided, any pedestrian walking along and upon a highway shall, when practicable, walk only on the shoulder on the left side of the roadway in relation to the pedestrian's direction of travel, facing traffic which may approach from the opposite direction.

5. No person shall stand in the portion of a roadway paved for vehicular traffic for the purpose of soliciting a ride, employment, or business from the occupant of any vehicle.

6. No person shall stand on or in proximity to a street or highway for the purpose of soliciting the watching or guarding of any vehicle while parked or about to be parked on a street or highway.

7. When traffic control signals are not in place or in operation, the driver of a vehicle shall yield the right of way, slowing down or stopping if need be to so yield, to a pedestrian crossing the roadway within a crosswalk when the pedestrian is upon the half of the roadway upon which the vehicle is traveling or when the pedestrian is approaching so closely from the opposite half of the roadway as to be in danger. Any pedestrian crossing a roadway at a point where a pedestrian tunnel or overhead pedestrian crossing has been provided shall yield the right of way to all vehicles upon the roadway.

8. No pedestrian shall suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close that it is impossible for the driver to yield.

9. Whenever any vehicle is stopped at a marked crosswalk or at any unmarked crosswalk at an intersection to permit a pedestrian to cross the roadway, the driver of any other vehicle approaching from the rear shall not overtake and pass such stopped vehicle.

10. Every pedestrian crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection, shall yield the right of way to all vehicles upon the roadway.

11. Between adjacent intersections at which traffic control signals are in operation, pedestrians shall not cross at any place except in a marked crosswalk.

12. No pedestrian shall, except in a marked crosswalk, cross a roadway at any other place than by a route at right angles to the curb, or by the shortest route to the opposite curb.

13. Pedestrians shall move, whenever practicable, upon the right half of crosswalks.

14. No pedestrian shall cross a roadway intersection diagonally; unless authorized by official traffic control devices, and when authorized to cross diagonally, pedestrians shall cross only in accordance with the official traffic control devices pertaining to such crossing movements.

15. Notwithstanding other provisions of this chapter, every driver of a vehicle shall exercise due care to avoid colliding with any pedestrian or any person propelling a human-powered vehicle and give warning when necessary and exercise proper precaution upon observing any child or any obviously confused or incapacitated person.

16. No pedestrian shall enter or remain upon any bridge or approach thereto beyond the bridge signal, gate, or barrier after a bridge operation signal indication has been given. No pedestrian shall pass through, around, over, or under any crossing gate or barrier at a railroad grade crossing or bridge while such gate or barrier is closed or is being opened or closed.

17. No pedestrian may jump or dive from a publicly owned bridge. Nothing in this provision requires the state or any political subdivision of the state to post signs notifying the public of this provision. The failure to post a sign may not be construed by any court to create liability on the part of the state or any of its political subdivisions for injuries sustained as a result of jumping or diving from a bridge in violation of this subsection.

18. No pedestrian shall walk upon a limited access facility or a ramp connecting a limited access facility to any other street or highway; however, this subsection does not apply to maintenance personnel of any governmental subdivision.

## WHAT IS THE STRATEGIC HIGHWAY RESEARCH PROGRAM (SHRP)?

Background:

The Strategic Highway Research Program (SHRP) is a $150,000,000 product-driven research program financed under the Federal-aid highway program. SHRP was developed in a partnership with the States, American Association of State Highway and Transportation Officials (AASHTO), Transportation Research Board (TRB), industry, and the Federal Highway Administration (FHWA). SHRP includes research in asphalt, concrete and structures, highway operations, and long-term pavement performance.

Congress, fully recognizing that this important program would require resources to implement the findings, authorized $108,000,000 over 6 years for both implementation efforts and for continuation of the Long-Term Pavement Performance Program (LTPP).

Purpose:

The purpose of FHWA's SHRP Products Implementation Program is to encourage and facilitate the application of those research findings that will improve the quality, efficiency, safety, performance, and productivity of our Nation's highway system.

Goals:

To fully, professionally, and aggressively communicate the SHRP products to the U.S. highway community.

To develop and implement both short- and long-range marketing strategies for SHRP products by taking full advantage of a variety of existing and innovative technology transfer delivery systems.

To bring into practice those SHRP products and techniques that are essentially complete and are implementable with minimal training and/or evaluation.

To promote customer evaluation of those SHRP products that require use of local materials and adaptation to regional, State, or specific industry practices.

To advance those promising but only partially completed SHRP products/processes through further research, development, test and evaluation, standard setting, and institutional awareness.

To provide technical and financial assistance to public and private agencies for the purpose of evaluating and ultimately adopting SHRP research products.

To provide training on the use of SHRP products and initiate activities that will enhance long-range educational efforts.

To promote activities by standard setting organizations such as AASHTO, American Concrete Institute, American Society for Testing and Materials, etc. that enhance the acceptability and credibility of the SHRP products.

Successful Implementation Operating Principles:

Established public and private sector partnerships.

Effective communication among all partners.

Top executive awareness, understanding, and support of the program - State, Federal, and industry-continued promotion of a highway program that is progressive and technology centered.

Full and continuous congressional financial support.

Effective use of Federal-aid highway funds by the States to test and evaluate SHRP products.

Continues State and industry participation on technical working and expert task groups.

Proper identification of the scope and integration of post-SHRP findings from national R&D programs sponsored by FHWA, National Cooperative Highway Research Program (NCHRP), U.S. Army Corps of Engineers, Federal Aviation Administration, private sector, etc.

Commitment of private sector to development, marketing, and support of hardware.

Source: "Implementation Plan-Strategic Highway Research Program Products", June 1993, U.S. Department of Transportation, Federal Highway Administration.

## WHAT TYPES OF LAMPS ARE USED FOR ROADWAY LIGHTING?

Background:

The general purpose of roadway lighting is to provide improved visibility for the various users of roadways and associated facilities. The "users" may include vehicle operators (automobiles, trucks, buses, motorcycles, bicycles), pedestrians and other citizens such as merchants and shoppers.

Purpose:

Lighting increases the comfort and safety of the motorist. It has been noted that lighting can be expected to reduce night crashes by about 30 percent.

The objectives of roadway lighting are:

To supplement vehicle headlights, extending the visibility range beyond their limits both laterally and longitudinally.

To improve the visibility of roadway features and objects on or near the roadway.

To delineate the roadway ahead.

To provide visibility of the environment.

To reduce the apprehension of those using the roadway.

LIGHT SOURCES:

There are two general types of light sources -- filament lamps and arc-discharge lamps. The main filament lamp is the incandescent lamp. Discharge lamps include fluorescent and high intensity discharge (HID) lamps.

1. Incandescent Lamp

* Filament wire encased in a bulb filled with an inert gas, usually hydrogen or krypton

* Light produced by current passing through filament heating filament to incandescence

2. Fluorescent

* Light produced by fluorescent coating on the inside of the tube. Coating activated by ultraviolet energy which is generated by the arc.

3. Mercury Vapor

* Arc tube inside the outer bulb contains gaseous material and electrodes.

* Light produced from mercury vapor

* Lamps may be clear or coated with phosphors to improve color rendition.

4. Metal Halide

* Light produced by combination of metallic vapors

* Excellent color rendition - Sports & TV broadcast; Short lamp life (16,000 - 18,000 hours life)

5. High Pressure Sodium (Efficient lighting/power)

* Light produced from sodium vapor

* Arc tube filled with sodium mercury and xenon. Xenon used for starting and mercury for color.

* No starting electrode - high voltage pulse used to start arc -- 2500 to 4000 volts (24,000 hours life).

6. Low Pressure Sodium (Causes everything to look like a dirty shade of brown)

* Very efficient

* Monochromatic -- single color only

* Large physical size - light hard to control; Lower lamp life (18,000 hours life)

Source: "Basic Lighting Design", Participants Notebook, Developed by the Office of Design, Florida Department of Transportation.

## WHAT IS MAGLEV?

"High-speed magnetically levitated ground transportation (maglev) is a new surface mode of transportation in which vehicles glide above their guideways, suspended, guided, and propelled by magnetic forces. Capable of traveling at speeds of 250 to 300 miles-per-hour or higher, maglev would offer an attractive and convenient alternative for travelers between large urban areas for trips of up to 600 miles. It would also help relieve current and projected air and highway congestion by substituting, for short-haul air trips, thus releasing capacity for more efficient long-haul service at crowded airports, and by diverting a portion of highway trips." The guideway is the physical structure along which MAGLEV vehicles are levitated. Guideway configurations proposed are: T-shaped, U-shaped, Y-shaped, and box-beam. The guideway can be constructed of steel, concrete or aluminum.

The three primary functions basic to MAGLEV technology are:

1. Levitation

2. Propulsion

3. Guidance

In most common designs, magnetic forces are used to perform all three functions, although a nonmagnetic source propulsion could be used.

### Levitation Systems

The two principal means of levitation are:

1. Electro Magnetic Suspension (EMS) is an attractive force levitation system whereby electromagnets on the vehicle interact with ferromagnetic rails on the guideway.

2. Electro Dynamic Suspension (EDS) employs magnets on the moving vehicle to induce currents in the guideway. Resulting repulsive force produces stable vehicle support and guidance because the magnetic repulsion increases as the vehicle/guideway gap decreases. However, the vehicle must be equipped with wheels or other forms of support for "takeoff" and "landing" because the EDS will not levitate at speeds below 25 PMH.

### Propulsion Systems

The three types of propulsion systems that have been proposed are:

1. "Long-stator" propulsion using an electrically powered linear motor winding in the guideway appears to be the favored option for high-speed MAGLEV systems. It is also the most expensive because of higher guideway construction costs.

2. "Short-stator" propulsion uses a Linear Induction Motor (LIM) winding on board and a passive guideway. While short-stator propulsion reduces guideway costs, the LIM is heavy and reduces vehicle payload capacity, resulting in higher operating costs and lower revenue potential compared to the long-stator propulsion.

3. A nonmagnetic energy source (gas, turbine or turboprop) can be used for propulsion, but this results in a heavy vehicle and reduces operating efficiency.

### Guidance Systems

Guidance or steering refers to the sideward forces that are required to make the vehicle follow the guideway. The necessary forces are supplied in a uniform fashion to the suspension forces, either attractive or repulsive. The same magnets on board the vehicle which supply lift, can be used concurrently for guidance; or separate guidance magnets can be used.

Source: "Final Report on the National MAGLEV Initiative" by the U.S. Department of Transportation, September 1993.

## DO MARKED CROSSWALKS PROVIDE BETTER PEDESTRIAN SAFETY?

The subject of proper placement and use, by both pedestrians and motorists, of marked crosswalks is one which arises from time to time in discussions among traffic engineering professionals and the lay public. This information sheet will present facts regarding the use of Marked Crosswalks as set forth in the State of Florida Uniform Traffic Control Regulations (Chapter 316, F.S.) and as promulgated by the Institute of Transportation Engineers (ITE).

### What are the official guidelines?

The State of Florida has set forth traffic control regulations in Chapter 316 of the Florida Statutes and, except where specifically permitted within the statutes, all local governments must follow this code. The basic reference in the code is the Manual On Uniform Traffic Control Devices (MUTCD) of the Federal Highway Administration. The MUTCD has been endorsed by the ITE and is used as the basis for much of the case law that has been made in the United States over the past several decades.

Traffic control devices include traffic signals, traffic signs, and painted roadway lines and markings. The MUTCD covers all aspects of the placement, construction and maintenance of every form of approved traffic control device.

There are five basic requirements for all traffic control devices. They must:

1. Fulfill a need.

2. Command attention.

3. Convey a clear, simple meaning.

4. Command respect of road users.

5. Give adequate time for proper response.

The MUTCD emphasizes "uniformity" of traffic control devices. A uniform traffic control device conforms to the regulations for dimensions, color, wording and graphics. The standard device should convey the same meaning at all times. Consistent use of traffic control devices protects the clarity of their messages. The MUTCD also requires that similar situations be treated in the same way.

### What is a crosswalk?

Crosswalks may be either "marked" or "unmarked". Chapter 316 defines a "crosswalk" as follows:

"(a) That part of a roadway at an intersection included within connections of the lateral lines of the sidewalks on opposite sides of the highway, measured from the curbs or, in the absence of curbs, from the edges of the traversable roadway."

"(b) Any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface."

Definition (b) above refers to "marked" crosswalks. All other crosswalks are, therefore, "unmarked". Crosswalks must be painted white and must be installed in accordance with Florida Department of

Transportation Roadway and Traffic Design Standards.

**How are crosswalks used?**

Normally, pedestrians must yield the right-of way to motorists. Florida Statutes require that pedestrians not leave a curb or other safe place such that it is impossible for a motorist to yield. In addition, pedestrians are required to yield to motorists whenever crossing a roadway at any point other than a crosswalk (marked or unmarked). These requirements place the burden of crossing at the appropriate place, and crossing in concert with the traffic signals, upon the pedestrian. Crosswalks are marked mainly to encourage pedestrians to use a particular crossing. Studies conducted on the relative safety of crosswalks support minimal installation of marked crosswalks. Studies conducted in several California locations gave surprising results. Although 2 times as many people used the marked crosswalks, 6 to 8 times as many crashes occurred in the marked crosswalks.

**What causes crashes at marked crosswalks?**

Research suggests that marked crosswalks give pedestrians a false sense of security. Pedestrians often step off the curb expecting drivers of vehicles approaching the crosswalk to stop. However, drivers frequently fail to stop and cause a vehicle/pedestrian crash. At all crosswalks, both marked and unmarked, *it is the pedestrian's responsibility to be cautious and alert before starting to cross the street.*

At crosswalks on multi-lane roadways, another frequent factor in causing crashes involves the driver of a vehicle in the lane nearest the curb stopping for a pedestrian who is waiting to cross or who is already in the crosswalk. The driver of a second vehicle traveling in the lane next to the stopped vehicle tries to pass the stopped vehicle and hits the pedestrian, even though it is illegal for drivers to pass a stopped vehicle at a crosswalk (Chapter 316.130(9)). Pedestrians should be very cautious when walking in a crosswalk, especially when their visibility is limited by vehicles already stopped at the crosswalk.

**Where are crosswalks normally marked?**

Crosswalks are marked at intersections where there is substantial conflict between vehicle and pedestrian movements, where significant pedestrian concentrations occur, where pedestrians could not otherwise recognize the proper place to cross, and where traffic movements are controlled. For example:

approved school crossings

signalized and stop sign controlled intersections where there is significant pedestrian traffic or where one or more crossing locations are prohibited

The foregoing examples follow the philosophy of using marked crosswalks to encourage proper pedestrian crossing behavior. In the first case, school children are encouraged to use a crossing which is normally being monitored. In the second case, pedestrians are encouraged to avoid a prohibited crossing movement.

In general, it is not good policy to paint crosswalk markings at midblock locations where traffic is not controlled by stop signs or traffic signals. Marked crosswalks should only be used where necessary to direct pedestrians along the safest route.

**What are special school crosswalks?**

Crosswalks should be marked at all intersections on any "suggested route to school", usually available through your local school district. They should also be marked where there is high conflict between vehicles and crossing students, where students are permitted to cross between intersections, or where students could not otherwise cross.

The best safety measure for school age children is to educate them on how and where to safely cross the street.

(Adapted from **Marked Crosswalks**, City of Buenaventura, CA, traffic information brochure series 1994.)

## WHAT ARE TRAFFIC CONTROL ISLANDS?

A Traffic-Control Island is a defined area between traffic lanes for control of vehicle movements or for pedestrian refuge. Within an intersection area, a median or an outer separation is considered to be an island. An island may be designated by paint, raised bars, mushroom buttons, curbs, guideposts, pavement edge or other devices and combinations.

## CLASSIFICATION AND FUNCTION

Islands frequently serve more than one purpose but may be generally classified according to their main function as follows:

1. Pedestrian Refuge Islands.

2. Traffic Divisional Islands.

3. Traffic Channelizing Islands.

## 1. PEDESTRIAN REFUGE ISLANDS

The specific function of a refuge island is to provide a place of safety for pedestrians who cannot safely cross the entire roadway width at one time because of changing traffic signals or oncoming traffic.

Refuge Islands are particularly useful at intersections in urban areas where there is a considerable amount of pedestrian traffic and where heavy volumes of vehicular traffic make it difficult and dangerous for pedestrians to cross, such as:

- On multi-lane roadways.

- In large or irregularly shaped intersections.

- At complex signalized intersections to provide a place of safety between different traffic streams to reduce pedestrian conflicts.



## 2. TRAFFIC DIVISIONAL ISLANDS

The function of divisional islands is to separate opposing traffic; also, they may be used to separate traffic in the same direction, e.g., to divide left-turn traffic in a median lane from the through traffic. Divisional Islands are used to guide traffic around an obstruction within the roadway (such as a bridge pier) or in advance of an intersection to separate opposing traffic. Divisional islands may also be located to prevent overtaking and passing at hazardous points, such as sharp curves or narrow underpasses.

Where Divisional Islands are continuous, they are called medians; the more important functions are as follows:

- Medians provide an insulating area between opposing streams of moving traffic.

- Medians provide protection and control of cross and turning traffic.

- Medians provide a refuge for pedestrians.

## 3. TRAFFIC CHANNELIZING ISLANDS

The primary function of a Channelizing Island is to control and direct a vehicle operator into the proper channel for his intended route. Channelizing Islands may be installed to bring about an orderly flow of traffic in areas that otherwise would be broad expanses of pavement.

Channelization is particularly helpful at streets intersecting at slanting angles, at 3-leg junctions, and at multileg intersections.

Traffic Channelizing Islands may be provided for separation (and special control) of turning movements.

Florida Statues Chapter 316 - State Uniform Traffic Control provides regulations governing driving on divided highways. Section 316.090(2) states "no vehicle shall be driven over, across, or within any such dividing space, barrier, or section, except through an opening in such physical barrier or dividing section or space or at a crossover or intersection as established, unless specifically authorized by public authority."

**SOURCES: 1. Manual on Uniform Traffic Control Devices (MUTCD) by the U.S. D.O.T.**

**2. Florida Traffic Laws, Chapter 316 - State Uniform Traffic Control**

## ROUNDABOUTS

A roundabout is a circular intersection similar to the "traffic circle" with which most motorists in this country are familiar. Roundabouts have been used throughout Europe, Australia, Great Britain and several other countries of the world for many years. They have only recently been introduced to America as a means of traffic control, although there are some isolated uses of roundabouts in this country that have been in place for a number of years.

Roundabouts, when installed according to accepted design principles, offer reductions in injury crashes, traffic delays, fuel consumption and air pollution while increasing intersection capacity and enhancing intersection aesthetics. They have also successfully been used to control traffic speeds in residential neighborhoods and are accepted as one of the safest types of intersection design.

The major differences between traffic circles and roundabouts are:

**Yield at Entry** At roundabouts the entering traffic yields the right-of-way to the circulating traffic. This yield-at-entry rule keeps traffic from locking up and allows free flow movement through the intersection.

**Deflection** The entry geometry and center island of a roundabout deflect entering traffic to slow the traffic stream and to reinforce the yielding process.

**Flare** The entry to a roundabout often flares out from one or two lanes to two or three lanes at the yield line to provide increased capacity through the intersection.

There are two basic types of roundabouts (Figure 1):

**Conventional roundabout** A one-way circular roadway around a curbed central island for circulating traffic, usually with flared approaches to allow multiple vehicle entry.

**Mini-roundabout** A one-way circular roadway around a flush or slightly raised central island of up to 15 feet in diameter, usually without flared entries.

Figure 1

Traffic engineers have several reasons why roundabouts are viable traffic control devices to be considered during the investigation of situations which may require some form of traffic control. Among the most often considered reasons are:

1. *Safety* - Roundabouts have been shown to reduce fatal and injury crashes by as much as 75% in Australia and 86% in Great Britain. The reduction in crashes is attributed to slower speeds through the intersection and to a reduced number of conflict points (Figure 2).

2. *Low Maintenance* - Roundabouts eliminate maintenance costs associated with traffic signals which amount to $3,000-$5,000 per year per intersection. In addition, the cost of electricity is reduced for a savings of about $1500-$2000 per year per intersection.

3. *Reduced Delay* - By yielding at the entry rather than stopping and waiting for a green light, delay is significantly reduced.

4. *Increased Intersection Capacity* - Intersections with a high volume of left turns are handled by a roundabout rather than by a multi-phased traffic signal.

= Conflict Point

Figure 2

5. *Reduction of Pollutants* - Reduced delay corresponds to a decrease in fuel consumption and a reduction in air and water pollution.

6. *Aesthetics* - The central island provides an opportunity to provide landscaping. Although landscaping requires maintenance, it also provides a secondary benefit in helping to support adjacent property values.

The correct way to drive a roundabout is simple:

As you approach a roundabout there will be a YIELD sign and a dashed yield limit line. Slow down, watch for pedestrians and bicyclists, and be prepared to stop if necessary. When you enter, yield to circulating traffic on the left, but do not stop if it is clear.

A conventional roundabout will have ONE WAY signs mounted in the center island. The signs help guide traffic and indicate that you must drive to the right of the center island. Mini-roundabouts may not have one-way signs if the center island is not raised. You must still drive to the right of the domed painted island.

Upon passing the street prior to your exit, turn on your right-turn signal and watch for pedestrians and bicyclists as you exit.

Left turns are completed by traveling around the central island (Figure 3).

Figure 3

(Adapted from Roundabouts, City of Buenaventura, CA, Traffic Information Brochure Series, 1995)

## WHAT ARE TRAFFIC VOLUME COUNTS AND WHAT ARE THEY USED FOR?

Traffic volume counts are basic to all phases of highway development and operation. No other single reference tells an engineer as much about a road as the number of vehicles which use it. Traffic volumes are needed for street and highway project development, financing considerations, project cost-benefit comparisons, project priority determinations, analyzing, monitoring and controlling traffic movement on roadways, traffic accident statistics, research purposes, street and highway maintenance, public information, highway legislation and other public and private purposes.

Traffic volumes vary from place to place, even along the same highway or roadway segment. Traffic volumes also vary from hour to hour, day to day, month to month and year to year. Both location and time elements must be properly identified and related to one another to develop accurate traffic volume data.

Traffic counts are the major source of traffic data. Traffic counts are very specific in that they only apply to one location and to the time period for which they have been obtained. Some of the major types of traffic counts in general use by engineers are annual counts, peak hour counts, turning movement counts and classification counts. Annual counts refer to traffic volume counts that are taken over a period of days throughout the year and converted to a single number known to engineers as Average Annual Daily Traffic (AADT). This number is reasonably close to the traffic volume that one could expect to see on any given day of the year. These volume counts are used for a number of engineering, economic and public purposes:

As a yardstick for evaluating present highway problems

As a criterion for safety evaluation

As a basis for planning and design estimates

As a basis for establishing need and priorities

As a reference for public information purposes

As a reference for other traffic volume computations

Peak hour counts are traffic volume counts taken during the time period of the day most likely to produce the highest volumes during any particular 24-hour period. For instance, the most common peak hour counts of interest to engineers are those that occur in the morning and afternoon. These usually occur around the times that most people are traveling to and from work; however, there are times when the peaks occur at less obvious times. These peaks may be due to a large employer having a staggered starting or quitting time, a school or college, or some other out-of-the-ordinary occurrence. The traffic engineer needs to have this information to properly evaluate the impact of this traffic pattern on the roadway network. Among the uses for this type of volume count are:

As a capacity consideration

For traffic signal system operations

As an aid to determining appropriate use of traffic control devices

Turning movement counts are taken at intersections to determine the actual movement of traffic through the intersection. Traffic engineers and others have a number of uses for these counts:

For roadway planning and alignment studies

For intersection design

For traffic signal system design

For evaluating traffic volume impacts

Classification counts are just a little different from simple traffic volume counts. In addition to determining the numbers of vehicles passing a given point on the roadway, classification counts also separate the traffic stream into its vehicle-type components and/or speed components; that is, how many passenger cars, how many trucks, how many vehicles with trailers, etc., and the variations in speed of the traffic stream. This data is very important to engineers for a variety of reasons:

As a means of determining percentages of trucks, buses, etc. with respect to the overall traffic stream

For neighborhood traffic calming studies with respect to "cut-through" traffic

As an aid in speed studies

For determining the appropriate use of traffic control devices

The foregoing discussion of traffic volume counts is an introduction to what this data is and why it is important to engineers, planners and the public. Traffic volume count data is one of the basic resources in determining the most efficient use of our limited tax revenues for streets and highways and supporting project selection decisions.

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