Chapter 11 Presentation Script

Slide 1 Welcome

Welcome to the Manual on Uniform Traffic Studies,
also called MUTS, computer-based training!
This training module will cover Chapter 11 - No-Passing Zone Study.

This training contains audio, so please adjust your speakers accordingly.
An alternate version is available on the resources page.
To begin select the start button or press Shift + N on your keyboard.

Slide 2 Form Access

During this training module, we will refer to one form in excel format stored on the MUTS online library through the FDOT's Traffic Engineering and Operations Office website.

Before continuing the training, consider scanning the QR code using your phone camera which directs you to the online library pictured.
The link to the form is also provided in the resources page to this training.
Please open Form number 750-020-13 as we will refer to this form later in the module.

Slide 3 Purpose

FDOT is authorized by Florida Statutes,
Section 316.0875 to determine those portions of any highway under its jurisdiction where overtaking and passing or driving to the left of the roadway would be hazardous.

The purpose of this MUTS chapter is to train engineers on how to conduct a no-passing zone study to establish the roadway's limits which would permit the passing driver the necessary sight distance at the critical position (passing and passed vehicle abreast) to allow a safe completion of the passing maneuver.

Slide 4

The 2022 Florida Design Manual or FDM will require practitioners to conduct a no-passing zone study if any of the following conditions apply subsequent to the last roadway resurfacing project:

- Newly constructed intersections
- Multiple new residential or commercial driveway connections
- New sight distance obstructions due to vegetation, tree growth or buildings
- History of wrong-way / head-on crashes or observations / complaints of near misses

Slide 5 **Where are potential no-passing areas?**

Let's discuss where we can encounter potential no-passing areas. The no-passing areas include Vertical and horizontal curves, railroad grade crossings, intersections, narrow bridges, transitions to and from multi-lane sections of the roadway, locations where passing sight distance is obstructed by bridges, viaducts, or tunnels, and other special conditions where passing must be prohibited because of inadequate sight distance.

Slide 6 **Elements of Passing Sight Distance**

Passing sight distance is the minimum sight distance necessary at the critical position where the passing vehicle A and passed vehicle are abreast to permit a passing driver to perceive an opposing vehicle B at a distance sufficient to allow safe completion of a passing maneuver. This graphic shows the four basic elements of minimum passing sight distance.

d_1 is the distance traversed during perception and reaction time and during the initial acceleration to the point of encroachment on the left lane. d_2 is the distance traveled while the passing vehicle occupies the left lane; d_3 is the distance between the passing vehicle at the end of the maneuver and the opposing vehicle; and d_4 is the distance traversed by an opposing vehicle for two-thirds of the time the passing vehicle occupies the left lane or two thirds of d_2.

Slide 7 Minimum Passing Sight Distance

MUTS Table 11-1 provides the minimum passing sight distance to be used for establishing no-passing zones.
This is based upon MUTCD Table 3B-1 and uses either the prevailing off-peak 85th percentile speed or the posted speed limit, and the eye and object height of 3.5 feet.

The values shown in MUTS Table 11-1 are for operational use in marking no-passing zones and are less than values contained in the FDOT FDM Table 210.11.2 for the construction of new alignments.

Slide 8 Where should a no-passing zone be installed?

Minimum stopping sight distance is the distance needed for drivers to see an object on the roadway ahead and bring their vehicles to a safe stop before colliding with the object.
This design criterion is based upon the roadway design speed.

Slide 9 Purpose

MUTCD Figure 3B-4, shown on this slide, provides an illustration of a no-passing zone at a vertical curve.
The beginning of a no-passing zone is the point at which the sight distance is less than the minimum passing sight distance specified in MUTS Table 11-1.

The zone's end is the point at which the sight distance becomes greater than the minimum passing sight distance specified in MUTS Table 11-1.
In no case shall a no-passing zone marking be less than 500 feet.
If the actual no-passing distance is less than 500 feet, the additional length of marking shall be added prior to the beginning of the no-passing zone.

Slide 10 Successive No-Passing Zones

Where the distance between successive no-passing zones is less than the minimum passing sight distance specified in MUTS Table 11-1,

.

This is applicable for one or both directions of travel.
Let's look at an example of the application of the minimum passing sight distances. In this case, there are two successive crest curves on a 60 miles per hour roadway.

The minimum no-passing sight distance, per MUTS Table 11-1, is 1,000 feet.
The distance from the end of the no-passing zone for the first curve to the beginning of the second curve no-passing zone is 700 feet.
Since this is less than the required 1,000 feet, the no-passing zone will be continued through the crest curves.

Slide 11 Warrants for No-Passing Zones

As we have noted before there are seven warrants for no-passing zones.
Each warrant will be discussed in the following slides.

Slide 12 Warrant 1: Horizontal and Vertical Curves

Warrant 1 is for horizontal and vertical curves.
This warrant is listed in Florida Statutes, Section 316.087 as shown on this slide and requires a no-passing zone at a horizontal or vertical curve where the sight distance is less than the minimum necessary for safe passing.

The minimum passing sight distance shall be based upon the 85^{th} percentile speed or posted speed limit.
Passing sight distance on a vertical curve is the distance at which an object 3.5 feet above the pavement surface can just be seen from a point 3.5 feet above the pavement.
The vertical curve was previously explained so we will focus on the horizontal curve next.

Slide 13

The passing sight distance on a horizontal curve is the distance measured along the centerline between two points 3.5 feet above the pavement on a line tangent to the embankment or other obstruction that cuts off the view on the inside of the curve.

Where centerlines are installed and a curve warrants a no-passing zone, it should be so marked where the sight distance is equal to or less than the minimum passing sight distance listed in MUTS Table 11-1.

Slide 14 **Warrant 2: Railroad Grade Crossing (Urban and Rural)**

In addition, Florida Statutes, Section 316.087 requires a no-passing zone when approaching within 100 feet of or traversing a railroad grade crossing.
This is MUTS Warrant 2.
Railroad grade crossings shall be marked in accordance with the FDOT Design Manual or FDM.

The no-passing marking shall extend from the railroad crossing down the roadway through the last 24-inch white bar of the railroad crossing pavement message.

This distance should always exceed distance "A" shown in the table to the left of the slide. The recommended distance to extend beyond distance “A” is 100 feet.

Slide 15 **Warrant 3: Intersections**

Florida Statutes, Section 316.087 requires a no-passing zone when approaching within 100 feet of or traversing any intersection.
MUTS Warrant 3 notes an exception to this requirement is a location on either state or county-maintained roadways, which is outside city limits, and is not marked at least 100 feet before the intersection by an official traffic control device indicating an approaching intersection.
Note all three criteria must be met to be eligible for the exception.

Let’s look at the example to the right of the slide.
The main road is County Road 31.
The intersection falls outside of city limits.
And there are no markings with official traffic control devices within 100 feet of the intersection.

Therefore, passing is allowed and a no-passing zone is not required.
Let's take a look at an example of MUTS Warrant 3 in the next two slides.

Slide 16

When an intersection is located within the city limits
and the major roadway has on-street parking,
that roadway shall be marked with a continuous no-passing zone.

Slide 17

If the roadway does not have on-street parking and is within the city limits,
a no-passing zone is required in advance of each intersecting roadway
at a distance that is equal to or greater than the minimum passing sight
distance listed in MUTS Table 11-1.
The stop-controlled intersecting roadway shall be marked with a minimum
no-passing zone of 200 feet before the intersection.

Slide 18

When roadways form an intersection outside the city limits
and the stop controlled, intersecting roadway is marked along the major roadway
by an official FDOT or county road department traffic control device
indicating an intersection, a no-passing zone is required on the major roadway.

The length of the zone shall be equal to or greater than the minimum stopping
sight distance listed in MUTS Table 11-2. The stop-controlled intersecting
roadway shall be marked with a minimum no-passing zone of 250 feet before
the intersection.

Slide 19 **Warrant 4: Narrow Bridges**

MUTS Warrant 4 is for narrow bridges.
A narrow bridge is defined as either the approach roadways with paved
shoulders when the bridge width, including shoulders,
is less than the width of the approach roadway,
or as the approach roadways without paved shoulders when the bridge shoulder
width is less than 2 feet.

The no-passing zone should be extended 1,570 feet in advance of the narrow bridge per FDOT Standard Plans Index Number 700-106.

Slide 20 Warrant 5: Roadway Transitions

MUTS Warrant 5 is for roadway transitions.
A no-passing zone should be marked from the beginning of the transition down the roadway a distance equal to or greater than that listed as dimension “B” in FDOT Standard Plan Index Number 711-001.

Slide 21 Warrant 6: Obstruction

Florida Statutes, Section 316.087 requires a no-passing zone when the view is obstructed approaching within 100 feet of any bridge, viaduct, or tunnel.
This is MUTS Warrant 6 for obstructions.

MUTCD Section 3B.10 notes fixed obstructions within a paved roadway can include bridge supports, refuge islands, median islands, toll plaza islands and raised channelization islands.

Slide 22

For a two-lane roadway, a no-passing zone shall precede and follow the tapered obstruction diagonal markings computed using MUTCD Section 3B.10, by a distance equal to twice the length computed of the tapered area to the obstruction or the minimum stopping sight distance contained in MUTS Table 11-2, whichever is greater.
The minimum taper length is 100 feet in an urban area or 200 feet in a rural area.

Slide 23 Warrant 7: Special Conditions

MUTS Warrant 7 is for other special conditions requiring a no-passing zone.
Examples of special conditions are a school zone, a hospital area or approaching a roundabout.
A location with high pedestrian volumes can also be considered for a no-passing zone.
For those special conditions, the engineer in charge should seek the assistance of the District Traffic Operations Engineer for the marking of that condition.

Slide 24 Methods for Establishing Warrant 1 No-Passing Zones

Now that we covered the seven different warrants where no-passing zones should be considered, let's discuss the five different methods available for establishing Warrant 1 no-passing zones.

You will recall Warrant 1 is for vertical and horizontal curves.
There are four different methods requiring field data collection listed here.
They are: Method One - two vehicle; Method Two - one vehicle;
Method Three - two persons walking and Method Four – ITS techniques.
We will discuss each separately.

FDOT prefers Method One, the two-vehicle method
on the State Highway System.
A traffic control plan is required when using any of these methods.
There is a fifth method which uses available construction plans or CADD files to establish the no-passing zone.

Slide 25 Method One (two-vehicle)

We will first discuss Method One.
The equipment needed includes two vehicles equipped with drivers and recorders; two cell phones with hands free technology,
a calibrated Distance Measuring Instrument or DMI in each vehicle,
two flashing amber lights and a target for eye height mounted on the rear of the leading vehicle.

Slide 26

The data collection is initiated by having the two vehicles separated by the minimum sight distance interval.
For this example, let's assume a 50 miles per hour design speed
yielding a minimum passing sight distance of 800 feet per MUTS Table 11-1.
The two vehicles will move separated by 800 feet.
The two vehicles need to be in constant communication while conducting the study.

Slide 27

The two vehicles will move forward until just before the leading vehicle goes out of sight and the trailing vehicle will direct to stop both vehicles. At this time, the trailing vehicle can move up to obtain identical DMI readings. From this point, each vehicle should move forward 50 feet, stop, then move another 50 feet until the target on the leading vehicle goes out of sight over the crest of a hill.

This is illustrated by the trailing vehicle or V1 and the leading vehicle or V2 in this sketch. The trailing vehicle, or V1, operator should mark to the right of the centerline. This is the beginning of the no-passing zone. The leading vehicle, or V2, operator to the left. This is the end of the no-passing zone for the opposite direction.

Slide 28

The two vehicles should resume the study at 50-foot intervals until the leading vehicle can be seen which is represented by the blue V1 and V2 in the sketch. The vehicle will again mark the pavement. The trailing vehicle mark will represent the end of the no-passing zone for vehicles traveling in the direction of the study. The leading vehicle mark will represent the beginning of the no-passing zone for the opposite direction of travel.

Slide 29 **Method One (two-vehicle): Depressions**

It is possible for non-study vehicles positioned between the study vehicles to become lost in depressions although the vehicles are spaced the minimum sight distance apart and the drivers may see each other.
This is illustrated in this sketch by V1 and V2 being the 800 feet minimum passing sight distance apart but V1 has no visibility of V3.
If this is the case, the driver of the leading vehicle, V2, should decide where he or she believes the low point of a depression in the curve is and stop there, while notifying the trailing vehicle, V1, of what he or she is doing.
The trailing vehicle should then move forward.

Slide 30

The trailing vehicle, V1, should move forward until the target
on the leading vehicle is seen.
If the trailing driver notes that other oncoming vehicles continue to become lost,
the trailing vehicle must move forward to a point where the driver does not lose
an oncoming car in the depressions.
This V1 location would become the point to end the no-passing zone.
This step concludes the data collection using the Method One – Two Vehicle.

Slide 31 **Method Two (one-vehicle): Step One**

For Method Two, we will use the same roadway characteristics
as we reviewed in the example of Method One.
We will assume a 50 miles per hour design speed yielding
a minimum passing sight distance of 800 feet per MUTS Table 11-1.
Method Two only requires one driver in a vehicle equipped with DMI.

To mark a curve or hill for passing sight distance,
the driver should move slowly through the curve.
When the driver reaches the point at which the view opens up and is sure
there is a stretch of road ahead which is sufficient for safe passing,
the driver should stop the vehicle, preferably on the shoulder,
and place a paint mark on the right side of the roadway.
This point is the end of the no-passing zone in the direction of travel.

Slide 32

The driver should then reset the DMI to 0.000,
travel the required minimum passing sight distance per MUTS Table 11-1,
and stop to place a paint mark on the left side of the roadway.
This marks the beginning of the no-passing zone for vehicles traveling
in the opposite direction.

This point or beginning of no-passing zone also represents the minimum
passing length for both directions and could be adjusted further downstream
if the analysis vehicle's direction of visibility allows.

Slide 33 Method Two (one-vehicle): Step Two

A trip through the site in the opposite direction is required
following the same procedure to complete the determination of the location
of the no-passing zones for that site in both directions.
Method Two or one vehicle method essentially assumes a zero-height object
as there is no practical way to adjust the object height.

The method is therefore more likely to be conservative,
especially on hills where 3.5-feet high objects could be seen some distance
further than zero-height objects.
This step concludes the data collection using the Method Two – One Vehicle.

Slide 34 Method Three (two-person)

Method Three, also known as the two-person walking method,
is the most accurate, yet time consuming method.

In this method, two people using walkie-talkies or cell phones walk along
the centerline of the roadway, maintaining the minimum passing sight distance
between them. This minimum distance can be maintained by a taut rope,
chain, or wire.

Pre-stationing is the preferred method and allows more attention to be directed
to the task and less conflict with the motorists.
The height of eye is established by means of a target carried by each person.

Slide 35

An advantage of this technique is that no-passing zones may be determined
for both directions of traffic when both people have targets.
A disadvantage of this technique is a safety factor as two people
are in the centerline of the roadway.

To ensure overall safety in using this method,
proper work zone traffic control should be set up to stop vehicles
in at least one direction of travel and each person should always wear
personal protection equipment.
This step concludes the data collection using the Method Three – Two Person.

Slide 36 **Form No. 750-020-13: No-Passin**

Form Number 750-020-13 provides a means to record the results
of conducting Methods One through Three.
The heading of this form should be filled in completely.
Briefly describe the weather if relevant and any road conditions
which may influence the results of the data being collected under *Remarks*.

The information provided on this form includes Direction of travel,
the mileposts for beginning and ending of the no-passing zone,
the posted speed limit, and the type of no-passing zone.

This form is available on the FDOT Traffic Engineering and Operations
Office MUTS website for download.
You can access this website by scanning the QR code using your phone camera
or by visiting the resources page.

Slide 37 **Method Four (ITS Techniques)**

Method Four is based upon the use of recently adopted technologies.
One of these techniques is a computer-based system developed to determine
highway no-passing zones.
While this method is similar to Method One, which uses two vehicles,
Method Four uses GPS coordinates to report the boundaries of passing
and no-passing zones.
Similar to Method One, the two vehicles need to be separated
by the minimum passing sight distance obtained from MUTS Table 11-1.

The driver of the trailing vehicle manually confirms and communicates
the visibility of the leading vehicle's target continuously along the roadway.
The GPS marks the coordinates as recorded by the operators.
The GPS system can be taken at or near highway speeds and
keeps staff out of the roadway and roadside.

This system is described in Developing a System to Identify Passing
and No-Passing Zone Boundaries for Rural Two-Lane Highways report
prepared for the Missouri Department of Transportation or MoDOT by MRIGlobal
dated August 2016.

It is further explained in the No-Passing Zone System User's Manual
also prepared for MoDOT by MRIGlobal dated July 2016.
Both resources are available on FDOT's Traffic Engineering and Operations
Office MUTS website.

Slide 38

This system is designed to operate similar to Method One in which two vehicles travel a set distance apart from each other along a two-lane highway.
However, the method of maintaining the desired distance relies on GPS devices and real time communication between the GPS devices.

The driver in the trailing vehicle is continuously shown the distance along the roadway from the leading vehicle to alter travel speed as needed to maintain the minimum distance.

Rather than manually noting boundary locations between passing and no-passing zones, the driver of the trailing vehicle uses a switch to indicate when the leading vehicle goes in and out of view.
When the switch is flipped, the system records the coordinates where this happens.

Slide 39

This information is recorded on a laptop positioned in the passenger seat of the trailing or following vehicle.
The laptop should be preloaded with field data collection software so the data can be properly stored in the field.

The field data can be analyzed using a second post-processing software either on the data collection laptop or separate computer.
This software is also available on the FDOT Traffic Engineering and Operations Office MUTS website for download.
You can access this website by scanning the QR code shown using your phone camera or by visiting the resources page.

Slide 40

The post-processing software uses the data files assembled by the trailing vehicle to determine the location of centerline striping for both directions of travel.
The trailing vehicle data files contain a record of latitude/longitude coordinates, location when the switch is activated,
distance between vehicles, and total distance traveled every 0.2 seconds.
The post-processing software determines points of change in the centerline striping and reports these into a separate worksheet as the example shown here.

Slide 41 Chapter Summary

In closing, there are seven warrants for a no-passing zone.
Warrants 1, 2, 3, and 6 are included in Florida Statutes, Section 316.087.
There are five methods available for determining no-passing zones for
Warrant 1 - Vertical and Horizontal Curves.

Four of these methods involve field data collection and one method involves
plans review, with Method One, the two-vehicle method,
being the preferred method for studies on the state highway system.

Slide 42 End Of Lesson

[Web]

This concludes the Manual on Uniform Traffic Studies computer based training,
Chapter 11 - No-Passing Zone Study.
You will now be directed to a 10-question quiz to test your knowledge
and understanding on the material presented in this computer-based training.

A passing grade of 70% is required to obtain the Certificate of Completion
for the training.
If a grade below 70% is obtained, the trainees are required
to re-take the full training until a passing grade of 70% or higher is obtained.

If you do not pass the quiz, please return to the Index page
by selecting the Index button below and re-take this training.
Once you've received your certificate, please continue to the next chapter
by selecting the "NEXT" button below this CBT.
On the next slide, please read the directions carefully before continuing to the quiz.
Thank you for your time and attention.

[LMS]

This concludes the Manual on Uniform Traffic Studies computer based training, Chapter 11 - No-Passing Zone Study.
You will now take a 10-question quiz to test your knowledge and understanding on the material presented in this computer-based training.

A passing grade of 70% is required to obtain the Certificate of Completion for the training.
If a grade below 70% is obtained, the trainees are required to re-take the full training until a passing grade of 70% or higher is obtained.
If you do not pass the quiz, please return to the Course Content tab and re-take this training.

You will receive your certification after completing the full MUTS training and passing the quiz for each chapter.
please continue to the next chapter by returning to the MUTS course content tab and selecting the next chapter in the training.
On the next slide, please read the directions carefully before continuing to the quiz.
Thank you for your time and attention.