Chapter 9 Presentation Script

Welcome

Welcome to the Manual on Uniform Traffic Studies, also called MUTS, computer based training!
This training module will cover Chapter 9 - Non-Motorized Volume Studies.

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.

Form Access

During this training module, we will refer to four forms 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 forms is also provided in the resources page to this training.
Please open the four corresponding forms for this chapter (Forms number 750-020-09, -10, -11a and -11b) as we will refer to them later in the module.

References in other MUTS Chapters

The contents of MUTS Chapter 9 are referenced in several MUTS Chapters.
MUTS Chapter 3 references conducting Walking Speed Studies to adjust thresholds in Traffic Signal Warrant 4.
MUTS Chapter 4 provides information on collecting motorist turning movement counts, while MUTS Chapter 9 provides information on collecting non-motorist turning movement counts.

Motorists and non-motorist counts should both be collected during an Intersection Turning Movement Count.
MUTS Chapter 8 references conducting a Walking Speed Study for the calculation of pedestrian critical headway.

Section 1: Overview of Non-Motorized Traffic Monitoring Studies

We will begin with an overview of non-motorized traffic monitoring studies.

Purpose of Non-Motorized Studies

A variety of studies can be conducted to understand non-motorist presence and behavior, this training will focus on non-motorist volume and walking speed studies.
Non-motorized volume studies are used to capture presence and behavior of non-motorists.
Non-motorists include bicyclists, pedestrians, scooter users, roller skaters, mobility device users, skaters, and other users of non-motorized transportation.

Non-motorized volume studies can be used for a variety of purposes, including establishing the need for a wider sidewalk, developing crash exposure statistics for evaluating non-motorist safety, prioritizing corridor investments for enhanced non-motorist facilities, conducting before and after studies for new or improved non-motorist facilities, understanding non-motorist travel patterns, and developing and validating non-motorized travel demand models.

Types of Counts

Non-motorist counts typically occur at either intersections, circled in red, or along segments, boxed in blue.
Counts may be collected at either location depending on the data of interest and available resources.

Intersection Counts

Non-motorized counts at intersections provide an understanding of intersection operations and demand.
This involves counting non-motorists using crosswalks or facilities at intersections.
Intersection counts typically provide a high level of detail, such as individual crossing volumes as well as adjacent segment volumes.

Usually, data is collected for the number and direction of crossings in each crosswalk. Let’s use the intersection shown here as an example; the non-motorized counts can be collected along the red arrows as shown in the figure.
Typically, collecting intersection counts is more complex than collecting segment counts and may require more observers for manual data collection or more devices for automated data collection.

Non-motorized intersection counts are often included in vehicle
turning movement counts,
so historical data may be available from past intersection
turning movement counts.
The example on the slide shows pages from a previously conducted
Turning Movement Count.

The page on the right is a summary of the pedestrian activity at the intersection
that is included in the Turning Movement Count.
Refer to MUTS Chapter 4 for additional guidance on how to conduct
turning movement counts.
Non-motorists using facilities other than the crosswalks should also be counted,
for example bicyclists using the automobile lanes or bicycle lanes.

Segment Counts

Non-motorized counts on segments provide an understanding
of the non-motorists using a particular roadway.
Segment counts should consider all facilities along the segment.
In the example shown here, the number of bicyclists using the bicycle lanes
and the sidewalk should be counted.
It is important to collect data across all available facilities to provide
an accurate representation of non-motorist activity and demand on the segment.

Segment counts typically provide a low-to-moderate level of detail
and are less complex when compared to intersection counts.
Segment counts tend to be easier to collect using automated methods.

When choosing a location to conduct segment counts,
consider selecting bottlenecks, for example a bridge
where multiple routes converge.
An example is illustrated to the right.
If we were considering non-motorist travel in the region,
we might conduct counts on the bridges across the river
where travelers converge.

Non-motorist segment counts can become increasingly complex on corridors
with multiple bicycle and pedestrian facilities.
For example, a corridor that has a bike lane, shared-use path, and sidewalk.
Consider conducting the count where the facilities may merge,
for example where the bicycle lane transitions to the shared-use path.

In the example on the slide, to the west of the intersection,
counts would need to be taken on both sidewalks and both bike lanes.
However, to the east of the intersection counts would only need to be taken
on one sidewalk and a shared use path.
If counting on either side of the intersection can serve your purpose,
it may be easier to collect a count to the east of the intersection.
Take special consideration that the activity on either side of the intersection
is not substantially different.

Methods of Data Collection

Non-motorized counts can be collected using manual or **automated** methods. Both locations, segments, and intersections, can be counted using either method. The use cases, limitations, personnel requirements, equipment, and procedures for recording counts using these methods will be discussed next.

NCHRP 797 provides an overview for each data collection method and is a good resource for understanding the pros and cons of available methods.

Field Procedures
Let's take a look at the needed considerations for every field procedure.

A preparation checklist is always recommended. Sample checklists can be found in the Institute of Transportation Engineers or ITE Manual of Transportation Engineering Studies 2nd Edition; other specific checklists will be referred to throughout this presentation.

For observations conducted in the field, the observer should be positioned with a clear view of the non-motorists to be observed and located away from the edge of the travel way.

If more than one observer is performing the study,
they should maintain visual contact and be able to communicate with each other. Safety vests should be worn at all times.

Data Recording
The observer should maintain organized and correctly labeled data to provide an accurate non-motorized study.

Some considerations to achieve this include Fill out forms to the extent possible in the office prior to going into the field, **label** roadways on the equipment or forms, **properly** orient the equipment or form to the layout of the intersection, **coordinate** time intervals between observers, and **concentrate** on recording each count in the proper place on the form.

Section 2: Manual Non-Motorized Counts
Let's cover in more detail the manual data collection method for non-motorized counts.

Manual non-motorized counts involve manually recording each non-motorist as they proceed through the point of interest.
The minimum recommended duration for short term counts is four to six hours, although the preferred duration is 12 hours.

Manual non-motorized counts can provide insight into user characteristics and behaviors not easily gathered using automated methods and may be required for locations with complex geometries.
Manual non-motorized counts typically have a lower equipment set up cost; however, these become less efficient the longer the observer stays in the field.

Field
Typically, manual non-motorized counts are conducted using a tally sheet and recording each non-motorist with a tick mark.
Form number 750-020-09 is the Non-Motorized Volume Sheet and can be used as the go to template to record these counts.
Each form contains space for four time intervals.
Typically, 15-minute time intervals are used so each form contains a full hour of data.

After the counts are completed, a summary is prepared, and Form number 750-020-10 Summary of Non-Motorized Movements can be used to complete this step.
These forms will be discussed subsequently including how to access them.

A watch is used in conjunction with the forms to assign the non-motorist count to the appropriate time interval.
By collecting and recording data in the field, the setup and equipment needed is minimized and data is available as soon as the collection period has elapsed.

Alternative means to tally sheets are also available.
An electronic handheld count board with an internal clock allows users to record and store non-motorist data with the click of a button and download the data to a computer.
Similarly, mobile devices, such as laptops, tablets, and mobile phones, can be used to record non-motorists electronically.
Electronic methods may be easier to use than tally sheets for both input and post-processing of data.

Personnel
Manual non-motorized counts require **trained** observers who must be relieved periodically to avoid fatigue and degraded performance.
Breaks of 10 to 15 minutes are recommended at least every two hours, or 30 to 45 minutes every four hours for longer collection periods.

The number of observers required is dependent on the number of non-motorists and complexity of the type of count and location being observed.
If multiple observers are required, duties should be divided.
For example, one observer may record the north and west crosswalks, while a second observer records the south and east crosswalks.
Time periods should be coordinated, so each set of the collected data is consistent.
If more than one observer is performing the study, they should maintain visual contact and constant communication.

Video
An alternative to recording data in the field is to use cameras or drones to record a video of the location and then process the data in the office.
Here is an example of the camera equipment to be installed on a pole.
Here is an example of the field crew installing a camera on a utility pole.
Sometimes several cameras may be required to obtain a coverage of the area of interest.

The cameras are left recording in the field for the extent of the study period.
After the footage is recorded, the cameras are taken down and the video can be downloaded.
Once in the office, the video is reviewed and the data of interest can be recorded as a post processing operation, as shown here.

Video Benefits
Video recording offers several advantages to traditional field methods.
Counts or observations may be checked by a second observer.
Scheduling staff and accommodating breaks may be less complex.
Footage can be slowed down to facilitate counting at high volume locations.

If video recording is being used, it can be beneficial to record twice as much data as the project intends to use to reduce the risk of rain, lack of visibility, or other errors preventing the use of video recordings for a given time period.

Forms

Now that we have covered the different components for manual data collection, let's dive into the available forms in this chapter.
The forms available for manual data collection include Form number 750-020-09: Non-Motorized Volume Sheet and Form number 750-020-10: Summary of Non-Motorized Movements.
The form can be downloaded from the MUTS website or by scanning the QR code on this slide with a cellphone camera.

These forms include a section for roadway characteristics in the header which should be completed before heading out to the field.
The necessary roadway characteristic data can be obtained from FDOT District or local roadway databases as listed in MUTS Section 4.4.
Let's take a closer look into Form number 750-020-09 next.

Form 750-020-09: Non-Motorized Volume Sheet

Form number 750-020-09, Non-Motorized Volume Sheet is used to record manual counts of non-motorists in the field.
An example of a filled-out form is shown on the slide.
Let's take a closer look into the top portion of the form.

Before beginning to count, the analyst should record information about the characteristics of the time and location the count will be collected.
In the remarks section, note any additional information that should be considered, including intersection geometry.

Next, record the time intervals that will be used.

If there is a raised median present and it is four feet or greater in width, check yes, for the raised median.

Measure and record the crossing distance.
The crossing distance is the distance curb-to-curb or edge of roadway
This distance should be measured at the center of the crosswalk.
Raised median presence and crossing distances should be recorded for each intersection leg.

Recording

On the bottom portion of the form, the analyst should label the street names.
The sections of the form discussed so far may be completed at the office
on the computer, before printing out the form.

Prior to beginning the count in the field, the analyst should orient themselves
in the intersection.
Carefully consider your location in the field to ensure that you are oriented
in alignment with your data collection sheet to minimize errors.
This is especially important at skewed intersections
or intersections that are not cardinally aligned.

Now, counts can be recorded using tally marks in the boxes.
If there are additional behaviors or characteristics being observed,
the tally box can be subdivided. After the count is completed,
summarize the tally marks using the space provided below the tally boxes.

In addition to non-motorized volumes, various factors can be recorded
depending on the purpose of the data collection.
These factors include group size, mode, direction of travel, facility type,
helmet use and age.
If using the manual form, the analyst may divide the boxes
to record different attributes.
In the example shown here, the form input cells have been divided in half
to record whether pedestrians and bicyclists are using the sidewalk
or roadway shoulder.

The next few slides will review the basic concepts for recording
non-motorized counts in the field.

To maintain consistent and accurate counts,
it is recommended to orient the data collection sheet based upon your
orientation in the field.
The slide shows the observer standing on the northeast leg of the intersection.

To keep the form oriented to the observer’s location,
the observer should rotate the form to align with the existing
intersection orientation.

As shown in the animation, non-motorists are recorded in the corresponding bins for the first-time interval of the data collection period.

As illustrated here, the non-motorist count forms are used to record the number of non-motorists crossing.
If a non-motorist makes a turn at the intersection, the non-motorist should be counted each time they use a crossing.
This is shown with the red pedestrian in the animation.

Form 750-020-10: Summary of Non-Motorized Movements
Once the non-motorized counts are completed, the observer can use Form number 750-020-10: Summary of Non-Motorized Movements.
This form is used to summarize the manual counts collected using the Non-Motorized Volume Sheet.
Similar to the Non-Motorized Volume Sheet, the observer should record study characteristics of the time and location the count was conducted for.

In addition, the analyst should record the existence of pushbuttons, pedestrian signal heads, countdown signals, roadway width, and median presence.
The analyst will then proceed to record the total volumes collected in the field.
Finally, the analyst will summarize the total counts for the intersection.

If the electronic version of the form is used, the spreadsheet will automatically summarize the counts into the total rows by row and intersection.

When filling out the Summary of Non-Motorized Movements form, the location characteristic data should be consistent with the Non-Motorized Volume form used to record the counts in the field, as shown in the animation.
Similarly, the total counts used in the Summary of Non-Motorized Movements form should be taken directly from the Non-Motorized Volume form used to record the counts.

Section 3: Automated Non-Motorized Counts

An alternative to conducting manual non-motorized counts is
to use automated technologies.

Automated Non-Motorized Counts

Automated counts are the preferred means for obtaining long-term counts;
however, depending on the data needs, automated counts may also be used
to collect short-term counts.
A minimum of 7 days and a preferred duration of 14 days is recommended
for automated counts.

Automated methods allow counts to be collected efficiently over a long period
of time, requiring less labor than manual counts,
and have been shown to result in fewer errors.

Automated counts involve installing equipment to record non-motorist activity.
Typically, automated counts are less detailed than manual counts.
Automated counters may require maintenance and/or calibration over time.

Before choosing a site to install an automated counter or device to use,
consider why you are conducting the count.
Some of the purposes for conducting non-motorized counts
were previously presented and are shown on the slide.

After the purpose of the count is decided,
determine if the purpose will be best suited by a temporary
or permanent installation.
The main benefit of conducting a temporary count is allowing a wider selection
of facilities and regions to be counted.
A primary benefit of permanent installations is the provision of data
on seasonal trends.
A count program will typically have some permanent
and some temporary locations.

After the purpose and the time duration of the count are determined,
move on to the next step to select the site that should be counted.

Before automated count equipment is installed, a site must be selected.
The FDOT Statewide Non-Motorized Traffic Monitoring Program
has developed a process for assessing automated count locations,
which is described in Recommendations Report Number 1.
This process includes both a virtual and an on-site review of the location
to determine eligibility for an automated count.

A preparation checklist is recommended for every field procedure.
The FDOT Statewide Non-Motorized Traffic Monitoring Program
has prepared a checklist for conducting on-site reviews,
included in Recommendation Report Number 1.
A link to Recommendation Report Number 1 is included on the resources page.
After a site is selected, move on to the next step to select the
appropriate equipment to use at the site.

Automated count equipment generally includes sensors and a data recorder.

Automated count technologies differ in the types of sensors
and data recorders they use.
Sensors may use active or passive infrared light transmission,
piezo film, time-lapse video, in-pavement loop detectors,
pneumatic tubes, or other sensor types.

New technology including GPS transponders, location tracking mobile devices,
and accelerometers may be used to record non-motorists.
Guidance for selecting non-motorist counting technologies is included
in NCHRP 797, the FHWA Traffic Monitoring Guide,
and the FDOT Traffic Monitoring Handbook.

If an agency has specific equipment available to it,
site selection may need to be conducted in accordance
with equipment constraints.
After the site and equipment has been determined, equipment can be installed!

The personnel required for collecting automated counts are those needed
to install, calibrate, and recover the equipment.

If the installation crew needs to temporarily close facilities,
equipment should be installed during periods of low traffic.
Field personnel should adhere to a Personal Protective Equipment protocol.
Installed equipment should not interfere with pedestrians and bicyclists' flow.

A preparation checklist is recommended for every field procedure.
The FDOT Statewide Non-Motorized Traffic Monitoring Program
has prepared a checklist for installing short-term automated count equipment,
included as Appendix F in Recommendation Report Number 2.
A link to the report is provided on the resources page.

When equipment is installed, its proper operation should be checked in the field.
Calibration should be completed during installation of the equipment,
and periodically in the case of long-term counts.

After the counts are recorded, download the data.
Some data recording devices will upload the data automatically,
while others may require physically connecting to the device to retrieve data.

Data analysis may vary in complexity according to the purpose of the study.
Data may simply be charted by mode to show an hourly summary of activity
as illustrated in the chart to the right,
while other analyses may require a sophisticated statistical treatment.

Consider providing the collected count data to FDOT Non-Motorized
Traffic Monitoring Program for inclusion in the Statewide Repository.

Section 4: Walking Speed Studies

Non-motorist speed is a characteristic of interest on several projects
and can be determined through a walking speed study –
another type of non-motorized traffic monitoring study.
Note that Walking Speed studies can be modified and applied to
non-motorist road users other than pedestrians.

Walking speeds can be affected by pedestrian characteristics,
roadway characteristics, or environmental conditions.
The ITE Manual of Transportation Engineering Studies 2nd Edition suggests
fully abled pedestrians have walking speeds between 2.8 and 5.7 feet
per second and disabled pedestrians have walking speeds between
2.0 and 3.7 feet per second.

MUTS Chapter 3, Signal Warrant 4 is used to warrant a traffic signal
based upon pedestrian volumes.
This warrant allows a 50% reduction of the volume threshold
if the 15th percentile walking speed is less than 3.5 feet per second.
This allowance requires conducting a Walking Speed Study
in conjunction with the Signal Warrant 4 analysis.
More information on Signal Warrant 4 can be found in Chapter 3 of the MUTS.

In the example presented on the slide,
the pedestrian counts shown as red dots do not meet the 100%
Warrant 4 thresholds.
However, if a Walking Speed study is conducted and finds the 15th percentile
walking speed to be less than 3.5 feet per second, a reduced threshold,
shown by a dashed red line on the slide, can be applied.
In this case, the reduced threshold is now met by the pedestrian volumes.

General Field Procedures
The general field procedures discussed in slide 13 of this training
also apply to walking speed studies.

Field Procedures
Similar to manual non-motorized counts, previously discussed,
tally sheets, electronic devices,
or video cameras can be used to record data for walking speed studies.
The benefits and costs of using various methods
is similar to that of manual counts.

Forms 750-020-011a & -011b

There are two forms available to collect field data for walking speed studies:
Form number 750-020-011a was developed for intersections
and Form number 750-020-011b for Mid-Block locations.
These forms are filled out similarly,
but let's take a look into the main differences between these forms.

The slide shows the top portion of both Walking Speed Study forms,
identifying specific sections of the forms where data is entered.

Before beginning to count, record the characteristics of the time and location
the count will be collected.
These form fields may be completed at the office on the computer,
before printing out the form to take into the field.
In the remarks section, note any additional information
that should be considered, including intersection geometry.

Depending on whether the walking speed study is for an intersection
or a mid-block location,
fill out the relevant information for the crossing being studied.
If an intersection is being observed, carefully label the intersection diagram,
and orient yourself to the form before beginning the study in the field.

Mark and measure the crossing distance and record the crossing distance
on the form.
All the data mentioned thus far should be recorded before starting
to record crossing times.

Now let's identify specific sections of the forms where crossing time data is entered.
The bottom portion of both the intersection and midblock forms are the same.

Record the crossing times for each non-motorist considered in the study sample.
Record the classification of the non-motorist as well if it is of interest to the study.
For example, children may be classified separately from adults at a school crossing.
Specific notations regarding characteristics of the pedestrian may be recorded in the *Notes* column while in the field.

After all the observations are made, calculate the average and 15th percentile walking speeds.
If the electronic version of the form is used to input the field data, the spreadsheet will automatically calculate the average and 15th percentile walking speeds.

Field Procedure
The observer should measure and mark the crossing distance prior to recording Walking Speed data.
The crossing distance should be measured **from** curb to curb, or edge of roadway to edge of roadway from the center of the crosswalk, as shown with the red arrow on the slide.
After determining the influence area, the observer will record the time individual pedestrians take to complete the crossing.

A sample size of 100 observations is suggested.
If 100 observations cannot be recorded, it is suggested to collect the walking speed of 90% of the observed pedestrians during the daily peak four hours, determined from pedestrian counts at the location.

For two-stage crossings, individual measurements should be taken for each stage of the crossing.
A two-stage crossing is defined as a crossing with a median refuge or landing area that is at least 4 feet wide, as shown on the slide.
At these locations, the crossing for each side of the road should be measured and walking speeds should be calculated separately for each crossing stage.

Let's take a look at an example of conducting a walking speed study at an intersection.
The animation shows pedestrians crossing with the timer at the bottom left corner indicating when the crossing time should start and stop.
At the bottom right of the slide,
an excerpt of the Intersection Walking Speed Study form shows where crossing times are recorded.

The animation shows pedestrians crossing at different speeds.
Note that in the field, only the time it takes the pedestrian to cross the roadway is recorded.
The crossing speed will be calculated after the data is collected;
this is automatically calculated by the form if the data is recorded electronically into the data collection form.

Note that the crossing time should be from when the pedestrian first crosses the mark at the beginning of the crosswalk to when they completely cross the mark at the end of the crosswalk.
From the three observations illustrated,
the various crossing times will produce a distribution of walking speeds.

At uncontrolled crossings, a pedestrian may rush across the road more quickly to avoid oncoming vehicles than if a traffic control device was provided.

Considering this, it may be appropriate in some cases to record the walking speed of pedestrians along the sidewalk approaching a crossing, in addition to recording the walking speed at the actual crossing.
The animation on the slide shows an example where the walking speed approaching the crossing is significantly slower than the walking speed for crossing the roadway.

Calculations
After the crossing times are collected in the field, the walking speed calculations can be completed in the office manually.
If the electronic version of the form is used, the spreadsheet will automatically complete these calculations.
Let's take a look at the steps to follow for manual calculation purposes.

First, the average walking speed for each pedestrian is calculated as the crossing distance divided by the crossing time recorded in the field.
Speeds may be classified if required by the study.

Next, the cumulative percentage of observations by classification are plotted to generate a cumulative speed curve, as shown on the slide.
This curve can be used to observe the 15^{th} percentile walking speed, which is generally used for design purposes, such as signal timing clearance calculations, and may also be used to justify a volume threshold reduction for MUTS Chapter 3, Signal Warrant 4.
The graph can be useful for demonstration purposes but is not automatically generated by the form.

Section 5: Summary of Non-Motorized Studies
We will briefly summarize what we have talked about in this training.

Chapter Summary

Non-motorist characteristics and behaviors are studied
through non-motorized traffic monitoring studies.
This training covered two primary types of studies, shown in blue,
that can be used to achieve several purposes, shown in red.

Non-motorized counts can be conducted at intersections
or along segments using manual or automated methods,
depending on the purpose of the count and the resources available.
Walking speed studies can be conducted to inform signal operations
or Signal Warrant thresholds.

In addition to the information provided in MUTS Chapter 9
regarding non-motorized counts,
the following resources can provide additional information
on non-motorized count methodologies:
FDOT Non-Motorized Traffic Monitoring Program,
FDOT Traffic Monitoring Handbook Chapter 5, NCHRP 797:
Guidebook on Pedestrian and Bicycle Volume Data Collection,
and FHWA Traffic Monitoring Guide Chapter 4.
Links for each of these resources are provided on the resources page.

End of Lesson

[Web]

This concludes the Manual on Uniform Traffic Studies computer based training,
Chapter 9 - Non-Motorized Volume Studies.
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 9 - Non-Motorized Volume Studies.
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.