Chapter 8 Presentation Script

Welcome

Welcome to the Manual on Uniform Traffic Studies, also called MUTS, computer based training!

This training module will cover Chapter 8 - Gap 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.

Form Access

During this training module,
we will refer to two forms in excel format stored on the MUTS online library.

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 resources page to this training.

Please open forms number 750-020-08a and 750-020-08b,
as we will refer to them later in the module.

Introduction

This training module will define vehicle and pedestrian gap studies.

Through the slides, we will provide guidance for practitioners on how to conduct a gap study
and guidance on field data collection procedure.

A gap study determines the size and the number of gaps in the vehicular traffic stream.

This chapter will walkthrough calculations of the critical headway for both pedestrians and vehicles.

Gap studies are primarily used at unsignalized locations,
including two-way stop-controlled intersections, roundabouts, driveways,
or mid-block pedestrian crossings but can be conducted at other locations as well
depending on need.

Use of a Gap Study

Vehicular gap studies can be used for model calibration, conducting roadway capacity analysis,
and vehicular delay considerations.

The pedestrian gap study is commonly used in Traffic Signal Warrant 5.

For detailed information on the application of gap study results
for traffic signal warrant evaluation, refer to MUTS Chapter 3.

Definitions

The following section will walk through the definitions of key terms used for a gap study.

The next slides provide definitions along with schematics to define these key terms.

Key Definitions

The figure illustrates the difference between the gap and headway.

The gap is measured from the leading vehicle's back bumper to the following vehicle's front bumper.

On the other hand, the headway is measured from the front of both vehicles' bumper.

Both gap and headway are measured in seconds.

Gaps and headways should be measured consistently across vehicles.

Therefore, a reference point must be established.

A reference point is a predetermined spatial location to measure gaps or headways.

Typically, the reference point is the centerline of the minor roadway when conducting a gap study
but can vary based on the project and the location characteristics.

The following slide will show an animation depicting the gap and headway.

Key Definitions

As the first vehicle crosses the reference point, the gap and headway can begin to be measured.

The headway is measured from the same point of the vehicles,
so the front of the first vehicle to the front of the second vehicle.

The gap is measured from the back of the first vehicle to the front of the second vehicle.

We will discuss how to measure the headway in the field in future slides.

Key Definitions

The critical gap or headway is the minimum gap, in seconds,
that the average vehicle or pedestrian would accept.

The following animation will show an example of the critical gap.

As shown in the animation turning right, the critical gap or headway
is the minimum amount of time between vehicles on the major street traffic stream
that an average turning vehicle or pedestrian is equally likely to accept or reject the gap.

Practically, this time will allow the entry of one vehicle on a minor movement or one pedestrian.

Key Definitions

Gap acceptance is the completion of a vehicle's or pedestrians' movement into a gap.

The following animation shows a rejected gap followed by an accepted gap.

As the first two vehicles travel rightward, they are too close together for the red vehicle on the minor street to make its turning movement.

The second gap is large enough for the vehicle on the side street to complete the turning movement.

We will discuss gap acceptances and rejections in further detail later in this training module.

Key Definitions

Lag is the time difference between when the minor street vehicle arrives to the stop bar and when the major traffic stream next vehicle's front bumper crosses the side street vehicle at the stop bar.

Lag is also measured in seconds.

The following animation represents lag.

Once the side street vehicle approaches the stop bar, the lag is the time the black vehicle will reach the point the arrow is at.

Lag measurements are typically not included in gap studies.

Equipment and Personnel Needs

The following slides will describe the equipment and personnel needs to conduct a gap study.

Equipment Needs

The equipment used for a gap study can vary based on the equipment available to the engineer.

Equipment for a gap study can include electronic count boards, stopwatches, audio tapes, laptops, and video.

Not all this equipment is required simultaneously.

Electronic count boards, stopwatches, audio tapes, and video can be used individually or in combination to conduct a gap study depending on the capabilities of each device.

Stopwatches are typically used for manual data collection.

Audio tapes aid practitioners in the field as observers speak into the recording with field data collection information such as movements being completed.

Using laptops in the field is not required but can replace the need for printed forms.

If video is used alone, the majority of the equipment listed in this slide would not be required.

Supplementing manual data collection with video recordings allows review of any possible field errors but it is not required.

Personnel Needs

To conduct a gap study, the personnel should place themselves in a location with good visibility of the reference point.

The personnel should also locate themselves away from motorists' sight to not influence driver behavior or pedestrian behavior.

Typically, one observer is enough to record the gap data if no additional data needs to be recorded.

Field Procedure

Let's take a look at how to conduct a gap study in the field.

Field Procedures

To calculate the gap in the field, a stopwatch or other timing device is typically used.

The observer measures the headway between vehicles in seconds and records the headways on the Gap Study form.

For divided roadways that accommodate two stage vehicle or pedestrian crossings, the gap should be determined for each direction of travel.

Measuring the headway is the same for both vehicles and pedestrians, but a different reference point is likely used.

Like previously mentioned, the reference point for vehicles generally is the centerline of the minor roadway which is currently shown on the slide.

For pedestrians, the reference point may be at the center of a marked crosswalk.

If no marked crosswalk exists, the engineer should choose a reference point near where pedestrians are primarily crossing.

In this case, a light pole or a tree could provide a consistent reference point.

The practitioner should choose a reference point based on the field conditions.

The observers should locate themselves out of a vehicle's direct line of sight to not influence driver or pedestrian behavior.

The observer, represented by the person in orange, should not be located directly adjacent to the roadway.

Instead, the observers should locate themselves in an area with good visibility
that is offset from the roadway.

The location of the observer will vary based on field conditions.

Field Procedures

In practice, measuring the gap between vehicles is more difficult than measuring the headway.

Therefore, we recommend measuring the headway when conducting a gap study.

Imagine you are the observer standing at location with a clear view
of the reference point that avoids influencing driver behavior.

As the two vehicles follow each other, the observer begins the stopwatch
once the front bumper of the first vehicle passes the reference point.

The observer stops the stopwatch
when the front bumper of the second vehicle reaches the reference point.

In this example, the measured headway is two seconds.

Vehicular Gap Studies

Now that we know how to measure a headway in the field,
let's discuss how to conduct a gap study using the applicable forms.

Vehicular Gap Study

A vehicular gap study can be used to evaluate an intersection's performance, calibrate a model,
or determine vehicular delay.

The vehicular gap study uses form number 750-020-08b.

To estimate the critical vehicular gap, we will discuss the mean sampling method.

Alternative methodologies can be found in ITE Manual
of Transportation Engineering Studies 2nd Edition, Chapter 6.

Form Access

Form number 750-020-08b is the Vehicular Gap Study form
which is used in vehicular critical headway studies.

The form can be downloaded from the MUTS website
or by scanning the QR code on this slide with a cellphone camera.

It is important to be aware that there are two tabs within this form.

We will take a closer look at these tabs in the next slides.

Form 750-020-08b

Form number 750-020-08b has two tabs the Field Data tab and Analysis tab.

The Analysis tab is automatically calculated using the inputs from the Field Data tab.

Form 750-020-08b: Field Data Tab

Before conducting a vehicular gap study, the header for the Field Data tab should be filled out.

The gap or headway data is recorded into bins with a predetermined time interval.

The applicable gap or headway size can be selected in the excel sheet using the drop-down choice in excel.

The commonly used interval for most gap acceptance studies is 2 seconds.

Per the ITE Manual of Transportation Engineering Studies 2nd Edition, a suggested sample size of 200 accepted gaps for a 2-second bin interval is provided.

If a 1-second bin interval is used, a sample size of 500 accepted gaps is suggested.

If a computer is unavailable for the field, the Field Data tab can be printed, and the results can be coded into the digital tab later.

Gap Study Example

The animation shows how the form would be filled out in the field.

As vehicles wait at the minor street stop bar, the size of accepted and rejected gaps is logged.

This process continues to be repeated throughout the sampling period.

If a computer is unavailable in the field, these tallies can later be transferred over to the field data form electronically.

The Analysis tab, discussed in further detail later in the module, will automatically calculate the critical gap from the inputs in the Field Data tab.

One Stage and Two Stage Crossings

When conducting a gap study, the way the headway is measured depends on field conditions.

A one stage crossing is represented on the left picture where the vehicles and pedestrians look in both directions when accepting or rejecting a gap.

A two-stage crossing, pictured on the right, occurs when a large enough median is available to store vehicles or pedestrians while these wait to find an acceptable gap in the opposite traffic stream to complete the second stage of the crossing.

For two-stage crossings, the gap should be recorded for each direction of traffic
which is made visible by the two reference points highlighted in blue and red on the right image.

Form 750-020-08b: Analysis Tab

The flowchart shown on this slide depicts
the process that is followed to estimate the mean critical vehicular gap.

The form in the top right shows which section of the Analysis tab is completed through the 4 steps.

First, the accepted and rejected gap data is tallied into applicable bins in the Field Data tab
and carried over automatically to the analysis tab.

Note the data collected in the field needs to be entered in the electronic format of the form
in the Field Data tab to be able to automatically complete the calculations in the Analysis tab.

Form 750-020-08b: Analysis Tab

Then, we calculate the proportion of gaps for different critical gap times
which we will show referring to this step as Table A.

Form 750-020-08b: Analysis Tab

Next, we calculate the number of accepted gaps for each critical gap time
which requires inputs from Table A.

We will refer to this step as Table B and it will be used to calculate the number of accepted gaps.

Form 750-020-08b: Analysis Tab

Lastly, we calculate the critical gap percentage and estimate the mean critical gap.

All these calculations are automatically completed in Form 750-020-08b
under the Analysis tab when the field data is entered in the form electronically.

Estimated Vehicular Critical Gap

We will now walk through the vehicular critical gap
calculation to provide background into the Analysis tab.

If the engineer decides to conduct the calculations manually, these are the steps to be followed.

First, the accepted gaps are summarized into the applicable bins using the field data input
which is automatically carried over from the Field Data tab.

The example we will walk through today uses a two-second bin size
and shows the accepted and rejected gaps for each gap size
for a total of 200 hundred measurements in the field.

The values seen in the table are sample values that will be used throughout the example.

The following slide will walk through a sample calculation for the proportion of accepted gaps.

The proportion of accepted gap formula is shown below.

The proportion should increase as the gap size increases as shown in our example.

Increasing Accepted Gap Proportion

Using the sample data presented on the previous slide,
this table shows the calculation of the proportion of accepted gaps.

For each column or bin size, the number of accepted gaps, shown in blue,
is divided by the number of accepted and rejected gaps, shown in red, and multiplied by 100.

The animation walks through each individual calculation.

As the gap size increases, so should the proportion of accepted gaps.

For the next step, we will use the number of accepted and rejected gaps
and transpose these values to populate the gap proportions for Table A.

Table A: Gap Proportion

The slide shows a blank Table A
that we will fill out based on the number of accepted and rejected gaps shown in the previous slide.

Table A: Gap Proportion

To calculate the gap proportion for each critical gap size, we start with a critical gap of zero.

The column that we will calculate first is highlighted in red.

The field data to the right shows the number of accepted and rejected gaps for each gap size.

We calculate the gap proportion of a critical gap of zero using the formula shown on this slide.

We divide the total number of accepted plus rejected gaps by the total sample size times 100 percent.

For example, for an accepted gap size of 1, the calculation is 60 divided by 200 multiplied by 100.

The same steps are taken for the remaining gap sizes.

Table A: Gap Proportion

After calculating the gap proportion of a critical gap of zero seconds,
we will calculate the weighted gap proportion for the remaining critical gap sizes.

The weighted gap proportion uses the formula shown on this slide.

Now, we will calculate the weighted critical gap proportion for a critical gap of 2 seconds.

First, we compare the accepted gap size to the critical gap.

If the accepted gap is less than the critical gap,
we assume that there will be no accepted gaps and all gaps will be rejected.

Because 1 second is less than the critical gap of 2 seconds,
all gaps of 1 second will be assumed to be rejected.

Now we use the rejected proportion at a critical gap of 0 seconds
to calculate the remaining gap proportions.

For an accepted gap size of 3 seconds, we divide 25 by 100 minus 30.

We repeat this same calculation across all accepted gap sizes.

It is important to note, the critical gap proportion calculations
use the 0 second critical gap proportions previously calculated
to complete the table as shown in the corresponding yellow and red colored boxes.

Table A: Gap Proportion

Now we repeat the same steps from the previous slide for a critical gap of 4 seconds.

First, we compare the accepted gap size to the critical gap.

In addition to 1 being less than 4, 3 is less than 4 as well.

Now we have two gap sizes that are rejected, 1 and 3 seconds.

To calculate the weighted gap proportion, we divide the percentage of accepted gaps by 100 minus 30 and 25 or 55 which represent the rejected gaps lower than the critical gap.

For a gap size of 5 seconds, the calculation is 22.5 divided by 100 minus 55.

The same steps are repeated for the rest of the accepted gap sizes.

Note that the critical gap proportion calculations
use the 0 second critical gap proportions initially calculated
to complete the table as shown in the corresponding yellow and red colored boxes.

Table A: Gap Proportion

We repeat the same steps for a critical gap of 6 seconds.

As we know from the previous slides, a gap of 1- or 3-seconds would be rejected,
and now a gap of 5 seconds is rejected as well.

The weighted gap proportion calculation is used for the remaining accepted gap sizes.

Note that the critical gap proportion calculations
use the 0 second critical gap proportions initially calculated
to complete the table as shown in the corresponding yellow and red colored boxes.

Table A: Gap Proportion

Now the only critical gap left is the one of 8 seconds.

All other accepted gap sizes are less than the critical gap size and are therefore rejected.

Using the weighted gap proportion equations, the weighted gap proportion for 9 seconds is 100%.

Note that the critical gap proportion calculations
use the 0 second critical gap proportions initially calculated
to complete the table as shown in the corresponding yellow and red colored boxes.

After all the columns are calculated, the results from Table A will be carried over
to calculate the values in Table B, mean critical gap, and critical gap proportion.

Table B: Number of Accepted Gaps

Now that we know the gap acceptance percentage for each critical gap from Table A,
we will use that information to calculate the number of accepted gaps in Table B shown on this slide.

Table B: Number of Accepted Gaps

First, we will calculate the total number of accepted gaps.

The Total column in Table B is the total number of accepted gaps recorded in the field.

These accepted gaps are the same values seen before.

Using the Field Data, we fill in the total column.

Table B: Number of Accepted Gaps

Now we will focus on the first row of Table B, or accepted gap of 3 seconds.

We know the total number of accepted gaps we can have is 5.

Now, we compare the accepted gap size to the critical gap size.

If the critical gap is greater than the accepted gap, then all gaps would be rejected.

In this case, all critical gaps greater than two seconds will be rejected.

The total number of accepted gaps must stay the same,
so we now know that the number of gaps accepted with a critical gap of 2 seconds
equals the total number of accepted gaps for 3 seconds which is 5.

Table B: Number of Accepted Gaps

Next, we will fill out the rest of the column for a critical gap of two seconds.

The first calculation we complete is to find the number of total gaps for a critical gap of two seconds.

The calculation will require data from Table A.

Table A and Table B

Using the same critical gap column from Table A and Table B of two seconds,
we will calculate the total critical gaps.

The equation shown on this slide shows how to calculate the number of gaps for a critical gap.

The critical gap total is equal to the number of accepted gaps times 100 divided by the proportion of accepted gaps for the corresponding accepted gap size.

This calculation will show how to calculate the total number of gaps accepted for a critical gap of 2 seconds.

The number of gaps is five and is multiplied by 100 and divided by the respective distribution of gaps from Table A.

In this case, the distribution is 35.7.

Following through with the calculation, the total number of accepted gaps for a critical gap of 2 seconds is 14.

Table A and Table B

The number of accepted gaps for each accepted gap time uses the following equation.

The proportion of accepted gaps for each accepted gap time is multiplied by the total number of gaps for the corresponding critical gap.

For 5 seconds, this calculation is 32.1 multiplied by 14 divided by 100.

All calculations for the number of accepted gaps for a critical gap of two seconds are shown.

Now, the total accepted gaps and the number of accepted gaps with a critical gap of 2 seconds is known.

Table B: Number of Accepted Gaps

The remaining cells within the table need to be calculated in order to obtain the mean critical gap.

The next step is to calculate the number of accepted gaps for 5 seconds.

From previous calculations, we know the total number of accepted gaps and the number of accepted gaps with a critical gap of 2 seconds.

Following the same process, if the critical gap is greater than the accepted gap, the cell will equal 0.

For 5 seconds, the critical gap of 6 and 8 seconds will equal 0.

The number of accepted gaps for 4 seconds is calculated by subtracting the accepted gaps at 2 seconds or 4.5 from the total gaps for the accepted gap size which is 15.

The resulting equation is 15 minus 4.5 which equals 10.5.

Table A and Table B

After calculating the remaining number accepted gaps for 5 seconds which resulted in 10.5 gaps from the previous slide, the remaining number of accepted gaps for a critical gap of 4 seconds can be calculated.

First, the total number of accepted gaps
must be calculated using the formula on the right side of the slide.

In this case, the equation is 10.5 times 100 divided by 50 which equals 21.

The remaining rows for a critical gap of 4 seconds in Table B can now be calculated.

The remaining values are calculated using the equation at the bottom of the slide.

Using this equation, the number of accepted gaps for 7 and 9 seconds
equal to 9.3 and 1.2, respectively.

Table B

These steps are repeated for a critical gap of 6 and 8 seconds.

First, we must find the value that can be calculated using the total columns.

Then calculate the rest of the column using the methodology presented in the previous slides.

The animation shows the order these values would be calculated in.

The critical gap percentage and mean critical gap remain unknown.

Let’s now solve for these values.

Critical Gap Percent

The critical gap percent is calculated using the total number of gaps in each column
and dividing by the total number of accepted gaps which is 50 for our data set.

For a critical gap of 2 seconds the equation is the following:
14 divided by 50 multiplied by 100 equals 28 percent.

The calculation is repeated for the remaining gaps.

Mean Critical Gap Final Calculation

To calculate the mean critical gap, the total critical gap in seconds by critical gap bin size
is multiplied by the corresponding total accepted gaps in the column.

The data is then summed over all gaps and multiplied by the total gap.

The summation depicted in the formula is then divided by all the accepted gaps
which is 50 for our data set.

For this example, the calculation is as follows:
2 times 14 plus 4 times 21 plus 6 times 13.1 plus 8 times 1.9 divided by 50.

This calculation equals 4.12.

The mean critical gap, rounded, is 4 seconds, which means based on the sample,
the average vehicle will not accept a gap less than 4 seconds.

Table B

The final calculated values for Table B are shown on this slide.

The Analysis tab of Form 750-020-08b automatically calculates the critical gap proportions
and mean critical gap using methodology just described.

Form 750-020-08b: Analysis Tab

The following images overview the top and bottom half of Form 750-020-08b: Analysis tab.

This form automatically calculates the gap proportions and mean critical gap
from the field data recorded in the Field Data tab.

Note the results that we calculated step by step
are the same results that the form automatically populates shown on this slide.

Pedestrian Critical Headway

Now that the vehicular gap methodology has been discussed,
let's walk through the pedestrian gap study and how to calculate the pedestrian critical headway.

Pedestrian Gap Study

Typically, the purpose for a pedestrian gap study is related to pedestrian safety and behavior.

The outcome of a pedestrian gap study is commonly used for Traffic Signal Warrant 5.

Traffic Signal Warrant 5 determines whether a traffic signal
is needed for a pedestrian school crossing.

For detailed information of the application of gap study results for signal warrants evaluation,
refer to MUTS Chapter 3 - Traffic Signal Warrant Summary.

A pedestrian gap study is conducted usually at unsignalized intersections
such as an unsignalized midblock crossing or a two-way stop-controlled intersection.

The critical pedestrian headway represents the minimum headway between vehicles
that a pedestrian will accept while crossing the roadway.

Conducting a Pedestrian Gap Study

Conducting a pedestrian gap study is similar to a vehicular gap study.

The vehicle headways are tallied using a consistent reference point, and observers collect the data from a location that does not influence pedestrian or vehicular behavior.

Form 750-020-08a or 750-020-08b can be used.

Typically, form 750-020-08a would be sufficient for a pedestrian gap study related to Traffic Signal Warrant 5.

If using form 750-020-08a, the pedestrian headway will need to be calculated before data gathering.

Form 750-020-08b can calculate the mean critical headway based on accepted and rejected gaps.

The following slides will demonstrate the pedestrian critical headway calculations.

Pedestrian Gap Availability Study

Form number 750-020-08a is used to conduct a gap availability study.

For a gap availability study, all adequate gaps are logged.

Determining an adequate gap requires calculating the critical pedestrian headway before the field data collection is conducted.

The number of adequate gaps logged on Form 750-020-08a can be used to determine the outcome of Traffic Signal Warrant 5.

Now that we have an overview of a pedestrian gap study, let's walk through an example calculation.

Pedestrian Critical Headway: Single Pedestrian

The estimated pedestrian critical headway is calculated using the following equation and default values.

A walking speed study may be required to adjust the default value of "S-p" depending on the presence and influence of people with disabilities, elderly, or children that would impact the average walking speeds at the study location.

For detailed information on how to conduct a walking speed study, refer to MUTS Chapter 9 - Non-Motorized Volume Studies.

Note that if a median refuge is provided, the field data collection and associated calculations should be conducted separately for each leg or crossing.

Single Pedestrian Example

In this example, the pedestrian crossing length is 60 feet,
and we will use the default values for walking speed and start up time.

The calculated critical headway is 20.1 seconds.

Gaps greater than 20.1 seconds are considered an adequate gap.

We will now use Form 750-020-08a and the critical headway we just calculated
to collect field data for a pedestrian gap availability study.

Form 750-020-08a

Form number 750-020-08a is the Gap Study form that allows practitioners to record adequate gaps over multiple time periods.

This form is available in an excel version on the MUTS online library
or by scanning the QR code on the top right corner with a cellphone camera.

Before beginning a gap study, the header of this form
should be filled out with the respective information for each item.

Form number 750-020-08a is designed to collect gaps over multiple time periods.

Once in the field, the engineer will begin to tally the total number of available gaps
for the specific time period.

Form 750-020-08a

Now that we have overviewed Form number 750-020-08a: Gap Study,
let's walkthrough how to conduct a study and use the form.

Remember, we recommend recording the headways between vehicles when conducting a gap study.

Since we are only recording adequate gaps, we will only record gaps greater than 20 seconds.

As the vehicles' front bumper passes the reference point, the observer begins the stopwatch.

As the next vehicle crosses the reference point, the observer stops the stopwatch or timing device
and tallies that gap on the form under the corresponding bin.

Note that the pauses in the vehicle’s paths in the animation are only done for emphasis.

Vehicles in the field will continue moving.

The gaps are tallied throughout the time period filled out in the header.

This last gap in the animation is not recorded since it is less
than the pedestrian critical headway of 20 seconds.

Pedestrian Critical Headway

One caution with using the equation for calculating a pedestrian's critical headway is that the default values present a conservative estimate for the critical pedestrian headway.

For example, the default walking speed represents the 15th percentile walking speed which may overestimate the critical headway.

A walking speed study may be required to better represent the pedestrian critical headway.

For detailed information on how to conduct a walking speed study, refer to MUTS Chapter 9.

For most applications in Florida, the single pedestrian critical headway calculation is sufficient.

An adjustment is used to calculate group critical headways.

In Florida, groups of pedestrians which platoon while crossing may be seen at concerts, sporting events, or other large events.

The following slides will walk through how to calculate the group pedestrian headway.

An alternative to calculating a single or group pedestrian critical headway and using assumptions is to use to form 750-020-08b when conducting a pedestrian gap study.

Form 750-020-08b will calculate the mean critical headway using the methodology previously discussed from the accepted and rejected gaps tallied in the sheet.

Group of Pedestrians

If there are a group of pedestrians, the critical group headway is calculated using the following equation.

The spatial distribution of pedestrian is based on the data seen in the field.

"T-g" in the equation is the group critical gap, and the required inputs include the single pedestrian critical headway, previously calculated, and the spatial distribution of pedestrians.

If there are no platooning pedestrians, or pedestrians crossing behind one another, in the field, the group critical headway is equal to the single pedestrian's critical headway.

In Florida, most applications of a pedestrian gap study will only require a single pedestrian's critical headway.

Group of Pedestrians

The spatial distribution of pedestrians is calculated using the following equation.

The spatial distribution of pedestrians "N-p" requires the crosswalk width and the number of pedestrians in the crossing platoon.

8.0 represents the default clear effective width used by a single pedestrian to avoid interference when passing other pedestrians.

Group of Pedestrians

The number of pedestrians in the crossing platoon or “N-c” is calculated from the following equation and requires the pedestrian flow rate and vehicular flow rate which are determined by field conditions.

The single pedestrian critical headway is calculated per the equation on Slide 53.

The following example will walk through the critical headway calculations for a group of pedestrians.

Group Pedestrian Headway: Example

We will use the same scenario as the one for our single pedestrian headway calculations example.

From field observations, the pedestrian flow rate is determined to be 0.1 pedestrians per second and the vehicular flow rate is 0.25 vehicles per second.

The single pedestrian critical headway is 20.1 seconds per our last example.

Based on the example values and formula,
the number of pedestrians in the crossing platoon is equal to 43.57.

The crosswalk width is 10 feet.

The number of pedestrians in the platoon is input into the spatial distribution of pedestrian formula.

Inputting the relevant values, the spatial distribution of pedestrians is equal to 35 seconds.

The spatial distribution of pedestrians we just obtained will now be used
as an input into the pedestrian critical group headway.

Group Pedestrian Headway: Example

The individual critical pedestrian headway and spatial distribution
is input into the group critical headway equation shown.

By completing the calculations, the estimated group critical headway is 88.1 seconds.

While this value may seem high, this is for a group of 44 pedestrians in the crossing platoon.

The group critical headway is dependent upon field observations.

Gap Study Summary

The gap study is commonly used for roadway capacity analysis, vehicle delay considerations,
and Signal Warrant 5.

Conducting a gap study requires equipment such as a stopwatch or other timing device
and can be supplemented with video recordings.

Engineers conducting a gap study should find a location with good visibility and a reference point.

Additionally, the engineer should choose an observation location away from motorists’ sight
to not influence driver or pedestrian behavior.

Typically, one observer is sufficient to conduct the study.

There are two sets of digital forms that can be used to conduct a gap study.

Form 750-020-08a is typically used for pedestrians and provides a means to record adequate gaps.

Form 750-020-08b is typically used for vehicular gap studies
but can also be applied to pedestrian gap studies.

The Analysis tab of Form 750-020-08b automatically calculates the mean critical gap.

Both forms are available digitally on the MUTS website or by scanning the Q-R code
on the top right corner of the slide with a cellphone camera.

Concludes

This concludes the Manual on Uniform Traffic Studies computer based training,
Chapter 8 – Gap Study.

[Web]

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 enter your first and last name before continuing to the quiz.

Thank you for your time and attention.

[LMS]

You will now take a 10-question quiz to test your knowledge and understanding on the material presented in this computer-based training.

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If you do not pass the quiz, please return to the Course Content tab and re-take this training.

Once you've passed the quiz and received your certificate please continue to the next chapter by returning to the MUTS course content tab and selecting the next chapter in the training.

Please, continue to the quiz and thank you for your time and attention.