



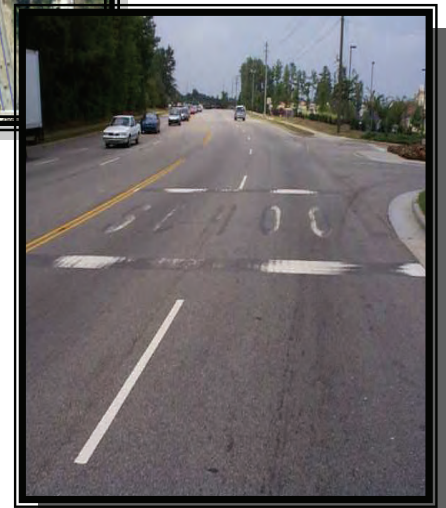
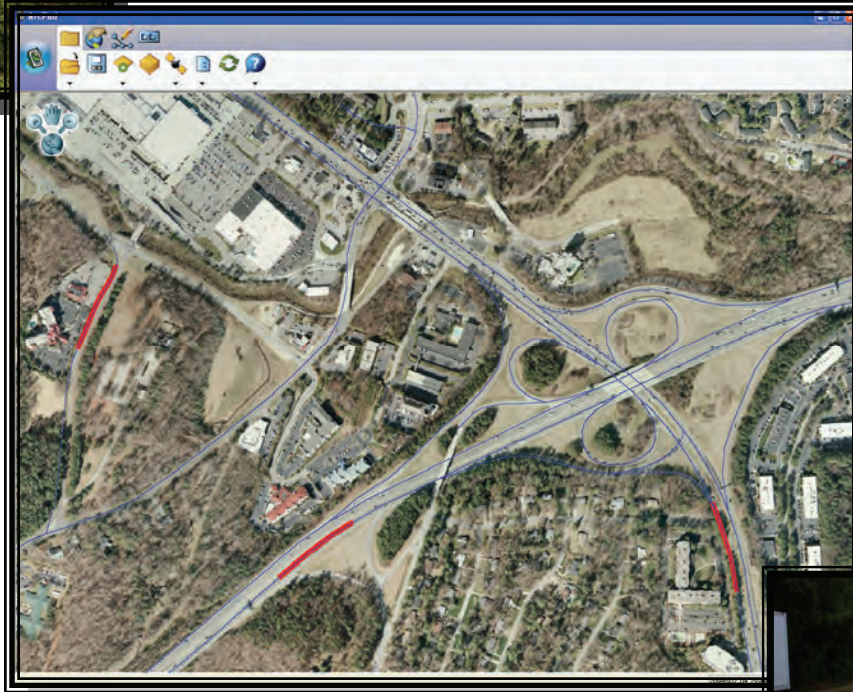
NCDOT

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Connecting people and places in North Carolina — safely and efficiently, with accountability and environmental sensitivity.

Maintenance Condition Assessment Program

Manual



Maintenance _____

Condition _____

Assessment _____

Program _____

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PREFACE

Welcome to the Team!! Thanks to you, the North Carolina Department of Transportation continues to improve and enhance its maintenance management system.

The collection of data on the condition of state-maintained highways will provide an indication of the level of maintenance we are now providing. This information will enable us to address funding level needs and develop a strategy for prioritizing maintenance operations.

This manual presents the procedures of the maintenance condition survey. Instructions on the collection and reporting of survey data are provided, as well as detailed descriptions, examples, and illustrations of the features to be measured. In addition, a summary of these feature definitions is provided in the appendix.

It is imperative that the surveys be conducted in a timely manner, and that the data is uploaded as soon as practical. If you have any trouble or questions, contact:

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INTRODUCTION

Quality assurance in highway maintenance has been the subject of study and discourse for several years. It may best be described as the planned and systematic actions needed to provide adequate confidence that highway facilities meet specified requirements. Such requirements are usually defined by the highway agency but are intended to reflect the needs and expectations of the user.

First largely considered in the 1960s as part of the maintenance management system concept, the issue of quality assurance in highway maintenance has since remained an active topic due mainly to increased work loads, greater maintenance demands, limited maintenance funds, and public perceptions of maintenance departments. The need for better quality maintenance has increased significantly within the last few years in recognition of the change in focus from new highway construction to maintenance and rehabilitation of existing roadways.

Building off of the successes of current quality management programs and the National Cooperative Highway Research Program (NCHRP) project 14-12, *Highway Maintenance Quality Assurance*, a program is being developed to implement quality management practices for North Carolina Department of Transportation.

The program will accomplish the following objectives:

- Determine the expectations of the traveling public.
- Be able to assure the public that NCDOT is meeting those goals.
- Develop the funding level needed to achieve a desired service level.
- Develop a “priority strategy” to direct maintenance operations.
- Achieve a uniform service level throughout the state by identifying excessively high or low areas of maintenance.
- Identify areas requiring additional employee skills or equipment to accomplish assigned tasks.

Using various interactive components to fulfill these objectives will enable the NCDOT to shift from a “fixing” reactive mode to a “prevention” proactive mode, thereby incurring the benefits associated with repairs that do not have to be repeated. Eventually, this may lead the way to greater levels of customer satisfaction at unit costs below those currently experienced by the agency.

The purpose of this manual is to provide a method for collecting roadway maintenance information in order to determine the overall condition of highways in the state. With this data, a maintenance needs report can be generated addressing required funding levels, a strategy for prioritizing maintenance operations, and areas of excessively high or low maintenance. This maintenance condition survey is the first, and perhaps the most important, step of a maintenance management system for NCDOT. A quality management system must be based upon good data, therefore it is imperative that the information collected is uniform and consistent.



CONDUCTING THE ASSESSMENT/SURVEY

The maintenance condition assessment program has been developed to assist the NCDOT to plan, schedule, budget, and report highway maintenance activities and needs. The agency has performance standards that describe how individual maintenance tasks are to be performed, the resources required to carry out the task, and the expected rate of production. The information from this maintenance condition survey will be used to evaluate the effectiveness of maintenance performance and identify opportunities for improvement. To maintain credibility of the program, the data must be collected accurately and completely.

Rating teams will be composed of two persons, and will be responsible for conducting the survey and reporting the findings. Each team will be assigned several segments for survey. The element features will be reviewed and assessed according to the criteria in the next chapter. To assure statewide uniformity of the maintenance inventory system, there should be no deviation from the criteria. Several passes through the survey segment may be required to adequately assess each feature.

Because the reviews will be made on foot, special precautions must be made for protection of the reviewers from traffic. The team's first responsibility is the safety of motorists, pedestrians, and themselves. Always be aware of traffic conditions. For the safety of the crew, it may be necessary to schedule the survey of those segments with high traffic volumes during off-peak traffic periods. The survey team should walk together, on the same side of the road, facing traffic as the segment is evaluated. This is for the protection of the team, and to assure that features will not be overlooked.

A list of equipment and supplies that should be used by the survey team is shown on the following page. While some of these are necessary for proper collection of the data, other items will make the survey safer and more efficient.

Also, if there is a problem with the randomly-selected site (the road is under construction, it is in an interchange area, a significant portion of the road segment is bridge structure, etc.), do not survey the section. On the Tablet form select "Section Skipped" and hit the "Ok" button. Then proceed to an alternate section to survey and make up for the section that was previously skipped.



CONDUCTING THE ASSESSMENT/SURVEY

Equipment Needed

Personal Protective Equipment (safety vest, foot protection, etc.)
Roof-top revolving amber light
Copy of the *Maintenance Condition Survey* manual
Clipboard
Pencils and erasers
Vehicle-installed distance measuring instrument -Optional-
Measuring wheel or tape
Small measuring ruler (6 in)
Straightedge
Insect repellent with Deet
First aid kit
Calculator
Bush axe / Machete
Gloves
Tablet PC
GPS Receiver
Binoculars
Flashlight
USB Flash Drive (Memory stick for Data)



REPORTING ASSESSMENT DATA

The information collected during the Assessment will be recorded using Tablet type PCs with ArcPad Software. An Example of the electronic Form you will fill out for the Random Sections is shown on the next page. All pertinent information will be filled in by the assessor in the given blanks or by using drop down menus. The date of the survey and names of those conducting the survey must also be entered on the form. It is important that the inventory form be filled out completely. All information blocks on the form must be completed. If a segment can not be assessed then make sure to select “Section Skipped” on the electronic form before moving on. If you do have to Skip a Section, be sure to assess one of the back-up sections. If a feature does not exist in the segment (for example, there may be no guardrail), enter “0” in both the Inventory and Condition blocks.

Quality Control visits will be made by SRMU personnel while the Assessment is being conducted. This will assist the raters by clearing up questions and problems that may arise and ensures data quality. Any remarks about the Assessment can also be made on the back sheet in this manual. If a concern needs to be addressed immediately then contact Lonnie Watkins at (919) 212-6091 or by email at: lwatkins@ncdot.gov

For the first week, each day data will be backed up on the supplied USB memory devices and uploaded to the network . The following weeks the data shall be uploaded weekly.



REPORTING ASSESSMENT DATA

Drop_inlets

Page 1 | Picture | Symbology | Geography

Blocked < 50%
Grates
Eroded & Perched
Outlets
Assessment Status
Assessment Date: 8/31/2009
Flater
COMMENTS
Failure Picture

ok

Example: Point Element Assessment Form in ArcPad

RandomSections

Page 1 | Page 2 | Page 3 | Picture | Symbology | Geography

SecNumCnty: 1184
Shoulder Inventory Length: 0
Shoulder Failure Length: 0
Shoulder Failure Criteria
Shoulder Failure Picture
Lateral Ditch Inventory Length: 0
Lateral Ditch Failure Length: 0
Lateral Ditch Failure Criteria
Ditch Failure Picture
Median Barrier Inventory Length: 0
Median Barrier Failed Length: 0
Median Barrier Failure Criteria
Median Barrier Failure Pic
Guardrail Inventory Length: 0
Guardrail Failure Length: 0
Guardrail Failure Criteria
Guardrail Failure Picture
Brush & Tree Inventory Length: 0
Brush & Tree Failure Length: 0

ok

Example: Random Segment Assessment Form in ArcPad



ELEMENT FEATURES AND CONDITIONS

This chapter provides a procedure for collecting information in order to evaluate the condition of selected sections of roads maintained by NCDOT. The results from this survey will be used to estimate the overall condition of roadways throughout the state and determine highway maintenance needs.

Four maintenance elements will be rated for each survey segment: (1) unpaved shoulders and ditches, (2) drainage, (3) roadside, and (4) traffic control devices. Each element will consist of several features and characteristics that will be evaluated against certain threshold conditions. The elements and their features to be rated are shown on the following table.

An explanation of each feature follows in this chapter with a description of the feature, the threshold condition that will be rated, and photographs of the characteristics of each feature. The descriptions also provide methods of measuring the features and any special instructions to take into account during the survey.

Each team will be assigned several segments for survey. The element features will be reviewed and assessed according to the criteria on the following pages. To assure statewide uniformity of the maintenance inventory system, there should be no deviation from the criteria.

Several passes through the survey segment site may be required to adequately assess each feature. Because most of the reviews will be made on foot, special precautions must be made for protection of the reviewers from traffic. Always be aware of traffic conditions.



ELEMENT FEATURES AND CONDITIONS

Element 1 - Unpaved Shoulders and Ditches

Shoulders
Lateral Ditches

Element 2 – Drainage

Crossline Pipes Blocked
Crossline Pipes Damaged
Gutters Blocked
Inlets (Blocked or Damaged)

Element 3 – Roadside

Brush & Tree Control
Turf Condition

Element 4 - Traffic Control Devices

Pavement Striping
Words & Symbols
Pavement Markers



SHOULDERS AND DITCHES

Within a sample section, you will need to assess the Shoulders and Ditches. Where there is unpaved shoulder, the section will be assessed for the presence of both Low and High shoulder. For unpaved shoulders, two longitudinal measurements will be recorded: the Total Segment Inventory of unpaved shoulders and the Measured Amount that the feature exceeds the threshold conditions.

Unpaved Shoulders (Low & High)

Feature Description:

Low Shoulders occur when the elevation of the unpaved shoulder is lower than the roadway edge of pavement. A low shoulder can result in an unsafe recovery in the event a vehicle leaves the roadway. A low shoulder can also hold water that may eventually penetrate the base and subgrade and weaken the roadway.

High Shoulders occur when the elevation of the unpaved shoulder is higher than that of the roadway edge of pavement. A high shoulder can restrict water drainage and result in ponding at the edge of roadway. The standing water can cause vehicle hydroplaning, and may also infiltrate the base and subgrade and weaken the roadway. The relief of ponding caused by a high shoulder may also scour the shoulder and front slope.

Threshold Condition:

A **Low Shoulder** should be noted where there is a drop-off greater than 3" within the shoulder width or 10', whichever is less.

A **High Shoulder** should be noted where the elevation difference is 2" above the road surface, or higher within the shoulder width or 10', whichever is less.

Total Sample Section Inventory: The total shoulder length in the segment will be recorded. For example, if a typical two-lane, two-way roadway is being inspected, the total shoulder length will be 1,056 feet (0.1 mi. x 5,280 ft. x 2 shoulders). For the assessment of a four-lane roadway divided by a grass median, the total shoulder length may be 2,112 feet (0.1 mi. x 5,280 ft. x 4 shoulders).

Measured Amount: Each shoulder in the segment is to be evaluated. The Measured Amount is the longitudinal length wherever a shoulder exceeds the given threshold condition listed above for both Low and High Shoulders within the sample section being assessed. On the ArcPad form, record the sum of the lengths, **in Feet**, that meet both conditions.

Special Instructions: There may be an area in the sample section where an unpaved shoulder does not exist due to curb and gutter, valley gutter, median barrier, paved shoulder, etc. When this occurs, the Total Sample Section Inventory must be reduced by the length of these features. If a portion of the shoulder is paved and the width is 10' or greater, then the Total Sample Section Inventory must be reduced by that portion of the section length.



SHOULDERS AND DITCHES



Examples: Low Shoulders



Examples: High Shoulders



SHOULDERS AND DITCHES

Within a sample section that is being assessed only one ditch feature will be rated. When assessing Lateral Ditches, two longitudinal measurements will be recorded: the Total Segment Inventory of the Lateral Ditch and the Measured Amount that the feature exceeds the threshold condition.

Lateral Ditches

Feature Description: Lateral ditches are trough-shaped channels oriented parallel to the roadway. Located along the roadside and in medians, these ditches are constructed to collect and disperse surface water in a controlled manner, and assist in the drawdown of groundwater from the road base to prevent saturation and loss of support. A blocked ditch can cause saturation of the base and subgrade, which may lead to pavement failure. The relief of ponding caused by a blocked ditch may also erode downstream slopes and ditches when the water is released. Because ditches are constructed to collect and disperse surface water in a controlled manner, they are often seeded and mulched to prevent erosion but may be lined with rip rap or even paved. A proper lining helps dissipate water flow velocities, and it prevents loss of roadbed support by stabilizing the soil. Ditch erosion can not only impact road stabilization and contaminate natural drainage areas, it can also be a safety problem for errant motorists.

Threshold Condition: Lateral ditches that are **50% blocked** or more and are not functioning properly should be noted. An eroded lateral ditch should be noted when there is a lining loss of **1 foot** below the original ditch line, or lower. There should also be no joint separation, misalignment, or undermining in paved ditches.

Total Sample Section Inventory: The total lateral ditch length in the segment will be recorded. For example, if a typical two-lane, two-way roadway is being inspected, the total ditch length will be 1,056 feet (0.1 mi. x 5,280 ft. x 2 ditches). For the assessment of a four-lane roadway divided by a grass median that has a single median lateral ditch, the total ditch length will be 1,584 feet (0.1 mi. x 5,280 ft. x 3 ditches).

Measured Amount: Each lateral ditch in the segment is to be evaluated. Once the ditch's design shape is determined, check where blockage occurs that is 50% or higher from the ditch invert or where the ditch has eroded 1 foot or lower than the original ditch line. When noted, measure the longitudinal length of blocked ditches (that are not functioning properly) and eroded ditches. Record the sum of the lengths of blocked and eroded ditches.

Special Instructions: Outfall ditches will not be rated as part of this survey. Also, do not deduct ordinary driveway pipe; the length of the driveway pipe will be included in the lateral ditch inventory. While ordinary driveway pipe will not be assessed for damages or erosion, it will be assessed for blockage. If either inlet or outlet is 50% blocked or more, include the length of the driveway pipe in the sum of blocked and eroded ditches. Also if a lateral ditch is piped it will be treated the same as a driveway pipe, regardless of the length.



Examples: Lateral Ditches — Blocked

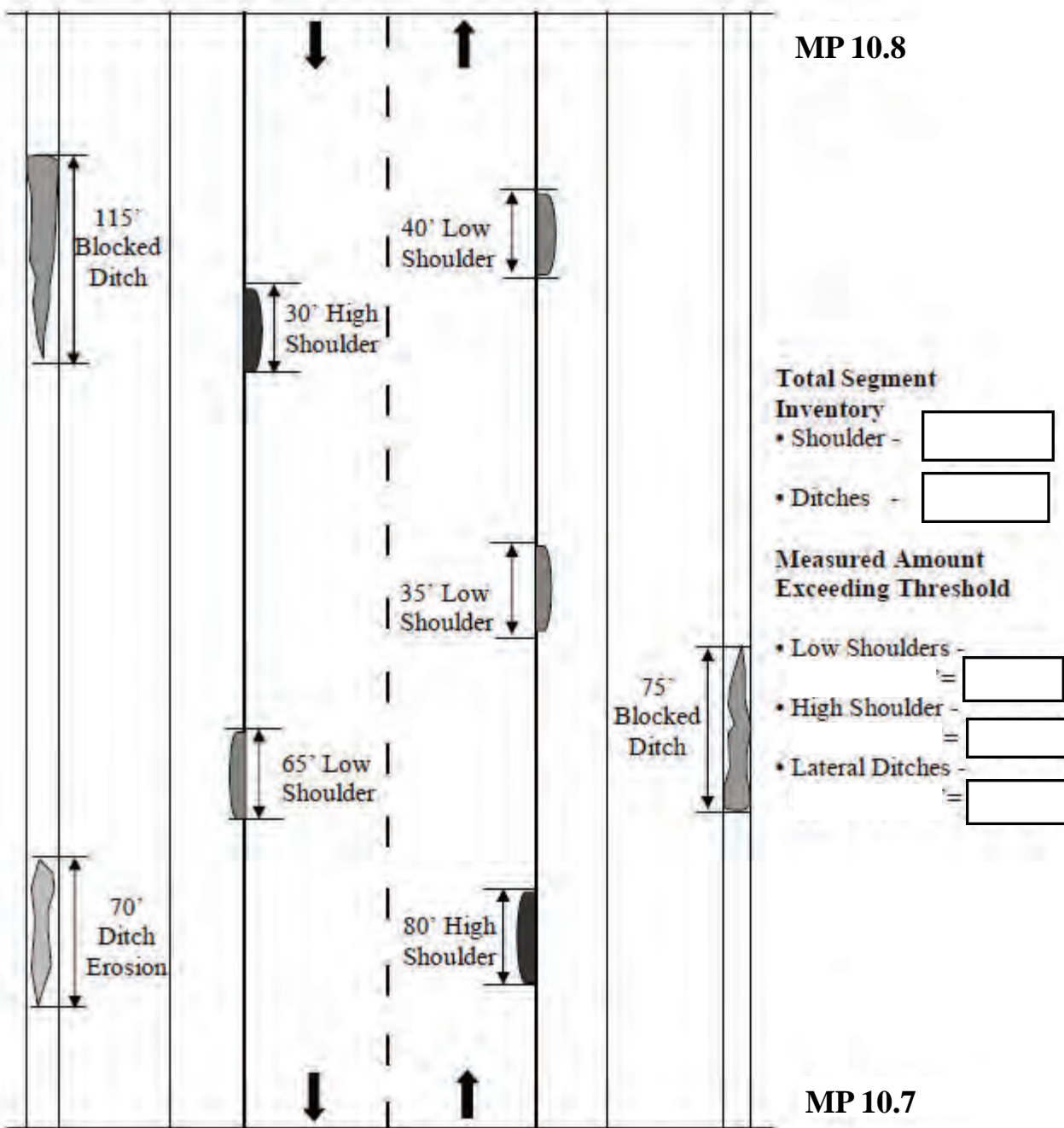


Examples: Lateral Ditches — Eroded



SHOULDERS AND DITCHES

Example: Unpaved Shoulders & Ditches





DRAINAGE

Three drainage features will be rated: crossline pipes, gutters, and inlets. For each feature, two measurements will be recorded.

Except for gutters, the total number of drainage features in the segment will be noted as the Total Segment Inventory. Then, the number of these features that do not meet the threshold condition will be recorded as the Measured Amount. For gutters, the total longitudinal length of gutter in the segment will be recorded as the Total Segment Inventory. Next, the length of gutters exceeding the threshold conditions will be recorded as the Measured Amount.

Crossline Pipes Blocked

Feature Description: Crossline pipes are subsurface conduits that carry water under the roadway to the natural drainage area. Designed for each location, pipes come in a variety of materials, sizes, and shapes. If a blocked pipe causes ponding at the inlet and in the upstream ditch, the water can penetrate the subgrade and weaken the roadway. A restricted pipe can also result in scouring at the outlet due to the increased water flow.

Threshold Condition:

1. Crossline pipes shall have openings greater than **50%** of diameter open.
2. No eroded area at the inlet or outlet that is wider or longer than 1.5 times the pipe diameter and greater than 6" deep.

Total Inventory: The total number of crossline pipes in the segment will be recorded.

Measured Amount: If at all possible, each crossline pipe in the segment is to be evaluated. If either inlet or outlet is 50% blocked or more, that pipe will be recorded as a single feature that does not meet the threshold condition. On the ArcPad form, record the number of crossline pipes that are blocked.

Special Instructions: Only Crossline Pipes maintained by Roadway Maintenance (48 inches or less) will be evaluated. Pipes and culverts maintained by Bridge Maintenance (larger than 48 inches) will not be rated as crosslines. Also, pipes along the lateral ditch that serve as a crossline pipe at an intersecting roadway will be evaluated. Drainage pipes that are part of a closed system will not be assessed



Examples: Crossline Pipes Blocked



DRAINAGE

Three drainage features will be rated: crossline pipes, gutters, and inlets. For each feature, two measurements will be recorded.

Except for gutters, the total number of drainage features in the segment will be noted as the Total Segment Inventory. Then, the number of these features that do not meet the threshold condition will be recorded as the Measured Amount. For gutters, the total longitudinal length of gutter in the segment will be recorded as the Total Segment Inventory. Next, the length of gutters exceeding the threshold conditions will be recorded as the Measured Amount.

Crossline Pipes Damaged

Feature Description: See feature description for Crossline Pipes Blocked. If the pipe is damaged due to cracking, joint failures, or corrosion, water infiltration and exfiltration may result in loss of fines from the subgrade, causing roadway settlement and pavement failure.

Threshold Condition: Where a pipe is **damaged** so that it affects the functionality of the system, it should be noted.

1. No damage due to cracking, joint failures, or corrosion.
2. No water infiltration causing pavement failures, shoulder failures, or roadway settlement.

Total Inventory: The total number of crossline pipes in the segment will be recorded.

Measured Amount: If at all possible, each crossline pipe in the segment is to be evaluated. If the pipe is damaged, that pipe will be recorded as a single feature that does not meet the threshold condition. On the survey form, record the number of crossline pipes that are damaged.

Special Instructions: Only Crossline Pipes maintained by Roadway Maintenance (48 inches or less) will be evaluated. Pipes and culverts maintained by Bridge Maintenance (larger than 48 inches) will not be rated as crosslines. Also, pipes along the lateral ditch that serve as a crossline pipe at an intersecting roadway will be evaluated. Drainage Pipes that are part of a closed system will not be assessed.



Example: Crossline Pipe Damaged



DRAINAGE

Three drainage features will be rated: crossline pipes, gutters, and inlets. For each feature, two measurements will be recorded.

Except for gutters, the total number of drainage features in the segment will be noted as the Total Segment Inventory. Then, the number of these features that do not meet the threshold condition will be recorded as the Measured Amount. For gutters, the total longitudinal length of gutter in the segment will be recorded as the Total Segment Inventory. Next, the length of gutters exceeding the threshold conditions will be recorded as the Measured Amount.

Gutters Blocked

Feature Description: Gutters are open drainage channels that direct the flow of water from the road surface and roadside area to a catch basin or other outlet. Examples of open-channel gutters are curb and gutter and valley gutter. Also if Concrete Barrier is present, the base on each side serves as Curb & Gutter and is to be recorded as such. An obstruction in the gutter may divert water flow onto the travelway and cause vehicle hydroplaning.

Threshold Condition: Gutters that are not functioning as designed due to an obstruction 2-inches or greater in depth for at least 2 feet of gutter length should be noted

Total Segment Inventory: The total gutter length in the segment will be recorded. For example, if a typical five-lane roadway is being inspected, and it has a median concrete barrier and Curb & Gutter on the outside, the total curb and gutter length will be 2,112 feet (0.1 mi. x 5,280 ft. x 4 gutters).

Measured Amount: Measure the longitudinal length wherever a gutter is not functioning as designed due to an obstruction 2 inches or greater for at least 2 feet of curb length. On the ArcPad form, record the sum of the lengths of gutter that meet or exceed this condition.

Special Instructions: Blockage will not be noted if it will not obstruct water flow (grass growing in a construction joint, trash that will be flushed clean in the next storm, etc.). At intersections, measure the gutter longitudinally through the intersection; do not measure around the corner radius. Short sections of monolithic barrier (such as a 4-foot wide by 50-foot long concrete median island) will not be included in this inventory.



Examples: Gutters Blocked



Example: Curb & Gutter - Monolithic Island or Median





DRAINAGE

Three drainage features will be rated: crossline pipes, gutters, and inlets. For each feature, two measurements will be recorded.

Except for gutters, the total number of drainage features in the segment will be noted as the Total Segment Inventory. Then, the number of these features that do not meet the threshold condition will be recorded as the Measured Amount. For gutters, the total longitudinal length of gutter in the segment will be recorded as the Total Segment Inventory. Next, the length of gutters exceeding the threshold conditions will be recorded as the Measured Amount.

Inlets (Drop Inlets, Catch Basins, Shoulder Drains, Funnel Drains, etc.)

Inlets Blocked:

Feature Description: Inlets are the openings through which water enters an underground drainage network. They can be found in curbs, ditches, valley gutter, and at other locations that are designed to collect water runoff. Examples of inlets are catch basins, drop inlets, shoulder drains, and slope flumes. If the inlet is blocked, water ponding may occur at the obstructed opening. This can result in scour and erosion at an off-road structure, or vehicle hydroplaning if adjacent to the travelway.

Threshold Condition: Grates, Outlets, and Inlets that are **50% blocked** or more should be noted.

Inlets Damaged:

Feature Description: If the structure is damaged, water can penetrate the base and weaken the roadway. Also, a damaged or missing grate is a safety hazard to motorists, bicyclists, and pedestrians.

Threshold Condition: Inlets that are **damaged** or that have **missing or broken grates** should be noted.

No eroded area within 1' of the structure that is greater than 6" deep or below the base elevation of the concrete apron.

Inlets and Outlets are not damaged and are functioning properly.

Grates are present and not broken

Total Inventory: The total number of inlets in the segment will be recorded.

Measured Amount: Each inlet in the segment is to be evaluated. On the ArcPad form, record the number that exceeds or meets the above listed criteria for both blocked and damaged.

Special Instructions: For the Inlets that are located along the shoulders or median, do NOT fail if the inlet is ONLY covered by a thin layer of grass / mowing clippings that will more than likely be blown off or washed away when the next rain occurs.



Examples: Inlets Blocked



Examples: Inlets Damaged / Missing



DRAINAGE

Example: Drainage — Curb & Gutter, Inlets, Crossline Pipes

MP 108.0

Total Segment Inventory

- Crossline Pipes
- Gutters
- Inlets
- Ditches

Measured Amount Exceeding Threshold

- Crossline Pipe Blocked $\geq 50\%$
- Crossline Pipe Damaged
- Gutters Blocked $\geq 2' \times 2'$
- Ditches Blocked
- Inlets Blocked $\geq 50\%$
- Inlets Damaged

MP 107.9



DRAINAGE

Example: Drainage — Crossline Pipe under Side Street



MCAP

DRAINAGE



ROADSIDE

Brush and Tree Control

Feature Description: Brush and tree control involves the removal of large vegetation for safety reasons, to maintain a roadway clear zone, and to provide adequate sight distance. Although trees are an appealing roadside feature, the presence of large trees in the recovery area can be a hazard to errant motorists. A tree canopy can also be a problem if it restricts the visibility of traffic control devices (traffic signals or signs), reduces the stopping sight distance of drivers travelling the road, or limits the sight distance of drivers entering the roadway.

Threshold Condition: Freeways: 45' from travelway, 5' behind guardrail, not blocking signs.
Freeways are defined as a route with a controlled access fence.
Non-Freeways: Vertical clearance of 15' over roadway and 10' back of ditch centerline or shoulder point.

Total Segment Inventory: Where ever you have turf present within the random section, you will also have Brush & Tree Inventory, regardless if there is only grass visible with no other vegetation. For example, if a typical two-lane, two-way roadway is being inspected, the total roadside length will be 1,056 feet (0.1 mi. x 5,280 ft. x 2 shoulders). Median vegetation will not be inventoried or assessed. In that situation the total roadside length will be 1,056 feet (0.1 mi. x 5,280 ft. x 2 shoulders).

Measured Amount: Each forested / large vegetation piece in the segment is to be evaluated. The Measured amount is the longitudinal distances where the brush and tree exceeds or meets the above threshold conditions within the control zone. Enter the sum of these lengths on the assessment form.

Special Instructions: Brush and small trees within the control zone **should not** be noted if they would be mowed in normal mowing operations. However, if the brush and trees are so large that a tractor mower cannot mow them, then their longitudinal length should be measured. An exception is brush and trees that will not be removed due to public sensitivity, such as growth in a residential area. If a tree is beyond the control zone but is a safety concern, it should be measured.



Examples: Brush and Tree Control



ROADSIDE

Within each sample section, Turf Condition will be evaluated where applicable. Two longitudinal measurements will be recorded: the Total Segment Inventory of the feature and the Measured Amount that the feature exceeds the threshold condition.

Turf Condition

Feature Description: Turf cover is essential to maintaining the stability of unpaved shoulders, slopes, and the ditch line. Without proper vegetation, soil erosion can lead to water infiltration and loss of roadbed support, and even contamination of natural drainage areas due to sediment loss.

Threshold Condition: Areas of “**Brown Out**” or **Bare or Erodible** turf will be recorded.

Total Sample Section Inventory: The total roadside length in the Sample Section will be recorded. For example, if a typical two-lane, two-way roadway is being inspected, the total roadside length will be 1,056 feet (0.1 mi. x 5,280 ft. x 2 shoulders). For the assessment of a four-lane roadway divided by a grass median, the total roadside length may be 2,112 feet (0.1 mi. x 5,280 ft. x 4 shoulders).

Measured Amount: Each shoulder, slope, and ditch is to be evaluated. The Measured Amount is the longitudinal length (parallel to the roadway) of any area that has poor turf growth. On the ArcPad form, record the sum of the lengths of poor turf growth.

Special Instructions: Only the condition of turf within the normal mowing limits will be evaluated.

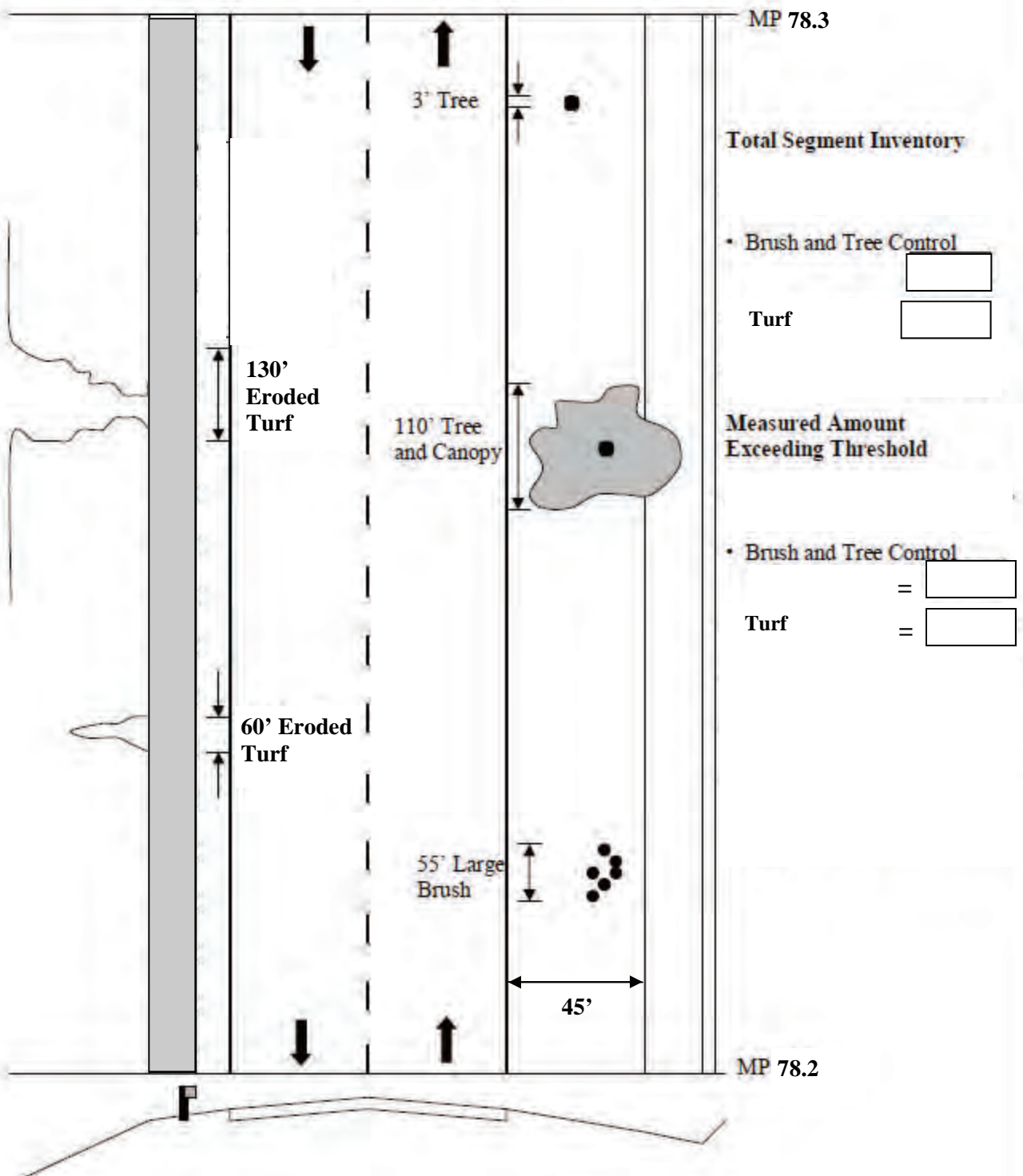


Examples: Turf Condition



ROADSIDE

Example: Roadside





TRAFFIC

Pavement Markings / Striping

Feature Description: Pavement Markings are applied to the road surface to convey warnings or information without diverting the driver's attention from the roadway. They consist of center lines that separate traffic traveling in opposite directions, edge lines that provide an edge of pavement guide for drivers, and lane lines that separate traffic traveling in the same direction. When pavement striping is worn or missing, this important traffic control device does not guide and direct motorists as intended, may cause driver confusion, and could even direct motorists into the wrong path.

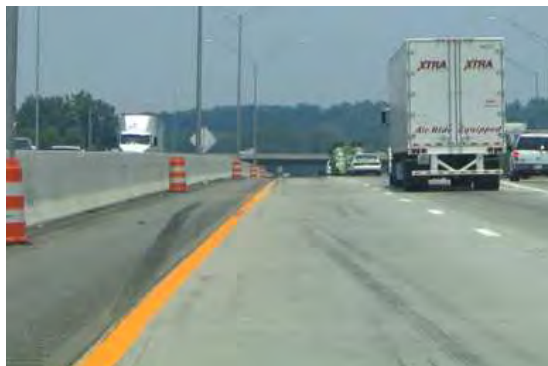
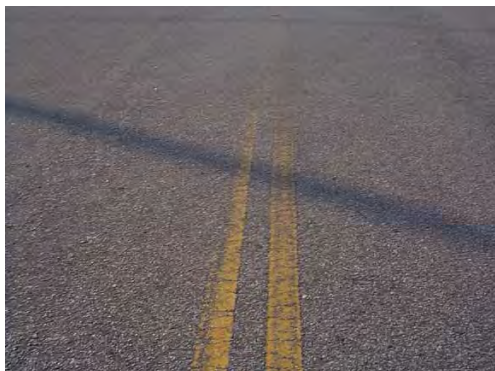
Threshold Condition: Markings / Striping that have significant portions that are **worn, missing, obliterated, or non-retroreflective** should be noted.

Total Segment Inventory: All Markings / Striping within a section will be collected as Inventory. You will be given a handout with some precalculated inventory amounts for general sections. Use this ONLY as a base amount then add or subtract any other necessary markings.

See handout for Inventory details.

Measured Amount: The measured amount is the longitudinal length where center lines, edge lines, or lane lines do not meet the Threshold Conditions. On the ArcPad form, record the sum of the poor pavement striping.

Special Instructions: Only the marking is to be measured. When recording broken lane lines or center lines, measure the painted marking and not the unpainted gap. For example, if rating a normal broken lane line, measure the 10 foot marking and not the 30 foot gap. This inspection will be done during the day.



Examples: Pavement Striping



TRAFFIC

Words and Symbols

Feature Description: Words and symbols on the pavement may be used for the purpose of guiding, warning, or regulating traffic. Some examples are Right Turn Arrows, Merge Arrows, Stop Bars, Lane Ends, Crosswalks, School Area Markings, and Railroad Crossing Markings, etc.

Threshold Condition: Word or symbol markings that have significant portions that are **worn, missing, obliterated, or non-retroreflective** should be noted.

Total Segment Inventory: The total number of word and symbol markings in the segment will be recorded.

Measured Amount: Count the number of words or symbols that are either worn, missing, obliterated, or non-retroreflective, and record on the ArcPad form.

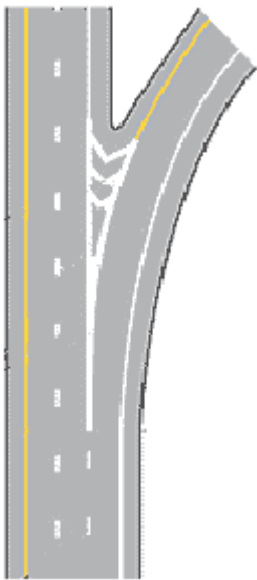
Special Instructions: For two-way left turn lane paired arrows, count as two symbols. Even though individual pavement marking patterns will make up a word (such as an ONLY, a RXR, or a SCHOOL), count the entire pattern as one word. All types of crosswalks (hi-visibility and standard) will count as one symbol. This inspection will be done during the day.



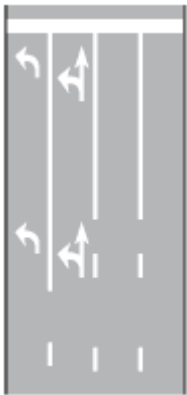
Examples: Failed Words and Symbols



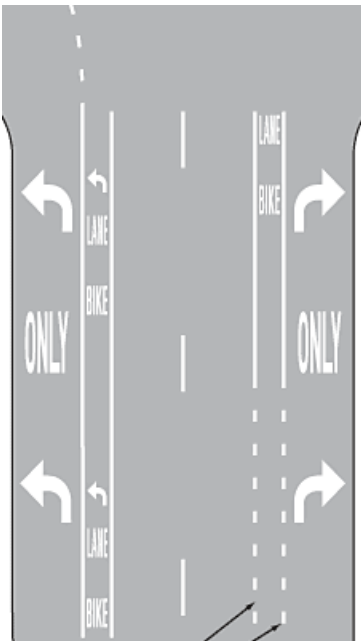
TRAFFIC-WORDS AND SYMBOLS EXAMPLES



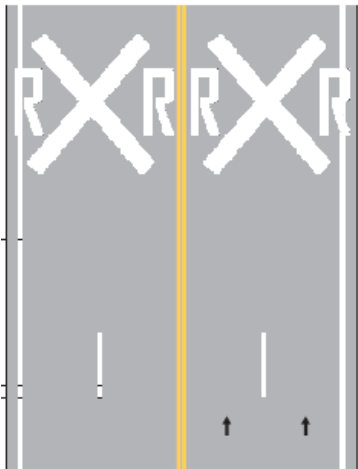
Symbols: 0



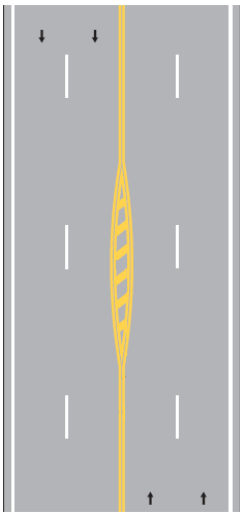
Symbols: 5



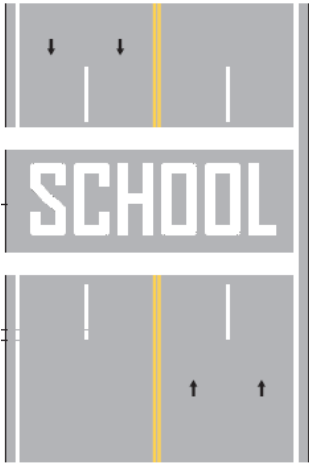
Symbols: 14



Symbols: 2



Symbols: 0



Symbols: 1



TRAFFIC

Pavement Markers

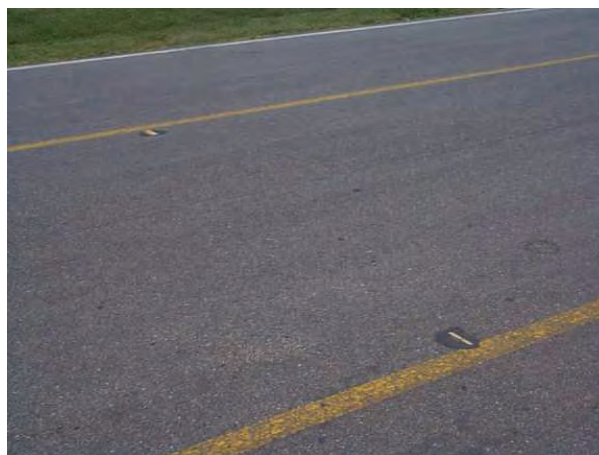
Feature Description: Pavement markers may be used as positioning guides or to supplement pavement markings. These may be surface-mounted, recessed, or snow plowable. Pavement markers are normally spaced every 80 feet, except in areas of severe road curvature (horizontal curves $> 6^\circ$) where the spacing is 40 feet. A spacing chart for pavement markers is provided in the NCDOT Roadway Standard Drawings on standard 1250.01, sheet 1 of 3.

Threshold Condition: Pavement markers that are damaged or missing should be noted.

Total Segment Inventory: The total number of pavement markers that should be in the segment will be recorded. For a typical two-lane, two-way roadway, the number of pavement markers will be 7 (0.1 mi. x 5,280 ft / 80ft). If assessing a five lane road (two through lanes each direction with a two way left turn lane), the number of pavement markers will be 26 (4 lane lines x 0.1 mi. x 5,280 ft. / 80 ft.)

Measured Amount: Count the number of pavement markers that are either damaged or missing and record on the ArcPad form.

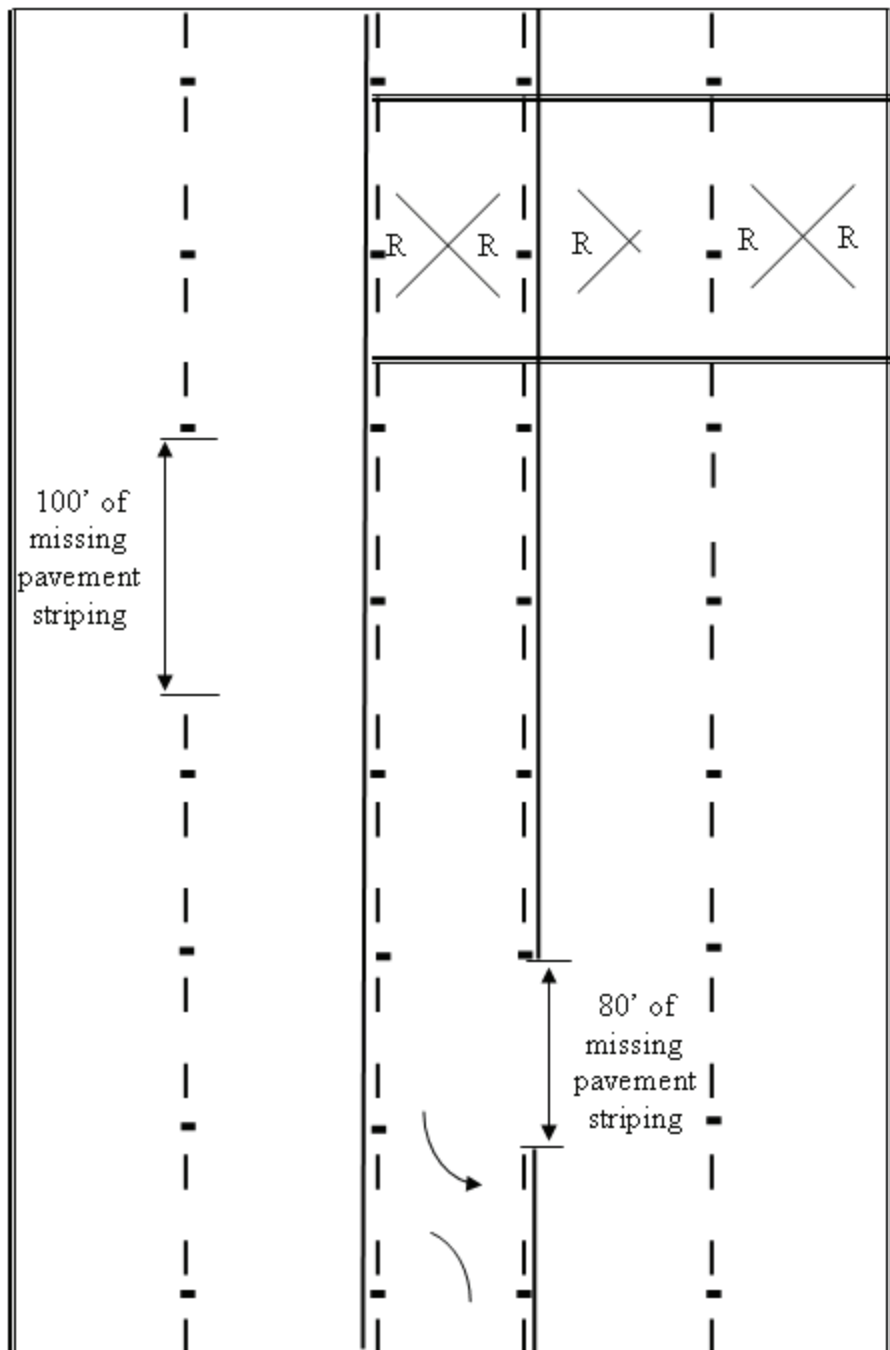
Special Instructions: Pavement markers will only be assessed on the Interstate and Primary System. If pavement markers have not been installed in the segment being rated, both the Total Segment Inventory and the Measured Amount will be "0". **This inspection will be done during the DAY**



Examples: Pavement Markers



TRAFFIC



MP 67.4

Total Segment Inventory

- Pavement Striping
- Symbols
- Pavement Markers

Measured Amount of Feature Exceeding Threshold

- Pavement Striping =
- Symbols
- Pavement Markers

MP 67.3

MCAP

TRAFFIC



SHOULDERS AND DITCHES

Component Element	Performance Standard	Random Section	Special Instructions	Measurements to be Recorded
Shoulders and Ditches				
Shoulders	<ol style="list-style-type: none"> No dropoffs greater than 3" within 10' of the edge of Travelway No shoulders higher than 2" within 10' of the edge of Travelway. 	Random Section	If paved portion is greater than 10' wide or, if concrete gutter is present, then inventory is 0.	<ul style="list-style-type: none"> Total shoulder length Length that does not meet performance standard
Shoulders Cont.	<ol style="list-style-type: none"> No shoulders that cause water to drain back within the Travelway. 	Random Section		
Lateral Ditches (Includes Rip Rap and Paved)	<ol style="list-style-type: none"> No more than 50% blocked No erosion greater than 1' below original ditch line 	Random Section	None	<ul style="list-style-type: none"> Total ditch length Length that does not meet performance standard



Low Shoulder



High Shoulder



Blocked Ditch



DRAINAGE

Component Element	Performance Standard	Random Section or Inventory	Special Instructions	Measurements to be Recorded
Drainage				
Crossline Pipes (< 54") (Blocked)	<ol style="list-style-type: none"> Greater than 50% diameter open. No eroded area at the inlet or outlet that is wider or longer than 1.5 times the pipe diameter and greater than 6" deep. 	Sample from Inventory	Pass/Fail	Only record that element passed or failed
Crossline Pipes (<54") (Damaged)	<ol style="list-style-type: none"> No damage due to cracking, joint failures, or corrosion that affects performance / functionality. No water infiltration causing pavement failures, shoulder failures, or roadway settlement. 	Sample from Inventory	Pass/Fail	Only record that element passed or failed
Drop Inlets/Catch Basins/ Shoulder Drains/ Funnel Drains/etc. (Blocked)	<ol style="list-style-type: none"> Grates, Box, Outlets, and Inlets that are 50% blocked or more should be noted. 	Sample from Inventory	Pass/Fail	Only record that element passed or failed
Drop Inlets/Catch Basins/ Shoulder Drains/ Funnel Drains/etc. (Damaged)	<ol style="list-style-type: none"> Inlets that are damaged or have missing or broken grates should be noted. No eroded area within 1' of the structure that is greater than 6" deep or below the base elevation of the concrete apron. Inlets and Outlets are not damaged and are functioning properly Grates are present and not broken. 	Sample from Inventory	Pass/Fail	Only record that element passed or failed
Curb & Gutter/ Valley Gutter/ Median Barrier (Blocked)	<ol style="list-style-type: none"> No obstruction greater than 2" deep for a length of 2' 	Sample from Inventory	Would not be counted if it would not obstruct flow, such as grass growing in a expansion joint	Length that does not meet performance standard



ROADSIDE

Component Element	Performance Standard	Random Section	Special Instructions	Measurements to be Recorded
Roadside				
Brush & Trees	<div>1. Freeways: No Trees or woody growth within 45’ of travel way, measured along surface of ground (excluding ornamental plantings and guardrail). Ramps to be cleared 10’ behind ditch.</div> <div>2. Non-Freeways: Vertical clearance of 15’ over roadway, including paved shoulders. 10’ back of ditch centerline or shoulder point.</div> <div>3. No dead trees, or leaning trees that present a hazard.</div> <div>4. Freeways: A clear distance of 5’ behind guardrail or concrete barrier (excluding ornamental plantings).</div>	Random Section		<div>• Total length of brush and tree that is present within the Control Zone.</div> <div>• Length that does not meet performance standard</div> <div>• Brush & Small trees within the Control Zone should NOT be noted if they would be mowed in normal mowing operations.</div> <div>• Median Vegetation will NOT be inventoried or Assessed.</div>
Turf Condition	<div>1. No “Brown Out” or bare or eroded areas</div>	Random Section		<div>• Total length of turf condition</div> <div>• Length that does not meet performance standard</div>



TRAFFIC

Component Element	Performance Standard	Random Section	Special Instructions	Measurements to be Recorded
Traffic				
Pavement Striping/Markings	1. Edgelines, centerlines, or skip lines within a section that have significant portions that are worn, missing, obliterated, or non-retroreflective should be noted.	Random Section	<ul style="list-style-type: none"> Record: Pass/Fail 	<ul style="list-style-type: none"> Total Inventory within Section Amount failed in feet.
Words and Symbols	1. Words or Symbols that have portions that are worn, missing, obliterated, or non-retro reflective should be noted as Failed.	Random Section	<ul style="list-style-type: none"> A word is counted as one. Record: Pass/Fail 	<ul style="list-style-type: none"> Total Inventory within Section Amount failed.
Pavement Markers	1. Either Damaged or Missing count as failure.	Random Section	<ul style="list-style-type: none"> Record: Pass/Fail Only on Interstate or Primary System 	<ul style="list-style-type: none"> Total Inventory within Section Amount failed.

Comments about the Manual

Please provide Feedback

Thank You!



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